THURSDAY, AUGUST 3, 1911.

ZOOGEOGRAPHY.

Bartholomew's Physical Atlas, vol. v., Atlas of Zoogeography: a Series of Maps Illustrating the Distribution of over Seven Hundred Families, Genera, and Species of Existing Animals. Prepared by Dr. J. G. Bartholomew, W. Eagle Clarke, and P. H. Grimshaw. Pp. viii+67+36 plates+xi. (Edinburgh: J. Bartholomew and Co., 1911.) Price 2*l.* 12*s.* 6*d.* net.

THE fifth volume of "Bartholomew's Physical Atlas" is devoted to "Zoogeography"—that is, as the word clearly indicates, the science of the distribution of animal-life over the world's surface. Little was known and still less was understood about this branch of zoology in former years. But when the "Origin of Species" began to be discussed it was quickly perceived how closely the localities of animals and plants are connected with their affinities, and how important "zoogeography" is to the student of animal and vegetable life. Linnæus and his immediate followers did not understand this. They thought that such terms as "East Indies" or "Brazil" were quite sufficient indications of the locality of an animal. But, as the science of zoology advanced, authors became gradually more particular as to their localities, and nowadays unless the place of origin is exactly known a specimen loses at least half its value. In early days the faunal character of each geographical area was supposed to depend entirely on its climatic and physical peculiarities. This idea, however, has been abundantly proved to be incorrect. In many cases tracts of the world's surface exactly similar in climate and in other physical conditions can be shown to be entirely different as regards their animal life. It was not until the theory that the descent of animals is accompanied by modifications of their structure became appreciated that any correct views were put forward on the laws of their geographical distribution. The authors of the present work describe the commencement of this new period as follows:—

"The first attempt to map out a set of zoogeographical regions, based upon the actual distribution of species, and apart altogether from purely geographical considerations, was made by Dr. P. L. Sclater. This eminent zoologist, who is, fortunately, still living, read a paper before the Linnean Society of London, in June, 1857, entitled 'On the General Geographical Distribution of the Members of the Class Aves.' Taking as his basis the Passerine, or 'Perching' Birds, he proposed the division of the earth into six great regions, which he defined geographically, and whose area in square miles he roughly estimated. At the same time, he furnished a tabulated statement of the number of species found in each region, and gave an indication of the peculiar and characteristic genera. As this paper was an epoch-making one, and as its divisions correspond very closely with the main regions adopted in most of the schemes since proposed, it is perhaps desirable to quote the main features before proceeding further."

The authors then proceed to enumerate the six great "regions" into which Dr. Sclater had proposed to divide the earth's surface for zoological purposes, adding in each case a short description of their boundaries and estimated areas, also a rough calculation of the number of species of birds then known to be found in each of them. These six regions were as follows:—(1) The Palæarctic region (embracing Europe and North Asia, and the northern part of North Africa); (2) the Ethiopian region (Africa, except the portion north of the Sahara); (3) the Indian region (southern Asia and the adjacent islands); (4) the Australian region (Australia and the Pacific Islands); (5) the Nearctic region (North America); and (6) the Neotropical region (South and Central America).

The publication of Dr. Sclater's article induced many other zoologists to state their views on the subject. Günther, Blanford, Huxley, Heilprin, and Blyth were among the number. Many of them agreed more or less with Dr. Sclater's proposals, but offered criticisms on particular points, and suggested emendations of his nomenclature. But in 1876 appeared Dr. Wallace's classical and important work, "On the Geographical Distribution of Animals," which combined all that had been previously known on the subject with the knowledge acquired by the travels and experiences of this great naturalist. In this work Dr. Wallace absolutely adopted Dr. Sclater's division of the world into six great regions and his nomenclature, only suggesting that the name of the "Indian" region should be changed to the "Oriental" region, an improvement which subsequent authors have been generally willing to agree to.

Dr. Wallace, after fully considering the question, states decisively his reasons for adopting the six zoological regions proposed by Dr. Sclater as follows:—

"So that we do not violate any clear affinities or produce any glaring irregularities, it is a positive, and by no means an unimportant advantage to have our regions approximately equal in size, and with easily defined, and therefore easily remembered, boundaries. All elaborate definitions of interpenetrating frontiers, as well as regions extending over three-fourths of the land-surface of the globe, and including places which are the antipodes of each other, would be most inconvenient, even if there were not such great differences of opinion about them. There can be little doubt, for example, that the most radical zoological division of the earth is made by separating the Australian region from the rest; but although it is something useful and definite to know that a group of animals is peculiar to Australia, it is exceedingly vague and unsatisfactory to say of any other group merely that it is extra-Australian. Neither can it be said that, from any point of view, these two divisions are of equal importance. The next great natural division that can be made is the separation of the 'Neotropical' region of Dr. Sclater from the rest of the world. We should thus have three primary divisions, which Prof. Huxley seems inclined to consider as of tolerably equal zoological importance. But a consideration of all the facts, zoological and palæontological, indicates that the great northern division (Arctogæa) is fully as much more important than either Australia or South America, as its four component parts are less

important; and, if so, convenience requires us to adopt the smaller rather than the larger divisions."

Convinced by these weighty arguments, the authors of "Zoogeography" adopt the six Sclaterian regions without exception, and use them throughout their work, making only the change of the name of the "Indian" region into the "Oriental" region, as was suggested by Dr. Wallace. They take these six regions one after the other, and describe their extent, the best mode of their division into subregions, their most obvious physical features, and the chief zoological characteristics which distinguish them. One of the more difficult points to be considered is the relation of North America to the Palæarctic region. So similar in many respects are their faunas that Heilprin had proposed to unite them under one name as the "Holarctic" region, which has met with approval by Huxley, Newton, Lydekker, and other writers. But after discussing the question, our authors follow Wallace in rejecting Heilprin's proposal, and give good reasons for doing so.

The third and most important part of the present work is the zoological section, to which we must now direct attention. It is obvious that an exact knowledge of the general distribution of animal life must be based on a thorough acquaintance with the particular distribution of each species. But, as is well pointed out in the present work, the distribution of animal life in many areas "has not been investigated in sufficient detail to afford the necessary data, and in such cases it is impossible to define the range of species with precision." Moreover, in many groups of animal life, especially in the lower forms, the species are so multitudinous, and as yet so little known, that they cannot be used for such a purpose. But all the higher forms, such as mammals, birds, reptiles, and amphibians have been dealt with in this work, besides the more important families of fishes, and a selection of the better-known groups of insects and molluscs. The zoological portion of the letterpress of "Zoogeography" occupies some forty-four pages of two columns each, and seems to be very complete, though it involves a mass of details, which it must have been a hard task to put together and to arrange in order.

Following this portion of the work is a "bibliography," containing the titles of the separate books and the principal articles published in journals relating to zoological distribution. This, we think, though useful as it is, might have been improved by the addition of the names of the leading authorities on the faunas of each of the different parts of the world, something like that which was given by Dr. Sclater in his presidential address to the Biological Section of the British Association at Bristol in 1875. It must be admitted, however, that such a list, though of much value, would have somewhat inconveniently increased the bulk of the "bibliography."

