THURSDAY, AUGUST 8, 1912.

## RECENT MEDICAL BOOKS.

(1) *Recent Methods in the Diagnosis and Treatment of Syphilis.* The Wassermann Serum Reaction and Ehrlich's Salvarsan. By Dr. Carl H. Browning and Ivy Mackenzie. In collaboration with J. Cruickshank, C. G. A. Chislett, W. Gilmour, and H. Morton. With an introduction by Prof. R. Muir, F.R.S. Pp. xxvi+303. (London: Constable and Co., Ltd., 1911.) Price 8*s.* 6*d.* net.

(2) *Scientific Features of Modern Medicine.* By Prof. Frederic S. Lee. (Columbia University Lectures.) Pp. vii+183. (New York: The Columbia University Press; London: Henry Frowde, 1911.) Price 6*s.* 6*d.* net (1.50 dollars).

(3) *On the Physiology of the Semi-circular Canals and their Relation to Sea-Sickness.* By Dr. Joseph Byrne. Pp. ix+569. (New York: J. T. Dougherty; London: H. K. Lewis, 1912.) Price 12*s.* 6*d.* net.

(4) *The Prevention and Treatment of Disease in the Tropics.* A Handbook for Officials and Travellers, compiled chiefly for the use of Officials in the Sudan. By Edward S. Crispin. Pp. 95. (London: Charles Griffin and Co., Ltd., 1912.) Price 1*s.* net.

(5) *The Doctor and the People.* By H. de Carle Woodcock. Pp. xii+312. (London: Methuen and Co., Ltd., 1912.) Price 6*s.* net.

(6) *The Nervous System.* An Elementary Handbook of the Anatomy and Physiology of the Nervous System. For the use of Students of Psychology and Neurology. By Dr. J. D. Lickley. Pp. xii+130. (London: Longmans, Green and Co., 1912.) Price 6*s.* net.

(1) OF all modern work in pathology, none has received more public attention than the work of the last seven years on syphilis; and this not only from the universal evil of the disease, but from the profound significance of the discovery of its actual cause, the *Spirochæta pallida*. By this discovery, it was brought into line with other infective diseases—malaria, yellow fever, sleeping sickness. New methods of study, new tests for diagnosis, new lines of treatment, came into use. The mere literature on the subject, from 1905 to 1912, would take years to read. Among a legion of novelties, two are especially notable: the Wassermann serum reaction and Ehrlich's salvarsan. The logic of the Wassermann test is one of the most complex of all the reasoning processes in bacteriology; but it hangs on to that simpler test, Widal's reaction, which is familiar to all doctors; and, in spite of the profundity of its logic, it is practicable over a very wide and important field of work. The results of treatment with salvarsan, though it is not a drug to be played with, nor free from all possibility of risk, are amazing. None of us can doubt that, in salvarsan, we have a drug which acts directly on syphilis, as quinine acts directly on malaria.

Dr. Browning and Dr. Ivy Mackenzie give us a complete, authoritative, and wise exposition of this great subject. They weigh carefully all the questions and half-certainties which have come of the wide use of the Wassermann test, and estimate with admirable judgment the bearings of this test on our knowledge of certain diseases of the central nervous system. Part i., 150 pages, is occupied with this exhaustive study of the Wassermann test; and part ii., of equal length, is occupied with a no less thorough and valuable study of salvarsan. Nothing is left out, nor slurred over. The whole book is a monument of patient, elaborate investigation; and, though it is very closely written and closely argued, yet it is so well arranged that the essential facts stand out in clear light. We congratulate the writers, and their collaborators, on the completion of a piece of really first-hand and first-rate work.

(2) Dr. Frederic Lee, Professor of Physiology in the Columbia University, is already known over here as an excellent writer and teacher. His present book contains his Jesup Memorial Lectures, given last year in New York. They are written in a very pleasant style, quiet and thoughtful; and they are concerned with the principal factors of modern medicine, and with the spirit which has guided the advance of the last half-century. Dr. Lee has been entirely successful in his "endeavour to present the subject-matter clear-cut and in language that is not too technical for the intelligent layman"; and it would be hard to find a better book, for general reading, on the present methods, objects, results, and prospects of the medical sciences. Of course, the field is too vast to be covered by a course of lectures; but Dr. Lee has selected his instances carefully, and has arranged them in good order. One of the best lectures is that on "The Rôle of Experiment in Medicine." But the whole book is good.

(3) With Dr. Byrne's book on the semicircular canals, we come back to one of the deepest of all physiological studies, the mystery of the instinctive habit of equilibration. Dr. Byrne writes with almost excessive care to omit nothing. Pages 1 to 124 are given to general anatomical and physiological considerations; this part of the book is written with the utmost concentration of facts: it is admirably complete, but very hard reading, and rather too long. Pages 125 to 336

are occupied with the anatomy and physiology of the semicircular canals—those amazing, delicate, extended tubules of the internal ear, which, being themselves in different planes, somehow ensure our adjustment to the different planes of our surroundings. The third part of the book, pages 339 to 525, is concerned with sea-sickness, which Dr. Byrne has studied for many years, with consummate patience, in himself. He rightly points out that the final arbiter, in sea-sickness, is neither stomach, nor semicircular canals nor other outlying kingdoms of the body, but the brain itself, the Capitol of life. Every page of his book is full of learning, and crowded with condensed facts: it is a splendid example of laborious thoroughness. Such work seems to leave not a word more to be said on the subject.

(4) It is a strange contrast between Dr. Byrne's close-packed, exhaustive monograph and Mr. Crispin's short manual. Mr. Crispin writes for "those who are stationed or travelling in out-of-the-way parts of the world, away from medical advice." His book is very short, very laconic; the rules which he gives are shrewd, practical, and accurate, so far as they go, but the book is too short. Still, it is a good little book, and he writes of what he knows through and through; for he is Assistant-Director of the Sudan Medical Department. The book gives many useful hints for the safe-guarding of a man's health when he is hopelessly out of reach of medical or surgical help.

(5) Dr. Woodcock's book offers another contrast. It is a series of essays on the doctor's life and work, his duty to his patients, his duty to the public, his duty to his own profession. It is written very pleasantly, with innumerable good instances, vivid experiences, and kindly words of praise for the famous doctors and surgeons of to-day. Perhaps the best chapters are those on contract practice, Poor Law experiences, and public health. Dr. Woodcock has seen dreadful things in the slums, and has fought them. In other happier chapters, he praises Edinburgh, his University, and Leeds, that nursing-mother of many great physicians and surgeons. It has been said that "doctors, when they write well, write very well indeed," and Dr. Woodcock can write very well indeed. He is at his best when he tells of what he has seen with his own eyes and done with his own hands.

(6) Dr. Lickley's manual on the nervous system is very clearly written and well illustrated. He is a demonstrator of anatomy at Newcastle (University of Durham), and writes for students medical and non-medical. The chapters on the minute anatomy of the brain and spinal cord must be read alongside of dissections; but there are many passages in the book which are of great interest to the general reader, and are made easily intelligible by diagrams and pictures. There is room, in the next edition, for a diagram of the motor areas of the brain, marked in their proper places on its surface. We commend this book to all who wish to get a plain understanding of the chief facts concerning the central nervous system.

## *BIOLOGICAL PROBLEMS.*

(1) *Upon the Inheritance of Acquired Characters.* A Hypothesis of Heredity, Development, and Assimilation. By Eugenio Rignano. Authorised English translation by Prof. Basil C. H. Harvey. With an Appendix upon the Mnemonic Origin and Nature of the Affective or Natural Tendencies. Pp. v+413. (Chicago: Open Court Publishing Co., 1911.) Price 12*s.* 6*d.* net.

(2) *Biological Aspects of Human Problems.* By Christian A. Herter. Pp. xvii+344. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1911.) Price 6*s.* 6*d.* net.

(1) THIS book, by the talented editor of *Scientia,* appeared in French in 1906, and later in German and Italian. We welcome it in its excellent English translation by Dr. Basil Harvey. Approaching the problem of inheritance from the side of physics and engineering, Rignano confesses that he was at first attracted to Weismann's position that there is no evidence of the transmission of somatic modifications. He felt, however, that the fundamental biogenetic law of ontogeny recapitulating phylogeny was difficult to reconcile with non-transmission. Reflecting on this difficulty, he was led to a new biogenetic hypothesis, which suggests a mechanism whereby the inheritance of acquired characters may be effected. Whatever one may think of the special hypothesis which the book expounds, there can be no two opinions as to the author's fair-mindedness, scholarship, and ingenuity.

According to Weismann's view, a reproductive portion of the germ-plasm is segregated in early development from the portion that forms the soma, and remains apart without sharing in body-making. According to Rignano's "centroepigenetic hypothesis," "the germinal substance, although limited to a single zone, and separated and differentiated from the rest of the soma, nevertheless exercises its epigenetic, formative action upon all the rest of the organism and during the whole of development, without undergoing any alteration whatever through this participation in development." We do not understand why the somatogenic part of the germ-plasm, which has the developing of the body as its business, should require any assistance from the primordium of the

future gonads. For this is what it seems to us to come to. Early in the book, Rignano speaks of the germinal substance exerting a formative influence on the developing soma, but he draws a curious distinction between the *effective* germinal zone (or "true place of origin of the germinal substance") and the *apparent* germinal zone (or the place where the sexual cells are built up out of material separated out or secreted by the effective germinal zone); and gradually it turns out that in higher animals the activating central zone is constituted by the least differentiated part of the nervous system. So the hypothesis has nothing to do with pervasive gonadial hormones. In any case, Rignano's view is that the central zone activates the developing organism, provoking a passage from one ontogenetic stage to another, until the equilibrium of the adult stage is reached. Then, however, a new perturbing influence comes into play: the body exhibits functional modifications. This implies the deposition of specific elements in the somatic nuclei, and some of these are deposited likewise in the germinal substance of the central zone. It is thus that the transmission of acquired modifications becomes possible. A specific potential element deposited in the nucleus by a specific nervous current flowing through it may also be called an elementary nervous accumulator. It adds itself to others already present without changing them, and it is able, as soon as it finds itself again in conditions of environment like those present at the moment when it was deposited, to restore the same specific current by which it was deposited. We rub our eyes and wonder if we are reading biology at all.

It is impossible in a few lines to do justice to an elaborate attempt to establish a new biogenetic theory, but we would submit the following remarks:—(*a*) Many who are disinclined to dogmatism on the subject of the non-transmission of somatic modifications, who feel that "there must be something in Lamarckism after all," will be in sympathy with Rignano's enterprise. (*b*) If the variations that count are germinal, and if the continuity of the germ-plasm expresses a fact, there is no difficulty in reconciling a reasonable statement of the recapitulation doctrine with Weismann's position. (*c*) It seems to us that Rignano has not taken sufficient account of the modifications that the recapitulation doctrine has been coerced to accept at the hands of expert embryologists. (*d*) It appears to us that Rignano has misunderstood Weismann's, or, indeed, the modern conception of development. (*e*) We think that the author, who has all our admiration, has been in his theory of "centroepigenesis" entirely misled by irrelevant physical analogies.

(2) The late Dr. Herter was led to write this book by the conviction that the conclusions of biology ought to furnish some trustworthy guidance in the art of life. The first chapter seeks to show that the animal body is a mechanism, and that the mechanistic theory is the one which now best serves the interests of humanity. But the difficulties of the mechanistic conception are inadequately stated, and the modern statement of the vitalistic position is not dealt with. In the second chapter, which deals with growth and reproduction, Mendelism is regarded as a discovery gained through the mechanistic hypothesis, and the theory of sex chromosomes as a corroboration. This will be apt to suggest to the unwary reader that the alternative to the mechanistic view is something mystical or magical. The third chapter is a frank advocacy of the view that the physical processes in the brain precede and cause the various phases of psychical life; the human animal is a conscious automaton; the mind is a function of the brain. The difficulties of this materialistic position are not appreciated.

The second part of the book deals with the self-preservative instinct in its varied expression and with the difficult problem of controlling it in the interests of the race as a whole. Its chapters are full of good counsel based on the author's wide experience and long reflection.

The third part of the book is devoted to the so-called sex instinct, and its pervasive influence for good and ill. We can only refer to a few points. The instinct has to be imperious, and is therefore a source of danger. As Emerson said, "the preservation of the species was a point of such necessity that Nature has secured it at all hazards by immensely overloading the passions, at the risk of perpetual crime and disorder." According to Dr. Herter, one of the most important evolutionary changes in progress is "a betterment in the attitude of women toward the ideals—or lack of ideals—harboured by men." In reference to the problems of marriage, it is rightly insisted that one criterion at least may be relied on, namely, the welfare of the family.

We have then a thoughtful endeavour to use biological results in the guidance of life. The author was a medical professor in Columbia University, and a scholarly biologist. His book is leagues away from anything amateurish or faddist; it is full of wise teaching. And yet we must confess that it is to us amazingly disappointing, being shackled with materialistic and naturalistic limitations. We must, indeed, always pay respect to the courage of naturalism—what Huxley called "the resolute facing of the world as it is." We doubt, however, whether the form it takes in this

book is necessary or warrantable. "It assumes that the human organism, like all others living on the surface of the earth planet, is a machine; and it assumes that there is no evidence that this machine is not a machine in all respects, like any engine which is the creation of man." But this is an assumption that we dare not scientifically make; it gives a false simplicity to the facts, and it does not work out.

## *RECENT BOOKS ON CHEMISTRY.*

(1) *Organic Chemistry.* By Prof. W. H. Perkin, F.R.S., and Prof. F. Stanley Kipping, F.R.S. Pp. xi + 664 + xx. Entirely new edition. (London and Edinburgh: W. and R. Chambers, Ltd., 1911.) Price 7*s.* 6*d.*

(2) *An Experimental Course of Physical Chemistry.* Part ii.—"Dynamical Experiments." By Dr. James F. Spencer. Pp. xvi + 256. (London: G. Bell and Sons, Ltd., 1911.) Price 3*s.* 6*d.*

(3) *A First Year Physical Chemistry.* By Dr. T. P. Hilditch. Pp. xx + 176. (London: Methuen and Co., Ltd., 1912.) Price 2*s.* (Text-books of Science.)

(4) *Physico-Chemical Calculations.* By Dr. Joseph Knox. Pp. viii + 188. (London: Methuen and Co., Ltd., 1912.) Price 2*s.* 6*d.* (Text-books of Science.)

(5) *Practical Chemistry for Engineering Students.* By Arthur J. Hale. With an introductory note by Prof. R. Meldola, F.R.S. Pp. xx + 192. (London: Longmans, Green and Co., 1912.) Price 3*s.* net.

(6) *A School Chemistry.* By F. R. L. Wilson and G. W. Hedley. Pp. xxii + 572. (Oxford: the Clarendon Press; London, Edinburgh, New York, Toronto, and Melbourne: Henry Frowde, 1912.) Price 4*s.* 6*d.*

(7) *Notions Fondamentales d'Analyse Qualitative.* By Prof. V. Thomas and D. Gauthier. Pp. viii + 331. (Paris: Gauthier-Villars, 1912.) Price 10 francs.

(1) THE new edition of Perkin and Kipping's "Organic Chemistry" embodies all the familiar features of the earlier editions. But the material of the Appendix has now been incorporated in Parts i. and ii., and new chapters or sections have been added, dealing with subjects such as the Grignard reagents, the configuration of the carbohydrates, and the cyclo-paraffins. In its revised form the book will carry on effectively the useful work of the former editions as a standard text-book of organic chemistry.

(2) The second part of Dr. Spencer's "Experimental Course of Physical Chemistry" describes the methods to be used in carrying out a number of "dynamical experiments" on mass-action, electrolysis, thermo-chemistry, and radio-activity. To those who are already familiar with the first part of the work no further commendation of the volume now issued will be needed.

(3) The production of a "First Year Physical Chemistry" is an interesting sign of the importance that is now attached to a subject that has attracted to itself so large a proportion of workers in both branches (organic and inorganic) of pure chemistry. But Dr. Hilditch's book is of greater importance than its unassuming title would suggest. Whereas so many text-books of physical chemistry bear upon almost every line of their text the imprint "made in Germany," Dr. Hilditch has written a book that is refreshingly new in its point of view, and one which would make an excellent basis for a larger volume on the subject. It is remarkable to how large an extent English writers who have come under the influence of the German school of physical chemistry have based their exposition upon Continental lecture courses, attaching excessive importance to those topics which have been included in the syllabus of the Continental schools, and ignoring or neglecting work of fundamental importance which has been done in their own country. Dr. Hilditch has written a well-balanced book, in which ions are regarded as of less importance than atoms, and dilute solutions are not allowed to monopolise an undue proportion of the space available. He has thus found room to describe Sir William Perkin's work on magnetic rotatory power, and has devoted an exceptional amount of attention to the physical chemistry (including the optical rotation) of organic compounds. The chapter on "Crystalline Structure" covers less than six pages, but is an admirable summary of the salient points.

(4) Dr. Knox has put together a series of 365 problems, to many of which full solutions are given in the text. The book will be very useful to those whose fortune it is to be tested by examiners who believe in numerical exercises as a test of exact knowledge in physical chemistry.

