THURSDAY, AUGUST 14, 1913.

MATHEMATICS IN CHINA AND JAPAN.

The Development of Mathematics in China and Japan. By Yoshio Mikami. Pp. x+348. Leipzig: B. G. Teubner; London: Williams and Norgate, 1913.) Price 18 marks.

THE time has not yet come for anything like a complete or final history of mathematics in the Far East; meanwhile Mr. Mikami's work will be welcomed as being practically the first book on the subject accessible to Europeans. Its contents are unavoidably miscellaneous, but there are two or three topics on which some remarks can be made.

First of all we find, as usual, that in the earliest periods there is a special calculating apparatus, which dominates not only methods of computation, but forms of mathematical thought, for many generations. In the case of China this consisted of a board ruled in columns, and a set of calculating sticks or counters. So far we have the equivalent of the abacus; but there is a very important modification, apparently familiar at least as early as 50 B.C. Red counters were used for additive, and black for subtractive numbers, so there was a visible distinction between $+a$ and $-a$ of a most convenient kind.

An abacus does not lend itself to calculation with vulgar fractions, and strangely enough it failed to suggest decimals. However, the Chinese appear to have been in possession of all the rules for working with vulgar fractions as early as the middle or later half of the sixth century, although it was confessed a difficult subject even by learned men. In this respect they were 1000 years or so ahead of Europe. Unfortunately Mr. Mikami does not give any account of the notation (if any) used for fractions at this date.

Approximations to π occupied the attention of many mathematicians both in China and in Japan. Perhaps the most remarkable fact in this connection is that Tsu Ch'ung-chih (A.D. 430–501) calculated π in an Archimedean manner, arriving at upper and lower limits 3·1415927 and 3·1415926. In some unknown way he hit upon the values 22/7 and 355/113, which he called the inaccurate and accurate values respectively. The appearance of this celebrated value 355/113 at so early a date is very remarkable. It may be added that $\pi = \sqrt{10}$ occurs before A.D. 139, and that many Chinese and Japanese have calculated π to a large number of places of decimals.

Another striking thing is that the Chinese seem to have practised Horner's method of solving numerical equations in the thirteenth century (see pp. 74–8). In fact, both Chinese and Japanese constantly use the principles of reversion of series and successive approximation. We can venture to smile at Mr. Mikami's hint that it is "not impossible" that Europeans may have known of the Chinese method; but while doing so we must be careful not to accuse our Eastern kinsmen of borrowing without acknowledgment, unless due evidence is at hand.

There is, in fact, an extraordinary instance of independent discovery, upon which Mr. Mikami makes no remark, but which appears to be absolutely certain, unless somebody has committed an ingenious and elaborate fraud. Early in the nineteenth century Steiner published some extremely elegant results about rings of touching circles (or spheres) touching two given circles (or spheres). His proofs depend partly upon using the method of inversion, so as to change one of the fixed circles (spheres) into a line (plane). Under certain conditions we have a poristic ring of variable touching circles. Now on pp. 238–46 of the present work Mr. Mikami gives a summary of work by the Japanese Ajima Chokuyen, dated 1784, where Steiner's problem for circles is discussed without inversion, and the algebraic conditions are given (in their simplest form) for poristic rings of n circles when $n=3, 4, 5, \ldots 10$: and the method is general enough for the condition to be calculated in any case.

Various problems are given from time to time. Some of these are of a familiar type, and may be of Indian or even Egyptian origin (*e.g.* we have a variation of the sloping reed question). Others, especially of the Japanese, are evidently of native origin—suggested by toys, jugglers' tricks, and so on.

Matters of more general interest are a rule for finding out whether an expected child is to be a boy or a girl, the author's interview with one of the last great Japanese mathematicians of the older school, and lastly the title-page, which is a very significant document. Written in English by a Japanese, the book has been revised by an American professor and published by a German who has probably done more than any of his craft for the spread of scientific literature. The language is that of the lazy lion; the rest belongs to the lands of the two eagles and the rising sun. Let the lion beware lest reflection show him that he has an ass's head.

The reviser, Prof. G. B. Halsted, has shown admirable taste in not converting Mr. Mikami's idiom into standard English. In some cases it is rather difficult to understand the author's explana-

tion of obscure rules and processes; but, on the whole, the impression produced is that the greatest of modern tongues is branching off into a new and picturesque variety, destined to flower in due course as it passes from science to poetry.

G. B. M.

TECHNOLOGICAL CHEMISTRY.

A Dictionary of Applied Chemistry. By Sir Edward Thorpe, C.B., F.R.S. Assisted by Eminent Contributors. Revised and enlarged edition. Vol. iv. Pp. viii+727. (London: Longmans, Green and Co., 1913.) Price 45*s.* net.

THE fourth volume of Sir Edward Thorpe's well-known "Dictionary of Applied Chemistry" covers subjects ranging from oilstone to soda nitre. Among the longer articles are those dealing with some important oils, paints, opium, oxygen and ozone, paper, paraffin, petroleum, photography, platinum, polarimetry, potassium, pottery, quinones, radio-activity, rubber, saponification, sewage, silicon, silk, silver, smoke, soap, &c.

The first edition of this work has won for itself a well-deserved place in the library of the consulting chemist. A book of this description cannot be reviewed adequately by one writer, even after making due allowance for the omniscience of reviewers generally. Each important subject appears to have been written by a specialist, and accordingly none but a specialist in a particular subject is competent to express an opinion on the merits or demerits of each of the articles. I must say, however, that after reading those subjects in which I myself am more particularly interested, I have formed the opinion that the new edition of the dictionary will supplant the old one, not merely because it brings the subject-matter up-to-date, but also because it is a higher-class production. There seem to be very few misprints, and, without taking up the rôle of a schoolmaster correcting exercises, I must confess that I did not like the phrase "monoatomic chemical reaction" in the article on radio-activity (p. 535)—it is my opinion that "monomolecular," or better, "unimolecular," should have been written.

This dictionary—as perforce all dictionaries—is not likely to be consulted by a specialist in his own particular subject, since the articles are too brief for that; but it will prove exceedingly useful when it is necessary to look up outside subjects, because the main facts and principles are not here befogged with detail, as would be the case if reference were to be made to a comprehensive monograph. The book will also prove very useful for the university or college student of general technological chemistry. It is not easy to name a text-book which covers this ground adequately. Such a text-book could certainly not be properly written by any one man, or indeed, by any half-dozen men. A writer of a general treatise is almost certain to err when he attempts to describe unfamiliar processes by paraphrasing the writings of those who know. Pottery as described in treatises on general chemistry might be cited in illustration. One excellent text-book on chemistry has some eight lines on the subject, and in those eight lines there are five mistakes of fact! A student of technological chemistry working through the special articles in this dictionary has some assurance that the articles are written by men who have first-hand knowledge, and his confidence is accordingly well founded.

J. W. MELLOR.

CLIMATOLOGY.

(1) *Das Klima.* By Dr. Eugen Alt. Bücher der Naturwissenschaft herausgegeben von Prof. Siegmund Günther. 12 Band. Pp. 136. (Leipzig: Philipp Reclam, jun.) Price 1.50 marks.

(2) *Aus dem Luftmeer.* Meteorologische Betrachtungen für mittlere und reife Schüler. Von Max Sassenfeld. Pp. iv+183. (Leipzig und Berlin: B. G. Teubner, 1912.) Price 3 marks.

(3) Contribution a l'Etude des Relations existant entre les Circulations Atmosphériques, l'Electricité Atmosphérique et le Magnétisme Terrestre. By Alfred Vialay. Pp. viii+203. (Paris: H. Dunod et G. Pinat, 1911.)

(4) *Meteorology: A Text-book on the Weather, the Causes of its Changes, and Weather Forecasting.* For the Student and the General Reader. By Prof. W. I. Milham. Pp. xvi+549+50 charts. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 19*s.* net.

(1) IN this little book Dr. Alt seeks to give an account of the fundamental principles and facts of climate, and its importance in the development of civilisation. The first four sections deal with the methods of climatological research, and with the climatic elements, temperature, wind, rainfall, and humidity in their relations with each other, and their distribution in time and space. In the next two sections the author considers climatic zones, viz., polar, cool temperate, warm temperate, tropical with small rainfall, and tropical with one wet season or two wet seasons. The seventh section is devoted to types of climate, land and sea climate, mountain climate, and after

brief notes on variations of climate, and on climate culture, he concludes with an account of the climate of each of the five continents. The book is well written and arranged, and the author has made discriminating use of recent investigations.

(2) It is a commonplace that men seize upon the exceptional and regard it with especial interest while they let pass unobserved the beautiful and wonderful processes which are taking place every day. Herr Sassenfeld has written his book with the object of stimulating and guiding the youth of Germany in the observation of the recurring phenomena of meteorology, which may be for all, as they are already for some, a source of interest and pure delight.

In fewer than 200 pages the author covers the whole ground of meteorological observation and investigation: he devotes a chapter to the temperature of the upper atmosphere, giving Wagner's results for the temperature at heights of 1, 2, . . 10 km. for January and July, and for the whole year. In a small table he indicates the characteristic lag in annual variation of temperature by showing how the difference between the autumn and spring temperatures increases with altitude. Special attention is given to clouds, and three excellent illustrations of different types are reproduced from photographs lent by Dr. Süring, of Potsdam. Pressure is introduced in the middle of the book, after temperature, water vapour, dew, hoar frost, clouds, and rainfall have been considered. Although pressure is of fundamental importance in the study of meteorological processes, it introduces an idea which is strange to the mind and difficult of apprehension; and it is probably wise to impart some knowledge of the meteorological phenomena which affect human life most directly before seeking to teach the bases of dynamical meteorology. Wind, types of weather, and electrical and optical phenomena are next discussed in turn, and an appendix contains a valuable set of monthly rainfall normals for about forty places. The book is printed in Gothic type.

(3) This is a discursive book which shows that the author has read very widely: he deals with the atmospheric circulation in winter and summer in the northern and summer hemispheres, and shows that he is acquainted with most of the literature on the subject. In the second and third sections he deals with atmospheric electricity and terrestrial magnetism, in which he is equally widely read and up-to-date: he includes, for example, a page on Simpson's results regarding the electricity of rain, and proposes his own interpretation of them. The author disagrees with or disparages a large part of the work in meteorology of men like Ferrel and Helmholtz, but there is no evidence of his ability to succeed in solving the problems in which he concludes their work failed. His book may, however, be very useful for the references which it contains. Many of these are not found in current works, *e.g.* the reference on p. 118 to Beale's observations of the diurnal variation of the barometer in 1666.

(4) Prof. Milham has made an excellent plan for his text-book of meteorology. To each chapter is prefixed a table of headings and subheadings, which indicate the scope of the text: each chapter is followed by sets of questions, of topics for investigation, of practical exercises, and of references to the more recent and directly important works and researches on the special subject of the chapter. The book extends to more than 500 pages of text, in addition to a number of plates reproducing beautiful photographs of clouds, snow-crystals, and other phenomena. It is generally well written and trustworthy, but the author lapses occasionally as when, in describing what the world will be like after the atmosphere has gone and the temperature has fallen below the boiling point of hydrogen, he says: "The constant bombardment by meteors will make life in the open more dangerous than on a modern battlefield." The practical way, in which the United States weather service is regarded, is indicated by the appearance early in the book of "the financial saving caused by the Weather Bureau" as a suitable subject for investigation.

The first part of the book deals with meteorology proper, the atmosphere, its constitution, temperature, and circulation, and with weather offices and their work. In the second part the author treats of climate, of atmospheric optics, acoustics, and electricity, and, what is more novel, but of considerable importance, of floods and river stages, their measurement, characteristics, and prediction, the latter forming, in the United States, a part of the regular work of the weather bureau.

E. G.

THE HABITABILITY OF THE PLANETS. Are the Planets Inhabited? By E. Walter Maunder. Pp. iv+166. (London and New York: Harper and Brothers, 1913.) Price 2*s.* 6*d.* net.

THE question discussed in this little book used formerly to be considered in every popular book on astronomy, and it was generally supposed that all the planets were very probably inhabited by some sort of intelligent beings. The progress of astrophysics has thrown a great deal of light on the physical constitution of the planets, and this excellent summary of modern telescope-work, and of the consequences of the heat and light received

by the planets and the force of gravity at their surfaces, is therefore most useful. Mercury and the outer planets are easily disposed of, and Mr. Maunder even considers what would be the condition of Jupiter and Saturn if cooled sufficiently to become solid at the surface. The results are not encouraging.

Special interest attaches to Mars, which is therefore discussed in considerable detail. The atmosphere is thinner than that at the top of the Himalayas, and though the maximum temperature is well above the freezing point, water must be normally in the state of ice and cannot be liquid to a depth of more than one or two inches, and that only in the torrid zone and during a few hours each day. Mars is therefore essentially a frozen planet, and the extremes of cold experienced there, not only every year, but every day, far transcend those of our polar regions. If there is any vegetation it must be confined to some hardy forms of a low type, stretches of which may account for the so-called "seas." The polar spots cannot be caused by snow, but only by hoar frost.

In a chapter on the illusions of Mars it is shown that recent observations tend to resolve the canals into disconnected knots of diffused shadings. They are therefore caused by an immense number of minute markings which, when fairly near each other and separately below the limit of distinct vision, appear like lines. Several other illusions of Mars not alluded to by the author were exposed by Johnstone Stoney in his papers on telescopic vision in the *Philosophical Magazine* in 1908.

Venus is thus the only planet left which may be inhabited; but the question hinges altogether on whether the rotation-period is something like that of the earth, or equal to the period of revolution round the sun, which is still uncertain. In the latter case one half of the planet will be scorched and the other half frozen.

OUR BOOKSHELF.

Life in Ancient India in the Age of the Mantras. By P. T. Srinivas Iyengar. Pp. x+140. (Madras: Srinivasa Varadachari and Co., 1912.)

THIS little book is a good example of the kind of work which native Indian scholars are competent to undertake. The author wisely leaves to European scholars the comparative study of ancient Hindu beliefs and custom. He has undertaken the more useful, if less ambitious, task of analysing the Vedic Mantras, that is to say, the older collection of hymns, as contrasted with the Brahmanas or ritualistic treatises which supplement them. He brings together in a systematic, readable form the scattered references illustrating belief and custom. On the religious side he quotes the original texts describing the priest and his duties, magic, sacrifice, the fire cult, and the state of the soul after death. In the social department he deals with the king and his nobles, agriculture and other occupations, medicine and surgery, household life, war, sea voyages, amusements, the status of women, and so on. In each case he gives literal translations of the original texts, either made by himself or collected from authoritative versions, with detailed references to the originals. The value of such a collection is obvious, and the work, so far as it goes, has been carefully and judiciously carried out. In a new edition he would do well to replace the extracts in Sanskrit, which is unintelligible to most European anthropologists, by a Latin version in those cases where it is impossible to give an English rendering.

Mr. Srinivas Iyengar proposes, with the help of other scholars, to extend this series through the later periods of Indian history. If these monographs are prepared as carefully as that now before us the series will be welcomed by European students of Hindu beliefs and sociology.

Probleme der physiologischen und pathologischen Chemie. By Dr. Otto von Fürth. 2 Band. Stoffwechsellehre. Pp. xiv+717. (Leipzig: F. C. W. Vogel, 1913.) Price 23 marks.

THE appearance of the second volume of Prof. v. Fürth's important book will be welcomed by all who have profited by reading the first volume. The total work is divided into fifty lectures, twenty-five in each volume. They might just as well have been called chapters, for no teacher could ever give lectures of such portentous length. Those before us treat of the large subject of metabolism, both in health and disease. We therefore not only find a description of the chemistry of nutrition, secretion, gaseous exchanges, and so forth, but large sections are devoted to the consideration of such subjects as diabetes and fever.

The book is fully worthy of its author's eminence in this branch of knowledge, and abundant references to literature occur on every page. The information is admirably up-to-date, and the book can be confidently recommended to advanced students as authoritative and interesting. The interest might have been increased by the insertion of illustrations; even the advanced student will find it difficult, for instance, to grasp the meaning of dissociation curves of hæmoglobin unless these are graphically represented.

Prof. v. Fürth is to be congratulated on the completion of his ambitious task, and his readers will wish it every success. W. D. H.

Practical Management of Pure Yeast. The Application and Examination of Brewery, Distillery, and Wine Yeasts. By Alfred Jörgensen. Translated by R. Grey. Second edition. Pp. 128. (London: *The Brewing Trade Review*, 1913.) Price 5*s.* net.