We now come to the maps, the most important feature in the work, which have been planned to illustrate the distribution over the world's surface "of more than seven hundred families, genera, and species of existing animals." It is to be regretted that the extinct forms of animal life have been altogether unnoticed, as they serve to explain in some degree the anomalies of the present state of distribution. That the task of inserting them would have been serious it must be confessed. We observe that the dodos (Didida) have been mentioned. But we think that a few words might also have been devoted to the moas (Dinornithidæ) of New Zealand, the rocs (Æpyornithidæ) of Madagascar, and to other forms which have only recently become extinct. Taken as a whole the thirty-six plates of the atlas are excellent, and fully sustain the claim of the great firm which has produced this handsome volume to issue nothing but first-class work.

In books of this kind, accompanied by a large number of illustrations, there are often slight discrepancies between the plates and the descriptions of them in the text. We find nothing of this sort in the present work, in which it is obvious that the main object of the text has been the description and explanation of the illustrations. In fact, we consider that Mr. Bartholomew and his enterprising firm deserve the greatest credit for the production of the fifth volume of their "Physical Atlas," which, we are sure, will long remain the leading authority on "zoogeography."

CENTRAL ASIA.

L'Asia Centrale: noti di viaggio e studi di un Diplomatico giapponese. By Nisci Tocugiro (Nishi Tokujiro). Translated by L. Nocentini. Pp. xxx+317. (Turin: Unione Tipografico-Editrice Torinese, 1911.) Price 4.50 lire.

THE distinguished Sinologist, Prof. Lodovico Nocentini, has translated into Italian an interesting Japanese work on the geography, ethnography, and political conditions of Central Asia, which was written a quarter of a century ago by Mr. Nishi Tokujiro (or Tokujiro Nishi, as we should say), then First Secretary of the Ministerial Council at Tokyo. The translation, with additions and notes by the translator, which bring it up to date, has now been presented to the Italian Geographical Society, with a preface by the president of that body, Signor Cappelli. Mr. Nishi has been prevented by other work from adding new material to the book himself.

In 1880 Nishi Tokujiro, then attached to the Imperial Legation at St. Petersburg, left on his homeward journey by way of Central Asia, passing through Russia and Chinese Turkestan on the way, and this volume, produced in 1885, was the result of his *noti di viaggio* and general knowledge. When published it would, had it been translated promptly, have been of great interest, and even now, with the addition of Prof. Nocentini's notes, it is valuable as a general account of Central Asia. For non-Italian readers, however, its value is somewhat discounted by the unscientific transliteration of all names, whether Russian, Chinese, Turki, or what-not, into a guise which, though it may reproduce the correct sounds of the originals to an Italian reader, is confusing to those of other nations, who have to re-transliterate into the forms familiar to them. What English or German

reader, to take instances, would at once recognise in "Coccienco" the Russian name Kochienko, in "I-'r O-scen" the Chinese Yi-erh Wo-shen, in "Cucia" or "Cuccia" the town of Kucha, or even in "Culgia" that of Kuldja? And ought the town of Piotr-Alexandrovsk to be literally translated into Italian as "Pietro-Alessandro"? In England we do not talk of "Coachienco," "Yee-erh," "Cootcha," or "Peter-Alexander" (though we might have sixty years ago), and nowadays the strictly scientific "Kočyenko," "Kuldža," or "Kuča," would be perfectly well understood here. In this matter of transliteration the Italians (like the French in dealing with Arabic names) are half a century behind the times. This book will be read, out of Italy, only by those who have some knowledge of Central Asia and its languages, but do not necessarily know even enough Italian to recognise the name of the author of this book in its Italian form, "Nisci Tocugiro."

Mr. Nishi's work was a very complete description of the lands and peoples of Central Asia, so far as counting of heads goes, but not a particularly thorough one. Its historical sections are the best, but its great interest lies simply in the fact that it was the work of a Japanese so early as the eighteenth year of Meiji. Even then the relentless advance of Russia in Asia was being noted by the watching Japanese, and the resources and possibilities of her Asiatic dominion were being "sized up" by the unimportant traveller Nishi, who was significantly, on his return to Japan, attached to the general staff. Who knows but even then the Japanese were beginning to prepare for the inevitable struggle, which came twenty years later, just when the dominion of all Asia seemed about to fall irrevocably into Russian hands? Mr. Nishi had no great belief when he wrote in the ability of China or even England to stop Russia. He seems to shrug his shoulders over the vain English protests against the advance of the colossus of the north, which emanated in "Mervous" succession from our Foreign Office for twenty years, and ended with the "Penjdeh incident" (Signor Nocentini calls the place "Pange"), which seemed to make our weakness patent to all the world. The ally of 1902 did not seem very admirable to a Japanese in 1885. We have, however, got over our "mervousness" now that Russia is brought up short by the great mountain-barriers, and indeed it is not probable that we ever had any real justification in trying to stop her advance into Turkestan. Her taking of Merv was much more inevitable than our taking of Mandalay, and she only went beyond bounds when she took Penjdeh and the Kushk valley from Afghanistan. The real danger of war which then ensued was a signal to her to stop, for we know now, since Japan has shown us, that Russia's power is all "bluff"; she had no more wish for war with us in 1885 than with China over the question of Kuldja in 1880, or with Japan in 1903. In 1880 China met her bluff with greater bluff, and in 1903 Japan took her at her word, with the result that the history of Asia has entered on a new phase, incredible had it been prophesied in 1885, even to the self-confident countrymen of Mr. Nishi.

Signor Nocentini brings the political part of the book fully up to date, even including an account of Dr. Stein's discoveries and the text of the Anglo-Russian agreement relative to Tibet. We see from this that the prohibition of the sending of scientific expeditions to Tibet by either Russia or England expired in 1910. But in view of the disturbed condition of Tibet owing to the Chinese invasion, it is not probable that any such expeditions will be sent there for some time yet.

The typographical and ethnological details have not been brought up to date. The mountains stand where they stood in 1885, and the Jaxartes has not yet again changed its course, while the ethnic peculiarities of Kirghiz, Uzbegs, Sarts, Eleuths, and Dungans remain the same, so this does not matter. But details of the population of the cities and of the dislocation of Russian troops in Asia in 1881 have now merely an antiquarian interest.

Nevertheless the book is a very interesting one, and is well worth persual by those who study the subject. What the future of this huge land will be, who can say? The Japanese war has probably put a stop to all Russian advance for many a year to come, unless a parliamentary China should foolishly (thinking herself, in Babu-wise, the equal of Japan) try to oust Russia from northern Manchuria. In that case China will lose much, while Japan will look benevolently, this time, upon Russia's chastisement of her. Then we English would be well advised to insist that Russia, whatever else she may take, shall leave Chinese Turkestan in Chinese hands. Otherwise a fresh attack of "mervousness" may arise, if Russia is in Kashgar and Khotan.

If there is no war between Russia and China within the next few years, the Russians will be able to devote their rather intermittent energies to the development of the enormous territory that is already theirs. Railways are a necessity to her military hold of Central Asia, and there are lines yet to be built which are of great strategic importance, though they may not "pay" for a century. A railway from Orenburg through Akmolinsk to Semipalatinsk is projected, and another line should run from Tashkend to Krasnoyarsk, by way of Aulië-ata, Vyernyi (where the recent earthquake took place), Sergiopol, Semipalatinsk, and Barnaul, with a branch to the Ili valley, and, if China will permit, on to Kuldja. This line would bind Turkestan to eastern Siberia, and enable troops to be railed from Samarkand to Irkutsk direct. But the country to be traversed is mostly steppe, and the immediate value of the line would only be military, as in the case of the existing Orenburg-Tashkend railway. So Russia will be condemned indefinitely to pour out millions of roubles into the wilderness (and the contractors' pockets), and only a century hence will the slow work of the present day bear fruit in a great and mighty country, the home of millions of peaceful and hard-working Russians—a new Canada.