(5) Mr. Hale is one of those who are engaged in teaching chemistry to students who, "preparing for some particular profession or industry," fail (as Prof. Meldola points out in an introductory note) "to realise the importance of subjects which they regard as being outside their own province." Mr. Hale's solution of the problem of securing efficient instruction for such students depends on using those facts with which they are most familiar and to which they attach most importance, in order to prove and illustrate the fundamental laws and principles of chemistry. In the book under review the engineer's point of view has been specially studied, and a course of preparations, qualitative and quantitative analysis, is described

which is specially suited to his requirements. The book also includes the practical work for students taking a course in the "Chemistry of Building Materials."

(6) The "School Chemistry" of Messrs. Wilson and Hedley has been issued as the result of a demand for a somewhat shorter course than that described in their "Elementary Chemistry." The book is characterised by the sound and logical method of teaching, largely historical, which is happily becoming so common in school-books on chemistry. Exception must be taken to the statements that "the percentage of xenon in air is only 0·0000026, or 1 part in 38,461,538 parts of air"; the two statements are by no means identical, and it would be interesting to know what weight the authors attach to the eighth significant figure in their calculation.

(7) The French authors remark that "Books on analysis, and especially books on qualitative analysis, are very numerous. If one excepts the classical treatise of Fresenius, one may say that all the others have been written in preparation for an examination. This book, in distinction from the others, is written for those who wish to learn, and not for those who are seeking for diplomas." The product is an interesting volume, in which the principles and general methods of analysis, as well as the properties of the chief metallic and non-metallic radicles and compounds, are described. This they hope to supplement later by a book on industrial analysis.

## *DIFFERENTIAL GEOMETRY.*

*Lectures on the Differential Geometry of Curves and Surfaces.* By Dr. A. R. Forsyth, F.R.S. Pp. xxiii+525. (Cambridge: The University Press, 1912.) Price 21*s.* net.

DIFFERENTIAL geometry is a technical and rather forbidding term, but the subject is of the highest interest, and not to mathematicians alone. It includes the whole theory of map-drawing; it is required for the problem of soap-film surfaces; and if the earth were much different from a sphere the theory of geodesics would enter into practical questions of navigation and engineering.

There are two well-known and excellent treatises on the subject, by Darboux and Bianchi respectively; but hitherto there has been nothing corresponding to them in English, so that the appearance of the present volume will be welcomed even by those acquainted with its topic, and will no doubt lead more Englishmen than before to the study of it.

The general features of Dr. Forsyth's work are such as might have been anticipated. As between Darboux and Bianchi, it occupies a sort of middle position, being less individual and synthetic than the one, and less analytical than the other. For example, in the chapter on minimal surfaces we miss Darboux's historical notes and correspondingly progressive treatment; while on the other hand we are spared the Riemann-Christoffel symbols, which play so large a part in Bianchi's exposition. Besides Gauss's fundamental theory, it is the Mainardi-Codazzi relations which mainly help in developing all the earlier theory of curves on surfaces, &c., as here investigated.

The author's unrivalled power of dealing with complicated analysis is admirably illustrated by the section on differential invariants (p. 203-232). It would be very difficult indeed to improve upon this: it gives a convincing example of the value of Lie's theory of contact-transformations, an illustration of Jacobi's theory of systems of partial differential equations, a "complete" set, up to a certain stage, of differential invariants, with the geometrical interpretation of each, and finally sufficient detail to enable a student to work out, if he cares to do so, the system of invariants for the next stage.

In trying to estimate the value of a mathematical treatise, we naturally turn to pages which deal with problems still partly, at any rate, unsolved, or evidently not reduced to a natural and definite conclusion. In the present case we may take the theory of geodesics, and the problem of deformation of surfaces. With regard to the first, there are certain fundamental results due to Gauss; the connection of the theory with the strict calculus of variation; and the statement of the analytical problem in the simplest form consistent with present knowledge. On every one of these points Dr. Forsyth writes with complete mastery, and gives a most valuable set of examples. Whether we are likely to get soon any substantial contribution to the theory is doubtful, but, at any rate, we have here a clear account of its present state, and there may at least be some more special results awaiting discovery.

On the problem of the deformation of surfaces we have a very interesting chapter (pp. 354–406), which, amongst other things, gives the critical equation in Darboux's form, a remarkable theorem of Beltrami's, and a summary of Weingarten's method. We have also a simple proof of the theorem that, in general, a surface cannot be deformed while a curve upon it is kept rigid. This last is an excellent example of a mathematical theorem which anybody can understand, but which requires very careful discussion to prove in a satisfactory way. Everybody can see cases of

exception; for instance, a plane can be deformed while one line of it is fixed; again, most people would agree, after reflection, that a spherical cap is fixed when its circular rim is fixed; but our power of correct intuition is very limited, and the theorem can (apparently) only be proved by an analytical definition of deformation, and the theory of differential equations.

Other chapters of the work, equally interesting, but more familiar, are those on curves in space, curves on surfaces other than geodesics, surfaces with plane or spherical lines of curvature (including Weingarten surfaces), triply orthogonal systems, and congruences of curves. The last of these is admittedly only a brief introduction, and the others, of course, can be supplemented from original papers. As to the latter, sufficient references are given to start the student on his researches; and most, if not all, of the leading names appear to have been included, though one cannot help missing Casey in connection with cyclides, and Kummer is not alluded to, though Hamilton is, when the author is discussing systems of rays.

It should be added that there are numerous sets of excellent examples, many of them based upon original papers. It is a pity that in the latter case references have not been given. Finally, the choice of symbols is very judicious, and a list of those which have special meanings is given on pp. xix–xxiii. Dr. Forsyth may be congratulated on producing a work of great interest and value, which is perhaps the best treatise that he has ever composed.

G. B. M.

## OUR BOOKSHELF.

*Festschrift zum sechzigsten Geburtstage des Herrn Geheimen Hofrats Prof. Dr. Johann Wilhelm Spengel in Giessen.* Herausgegeben von A. Brauer, L. Döderlein, L. Dollo, H. Ludwig, E. L. Mark, M. Weber, und A. Weismann. *Erster Band.* Pp. viii + 609 + 32 plates. Price 75 marks. *Zweiter Band.* Pp. vi. + 863 + 41 plates. Price 100 marks. *Dritter Band.* Pp. v + 572 + 18 plates. Price 50 marks. (Jena: Gustav Fischer, 1912.)

THE Editor of the *Zoologische Jahrbücher* has received a bulky tribute of esteem in the three-volume *Festschrift* that supplements this year's issue of that journal. In the first volume the twenty-four essays are chiefly of systematic character. Even a list of these would occupy too much space, and we can merely draw attention to some of the more interesting points. A Pantopod-larva from Kiel leads Richters to suggest a crustacean origin for the group. Friese and v. Wagner continue their admirable studies on bees by a contribution to our knowledge of arctic-, alpine-, and steppe-forms of humble-bees. M. M. Metcalf describes an Opalina the nuclei of which fail to complete their mitosis. Many other papers of interest to systematists occur in this section. The second volume is chiefly anatomical, and the most important paper is probably that by Julin on the development of Pyrosoma. The other papers are largely descriptive and of interest mainly to the anatomist. The third section of the work is composed of general papers and of physiological ones. The most elaborate of these is the very detailed study of muscular contraction and movement in Lamellibranchs carried out by Polimanti at Naples; but there is also a very careful study of the ciliary apparatus in the eyes of vertebrates by C. Hess, another on the spermatophores of crustacea by E. A. Andrews, and an interesting account of the insect larvæ which use their hind gut as an organ of propulsion. Upon the whole, however, it must be confessed that this *Festschrift*, in spite of its great bulk and beautiful plates, is a dull work.

*Oil-Finding: an Introduction to the Geological Study of Petroleum.* By E. H. Cunningham Craig. With an Introduction by Sir Boverton Redwood, Bart. Pp. xi + 195. (London: Edward Arnold, 1912.) Price 8*s.* 6*d.* net.

MR. CUNNINGHAM CRAIG has attempted to meet the demand, resulting from the widespread modern interest in petroleum, for a simple text-book of the art of oil finding, and has at least produced a book which is striking and interesting. The opening sentences at once arrest attention, for, unlike his predecessors who have regarded the origin of petroleum as an interesting academic question, having little bearing on its present distribution or the search for productive areas, he starts off with the assertion that it absorbs and includes nearly every other question as to the occurrence, distribution, and winning of oil. His first care, therefore, is to deal with this question in no uncertain tones; for him petroleum is produced by a metamorphosis from the accumulated débris of land vegetation, which has become buried by sediment and undergone a transformation analagous to, though differing from, that which has given rise to beds of coal; and the association of salt with petroleum, so constant that it has been regarded by most other writers as causal, becomes for him a mere accidental coincidence.

Having dealt with the origin of petroleum, the author proceeds to describe the geological structures which have been found most suitable for the accumulation of workable deposits, and concludes with a description of the methods of geological survey as it should be carried out in the examination of oil fields which, though avowedly intended for beginners, contains several hints that are not infrequently overlooked by practised geologists. Though the book contains not a few assertions with which we cannot agree, it is both interesting and useful, when its avowed purpose is borne in mind.

## 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.]*

### August Meteor-showers.

THE following meteor-showers become due during the month of August:—

Epoch August 12, 4h. 30m., approximately fifteenth order of magnitude. Principal maxima, August 9, 22h. 55m., and August 11, 19h. 15m.; secondary maxima, August 10, 12h. 45m., and August 11, 11h. 25m.

Epoch August 13, 2h. 30m., approximately seventeenth order of magnitude. Principal maxima, August 13, 7h. 50m., and August 15, 4h.; secondary maxima, August 14, 1h. 20m. and 13h. 15m.

Epoch August 15, 8h., seventeenth order of magnitude. Principal maximum, August 16, 20h. 15m.; secondary maxima, August 15, 11h. 50m., 21h. 40m., and August 16, 10h. 25m.

Epoch August 20, 16h., seventeenth order of magnitude. Principal maximum, August 18, 16h. 30m.; secondary maxima, August 17, 8h. 5m., and August 18, 6h. 40m.

Epoch August 17, 9h. 30m., third order of magnitude. Principal maximum, August 18, 20h. 30m.; secondary maxima, August 19, 14h. 10m., August 20, 12h. 45m., and August 21, 10h. 25m.

Epoch August 23, 16h., fifth order of magnitude. Principal maximum, August 22, 9h.; secondary maxima, August 21, 23h. 10m., and August 22, 12h. 55m.

Epoch August 23, 20h. 30m., twenty-fourth order of magnitude. Principal maximum, August 22, 20h. 50m.; secondary maxima, August 20, 0h. 35m., and August 23, 6h. 40m.

Epoch August 25, 21h. 30m., approximately first order of magnitude. Principal maximum, August 25, 8h.; secondary maxima, August 24, 5h. 10m., and August 25, 2h. 55m.

Epoch August 29, 21h. 30m., fourteenth order of magnitude. Principal maximum, August 30, 5h. 30m.; secondary maxima, August 31, 3h. 55m. and 13h. 45m.

Though the meteor-showers of August are somewhat numerous, yet, taken in general, they do not indicate great meteoric intensity, and this remark is true as regards the middle portion of the month, when the Perseid radiant is usually expected to be most active. The most noteworthy maximum in the early part of the month occurs on August 4, 2h. 5m., and other maxima of less intensity belonging to this period that may be particularised are those of August 4, 9h. 55m. and 23h. 45m., August 8, 2h. 40m., and August 9, 22h. 55m. During the middle period, August 10–20, maxima of note occur on August 13, 7h. 50m., August 16, 20h. 15m., and August 18, 20h. 30m. There is considerable meteoric activity also on August 22 and 25.

Early Perseids should be in evidence on the nights of August 2–6, and there are rather weak maxima of these meteors on the nights of August 10–11. The conditions as regards intensity improve on August 14–16, and the Perseid radiant may be found to be considerably, if not most, active on the night of August 16. JOHN R. HENRY.

July 29.

### A Flower Sanctuary.

THE ravages of plant-raiders, about which Mr. Perrycoste so justly complains in your number for July 25, are a serious and growing evil, and the deplorable effects are felt and seen in almost every accessible part of the realm. I am encouraged to hope that the case of the Cheddar pink is not so crying as that of some other plants, especially orchids and ferns. It is far easier to grow the Cheddar pink from the seed which it produces so freely than to extract the roots thereof from its native limestone chinks. Let us hope that the plants Mr. Perrycoste saw offered for sale were grown for that purpose, just as white heather, once esteemed and hunted up as a rare emblem of good luck, is now grown in thousands by nurserymen, and hawked through the streets of northern towns at a penny a bunch. I do not know to which Thalictrum Mr. Perrycoste refers as suffering from plant-stealers; fortunately the Welsh poppy (*Meconopsis cambrica*) has spread to many districts of the country, and is naturalised far and wide.

In this matter, unluckily, botanists are among the worst offenders, for they reckon a herbarium specimen incomplete unless the root is taken away as well as the inflorescence and seed. HERBERT MAXWELL.

Monreith, July 27.

### Contrast Colours in the Use of Zone-plates.

THESE effects would never escape the notice of those who experiment with zone-plates, but perhaps they have not been previously recorded.

A zone-plate is placed at 14 ft. from an electric glow-lamp; 6 ft. further on a red image of the filament is formed, which is conveniently observed with a microscope eyepiece. As this is moved away from the plate there follows in view a continuous succession of images in all the colours of the rainbow. The chromatic dispersion extends along the general axial line through more than 6 ft. Whatever may be the colour of the filament, the groundwork of the circle of illumination assumes the complementary colour. It is surprising to observe how strong is the yellow field impressed upon the eye, while the violet image is growing imperceptible. W. B. CROFT.

Winchester College, July 24.

## LORD MERSEY'S REPORT ON THE LOSS OF THE "TITANIC."

THE proceedings of the Court, over which Lord Mersey presided as Wreck Commissioner, extended over thirty-seven days of public sittings, at which ninety-seven witnesses were examined, a large number of documents, charts, and plans were produced, and a great mass of facts and evidence was accumulated in connection with this "formal investigation" of the circumstances attending the loss of the *Titanic*. On the basis of these materials Lord Mersey, with the aid of five assessors, has produced a report in which twenty-six questions formulated by the Board of Trade are specifically answered. These questions "deal with the history of the ship, her design, construction, size, speed, general equipment, life-saving apparatus, wireless installation, her orders and course, her passengers, her crew, their training, organisation, and discipline; they request an account of the casualty, its cause and effect, and of the means taken for saving those on board the ship; they call for a report upon the efficiency of

the Rules and Regulations made by the Board of Trade under the Merchant Shipping Acts, and on their administration; and finally for any recommendations to obviate similar disasters which may appear to the Court to be desirable." The field of inquiry thus opened was very extensive; many of the questions involved matters of personal responsibility and conduct; even as regards matters of fact there were considerable differences of opinion and evidence, as was inevitable in the circumstances. All who followed the course of this difficult and prolonged inquiry must have been impressed with the firmness, impartiality, and judicial ability displayed by Lord Mersey throughout the proceedings. His readiness to accept any valuable contributions of fact or personal opinion from those qualified to assist the Court; the summary but thorough manner in which questions of a personal nature—especially those affecting Mr. Bruce Ismay and Sir Cosmo and Lady Duff-Gordon—were dealt with; the frank announcement of decisions reached by Lord Mersey on certain points at comparatively early stages of the investigation, and the consequent saving of time; the courage with which attempts to give disproportionate importance to side issues or to class interests were rendered futile; the patience and fairness with which many of the witnesses, especially those of the seaman class, were treated and their evidence made clearer; the mastery of technical details displayed; and many other characteristics of procedure which cannot be mentioned, gave distinction to this memorable inquiry, and demonstrated the great advantages secured by the selection of an experienced judge as Wreck Commissioner. Long as the proceedings lasted, it could not be said that there was any avoidable waste of time, unless it occurred in the speeches of counsel. Great industry must have been applied to the analysis of the evidence and the preparation of the report; otherwise it could not have been produced so promptly. There are, however, no traces of haste or lack of mature consideration in its contents and recommendations; it epitomises the history of the *Titanic* and makes clear the causes of her loss; it contains valuable suggestions for increasing the safety of life and property at sea, and in other ways is a most important and valuable document.