THE first edition of this book was reviewed in NATURE of November 5, 1903 (vol. lxiv., p. 4). The present issue has been revised and greatly

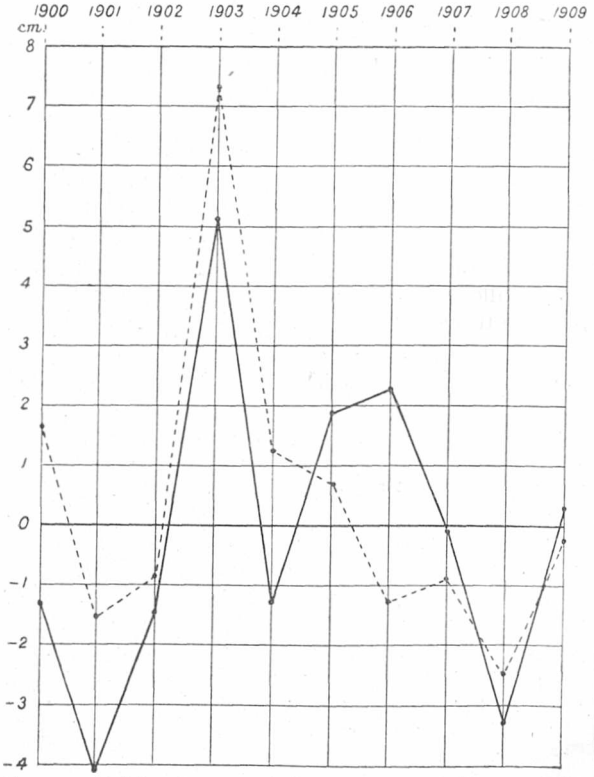
extended by the author, who is director of the Laboratory of Physiology and Technology of Fermentations at Copenhagen. The new work is a remodelling of the first edition, and due regard has been paid throughout to the advancement of this branch of applied science during the last decade. The absence of an index is scarcely compensated for by the somewhat full table of contents.

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.*]

Variation of Mean Sea-Level.

THE many papers which have been written in recent years upon the above subject have dealt chiefly with the now well-known annual fluctuation (first noticed by Lord Kelvin nearly fifty years ago), by which the mean intertidal level of the sea stands on our North Sea and Baltic coasts something like 20 cm. higher in



Mean annual heights of mean sea-level, 1900–9, compared with the mean for the whole period. ------ At Dundee. ——— Mean of fourteen Danish and German ports, after Dr. Brehmer.

autumn than in spring. But while we still know too little about the details and the causes of this phenomenon, we know much less about the fluctuations of longer period, or even of the elementary facts of correspondence between different coasts in regard to the mean level in successive years.

A paper published a couple of months ago by Dr. Brehmer, of Hamburg, in the *Annalen der Hydrographie*, gives a valuable set of data for the years 1900 to 1909, drawn from fourteen German and Danish ports, from Bremerhaven to Memel. The results at all these ports are very concordant, and all show a remarkable elevation of mean sea-level in 1903. I had lately been analysing the tide records at Dundee (for the years 1897–1912), and the correspondence of the mean annual values at Dundee with Dr. Brehmer's observations, as the accompanying diagram shows, is so remarkably close as to deserve particular attention. Only between the years 1905–7, and especially in 1906, is there any noteworthy discrepancy.

D'ARCY W. THOMPSON.

August 1.

On the Transmission of X-Rays through Metals.

WHEN a beam of X-rays is allowed to pass normally through thin rolled metal sheets and fall upon a photographic plate placed behind and parallel to the sheet, some curious patterns are obtained.

These patterns fall into two classes: (*a*), in which the central spot produced by the direct beam is surrounded by an irregular halo of smaller spots, and (*b*), in which the central spot is surrounded by faint extended patches forming a *perfectly symmetrical pattern*. The design varies with the metal.

Class (*a*) markings are given by metal sheets which are either well aged or recently annealed, while the symmetrical patterns of class (*b*) are only obtained with newly rolled sheets. The spots of the former are due to reflections from the microcrystals within the metal, while the symmetrical patterns of the latter are produced by the structure imparted to the metal in passing through the rolls. These star-like patterns are evidently analogous to those obtained when a beam of light passes through a crystal which appears streaky to the naked eye. By annealing a newly rolled sheet the pattern changes from class (*b*) to class (*a*) and *vice versâ*.

It will be of interest to study the nature of the structure which gives rise to the symmetrical patterns.

H. B. KEENE.

University of Birmingham, August 7.

A Red-water Phenomenon due to Euglena.

A PHENOMENON of dichromatism in Euglena precisely similar to that described by Prof. Arthur Dendy in NATURE of August 7 was recorded by me in *The Essex Naturalist* in 1890 as occurring at Donyland Heath, near Colchester. During July and August the surface of the largest pond on the heath was almost completely covered with a film which was red in the morning and turned to green in the afternoon. I watched the change take place on August 3 at noon, the transformation taking about half an hour. The omen of blood was viewed with some alarm by the superstitious in the village, and was held to betoken some ill for the community. After the heavy rains of August the pond was quite clear of the film, and no earthquake occurred.

Dr. D. D. Cunningham mentions, in *Science Gossip*, 1886, a similar phenomenon in tanks around Calcutta.

Colchester, August 8. CHARLES E. BENHAM.

The Ribbon-Fish.

A SPECIMEN of the rare, deep-sea ribbon-fish, *Trachypterus arcticus*, which was landed at the Grimsby market recently, has been sent to me. The following details of the specimen are perhaps worth reporting:—Length, 5 ft. 8½ in.; greatest width, 10¾ in. No anal or pelvic fins. Caudal fin not axial, and the ventral portion without fin rays. Base of pectoral fin horizontal. Dorsal fin with 154 smooth rays. Teeth small but sharp. Skin silvery, and spinous on the ventral edge of body and along lateral line. Eye 3 in. in diameter. Lower line of body straight.

F. J. COLE.

University College, Reading, August 2.

THE INTERNATIONAL MEDICAL CONGRESS.

AFTER an interval of thirty-two years, the International Medical Congress returned to London, and was opened at the Albert Hall on August 6 by Prince Arthur of Connaught on behalf of the King. The number of members ran far into the eighth thousand, as compared with 3182 a generation ago. Before this unprecedented assemblage the foreign delegates, whose names are given below, were presented to Prince Arthur, and each said a few words, the fewest and most appreciated, apparently, coming from Dr. Wu, representing the Chinese Republic. After Sir Edward Grey had welcomed the foreign members, Sir Thomas Barlow, the president of the congress, gave his address, which took the form of a retrospect of the progress attained since 1881. The president recalled the supreme names of Pasteur, Lister, Virchow, Huxley, and Koch, remarking that there were giants in those days; but he showed how their pioneer work has been, and is being, followed up by the many devoted workers of our own time. He took occasion, also, to defend vivisectors, especially in this country, from the charges of cruelty and futility commonly brought against them by malice and ignorance.

The general addresses to the congress were delivered on succeeding days by Prof. Chauffard, of Paris, on prognosis in medicine; by Prof. Harvey Cushing, of Harvard, whose discussion of the relation between surgery and medicine was found to contain, as its main feature, the finest defence of experiments on animals that has been heard for many years—a defence supported by the resolution in favour of vivisection which was later passed by the various sections of the congress; by Prof. Ehrlich, of Frankfurt, on pathology nominally, but actually on the most remarkable and beneficent of single achievements in scientific therapeutics that the history of medicine can record; by Prof. W. Bateson, on heredity, a subject which, in his lecture, and in other pathological aspects, received, as was long overdue, much attention at the congress; and by Mr. John Burns, President of the Local Government Board, upon public health. An address on this subject from a determined opponent of vaccination was, perhaps, the most startling novelty of the congress, though the address was well worth hearing, and this aspect of it would fortunately be unknown to most of our foreign guests at the time.

Amid the multitudinous features of the congress, with its hundred or so set discussions and its more than six hundred papers, one subject stands out in clear relief, as would be expected by every reader of Prof. Ehrlich's great address on chemio-therapy, a slightly abbreviated form of which is to be found on p. 620. Those who heard that address were well prepared for the discussion on the duty of the State in regard to syphilis, which was held in the Albert Hall on Saturday at a combined meeting of the sections of dermatology and syphilography, and of forensic medicine, under the presidency of Sir Malcolm Morris, whose initial part in the public advance we have made in the last two or three weeks must be duly honoured by future historians of public health. The result of Saturday's discussion was the unanimous passage of a resolution calling upon the Governments of all countries represented at the congress to make systematic provision for the diagnosis and treatment of all cases of syphilis not otherwise cared for.

Monday's debate on the treatment of syphilis by salvarsan made clear the real significance of the resolution already passed. The reception accorded to Prof. Ehrlich will never be forgotten by those who were privileged to be present. He introduced the discussion, and was followed by Prof. Wassermann, to whom we owe the invaluable blood reaction for the recognition of syphilis, and by Prof. Hata, of Japan, who helped Ehrlich in the great constructive search which led to salvarsan as the six hundred and sixth synthetic compound tested, and now acknowledged to be, as Prof. Wassermann said, "the mightiest weapon in the whole of medicine." Lieutenant Gibbard, R.A.M.C., reported on the revolution wrought by salvarsan in the treatment of syphilis in the British Army, and other speakers, from all parts of the world, whose total experience must run now into scores of thousands of cases, testified to the power of this remedy. Fate has been cruel, indeed, that young Schaudinn, who found the spirochæte only some seven years ago, thus providing Ehrlich with the living object of his chemical genius, should have been struck down in his early thirties, even before the first molecule of salvarsan came into existence upon a planet which the spirochæte has so long ravaged. It need only here be added that, thanks to Schaudinn, Wassermann, and Ehrlich, the whole problem of syphilis is now utterly revolutionised. The medical profession to-day asks only to be allowed to cure the victims of this infection, thereby preventing it as nothing but cure can ever do. The Royal Commission now demanded will be concerned with that central question, "the provision of diagnosis and treatment"; the horrible and useless measures taken in the past can never again be contemplated, and only unteachable ignorance and prejudice against knowledge can excuse the suggestions already made by two members of the House of Commons in this respect.

Another racial poison, alcohol, was the subject of an important discussion on alcohol and degeneracy, in the section of forensic medicine, introduced by Dr. Laquer, of Wiesbaden. The discussion was valuable, but as one-sided as that on the same subject which was held at the International Eugenics Congress last year, for at neither did the distinguished English author of a familiar report on parental alcoholism appear to defend his unique results on this subject.

The debates on various surgical problems, notably the operative treatment of cerebral tumours, excited great interest, and were doubtless profitable. Sir Victor Horsley had a notable reception

as a pioneer in this field. But when all credit is accorded to the skill and success of surgeons, we must acknowledge that it will be better to use salvarsan early, which means having ever fewer patients in need of it, than to operate, however skilfully, upon cerebral syphilis; and it will be a great day, certainly, though too slowly approaching, when the principles of "chemiotherapy" can be brought to bear upon the cells of malignant tumours, in the brain and anywhere else. The debate on cancer at the congress was undoubtedly disappointing. Devoted, laborious, and valuable work has been done, very notably by Dr. E. F. Bashford, who was the first reporter upon the subject, and his associates of the Imperial Cancer Research Fund, but the goal is not yet reached. The work of Dr. Freund, of Vienna, who followed him, and who has found substances in malignant cells which are toxic to normal cells, and *vice versâ*, is very promising, and it may be surmised that the views as to specific ferments respectively favouring and disfavouring the chemical processes of the malignant cell, which were advanced by Dr. John Beard, of Edinburgh, some years ago, on the basis of Pasteur's fundamental stereo-chemical discovery, are nearer the line of effective advance than was at the time supposed. Prof. Ehrlich, who worked at cancer in past years, may perhaps return to the subject now and surpass himself. Meanwhile, the results of surgery, and very notably of radium, that astonishing agent, which certainly produces cancer under some conditions, and certainly cures it under others, are very welcome, and improve rapidly every year.

Prof. Simon Flexner could not come, and so we did not hear from his own lips about his work on the ultra-microscopic organism of infantile paralysis. But there was an important debate on "filter-passers," and the time is coming when biology and our views of protoplasm and living matter in general will have to face the strange results of recent research into this subject.

On Wednesday, with a lofty appeal for peace in the name of medical science, from the lips of the president, the congress was brought to a close. Its record, its numbers, its knowledge, have never been equalled, and will most surely and soon be utterly surpassed; but mankind will have ceased to care at all about health and disease, sanity and madness, life and death, before the visit of Prof. Ehrlich, the merciful records and the illimitable promise of his creative genius, at the International Medical Congress of London, 1913, are forgotten, or without homage, wonder, and gratitude remembered. C. W. SALEEBY.

The following is the official list of delegates from foreign Governments to the congress:—United States of America, Dr. William Thayer; Austria, Prof. Ritter von Haberler; Argentina, Dr. Eliseo Segura; Belgium, Prof. Heger; Brazil, Prof. Marcos Cavalcanti; China, Dr. Wu; Cuba, Dr. Aristides Agramonte; Denmark, Dr. Madsen; France, M. Landouzy; Germany, His Excellency Prof. v. Schjerning; Guatemala, Dr. Azurdia; Holland, Dr. Rijnberk; Hungary, Prof. Emil de Grosz; Italy, Prof. Bianchi; Japan, Dr. Takamina; Mexico, Dr. Jose Larumbé; Monaco, Dr. Caillaud; Nicaragua, Dr. Alejandro Cesar; Norway, Prof. Dr. Uchermann; Portugal, Dr. Luiz de Freitas Viegas; Russia, General Dr. Rapschewsky; Servia, Dr. Subbotitch; Spain, Dr. Recasius; Switzerland, Prof. Sahli; Sweden, Prof. Essen Möller.

On August 6, in connection with the congress, the Royal College of Surgeons conferred its honorary fellowship upon Prof. R. Bastianelli, Rome; Prof. A. Bier, Berlin; Mr. F. D. Bird, Melbourne; Dr. G. W. Crile, Cleveland, U.S.A.; Dr. Harvey Cushing, Harvard; Dr. von Eiselsberg, Vienna; Dr. E. Fuchs, Vienna; Dr. H. Hartmann, Paris; Prof. W. Korte, Berlin; Dr. W. J. Mayo, Rochester, U.S.A.; Dr. A. Monprofit, Paris; Dr. J. B. Murphy, Chicago; Dr. J. Nicolaysen, Christiania; Dr. F. J. Shepherd, Montreal; and Prof. T. Tuffier, Paris.

At the closing meeting it was announced that the Permanent Commission of the International Congress had unanimously decided to accept the invitation of the Bavarian Government and of the town and University of Munich to hold the next Congress of Medicine in that town in 1917.

The commission further accepted the recommendations of the committees appointed to award the congress prizes as follows:—

(*a*) The Moscow prize, awarded to Prof. Charles Richet, of Paris, for his work on anaphylaxis.

(*b*) The Paris prize, awarded to Prof. A. von Wassermann, of Berlin, for his work on experimental therapy and on immunity.

(*c*) The Hungary prize, awarded to Prof. A. E. Wright, of London, for his work on anaphylaxis.

The committee of the Permanent Commission has been elected as follows:—

President.—Prof. Dr. Friedrich von Müller, of Munich (president-elect for the eighteenth congress).

Vice-Presidents.—M. Calman Müller, of Budapest (president of the sixteenth congress); Sir Thomas Barlow, of London (president of the seventeenth congress).

Secretary-General.—M. H. Burger, of Amsterdam.

Assistant Secretary.—D. Ph. van der Haer, of The Hague.

Member.—M. L. Dejace, of Liège (president of the International Association of the Medical Press).

The following resolutions sent up by the sections of congress will be considered by the commission:—

(A) That, sensible of the ravages wrought by syphilis in the health of the community, and deploring the inadequacy of existing facilities for checking its dissemination, the International Medical Congress calls upon the Governments of all the countries here represented—

(1) To institute a system of confidential notification of the disease to a sanitary authority, wherever such notification does not already obtain.

(2) To make systematic provision for the diagnosis and treatment of all cases of syphilis not otherwise provided for. (Submitted by the combined sections of dermatology and syphilography and of forensic medicine.)

(B) (*a*) That the section is of opinion that beri-beri among natives who live principally on rice is brought about by the continuous and too exclusive use of rice submitted to a too complete milling, which removes the cortical and subcortical layers of the grain.

(*b*) The section urges all authorities charged with the health of native communities to restrain by every means in their power the use of this rice in the dietary of coolies.

(*c*) In view of the proved non-infectiousness of beriberi the section suggests that all port and sanitary

authorities should abolish foreign quarantine and other restrictive measures against this disease.

(*d*) The section resolves that the malady known hitherto under the name of Malta fever shall in future be named "undulant fever." (Submitted by the section of tropical medicine and hygiene.)

(C) That this congress records its conviction that experiments on living animals have proved of the utmost service to medicine in the past, and are indispensable to its future progress. That, accordingly, while strongly deprecating the infliction of unnecessary pain, it is of opinion alike in the interests of man and of animals that it is not desirable to restrict competent persons in the performance of such experiments. (Submitted by various sections.)