The future of China, who can prophesy? But it is improbable that a century hence China will have allowed the Japanese to retain their control of southern Manchuria, or even Korea, and the islanders may be driven back to their home, even as we were expelled

from France in the fifteenth century. History always repeats itself in similar cases. But Japan will have done her work well, and the notes made by Nishi Tokujiro in his journey twenty-five years ago would have shown us then, had we had ears to hear or eyes to see, that already Japan was studying the huge continent at her door, and weighing the possibilities that might come forth from it in the fulness of time.

It remains only to say that the book is "bound" only in paper covers, and falls to pieces directly it is cut. We presume that Italians send their books to the binders before they read them. L4.50 seems a high price for a book of 300 pages that has no binding and no illustrations. Unlike the French, the Italians understand the value of an index, and this book has a good one.

LUCIANI'S HUMAN PHYSIOLOGY.

Human Physiology. By Prof. L. Luciani. Translated by Frances A. Welby. Edited by Dr. M. Camis. With a preface by Prof. J. N. Langley, F.R.S. In two vols. Vol i., Circulation and Respiration. Pp. xiv+592. (London: Macmillan and Co., Ltd., 1911.) Price 18*s.* net.

THE rapid progress in the science of physiology makes it increasingly difficult for any single individual to give a comparatively complete presentation of the whole subject. In consequence of this fact, the larger text-books are usually written by several authors. While there are many advantages in this method, a loss of unity in the treatment of the subject inevitably results. Luciani's work gives a more detailed account of the subject than the majority of text-books of single authorship, and thus occupies a place intermediate between the larger works and those of moderate size.

The arduous labour of translation has been carried out very efficiently, the English version being clear, accurate, and eminently readable. The translator has also had the advantage of the assistance and advice of Dr. Aders-Plimmer on chemical subjects, and of Mr. W. L. Symes on many technical difficulties. The references to the literature of the subject appended to the various sections of the work form a very useful feature. The editor, Dr. M. Camis, has rendered these more complete by the addition of the chief recent English and American physiological papers. These references will undoubtedly offer valuable guidance to senior students of physiology desirous of extending their knowledge of physiology beyond the limits of their text-books.

The present volume, which extends to 600 pages, deals with the general physiology of living matter, the physiology of blood, the circulation, respiration, and lymph.

The introduction gives a brief but masterly account of the general objects and domain of physiology. The first three chapters deal with the structural features, the chemical and physical basis of living matter, its fundamental properties, and the conditions by which it is influenced. The third chapter closes with an interesting account of the hypotheses of Pflüger, Hering, and Verworn regarding the nature of the processes which take place in living substance.

The fourth chapter deals with the formed constituents of blood. The historical development of the subject is excellently epitomised. The general physico-chemical characters of the blood as a whole are next described. A brief account of the methods used in determining the rate of coagulation might have been added with advantage. The morphological elements of blood are then described. The plate showing absorption spectra is somewhat diagrammatic, methæmoglobin and acid hæmatin being represented as having identical spectra.

An excellent account of the chemical and physical properties of blood plasma, and of the theories of its coagulation, forms the main subject-matter of chapter v. The chapter concludes with an account of the effects of bleeding, transfusion, and the bactericidal and immunising properties of blood.

An exceptionally detailed account of the historical development of our knowledge of the circulation of the blood is given in chapter vi. The author ascribes the discovery of the true course of the circulation to Cesalpinus rather than to Harvey, differing in this respect from the large majority of physiologists. In the preface to this volume, Prof. Langley has given the chief reasons for critical caution in studying Prof. Luciani's views on this subject.

The mechanics of the heart and blood flow are fully discussed in chapters vii. and viii. The discussion of the myogenic and neurogenic theories of cardiac rhythm given in chapter ix. offers an excellent example of the author's skill and impartiality in presenting the evidence for and against rival views. The account given embodies the most recent work on the subject, including that of Carlson on *Limulus polyphemus*.

Chapter x. provides an excellent account of the vaso-motor nervous mechanism. Chapter xi. is devoted to the chemistry and physics of respiratory exchanges. A most interesting review of the historical development of the subject is given, both from the chemical and physiological points of view. A description of Haldane's method for determining the oxygen capacity of blood might have been appended to the account of the methods for the extraction of the gases of the blood.

The nervous and chemical control of respiratory rhythm form the subject-matter of chapter xiii. Some interesting recent observations by Italian workers, throwing new light on the mode of production of certain forms of polypnœa in muscular work, are recorded. A somewhat fuller discussion of recent views on the chemical regulation of respiration would have been welcome.

The present volume concludes with an excellent account of the physiology of lymph and lymphatic organs.

The book is singularly free from errors; yet in a text-book of this extent minor errata inevitably occur. The following may be mentioned with the view of aiding to some extent in the preparation of a table of errata. On p. 25 "cornea" is used instead of "stratum corneum"; on p. 109 "carbon bisulphide"

should be replaced by "ammonium sulphide"; on p. 333 "afferent" by "efferent"; and on p. 415 "inspiratory" by "expiratory."

The present edition is a distinct advance on the earlier issues, the more recent additions to physiology being fully given. Such are some of the chief characteristics of this book. So brief a review as the foregoing necessarily leaves unmentioned many other important features. The book is a remarkable achievement, especially in view of the fact that it is the work of a single author, and appears to the reviewer to possess special qualities and merits, which entitle it to a high place amongst the existing English text-books of physiology. The issue of the remaining three volumes will be eagerly awaited by all who have studied the present volume.

ABBE'S THEORY OF IMAGE FORMATION IN THE MICROSCOPE.

Die Lehre von der Bildentstehung im Mikroskop von Ernst Abbe. Edited by Otto Lummer and Fritz Reiche. Pp. xii+108. (Braunschweig: F. Vieweg und Sohn, 1910.) Price 5 marks.

AN account of Abbe's theory of the microscope image given by so distinguished an optician as Prof. Lummer cannot fail to arouse a large amount of interest among all students of optical theory, as well as among workers with the microscope. It demands the more attention in that it is professedly a reproduction of Abbe's theories as propounded by himself. Lummer tells us that in the winter of 1887, in company, among others, with Winkelmann, Czapski, Rudolph, and Straubel, he attended a series of lectures given by Abbe in Jena, and it is clear that he enjoyed exceptional opportunities of becoming acquainted with Abbe's views and his manner of regarding microscope theory.

The work, we are told, is founded solely on the carefully preserved notes of these lectures. One question only, it was thought, needed to be reviewed from the modern point of view: Is the Fresnel-Huyghens secondary-wave interference theory a satisfactory basis for the discussion of the phenomena, or will the more modern theory of Kirchhoff and Maxwell lead to some modification of the conclusions arrived at? It may be answered at once that Lummer attacks the problem of image formation by limited beams from the latter point of view, and shows that it leads to identical results with the former.

The intrinsic interest of the book is very great, and the methods employed are most instructive, both in the establishment of general principles and in their application to the special cases which arise in microscope imagery when periodic structures are viewed by transmitted light. Thus, in the latter case, the determination of the distribution of light intensity in the image plane requires an integration over the plane of the structure viewed, and over that of the actual or virtual aperture. By variation of the order of integration the authors are able to bring out clearly the part played by the different "diffraction spectra" in the formation of the image. The same thing is shown in a different manner more fully, and still more clearly, in Lord Rayleigh's well-known paper of 1896, "On the Theory of Optical Images, with special reference to the Microscope."