The report proper is one of the briefest ever made: it runs as follows: "The Court, having carefully inquired into the circumstances of the above-mentioned shipping casualty, finds, for the reasons appearing in the Annex hereto, that the loss of the said ship was due to collision with an iceberg, brought about by the excessive speed at which the ship was being navigated." The annex to the report is a closely reasoned and highly condensed document of more than seventy foolscap-sized pages of print, and well deserves careful study. There has been some criticism of the "form of words" used in the report proper, but most people will be disposed to regard it as hyper-criticism, and to concur with the view that the loss of the ship was primarily due to the extremely high speed (twenty-two knots) which was maintained after it was known that the *Titanic* had entered upon a region where icebergs and ice had been reported to be present by means of wireless messages sent from other ships and received on board the *Titanic*. Some of these messages, including one or two of the most important, do not seem to have been handed to the captain or officers of the *Titanic* by the operator in charge of the Marconi apparatus. This ought not to have happened, and any similar occurrence should be made impossible in future; but Lord Mersey shows conclusively that Captain Smith and his chief officers "all knew on the Sunday evening that the vessel was entering a region where ice might be expected." In such circumstances, adds Lord Mersey, "I am advised that with the knowledge of the proximity of ice which the master had, two courses were open to him: the one was to stand well to the southward instead of turning up to a westerly course, the other was to reduce speed materially as night approached. He did neither." In face of the evidence given by experienced seamen, long engaged on the trans-Atlantic service to New York, Lord Mersey admits that the captain of the *Titanic* only did what has been usually done for a long period, in holding to the usual course and maintaining full speed, and states that this common practice on the New York ocean routes had not been accompanied by casualties. It is well known that this year ice has been met much further south than it is ordinarily found at the season when the *Titanic* was lost. Lord Mersey tersely sums up his conclusion in the statement that Captain Smith "was exercising his own discretion in the way he thought best. He made a mistake, a very grievous mistake, but one in which, in face of practice and of past experience, negligence cannot be said to have any part; and in the absence of negligence it is, in my opinion, impossible to fix Captain Smith with blame." So much for the past; as to the future, Lord Mersey significantly adds: "it is to be hoped that the last has been heard of the practice [*i.e.*, maintaining full speed in a region where ice is likely to be met], and that for the future it will be abandoned for what we now know to be more prudent and wiser measures."

It may be interesting to illustrate what the high speed above mentioned involved in the case of the *Titanic's* approach to and collision with the iceberg, although this section of the annex to the report had been to a great extent anticipated by an analysis of evidence given before the Senatorial Committee in the United States. About thirty-seven seconds only elapsed between the moment when the iceberg was first sighted and that when collision took place. That collision caused damage to the bottom of the starboard side of the vessel, about ten feet above the level of the keel; the damage extended over a length of about 300 feet from the bow, and in consequence of the high speed, it was done in about ten seconds. In other words, the fate of the great ship was sealed in less than one minute from the moment when

the iceberg was sighted from the "crow's nest" on the foremast. Her fate was sealed, because the nature and longitudinal extent of the injury threw open to the sea more than one-third of her length, and destroyed the watertight subdivision of that portion of the vessel. In the annex it is stated that the transverse bulkheads which formed the watertight partitions of the *Titanic* in the damaged forward portion were so spaced that if the four foremost compartments had been simultaneously flooded, she might have remained afloat; but when the forward boiler-room was also flooded the ship necessarily foundered. According to the standard of subdivision hitherto accepted as sufficient for mercantile steamships, it would have sufficed to have made provision to keep the *Titanic* afloat when any two compartments were flooded simultaneously. It will be seen, therefore, that the accepted standard was considerably exceeded in the great ship; but in consequence of her loss it is obvious that there must be a reconsideration of that standard and of the methods of subdivision to be adopted in future. Transverse watertight bulkheads have been preferred for most mercantile steamships up to the present time; they were used almost exclusively in the *Titanic*. Horizontal watertight partitions and longitudinal vertical watertight bulkheads are commonly employed in warships, and have been used in a few passenger steamers in association with transverse bulkheads. It seems probable that a similar practice will find favour in mercantile marines after what has happened. A strong departmental committee has been appointed by the Board of Trade and is now at work. Lord Mersey recommends that this committee should deal with the whole subject, and it may be anticipated that this course will be approved.

Boat equipments and life-saving appliances in passenger and emigrant vessels have been extensively criticised and discussed since the *Titanic* was lost. It came as a shock to the general public to be told that the provision made in that ship, in the form of boats and rafts, was only sufficient for the accommodation of one-third of the total number of souls she was licensed to carry by the Board of Trade, and that the boats, &c., actually carried by the *Titanic* were considerably in excess of the accommodation required by the official regulations. Yet these facts were well known to all persons familiar with the mercantile marine, and with shipping legislation; and the arrangements were not considered unreasonable, because losses of life in ocean-going passenger steamships over a long period of years had been trivial. Moreover, great practical difficulties stood in the way of making larger provision for boats and rafts which could be so installed as to ensure their efficient use in case of emergency, under ordinary conditions of weather at sea. A cry went up in the Press demanding the immediate provision of a minimum number of boats and life-saving appliances (rafts, collapsible boats, &c.) which should ensure accommodation for every human being who might be carried in any ship under her Board of Trade certificate. Lord Mersey's Court was instructed to consider and report on the existing rules and regulations of the Board of Trade. Section 6 of the annex deals with that subject, tracing the history of the regulations in detail and giving the reasoning on which they have been based. Lord Mersey's conclusions may be summarised as follows: Boat accommodation should, where practicable, be carried in future for all on board passenger and emigrant steamships; the officials of the marine department of the Board of Trade were blameable for omitting, during many years, any revision of rules made in 1894 for the boat equipment of ships, although there had meanwhile been an enormous increase in the dimensions and tonnage of passenger steamships. These rules are now under consideration by an advisory committee of shipowners and others appointed by the Board of Trade, and it seems probable that a sensible increase will be made in the statutory minimum for boat accommodation, although the provision recommended by Lord Mersey may not be enforced. In the annex to the report it is made clear that although only 711 persons were saved in the boats of the *Titanic* out of 2201 persons on board, the total accommodation of the boats carried was sufficient for 1178 persons. Furthermore, it is stated that at the time of the collision there was a dead calm, and exceptionally favourable conditions, which enabled the boats to be lowered in safety and to be navigated without danger until the *Carpathia* arrived. One other fact must be mentioned. Modern passenger steamships of the largest dimensions have their boat decks situated from 60 to 70 feet above water, and consequently the most moderate rolling motion of the vessels would make it impossible to lower the boats safely from that great height, while passengers would necessarily find it difficult and dangerous to enter the boats when swinging at the davits. These and other important features of the problem must be considered by the advisory committee before fresh rules are framed, and it is fortunate that members of the committee have practical knowledge of the working conditions in sea-going ships. This is obviously not a subject for amateur legislation. It is understood that revised regulations will be submitted to Parliament by the President of the Board of Trade during the autumn session, in accordance with the Merchant Shipping Act.

The final recommendation made by Lord Mersey is perhaps the most important, and it deserves quotation in full:—

"That (unless already done) steps should be taken to call an International Conference to consider and as far as possible to agree upon a common line of conduct in respect of (*a*) the subdivision of ships; (*b*) the provision and working of life-saving appliances; (*c*) the installation of wireless telegraphy and the method of working the same; (*d*) the reduction of speed or the alteration of course in the vicinity of ice, and (*e*) the use of searchlights."

There is good reason for believing that such an international conference will be arranged, and its action should be of great benefit to the mercantile marines of the world, which are and will remain necessarily in competition with one another, but should not carry on that competition in a manner likely to be prejudicial to the safety of life and property at sea. If the loss of the *Titanic* should bring about a better understanding and the universal acceptance of principles which will add to the security of ocean navigation, the lessons learnt from that terrible disaster will be of permanent value.

## *THE DISCOVERY OF HUMAN REMAINS AT CUZCO, PERU.*

THE Yale expedition to Peru has made an important discovery of human remains in the vicinity of Cuzco, which are described in the April number of the *American Journal of Science*. We have, first, a full report of the circumstances of the "find" by the director of the expedition, Mr. Hiram Bingham. Following this, Mr. I. Bowman contributes a very cautious and well-considered report on the geological position. He comes to the conclusion that the beds in which the remains were found belong to a glacial series; that the bones were deposited during a period of pronounced alluviation; that since their deposition they were overlaid by from 75 to 100 ft. of gravel, and were at a later period partially eroded. Though at first sight the immediate surroundings suggest the occurrence of a landslip, this view does not commend itself to him, and he provisionally estimates the age of the remains at from 20,000 to 40,000 years.

The anatomical material consists of fragments of a cranium, portions of ribs, the right *os innominatum*, one complete and one imperfect femur. Mr. G. F. Eaton's report indicates that this femur falls within the range of femoral variation in normal male adult Peruvians of the later Inca period. The remains were accompanied by a portion of the tibia of a wolf or wolf-like dog, closely resembling a small gray wolf, *Canis occidentalis*. It may be remarked that three varieties of breeds of domestic dogs are known to have existed in Peru during the later Inca period—a small-sized breed of the bulldog or pug type, with a short snout and undershot jaw; a small house-dog like the dachshund, with slender snout; and a larger, slender-limbed variety, with wolf-like skull, originally classed by Tschudi under the name *Canis ingae pecuarius*. The two latter types are supposed to be descended from a larger wolf-like variety, itself derived from the American wolf. Thus the presence in this site of a large wolf-like dog, while it offers in itself no proof of great antiquity, does not render that supposition untenable.

But, besides the canine remains, those of what seems to be a bison have also been found; the study, however, of these rib fragments cannot differentiate the bison from domestic cattle. According to Mr. Eaton, if the Cuzco remains date from a period preceding the Spanish Conquest, it would appear that the bovine remains belong to some species of bison, for no other feral group of the bovidæ need be considered. The difficulty remains that though the Spaniards found captive bison at Montezuma's capital, the American bison in the free state is not known to have ranged further south than north-eastern Mexico.

The existence, therefore, of the associated canine and bovine remains raises considerations not easily reconciled with the geological environment, and for the present the exact age of the Cuzco remains must continue to some extent to be uncertain. It is much to be desired that further examination of this promising site may lead to the discovery of further evidence on which a final decision may be safely based.

## *THE LATE MR. A. O. HUME, C.B.*

MR. ALLAN OCTAVIAN HUME, whose death took place at his residence in Upper Norwood on July 31, at the age of eighty-three, ranks as one of the chief benefactors to the natural history departments of the British Museum. During the latter portion of his career (1849 to 1882) as a Bengal civilian, the deceased gentleman devoted his leisure and much of his fortune to collecting skins and eggs of Indian birds and heads of Indian big game. The result was the bringing together of a collection such as had never been made before, including, as it did, not only specimens obtained by himself and his assistant, Mr. W. R. Davison, but many purchased from other collections. Except for a selection of specimens—chiefly big game—retained for his own lifetime, but ultimately to come, we believe, to the nation, this collection was presented to the British Museum between 1885 and 1891. Previous to this the Museum collection of Indian birds was poor, whereas now it is surpassingly rich.

The total number of skins and eggs of birds added to the Museum collection was 75,577, of which 258 were types. The big-game collection comprised 223 specimens, in addition to which were 371 mammal skins, including several types.

Mr. Hume started and for fifteen years maintained *Stray Feathers*, and was also author or co-author of several other works on Indian ornithology. To kind attention received in the 'seventies at Mr. Hume's Simla residence, the present writer owes his recovery from severe illness. R. L.

## *NOTES.*

THE second International Congress of Entomology was opened at Oxford on Monday last, under the presidency of Prof. E. B. Poulton, F.R.S., and is still in progress.

A COMMITTEE has been appointed by the President of the Board of Trade to advise him, in the interests of safety of life at sea, with regard to methods of stowing, launching, and propelling ships' boats, and other kindred matters. Prof. J. H. Biles is the chair-

man of the committee, the other members being Rear-Admiral the Hon. S. A. Gough-Calthorpe, Mr. A. E. Doxford, Captain J. G. H. Flint, Mr. M. Joyce, M.P., Mr. J. Maxton, Mr. F. J. Stephen, and Mr. H. B. Wortley. The secretary is Mr. F. P. Robinson, of the Board of Trade. The terms of reference are:—(1) As to what are the most efficient arrangements for stowing boats on steamships of all classes, for launching them in an emergency, and for embarking the passengers and crew; (2) as to whether, and, if so, to what extent, mechanical propulsion can with advantage be adopted either in addition to, or in substitution for, propulsion by oars and sails; (3) as to the question of rafts, and, in particular, whether, if of approved character, they should be allowed in substitution for boats; and, if so, to what extent and under what conditions; (4) whether, independently of the foregoing, the committee desire to make any recommendations with reference to the above-mentioned matters which would in their opinion contribute to the safety of life at sea.

A COMMITTEE, consisting of Mr. R. A. S. Redmayne, C.B., H.M. Chief Inspector of Mines (chairman), Sir Arthur Markham, Bart., M.P., Mr. C. E. Rhodes, Mr. F. Rigby, and Mr. H. Smith, has been appointed by the Home Secretary to inquire into the circumstances in which spontaneous combustion of coal occurs in mines, its causes, and the means of preventing it, or of dealing with it when it has arisen.

HIS attention having been called to the recent developments in wireless telegraphy, Col. Seely, the Secretary for War, has appointed a committee to consider the application of the developments to the needs of the British Army.

THE following appointments to lectureships have been made by the Royal College of Physicians of London:—Goulstonian lectures, Dr. A. J. Jex-Blake; Oliver Sharpey lectures, Dr. A. D. Waller, F.R.S.; Lumleian lectures, Dr. F. de Havilland Hall; Croonian lectures (1912), Prof. C. S. Sherrington, F.R.S.; and FitzPatrick lectures, Dr. C. A. Mercier.

THE annual meeting of the British Pharmaceutical Congress took place in Edinburgh last week. It has been decided to hold the jubilee congress in London next year, and Mr. J. C. Umney has been elected to preside over it.

THE annual autumn meeting of the Institute of Metals is to be held at the Institution of Electrical Engineers, Victoria Embankment, on September 25 and 26. Some ten papers have been prepared for reading and discussion, and a reception and various excursions have been arranged. Weather permitting, aëroplane competitions will take place at Brooklands on September 26 for the Institute of Metals aviation prize. Those desirous of taking part in the meeting are requested to communicate with the secretary, Mr. G. Shaw Scott, Caxton House, Westminster, S.W.

MR. AUSTEN CHAMBERLAIN presided over a meeting on Wednesday of last week at the London Chamber of Commerce, the object of the gathering being the formation of a City subcommittee, and to confer as to the best means of organising a systematic appeal in special directions in support of the fund for placing the London School of Tropical Medicine upon a permanent and adequate basis. A subcommittee of forty-six gentlemen was elected to cooperate with the general committee constituted at the Foreign Office on July 17. It was stated at the meeting that the sum received amounted to 28,000*l*. Since the date of holding the meeting the sum of 500*l*. has been voted to the school by the Chartered Bank of India, Australia, and China.

PROF. W. A. BONE, F.R.S., has accepted an invitation to lecture before the German Chemical Society on November 30 next on "Surface Combustion." The lecture, which will be an open one, will be delivered at the Hofmannhaus, Berlin.

BY the death, at the age of twenty-five, of Harold Donaldson, who was drowned while bathing near Swansea, on Monday, July 29, the National Physical Laboratory has suffered a severe loss. Donaldson entered Sidney Sussex College from the Swansea Technical School with a college scholarship, and at Cambridge took honours in mathematics and physics, greatly distinguishing himself in the latter. He also graduated at London University with honours in physics. After holding for a time the post of assistant demonstrator at the Cavendish Laboratory, and doing some research work under Sir J. J. Thomson, he joined the staff of the National Physical Laboratory rather more than a year ago, and was attached to the metrology division. He soon showed that he had in a high degree all the good qualities needed for such a post. He possessed a clear insight as to the essential points in an investigation, a marked ability in suggesting the method to be adopted, and a ready grasp of the experimental means required for its solution, with great enthusiasm and love for his work. He was careful and accurate and at the same time prompt and businesslike. His investigations into the changes in dimensions of certain fused silica standards promised to be of the first importance; personally he had won the cordial esteem of all his colleagues.

THE death is announced, in his seventy-third year, of Prof. John Alsop Paine, of Tarrytown, N.Y. From 1862 to 1867 he was employed by the New York Board of Regents in research work on the flora of the State. His next appointments were as professor of natural science at Robert College, Constantinople, and the Lake Forest University successively. In later years he gave his attention mainly to archæology. From 1872 to 1874 he was archæologist to the first expedition of the Palestine Exploration Society east of the Jordan and Dead Sea. Prof. Paine was a member of the staff of the "Century Dictionary," and was for seventeen years curator of the Metropolitan Museum of Art, New York.

CAPTAIN AMUNDSEN arrived in Christiania on Wednesday of last week, and was received in audience by King Haakon.

CAPTAIN MIKKELSEN and Mr. Iversen have reached Copenhagen and had bestowed upon them the gold service medal by the King.

THE John Scott legacy medal and premium have been awarded by the Franklin Institute to Mr. S. Cowper-Coles in consideration of his work on the Sherardising process.

RULES and regulations have now been drawn up for the recently established Indian Research Fund Association, particulars of which are to be found in *The Pioneer Mail*, Allahabad, of July 12. The objects for which the association has been established are the prosecution and assistance of research, the propagation of knowledge and experimental measures generally in connection with the causation, mode of spread, and prevention of communicable diseases.

THE British Fire Prevention Committee recently held its summer meeting at the Regent's Park Testing Station, when some important high-temperature fire tests were made on a reinforced concrete floor on sets of electro-glazed casements of the Chadrac type, on sets of electro-glazed casements of the Luxfer type, and with a double door constructed of reinforced concrete made to the specifications of the chairman of the Belgian Government Fire Committee. Reports on the tests are to be published by the Committee in due course.