THE CONTINUATION OF MILNE'S WORK IN SEISMOLOGY.

A WELL-INFORMED writer in *The Times* of August 7 has insisted on the importance of securing the continuity of the late Prof. Milne's great scheme of seismological observation and research. Milne himself always fought strenuously against his own undertaking being absorbed and lost in any international scheme. It is true that in connection with the international system there are some admirably equipped laboratories, furnished with a variety of instruments of extreme delicacy and sensitiveness; but the establishment of one of these is so costly an undertaking that such laboratories can never become numerous. Milne's aim was to secure a great number of seismological stations, scattered as widely as possible over the globe, each furnished with instruments of the same pattern, the records of which would be strictly comparable. The practical results which have been secured by Milne's scheme have shown that the comparatively simple type of apparatus which he advocated has furnished just such an observational basis for research as is necessary. Milne, at the outset, saw in the British colonies and dependencies the means for a wide extension of his scheme—though he by no means limited his efforts within the Empire. It would, indeed, be a disgrace, as well as a misfortune, to British science if the great undertaking originated by Milne were to suffer dislocation, or to be lost by absorption in any other scheme; and, at the same time, no more worthy monument to Milne's enterprise could be imagined than the maintenance and development of the system of observations to which he devoted his genius and energy, and for which he received little practical encouragement during his lifetime.

It is a very fortunate circumstance that the British Association is holding a meeting so shortly after Milne's lamented death, for no time must be lost if his invaluable organisation is to be rescued from the ruin which is threatened by the loss of its master-spirit. From the year 1841 onward, the association has been the nursing mother of seismological science in this country, and has helped Mallet, and afterwards Milne, by contributions from its funds, and especially by publication of their results. Milne was always ready gratefully to acknowledge the great aid afforded to him by the association, and devoted much of his time during the last year of his life to drawing up a valuable index to the numerous contributions to seismology scattered through seventy-two volumes of the association's reports. This index is now in type, and will be presented at the forthcoming Birmingham meeting. It may be hoped that on this occasion a means may be found for consummating the great aid which the association has always furnished to seismological science, by inaugurating an effort to place Milne's system of observation and research on a sound and permanent basis. It may be suggested that as a national system of meteorological observation has been evolved from the meteorological committees of the British Association, a national seismological scheme may, in like manner, be developed from the association's committees on the subject.

On August 8 a second letter appeared in *The Times* from the president of the Royal Society, strongly urging the importance of continuing Milne's organisation, and making it a national undertaking. Sir Archibald Geikie, besides bearing eloquent testimony to Milne's genius and enthusiasm as a scientific worker and his loveableness as a man, is able to quote from a letter just received from Prince Galitzin, the president of the International Seismological Association, in which it is asserted that Milne "through his most important investigations set seismology on a firm scientific basis, founded upon instrumental observation," that "he can duly be considered as the real founder and promoter of this new and important branch of geophysics," and that the continuation and development of his great work "would be the best monument to his memory." J. W. J.

THE ULTIMA THULE OF POLYNESIA.[1]

EASTER ISLAND, so called because of its discovery by the Dutchman Roggeween on Easter Day, 1722, presents several as yet unanswered problems in ethnology and linguistics. One of these is the provenance of the gigantic stone statues found in the island, another the decipherment of the singular incised tablets which appear to show a form of writing or hieroglyph, though written characters are found nowhere else east of Java. A third problem, the origin and settlement of the present population, or rather of the generation which is now so rapidly passing, is less difficult, and is that which Mr. Churchill has set himself the task of investigating in the present volume.

In his former book on the Polynesian wanderings (see NATURE, September 21, 1911, p. 381), the author discussed the entry into the Pacific of the primitive Polynesians, whom he called the proto-Samoans, and their settlement in the region he defined as Nuclear Polynesia, comprising the island-groups surrounding Samoa, and including

[1] "Easter Island. The Rapanui Speech and the Peopling of South-east Polynesia." By William Churchill. Pp. iv+340. (Washington: Carnegie Institution of Washington, 1912.)

the Tonga and Viti clusters, with Rotuma, Uvea, and Fakaafo. He maintains that there was a later migration of the same race, the course of which into Polynesia cannot now be traced. These second comers he calls the Tongafiti, and regards them as having been so long separated from the proto-Samoan that their language had independently and divergently developed. But during the dominance of the Tongafiti in Nuclear Polynesia their speech had become mixed to some extent with the proto-Samoan.

After the expulsion of the Tongafiti from Samoa about the eleventh century of our era, they took refuge in the islands eastward, the Cook and Austral Islands, which became the centre of the migrations which ultimately reached Hawaii and New Zealand. This central region is not dealt with in Mr. Churchill's present work, and he defines the region discussed as "south-east Polynesia," comprising the Paumotu group with Mangareva, the Marquesan and Tahitian groups, and Rapanui or Easter Island.

Mr. Churchill's material for the examination of the languages consists mainly of the vocabularies collected by the French missionaries in Rapanui, the Marquesas, and Tahiti, with Tregear's vocabularies of Paumotu and Mangareva, also derived from French sources. All these lack, as Mr. Churchill notes, the fullness and detail of the Samoan, Tongan, and Maori dictionaries of Pratt, Baker, and Williams, for they start with an original list in French, for which their compilers have sought to ascertain the Polynesian equivalents.

Mr. Churchill's method in the present work is similar to that followed in the "Polynesian Wanderings." After a valuable discussion of the Polynesian alphabet, and of metathesis in Polynesian words, he deals with the sources and variety of Rapanui speech, deducing from its treatment of modern loan-words (European) its principles of deviation from the Polynesian standard. Then, by an examination of the Rapanui vocabulary, he proceeds to distinguish the words which occur (1) in both proto-Samoan and Tongafiti; (2) in proto-Samoan alone; and (3) in Tongafiti only. The first are called general Polynesian. In a table of 957 Rapanui words he refers 436 to general Polynesian, 110 to proto-Samoan (*i.e.* with cognates in Samoan), and 119 to Tongafiti (*i.e.* with cognates in Maori). But 292 words are restricted to south Polynesia alone, that is, have cognates only in Paumotu, Mangareva, the Marquesas, and Tahiti. He states that "the proto-Samoan element represents an older and more primitive type than is shown in the modern languages of Nuclear Polynesia," pointing to the migration from Samoa as having taken place whilst two aspirates were in use, and before the formative elements had been acquired which have enabled the language in Nuclear Polynesia to maintain the final consonant of a closed stem, as in Mr. Churchill's proto-Samoan stem *ikof*, which became *i'ofi* in Samoan and *iko* in Rapanui.

Paumotu is regarded as the "second station of the Tongafiti migration after its expulsion from Samoa, and its centre of distribution to the seats of the present great settlements of this swarm." Mangareva is also dealt with as a centre of distribution, and the Marquesas as affording indications of their being in the fairway of the migration to Hawaii. All these are numerically dealt with, and their words classified as general Polynesian, proto-Samoan, and Tongafiti. A very important result appears in the statement that in the Paumotu vocabulary, whilst 52 per cent. of its words are cognate with the other Polynesian languages, 48 per cent. are found peculiar to Paumotu. Mr. Churchill regards these words as true Polynesian which have gone out of use, as Polynesian words are prone to do, or have been invented to express a new environment, and quotes Dr. Friederici on word-tabu and the theoretical formation of new words. Here two important facts seem to have been lost sight of. In other languages the words used as substitutes for tabu-words are *not* usually new inventions, else they would not be understood by the hearers, but are words really belonging to the languages, though not in general use. Similarly, unless a foreign word is introduced, a new object or action is named by a word already known. In the opinion of the present writer, the fact that the peculiar Paumotu words are totally unlike any others in the island region (except a few in the allied Tahitian) appears to show that they are not Polynesian at all, but rather a remnant of some pre-Polynesian speech.[2]

Mr. Churchill finds in the four languages discussed a wide speech-group of broad diffusion and of considerable complexity. He subdivides this into: (1) a Polynesian speech which has passed from the use and memory of other Polynesians; (2) a later proto-Samoan colony taking refuge from Tongafiti tyranny; (3) a Tongafiti settlement; (4) a migration of associated proto-Samoan and Tongafiti from the west which was caught in the Paumotu chain, only a few stragglers reaching the other groups; (5) from the Paumotus, part of a subsequent migration reached Rapanui, the last home of the Polynesians.

Apart from its theory, with all the interesting issues involved, Mr. Churchill's book has the very practical advantage of presenting in a convenient form Rapanui, Paumotu, Mangarevan, Tahitian, and Marquesan vocabularies, with an extremely useful finding-list in English and Rapanui. The student, whether in accord with Mr. Churchill's theory or not, will find it of much value as a record of the languages. SIDNEY H. RAY.

THE SOUTH AFRICAN NATIONAL BOTANIC GARDEN.

THE work of the last session of the Union Parliament included the establishment of a National Botanic Garden at the Cape. This was the natural outcome of the cordial reception given in the House of Assembly to the resolution moved by Sir Lionel Phillips on May 6.

[2] *Cf.* Reports of Cambridge Anthropological Expedition to Torres Straits, vol. iii., p. 519 *et seq.*

Kirstenbosch, the site selected, is peculiarly favourable for the purpose, and affords scope for the development of a singularly beautiful South African garden. It is a farm on the Rhodes estates, to the south of Groote Schur, on the eastern slopes of Table Mountain. It contains the ruins of at least three old homesteads, and was probably occupied very early in the history of the settlement of this portion of the Cape Peninsula. The country seat of Van Riebeek, the first Dutch Governor (1652–1662), adjoins Kirstenbosch on its eastern boundary, and, according to tradition, Van Riebeek obtained from the latter a large supply of native woods for building purposes.

The survey of the Kirstenbosch estate is not yet completed; its area is probably about 400 acres. Of this, the eastern half consists of flat or slightly undulating land, about 200 ft. above sea-level. Above this the western half rises to about 1000 or 1500 ft. The latter includes the lower ends of three richly wooded gorges, in which the native vegetation during recent years has been little interfered with except by occasional fires. The lower-lying parts have been heavily planted with pines (*P. pinaster* and *P. pinea*), oaks, and poplars. Here the native bush has been mostly exterminated. The poplars have completely taken possesion of considerable areas. The oaks, most of which were pollarded many years ago, have been altogether neglected, and now, with few exceptions, are in an advanced state of decay.

The underlying rock, except perhaps in the most elevated parts of the estate, is granite. The slopes, however, are for the most part strewn with blocks of Table Mountain sandstone, fallen from above. Along one edge of the area there is believed to be an outcrop of Malmesbury slates. Many acres are overlain by a rich deposit of humus derived mainly from the oaks and the poplars. The water supply is exceptionally good. Two of the streams from the adjacent gorges, traversing the whole breadth of the estate, are permanent, and a spring, issuing about 200 ft. above the eastern boundary, is perennial. It will therefore be a matter of no great difficulty to irrigate as much of the cultivated land as may be necessary. In the cultivation of South African vegetation the importance of aspect is very considerable. Kirstenbosch offers a choice which is unlimited, save towards the west (where it is shut in by the lower slopes of Table Mountain), and also, of course, there is no direct exposure to the sea. Another factor which calls for careful consideration is that of wind. The well-known Cape South-Easter, which is of frequent occurrence during the season of most active growth and of flowering, has a most injurious effect upon very many species. Owing to the curvature of the Table Mountain range between Mowbray and Muizenberg, and the situation of Kirstenbosch in the curve, the south-east wind rarely reaches it.

Kirstenbosch, therefore, possesses a combination of natural features which make it eminently suitable for the cultivation and study of a very large proportion of the varied floras of South Africa. It already bears several hundreds of species more or less representative of the Cape region itself. Experience already obtained of the cultivation in the Cape Peninsula of dry-climate species from Namaqualand and the central plateau, and of sub-tropical forms from the south-eastern coast belt, affords no room for doubt that many of these also will find a suitable home side by side with the flora of Table Mountain and the adjacent Cape Flats.

The control of the garden is vested in a board of five trustees, to which the following have been nominated by the Government:—Lord de Villiers, Sir David Graaff, Sir Lionel Phillips. Two further nominations are yet to be made, one by the Corporation of Cape Town, and another by the Botanical Society of South Africa, constituted for the purpose of giving general and financial support to the project.

The trustees have made the following appointments:—Hon. director, Prof. H. H. W. Pearson; secretary, Miss H. J. Davison. Plans for a director's residence and a laboratory have been approved. A gardening staff will be appointed immediately.

WIRELESS TIME SIGNALS.

IN the *Annuaire* for 1913 of the Paris Bureau des Longitudes will be found a full account by Commandant Ferrié of the development of wireless time-signalling.

For a long period in the past local time was the only requirement of this kind, until the discovery of America rendered the determination of longitude at sea a matter of great practical importance, thus making the knowledge of the time on a fixed meridian as necessary as that of local time. The growth of railway enterprise in the nineteenth century made the adoption of standard time over large districts an obvious convenience, with the result that different countries adopted their own standard time, and Paris time, for instance, was made legal time throughout France in March, 1891. The subsequent gradual adoption of Greenwich time, or time differing from Greenwich by an exact number of hours or half-hours, has continued until the present time, France, only so recently as March, 1911, substituting Greenwich time for Paris time throughout France and Algeria.

The accurate determination of local time (or Greenwich time altered by a constant) comes into the domain of practical astronomy, and is responsible for a considerable amount of routine work, especially at Government observatories. The difference of longitude between two stations, including, for instance, the "constant" mentioned above, has provided a problem the solution of which has steadily progressed towards accuracy since the invention of the electric telegraph; but for any place not in telegraphic communication with a fixed observatory the greatest stride in

advance since the invention of the chronometer has been the application of wireless telegraphy, of which the possibilities began to be considered in this connection very soon after Marconi's first success.

Few unexplored districts of the habitable globe would be beyond the reach of a powerful wireless installation if distributing stations were an ordinary adjunct of every national observatory, and it is likely that the network of stations will be able to distribute Greenwich time over the whole of the oceans.

For general purposes time-determination within a quarter of a second is sufficiently exact, but this accuracy at a fixed observatory was by no means always attainable under old conditions, since a week of cloudy skies, especially if accompanied by considerable changes of temperature, would leave the fixed observatory almost as dependent on the rate of a chronometer as a ship at sea. Here, however, the new development steps in and suggests that, since it is not likely to be cloudy everywhere, the time can be checked by that of an observatory perhaps thousands of miles away; so that no error approaching a second of time need be feared.

This state of things, needless to say, is not yet universal; but there is no doubt about the beginning that has been made. The distributing stations, requiring great electrical power and much more costly and elaborate fittings, will always be comparatively few, but the receiving stations can also take part in the scheme. The Eiffel Tower station sends out the Paris Observatory determination of Greenwich mean midnight, for instance, and this is received, say, at Greenwich with a modest equipment and compared with the Greenwich determination. The difference can be sent without much delay to Paris by post or telegram. When it is remembered that at night, under favourable conditions, signals from the Eiffel Tower have been received at a distance well above 3000 miles (5200 kilometres), it will at once be seen how this device will prevent any accumulation of error due to a spell of bad weather.

But a quarter of a second cannot be regarded as indicating the possible limit of accuracy attainable. By employing clocks with a small difference of rate, coincidences of beat can be noted with great accuracy, the arrangement forming what might be called an acoustic vernier. For example, if two sidereal clocks supposed to be synchronised differ by a small fraction of a second owing to a difference of lag in taking up the current from the control clock, this difference can be readily obtained by comparing each with the same mean solar clock, as the coincidences will occur at a definite interval. An accuracy of one-hundredth of a second (to use a loose, convenient phrase) is not by any means impossible in this way, and Commandant Ferrié suggests one-thousandth of a second as practicable. In this way may be measured not only the lag between the clock beat and the closing of the transmitting circuit, the additional lag before the Hertzian waves actually leave the Eiffel Tower, and the lag at the receiving station, but also the velocity of the waves themselves, which can be measured, he says, with an error of less than 3 per cent., though this velocity nearly reaches 200,000 miles per second.

It is part of the routine of the station to transmit time-signals by night and by day, the latter being followed by a meteorological report giving barometric pressure, direction and force of the wind, and the state of the sea for six stations in and around the Atlantic. Similar work, at times arranged not to interfere with that of the Eiffel Tower, is done at the German station at Norddeich, and other extensions will doubtless follow. Japan, at any rate, has already started an independent system.

Commandant Ferrié's account gives very full mechanical details of each step of the process, and should be of great interest to the growing number of people possessing private wireless installations, some of whom compare their time almost daily with both Eiffel Tower and Norddeich. There is no indication at present of any intention to erect a distributing station at Greenwich, and, as stated above, it may be considered unnecessary, the fortuitous presence of the Eiffel Tower giving Paris a great advantage, as its range goes far beyond the British Isles.

W. W. B.

NOTES.