The special cases here dealt with are those of a single luminous slit, two parallel slits, self-luminous or viewed by transmitted light, and a single slit of finite breadth, with or without phase difference; finally, in a separate chapter the case of a grating is considered, and the effect discussed of limiting the image-forming rays to certain of the grating maxima. In dealing with images formed by transmitted light, the case of oblique illumination is also treated. The source of light is supposed either at a finite or infinite distance, but, as might be anticipated, there is no special discussion of the case of "critical" illumination. Throughout, the treatment is not for a circular aperture, but an aperture of special form is assumed to simplify the integration.

The main interest of the volume, however, lies in the light it throws on the manner in which Abbe derived his well-known theory. From this point of view we must confess that we find the book a little disappointing. It is not easy to agree with Prof. Lummer as to the necessity, or even the desirability, in this book, of devoting space to showing how far the older theory is in agreement with more modern views, and this is not the only feature which tends to produce a sense of uncertainty as to how far the account given can be regarded as a direct reproduction of Abbe's presentation of the subject. What admirer's of Abbe's work would wish to have is a close and faithful transcript of Abbe's own development of the theory, with the minimum of variation from the line of argument he may have followed. The volume is, however, inspired by a true enthusiasm for Abbe's teaching, and a just appreciation of the value of his work, and the future historian of science will be indebted to Prof. Lummer for the trouble he has taken to present in a manner worthy of its origin the material at his disposal.

THE NUTRITION OF THE ALGÆ.

Die Ernährung der Algen. By O. Richter. Pp. viii+192. (Leipzig: Dr. W. Klinkhardt, 1911.) Price 12 marks.

SINCE the appearance in 1905 of the second part of Oltmann's work on the morphology and biology of the algæ, so large a number of memoirs on the nutrition of the algæ have appeared, that Dr. Richter has thought it worth while to collect them into a volume for the *International Review of Hydrobiology and Hydrography*. The references are grouped under three headings—(1) the significance of chemical elements and certain chemical compounds in the physiology of nutrition; (2) the influence of various chemical and physical factors of the nutrient substratum on the form and development of the algæ; and (3) an appendix on the influence of temperature and light on the algæ with reference to their culture.

It is not possible to give anything like an adequate account of the numerous investigations which are brought under review. After a brief discussion of the metallic elements which are of importance to the algæ, the non-metallic elements and compounds are considered. Reference is made to the evolution of oxygen in carbon dioxide assimilation and the various methods by which it can be quantitatively determined. Engelmann's well-known bacterial method and Beyerinck's method of using luminous bacteria are spoken of by the author as "two of the most elegant methods for the demonstration of the evolution of oxygen." Beyerinck found that luminous bacteria, when placed in contact with algal filaments, are phosphorescent when oxygen is being evolved, but cease to be luminous in its absence.

In reference to Bokorny's observations on Spirogyra and Zygnema in support of Baeyer's hypothesis that formaldehyde is the first product of carbon dioxide assimilation, the author concludes that, in view of their far-reaching scientific importance, it is necessary that these investigations should be repeated with absolutely pure cultures of algæ. This appears to be so much the more desirable as Treboux, working with pure cultures of some of the lower algæ, was unable to obtain starch formation either with formaldehyde or methylal. Dr. Richter very properly lays stress upon the great importance of pure cultures in these experiments in order to prevent the contamination with carbon dioxide produced by fungal or bacterial growths, which may completely vitiate the results. He fully discusses the results obtained by various observers upon the assimilation of organic nutrient substances, such as glycerine. Many algæ seem to prefer organic compounds containing nitrogen; others prefer carbohydrates. Among the former are diatoms, and indeed these organisms seem to have a preference for albuminoid food substances.

The second part of the book is taken up with a consideration of the papers dealing with the poisonous action of various chemical compounds, the influence of narcotics, the deleterious effects of different species of algæ upon one another, and the reactions of the nutrient material upon their growth and development. The poisonous action of minute traces of metals, termed by Naegeli oligodynamic, is illustrated by some interesting experiments made by the author to show the deleterious influence exerted by coins when placed in contact with diatom cultures on agar. In discussing the effects of light and temperature on the algæ, the author shows clearly that variation in intensity has a very marked effect on their growth and on the formation of various organs.

The book may be commended to students as a very useful summary of the important researches bearing upon algal nutrition and the various factors by which it is controlled. Very few of the problems, of course, are peculiar to algæ (they are problems of plant nutrition generally), and the book is to some extent lacking in completeness, because, in his desire to confine himself strictly to algæ, the author has neglected many papers dealing with plant nutrition, which are just as applicable to algæ as to other plants.

There is a very full index, both of subjects and of authors, together with a good table of contents and a list of nearly five hundred references.

H. W.

POPULAR ASTRONOMY.

(1) *Star-Lore for Teachers: Suggestions for the Teaching of Astronomy by direct Observation, Experiment, and Deduction.* By B. Lowerison. Pp. 67; interleaved for notes. (London: The Clarion Press, n.d.) Price 1s.

(2) *The Star Pocket-book; or, How to Find Your Way at Night by the Stars. A Simple Manual for the Use of Soldiers, Travellers, and other Landsmen.* By R. Weatherhead. With a foreword by Sir Robert Ball. Pp. 80. (London: Longmans, Green, and Co., 1911.) Price 1s. net.

(3) *Les Progrès Récents de l'Astronomie (III.—année 1909.)* By Prof. Paul Stroobant. Pp. 174. (Brussels: Hayez, Rue de Louvain, 1911.)

(1) IF the automatic response to the stimulus of the starry heavens has not forced a man to acquire enough astronomical knowledge to instruct his pupils intelligently in star-lore, that man has no business to be a teacher of the subject. Lacking the capacity or desire to observe and find out for themselves, we fear that such misplaced persons will gain little from this book.

The information is tabloidal, sometimes even awkwardly abbreviated, and the compilation bears internal evidence of the lack of that fuller knowledge so essential in anyone who professes to direct the teacher.

The motive is worthy, and as the book was written "for love" we should, perhaps, modify the criticisms that suggest themselves at once. But *gamma* is not the brightest star in Corona (p. 29), nor is Sirius a notable Algol variable, as might be deduced from p. 49; and objection may be taken to "astrology" as a translation of "L'Astronomie."

The children under the author's tuition probably enjoy their astronomy lessons immensely, and he is to be congratulated upon the modest but effective equipment so thoughtfully provided for them. We would that other teachers could be induced thus to recognise the wonderfully educative potentialities of astronomy, but we fear that, despite the excellent intention, this small book can do but little to further the recognition.

(2) As a practical naval instructor, Mr. Weatherhead was asked to lecture to a number of army officers on the use of the stars as guides in night marches, and he now gives the general public the benefit of his admirable notes. A brief introduction, directions as to how to identify the chief stars, and a key to the nomenclature of them, are followed by some excellently clear charts showing the brightest, most conspicuous groups. A few tables and examples make it clear how to find north or south by three of the simplest methods. All interested in the stars apart from their

physical features will find the pocket-book instructive and interesting.