THE new series of publications issued by the Babylonian Section of the Museum of the University of Pennsylvania continues to make good progress. Part i. of the second volume contains a beautifully copied series of no fewer than 123 plates devoted to "Business Documents of Murashu Sons of Nippur, dated in the Reign of Darius II.," and is the work of Prof. Albert T. Clay. The volume contains 228 legal and commercial documents, which are here published for the first time, and they afford students a mass of new material for obtaining information with regard to the social and economic conditions which prevailed in Babylonia during the Achaemenian period. Not the least interesting feature of these inscriptions are the Aramaic endorsements scratched or written on many of them, and the proper names include many of Persian and Egyptian origin, borne by members of the foreign colonies at Nippur. Part ii. of the volume is devoted to temple-accounts of the Cassite period from Nippur, and we note that one of them bears a very interesting seal-impression, showing the form of plough in use in Babylonia in the fourteenth century B.C. Both Prof. Clay, the editor of the texts, and Mr. Eckley Brinton Coxe, who has established a fund for the publication of the series, are to be congratulated on the able manner in which the work is carried out.

IN the last issue of the *Bulletins et Mémoires de la Société d'Anthropologie* ( ser. vi., vol. ii., parts 5 and 6), M. G. Courty makes an attempt to interpret certain rock carvings in the department of Seine-et-Oise. Many of these assume the form of crosses with little circular cups at the extremities of the limbs. These he supposes to represent prehistoric chariots. As an illustration he gives a photograph of a primitive plough still in use in the department of Lot. But M. Marcel Baudoin brings these carvings down to the Neolithic period, and thinks that they represent a modified form of the Swastica symbol, a view certainly more probable than that advanced by M. Courty. The latter is on safer ground when he finds in some of this class of carvings representations of prehistoric huts, with which M. Guébhard aptly compares the series of Etruscan hut urns from the commune of Marino, described by S. L. Pigorini and Lord Avebury ("Archaeologia," Col. xlii. (1869), pp. 99–123).

*The Quarterly Review* for July, 1912, publishes an excellent article on the study of eugenics by Dr. A. F. Tredgold, who is entitled, both by his qualifications and experience, to speak with authority on the subject. He points out afresh the well-known and disquieting fact that, in spite of all expenditure on education and sanitation, there is a constant increase in the ratio of persons amongst us "who are on the down grade and falling out in the march of civilisation—the biologically unfit." He gives some interesting figures to show that, although the incidence of disease, and especially microbic diseases, such as smallpox, consumption, and typhoid, has been reduced by about 50 or 60 per cent. in the last forty years, and the death-rate has fallen from 21 to 14 per thousand, there is nevertheless an increase in the average rate of illness at all ages in the community, an increase which seems to bear witness to a depressed vitality and power of resistance in the nation. The Hearts of Oak Benefit Society shows an average increase of days' sickness per member from 1·63 in 1901 to 2·37 in 1910, while the National Deposit records an advance from 2·92 to 3·34 days per member. In the Manchester Unity of Oddfellows the average payment per member of sick benefit was 17*s.* 2½*d.* in 1886, and 1*l.* 0*s.* 4¾*d.* in 1910. These figures, which relate to lives specially selected for their prospect of good health, provide the groundwork for much thought in connection with the finance of the National Insurance Act, which takes account of nearly all sections of the population. "Quem Deus vult perdere prius dementat," says Dr. Tredgold with regard to the frantic efforts of those who would seek the national salvation by means of hospitals, asylums, special schools, old-age pensions for paupers, night shelters for vagrants, and free meals for the unemployable. The science of eugenics is no fad of the moment; it is a serious attempt to discover and apply in organised society the principles on which the real improvement and progress of mankind has been and must be based.

SELECTIVE media, *i.e.* media favouring the growth of one species or variety, have been largely used for the isolation of bacteria, particularly those of the "coli" group. Mr. Cecil Revis has investigated the action of some of these media, and finds that they tend to suppress what may be regarded as the feebler growers, so that the particular species or variety isolated will depend largely on the medium employed. He also concludes that the atypical varieties of *B. coli* are not degenerate forms, but are true variants. Coccoid forms of *B. coli* were found to appear in certain media. Experiments were made with ground *B. coli* to detect the presence of intra-cellular enzymes capable

of fermenting sugars (which the living organism is able to accomplish), but none was found. Mr. Revis suggests that in the fermentation of dextrose by *B. coli*, gluconic acid is first formed, and that it is quite possible to explain, by successive oxidation, reduction, and condensation, the appearance of all the end-products formed in the fermentation of dextrose by *B. coli* (*Cent. f. Bakt.*, 2nd Abt., Bd. 33, pp. 407 and 424).

PRAZMOWSKI contributes an elaborate study of *Azotobacter chroococcum* to the *Bull. Internat. de l'Acad. des Sciences de Cracovie* (No. 3B, March, 1912). This bacterial organism was isolated from the soil and from Delft canal water by Beijerinck; it forms a brownish pigment and fixes atmospheric nitrogen. A full description of its morphology and development is given. True resistant spores are occasionally formed by it, also "vegetative spores," analogous to the arthrospores of de Bary.

IN the five articles constituting part v. of the Annals of the South African Museum Dr. R. Brom discusses various groups of the local fossil reptiles, describing in the first a new Propappus, and showing that its bigger relative, Pariasaurus, stood higher on its limbs than generally believed. Both reptiles were tortoise-like in habits, and probably protected themselves by digging in the ground. In the second he describes a new mosasaurian of the genus Tylosaurus, and in the third a cynodont from the Stormberg. More important are certain observations in the fourth on the dicynodont skull, where it is stated that the bone in which the pineal foramen is pierced is probably a neomorph, the paired bones behind this representing the parietals. In this connection reference may be made to a paper by the same author, in the second part of the Proceedings of the Zoological Society for 1912, on the structure of the internal ear in dicynodonts and the hemology of the mammalian auditory organs, in which he reverts to the old view that the incus corresponds to the reptilian quadrate, the removal of the latter element from the mandibular joint being foreshadowed in Cynognathus, in which it has partially slipped out.

IN *The Field* of July 27 "Isaac Bikerstaffe" concludes a particularly interesting series of articles entitled "Some Principles of Growth and Beauty"—in other words, on spirals in art and nature. In this final instalment, in which he deals with the spirals of horns, the author has cleared up a misconception with regard to the direction of the twist in the Cyprian sheep and the bharal. In those species the right horn has been stated to form a left-handed spiral, and thereby to differ from that of more typical sheep, in which the spiral is a right one. The difference is really due to the upper part of the horns of the two species in question having undergone a "perversion," whereby a change in the curve has been brought about. Accordingly, all sheep agree in having "homonymous" horns.

IN *The Queensland Naturalist* for May Mr. H. Tryon records the invasion of the Brisbane district and certain other parts of Australia by a large ant (*Pheidole megacephala*), the native home of which is believed to be Mauritius and Madeira. In its new haunts it occurs in myriads, alike in the open country and in houses, and is a deadly enemy to most insects, although not, unfortunately, to aphides and various other species injurious to vegetation.

IN the August number of *The Selborne Magazine* the editor gives a figure of the shell of Gilbert White's tortoise, "Timothy." The shell, which is exhibited in the Reptile Gallery at the Natural History Museum, has lost a few of its horny plates—a circumstance which should have been noted in the legend to the figure.

FROM the Transactions of the Royal Scottish Arboricultural Society, vol. xxvi., part 2, July, 1912, it is pleasing to note that Wiesner's brilliant researches on the *Lichtgenuss* of plants are being followed up by investigators in forestry work. Wiesner's term may be rendered as *photic ration*, or the ratio between the intensity (i.) of the light actually falling upon a plant or its parts, or its habitat, and the intensity (I.) of full daylight at the same time. The ratio between the two intensities (i. : I.) is the *specific photic ration*. In a paper on the relation of light intensity to advance growth—that is, to the trees which have sprung up in openings in the forest, or under the forest canopy, before regeneration fellings were commenced—Mr. G. P. Gordon, B.Sc., describes observations made by him on oak and beech forests. Graphic representations are given, in which the number of seedlings per 0·8 square pole for each species of tree is plotted vertically, while the *specific photic ration* is plotted horizontally. The curve for oak indicates that as the light intensity increases the number of seedlings per unit area of the advance growth increases, reaching a maximum when the light intensity is one-fourth that of full daylight, and that large variations in light intensity are associated with comparatively small changes in number of seedlings. The curve for beech is very different, there being a comparatively large variation in seedling number for a small variation in light intensity, while the maximum is reached at one-fortieth the full daylight intensity. The author concludes by pointing out the practical importance of the *Lichtgenuss* method in forestry.

AN excellent memoir on the North American species of the water-lily, genus Nymphæa, has been published by the Smithsonian Institution (Contributions from the U.S. National Herbarium, vol xvi., part 3). The authors of this monograph, Messrs. Miller and Standley, rightly point out that there are some groups of plants the taxonomy of which cannot be properly understood from ordinary herbarium material, which in the case of succulent plants is often practically useless. This appears to apply also to aquatics, and this memoir represents a remarkably successful attempt to revise the knowledge of an interesting genus in the light of the examination of fresh living material from all parts of a large country. Several new species are described, raising the number for the United States to nineteen, and in all cases the descriptions are accompanied by figures of the leaf out-

line and the stigmatic pattern, with photographic illustrations of the flowers, fruits, and seeds, and maps indicating the distribution of the species. In addition there are five beautiful plates showing the plants photographed in their natural surroundings, which add greatly to the attractiveness of this admirable publication.

THOSE who have travelled in Italy and have observed the way in which small birds of every kind are shot for sport will be pleased to read a short note by Prof. Giacinto Martorelli in the *Rendiconto del R. Istituto lombardo*, xlv., 9. The author considers that the laws in force for the protection of wild birds are inadequate to stop the extermination of the large number of migratory species that traverse the Italian mainland twice a year. The object of the paper, generally speaking, is to urge that the close season should commence much earlier than it does at present. He considers that there is no reason for continuing the close season later than August 15, but observes that the laws are not strictly adhered to in practice.

THE results for the year 1911 of the observations made under the superintendence of the Norwegian Meteorological Institute are given in two large volumes, as in previous years. An outstanding feature of these valuable data, which extend so far north as latitude 71°, is the very large amount of precipitation as rain or snow on the exposed and rugged western borders of the country. A glance at the Daily Weather Charts issued by our own Meteorological Office shows that the majority of the barometric depressions which arrive from the North Atlantic merely skirt our northern shores and expend their energy on the Norwegian coast. On a map which accompanies the rainfall volume, the yearly isohyets are drawn for each 200 millimetres, and show that in several coastal districts the amounts reach 2000 and even 3000 mm. (about 118 inches). But the vapour-laden currents lose most of their moisture on the windward side of the mountains; the districts on the Swedish borders receive an annual rainfall of only 600 or even 400 mm. (15¾ in.). The number of rainfall stations is at present about 500 (one station for each 673 km.²), which compares poorly with that of some other countries, *e.g.*, the British Islands (one station for about each 70 km.²). The careful publication of this large amount of data so nearly up to date reflects much credit upon the director and small staff of the institute in Christiania.

IN the *Mededeelingen en verhandelingen* issued by the Royal Meteorological Institute of the Netherlands (No. 13*a*), Dr. J. P. van der Stok has commenced an important discussion of the climate of the south-eastern part of the North Sea, based on observations made on board the five Dutch lightships. The work is to consist of two parts: (1) the results and discussion of the observations for each separate locality, and (2) summaries of the aggregate results and climatological constants giving a general view of the climate of the whole area. We have received the first instalment of part i., containing the results of twenty-five years' observations at the Terschellingerbank lightship, moored about 12½ miles, and of twenty years' observations at the Haaks lightship, moored about 17 miles off the coast, and embracing together no fewer than ninety-four tables. From the thoroughness with which the work is being carried out we may look forward to some valuable meteorological results.

A NEW geographical magazine has appeared, the *Bulletin de la Société Serbe de Géographie*. As Servian is a language little read outside the country, abstracts of the articles are given in French, German, or Italian. Among the articles in the first number are a discussion of the influence of economic conditions on settlement, a tectonic sketch of the environs of Belgrade, the glaciation of the Šarplanina and the Korab, and on the displacement of the coast line in Croatia and Dalmatia within historic times. In the last the author, A. Gavazzi, of Agram, controverts from personal observation the view frequently expressed that the coast has sunk in the past 2000 years.

PROF. J. C. BRANNER, in a paper read before the Seismological Society of America (Bulletin, vol. ii., pp. 105–117), shows that Brazil is not so free from earthquakes as is often supposed. He gives a list of more than fifty recorded shocks, the first of which, of somewhat doubtful authenticity, occurred in 1560. The majority were of slight intensity, only two attaining a strength sufficient to cause slight damage to buildings. Prof. Branner indicates six small districts, which are occasionally visited by earthquakes. As the country is larger than the United States, covering more than three million square miles, it would seem probable that no other portion of the globe of equal area is so rarely shaken by earthquakes.

A GOOD deal has been recently heard about "holes in the air" in connection with sudden collapses of flying machines. Prof. W. J. Humphreys, of the Washington Weather Bureau, writing in *The Popular Science Monthly* for July, classifies the eight different types of atmospheric disturbance as follows:—A vertical group, including aërial fountains, aërial cataracts, aërial cascades, and aërial breakers, and a horizontal group, including wind layers, wind billows, and aërial torrents; in addition wind eddies fall under both groups. Holes in the sense of vacuous regions do not exist.

THE International Association for promoting the Study of Quaternions and allied systems of mathematics has issued its report for June, 1912 (New Era Press, Lancaster, Penn., U.S.A.). In addition to the usual bibliography, a useful purpose is served by Dr. James Byrnie Shaw's table of comparative notation for vector expressions, which will be extremely handy for reference, and in particular for non-specialists in quaternions when they are reading papers where these are used. A system of notation is also proposed by Dr. Alexander Macfarlane, the president, with a discussion of the underlying principles. M. G. Combebiac gives a notice of the late Captain F. Ferber, better known in connection with aëroplanes than with vectors.

## OUR ASTRONOMICAL COLUMN.

THE SPECTRUM OF NOVA GEMINORUM NO. 2.—No. 4592 of the *Astronomische Nachrichten* contains two papers dealing with the apparent absorption lines in the spectrum of Nova Geminorum No. 2.

In the first, Herr R. Furuhjelm discusses spectra taken with the one-prism spectrograph attached to the 80-cm. refractor at Potsdam Observatory, and finds coincidences between the fine dark lines in the nova spectrum, between λ3850 and λ4650, and the spark lines of Ti, Sc, and Sr, and possibly of Fe and Yt, having intensities of 15 or more in the lists of Exner and Haschek. He does this by first deriving a mean apparent radial velocity of −541 kms. from the shifts of all the lines, and applying this as a correction to the laboratory wave-lengths; the latter differ from the measured nova wave-lengths by about 7 Å In the spectrum taken on March 15 he is able to fit all the Ti, Sc, and Sr lines, numbering 10, 7, and 2 respectively, and 4 each of the 5 Fe and 5 Yt lines; 20 is the limiting intensity in the latter case. The differences between his calculated and observed wave-lengths range from −1·21 to +1·36 Å.

Herr Furuhjelm also compares his lines with the lines for these same elements, of intensity 5 and over, in Dyson's list of chromospheric lines, and finds that there are only six lines in the chromospheric spectrum not found in that of the nova, and these lines belong to other elements.

Negatives taken on later dates did not afford so many, or so close, coincidences, and the necessary compensation for displacement varied considerably. Herr Furuhjelm concludes that the apparent radial-velocities vary too much to be considered as real, two negatives taken on March 17 giving very different values.

Dr. Ludendorff, on a negative secured with spectrograph iv., at Potsdam, on March 15, finds that 37 of the dark nova lines between λ4310 and λ4530 coincide with lines in Rowland's table, with differences corresponding to radial velocities ranging from +19 to +82 kms.; the mean is +49 kms., giving a heliocentric radial velocity of +20 kms. He also compares his lines with the radium, uranium, and emanation lines falling in this region. The agreement for radium and the emanation is very uncertain, and for uranium negative, while the radial velocities are very different from those found by Dr. Giebeler. From his results, Dr. Ludendorff does not venture to answer the question as to the presence of these radio-active elements in the nova.

OBSERVATIONS OF JUPITER.—The transit of the minor planet Lutetia across Jupiter on May 7 took place too early to be observed at the Yerkes Observatory, but Prof. Barnard made observations of the great red spot and of a transit of satellite ii. on that date, and records them in No. 4591 of the *Astronomische Nachrichten*. The spot was fairly well seen, and the bay north of it was, as usual, well defined. The southern edge of the spot was in contact with, or partly overlapped by, a heavy, irregular, and somewhat narrow, dark belt. At 18h. 0m. there was a long, dusky marking on the following limb of the planet, in the same latitude as the spot, which subsequently would overtake the spot and probably provide some interesting phenomena.