THE exhibition of specimens illustrating the modification of the structure of animals in relation to flight which has been in preparation for many months at the Natural History Museum will be open to the public on Friday, August 15. It occupies the fourth bay on the right of the central hall, and comprises 166 mounted objects and twelve microscopic specimens for the purpose of elucidating the subject in a popular manner. The adaptation of each kind of flying animal for aërial locomotion is explained, and the changes that must have taken place in the structure of the body before the animal could really fly are indicated, and attention is directed to the remarkable fact that the power of flight has been evolved independently in different groups of animals—*e.g.* bats, birds, Pterodactyles, and insects.

THE death is announced, in his fifty-first year, of Prof. Edwin Goldmann, honorary professor of surgery in the University of Freiburg i/B. since 1892. Prof. Goldmann's scientific career and work are referred to in an appreciative notice contributed by Prof. Ehrlich to *The Times* of August 13, and here summarised:—As a pupil and friend of the famous pathologist Weigert, he mastered the technique of microscopy completely. In early days he busied himself principally with researches into biochemistry. Here he turned his attention especially to the study of minute vascular changes. And then an inner impulse compelled him to devote himself to the important field of cancer research, and by ingenious experiments to advance our knowledge of this difficult problem. His great work with a large

number of instructive illustrations set in a right light the significance of cell division for biology and the spread of cancer; and afforded far-reaching insight into the complicated means of curing tumours. He reached the summit of his work in the last few years, during which he prosecuted his studies, which must be regarded as classical, in the staining of living tissues. Goldmann recognised clearly that if we desire to know and study the functions of the living cell the staining of living tissues offers the most profitable means. There were previously only a few works dating from an older generation, such as those on methylene blue, but they, corresponding to their own time, followed an incomplete technique. Here came in Goldmann's work. He succeeded in discovering a method of carrying out an exact pursuit of *intra vitam* staining in microscopic sections. The staining material, pyrrol blue, possesses the peculiarity of colouring a very special kind of cells which are found in the connective tissue and of making them visible to the eye, while the dye allows certain round granules contained in these cells to show up distinctly and in an intensive blue. Now Goldmann was able with the help of his method completely to clear up the great significance of the function of these cells, and to show that both in normal functions, as, for example, in digestion, and also in the majority of disease derangements, as in the case of tuberculosis and carcinoma, they play a very important part. His last important work also, "Ueber die Vitalfarbung am Centralnervensystem," dealt with that method and arrived at important conclusions concerning the nutrition of the central nervous system and the circulation of the cerebro-spinal fluid.

PROF. H. C. JONES, professor of physical chemistry at the Johns Hopkins University, has been awarded the Edward Longstreth medal of the Franklin Institute of Philadelphia for his work on the nature of solutions.

THE inaugural address at the re-opening of the School of Pharmacy in October will, by invitation of the Pharmaceutical Society, be delivered by Dr. F. B. Power, director of the Wellcome Research Laboratories. On the same occasion Dr. Power will be presented with the Hanbury medal.

THE Paris correspondent of *The Times* announces that the expedition to Franz Josef Land, under the command of M. Jules de Payer, left Havre on August 10. The object of the expedition is to explore the little-known north-eastern corner of Franz Josef Land, and a programme of scientific work has been prepared. The base will be established in Zichy Land.

PROF. CHARLES F. MARVIN, professor of meteorology to the U.S. Weather Bureau, has been appointed to succeed Mr. Willis L. Moore as chief of that bureau. The new head of the office has been in the Government service since 1884, and is widely known for his important meteorological investigations. It is announced that under the new administration the Weather Bureau will pay greater attention to such weather reports and forecasts as are likely to affect agriculture.

THE fifth annual conference of the National Association for the Prevention of Consumption was opened by the Prime Minister at the Central Hall, Westminster, on August 4, Lord Balfour of Burleigh presiding. A considerable portion of the session was occupied with a discussion on tuberculin treatment, in which Dr. H. W. G. Mackenzie, Prof. Sims Woodhead, Prof. Sali, and Dr. Lydia Rabinowitsch took part. On August 5 Sir R. W. Philip delivered an address on the need for coordination of anti-tuberculosis measures, which evoked an interesting discussion.

OFFICIAL tests of a system of wireless telephony invented by a Japanese electrician, Mr. Torikata, have led to the adoption of the system by the Japanese Government, which has ordered all the shipping companies subsidised by it to install the apparatus on their principal vessels. The instructions have already been followed by the three largest Japanese mail steamship lines, we learn from *The Japan Chronicle* (July 17), with eminently satisfactory results. Patent rights for the invention have been secured in Japan, England, and France, and others are pending in Germany and the United States. It is stated that the present range of audibility of the Japanese system is sixty miles. The advantage claimed for the apparatus over competing systems is its simplicity, it being no more difficult to use than an ordinary telephone.

ASAMA-YAMA, the well-known Japanese volcano, has again been displaying great activity. On June 17, reports the Tokyo *Asahi*, an eruption occurred which is believed to be the most violent on record. Dense black clouds rose to a great height above the crater, and two streams of lava poured forth, one flowing towards Rogome Station, on the south, and the other invading the forest in Kita Saku district, on the west. Further eruptions occurred on June 20 and 26. A heavy fall of volcanic ash, lasting three hours, took place on the former date at Takazaki, thirty miles east of the volcano. On June 26 Dr. Omori, the distinguished Japanese seismologist, with a party of assistants, ascended the volcano with the view of investigating the conditions, but found advance beyond the ninth stage impossible. The party retired to the observatory at the base, intending to await a favourable opportunity of reaching the summit. Several cracks appeared in the upper half of the volcano, from which issued volumes of dust and vapour, and there were indications that a new crater is forming.

WE announce with regret the death, as the result of an aëroplane accident, of Mr. S. F. Cody, the well-known airman, while flying with a passenger near Aldershot on August 7. The machine the collapse of which caused the accident was the new large biplane which Mr. Cody had built for the purpose of competing in the coming waterplane race round Great Britain. It was as a kite-flyer that Cody first came into prominence. In 1903, after two failures, he all but succeeded in crossing from Calais to Dover in a collapsible 14-ft. boat drawn by a kite. In 1906 the War Office appointed Cody chief instructor in kite-flying. In 1907 he was largely responsible for the engineering work of the Army airship, *Nulli Secundus*. In 1909 he achieved a cross-country flight of forty miles in

sixty-three minutes—a record at the time. Cody was born in 1862, and was in his forty-seventh year when he began his experiments with flying machines. At the time of his death he was building a triplane on which he proposed to try to cross the Atlantic.

To the large collection of the contents of "short stone cists" found in the north-east of Scotland, and displayed in the anatomy museum of the University of Aberdeen, there have been added recently the contents of two others. One was found at Ellon, Aberdeenshire, and the other at Burgie, Morayshire. Both cists lay in elevated gravelly situations, with no external marks or monuments to indicate their positions, and had their long axes directed from east to west. Their roofs and walls were composed of large flat stones indigenous to the parts of the country in which they were found, and their floors of a layer of sand in which pebbles were embedded. The Ellon cist measured (inside) 3 ft. 4 in. by 2 ft. 1 in. by 17 in. deep, the Burgie cist 3 ft. by 1 ft. 10 in. by 2 ft. deep. The former cist contained a fully formed male human skeleton, showing characters ordinarily met with in skeletons found in short cists, viz., stature about 5 ft. 5 in., round skull, short broad face, narrow orbits, and rather wide nose. To its right lay the much-decayed remains of the skeleton of a person from fifteen to twenty years of age. In the cist at Burgie were found remains of a fully formed human skeleton, much decomposed, the skull of which had been so injured after the cist had been found that no observations could be made from it. In both cists the skeletons had been buried in a crouching position. An urn of the "drinking-cup" variety and a flint scraper were found in the Ellon cist, but nothing beyond skeletal remains in the Burgie one.

THE special feature of the present summer is the general dullness of the weather, with which is also necessarily associated a persistent low day temperature. Greenwich this year has the least sunny July on record since the registration of sunshine has been established, and although since August opened the weather has been somewhat brighter, still, many days have been very dull. Only one day at Greenwich has had the mean daily temperature in excess of the average from July 1 to August 11, a period of six weeks, and the highest maximum temperature observed is 76°, on July 12. Notwithstanding the cloudy character of the summer, there has been remarkably little rain, and prior to August 9 a drought had occurred in many parts of the British Isles. At Greenwich no rain fell from July 22 to August 6, a period of sixteen days; at Bath there was no rain for seventeen days, and at Nottingham for eighteen days. For the first sixty-eight days of summer from June 1 to August 7 the aggregate rainfall at Kew is 47 per cent. of the average, and at Greenwich 61 per cent. For the corresponding period in other parts of England Bath had only 20 per cent. of the average, Jersey 27 per cent., Nottingham 33 per cent., Liverpool 65 per cent., and Dover 68 per cent. In Scotland Leith had only 32 per cent. of the average rain and Wick 59 per cent., whilst in Ireland Valencia had 57 per cent., and Birr Castle 68 per cent. Rain has now fallen in many parts of the British Isles, but in places the conditions continue dry.

MR. C. ROBINSON, writing from Lancaster, says that while walking along a grassy path near some trees on a dark night he saw, "gleaming out of the darkness at my feet, what might have been a piece of frosted silver reflecting moonlight." Upon picking up the object he found it was a piece of decayed wood, which he took away with him, but was disappointed to find afterwards that the wood had lost its luminosity. The phosphorescence of decaying wood is not an unusual phenomenon, and is frequently due to the mycelium of a fungus which permeates the wood of old tree-trunks, and has the property of emitting light under the same conditions as those of respiration. When the wood is taken away from its natural surroundings, the luminosity disappears because the relations and conditions of life of the fungus are not the same as before.

IN his lecture on the pygmies of New Guinea recently delivered at the Royal Institution, Capt. C. G. Rawling gave a full account of the expedition organised by the Ornithologists' Union, assisted by the Royal Geographical Society, which left England in 1909 to explore the south-west coast of Dutch New Guinea. He sums up the results as follows:—Large and valuable collections of birds, mammals, reptiles, butterflies, and moths, with botanical and ethnographical specimens, have been made; a new and hitherto unknown race of pygmies was discovered, studied, measured, and photographed; a range of mountains, containing the greatest precipice in the world, together with 3000 miles of country, have been surveyed and mapped; new snow mountains and great rivers were found and explored; a long stretch of coast-line was surveyed. This, the longest cross-country journey ever undertaken in Dutch New Guinea, has proved the impossibility of the Mimika River as a line of advance to the snows, and, on the other hand, the value of the great rivers to the east, if an expedition in the same direction is again contemplated.

CERTAIN human bones discovered in 1911 by Mr. Hiram Bingham in gravel near Cuzco, Peru, have been considered to indicate the existence of man in that country between 20,000 and 40,000 years ago. In an article in the July number of *The American Journal of Science*, Mr. G. F. Eaton, who has visited the spot, states that the associated remains are essentially of a modern type, including, as they do, bones of domesticated cattle. He therefore concludes that the bones were buried some time "during the three centuries and a half that have elapsed since the Spaniards brought domestic cattle to Peru." In a second article in the same issue, Mr. H. E. Gregory states that although his investigations on the spot do not definitely disprove the theory of the great age of the bones, yet "the geologic data do not require more than a few hundreds of years as the age of the human remains found in the Cuzco gravels."

IF we may judge from a report on their breeding in that State, published in the Bulletin of the Illinois

State Laboratory of Natural History, vol. ix., art. 7, carp seem much more highly esteemed as food-fishes in those parts of the United States where they have been introduced than in this country. Their greatest enemies are garpike, which attack the young, and a fungus which infests the spawn, and against the ravages of these two foes remedial measures are suggested by Dr. S. A. Forbes in the article cited.

THE King has presented to the British Museum (Natural History) a tiger shot by himself in the Nepal tarai during his Majesty's tour in India in the winter of 1911–12. The specimen, which was mounted by Rowland Ward, Ltd., has been placed on exhibition in a special case on the second floor of the building, between the Banks statue and the upper mammal gallery, opposite a portion of the Hume collection of Indian big-game heads. The animal is set up in a partially crouching attitude on artificial groundwork amid real Indian jungle-grass.

ACCORDING to the sixth annual report (for 1912) of the American Bison Society, the number of pure-blooded bison in the United States and Canada increased during the season 1911–12 from 2760 to 2907 head. At the instigation of the society the U.S. Government has allocated a tract of 15,000 acres in South Dakota and the adjacent States to form an additional bison-preserve. As it includes part of the winter feeding-grounds of the great herds of bison that formerly ranged to the north and north-east, it ought to be admirably suited for the purpose.

IN spite of several more or less well-attested instances of such an occurrence, there is a very general tendency to refuse to believe that female mules may occasionally be fertile. A case recorded in *The Field* of August 2, by Mr. G. J. Harvey, Government Veterinary Surgeon at Nicosia, Cyprus, seems, however, to be beyond reasonable doubt. In this instance the mule, which is stated to have given birth to another foal a year previously, was seen by Mr. Harvey in the act of suckling her foal, then two months old. The parent, which stood 13·2 hands, is stated to be the offspring of a she-ass by an unknown sire, and certified to be an undoubted mule.

THE brown discoloration and unpleasant flavour acquired by peaches shipped for long distances has been attributed to so-called "ice-scald." That this injury is not a temperature effect is shown by recent experiments by Mr. G. R. Hill (Cornell University Agricultural Experimental Station, Bulletin 330), and evidence is adduced indicating the harmful effect to be due to an accumulation of carbon dioxide within the paper wrapper round the fruit during transit. During the investigations it was found that growing tissues, such as green peaches and germinating wheat, respire more than twice as rapidly aërobically as anaërobically, whilst ripe fruits respire as actively anaërobically as aërobically. Ripe apples lose their colour, texture, and flavour, and assume the qualities of half-baked apples by being kept for a sufficient length of time in oxygen-free gases. The softening of peaches (hydrolysis of pectose) appears to be decreased greatly by carbon dioxide and to a considerable extent by hydrogen and nitrogen; under similar conditions the fruit becomes brownish, and acquires a very bad flavour. Good ventilation and refrigeration, therefore, would appear to be the essential conditions under which this fruit should be stored.

A FURTHER report on the Isle of Wight bee disease has been issued as Supplement No. 10 to the Journal of the Board of Agriculture. Of the various sections of the report the first is contributed by Drs. Fantham and Porter, and deals with the life-history of the parasite (*Nosema apis*), with parasite carriers, examination of pollen, honey, and wax, and of certain insects found in hives; the second section, by Dr. Graham-Smith and Mr. Bullamore, describes results of infection experiments with the parasite, the mode of spread, and the means of treatment and prevention. The bacteriology of the disease is reviewed by Dr. Malden, and a summary of the investigations forms the last section. Up to the present no curative measures have been found, but certain preventive measures have yielded satisfactory results. No species of bacteria constantly associated with the disease has been found, and *B. pestiformis apis*, which is frequently in diseased stock, and was at one time thought to be the causal agent, is not pathogenic in pure culture. Bacteria, however, may play an important secondary part in producing the symptoms when the resisting powers have been lowered by the action of Nosema.

MR. G. RICCHIERI has contributed a lengthy summary of recent work on the nature of the earth's interior to the "Miscellanea di Studi" (R. Accad. Scien. Letter. di Milano). The conclusions of mathematicians and hypotheses of mathematicians, seismologists, and geologists are generally given in detail; but an account can scarcely be held complete which refers for the Rev. O. Fisher's views to the article on geology in the ninth edition of the "Encyclopædia Britannica," and omits all reference to the work of Dr. Milne and the deductions of Mr. R. D. Oldham.

IN a paper communicated to the R. Accademia dei Lincei, Dr. G. Agamennone describes an interesting spurious earthquake caused by the sudden fall in Rome of a wall 60 metres long, 20 metres high, and 1·25 metres in mean thickness. The resulting shock was sensible to man at a distance of 350 metres, and it was recorded by a seismograph at the Collegio Romano, about 700 metres from the fallen wall. The maximum amplitude of the movement was only 0·005 mm., and this was attained two or three seconds after the beginning; the period of the vibrations was about one-third of a second, whereas in earthquakes of near origin the period is rarely less than one second.

THE meteorological charts of the North Atlantic and North Pacific Oceans, issued by the U.S. Weather Bureau, for August, contain instructive articles by Mr. W. E. Hurd on the formation and movements of tropical cyclones. Several physical causes play a prominent part in their formation, but heat and moisture are necessary conditions. Mr. Hurd refers in detail to the works of various investigators, including such

well-known names as Viñes, Meldrum, Algué, and others; to the variation of the storms with time and place; to their tracks and rates of progression of the vortices; the whole of which will repay careful perusal. Actual reference is not made to the article on the same subject in the valuable "Barometer Manual" issued by the London Meteorological Office, which epitomises the results of observations and experience extending over many years. A glance at this work, in conjunction with Mr. Hurd's compilation, explains how in either hemisphere the wind travels round the cyclonic centre in a direction contrary to the apparent diurnal course of the sun, the westerly wind being therefore always found in the portion of the whirl nearest to the equator. The average rate of progression (irrespective of the wind-force in the whirl) varies from about 300 miles a day in the West Indies to from fifty to 200 miles in the southern Indian Ocean. Fassig found that in the West Indies the average daily rate further increased after the recurve of the storm.