(3) Dr. Stroobant's annual summaries of the most important results obtained in astronomical research each year are models of concise and careful compilation, in which the general reader, as well as the professional astronomer, will find much to interest and instruct.

Limitations of space forbid any extensive *résumé* or discussion of the various sections here, but, whether it be in solar physics or in astronomy of position, it would be difficult to point to any result of value that is not included. In the present volume, as one would naturally expect, Halley's comet is given a prominent place, the bringing together of the most important observations and results occupying about sixty pages; the history of the 1909–10 apparition is brought up to the end of July, 1910, and illustrated by several photographs and charts. W. E. R.

OUR BOOK SHELF.

Inorganic Chemistry for Schools. By W. M. Hootton. Pp. viii+408. (London: Edward Arnold, n.d.) Price 3*s.* 6*d.*

THE author of this volume has exercised a considerable amount of ingenuity in illustrating his subject by reference to many of its most interesting technical applications. His own knowledge is evidently extensive and up-to-date, and it is therefore all the more to be regretted that he should have adopted a method of teaching which is radically bad and indefensible. As in so many other cases of the kind, he has evidently sacrificed sound method to the demands of those who require "a sufficient preparation for the London Matriculation (new syllabus), Northern Universities Matriculation, and Army Entrance Examinations in chemistry," compressed into a two years' course, and has adopted a system which approaches perilously near to "cramming" pure and simple.

Formulæ are introduced on p. 48, but the pupil has to take them as *ex cathedra* pronouncements until on p. 261, almost at the close of his course, he receives a faulty explanation of the way in which they may be deduced. In the meantime, he must be puzzled by being told, on p. 51, without any explanation, that "phosphorus pentoxide (P_4O_{10}) is a white powder easily soluble in water." It would scarcely be possible to conceive a more direct violation than this of the maxim which forms the opening words of the preface, that "It is demanded of a school course of chemistry that it shall train the reason"! The imperfections of his own reasoning is shown by a statement on p. 267 that "according to Avogadro's theory, the atomic weights of elementary gases are numerically equal to their densities." Such a statement, if reproduced by his pupils, and applied by them to mercury, sulphur, and phosphorus, should go a long way towards securing their failure in the examinations for which this book is intended to prepare them. Such errors would be impossible if the author had consulted the original papers or the "reprints" by which they are now rendered so easily available.

The same lack of accuracy and absence of all historic sense is shown in a very picturesque way on p. 46, Fig. 14, where Lavoisier is represented as heating mercury in a long-necked retort by means of coal-gas and with the help of the burner invented several decades later by Bunsen. In a book so faultily designed and containing such errors, the inclusion of diagrams of electric furnaces for the manufacture of calcium, of carbide, and of carborundum, is a very inadequate compensation. Such a volume cannot be recommended.

East and West. Comparative Studies of Nature in Eastern and Western States. By S. D. Kirkham. Pp. x+280. (New York and London: G. P. Putnam's Sons, 1911.) Price 7*s.* 6*d.* net.

THE title refers to the two horizons of the American continent so widely distant that there is the greatest difference in the scenery and organic life representative of the States situated on the Atlantic and Pacific slopes. Primarily it is the author's desire to interest his countrymen in the natural beauties of the land of their inheritance. He presents a dozen sketches of typical scenes or associations with which he is familiar. The descriptions are taken from localities in the States of New York or Massachusetts, on the east, and from the States of California and Arizona on the west, where the author has evidently spent some time in leisurely observation. Cape Ann, Long Island woods, Chaparral and Arizona gardens are sufficiently explanatory as to their situation; other localities described are the forest-clad waterways in the Adirondacks, the "finger-lakes"—so called on account of their configuration—in New York State, and the Elysian fields, situated in this case in the Santa Inez valley in California.

The sketches or impressions relate almost entirely to natural artistic effects, plant associations, or the habits of birds; they will appeal with special force to the traveller who has trodden paths remote from civilisation. To English readers many of the names of birds and plants will be a puzzle; chickadee, road-runner, phœbe, and vireo are strange; similarly madrona, bay berry, and hobble bush require translation. An appendix of scientific names would add materially to a better understanding of the text. It is evident that the author has found greater diversity and brilliancy in the plant- and bird-life in the western States, for which reason the later sketches are the more attractive and illustrative.

Columbia University Contributions to Anthropology. Edited by Franz Boas. Vol. ii., Kwakiutl Tales. By Franz Boas. Pp. viii+495. (New York: Columbia University Press; Leyden: E. J. Brill, Ltd., 1910.)

THIS volume is the first to appear of a projected annual series under the general editorship of Dr. Franz Boas, and forms, with tales previously published by him, a large mass of material for the study of the myths of the Kwakiutl, who live between River Inlet and Cape Madge, on the coast of British Columbia. There are here many interesting parallels to legends of Japan, Australia, and other distant lands, as well as racial and local tales, often humorous, of culture-heroes and sorcerers, and naïve explanations of the origins of dances and ceremonies, and of animals and natural objects. The usefulness of the collection could have been much increased, especially for readers not familiar with American-Indian lore, by multiplying the footnotes, and by an introduction such as Dr. Boas himself supplied to Teit's "Traditions of the Thompson River Indians," for, as pointed out by him elsewhere, the traditions and organisation of the tribe are mutually explanatory, and here we have the traditions only.

The first tale, for example, has no notes, and yet the general reader can scarcely be expected to know that the victor who takes unawares an adversary more powerful in magic is a tribal culture-hero, and that the double-headed serpents forming the belts and

canoes of the rivals are each the dread SISIUL, which has a horned snake's head at each end, and a two-horned human head in the middle. It is an unlucky mischance, in a volume otherwise so carefully produced, that four lines which should begin p. 451 are printed at the top of p. 452, and it is only appreciation of the great value for reference of a series for which we are heartily grateful to Dr. Boas and his university that prompts us to beg that no future volume shall, like this, be without an index.

A. R. WRIGHT.

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.*]

The Nature of γ Rays.

DR. E. VON SCHWEIDLER pointed out in 1905 that an effect (such as ionisation by α rays) due to a finite number of independent events would be subject to fluctuations. The mathematical theory of the different experiments which have been made to exhibit this with light, α and β rays, has been developed by Mr. N. R. Campbell.

One of us began some preliminary experiments in 1908 at the Cavendish Laboratory to detect discontinuous effects with γ rays. Two forms of apparatus have been used in our experiments. In the first, two similar cylindrical ionisation vessels were placed close together with their axes directed to the source of the γ rays—some radium.

If the γ rays have a spherical wave front, the two similar vessels, being symmetrically placed with respect to the source, should be equally effected by the γ rays, though the resulting ionisation due to the equal effects may not be the same. If, on the other hand, the γ rays are any type of corpuscular radiation (in the Newtonian sense) made of a finite number of particles, the effect in the ionisation vessels would be unequal over short periods of time. To compare the number of ions produced in the two vessels, the electrodes were connected to an electrometer, one vessel being positively, the other negatively, charged. The positive and negative currents from the two cans were balanced as closely as possible for long periods of time, and so there was no large steady drift of the electrometer. The quartz fibre electrometer (Proc. Camp. Phil. Soc., xv., p. 106, 1909) showed fluctuations in the balance.

In the second apparatus a box-shaped ionisation can with a central plane electrode was used. The positive ions formed in one half of the can were received on one side of the flat electrode, the negative ions from the other half of the can on the other side of the electrode. Large fluctuations were observed when the source of γ rays was placed in the plane of the electrode outside the can. This experimental result would be explained if (1) the γ rays from radium are projected particles, or (2) if the number of ions produced in air by a constant source of γ rays is subject to fluctuations.