Herr Archenhold observed the spot at Treptow, and recorded its transit at 11h. 3·5m. (M.E.T.) on July 12; this gives a correction of +4m. to Herr Kritzinger's ephemeris. The spot appeared intensely white, without any trace of colour, while the "*streifen*" appeared to have a rosy-brown hue.

THE THREE-PRISM SPECTROGRAPH AT MOUNT WILSON.—A most interesting description of the three-prism spectrograph constructed for use with the 60-in. reflector, in its Cassegrain form, at Mount Wilson, is published by Prof. Adams in No. 3, vol. xxxv., of *The Astrophysical Journal*. He also describes the method of working the instrument and reducing the plates, and gives a list of fifty stars, mainly of types A and B, that have been found to have variable radial velocities. The programme of work is directed to the measurement of the radial velocities of stars for which Boss has already determined proper motions, and the results are expected to provide valuable data for the study of star streams. Several stars have been found to have one or more hydrogen lines bright, and a table is also given of seven stars having very large radial velocities. Most of these are of the later types, and show radial velocities ranging from 96 to 170 kms.; their actual velocities in space were calculated and range from 119 to 343 kms. per sec. One star, Lalande 28607, is notable because it is of the A type, and has a radial velocity of −170 kms.; no other star of this type is known to have a constant velocity approaching this in magnitude.

## THE INSTITUTION OF MECHANICAL ENGINEERS.

THE summer meeting of the Institution of Mechanical Engineers opened on Tuesday, July 30, in Belfast, and terminated on Friday, August 2. Papers were read and discussed on Tuesday and Wednesday mornings in the Municipal Technical Institute. As is customary during this meeting, a special feature was made of visits to works and points of interest to engineers in the neighbourhood of Belfast.

A paper dealing with rolling-stock on the principal Irish railways was read by Mr. R. M. Livesey, locomotive superintendent, Co. Donegal Railways Joint Committee. Practically the only reason for the construction of a narrow-gauge line is cheapness, and no doubt in certain cases a considerable saving can be effected. But if, as in many instances in Ireland, such railway has to be fully equipped, almost on the same lines as a broad-gauge railway, in order to comply with the somewhat onerous requirements of the Board of Trade, then there is very little to be gained from the point of view of economy. The author quoted one such railway which cost 11,500*l.* per mile, although no really heavy work was involved in its construction. No railway should be built of narrow-gauge if the cost will exceed 5000*l.* per mile, and then only if the proposed line will be for ever isolated from those of standard gauge, and the traffic is always likely to be small. The mileage of narrow-gauge lines in Ireland is 525, nearly all of which is 3-ft. gauge. It seems regrettable that the majority were not linked up to form one large system. The author gives particulars and illustrations of typical locomotives and cars used on these lines.

Mr. W. Redfern Kelly, engineer-in-chief to the Belfast Harbour Commissioners, presented a paper on the new graving dock at Belfast. This dock is the only graving dock in which it is possible to place the *Olympic*, the world's largest specimen of naval architecture. The Belfast Harbour Commissioners have expended on this dock and its collateral works no less than 350,000*l.* The works were commenced in 1904, and were finished in about seven years. The length over all is 901 ft., the breadth is 128 ft. from coping to coping, and 96 ft. at the entrance. Full descriptions and illustrations were given by the author of

the elaborate pumping appliances and machinery for operating the dock.

Mr. John Horner, of Belfast, contributed a paper dealing with the evolution of the flax-spinning spindle. Simple in construction, and decidedly effective in use, the spindle in its primitive form has descended from remote prehistoric times to the present day. This paper is of peculiar interest from the illustrations given from photographs of spindles used among primitive nations; one from the Congo has a whorl made from cassava root. Arkwright's spinning frames are also illustrated and described in the paper.

The commercial utilisation of peat for power purposes was dealt with by Mr. H. V. Pegg, of Belfast. The author has experimented with air-dried, hand-cut peat fired into a special form of gas producer. Owing to the high and varying percentage of hydrogen in the gas, it proved unsuitable for use in the works gas-engine. From the experience then gained, it appears to be wiser to extract the tar from the gas, and, further, that the producer must be comparatively non-sensitive to the amount of moisture in the peat fuel.

Mr. Daniel Adamson, of Hyde, presented a paper dealing with some conditions affecting the durability of wire ropes for lifting appliances. The most important of these are the quality of the material and the size of the wire, as well as the diameters of the pulleys and the arrangements of the ropes. The wire used is of crucible steel, having a tensile strength of from 80 to 130 tons per square inch. The effect of oiling the ropes is found to be very beneficial, increasing the life of a given rope by two or three times.

Mr. Charles Wicksteed, of Kettering, read a paper on reciprocating straight-blade sawing-machines. Saws were first found in the form of a notched bronze knife in the third dynasty, about 5000 B.C. The first knives on record were made out of flint, and were, in fact, saws with minute teeth. The author gives descriptions and illustrations of various types of modern hand and power-driven saws. The latter machines have now made themselves indispensable in modern engineering establishments.

## *THE RECENT CONGRESS OF THE ROYAL SANITARY INSTITUTE AT YORK.*

THE Health Congress of the Royal Sanitary Institute, which was held at York during the week ending August 3, was attended by a large number of delegates. Although but few new scientific facts were brought to the notice of the meetings, many papers of great interest and value to the public health student and worker were read, and some useful discussions followed. Reference should also be made to the general appreciation of special addresses by the President (the Archbishop of York), Prof. Karl Pearson, and Prof. Henry Kenwood. The following communications may claim a special scientific interest. Dr. Myer Coplans exhibited an instrument, which is an application of the form of ohmmeter which has been in use for many years for testing electrical installations, for the purpose of obtaining the conductivity of liquids. The conductivity of pure water containing an electrolytic substance in solution being due almost wholly to dissolved matter, it is possible, in very dilute solutions, to estimate the percentage amount of substances in solution. By such means it was demonstrated that a fairly ready method is afforded for testing variations in the condition of public water supplies, more particularly the effects of sewage pollution, water softening, the presence of metals (such as lead, iron, or zinc), and the ability of water to take into solution dangerous metals when placed in contact with them for any given period, the addition of water to milk, &c. Dr. Coplans in another paper dealt with some points in the purification of water, in which he pointed out that as all particles in suspension, bacteria included, show, with efflux of time, a tendency to agglutination, and the newly formed aggregates slowly sink, if at any time during the process of agglutination the so-called bacterial counts are made by the usual methods, the results show a considerable reduction of the organisms originally present, although in reality there is no reason to presume the death of a single organism; for if a number of organisms be aggregated into a single mass the result of "plating," followed by incubation, is but a single colony. He concludes that the number of colonies developing, as the result of "plating," followed by incubation, is evidence solely of the number of distinct masses of organisms pre-existing; there is no relationship established as to the total number of organisms originally present; furthermore that the methods available for the isolation and recognition of disease-producing organisms in water are so faulty as to be altogether untrustworthy, in so far as negative results are concerned. In this connection he refers to the experiments undertaken at the laboratories of the Metropolitan Water Board, in which in 66 per cent. of the samples intentionally polluted with millions of germs of typhoid fever it was impossible to recover or to recognise the dangerous organisms. He concludes that with such glaringly defective methods for the detection and recognition of dangerous pollution, it becomes increasingly necessary to guard jealously the purity of our water supplies, a proposition which involves an important corollary, namely, the effective control and disposal of domestic sewage and slop-waters. Mr. A. G. Ruston, dealing with the subject of "Air Pollution by Coal Smoke," directed attention to the difference between domestic and boiler soot obtained from the same coal, domestic soot being characterised by its relatively high content of tar and volatile substances and its low content of ash. He furnished experimental evidence that for every ton of coal purchased by the average householder, one hundredweight goes up the chimney unconsumed, while so far as the factory is concerned there is at least a loss of one stone out of every ton of coals. In one district of Leeds, the centre of one of the chief industrial areas, he finds that fully 40 per cent. of sunlight during the year of his investigation was shut off by the smoke in the atmosphere, and that the solid impurities which reached the ground as the result of coal combustion amounted to the high figure of 1565 lb. per acre.

Mr. J. E. Purvis and Mr. G. Walker described experiments which demonstrated that as the result of the sewage contamination of sea-water, nitrates are not formed until after six weeks, when there is a coincident increase in the number of bacteria present.

Other papers specially worthy of reference dealt with the subjects of the public health aspects of poliomyelitis; the municipal dispensary; the sanatorium and tuberculin treatment in the prevention of consumption; the physiological effects of exercise; the teaching of domestic economy in elementary and secondary schools; the housing of the working classes; rural housing; housing and town planning; the ventilation of churches and dwellings; the abolition of private slaughter-houses; the hygiene of the steel trades; the prevention of wool-sorter's disease; the pollution of streams by coal-washing water and spent gas liquor; works for sewage purification in country houses; the theory of probable error in its application to vital statistics; the eradication of the tuberculous milch-cow.

## JOINT MEETING OF LEARNED AND TECHNICAL SOCIETIES IN CORNWALL.

THE recent meeting—the outcome of the happy suggestion of a number of representative Cornishmen more than a year ago—furnished an opportunity such as has never before occurred, for the members of council and officers of our principal scientific and technical societies to meet each other, while at the same time making acquaintance with the mining and engineering industries of what is one of the oldest mining districts in the world, and probably the premier district as regards record of continuous working. Visits to typical tin-mines, china-clay pits, and engineering works formed part of the programme, including a trip to the uranium mines from which the British Radium Corporation obtains its supplies of pitchblende.

One of the most interesting features was a visit to the King Edward Mine, a real working mine which produces and sells "black-tin," and, as part of the Cornwall School of Metalliferous Mining, is worked entirely for, and largely by, students. The success which this, the only mine in the world which is worked on such lines, has achieved in the promotion of technical education has led to the suggestion for an amalgamation of the Cornwall schools with the Imperial College of Science and Technology.

The excellent work of the Royal School of Mines (now one of the units forming the Imperial College) is seriously handicapped by the lack of a practical training ground for the study of mining, ore-dressing, and mineral valuation, &c., and arrangements might possibly be made by which certain of the Royal College of Science students in geology, mineralogy, and technical mineral chemistry could also spend a portion of their time in a district where commercial requirements are paramount, where conditions for practical working are ideal, and where technical education may be said to have been born in 1833, when the Royal Cornwall Polytechnic Society was founded. The roll of this institution, together with those of the other two Cornish societies, includes some of the most celebrated names in connection with science and engineering, and the records of the men whom Cornwall has furnished and is still furnishing afford ample justification for an amalgamation useful and honourable to them and to others having more funds but fewer facilities for completing their curriculum.

## THE METEOROLOGICAL OFFICE AND ITS OBSERVATORIES.

THE year 1910 will be memorable in the history of the Meteorological Office, not only because it witnessed the removal of the office to South Kensington, but also because in the same year the Meteorological Committee took formal charge of the observatories at Kew and Eskdalemuir, and provision was thus made for the natural coordination of meteorology with the geophysical sciences of terrestrial magnetism and seismology.

The premises in Victoria Street, Westminster, which had been the home of the Meteorological Office for more than forty years, had been designed as residential flats, and had no facilities for observation or experiment. The only observatory under the direct control of the office was situate in the south-west of Ireland, two days' journey from London, and thus any experiments with regard to instruments or special observations that were required had to be carried out by arrangement with some other authority.

In preparing the plans for the new building at South Kensington the needs of the office in this respect were kept in view, and amongst other provisions a large flat roof was arranged for, conveniently accessible from the other parts of the building, and with a small laboratory, photographic room and workshop in direct communication.

Immediately the new building was occupied Dr. Shaw organised a corps of observers and set on foot a regular system of meteorological observations. At present there are installed on the roof an anemometer, thermograph, and solar radiation recorder, each with its recording parts conveniently arranged for public inspection. In addition there is a self-recording rain gauge, a wind-direction recorder, and a sunshine recorder. Within the building are barographs of the ordinary pattern, and a microbarograph recording minor fluctuations of pressure. By the courtesy of the trustees of the British Museum it has been possible to arrange, in addition, a meteorological station in the grounds of the Natural History Department.

An interesting development in cloud photography has been made possible by the cooperation of Mr. John Tennant, and simultaneous photographs of the same cloud being taken on the roof of the office and at Mr. Tennant's house, about a mile distant, the pictures are afterwards combined to form stereoscopic slides.

While these arrangements indicate a considerable advance, there has been a no less marked advance as regards the associated observatories. For more than forty years the Meteorological Office had maintained an observatory at Valencia, co. Kerry, and by means of annual subsidies it had secured continuous meteorological records at a number of other observatories in the British Islands. Results from all these institutions have been collected by the office, and for the twelve years, 1869–1881, reproductions of the daily curves, on a reduced scale, have been published in *The Quarterly Weather Report*. The whole series of original records form probably a unique register of the atmospheric phenomena of any country.

In 1910, as already stated, an arrangement was entered into between the Royal Society, the National Physical Laboratory, and the Meteorological Committee, and with the sanction of H.M. Treasury, under which the Meteorological Office took over the observatories, both at Kew and at Eskdalemuir, and is now therefore directly responsible for the control of three observatories, situated respectively in the south-east of England, the south-west of Scotland, and the south-west of Ireland.

Of the three observatories, that at Valencia, which has been longest under the control of the office, was at first and for many years a purely meteorological observatory, but observations of the magnetic elements were added in 1900 at the request of a committee of Irish physicists, of whom the late Earl of Rosse was one of the most active members.

Of the other observatories, that at Kew is the oldest. The building was erected by King George III. in 1769, and it was in regular use as an astronomical observatory and physical museum from that year until 1841, when it passed into the hands of the British Association, in the care of which it remained for the next thirty years.

In 1871 the British Association withdrew its support, and the responsibility for the observatory passed to the Royal Society, when Mr. J. P. Gassiot generously presented securities representing 10,000*l.* as a fund to secure the "maintenance of a central magnetical and meteorological observatory at Kew."

Notice of this gift was received by the Royal Society in March, 1871, and in June of the same year a deed expressing the donor's wishes was sealed and a committee was appointed to administer the trust. The

first members of this committee were the then members of the Meteorological Committee of the Royal Society—in other words, the executive of the Meteorological Office. The connection between the two institutions had always been close, but now, naturally, it became still more intimate, and indeed the control of both the office and the observatory remained practically in the same hands until 1900, when the observatory became the provisional home of the National Physical Laboratory.

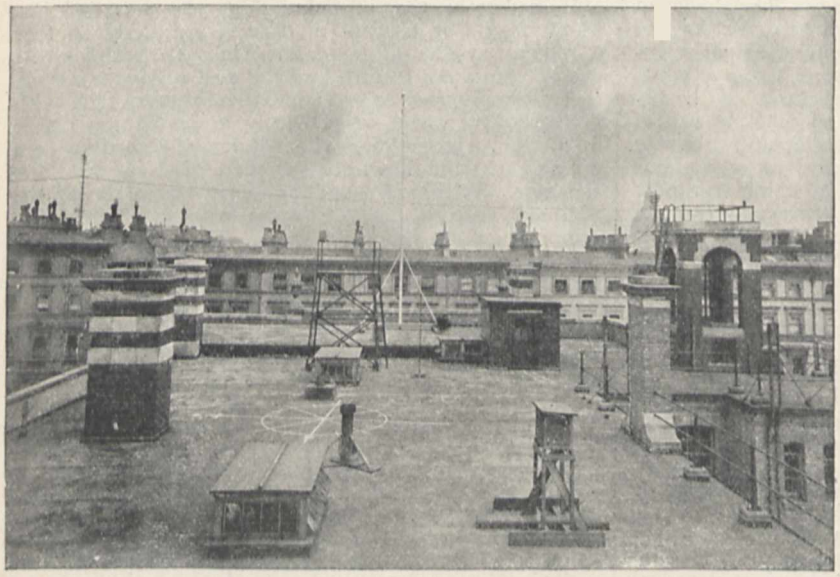

FIG. 1.—Meteorological Office.—Roof. From the "Sixth Annual Report of the Meteorological Committee," by permission of the Controller of H.M. Stationery Office.

Shortly after the transfer of Kew to the National Physical Laboratory in 1900 it was found that the electric tramways were seriously interfering with the magnetic instruments. Formal representations were made to the Government, and as a result a new observatory was provided out of public funds at Eskdalemuir, with a grant of 1000*l.* a year for its maintenance. The new observatory was installed under the direction of the National Physical Laboratory, and, being opened in 1908, it remained under the control of the laboratory for two years, until 1910, when the administration of both observatories was transferred to the Meteorological Committee, by which, with the assistance of the Gassiot Committee of the Royal Society, they have since been carried on.

Consequent upon the transfer, certain changes have been made in the routine duties at the observatories, and it has been found possible, for instance, to arrange for observations to be taken at Kew at 7 a.m., 1 p.m., and 6 p.m. each day, and to be telephoned to South Kensington for incorporation in *The Daily Weather Report* as part of the "London" observations.

At Eskdalemuir the changes that have taken place have been both by way of increased equipment and of increased staff. The new instruments added have been obtained partly by purchase and partly by generous donations from Prof. A. Schuster, F.R.S., and the outfit for seismological investigation at this station now comprises no fewer than four instruments, of the Milne, Omori, Galitzin, and Weichart patterns respectively.