THE *Ergebnisse der magnetischen Beobachtungen* of the Royal Observatory of Wilhelmshaven for the year 1911, in addition to valuable information about magnetic diurnal and secular variation at Wilhelmshaven, contains an elaborate discussion by Prof. Bidlingmaier of what he calls "die erdmagnetische Aktivität." By "activity" he means a more exact numerical measure of the energy of magnetic forces than is afforded by the present international scale, which assigns 0 to a quiet, 1 to a moderately disturbed, and 2 to a highly disturbed day. Prof. Bidlingmaier's introductory remarks on the theoretical side are of extreme generality, but practically he assumes the "activity" for a given interval of time in a magnetic element to be proportional to the mean square of the differences of its values taken at a large, theoretically infinite, number of equidistant times throughout the interval from the mean value during the interval. By summing the "activities" for three rectangular components one would have a measure of the total "activity." The interval of time may be the hour, the day, or the year. In the first case, in practice, Prof. Bidlingmaier seems to approve of values at six-minute intervals. The labour involved in arriving at hourly "activities" throughout the whole year being very great, an attempt was made to see whether the "activity" in this case could be expressed as a definite function of the range. Hours having the same range were collected in groups, and the corresponding mean measured "activities" were plotted as ordinates of a curve of which the abscissæ were the ranges. A regular curve was thence derived, somewhat resembling part of an hyperbola. The work merits the attention of all interested in magnetic disturbance.

Engineering for August 8 contains an illustrated account of experiments on the distribution of wind velocity in the space surrounding a circular rod in a uniform current of air. These experiments were conducted at East London College by Prof. J. T. Morris. The wind velocity was measured by electrical apparatus. Electrically heated wires were attached to the circular rod, and the cooling of these wires by the air current was used as a measure of the wind velocity. The method has been described already by Prof. Morris at the Dundee meeting of the British Association, and at the recent soirée of the Royal Society. The present article gives complete sets of curves showing the wind velocity at different distances from the rod for various speeds of main air current, together with velocity-contour lines for currents of fifteen and five miles per hour. The "shadow" of the rod is brought out clearly by these graphs, and extends much further at low than at high velocity. Judging from the results, the electrical method of measuring air velocities seems to possess considerable advantages in the field of experimental aërodynamics.

THE foreign commerce and navigation of the United States for the year ending June 30, 1912, is dealt with in a volume prepared by Mr. O. P. Austin, and published at Washington by the Department of Commerce and Labour in the United States. The bulky volume of 1342 pages is concerned almost wholly with statistics, and provides detailed information of every department of the trade of the United States. In the fiscal year 1912 the exports of manufactures from the States were larger than in any earlier year in the record of American commerce, and imports of manufacturers' materials also showed larger totals than in any earlier year except 1910. This increasing share which manufactures form in American exports, and manufacturers' materials form in the imports, is chiefly a development of recent years. Manufactures are supplanting foodstuffs as a leading factor in the export trade of the United States. While the value of foodstuffs exported increased from 1885 to 1900, it has actually declined since that date. The percentage which foodstuffs formed of the total exports has declined steadily since 1880; on the other hand, the percentage of manufactures has as steadily increased.

OUR ASTRONOMICAL COLUMN.

RADIAL VELOCITY OF 915 STARS.—Prof. Campbell publishes in Lick Observatory Bulletin, No. 229, a further valuable contribution to the radial velocities of stars secured with the Mills spectrographs attached to the 36-in. refractor at Mount Hamilton, and with the instruments of the D. O. Mills Expedition at Santiago, Chile. Prof. Campbell states that the results for those brighter stars of classes F, G, K, and M, of which the radial velocities appear to be substantially constant, or the approximate systemic velocities may be estimated, including proper-motion and other auxiliary data, relating to nearly 900 stars, have existed in manuscript form ready for the printer for more than a year. It was proposed to issue them in the form as previously published for the stars classes B and A, but want of funds made such a scheme impossible. Even now the necessary means are not forthcoming, so, to avoid further delay, he publishes them in the briefest form in the present bulletin.

All available results for stars of these spectral classes have been included, whether the observations of the same stars have been published or not in former lists; there are also included velocities for a few stars of classes B and A. Results for a few stars obtained at

other observatories are also inserted in the tables. Thus this and all preceding publications make available all the radial velocity results obtained at Mount Hamilton and Santiago up to date, excepting suspected variables and stars the spectra of which contain lines not sufficiently serviceable for measurement. The published lists include, therefore, all stars as bright as the 5·00 visual magnitude in the Revised Harvard Photometry, Annals 50, and, in addition, many hundreds of stars fainter than magnitude 5·00.

STELLAR PARALLAXES.—Prof. Frederick Slocum, in conjunction with Prof. S. A. Mitchell, of Columbia University, publishes in the July number of *The Astrophysical Journal* (vol. xxxviii., No. 1) the results of some stellar parallax determinations from photographs made with the 40-in. refractor of the Yerkes Observatory. The apparatus and methods used were similar in general to those previously described by Prof. Schlesinger, so the communication, to which reference is here made, is limited to the actual results of the investigation. The following table sums up in brief the values determined :—

Star	R.A. (1900) h. m.	Dec. (1900) ° ′	Mag. and spectrum	Relative parallax	Probable error
				″	″
φ Andromedæ	1 4	+46 43	4·4 B_8	+0·004	±0·008
48 Cassiopeiæ	1 54	+70 25	4·6 A_2	−0·002	0·016
20 Persei	2 47	+37 56	5·7 F	−0·012	0·007
9 Camelopardalis	4 44	+66 10	4·4 B	−0·032	0·011
μ Orionis	5 57	+ 9 39	4·2 A_2	+0·036	0·016
Groningen VII., No. 20.	16 21	+48 35	10·7	+0·125	0·012
Anonymous	17 33	+18 37	9·1	+0·108	0·011
BD 18°3423°	17 34	+18 37	9·0	+0·003	0·004
BD 18°3424°	17 34	+18 37	9·2	+0·003	0·008
96 Herculis	17 58	+20 50	5·5 B	−0·004	0·008
17 Lyræ C	19 4	+32 21	11·3	+0·124	0·008
P Cygni	20 14	+37 43	4·9 B_4P	−0·021	0·016
τ Cygni	21 10	+37 37	3·8 F	+0·006	0·016
Nova Lacertæ	22 32	+52 12	8 to 13 P	+0·027	±0·012

THE BIRMINGHAM MEETING OF THE BRITISH ASSOCIATION.

WE understand that the argument of the presidential address to be delivered by Sir Oliver Lodge at the Birmingham meeting is as follows :—A marked feature of the present scientific era is the discovery of, and interest in, various kinds of atomism, so that continuity seems in danger of being lost sight of. Another tendency is toward comprehensive negative generalisations from a limited point of view. Another is to take refuge in rather vague forms of statement, and to shrink from closer examination of the puzzling and the obscure. Another is to deny the existence of anything which makes no appeal to organs of sense, and no ready response to laboratory experiment.

In his address the president will contend against these tendencies. He will urge a belief in ultimate continuity as essential to science; he regards scientific concentration as an inadequate basis for philosophic generalisation; he believes that obscure phenomena may be expressed simply if properly faced; and he will point out that the non-appearance of anything perfectly uniform and omnipresent is only what should be expected, and is no argument against its real substantial existence.

Since we gave, in NATURE of July 17, summaries of the provisional programmes of most of the sections of the British Association, for the meeting to be held in Birmingham on September 10–17, notes on the forthcoming proceedings of the Engineering Section have reached us. A varied programme of engineering activity will be presented at the meetings of this section, under the presidency of Prof. Kapp, who will deal with electric traction in his opening address. A group of connected papers on the various influences which affect the propagation of electromagnetic waves will be read by Profs. Howe and Marchant and Dr. Eccles. Heat tests of electrical machines will be discussed by Mr. W. R. Cooper, and a practical demonstration of the varied uses of electric cooking appliances will no doubt prove of interest to the members of all sections.

Mechanical engineering claims a large share of the attention of the members, and will include an important paper by Mr. Lanchester, on the application of the internal-combustion engine to railway locomotion, in which he will describe his very successful work in this branch of engineering. Prof. Burstall will discuss the much-debated subject of solid, liquid, and gaseous fuels, and the committee on gaseous explosions will probably present a report on the temperature distribution in the cylinders of internal-combustion engines. A novel hydraulic weighing machine will also be described by Dr. Hele-Shaw, and a new process of bank-note engraving by Mr. Bawtree.

Considerable interest attaches to the report of the new committee for investigating the stress distribution in engineering materials, which will be discussed with the Mathematical and Physical Sections, and connected with this subject Prof. Coker will describe some optical determinations of stress in chain links and in thick cylinders under fluid pressure, Mr. Reid will discuss the flow of plastic solids, Prof. Dixon will deal with impact tests, and Mr. Robertson with the strength of free-ended columns.

Civil engineering is represented by a group of interesting papers, including one by Dr. Cornish on land-slides, accompanied by upheaval in the Culebra cutting of the Panama Canal, while Dr. J. S. Owens and Mr. E. R. Matthews will discuss the movements of sand and shingle in connection with marine engineering work.

A paper of great local interest, by Messrs. Gleadow and Shackle, will describe the fine new station of the Great Western Railway at Snow Hill, while the subject of metals for structures will be discussed by Mr. Walmisley.

The programme of the meeting of Section G is therefore not only of unusual interest, but many of the papers to be read are of considerable importance in relation to industries for which Birmingham is famous.

BONAPARTE RESEARCH FUND GRANTS.

THE committee of the Paris Academy of Sciences appointed to consider the distribution of the Bonaparte Research Fund has made the following recommendations for the year 1913 :—H. Caillol, 3000 francs, for the completion of his work entitled "Catalogue des coléoptères de Provence"; A. Colson, 2000 francs, to enable him to continue his experimental work in physical chemistry; E. Coquidé, 2000 francs, to assist him in carrying out his study of the turf lands of the north of France from the agricultural point of view; C. Schlegel, 2000 francs, to enable him to continue his researches on Crustacean development; Jules Welsch, 2000 francs to assist him in his geological exploration of the coast lines of France and Great Britain, and to extend them to Belgium and Scandinavia; MM. Pitard and Pallary, 6000 francs, equally divided, for their scientific expedition in Morocco, organised by the Société de Géographie; Louis Roule, 2000 francs, for the continuation and extension of his researches on the morphology and biology of the salmon in France; M. Pougnet, 2000 francs, to enable him to continue his researches on the chemical and biological effects of the ultra-violet rays, and for the construction of a quartz apparatus to be used for studying the action of ultra-violet light

upon gaseous bodies; M. Dauzère, 2000 francs, for his work on the cellular vortices of Bénard; M. Gard, 2000 francs, for the publication of a work and atlas dealing with the material left by the late M. Bornet; M. Chevalier, 4000 francs, to meet the expenses necessitated by the classification of the botanical material collected in the course of his travels in western and equatorial Africa, and the publication of memoirs on the flora of these regions; Paul Becquerel, 2000 francs, for the continuation of his physiological researches relating to the influence of radio-active substances on the nutrition, reproduction, and variation of some plant species; Le Morvan, 4000 francs, for the completion of his photographic atlas of the moon; M. Pellegrin, 2000 francs, to aid him in the pursuit of his researches, and to publish his work on African fishes, more particularly those of the French colonies; M. Rengade, 3000 francs, for his proposed systematic examination of mineral waters for the presence and distribution of the rare alkaline metals; M. Alluaud, 3000 francs, for facilitating the study and publication of documents collected by M. Jeannel and himself on the alpine flora and fauna of the high mountainous regions of eastern Africa; M. Lormand, 2000 francs, for the purchase of a sufficient quantity of radium bromide to undertake methodical researches on the action of radio-activity on the development of plants; A. Labbé, 2000 francs, for the study of the modifications presented by various animals passing from fresh to salt water or the reverse; de Gironcourt, 3000 francs, for the publication of the results of his scientific expeditions in Morocco and western Africa: M. Legendre, 3000 francs, to assist him in the publication of the maps and documents dealing with his travels in China; H. Abraham, 2000 francs, for the determination, with Commandant Ferrie and M. A. Dufour, of the velocity of propagation of the Hertzian waves between Paris and Toulon.

THE EDUCATION OF EUROPEANS AND EURASIANS IN INDIA.[1]

THE reality of the problem dealt with in the report before us calls for no demonstration. The Hon. Mr. Madge, himself a member of the community, as also of the conference which, at the invitation of the Government of India, met at Simla in July, 1912, was stating a sober fact when he said on that occasion that to his community education was a matter of life and death.

The problem has been said to have two phases, of which one is concerned with the future of the lower stratum of the Eurasian community—the crux of the half-caste question at its worst. The problem in its other phase does not necessarily involve the difficulties inseparable from mixed descent. Undoubtedly every European resident in India is anxious to send his children "home" for at least a part of their education, but there is a substantial and increasing body of Europeans in India who must educate their children there. It is in this body that this phase of the problem centres. Dr. Graham, of Kalimpong, once wrote that one of the saddest experiences was to trace the gradual downcome, generation by generation, of the descendants of men who had helped to build up the British Empire in India.

The more specifically Eurasian problem is clearly not yet solved, for Sir Harcourt Butler, the President, told the conference that according to the best calculation available there were some 7,000 children who were receiving no education, and a Roman Catholic priest stated that there had been recently 134 applications for four vacancies in a Roman Catholic Orphanage. Compulsion was discussed, and, though the President made it quite clear that Government had no present intention of legislating to make attendance at school obligatory—the administrative difficulties involved would be very great—the conference passed a resolution pressing upon Government its opinion that the introduction of compulsory education was necessary to secure that certain classes of the community attended school, adding that it was recognised that this would involve the introduction of free education for all who could not pay fees.

The report shows that the conference realised that the solution of the second of the two phases of the problem lies primarily in the provision of efficient secondary schools, as such institutions are defined in the regulations of the English Board of Education, and now generally understood in this country, but the somewhat nebulous discussion which took place on the grading of schools suggests that those who in India are tackling the problem would be well advised to define more exactly the terms, such as "elementary," "secondary," and "collegiate," which are now becoming current there.

The European schools in India are provided and maintained by the denominations, the local governments assisting with grants and generally supervising the working of the system. This system will, and should, remain, for Government could not possibly undertake the task, and it is a mere waste of time to make vague proposals for Government schools. If, however, there is a danger to which the present system is prone, it is to be found in the tendency to attempt in a considerable number of schools work which could be done more efficiently in a few. The difficulties resulting from this quite natural tendency would decrease if there was less confusion as to the respective functions in the community of the elementary and the secondary school. It may be, as was suggested at the conference, that there is no place in the domiciled community for merely elementary education, though with 7000 children without any education at all this sentiment would seem to savour somewhat of aspiration.

In England we are beginning to appreciate the futility of teaching a child certain rudiments and then at the age of fourteen setting him adrift to find for himself. It is one thing to admit this; it is quite another thing to proceed as if it were within the scope of practical politics that every child should go through a secondary-school course, and to belittle in consequence the function of the school of the higher elementary type. The value to the community of a particular type of school does not depend upon the name by which that type is designated, and as one member of the conference pointed out, no one type of school is really higher than another. If one of the results of the recent Simla conference is the elimination from the minds of managers of the sway of "motives of fictitious prestige," a real advance will have been made.

[1] Report of the Conference on the Education of the Domiciled Community in India, Simla, July, 1912. Pp. iv+202. (Calcutta: Superintendent Government Printing, India.) Price Re. 1 or 1s. 6d.

THE MOUNT WILSON SOLAR OBSERVATORY.

THE Mount Wilson Observatory received from the Carnegie Institution of Washington the grant of 254,075 dollars, or 50,815*l*., for the year 1912, for construction investigations and maintenance, and the report of the director shows the magnificent way in which this great sum is being utilised. It is impossible in a short note to give an adequate account of the very admirable report of the director, which covers forty-one pages of very condensed matter. On

the first page Mr. Hale modestly states, "among the results of the year's work the following may be mentioned," and then he follows this with brief paragraphs, *thirty-five* in number, each of which is a piece of valuable research work far-reaching in its aim and an important thread in the web which comprises the complete knowledge of stellar distribution and development. Some of the results of these researches have been published in *The Astrophysical Journal*, and received notice in our astronomical column.