We are continuing the experiments with the view of determining what part each of these factors plays in producing the fluctuations observed.

T. H. LABY.
P. BURBIDGE.

The Physical Laboratory, Victoria College (University, N.Z.), Wellington, N.Z.

The Occurrence of a Fresh-water Medusa (Limnocnida) in Indian Streams.

MR. S. P. AGHARKAR, lecturer on biology in the Elphinstone College, Bombay, who has been kind enough to undertake the collection of fresh-water invertebrates on behalf of the Indian Museum, has recently sent me several specimens of a medusa from small streams in the Western Ghats. Although they were taken at so great a distance from the west coast of India, it is important to note that these specimens were obtained from a river-system which flows across the Indian Peninsula and reaches the sea more than 500 miles away on the shores of the Bay of Bengal. Mr. Agharkar writes as follows:—

"The Medusæ were collected in deep pools of the Koyna and Yenna rivers (tributaries of the Krishna). I was not able to get the hydroid form. I was told that the Medusæ (called flowers or wheels by people) occur regularly in these rivers every dry season. Probably they are present all the year round, only they are swept away by the current during the rainy season and a short time after that. During the dry season, when the stream becomes more or less a succession of deep pools, they become very marked."

In the structure of the manubrium and digestive system, the position of the gonads, the structure of the tentacles, and the form of the umbrella these medusæ agree precisely with *Limnocnida tanganyicae*. As regards generic identity, there can, indeed, be no doubt, and there is nothing in the specimens before me to suggest even a specific difference. They are not, however, in a particularly good state of preservation, having suffered somewhat in the post, and the question of specific identity may be left unanswered until after an examination of fresh specimens, which I anticipate no difficulty in obtaining at a suitable season. In the meantime, I should be extremely grateful for well-preserved specimens of Limnocnida from Africa in order that an actual comparison may be made.

N. ANNANDALE.

Indian Museum, Calcutta, July 7.

Standard Time in Portuguese Territories.

I BEG to inform you that Standard Time will be in use from January 1, 1912, throughout Portuguese territories, as follows:—

h.	m.	
8	0	E. Macao, Portuguese Timor.
5	0	E. Portuguese India (provisionally 5h. 30m. E.).
2	0	E. Portuguese East Africa.
1	0	E. Portuguese West Africa.
0	0	(Greenwich, or West Europe).—Portugal, St. Thomé and Principe Islands, Whydah.
1	0	W. Madeira, Portuguese Guinea.
2	0	W. Açores and Cape Verde Islands.

This observatory remains entrusted with the determination and the telegraphic transmission of Standard Time to the whole country, to the Lisbon time-ball, and to the time station at the Meteorological Observatory, Ponta Delgada (St. Miguel, Açores).

I take this opportunity to state also that the most trustworthy geographical latitude of this observatory is lat. N. 38° 42′ 30·5″ (prime vertical, meridian, and zenith telescope series of observations from 1872 to the present, printed or unprinted), and that the designation "*Lisbon, Tapada*," is now the most suitable for it, being similar, for instance, to "Florence, Arcetri," or "Naples, Capodimonte."

For two years a new astronomical observatory has been in existence and at work at Lourenço Marques; the geographical coordinates are (transit pier):—

Lat. S. 25° 58′ 4·9″ ± 0·2″ (meridian observations by Captain Gago Coutinho).

Long. E. 32° 35′ 39·4″ ± 0·05″ (moon culminations, simultaneously here, and geodetic connection with the Cape).

Altitude (top of pier), 59 metres.

CAMPOS RODRIGUES.

Observatorio Astronomico de Lisboa, Tapada-Lisboa-Portugal, July 25.

Obsolete Botanical and Zoological Systems.

WOULD some naturalist with a taste for bibliography be so good as to mention books which contain tables of obsolete botanical and zoological systems? Agassiz's "Essay on Classification" and the article on Zoology in the "Encyclopædia Britannica," ninth edition, furnish useful examples, but more are desired.

L. C. M.

LOLO AND BORDER TRIBES OF WESTERN CHINA.[1]

THIS book deals mainly with the little-known Lolo and neighbouring tribes in western China, who are believed to represent some of the pre-Chinese aborigines of that empire. The journey into the steppes of Tibet, which gives the title to the book occupies less than a sixth part of the volume, and is based upon notes by the late Lieutenant J. W. Brooke, upon his journey along the well-known route from Koko Nor to Nagchuka. Foiled in his attempt to enter Central Tibet in 1907, Lieut. Brooke, on the advice of Mr. Fergusson, turned his attention to the Lolo country in western China to the north of the Yangtse, and the present volume is issued as a memoir of that adventurous young traveller, who met a tragic death at the hands of the wild Lolos. In Mr. Fergusson, the resident missionary of Chengtu, the capital of Szechuan, Lieut. Brooke has found a sympathetic and competent editor, whose own notes indeed form the most important part of the book, based as they are upon a long personal acquaintance with those regions.

FIG. 1.—Lolo Chief hostages. From "Adventure, Sport, and Travel, on the Tibetan Steppes."

The warlike Mantze tribes, now settled in China, preserve the tradition of having come from Tibet, and this is generally supported by their physical features, their language, customs, and religion, as they are professedly lamaists. The part of Tibet, however, to which they are assigned by Mr. Fergusson is not clearly evident. They are stated to be "emigrants from Gari, a place north of Siklim [*sic*], near Camba Dsung . . . on the upper slopes of the Brahmaputra." Possibly the deserted town of Ge, near Khamba Jong, to the north of Sikkim, may be intended. The Tibetan legend of its desertion has been recorded by Lieut.-Colonel Waddell in his "Among the Himalayas" (p. 196), and is in keeping with a possible emigration to China.

The Lolo tribe and its affinities are less well known. This tribe, or rather the series of tribes bearing this general title, occupies the more inaccessible mountains in western China, on both sides of the Yangtse, in the provinces of Szechuan and Yunnan. It is the former section of the tribe which is dealt with here. The aggressive turbulence of this wild tribe has prevented travellers from penetrating the country to any great distance, though it and its people are not so wholly unknown as is represented in this book. M. P. Vial, in his "Les Lolos" (Shanghai, 1898), Colborne Baber, T. de Lacouperie, Colquhoun, and latterly Dr. Logan Jackson, in his "Back Blocks of China," have contributed to advance our knowledge of the subject; but Mr. Fergusson now adds much that is both new and interesting. These wild Lolos have hitherto preserved their independence, though in order to repress to some extent their habitual bloody raids into settled Chinese territory, hostages are taken from the frontier villages for their good behaviour.

FIG. 2.—Takin (*Budorcas sp.*). From "Adventure, Sport, and Travel, on the Tibetan Steppes."

"These hostages are representative chiefs who take turns of imprisonment to go pledge for the good conduct of the tribes. These chiefs are paid a nominal sum by the Chinese Government for thus serving a period in durance, and after serving a term of three

[1] "Adventure, Sport, and Travel, on the Tibetan Steppes." By W. N. Fergusson. Pp. xvi+343. (London: Constable and Co., Ltd., 1911.) Price 16*s.* net.

months they are allowed to be relieved by other representative men of their tribes." The accompanying photograph depicts some of these hostages, who may be taken as types of the tribe.