The contrast between the positions of the observatories at Kew and Eskdalemuir is complete. Kew lies almost at sea-level, in a well-wooded valley, on the banks of a tidal river, and close to great centres of population. Eskdalemuir is 800 ft. above the sea, on nearly the highest land in its neighbourhood, sixteen miles from the nearest railway station, and far remote from towns.

Both at Kew and Valencia provision is made for the continuous registration of barometric pressure; temperature of the dry-bulb and wet-bulb; the direction and velocity of the wind; rainfall and sunshine; and for eye observations at fixed hours of the weather and of the amount, form, and movement of the clouds. The Eskdalemuir Observatory is not yet fully equipped as a meteorological observatory, as it lacks in particular a record of wind-direction. At Kew there are eye observations of the temperature of the earth at 1 ft. and at 4 ft., and of solar and terrestrial

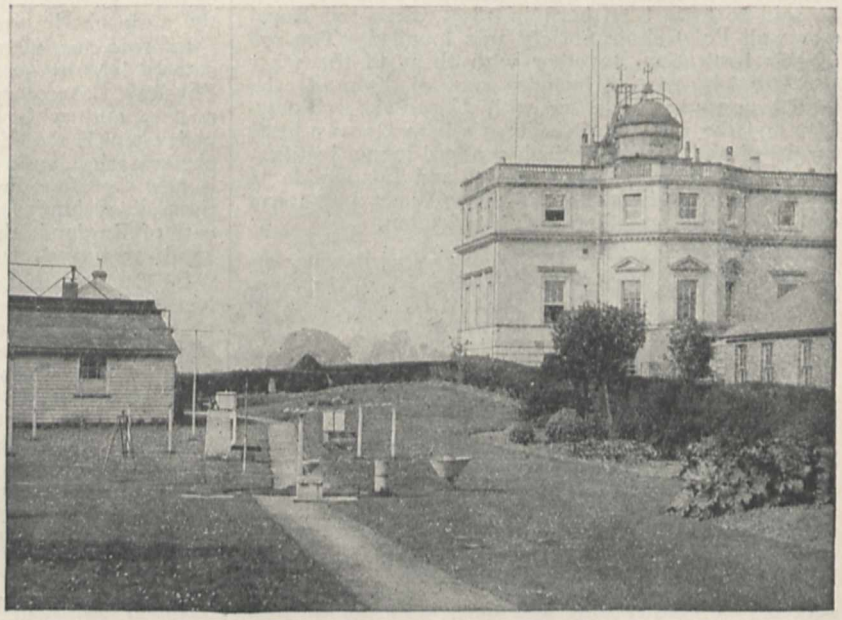

FIG. 2.—Kew Observatory.—Main building and meteorological instruments on the exposure lawn. From the "Sixth Annual Report of the Meteorological Committee," by permission of the Controller of H.M. Stationery Office.

radiation. At Valencia magnetic observations are taken periodically, but at Kew and Eskdalemuir both magnetism and atmospheric electricity are continuously recorded, together with earth movements. At Eskdalemuir the solar radiation is also observed. Since the beginning of 1911 daily values from the three observatories, together with wind values from four anemograph stations, have been published month by month in a new periodical issue, known as *The Geophysical Journal*, which is part iii.*a* of the "British Meteorological and Magnetic Year Book." In this publication Dr. Shaw, with the advice of the Gassiot Committee, has taken the forward step of adopting units based on the C.G.S. system for the meteorological tables, as well as for the magnetic and electrical tables. This is not the first time these units have been employed in meteorology, for in *The Weekly Weather Report* they have been used since 1909 for the purpose of presenting the results obtained from the ascents of kites and balloons. *The Geophysical Journal*, however, is the first British official publication where these units have been employed in their entirety, and for all the tables, and on this ground alone the new issue would be noteworthy, without reference to the fact that it supplies for the first time a monthly conspectus of the movement, temperature, and magnetism of the earth's crust, combined with the records of the temperature, humidity, pressure, rate of movement, and electric condition of the lower atmosphere.

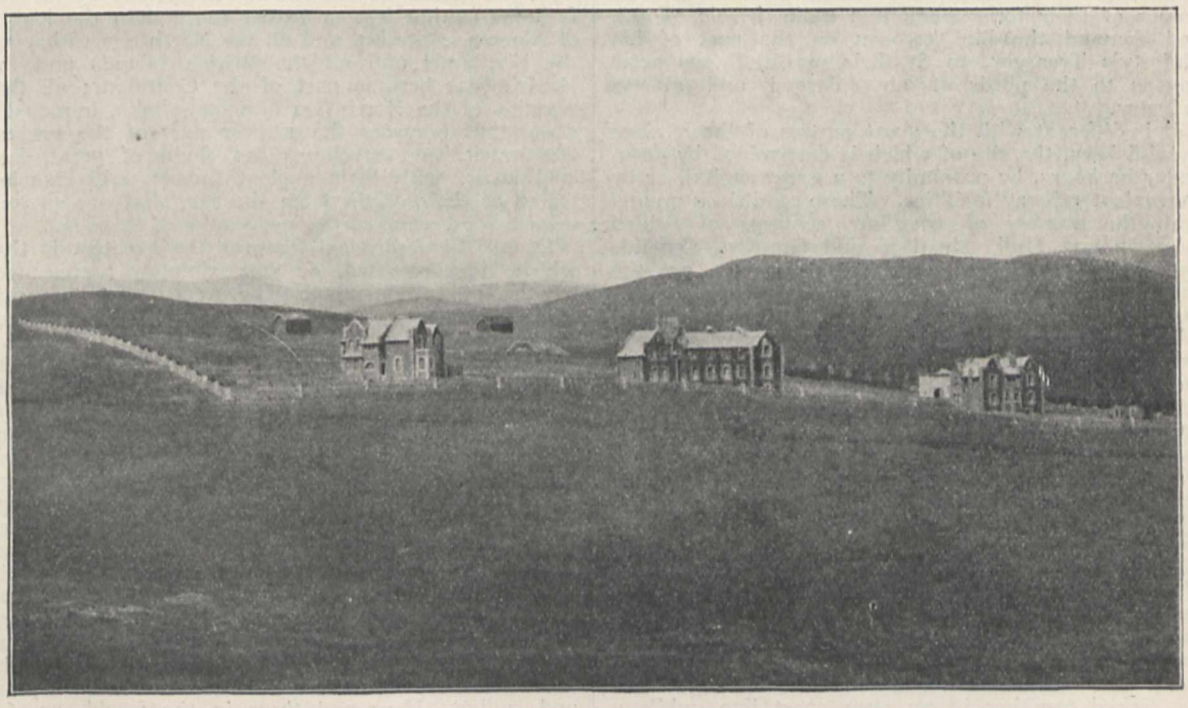

FIG. 3.—Eskdalemuir Observatory.—General view from the south-west. The office block is the middle one of the three buildings in line; the superintendent's house is on the left, the caretaker's house with assistants' quarters on the right. The two huts in the background are the wooden magnetic huts for "absolute" observations. In front of the right-hand hut is seen the mound of the underground magnetic chamber, with the stonework of the top of the porch. From the "Sixth Annual Report of the Meteorological Committee."

## THE NORTH SEA AND ITS FISHERIES.[1]

FOUR-SQUARE the North Sea lies, and its gates are three. To the northward lies the broad opening to the northern ocean, a frequented highway of the fisherman, where the sails of commerce are few. The eastern gate is the wide channel of the Skagerack, that leads through the narrow passes of the Belts and Cattegat to the great inland Baltic Sea; I like to think of it as an old road, a route of very ancient trade, the old highway of the Hanse merchants, the road to Muscovy! And lastly, in the south-west, there is the narrow strait that widens into the British Channel, the chief and busiest street of the modern maritime world. Of these three gateways, two open to the ocean and one to the inland sea, two to the salt waters and one to the brackish or the fresh; and herein, as we shall see presently, we have the simple clue to much of the physics and not a little of the biology of the North Sea.

Sailing in imagination round the North Sea, we pass from the rock-bound shores of northern Scotland, through all the varied scenery of our eastern borders, to the dull levels of the Dutch and Frisian coast, to a long line of low-lying shores, sandy or muddy, fringed with low islands, where through islands and broken coast the great rivers of central Europe find their outlet to the sea. Along the shores of Jutland, low, level stretches of sand confront us, until, crossing the Skagerack, we are again of a sudden in presence of rock and precipice. Then onwards along the many hundred miles of Norwegian coast we have more or less similar scenery of cliff and mountain, often glacier-topped, and the broken barrier of islands, behind which the deep fjords are sheltered from the Atlantic billows.

Around this long coast-line the fishing population is universally but unequally distributed. In the old days almost every sheltered creek or sandy bay, where the boats could be drawn up in winter, received its sparse settlement of fishermen, and their number, if in part regulated by the nature of the coast, was still more governed by the racial characteristics of the people: for some breeds of men are fishermen born, and some are not; and some races, such as the

[1] A discourse delivered at the Royal Institution on March 22 by Prof. D'Arcy W. Thompson, C.B. The diagrams, charts, &c., referred to in the discourse were shown, but are not reproduced.

Cornishmen, the Dutchmen, and the Norsemen, were long pre-eminent, and the Dutch the greatest of all. In the days of Queen Elizabeth, before ever a herring was caught by our own people, the Dutch sent to our coasts a yearly herring-fleet of 3000 sail. It was Dutch colonists, under William of Orange, who first taught Englishmen to trawl at Brixham; and to that Brixham fishery, and the direct influence and participation of the men who conducted it, all our modern trawling industry harks back. And again, in Scotland, our prosperous east coast fishery, far different from the struggling efforts of the western Celt, owes its origin to those Dutch and Frisian settlers who (as history and tradition tell us) came over under Mary Queen of Scots and her son, and who still retain no small trace of their origin in speech and custom and costume. These good people present a problem to the administrator, when (as oftentimes) they cling not only to their old ways, but, resisting all economic tendencies to concentration, cleave to the ancient homes of their forefathers, and make heroic efforts, and demand the like heroism on the part of his Majesty's Treasury, to fit their multitudinous petty havens to the needs of an enlarged and altered industry.

It is different with the great centres of the modern trawl-fishery, the site of which is determined by deep-water harbours, by proximity to a great capital, or by convenient railway facilities. These conditions greatly limit the number of trawling centres, of which Grimsby and Hull, Aberdeen and Granton, Ostende and Ymuiden, Geestemunde and Cuxhaven, are the chief. Proximity to the fishing-grounds matters less to these distant voyagers than to the herring-fisher. With him, ports contiguous to the successive seasonal fishing-grounds are a prime necessity, and railway facilities are of minor importance; for the fish must be cured in haste—and may be exported at leisure, generally (because most cheaply) by sea. And so it is that all down our east coast the herring ports are numerous, and are often remote from the greater centres of population.

The North Sea is a very shallow sea. We can sail from here to Hamburg, save for one little bit, in water under 20 fathoms deep, and from here to the north of Denmark in water that never exceeds 30 fathoms. Suppose the bottom of the North Sea to be raised up by successive stages—raise it by 10 fathoms, or 12 paces (just the breadth of this street from wall to wall), and immediately the islands of the Frisian shore are linked together in an even coast line, while a belt ten miles broad or more is added to the Danish coast; a multitude of low islands spring up off the Belgian and East Anglian coasts, and a greater island rises up in the Dogger Bank, where even now in heavy storms the waves break upon the sunken land. Let the North Sea rise but 20 fathoms, and from Flamborough Head eastward dry land fills the southern North Sea, save for a shallow inlet, parallel with our coast, that has been scoured out a little deeper than the rest by the tidal inflow from the Channel; the Dogger Bank is now a great low island some 150 miles long. Let our upheaval proceed some 10 fathoms more, or 30 fathoms in all, and now from the Yorkshire coast straight across to the most northerly point of Denmark the new shore line appears; and all to the south of it, an area of some 70,000 square miles, is now dry land, save for a few small lakes, chief among which are the celebrated Silver Pits, where nowadays the soles congregate.

Once more let the bottom of the North Sea rise up 50 fathoms, or 300 ft. (not yet near the height of St. Paul's), and the new coast line now runs round the Orkney Islands, and then from somewhere about Peterhead through the Skagerack to Sweden, with one conspicuous dip or bend, that under the conditions we have imagined would form a sort of new Zuyder Zee. Northward, far beyond the 50-fathom line, and away to the north of Shetland, the comparatively shallow bottom of the North Sea slopes downwards to the north, until we reach the 100-fathom line a little to the north of Shetland. But some sixty miles from the Norwegian coast this 100-fathom line bends southward, until it, like our other contour lines, enters the Skagerack. The deep groove that surrounds the Norwegian coast, and cuts off from it the comparatively shallow plateau of the North Sea, is a geographical feature of great importance, the meaning and history of which have not yet been fully told. The 100-fathom line is succeeded to the northward at no great distance by the 200-fathom line, and beyond this the depths increase rapidly, for we are now at the edge of the continental shelf, and the old abyss of ocean is but a stone's throw away. Elevate, then, in imagination, the bottom of the North Sea by, say 150 or 200 fathoms (rather less or rather more than the length of Albemarle Street), and all the North Sea to beyond the Shetlands and all the British Islands and the British seas become part of the Continent; all that remains of the North Sea is a large lake, immensely deep, that occupies the greater part of the present Skagerack, and continues the chain of great deep cold lakes, with their ancient faunas, still showing traces of their origin from the sea, that are so conspicuous a feature of the geography of Sweden.

Of all these physical features the greatest is that which is represented, or approximately represented, by the 100-fathom line. The geographer traces it along all the western coasts of the Old World, from the north of Norway to southern Africa. It encircles our own islands, it broadens here and there, it is the edge of our continental area, and beyond it the Continent plunges into the abyss of ocean. The geologist sees in it, in all probability, the actual coast line of early Tertiary times after the great changes that had raised part of the bed of the cretaceous ocean into dry land: the coast line of an age when broad plains or chalky downs stretched over the North Sea. And now that subsequent and successive changes, in which again subsidence and upheaval have alternated, and the great ice sheet has scraped and scooped the North Sea and filled its bed to unknown depths with its drift and clay, now over the shallow slopes and levels that the 100-fathom line bounds, the fisherman finds his place and calling. Here and there in the world, as, for instance, off the coast of Portugal, are isolated deep-sea fisheries; here and there the adventurous trawler, or halibut-fisher, plies his craft on the deeper slopes of the continental shelf to 200 fathoms, or a little more; but, broadly speaking, the 100-fathom line bounds and limits the ordinary operations of the fisherman. Where that continental shelf narrows, the fisherman's field is narrowed; where it widens out, he finds an ampler range; and in the region of the White Sea and the Murman coast, the whole of our North Sea area, in a belt round our western coasts, a broad girdle round France, a narrow one off Portugal and Spain, here and there in Africa, as off Morocco and down in Greyhound Bay—in all of these regions the continental shelf or plateau extends its rich and productive bed a long way from the land, and yet but a little way into the territory of Ocean.

What I have called the gateways of the North Sea are not merely highways of commerce, they are the doors by which Ocean itself enters into the narrow seas, bringing with it its quickening influence on life, and its regulating and ameliorating effects on climate; and there have been times when one or another, or all, of these gates were closed. It is to the opening

or shutting of these gates, and of others leading to more southern seas, that the geologist ascribes much of the successive changes of climate and of fauna during Tertiary times.

The topography of the North Sea, as well as of our land, bears its fragmentary records of these old times. The Dogger Bank is perhaps but a great moraine, and over it (when the great ice-cap had passed away) roamed the rhinoceros, the reindeer, and the mammoth. The deep groove off Norway was probably in part a channel whereby the river system of eastern Europe ran seaward, in part an eddy, where the Scandinavian glaciers gripped and scooped their hardest, and, first of all, probably a great crumple in the earth's crust. In the Moray Firth a deep channel, more than a hundred fathoms deep, exists; it is the course by which an older and greater Spey ran tributary into an older and greater Rhine.

Apart from the great tidal waves that roll in twice a day from the ocean round by our northern and southern gates, the great dominating movement of our seas lies in the Atlantic current, or system of currents, that we commonly call the Gulf Stream. The Gulf Stream itself is a river in the ocean (as Maury called it); but partly as a river, and in part as a great, wide, slow-drifting flood, the warm waters of the bosom of the Atlantic creep ever northward and eastward to bathe our shores, and to soften the climate of sea and land in northern Norway and distant Spitzbergen. A little branch of the current enters in by the southern gate, a somewhat greater eddies round the north of Scotland, and under these two impulses (aided by local differences in the density of the waters of the North Sea basin) a circling current flows down our eastern coasts, across to Denmark, and in part out again along the Norwegian shore. The direct influence of this system of currents on the life of fishes is immense, for by its means their floating eggs and young are dispersed and disseminated broadcast. In the south those of the plaice and sole are carried over to their nursery grounds on the flat Danish shore; and in like manner the eggs and fry of the cod are drifted from the western coasts round the north of Scotland into the North Sea, and in part out again to the Sea of Norway.