The past year has marked the completion of the 150-ft. tower telescope, and great things are expected of it in the future. The work so far done with it has proved that it is perfectly stable and on no occasion has trembling of the image been recorded. It may be mentioned here, and it is not generally understood, that the girder work forming the visible tower is really in duplicate, each girder containing another one inside completely independent of it, and not touching it, and thus forming a complete second but invisible tower. The outside girder work is thus designed to protect the inner one from vibration caused by the wind. The cœlostat and secondary mirror placed at the top of the tower are fixed to a

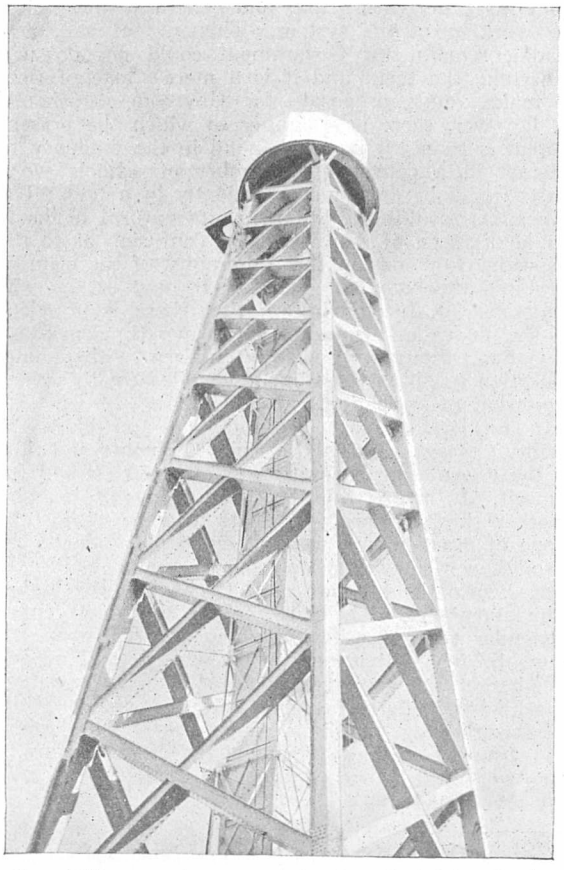


FIG. 1.—The tower telescope as seen from immediately below, showing the platform and dome at the top.

platform resting on the inner tower. The definition of the solar image is stated to be better than that of the Snow telescope after the early morning hours in consequence of the protection of the beam. In our astronomical column for March 20 a statement was quoted from *The Observatory* for March that the 100-in. mirror, when tested, was found to be probably useless. Mr. Hale, in his report, states that the tests indicate that it may become necessary to discard the disc, but in a footnote adds that "since the above was written. . . . There is now every reason to believe that the present mirror will prove suitable for use in the telescope." It may be that the information in *The Observatory* refers to a further examination subsequent to the footnote. The 60-in. reflector has a very large programme of work allotted

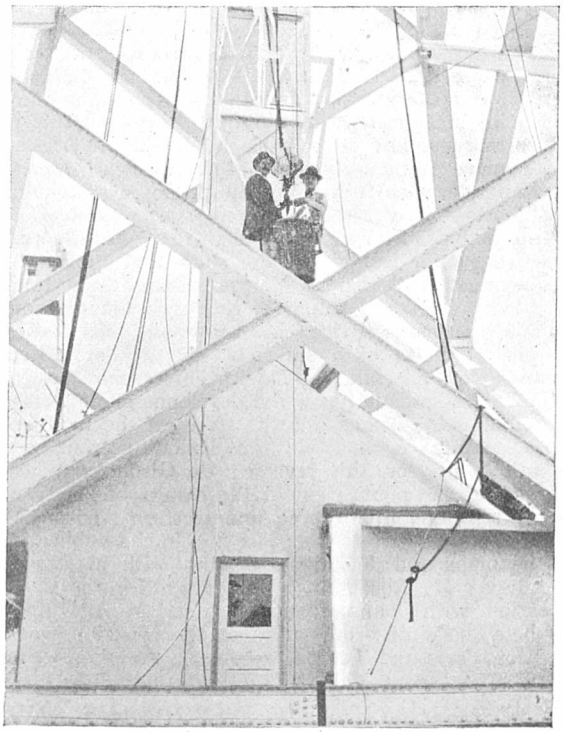


FIG. 2.—The observing house is directly below the tower and above the spectroscopes, which are situated in a deep vertical pit in the mountain.

to it, and mention is made that Prof. Barnard would prefer it for visual work on the planets to any of the large refracting telescopes with which he is familiar. This report will be a revelation to those who work at astrophysics or solar physics this side of the Atlantic, and will probably make some workers very downhearted when they compare their own means of research with those available at Mount Wilson.

CHEMIO-THERAPY.[1]

IT must be a great pleasure and a special honour for all of us to meet here personally on British soil for a scientific purpose, in order to take part in the great work which will be of benefit to the whole world. Are we not here in a country that has produced two men who must be considered among the greatest men of all times, Jenner and Lord Lister? Like a star in the darkness of his age, Jenner's great achievement, which broke the power of such an awful public plague as smallpox, still shines with peerless splendour. And on the occasion of the last congress which was held here we gathered with wondering admiration round Lord Lister, who through his introduction of antiseptics brought about a revolution in surgery which stands alone in the history of medicine. Here in England the first example of a modern Institute for Tropical Diseases, which is a model for

[1] From an address delivered before the seventeenth International Congress of Medicine at London on Friday, August 8, by Prof. Paul Ehrlich.

all other institutes of this kind, was created under the direction of Sir Patrick Manson. Through Ross's excellent work, Laveran's discovery of the causes of malaria was so far advanced that entirely new lines were opened up for the hygienic struggle against tropical and subtropical diseases.

The proof by Castellani that a trypanosome is the cause of sleeping sickness, the classical work by Bruce on illnesses caused through trypanosomes, the specific cause of kala-azar (Dum-dum sickness) as proved by Leishman, are all well known to us. The therapeutic influence of atoxyl in the cases of trypanosome diseases was first established in the Liverpool Tropical Institute by Thomas and Breinl, and quite recently Plimmer has brought forward the use of tartar emetic as an effective weapon against protozoal diseases.

The life-work of Almroth Wright is also known to all of us, *i.e.* his work on opsonins and on the prophylactic treatment of typhoid fever, which has been carried out in a practical and most excellent manner. Even these few names, to which I might add many others, show what a high and leading position England has taken and still holds in the fight against infectious diseases. To prevent the spread of and to heal infectious diseases was at all times the highest aim of medical aspirations; however, a systematic pursuit of this purpose has only been possible in recent times, as through the labours of all civilised nations we have got an insight into the nature of infections, the cause of diseases, and the means by which they are transmitted. Through these methods it has been possible to infect animals artificially and so obtain material on which to test the drugs in a systematic and rational manner. From the very first beginnings of therapeutics, chemio-therapy has indeed been in existence, as all the remedies which we employ are chemicals; on the other hand, experimental chemio-therapy could only develop in modern times in a fruitful manner as a result of all this pioneer work. But here also it has been proved that the four most important factors are: patience, skill, luck, and, last but not least, money.

Now, gentlemen, I may perhaps take the liberty of giving you an insight into the workshop of the chemio-therapeutic work. The whole area is governed by a simple, I might even say natural, principle. If the law is true in chemistry that "Corpora non agunt nisi liquida," then for chemio-therapy the principle is true that "Corpora non agunt nisi fixata." When applied to the special case in point this means that parasites are only killed by those materials to which they have a certain relationship, by means of which they are fixed by them. I call such substances "parasitotropic." But I should like immediately to add that there are evident exceptions to this law. So, for instance, we are acquainted with a small series of cases in which the apparent therapeutic results are obtained, although the allied substances in question do not possess parasite-destroying qualities. That is the case in the infiltration of the subcutaneous tissues which is caused by a kind of yeast (sporotrichosis). Here Block proved that the clinically highly therapeutic iodide of potassium first of all dissolves the cells of the infiltration, whilst the parasites, as such, are not in the first instance attacked.

But, in any case, it is safest and best for the development of chemio-therapy not to build on the basis of exceptional work, but it is better to start with such substances as produce the destruction of the parasites by fixation.

Now it has been assumed in different quarters that some of the more modern remedies are incorrectly regarded as parasiticides, but in reality they are not such. Thus, for example, salvarsan or mercury salts are not intended to act directly on the parasites but indirectly, owing to the fact that they excite the organism to the formation of specific anti-substances. This view is based mainly upon the fact that if one mixes the substances in question, such as, for instance, neosalvarsan, with certain pathogenic agents, *e.g.* spirochætes, in test-tubes, one cannot perceive any reduction in their mobility after observing them for hours together. From this fact, which was first discovered by Prof. Hata, the conclusion has been drawn that salvarsan or neosalvarsan, as such, did not in any way directly influence the spirochætes. Now it can very easily be shown that this conclusion is quite incorrect. If, for instance, following Castelli, one suspends the spirochætes of relapsing fever in indifferent mixtures of serum which do not injure their vitality, and if one fills two small tubes therewith and adds to one of the tubes a very small quantity of salvarsan or neosalvarsan, and if one then centrifugalises and then draws off the liquid; if one washes the remaining spirochætes again in a mixture of serum and again centrifugalises it; then one obtains in both tubes a deposit of spirochætes which on microscopic examination shows the same properties, *i.e.* equally good mobility of the spirochætes. If, however, the spirochætes obtained in this manner are injected into test mice, then one can very soon convince oneself that the spirilla treated with salvarsan do not give any infection to the animal, whilst the mice vaccinated with the contents of the control tube promptly shows signs of infection. This proves that salvarsan or neosalvarsan, as the case may be, is absorbed by the spirochætes, and must have damaged them, and that this trace of salvarsan, which is so exceedingly minute that it can scarcely be weighed, was sufficient to prevent the increase of the parasites in the animal body. Therefore, by this very simple and easily intelligible experiment, the direct effect of salvarsan and neosalvarsan on the spirochætes, and thereby the principle of fixation, is absolutely proved; the objection of the indirect effect based upon anti-substances therefore falls to the ground.

It was necessary, however, to penetrate more deeply into the mechanism of this fixation of remedies, and it is only after long-continued efforts that success has been attained in obtaining a clear conception. In order to make practical progress it appeared to be necessary not to be satisfied with the primordial idea, but to see in what manner the drugs are fixed by the parasites, or, as the case may be, by the cells. Only by taking a very roundabout way has it been possible to obtain clearness with respect to these complicated relations, and in this connection it was especially the studies on trypanosomes and especially the investigations of "drug-fast" strains of germs, which led to quite definite representations with regard to the process of fixation. There was no difficulty by continued treatment of the experimental mice with certain definite remedies, *e.g.* fuchsin, in finally obtaining a race of trypanosomes which had become immune against these remedies, *i.e.* "drug-fast," in the case mentioned above immune to fuchsin. There were especially three classes of different remedies which were very suited to this purpose:—

(1) The class of the arsenic compounds, in the following historical order: arsenious acid, arsenilic acid (atoxyl), arsenophenylglycine (salvarsan and neosalvarsan).

(2) The class of the so-called azo-dyes (the trypan red, manufactured by Weinberg, with which Shiga and I made experiments, and the trypan blue of Mesnil).

(3) Certain basic triphenylmethane dyes (fuchsin, methyl violet, &c.).

When a race of trypanosomes has been rendered

immune against fuchsin, then this race is immune against all the allies of fuchsin and methyl violet, &c., but it is not immune against the two other classes.

Also a race immune against arsenic compounds is only immune against such, but not against the two other classes. We see, therefore, that the immunity is of a specific nature inasmuch as it is limited to a definite class of chemical substances.

It was just this specific character which indicated that it must be a question of purely chemical processes. Earlier studies relating to another subject, *i.e.* those relating to toxins and antitoxins, pointed to the nature of the said processes. In connection with these it had been shown that the destructive toxins developed their injurious action on the cell by the fact that they are absorbed by certain specific component parts of the cell—side chains—which I have characterised as "receptors," and that the anti-substances represent nothing else than the cell receptors produced in excess under the influence of the toxin and thrown off.

For many reasons I had hesitated about transferring these views relating to receptors to chemical bodies at all, and in this connection it was especially the brilliant investigations by Langley relating to the effects of alkaloids which caused my doubts to disappear and made the existence of chemo-receptors seem probable to me.

From this point of view, the phenomena observed in connection with the "drug-fast" strain of germs can be readily explained experimentally, owing to the fact that the chemo-receptors under the influence of drug-fastness suffer a reduction of their affinity for certain groupings connected with the remedy, which can only be regarded as purely chemical. This reduction in affinity explains in the simplest possible manner why continually increasing quantities of the arsenic compound become necessary for the destruction, *e.g.* of a race of arsenic-fast trypanosomes, for the smaller avidity can only be overcome by a corresponding surplus of the arsenic compound, if the quantity necessary for the destruction of the parasites is to be finally fixed.

We, therefore, come to the conclusion that in the parasites there are present *different specific chemo-receptors,* for instance, the *arseno-receptor,* which fixes the trivalent group of arsenic as such; and the *acetico-receptor,* which fastens to itself the acetic acid group, an *iodine-receptor,* an *orthoamidophenol-receptor,* which conditions the fixation of the salvarsan, and many others in addition. A complete exhaustive knowledge of all the different chemo-receptors of a certain definite parasite is what I should like to characterise as the *therapeutic physiology of the parasite cell,* and this is a *sine quâ non* of any successful chemio-therapeutic treatment. I should like to emphasise the fact that many observations indicate that certain chemo-receptors are due to several different kinds of parasites, not to a single one. The knowledge of these is of special practical importance, because remedies which are adjusted to these have a healing influence on a very large series of the most various pathogenic agents. *The larger the number of different chemo-receptors, therefore, which can be demonstrated the greater is the possibility of a successful chemio-therapy.*

Now if we seek for specific remedies, then the first condition is that they must possess a certain definite grouping, which is chemically allied to one of the chemo-receptors of the parasite. This is only a necessary prior condition of the toxic effect, but in general it is not a sufficient one in itself. Hundreds of substances may fix themselves on a parasite and only a few are capable of bringing about its destruction.

In the therapeutically suitable substance there must, therefore, in addition to the fixing group, which brings about the fixation of the *haptophorae,* be another, which as such brings about the destruction, and therefore is to be characterised as the "poisoning" or *toxophoric.* This representation exactly corresponds to the views which we have already long since obtained with respect to toxins, in which we distinguish the presence of a haptophoric group which conditions the cell fixation and also the formation of the antitoxins, and a toxophoric group which brings about the injurious action on the cell. In the case of the highly complicated synthetic drugs the assumption will have to be made that the haptophoric group and the toxophoric group are not *directly* connected with one another, but as separate groups are linked with a chemical molecule in the character of side-chains. In this way we arrive in a natural manner to this, that chemio-therapeutic agents, built up in a complicated manner, may be compared to a poisoned arrow; the fixing group of the drug which anchors itself to the chemo-receptor of the parasite corresponds to the point of the arrow, the binding member is the shaft, and the poison group is the arrow poison fixed to the shaft of the arrow. Corresponding to this scheme in the case of salvarsan (dioxydiamidoarsenobenzol) the benzol group would correspond to the shaft, the ortho-amidophenol group to the point, and the trivalent arsenic group would correspond to the toxophoric group.

If we continue this comparison, then the substances which are used for poisoning the arrows are alkaloids and similar substances, which act injuriously on certain definite vital organs of the body; and so we shall also have to assume that the toxophoric grouping of the synthetic drugs poisons the protoplasm of the bacterial cell, and this only appears to be possible when a chemical affinity exists between the toxophoric grouping and the constituents of the cell. The circumstance that all the derivatives of arsenic which contain arsenic in the pentavalent form, *i.e.* in the fully saturated form, do not bring about any therapeutic action, but that this only commences when the arsenic group exists in the unsaturated condition corresponding to the trivalent radical, certainly points in the same direction. This difference between the saturated and unsaturated arsenic radical was discovered by the master mind of Bunsen, for in the year 1843, in his comparative studies relating to the non-poisonous cacodylic acid with the pentavalent arsenic and its poisonous reduction product, the cacodyl with the trivalent arsenic, he came to the conclusion that "the cacodylic acid had lost the power to form an attacking point, and at the same time it had lost its effect on the organism." In the subsequent period a very large series of analogous cases have become known corresponding to this truth, which point to the increased effectivity of the unsaturated radical. The best-known example is doubtless the high degree of toxic power of carbon monoxide as compared with the almost indifferent carbon dioxide.