The people live in rude huts and seldom build substantial houses, like the settled Mantze. Whilst termed "Lolo" by the Chinese, they call themselves "Nosu," alternatively spelt "Nossu" and "Nesu." The former appellation appears to us to be the same that is applied by the Tibetans to these and other savage tribes on their borderland, namely "Lalo" (spelt *kla-klo*). Their features seem to us to resemble those of the head-hunting Indo-Mongolian tribes of Assam, called "Nāga" by the Indians. They are said by Mr. Fergusson to be "certainly not" Tibetan. Their mode of tying up the hair (see Fig. 1) is suggestive of that of the Lepchas, whose non-Tibetan and proto-Malayan affinities have been indicated by Lieut.-Colonel Waddell.

Lieut. Brooke won the distinction of being "the first Englishman to shoot" that rare Eastern antelope, the takin (*Budorcas sp.*; see Fig. 2), and to study it in its haunts, of which we have here a detailed description.

Mr. Fergusson furnishes a detailed map of the southern part of the country plotted out by himself, a valuable contribution to Chinese geography.

RUBBER CULTIVATION.[1]

TO students of African rubber, the volume (1) by Dr. Cuthbert Christy will prove of considerable value. Dr. Christy was for a considerable time connected with the Mabira Forest Rubber Company, Uganda, and had many opportunities of obtaining first-hand information regarding the environment most suitable for Funtumia, the yields of rubber obtainable, and the chemical and physical problems associated with the coagulation of the latex. The author first gives a general account of the African rubber industry, and shows the fluctuation in exports of raw rubber from the Gold Coast, Sierra Leone, Southern Nigeria, Liberia, the French Ivory Coast, Togoland, the Kameruns, the Belgian Congo, and East Africa. There is, however, nothing which would lead one to expect that Africa will henceforth increase its crop of raw rubber, despite the large number of vines and trees which have been planted during the last few years.

A considerable amount of information is given on the botany, life-history, and structure of *Funtumia elastica*, Stapf, known in the early days as *Kickxia elastica*, Preuss. It appears that in Uganda this tree loses most of its leaves during the dry, hot period of January to March. It is, however, never quite leafless. Young shoots are produced and old leaves fall more or less freely at all seasons of the year. The trees flower from November to December, and the fruits are mature six months later. The author is of the opinion that the wind-blown seeds carried beyond the limits of the forest never produce permanent plants, owing to the long grass covering the country outside the forest areas. In the scrub formation (Acanthus) the seeds appear to have a better chance. The permanent Funtumia trees are found largely in belts where the forest is hilly; though these belts are usually well-defined, their distribution appears to be influenced by water-level conditions. In Uganda the trees appear to grow in large groups varying from family parties to large belts and areas several square miles in extent; in some cases the growth is entirely made up of this species, but in other cases the species is scattered.

Photograph by E. Brown.

FIG. 1.—Chagwe Forests, Uganda. An area cleared of underwood and seed sown at stake. Nearly all the trees in view are *Funtumia elastica*. From "The African Rubber Industry and *Funtumia elastica*."

After discussing the distribution, climate, and soils for Funtumia, the author goes into detail regarding other species of Funtumia—*Funtumia latifolia*, and *Funtumia africana*—the latex from which, however, possesses very little rubber, though it may be used.

[1] (1) "The African Rubber Industry and *Funtumia elastica* ('Kickxia')." By Dr. C. Christy. Pp. xvi+252. (London: John Bale, Sons, and Danielsson, Ltd., 1911.) Price 12*s.* 6*d.* net.

(2) "The Physiology and Diseases of *Hevea brasiliensis*, the Premier Plantation Rubber Tree." By T. Petch. Pp. iv+268. (London: Dulau and Co., Ltd., 1911.) Price 7*s.* 6*d.* net.

(3) "The Whole Art of Rubber Growing." By W. Wicherley. Pp. 154. London: West Strand Publishing Co., Ltd., 1911.) Price 5*s.* net.

even intentionally, by natives for adulteration. The chemical and physical characters of the latex and the methods of coagulation have received attention by Dr. Christy in Uganda, and his chapters on these subjects provide much interesting matter. The book is, however, one which must necessarily appeal to a limited section owing to the relative unimportance of the species dealt with as sources of rubber. It is true that Funtumia has supplied large quantities of Lagos-silk rubber in the past, and will continue to do so for many years to come. Nevertheless, it is a species which does not lend itself to cultivation; wherever it has been tried—in Ceylon, Malay, Samoa, New Guinea, &c.—its growth has been so slow and the yields so small that planters have abandoned all hopes of ever cultivating the tree profitably.

(2) This a book which deals with a very special side of the rubber industry, and is mainly of interest

FIG. 2.—High-tapping Funtumia (Mabira Forest). From "The Whole Art of Rubber Growing."

to planters in the East, and to students of mycology elsewhere.

After giving a general introductory statement on the structure of *Hevea brasiliensis*, its latex and rubber, and the tapping systems employed on plantations, the author comes to the special part for which he is qualified to deal, viz., plant sanitation from the mycological point of view. Leaf diseases—*Helminthosporium heveae and Gloeosporium heveae*—are dealt with, and the result of an examination of fallen leaves is described, it being shown that conspicuous defoliation was not due to these diseases. Among root diseases, the author pays particular attention to *Fomes semitostus*, which is now reported from most estates in Ceylon, Malaya, Sumatra, Java, and even Africa; to the Brown root disease—*Hymenochaete noxia* and to *Sphaerostilbe repens*, and he deals also with numerous miscellaneous fungi observed by himself and others on the roots of this particular tree.

Stem diseases are dealt with in a separate chapter. *Phytophthora Faberi* is described as a parasitic fungus affecting the stem and fruit of *Hevea brasiliensis*; it has also been associated with cocoa, with which rubber trees are often interplanted. Pink disease—*Corticium salmonicolor*, B. and Br.—formerly extensively known in Java as *Corticium javanicium*, Zimm., is also described. This disease appears to originate generally in the fork of the tree or where several branches arise close together from the main stem; it has caused considerable damage, especially in Java and Malaya. A new stem canker, *Coniothyrium sp.*, is reported to have made its appearance on a Ceylon estate in 1909; this apparently appears on young green shoots, the first sign of its appearance being the production of hard, yellowish patches due to the development of a corky layer under the epidermis. Stem diseases of seedlings and the sterilisation of nurseries also receive attention.

Some abnormalities in Hevea in the form of twisted seedlings, nodules, and twisted stems (fasciation) are well illustrated, and should prove of interest to teratological students.

Much of the information has already been published in Ceylon, but this should not seriously detract from its value. References to literature on each subject are freely given, and in this way the reader is enabled to secure further detail if he desires to do so.

It is to be regretted that this book deals only with diseases due to fungi and bacteria. The book would have been much more useful to planters and to others in Europe had it taken into consideration the numerous animal pests which at the present time are a source of great anxiety to all cultivators of rubber trees. It is the only book of its kind, and should find a place in the library of all who wish to maintain an interest in tropical agriculture.

(3) Mr. W. Wicherley's booklet covers a series of general problems connected with *Hevea brasiliensis, Manihot glaziovii, Ficus elastica, Castilloa elastica, Funtumia elastica*, and three of the new Manihots. The majority of the essays have already appeared in the London Press. The writer acknowledges his indebtedness to the officials of the Ceylon Botanic Gardens, and pays a tribute to past and present officers for the work they have done in connection with this cultivation.