Simply and clearly we may see by our chart the distribution of temperature in the North Atlantic, due, on one hand, to the Gulf Stream current, and on the other to the opposing currents from the pole, that bend westward in their southerly course and cool the Newfoundland Banks and the shores of the Eastern States, while a minor offshoot from the direction of Iceland, submerged beneath the warm Atlantic waters, approaches or invades our own seas. We see, in passing, the close-pressed isotherms on the Newfoundland Banks, where the two waters meet, and we may note, by the way, that it seems to be a fact that fish tend to accumulate just at such meeting places of different waters. But looking broadly at our own temperature phenomena the most striking points are: our western coast bathed by the warm current, the eastern remote from its influence; again, the rapid change of temperature from the favoured regions of southern Ireland and south-western England as we go farther north; and, lastly, the uniformity of temperature over the wide region that sweeps round from the North Sea by way of Iceland all round the North Atlantic to Newfoundland again.

The difference of temperature between our western or southern coasts and the eastern is in close relation with the great contrast between the fish of the two regions. Broadly speaking, to the former belong southern fishes, while fishes the home and distribution of which are in the north characterise the latter. There cannot be a more striking contrast than that between one of our fish markets and a market of Lisbon, Genoa, or Marseilles. The cod and the haddock, and nearly all their allies (save the hake) are absent from the latter; flat fish are few, and the great order of the spiny-finned fishes, the bream and the sea perch, the mullet, the gurnard, and a multitude of others, mostly alien to our markets and strange to our eyes, form the staple commodity. A difference, similar in kind though less in degree, exists between our western fisheries and those of the North Sea. The pilchard, the chief Clupeoid of the Atlantic coasts, finds its appropriate temperature on the Cornish coast, and rarely penetrates the colder waters to the east. The hake, which takes the place of the cod along the Atlantic seaboard, comes round indeed into the North Sea with the Gulf Stream eddy, but in meagre quantities. The bream, which both fresh and salted is an important food of the poor on the west of Ireland, is not in the North Sea an article of commerce. The trawlers that seek the coasts of the Spanish Peninsula and of Morocco find in these warm waters a fishery totally unlike that of the North Sea; while, on the other hand, our temperature curves make it plain and easy for us to understand how the North Sea has common attributes with regions so far off as the White Sea itself, with Iceland and Newfoundland and the Eastern States, and how our staple fishes, such as the cod, the haddock, the plaice and halibut, and the herring itself, find their extensive distribution in all these remote, but not dissimilar seas.

Lastly, ere we leave this matter of temperature, let me point out to you that the ocean not only acts in this part of the world as a warming influence, but also here and everywhere has a great steadying influence upon the temperatures. In another chart I show, not the mean temperatures, but the *range* of temperature, the difference between the summer heat of the sea and its winter cold. A little way west of Ireland the annual range of temperature is but 4°, and in Shetland it is but 6°; but the further we go into the narrow seas the more violent is the seasonal fluctuation, the greater is its range, until down in the German bight you have a range of at least 12° or 14° C., or 30° to 35° F. The water there is far colder in winter than in other parts of our sea. But there comes a great compensatory warmth in summer, which again has its influence in favouring this region as a nursery for young fish.

The problem of salinity, the distribution of the amount of salt in the sea, is a laborious one to investigate, but, so far as the North Sea goes, its main results are easy to understand. Some of you will see at a glance from this chart of Isohalines, how beautifully simple the arrangement is, and how perfectly it is in accord with the distribution of the three gateways of the sea, the two inlets of salt water, and the great Baltic source of fresh. But the further study of the salinity of the North Sea is very complicated indeed, for the mean condition which my chart represents is subject to change, and the changes are partly regular or periodic, and partly irregular and obscure. There is a constant battle, as it were, between the quantities of fresh water, on one hand, that the Baltic sends in, and the rivers bring down (for the former source especially tends to be dried up when the inland sea is frozen in winter time), and the varying supply of salt water from the ocean, for even the great ocean currents have their annual pulse, their ebb and flow. In the summer time over great part of the North Sea, water of low salinity spreads from the Baltic, and such changes as this have, we have every reason to believe, their close and intimate bearing on the migrations of the herring.

Lastly, together with these physical phenomena of

salinity, temperature, and current, we study the distribution of plankton, as it is called nowadays, the floating life of the sea. On his great voyage across the ocean, Darwin himself spoke of it as a weary waste of waters. It was but a few years afterward that Johannes Müller and others showed that every gallon of the waters over which we sail is a teeming world of microscopic life. A thousand varied forms people the surface waters. Some have their home around the shores, while others are denizens of the great ocean currents, and these coming more or less periodically within our reach, mark and render visible the currents to which they belong. These organisms are animal and vegetable, and among them the myriad tiny green algæ play their part in the economy of nature, renewing in the sunlight the oxygen of the sea, as the green herbage restores the balance of oxygen on land. Some few fishes, but fishes of great importance, feed all their lives upon plankton organisms, and their distribution is accordingly closely correlated with the abundance of these. The herring feeds, as many of the great whales do, on the teeming shoals of small crustacea that are especially characteristic of northern seas; the pilchard, which at times feeds on the same diet, is said to come to the Cornish coasts at the season when minute vegetable organisms reach their greatest abundance. But in early life all fishes whatsoever live on these floating microscopic organisms, on diatom and peridinian and copepod, while these same organisms are again the nutriment, direct or indirect, of the multitudinous worms and shellfish and crustacea on which the older fishes are in turn nourished. There is another and more difficult chapter still of the same story, relating to those yet smaller organisms, the bacteria, by the subtle alchemy of which the nitrogenous contents of the water are controlled, and which lay the first foundations of the ladder by which the inorganic elements pass into the fabric of living things. And lastly, among the elements of the plankton must be reckoned the egg and earliest stages of the vast majority of our food fishes. For it is an elementary and cardinal fact that, with the single important exception of the herring, every food fish of our seas lays eggs, tiny, globular, and transparent, which float in the surface waters of the sea. The eggs of the herring, on the other hand (as Walker showed in 1803, and as Goodsir and Allman re-discovered), are laid in sticky masses attached to weeds and zoophytes at the bottom. Here they are devoured in quantities by the haddock and other fish, and here they may at times be disturbed by the operations of the trawler, while the eggs of all the other food fishes float safely and undisturbed above.

But it is high time to pass to the fisheries of the nations bordering on the North Sea, and to consider their scale and magnitude in the briefest possible review.

Wherever there is sea-coast there are fishermen, and accordingly all the North Sea nations participate in the fishery; but the extent to which the fishery is pursued, its actual produce, and its importance relatively to the other sources of each country's wealth —all these things differ greatly.

Taking the last year (1908) for which statistics are easily available, Great Britain and the other five North Sea Powers bring to land some two million tons of fish a year; and of this great quantity Britain has for her share more than 60 per cent., Norway has 25 per cent., and the other four nations share among them 15 per cent. of the whole. Of the grand total catch of Great Britain no less than 84 per cent. is landed on the east coast of England and Scotland.

The composition of the catch is very different in different countries. I show you a diagram to illustrate how overwhelming is Norway's catch of cod; and another to illustrate the absence of plaice from the fisheries of that country, the small importance of this fish in Scotland, its greater importance in England, and its especial and peculiar predominance in Denmark. When we deduct our three staple fishes—herring, cod, and haddock—there remains less than 10 per cent. of the Scottish catch, a fifth of that of Holland, a third of that of England, about half of that of Denmark, two-thirds of that of Belgium.

When we translate the above catches into money-value, we find that six nations earn from their fisheries closely upon twenty millions a year (or say, 50,000*l.* a day), of which Britain takes 11,000,000*l.*, or actually about 62 per cent.; and that first return is probably trebled, or nearly so, by the indirect earnings and profits of the trade. The several shares are not alike in regard to quantity and value; for instance, Norway, with about a quarter of the total catch, has but an eighth of the total money-value, for her cod and herring are relatively cheap; while Denmark takes more than 4 per cent. in money in return for a little more than 2 per cent. in quantity, for her plaice and eels are costly fish.

But without pressing statistics further, it is plain that the small or even petty shares which certain countries earn from the fisheries are far from being less vital to them than is our greater share to us. It was common for our older writers of two centuries ago to attribute the wealth of Holland wholly, or almost wholly, to the herring-fishery. "It is almost wholly from the Herring-fishery," says one, "that they have raised a country labouring under the disadvantage of intemperate air, excessive Expense in maintaining their Dykes, and want of almost all those Necessaries in which we so greatly abound, to that Plenty, Wealth, and Power they at present enjoy." And when Charles V. made his pilgrimage to the tomb of the man who, long generations before, had invented pickled herrings, he manifested a similar belief. If no nation be nowadays so exclusively dependent on this or any other single industry, yet we may easily realise that, wealth and population considered, the two millions that Norway earns, or the three-quarters of a million that Denmark earns, from her fisheries, are, more even than in our case, of indispensable and immeasurable importance to the support and well-being of the people.

When we come to consider the quantities of fish that come from the North Sea, we find that England, in spite of the distant voyages that some of her trawlers make, and in spite of the considerable fisheries of her western and southern coasts, still takes two-thirds of her whole fish supply from that great fishing ground, the North Sea. Scotland takes an even greater part, more than four-fifths of the whole, and Holland, whose herring fishers go as far as Shetland, does not go beyond, and takes practically the whole of her fish from the North Sea area. Germany, on the other hand, takes only half her supply from the North Sea, the rest coming from the Baltic, and in part from her Iceland and other deep-sea trawlers. Denmark, again, gets the bulk of her supply from her Baltic coasts; and Norway, whose greatest fisheries lie far north upon her Atlantic shores, takes only one-fifth of her total catch from the North Sea.

Numberless methods are employed for the capture of fish, numberless modifications of bait and trap, of net and line; but for our purposes we may speak particularly of three only, the methods of the line-fisher, the fisher of nets, and the trawl fisherman. In each one of these methods great changes have taken place within recent memory, changes that have

revolutionised the industry and brought far-reaching consequences to the lives and prosperity of the fishermen.

Eighty years ago there was not a single first-class fishing-boat, not a single fishing-boat more than 30 ft. long, in Scotland. Thirty years ago there were more than 5000 such, and our Board in its first Report said, even then, that there had been a revolution in the industry. But another and a greater revolution had yet to follow, for trawling was then in its infancy, and steam had scarce begun to oust the sailing-boat. We have now in England some 1300 steam trawlers, in Scotland about 300, and about 400 more in the rest of northern Europe. Besides this, we have in Scotland about 1100 steam fishing-boats other than trawlers—mostly herring-drifters, the value of which is about 2½ millions of money; England has between 500 and 600 of these, and the rest of northern Europe at the last statistics about 150.

Steam and ice and railway facilities have done, in the last generation, for the fisheries what steam had done for the spindle and the loom: to the immense advantage of the people at large, and with the inevitable accompaniment of loss to some. But in the case of the fisheries, the loss and hardship have been tempered and attenuated by the fact that the great herring industry has, in great measure, escaped the tendency to concentration, both in regard to locality and in regard to capitalisation. Even the large steam-drifters, costing more than 2000*l.* a-piece, are, to a very large extent, the property of the fishermen themselves. The fishermen remain free men; they are independent, industrious, and prosperous; and, speaking at least for Scotland, though there are fewer fishermen than there were forty years ago, I think there can be no doubt that their prosperity as a class was never greater than it is now.

Let me say a word about the herring fishery. The herring constitutes more than two-thirds of the total quantity of fish landed in Scotland, and considerably more than half the value of the whole; and in Holland the numbers are all but identical. In England, on the other hand, it represents less than one-third of the entire quantity, and about one-eighth of the total value. If we deduct trawled fish, and deal only with the produce of the less capitalised industry, the industry of the men of net and line, then the comparison becomes still more striking; for we find that in Scotland 87 per cent. of the catch of such fishermen, and 83 per cent. of its value, are contributed by the herring alone. It is, and always has been, the mainstay of our fisherfolk.

There are many ways of catching herring. In the shallows of the Baltic Sea they capture them with fixed nets, forming great complicated traps. In Norway, in America, and to some extent on our west coast, they encircle them with a seine, after the manner of the pilchard fishery. But the great North Sea fishery is by means of the drift net, roped and buoyed, which forms a vertical wall, miles long, against which the shoal swims, and the fish are caught fast by the gills. Two hundred million square yards of netting are used in our Scotch herring fishery. The net is only a narrow strip, but make it into a single square, and it would more than cover London.

The herring is a northern fish, but it is one of the most widely distributed of fishes. It surrounds the North Atlantic, and even extends into the Pacific, where it forms one of the chief fisheries of Japan. But even in our own area the herring are not all alike, but fall into several well-marked varieties, or separate races. We have, for instance, the winter-herring, that breeds close inshore in early spring, loving water that is but little salt; and in the North Sea we have several races of such herring as this. Then we have another and greater sort, or set of races, that breed in summer and autumn, and these the fishermen follow throughout the year. They begin in spring or early summer to fish in the Hebrides a great herring the home of which is in the Atlantic; a month or so later the fleets are in Shetland, first on the west and afterwards on the east coast; in the height of summer and early autumn the Scotch east coast fishery is at its height, and by taking the average of many years we can precisely mark the successive dates, following each other week by week, or day by day, when the fishery culminates at successive points more and more to the southward along the coast. By October the fishery of the north-east coast is over, and the fleets are gathered at Lowestoft and Yarmouth, but here the herring that they capture is of another and a smaller race; and in the winter-time yet another, but lesser fishery, occurs in the Channel. I show you a few pictures of the busy times of the herring fishery.

The great bulk of the produce of the herring goes abroad, most of it by Königsberg and Danzig and Stettin, to those Eastern provinces by the Oder and the Vistula, where even in Strabo's time dwelt the tribe of the Ichthyophagi. But our own food-supply comes mainly from those fishes which, unlike the herring, dwell at the bottom of the sea, and are caught, not by net, but by trawl and line. Of such fish the trawler brings in everywhere nowadays the bulk of the supply. In Scotland, owing to the growth of steam-lining, he accounts for but 75 per cent. of the whole, but in England the trawler yields us 93 per cent. of these so-called "demersal" fish, such as the cod and the haddock, the plaice, turbot, and sole: of the last, indeed, he gives us every one. Hence the great modern concentration of this industry in a few great harbours and markets, such as Grimsby and Aberdeen. I show you a diagram of the percentage of all such fish (all fish other than herring) monopolised by Aberdeen alone, which, thirty years ago an unimportant fishing station, now provides us with about 70 per cent. of the whole Scottish supply.

The English trawling industry, far as it extends, is still busiest and most intense in the region of the Dogger Bank, where every square mile yields more than five tons of fish in a year. But this is by no means the richest part of the North Sea, for, measured by the daily catch of a trawler, the quantities steadily increase as we go northward; the kinds, however, are different, and it is the cheaper and coarser fish that swell the northern catch. But I can speak no more on this subject; I can only show you a few pictures to illustrate the great market of Aberdeen, where 400 tons of fish or more are laid out every morning of the year, a market, however, which Grimsby still surpasses in magnitude. And, by the way, we had an average of 650 tons in Aberdeen every morning of last week.

I have spoken, ever so briefly, of the North Sea as it appears to the topographer and the physicist, and of the fisheries as the economist and statistician deal with them, but I have said even less of the special studies of the biologist. He has to deal with and investigate, for instance, all the questions appertaining to the food of fishes, to their rate of growth (by means of the rings upon their scales, the concentric zones of their ear-bones, and in other and more indirect ways); by marking living fish he studies their migrations and their diverse rates of growth on different grounds; and he inquires into the question of their local races and varieties, and all the complex problems connected with their multiplication and their distribution.

In the end we come back to the ultimate problem of all, the most practical and urgent of problems, the

statistical question, whether the fish in our seas are being diminished in number by the operations of man. A whole lecture would scarce be enough for me to explain to you the difficulties of this problem, the methods by which it is attacked, and the preliminary conclusions which we may more or less confidently affirm. Let me say this in a word, that there is no one answer to the question, but that we must separately set and answer it for each species of fish, and even for this or that particular ground. More than a hundred years ago, when our fisheries were trivial, the haddock deserted our coasts, and became, for the time being, a rare fish. Again, in 1866, long before steam-trawling began, Huxley's Commission reported that the haddock was the only fish of which it might perhaps be said or shown that its numbers had suffered diminution. In Great Britain alone, we take 100,000 tons of haddock a year from the North Sea, and, in spite of fluctuations, I cannot find that its numbers perceptibly or significantly diminish. The cod shows no signs of recent diminution, and has even been increasing in the north. It is otherwise with the plaice, the diminution of which was already made clear to the Committee of 1893. All authorities are agreed that this fish shows serious diminution; and only next month our International Council meets at Copenhagen to take in hand, after long investigation, this important and burning question. The plaice is of small comparative importance to us in Scotland, for, as I have already shown you, our plaice are few; but even in Scotland our statistics tell us that the diminution of this fish, and especially of the large plaice, has been great and rapid.