Dyes act as bactericides only as such, but not in the form of their colourless products which correspond to the saturated type. *The fact is that all these unsaturated combinations contain unsatisfied avidities which render them capable of reacting additionally with other combinations.*

If, therefore, we poison a spirochæta with salvarsan, then there occur at least two different chemical fixations: first of all the fixation of the orthoamidophenol group, which primarily fixes the salvarsan to the parasite. It is only in consequence of this fixation that secondarily the trivalent arsenic group is given the opportunity of entering into chemical combination with the arseno-receptor of the cell, and so to exert its toxic effect. The avidity of the arseno-receptor can in itself be such that it can only react if favouring

factors, which chemically must be regarded as a stereo-chemical facilitation, come into action.

Examples of such stereo-chemical facilitations are frequently found in chemistry, *e.g.* in the chemistry of the ortho-condensations. And so the haptophoric group of the arsenic molecule primarily brings the arsenic along to the cell, and secondarily brings about its possibility of action.

Now, it is a frequent practice of many uncivilised peoples, in order to be certain of killing their enemies, that they not only rub over their arrow with one kind of poison but with two or three totally different kinds of poison. And so it also appeared advisable to imitate this procedure against the parasites, which is otherwise not very praiseworthy, and to poison our synthetically poisoned arrows not singly but doubly. In association with Dr. Karrer I succeeded in depositing the reduced arsenic compound, *e.g.* salvarsan, even on metals, and so in arriving at remedies which, used experimentally on animals, show an increased effect.

In the previous remarks I have described the conditions which are necessary in order that a certain substance may exert a parasiticidal effect, and indeed must effect such, if it operates directly on certain definite parasites in an aqueous solution, such as, for instance, is the case with the ordinary disinfectants. In the manner described above it is easily possible to arrive at a very large number of substances which will destroy bacteria and allied substances in aqueous solutions. But, of course, the problem is much more difficult when it is a question of internal disinfection or of the destruction of living parasites within the infected organism. If the problem is set before us of sterilising a room, then indeed it is an easy matter to do so, owing to the present advancement of science; but the task becomes more difficult when the room is filled up with materials; and when these materials are of such a delicate sensitiveness as living cells, then the difficulty of the problem will be manifest without any further explanation. As a matter of fact, it has proved that substances which bring about a colossal bactericidal effect in aqueous solutions even when they are highly diluted, are totally ineffective in therapeutics properly so called. For it has turned out that, generally speaking, these disinfectants are more or less powerful cell poisons, and seriously injure the organism; they are, therefore, not only parasitotropic but also *organotropic*.

Now, it depends exclusively on the relationship between parasitotropic and organotropic as to whether a certain disinfectant can be used as a remedy. In Robert Koch's celebrated experiment, in which even the largest doses of sublimate did not produce even a trace of therapeutic effect on anthrax infection, it is evident that the parasitotropic effect was reduced to nil by the organotropic effect. If the relationship of organotropic to parasitotropic is somewhat more favourable, then one may observe a peculiar phenomenon, consisting in the course of the infection being rendered worse to an extraordinary degree by the remedy, owing to the effect that the parasites increase to a much greater extent than is generally the case.

This phenomenon, discovered by Hata, is explained by the fact that the ratio of organotropic effect to parasitotropic effect is of such a nature that almost the whole of the poison is absorbed by the organism, but only in infinitesimal quantities by the parasites. According to a biogenetic foundation principle it is quite a common thing for substances which act destructively in *large* quantities to bring about an *increase in the vital functions* in smaller doses. Only such substances, therefore, can be used as therapeutic agents in which the ratio between organotropic effect and parasitotropic effect is a favourable one, and that can be easily ascertained by experiment by a comparison between *dosis toxica* and *dosis tolerata*. *Only such substances can be considered therapeutic agents of which a fraction of the dosis tolerata is sufficient to bring about therapeutic effects.*

The organotropic effect of drugs is, of course, to be attributed, according to the views of Langley and myself, to this, that there are, in the most various cells of the body and its organs, quite different chemo-receptors, exactly in the same manner as we have postulated for the parasites. Apart from the pharmacological effect of the various remedies, this chemical difference of the organs appears clearly in the vital colouring.

I will mention here—in order only to indicate a few examples—the methyl blue colouring of the nerve trunks, the neutral red colouring of the cell granules, and the distribution of the isamine blue in the so-called pyrrol cells, so carefully and excellently investigated by Edwin Goldmann. The pathologico-anatomical findings point also to a chemical divergence on principle. When we see that after the introduction of paraphenylenediamine only the summit of the diaphragm assumes a black colouring; when we see that vinylamine in the case of all kinds of animals isolates and injures the renal papillæ and causes them to die; when after the introduction of cyanosin, as Hata and Goldmann have found, certain definite regions in the hair of mice become coloured, and the colouring matter becomes stored to the greatest degree in the milk glands; when a colouring material of the pyronine series in the case of mice brings about a general dropsy amounting to 50–60 per cent. of the body without injuring the kidney, which doubtless is only to be referred to an alteration of the vessels of the subcutaneous connective tissue, then all these phenomena can only be explained by the fact that at these particular spots definite chemical connections of a specific nature must take place, which must be referred to the presence of certain definite chemo-receptors.

Now, according to the above representations, all these fixations are dependent on the haptophoric grouping of the drugs, and, therefore, it was a matter of great interest to observe how phenylarsenic acid, the mother-substance of the modern arsenic compounds, behaves when various different groups are attached thereto. In this connection it has turned out that when we introduce different constituent fixation groups, *e.g.* chlorine, the oxygen group, the hydrocyanic acid group, the sulphuric acid group, the ammonia radical, we can manufacture, starting out from one substance, a series of combinations, the toxic effect of which may vary fifteen hundredfold. The combinations which are to the greatest extent free from poison—these are derivatives of sulphuric acid, especially the sulpho-phenylarsine acid and its salts—are less toxic than sodium chloride, and, on the other hand, there are substances the very smallest quantity of which brings about death. And in this connection we can see that, according to the nature of the substances, very different organs of the animal's body are injured. Sometimes it is the intestinal tract, and the animals die of profuse diarrhœa; sometimes it is the liver, and the mice—a rare occurrence—become jaundiced and die of serious alterations in the liver; sometimes the red blood corpuscles become dissolved, and the animals die of severe anæmia. Frequently also the central nervous system becomes injured, and in the case of mice this usually relates to the vestibular nerve of the inner ear. The interference with the equilibrium, produced in this way, causes the mice constantly to turn in circles just like the Japanese dancing mice. In the case of human beings the optic nerve is the point of attack for numerous derivatives of

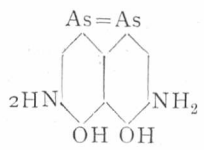
phenylarsine acid. The cases of blindness which have been observed after the use of very large doses of atoxyl, arsazetin, and other drugs are due to this injury.

From this it is evident that according to the selection of the group annexed to the phenylarsine acid quite different organs will be affected. This is only explained according to the above views by the fact that there are, as already previously stated, in the various organs specific chemo-receptors which energetically attract certain fixation groups somewhat as the magnet attracts iron. And this view also provides us with the principle *according to which we have to construct our poisoned arrows.* We must attach to the phenylarsine acid group, or, as the case may be, to the phenylarsenobenzol group, such grouping as is only related in a small degree to the organs of the sick body, but, on the other hand, is very closely allied to the receptors of the parasites.

I have explained above that the parasites possess a whole series of chemo-receptors which are specifically different from one another. Now if we can succeed in discovering among them a grouping which has no analogue in the organs of the body, then we should have the possibility of constructing an ideal remedy if we select a haptophoric group which is especially adjusted to the functions of the parasites.

A remedy provided with such a haptophoric group would be entirely innocuous in itself, as it is not fixed by the organs; it would, however, strike the parasites with full intensity, and in this sense it would correspond to the immune productions, the anti-substances discovered by Behring, which, after the manner of the bewitched balls, fly in search of the enemy. Let us hope that it will be possible chemio-therapeutically to hit the bull's-eye in this manner also. I do not consider this at all out of the question, as it may be proved in certain sicknesses, *e.g.* spirillosis in hens, that from the fiftieth to the hundredth part of the *dosis tolerata* of salvarsan entirely frees the animals from the parasites and leads to a cure. Such a dose truly represents a nil dose, as the hen cannot be damaged thereby in the slightest degree. But such favourable conditions have only very rarely been discovered up to the present; we shall have to be satisfied if we can succeed in obtaining good therapeutic results with the tenth or even the fifth or sixth portion of the *dosis tolerata.*

In the main the above are the principles which guided us in the construction of the new remedies. Among the numerous combinations which have been tested in experiments on animals in the case of trypanosomes and spirillar infection, and in the preparation of which I have been supported by the untiring co-operation of Dr. Benda, Dr. Bertheim, Dr. Kahn, and Dr. Karrer, and which have been biologically tested, especially by my respected friend Prof. Hata, and later by Dr. Castelli and Dr. Gonder and Frl. Leupold, salvarsan has proved to be the most efficient, the dioxydiamidoarsenobenzol of the formula.



Here the orthoamidophenol group acts as the conducting and the arsenic group as the toxophoric group.

But now, gentlemen, the step from the laboratory to practice, *i.e.* to the bedside, is an extraordinarily difficult and dangerous one—a step which can only be taken with the greatest care. Its difficulty and danger are in the main based upon two factors:—(1) On the fact that in the case of men there exist so-called idiosyncrasies, forms of supersensitiveness which do not occur in the case of animals; (2) it has been shown that certain illnesses of a constitutional nature can cause a supersensibility.

The treatment of patients is an exceedingly difficult and responsible task, and the clinical pioneers, such as Schreiber, Wechselmann, Iversen, &c., deserve our warmest thanks. They have thrown the first light upon the most important questions (dosology, indications, and counter-indications). From a series of observations, which is now so vast that it can scarcely be surveyed, there has, however, resulted what I might call the "therapeutic tactics," which I should here like briefly to explain.

The *therapia sterilisans magna,* which consists in this, that by means of one or at most two injections the body is freed from the parasites. In experiments on animals, and also in the case of a series of important maladies, this principle can be carried through in a clear and pure manner. Here, therefore, the old therapeutic remedy is applicable: "Frapper fort et frapper vite."

We have to ask ourselves the question, What are the causes which make it possible for a favourable result to be obtained, a result which may be taken as *therapia magna sterilisans,* radical cure of the body by means of a single injection? Typical antibodies can be shown to be produced fairly rapidly by the destruction of parasites, and especially of protozoa. Hence, it is quite evident that this assisting action of the organism ought to be eminently efficacious. For if the medicine has destroyed not the whole of the parasites, but only 95 per cent., and 5 per cent. have resisted its action, then these remaining 5 per cent. are sure to succumb to the influence of the antibodies which are rapidly formed. If this is the case, the *therapia sterilisans magna* is attained. Unfortunately, it has been shown that this salutary process may frequently be minimised considerably owing to the biological properties of the parasites. For it may happen that a part of the parasites which survive the first injection escape destruction by the serum either wholly or in part, and subsequently change into new varieties which have become serum-proof, and are known as a relapsing crop. It is clear that parasites of this kind which are able to form a large number of relapsing crops offer very great difficulties in their treatment, as in this case the auxiliary forces of the body fail to act, so that it is necessary to do one's utmost to destroy the whole of the parasites all at once by means of drugs, as owing to their great power of adaptation a single germ surviving may perhaps be the cause of the infection breaking out afresh.

If we compare the fight against parasitic diseases with a state of warfare, we find that, on one hand, great battles are fought which may lead to victory in the course of one or a few days. In combating bacteria such a victory would compare with *therapia magna sterilisata.* If, on the other hand, a fortress has to be taken, the goal cannot be reached with one single stroke, but it may take months and even years.

The measures employed in connection with a bacteriological siege aim on the whole at rendering the places which are not easily accessible more accessible for the therapeutic agent than is the case under ordinary conditions. On the other hand, however, the greater power of resistance of certain parasites has to be taken into account, and this is a purely chemical question which can only be solved by chemical means. The road leading to its solution which promises the best results is that of combined therapy.

From what has been said it will be seen that combined therapy is best carried out with therapeutic agents which attack entirely different chemo-receptors

in the parasites. For instance, it is useless to combine euchsin with its nearest relative, methylviolet; and it is useless to combine therapeutically trypane blue and trypane red, for both attack the same spots in the parasites, but it is necessary to select from each group the most effective substance and then to combine the most suitable representatives of the various types. It is clear that in this manner a simultaneous and varied attack is directed on the parasites, in accordance with the military maxim, "March apart but fight combined."

Combined therapy will in the future conquer an ever-increasing field of action. Thus, for instance, Broden, in the Congo, succeeded in connection with sleeping sickness in the human subject—it is true only in the early stage of this infection, which is so difficult to fight against—in obtaining good results by the combination of salvarsan and two basic colouring matters (trypallavin and tryparosan) by treatment lasting about a week.

It is precisely in the manifold character of the possibilities of combination that I see a special advantage, and peculiar possibilities of development. When once we are acquainted with the majority of the chemoreceptors of a particular kind of parasite, which will be a long piece of work, occupying many hands and heads, we shall have the most far-reaching possibilities of simultaneous attack by various agencies. And on this account combination therapeutics are also absolutely pluralistic in contrast to antitoxins, which may be said to act rather in one single direction.

And now, gentlemen, may I be permitted to refer to a few practical results? You are all aware that with a number of spirillar diseases the principle of *therapia sterilisans magna* has proved most successful. You are aware that it is possible by one single injection of salvarsan to cure framboesia (yaws), which is also caused by spirochætes, and is a scourge of the tropics, curing it completely except in rare cases where unimportant relapses occur; this has been shown by the work of Strong, Koch, and Castellani. Thus, in Surinam, a hospital in which more than 300 patients with framboesia were constantly under treatment was closed and turned to other uses after the introduction of the salvarsan treatment, as one single injection sufficed to cure the disease, and the patients could all be discharged but two. It is to be hoped that in this way it will be possible altogether to extirpate framboesia.

Exactly the same favourable results have been attained with recurring fever in the human subject, the fever immediately subsidising after the injection of salvarsan, and the patients being cured by one injection. The very rare cases of relapse occasionally occurring are also readily curable.

To continue dealing with salvarsan, in syphilis, which is so closely related to framboesia, a fair percentage of cures has been obtained in the very first stage of the disease by a single injection of a large dose, but, of course, the abortive cure by intensive treatment is far more certain.

With Vincent's angina and the diseases of the mucous membrane of the mouth, which are caused by spirochætes of the mouth, *therapia sterilisans magna* is possible; in fact, in many cases a mere local application of salvarsan suffices. I may here further mention tertian malaria, in which form, but in this form alone, salvarsan has proved successful, and blastomycosis (Petersen) and the Aleppo boil. As regards diseases of animals which can be cured by one single injection of salvarsan, I might specially mention breast disease of horses, which is of such enormous importance to the military authorities, and lymphangitis epizootica, the African glanders in horses.

Most important are the recent observations of Rogers, who found emetin to be a specific against the very serious amœbic dysentery. And if here it is indeed advisable and necessary to repeat the injections, yet the triumph of therapeutics remains unassailed; it is all one to the patient as to whether *therapia sterilisans* or *sterilisans fractionata* is employed, provided only he is relieved of his sufferings in a harmless manner.

Piroplasmosis also, which exerts a disastrous action, causing serious diseases in cattle and dogs, may, according to the observations of Nuttall, be favourably influenced by a pigment belonging to the class of trypane colouring matters, viz. by trypane blue, which was first composed by Mesnil. As I am informed, the fight against this disease has been taken up in a general manner at Pretoria under the auspices of Theiler. The injections are there performed, not by veterinary surgeons, but by the farmers themselves, and they are glad to save their valuable animals scot-free from this serious disease.

It is indeed easy to understand that the schizomycetes, which in themselves are so much hardier than the tender protozoa and spirochætes, will offer an increased resistance to the attack of drugs. Naturally here, too, there are fine differences, and it is perhaps no accident that the pneumococcus, the protoplasm of which is, of course, most sensitive, should in the course of treatment also have shown itself to be particularly sensitive. (I refer here to the fine researches of Morgenroth in the treatment of laboratory animals infected with the pneumococcus by means of derivatives of quinine, especially ethylhydrocuprin.) But in the case of hardier bacteria, too, such as the *Bacillus typhosus*, the possibility of sterilisation is not beyond hope. The first successful experiments in this sphere were carried out by Conrad on rabbits, and later confirmed and extended by Uhlenhuth and his fellow-workers on this species of animal.

If I briefly allude to the very hopeful experiments of Gräfin Linden, who has endeavoured to influence tuberculous infections favourably by means of combinations of copper and lecithin, and if I add that salvarsan also has been shown to have a beneficial action upon the malignant anthrax-bacillus, and upon that of glanders, and, possibly, upon that of erysipelas, both in animal experiments and occasionally, too, in human cases, then all that we know about the chemiotherapeutics of the specific bacterial diseases has been told, so that it is just in this direction that there lies a wide field still to be worked. This field, important as it is, is still in the very first stages of experimentation.