Many important questions I have had to leave untouched in this hurried sketch, but on one of these I must yet say a word, I mean the case of the small fisherman. We have seen in many ways that the industry as a whole tends towards concentration, to the use of larger boats, to the need of greater harbours; tends, in the case of line and trawl fishing, to gravitate towards the great centres of population and the great highways of traffic. And we have seen that an overwhelming proportion of the gain goes to those who work the fisheries on this larger scale, and that from their labours comes an overwhelming proportion of the supply. But there are still some 6000 small fishing-boats in England and 8000 in Scotland, and (though it is impossible to obtain exact figures) I think that about one-seventh or one-eighth of the 35,000 fishermen in Scotland, and a somewhat larger proportion of those in England, still live, as their fathers lived, by a petty industry, an industry closely akin to that by which thousands of men in Norway and Denmark live. With us they are the men who have been left behind, sometimes from lack of energy, often through poverty or the remoteness of their habitations, by the tide that has carried so many of their fellows to wider efforts and to comparative wealth. They are the fishers of crab, and shrimp, and lobster, the hand-line fishers of plaice and haddock and codling, the men who take, now and then, a day at the lines, a night at the herring, the dwellers in the antiquated harbours and in the tiny creeks of outlying coast and distant island. The kindliest of Scotch proverbs tells us that "it takes all sorts to mak' a world," and these men have their claim upon us and their right to live. It is not too much to say that nowadays every fishery department in the kingdom is making these men's case the subject of its anxious and peculiar care.

It is partly for biological reasons, connected with the preservation of the general supply of fish, but it is in great part for these men's sake, and for the line-fishers in general, in order that they may have a stretch of waters of their own, that we close against the trawlers the territorial and more than the territorial zone. When we close to trawling the waters of a shallow and sandy coast or bay, we are, on one hand, encouraging the lesser fishermen of the coast, and, on the other hand, we are trying to protect the young fish, flat-fish especially, whose nature it is to congregate on such grounds.

In some ways I think that the fishing industry, and the trawling industry in particular, may justly and rightly, and for the general good, have to submit in the future to greater restrictions than in the past—restrictions especially aimed, for the benefit of the industry itself, at lessening the waste of the younger fish. But, as Huxley said years ago, "Every legislative restriction means the creation of a new offence; means that a simple man of the people, earning a scanty livelihood by hard toil, shall be liable to fine and imprisonment for doing that which he and his fathers before him had, up to that time, been free to do!" Science, practical policy, and the interests of class and of constituency do not always tell the same story. And if responsibility be great upon the legislator, it is scarcely less upon the scientific inquirer, who, without pressing his side of the case too far, nor thinking that his opinion is all in all, must yet play a considerable part in reporting upon the merits of all fishery legislation, and in advising as to what had best be done, what it were better to leave undone, in the best light of his judgment, and with regard to the best interests of all.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

LONDON.—The following scheme of inter-collegiate advanced work in physiology has been approved for the Honours B.Sc. Examination:—First Term, October-December, 1912:—Guy's Hospital: "Respiratory Exchange," by M. S. Pembrey; "The Chemistry of Blood," by E. L. Kellaway and J. H. Ryffel. Second Term, January-March, 1913:—University College: "Activity of Enzymes and Physiological Chemistry pertaining thereto," by Prof. Wm. Bayliss, F.R.S., and R. H. A. Plimmer. St. Bartholomew's Hospital: "Central Nervous System of Electrocardiography," by J. S. Edkins, C. M. H. Howell, or E. P. Cumberbatch. Third Term, May-July, 1913:—King's College: "Physiological Chemistry of Nervous and Muscular Tissues," by Prof. W. D. Halliburton, F.R.S., and O. Rosenheim. Bedford College: "Advanced Physiological Histology," by J. S. Edkins and Miss M. Tweedy. Internal students of the University are free to attend all the courses.

Mr. A. H. Cheatle has been appointed to represent the University at the ninth International Otological Congress, which is to be held at Harvard University on August 12–17, and Sir G. Newman and Dr. Janet Lane-Claypon will be present in a similar capacity at the fifteenth International Congress of Hygiene and Demography at Washington on September 23–28.

An exceptional renewal for a third year of the science research scholarship held by Mr. E. N. da C. Andrade has been made by the 1851 Exhibition Commissioners, the scholarship held by Mr. H. T. Clarke has been renewed for a second year, and one has been awarded to Mr. H. T. Page for the ensuing year.

The Department of Technology of the City and Guilds of London Institute has issued its programme for the session 1912–13, containing regulations for the registration, conduct, and inspection of classes, the examination of candidates in technological subjects, and for the award of teachers' certificates in manual training and domestic subjects. The altera-

tions are not numerous, and chiefly concern the scope of certain of the schedules of work in technological subjects. We notice that by arrangement with the Postmaster-General, the institute will next year hold a special examination in magnetism and electricity for members of the Post Office staff, in connection with its examinations in telegraphy and telephony. The institute has been approved also by the Home Secretary for the purpose of granting certificates under the Order of February last prescribing the qualifications of surveyors for the purposes of the Coal Mines Act, 1911.

OXFORD.—The following members of Convocation have been appointed members of the new Board of Finance recently constituted by special legislation at the University, in pursuance of the scheme presented by the Chancellor, Lord Curzon of Kedleston, in 1908, and accepted by Council, Congregation, and Convocation:—The Right Hon. Sir George H. Murray, the Hon. Sidney Peel, Mr. F. W. Pember, the Dean of Christ Church (Dr. Strong), Mr. G. E. Baker, Mr. F. C. Miles, the Right Hon. F. Huth Jackson, Mr. H. T. Gerrans, and Mr. E. Armstrong. The first three gentlemen were nominated by the Chancellor, the next three were elected by Convocation, and the last three were nominated by Council.

MR. J. GOLDING has been appointed research chemist in dairying at University College, Reading. As stated in our issue of July 11, Dr. S. J. M. Auld has been appointed professor of agricultural chemistry at the same institution.

A SUMMER School of Geography is to be held in Yorkshire in August of next year. The school is being promoted by the Universities of Durham, Leeds, and Sheffield, in cooperation with the County and Borough Education Committees of Yorkshire.

MR. A. A. BOWMAN, lecturer in logic at Glasgow University, has been appointed professor of philosophy in the University of Princeton, New Jersey, in succession to Prof. J. G. Hibben, lately appointed president of the same University.

THE sum of 10,000*l.* has been given to the Chancellor of the Exchequer by a Welsh gentleman whose name has not transpired, for the furtherance of higher education in Wales. Of this amount the National Museum, Cardiff, is to receive 3000*l.*, the University College of Wales, Cardiff, 2000*l.*, and the National Library, Aberystwyth, 5000*l.*

NEW science laboratories at Cranleigh School, Surrey (the gift of Sir C. Chadwyck-Healey), were recently opened by Sir William Ramsay, K.C.B., F.R.S., who, in the course of his remarks, said that the effect of the laboratories would be to make it clear to them all that chemical discoveries were not at an end. It was not well, however, for the scholars to confine themselves to one subject only. They should strive to be as good as possible in many things, though they might excel only in one.

WE are informed that as a result of the efforts which have been made during the past two years a sum of 32,000*l.* is now available for the provision of new buildings for the Hartley University College, Southampton, and towards increasing its endowment. The larger portion of this sum has been promised by private individuals, but recently 2500*l.* has been promised by the Hampshire County Council, and 5000*l.* by the Southampton Borough Council. In addition to this the Southampton Borough Council has voted an additional 1*d.* rate for the college. The erection of the first block of new buildings, to provide accommodation for the arts departments of the college, can now be begun. A site has been obtained on high ground, not far from the Southampton Common, and it is confidently anticipated that the transference of the college to its new quarters will result not only in a large increase in the number of students, but also in a greatly enhanced interest on the part of residents in the southern counties in the question of the maintenance of a centre of university education in Southampton.

## SOCIETIES AND ACADEMIES.

### PARIS.

**Academy of Sciences,** July 22.—M. Lippmann in the chair.—M. **Bassot**: The preparation of a map of western Morocco on the scale of 1/200,000. Details are given of the measurement of the base and triangulation carried out up to the present. The work will be continued in October.—A. **Müntz** and H. **Gaudechon**: The degradation of phosphatic manures in the soil. From the experiments described it is shown that phosphatic manure should be given annually. Larger amounts than those required for one year are degraded to a non-assimilable form.—Paul **Sabatier** and Alph. **Mailhe**: The catalytic preparation of the phenolic and diphenylenic oxides. Mixed oxides. The method is based on the catalytic action of thorium oxide at 380° to 450° C., and examples are given of the ethers prepared in this way.—M. **Amann**: Observation of the solar eclipse of April 16 and 17, 1912, at the Observatory of Aosta, Italy.—L. **Ancel**: The photometry of the solar eclipse of April 17, 1912, with the aid of selenium and a recording galvanometer. The curve obtained during the eclipse is reproduced.—Louis **Dunoyer**: The disruptive discharge through pure sodium vapour.—P. **Noguès**: A new kinematograph. The instrument described can take 180 images per second, and has been applied to the examination of certain movements in running, jumping, and flight.—A. de **Gramont**: The ultimate lines and great sensibility of chromium, manganese, iron, nickel, and cobalt.—Félix **Bidet**: Equilibrium of the system ammonia gas and ethylenediamine chlorhydrate.—J. Larguier des **Bancels**: The solubility of coloured resinates submitted to the action of light.—A. **Guasco**: The detection of small proportions of carbon monoxide in air.—V. **Hasenfratz**: The hydrogenated derivatives of apoharmine.—G. **Vavon**: The catalytic hydrogenation of the ketones. An account of the products obtained from various ketones when acted upon by hydrogen in presence of platinum black. The course of the reaction depends upon the liquid in which the ketone is dissolved.—Edouard **Bauer**: The action of sodium amide upon 1 : 4-dibenzoylbutane.—F. **Jadin** and A. **Astruc**: The presence of arsenic in some parasitic plants and their hosts. Parasitic plants, like those growing directly on the soil, contain normally a small proportion of arsenic. There is no apparent connection between the proportions of arsenic present in the parasite and its host.—E. **Chuard** and R. **Mellet**: Variations in the proportion of nicotine in various organs of the tobacco plant in the course of growth.—M. **Gard**: The possibility and frequency of autofertilisation in the cultivated vine.—J. **Tournois**: The influence of light on the flowering of the Japanese hop and of hemp.—E. C. **Teodoresco**: The assimilation of nitrogen and phosphorus by the lower algæ.—I. **Pouget** and D. **Chouchak**: The law of the minimum. A discussion of a recent note by M. Mazé on the relations between a plant and its nutritive medium.—J. **Giaja**: The ablation of the pancreas in *Haliaetus albicilla*.—Pierre **Girard**: The electric charge of the red corpuscles of the blood. Measurements of the velocities of the red corpuscles in an electric field in isotonic solutions of saccharose, common salt, and serum.—Jean **Camus**: The toxicity of

mineral salts in the cephalo-rachidian fluid.—N. A. **Barbieri**: The non-existence of free or combined lecithines in yolk of egg and in biological structures. —Mme. and M. Victor **Henri**: Variation of the abiotic power of the ultra-violet rays with the wave-length. The abiotic power of the ultra-violet rays increases as the wave-length diminishes. There is no indication of a maximum.—Maurice **Holderer**: The mechanism of the arrest of diastases by filtration.—Em. **Bourquelot** and Marc **Bridel**: The reversibility of fermentations. The influence of the dilution of ethyl alcohol on the synthetic action of emulsin in this medium.—M. **Kœhler**: The Echinoderms of the Charcot expedition. —J. L. **Dantan**: The working of the genital gland in *Ostrea edulis* and *Gryphaea angulata*. The protection of natural oyster beds.—E. **Boullanger** and M. **Dugardin**: The mechanism of the fertilising action of sulphur.—Ed. **Dujardin-Beaumetz** and E. **Mosny**: The evolution of the plague in the marmot during hibernation.—J. **Vallot**: The comparative absorption of the chemical and heat radiations of the sun between Mt. Blanc and Chamonix.

### New South Wales.

**Linnean Society**, May 29.—Mr. W. W. Froggatt, president, in the chair.—Dr. R. **Greig-Smith**: Contributions to our knowledge of soil-fertility. No. 5. The action of fat-solvents upon sewage-sick soils. Experiments are brought forward to show that the action of the volatile disinfectants upon sewage-sick soils is to segregate or translate the fatty material which, in the soil under examination, constituted 19 per cent. of the volatile and organic matter. The lower layers of treated soil gave greater bacterial growths than the upper, into which the fatty substances had been carried by the evaporating solvent. When the soil was heated at 62° C. to kill off phagocytic protozoa, subsequent treatment with chloroform caused a very much increased growth of bacteria.—J. H. **Maiden** and E. **Betche**: Notes from the Botanic Gardens, Sydney. No. 17.—C. **Hedley**: Some land-shells collected in Queensland by Mr. Sidney W. Jackson. Primarily in quest of ornithological material and information on behalf of Mr. H. L. White, of Belltrees, Scone, Mr. Jackson visited the coastal districts of Queensland from Brisbane to Cairns in 1908. A large collection of land-shells was also gathered, a portion of which is treated of in this paper, including nineteen species, of which eleven and two varieties are described as new.—C. **Hedley** and A. F. Basset **Hull**: The Polyplacophora of Lord Howe and Norfolk Islands. Nine species referable to the five genera, Chiton (3), Ischnochiton (1), Ornithochiton (1), Acanthochites (2), and Lepidopleurus (2), are described as new, of which four are peculiar to Lord Howe Island, three to Norfolk Island, and two are common to both localities. None of them extend either to the mainland of Australia or to New Zealand, although two species are very closely allied to mainland species.

## *BOOKS RECEIVED.*

Aus dem Luftmeer. By M. Sassenfeld. Pp. iv+183. (Leipzig and Berlin: B. G. Teubner.) 3 marks.

Einführung in die Biologie. By Prof. K. Kraepelin. Dritte Auflage. Pp. viii+356. (Leipzig and Berlin: B. G. Teubner.) 4.80 marks.

English History Illustrated from Original Sources, 1066–1216. By N. L. Frazer. Pp. xvi+234. (London: A. and C. Black.) 2*s*. 6*d*.

The Task of Social Hygiene. By H. Ellis. Pp. xv+414. (London: Constable and Co., Ltd.) 8*s*. 6*d*. net.

Studien an intracellularen Symbionten. I., Die intracellularen Symbionten der Hemipteren. By Dr. P. Buchner. Pp. iv+116+Taf. 1–12. (Jena: G. Fischer.) 18 marks.

The Formation of the Alphabet. By Prof. W. M. Flinders Petrie. Pp. iv+20+ix plates. (London: Macmillan and Co., Ltd., and B. Quaritch.) 5*s*. net.

Les Alpes de Provence. By G. Tardieu. Pp. iv+310. (Paris: Masson et Cie.) 4.50 francs.

The Grouse in Health and Disease. Edited by A. S. Leslie, assisted by A. E. Shipley. Popular Edition of the Report of the Committee of Inquiry on Grouse Disease. Pp. xx+472+plates. (London: Smith, Elder and Co.) 12*s*. 6*d*. net.

Libya Italica. Terreni ed Acque, Vita e Colture della Nuova Colonia. By P. V. de Regny. Pp. xv+214. (Milano: U. Hoepli.) 7.50 lire.

Le Zebre. By Dr. A. Griffini. Pp. xxviii+298+41 plates. (Milano: U. Hoepli.) 4 lire.

Festschrift W. Nernst zu seinem Fünfundzwanzigjährigen Doktorjubiläum Gewidmet von seinen Schülern. Pp. vi+487. (Halle a.d.S.: W. Knapp.) 21.60 marks.

Problems in Eugenics. Papers Communicated to the First International Eugenics Congress, held at the University of London, July 24–30, 1912. Pp. xix+490. (London: Eugenics Education Society.) 8*s*. 6*d*. net.

An Introduction to the Chart of the Elements. Second Edition. Pp. 43+chart. (London: The Metallic Compositions Co.) 3*s*. 6*d*.

## FORTHCOMING CONGRESSES.

AUGUST 22–28.—(i) International Congress of Mathematicians, and (ii) International Commission on Mathematical Teaching. President: Prof. Klein. Treasurer: Sir J. Larmor, F.R.S., St. John's College, Cambridge.

SEPTEMBER (first week).—International Congress of Anthropology and Prehistoric Archæology. Geneva.

SEPTEMBER 4–11.—British Association. Dundee. President: Prof. E. A. Schäfer, F.R.S. Assistant Secretary: O. J. R. Howarth, Burlington House, London, W.

SEPTEMBER 4–13.—International Congress of Applied Chemistry. Washington, D.C. President: Dr. W. H. Nichols. Secretary: Dr. B. G. Hesse, 25 Broad Street, New York City, U.S.A.

SEPTEMBER 8–11.—Société Helvétique des Sciences Naturelles. Altdorf. President: Dr. P. B. Huber. Secretaries: Prof. J. Brülisauer (German) and M. P. Morand Meyer (French), Altdorf.

SEPTEMBER 23–28.—International Congress on Hygiene and Demography. Washington. President: Dr. H. P. Walcott. Secretary-General: Dr. J. S. Fulton, Army Medical Museum, Washington, D.C.

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