And if after what has been said we cast a glance over the development of medicine and especially of the fight against infectious diseases, we must recognise that in the last fifty years the most important advances have been made in every direction, advances connected above all with the names of Pasteur, Robert Koch, and von Behring.

On one hand we have the isolation of the pathogenic bacteria, which was made possible really by the Koch method of the solid culture medium, and in which Robert Koch's pupils and fellow-workers, Löffler, Gafftey, Pfeiffer, in the first order, participated; the study of protozoa, which started from Laveran's discovery of the germ of malaria; the discovery by Löffler and Frosch, Roux and Nocard, of the viruses which pass through filters; and the recognition of insects as intermediate hosts and transmitters of infectious diseases, which is connected with the name of Theobald Smith, and has led to the most important consequences.

On the other hand we have the study of the immunity theory which was first inaugurated so bril-

liantly by Metchnikoff, and received a new impetus from the wonderful discovery of antitoxin by von Behring, through which a wide new field, that of the science of immunity and the investigation of serums, was opened up, on which Pfeiffer, Bordet, Widal, Wassermann, and many others, including myself, have worked with successful result. Some of the most valuable fruits of these labours from a practical point of view have been the diagnosis of diseases first in the form of the Widal-Grüber reaction, and later the Wassermann syphilis-reaction, the importance of which for diagnosis and therapeutics cannot be estimated.

All these discoveries, especially in regard to the ways of spreading diseases on the part of the infecting agencies, have, in accordance with the principle that "Prevention is better than cure," been made good use of in the fight against epidemics and for prophylactic measures, and have brought about an improvement surpassing expectation. In the second place the struggle with diseases which have already broken out has been able to derive advantages from these discoveries, the most wonderful example being the diphtheria serum.

Now that the liability to, and danger of, disease are to a great extent circumscribed, so far as epidemics and many other diseases are concerned, the efforts of chemio-therapeutics are directed so far as possible to fill up the gaps left in this ring, more especially to bring healing to diséases in which the natural powers of the organism are insufficient. And I believe that now when definite and sure foundations have been laid for the scientific principles and the method of chemiotherapeutics, the way is visible before us; not always an easy but yet a practicable way. In the diseases involving protozoa and spirilla extraordinarily favourable results, as I have shown, have already been gained, which can also satisfy far-reaching tests. There are many valuable indications that in a series of other diseases—smallpox, scarlatina, typhus exanthematicus, perhaps also yellow fever, and, above all, infectious diseases caused by invisible germs—the prospects of success are brightening. But in contradistinction to these super-parasites the ordinary or common bacterial diseases (diseases due to the streptococcus and the staphylococcus, coli, typhoid, and dysentery, but, above all, tuberculosis) will still require a hard struggle. Nevertheless, I look forward with full confidence to this development also, and might, without being set down as an optimist, put forward the view that in the next five years we shall have advances of the highest importance to record in this field of research. There are indeed problems which often prove too great for the powers of individuals, and can only be solved by a many-sided effort. Considering the enormous number of chemical combinations which are taken into consideration in a struggle with diseases, it will always be a caprice of chance or fortune or of intuition that decides which investigator gets into his hands the substances which turn out to be the very best materials for fighting the diseases, or the basal substances for the discovery of such. But the chances in favour of finding a real cure, and so of winning the big prize, will naturally rise with the number of those who occupy themselves with the definite problem. It is just at this point, above all, that necessity arises to gather and unite all powers, and here special force attaches to that motto, *Viribus unitis*, which gives guidance in so many other fields; which in so exemplary and fine a way is the foundation of this great International Congress, to which thousands have been drawn from all lands, to give their testimony that in the world of science all national barriers have disappeared.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LEEDS.—The council of the University has accepted with deep regret the resignation of Mr. Roberts Beaumont, professor of textile industries. To mark its sense of the value to the University of his work, extending over a period of thirty-four years, the council has placed on record its high appreciation of the services which, during his long tenure of the professorship, Prof. Beaumont has rendered to the clothworkers' departments of the University, and to technical instruction in the textile industries.

LONDON.—Dr. W. C. McC. Lewis, having been appointed to the chair of physical chemistry in the University of Liverpool, has resigned his office in connection with the department of chemistry at University College. Dr. R. E. Slade has been elected to succeed him as assistant. Dr. Slade was educated in the University of Manchester. In 1909, he was appointed assistant-lecturer in physical and electrochemistry at the University of Liverpool, and was subsequently appointed lecturer-in-charge of the department of physical chemistry.

Dr. A. J. Clark, assistant in the department of pharmacology at University College, has been appointed lecturer in pharmacology at Guy's Hospital Medical School. His successor at University College will be appointed at the beginning of next session.

THE short Education Bill recently introduced into the House of Commons by the President of the Board of Education, which dealt with grants in aid of building, has been dropped for this session, owing to the great pressure of Parliamentary business.

BY the will of the Rev. L. C. Chamberlain, we learn from *Science*, 5000*l*. is bequeathed to the Smithsonian Institution for its mineralogical collections, and 2000*l*. for its collection of molluscs. There was also bequeathed 1000*l*. to the Academy of Natural Sciences in Philadelphia for increasing and maintaining the Isaac Lea collection of Eocene fossils. These bequests were made for the benefit of the scientific work in which the late Mr. Isaac Lea was interested, Mrs. Chamberlain, his daughter, having inherited the money from him. Mr. Chamberlain also bequeathed 20,000*l*. and his residual estate to the Thessalonica Agricultural and Industrial Institute, Turkey.

THE programme for the session 1913–14 of the department of technology of the City and Guilds of London Institute has now been published by Mr. John Murray. It contains the regulations for the registration, conduct, and inspection of classes, for the examination of candidates in technological subjects, and for the award of teachers' certificates in manual training and domestic subjects. The regulations are in the main the same as those of last year, but the rules respecting the award of full technological certificates have been revised. The passing of examinations in science, and in some cases in art, held by approved schools will be accepted as a qualification for the full certificate. Under certain conditions, candidates from approved schools may be exempted from the examination in the first grade in some subjects in which the examinations are held in more than two grades. In a number of technological subjects the syllabuses have been rearranged and redrafted.

THE Illuminating Engineering Society has issued a preliminary report of the joint committee appointed in 1911 to consider the questions in connection with the artificial lighting of schools. The report appears in *The Illuminating Engineer* for July. The com-

mittee was chiefly concerned with the needs of the children. The intensity of illumination necessary in schoolrooms depends on the nature of the work carried out. It is suggested that for ordinary clerical work the minimum illumination measured at any desk where the light is required should not fall below 2 foot-candles—four members of the committee say $2\frac{1}{2}$ foot-candles. For special work, such as stitching with dark materials or that in art classes, a minimum of 4 foot-candles is desirable; and for general illumination in assembly-rooms one foot-candle. As regards blackboard lighting, the committee recommends an illumination on the blackboard about 60 per cent. in excess of that prevailing in the rest of the room. To avoid glare it is recommended that no lamps should come within the solid angle subtended at the eye by the blackboard, and a space 2 ft. above it, unless they are completely screened from the eye by a shade impervious to light. With the same object it is suggested that for text-books intended for the use of young children matt paper, sensibly free from prejudicial reflection, should be employed. The use of light-tinted surroundings which serve to diffuse the light is recommended to avoid inconvenient shadows.

SOCIETIES AND ACADEMIES.

MANCHESTER.

Literary and Philosophical Society, July 22.—Dr. H. **Wilde**: Some new multiple relations of the atomic weights of elementary substances, and the classification and transformations of neon and helium. In several of the author's papers on the origin of elementary substances, published by the society (1878–1906), special attention was directed to the seventh series of his classification, on account of the magnitude and importance of its primary members in the economy of nature, viz. nitrogen, silicon, iron, and gold. Silicon in combination with oxygen constitutes more than half the weight of the earth's crust, and is the principal constituent of glass for all the purposes of civilised life. The policy of several writers in doubling the atomic weights of four of the gaseous members of this series, viz. neon, argon, krypton, and xenon, induced the author to review the multiple relations of the seventh series with the important result (1) that six triads are formed out of the eight principal members of the series, in which the sum of the atomic weights of the extreme members is double the atomic weight of the means, and are all multiples of seven. Triads of atomic weights have been fully recognised by Dumas, Faraday, and other philosophical chemists, as indubitable evidence of community of origin, of transmutation, and important factors in the classification of elementary substances. Radium (as was indicated in Dr. Wilde's tables of elements some years previous to its discovery) is one of the synthetic transformations of helium, and is the next higher member of the series to barium, as was since confirmed by Mme. Curie. Helium is also shown in the author's table of 1878 as the analytic transformation ultimate of radium and other members of the second series of elements. The positions of helium and neon, as the transformation ultimates of the second and seventh series respectively, are further interesting in connection with the recent announcements that these elements have been found in glass vessels and tubes in which they had no previous existence. Assuming the reality of these observations, the phenomena not only admit of explication from Dr. Wilde's classifications, but also account for the discordant results obtained by the experimenters engaged in the research. One of the investigators could only find neon, while others, working independently, found helium alone, and in other cases a mixture of both gases. These results were of sufficient interest to induce the author to ascertain the composition of various glasses used in the arts. The principal and most important constituent of the glasses tabulated by Dr. Wilde is silicon, the transformation ultimate of which is neon. The next important constituents of the glasses are barium, calcium, and lead, all members of the second series of elements, the transformation ultimate of which is helium. The alkali methods, sodium and potassium, are constituents of nearly all glasses, and their transformation ultimates (with others of the first series) will be hydrogen and neon, but without helium. All the silicates of the first and second, and some of other series, are easily vitrified in small quantities in laboratory crucibles. Their spectra can then be examined during electrification in tubes (under suitable conditions of temperature and pressure) for the discovery of new elements and the identification of those already known.

PARIS.

Academy of Sciences, August 4.—M. F. Guyon in the chair.—J. **Boussinesq**: The complete determination, by its partial differential equations, of the problem of slow regularised movement of a heavy liquid mass, in the midst of another fluid mass, indefinite and at rest, and equally incompressible.—G. **Charpy** and A. **Cornu**: The displacement of the critical points of iron by the addition of silicon. Contradictory results on this subject have recently been published by Vigouroux and Baker. Seven alloys have been prepared by the authors from Swedish iron to which increasing quantities of ferro-silicon were added. Complete analyses are given of the seven alloys, the silicon ranging from 0·11 to 6·10 per cent. The critical points were determined by the velocity of cooling method, the curves being recorded automatically with the double Saladin-Le Chatelier galvanometer. The point a_3 vanishes when the silicon reaches 1·5 per cent. The point a_2 remains clear throughout, but each increase of 1 per cent. of silicon lowers the temperature by about 11° C. The temperature of a_1 is slightly raised as the proportion of silicon increases, and tends to disappear when the silicon is more than 5 per cent.—Paul **Vuillemin**: The greening of the wood of the pear-tree. The wood is rendered green by *Helotium aeruginosum* and *H. aeruginascens*, the two species differing in the size of the spores. The name of Chlorosplenium is without systematic value, since several genera have been described under this name which are not closely allied. The colour of the wood is retained indefinitely and has been utilised in the arts.—R. **Gateaux**: Continued and analytical functionals.—Jules **Andrade**: The law of similitude of circular springs.—J **Rey**: A method of testing optical reflectors. The proposed method, which is applicable to all optical systems giving a real or virtual image of a luminous point placed at its focus, is based on a photograph of the image of square mesh wire gauze. The photograph shows not only that there is an imperfection of the surface, but gives the points of the surface the curvature of which is incorrect. Two reproductions of such photographs accompany the paper.—MM. **Massol** and **Faucon**: The absorption of the ultra-violet radiations by some mineral colouring matters in aqueous solution. The various colouring matters studied (potassium ferrocyanide, gold chloride, sulphate of copper, potassium chromate, uranium nitrate, nickel sulphate, chromium sulphate) absorb the ultra-violet radiations unequally. From a quantitative point of view, the absorbing power of synthetic organic colouring matters is much greater than that of the mineral colours.—Daniel **Berthelot** and Henry **Gaudechon**: The rôle of uranium salts as photochemical catalysts.

With the exception of uranium salts, none of the fluorescent and radio-active bodies used had any accelerating effect on photochemical reactions. The accelerating effect of uranium salts is limited to a special class of reactions, those which are produced spontaneously in ultra-violet light. The photocatalyst enables the reaction to proceed in ordinary light.—A. **Damiens**: The products of incomplete reduction of cerium oxide. By the action of a limited quantity of carbon on ceric oxide Sterba obtained a substance described by him as cerium oxycarbide. The reduction of ceric oxide is now shown to give a mixture of Ce_2O_3, CeC_3, and CeC_2; there is no confirmation of the existence of a definite oxycarbide.—F. **Jadin** and A. **Astruc**: Manganese in drinking water and mineral water. The results of a series of determinations of manganese in the drinking water of eight towns and nine mineral springs. All the latter showed appreciable amounts of manganese varying from 0·09 to 0·20 milligram per litre.—Charles **Nicolle** and E. **Conseil**: An attempt at the experimental reproduction of mumps in the ape.—H. **Pottevin** and H. **Violle**: Experimental cholera in the lower apes.—Jacques **Mawas**: The structure and morphological signification of the comb (*peigne*) of the eye of birds.—M. **Arabu**: The Neogene of the north of the Sea of Marmora.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical series), parts 1 and 2 for 1913, contain the following memoirs communicated to the society:—

December 21, 1912.—F. **Bernstein**: Contributions to mathematical statistics. I., The method of treating incomplete material.—G. **Tamman**: The phase-diagram of water.

January 11, 1913.—A. **Peter**: The diatomaceous flora of southern Hanover, including the Harz, and its distribution in the waters of the region.

January 25.—R. **Wedekind**: Further contributions to the zonal partition of the Upper Devonian.—E. **Perna**: The relations of the Upper Devonian of the Eastern Ural and that of Westphalia and Silesia.

February 8.—G. **Tamman**: The relation of the volume-surface to the polymorphism of water.—B. **Dürken**: The transplantation of young osteoblasts into the orbit of the larval frog.—O. **Wallach**: Researches from the Göttingen University Chemical Laboratory. XXVI., The behaviour of carvoxime and of eucarvoxime towards free hydrogen in the presence of colloidal palladium.

February 22.—M. **Planck**, P. **Debye**, W. **Nernst**, M. von **Smolukowski**, A. **Sommerfeld**, and H. A. **Lorentz**: Preliminary report on the course of lectures on the kinetic theory of matter instituted by the committee of the Wolfkehl foundation.—P. **Hertz**: The statistical mechanics of the spatial "aggregate," and the probability of a given "complexion" (kinetic theory of gases).—H. **Bolza**, M. **Born**, and Th. von **Kármán**: Molecular streams and discontinuity of temperature.—P. **Koebe**: Boundary adaptation in conformal representation.

March 8.—W. **Voigt**: Electric and magnetic double-refraction.—R. **Trümpler**: Determination of fundamental star-places from altitude-transit observations.

BOOKS RECEIVED.

The Official Guide to the Norwich Castle Museum. By the late T. Southwell. Fifth edition, by F. Leney. Pp. 182+plates. (London: Jarrold and Sons.)

Brief Sketch of the Natural History Museum of the University of St. Andrews. By Prof. McIntosh. Pp. 63+xvii plates. (St. Andrews.)

Handbuch der vergleichenden Physiologie. Edited by H. Winterstein. 35 Lief. (Jena: G. Fischer.) 5 marks.

A Text-book of Physics. Edited by A. W. Duff. Third edition, revised. Pp. xvi+686. (London: J. and A. Churchill.) 10*s.* 6*d.* net.

The Volatile Oils. By E. Gildemeister and F. Hoffmann. Second edition, by E. Gildemeister. Translated by E. Kremers. First volume. Pp. xiii+677+2 maps. (London: Longmans and Co.) 20*s.* net.

A Systematic Course of Practical Science for Secondary and other Schools. By A. W. Mason. Book II. Experimental Heat. Pp. vii+162. (London: Rivingtons.) 2*s.* 6*d.* net.

Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt. Jahrg. 1913. lxiii. Band, 1 Heft. Pp. 206+vii plates. (Vienna: R. Lechner.)

Light, Radiation, and Illumination. Translated from the German of Paul Högner by J. Eck. Pp. xii+88. (London: *The Electrician* Printing and Publishing Co., Ltd.) 6*s.* net.

Brazil in 1912. By J. C. Oakenfull. Pp. viii+498+plates. (London: R. Atkinson.) 5*s.*

The Place of Climatology in Medicine. By Dr. W. Gordon. Pp. 62. (London: H. K. Lewis.) 3*s.* 6*d.* net.

Common British Moths. By A. M. Stewart. Pp. viii+88+15 plates. (London: A. and C. Black.) 1*s.* 6*d.* net.

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