The statistics given of planted acreages and probable future yields (p. 144) are, in our opinion, calculated to give a wrong impression; the acreages now under rubber are, and the future annual crops will be, much larger than those suggested by the author.

There are some interesting illustrations, especially those showing high tapping of Funtumia trees in Uganda, and of methods of tapping adopted on trees of *Manihot dichotoma*. The book deals almost exclusively with matters relating to plantation subjects, and will be found useful by the general reader who is anxious to acquire a general knowledge of this section of the industry.

THE COAST OF NORTH DEVON.[1]

THIS is a book which should be in the hands of all who are interested in the scenery of the British Isles, and especially of those who intend to visit any of the holiday resorts on the northern or western coasts of Devon. It is not an ordinary guide-book, and it is not a geological treatise, but a description and explanation of some of the most picturesque and interesting coast scenery to be found in England or Wales.

1 "The Coast Scenery of North Devon." Being an Account of the Geological Features of the Coast-line Extending from Porlock in Somerset to Boscastle in North Cornwall. By E. A. Newell Arber. Pp. xxiv+261+2 sketch maps. (London: J. N. Dent and Sons, Ltd., 1911.) Price 10*s.* 6*d.* net.

It includes all information necessary as to the best means of seeing the different parts of the coast-line, and all the geological information that is requisite for understanding the structure of the country, the flexuring of the rocks, and the features which the cliffs present. Mr. Arber points out that one of the special features of this coast is the number of coastal waterfalls. "By this term," he says, "we imply waterfalls cut by streams in their passage over the sea-cut cliffs to the beach. Several of these coastal falls are of considerable height, and form striking landmarks on the coast. Their features, however, are so varied that no two of them are exactly alike in all respects. They show all stages in the evolution of a waterfall from its birth to its senile period of old age and decay."

Mr. Arber divides his subject, that is to say, the coast-line, into six districts, beginning with the most easterly, near Porlock, in Somerset, and ending with the most southerly, near Boscastle, in Cornwall. He mentions the best headquarters for each, and then describes the rocks seen in the cliffs, the ridges and headlands, the streams, and the waterfalls, all of which are illustrated by excellent photographs, fifty-nine in number, and two of these, reproduced in Figs. 1 and 2, will show the reader what kind of scenery is to be found in the area described.

The chief peculiarity of this area is that the two main watersheds are, roughly, parallel to the coast, and seldom more than three miles away from it. We have consequently the curious arrangement of a number of streams rising near the coast and flowing inland, and of a still larger number of short streams flowing from the watersheds to the cliff-line, over which most of them fall in one or more cascades. The explanation of this arrangement is that the sea has invaded and destroyed the country which originally lay outside the main watersheds, and is now advancing on the actual watershed ridges. This is illustrated by a clear map of the whole drainage system of the area.

Mr. Arber writes, on p. 20, as if there were only one watershed, and it is true that there are secondary watersheds which nearly unite them, but, as a matter of fact, there are two main watersheds separated by the Valley of the Taw, and it is doubtful if they were ever united. The Exmoor ridge may have been prolonged indefinitely westward, while the Hartland watershed must always have been truncated by the continuation of the Taw valley along the floor of Barnstaple Bay, before the recent depression or subsidence enabled the sea to advance so far over the western land.

This comparatively recent subsidence is a very important factor in the explanation of the present peculiar drainage system, and of the features presented by the coast-line, but Mr. Arber has not laid sufficient emphasis upon it. He refers to it in several places, but he also refers to what he terms the "recent elevation" of some parts of the coast, leaving the reader to infer that the one movement was as recent as the other. He should have made it clear that the upheaval which lifted the "Raised Beaches" to their present position, or rather to a still higher level, was antecedent to the subsidence which is indicated by the drowned valleys and the submerged forests. When the book reaches a second edition Mr. Arber will do well to add a short account of the Pleistocene history of the country to his introductory chapter.

Of the coast near Hartland Point Mr. Arber writes that it includes some of the wildest and grandest cliff scenery to be met with in the whole of Devon, and that as regards its coastal waterfalls he believes it to be quite unique so far as Britain is concerned. One

FIG. 1.—The valley of Milford Water and the head of the First Fall, from the cliffs above Speke's Mill Mouth, looking east (Hartland District). From "The Coast Scenery of North Devon."

of these waterfalls is that of Milford Water, and is shown in Fig. 1. This, moreover, is only the first fall of the stream from a level of about 160 feet above the sea; below it is a cañon, in which are three smaller falls before the stream reaches the beach. Fig. 2 is a side view of the same fall from below, showing the synclinal flexure of the rocks at this point, and the manner in which the stream turns at right angles along the syncline. After going for 132 yards to the south it again turns west across the strike of the rocks, a curious and interesting instance of the relation of stream channels to rock structure.

Part ii. of the book deals with some features of special geological interest, these being the marine erosion of folded rocks, sea-dissected valleys, and the evolution of coastal waterfalls. The author points out that the usual text-book explanation of bays and promontories along a sea-coast is not always the true one. They do not always coincide with the outcrops of softer and harder rocks. Some of the irregularities of the Devon coast seem to be due to the influence of previously existing physiographic features, the bays coinciding with the sites of valleys and the promontories with the dividing watershed ridges. Others are due to the influence of the flexures, and he finds that the anticlines are more stable under the action of sea erosion than are the synclines, while on land under the action of subaërial agencies the reverse is the case.

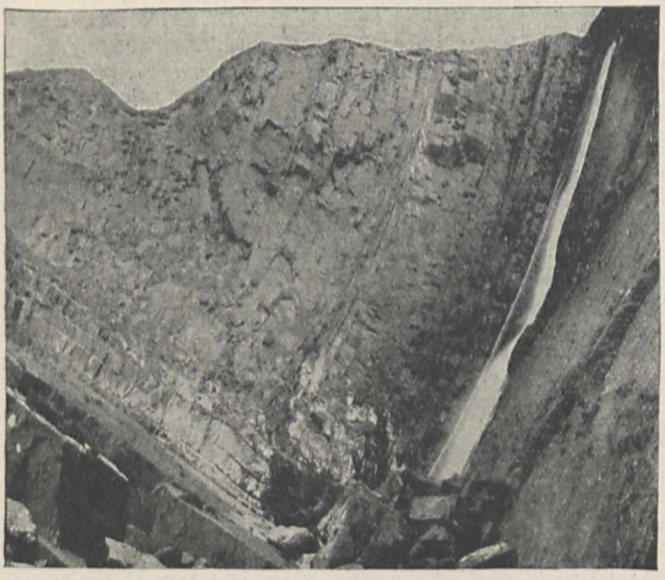


FIG. 2.—The First Fall of Milford Water and the synclinal fold, looking north. From "The Coast Scenery of North Devon."

Mr. Arber has certainly succeeded in showing how many points of interest there are along this piece of coast-line, both for the geological student and for the intelligent tourist. A. J. J.-B.

NOTES.

THE present summer is establishing a record for its high temperatures, and in many places for its persistent drought. At Greenwich the mean temperature for July was 68·3°, which is 4·6° above the average for the past sixty years. The mean of the day temperatures was 81°, and of the night temperatures 55·5°. There were nineteen days during the month with the shade temperature above 80°, and three days above 90°. This is the greatest number of days in July above 80° since 1868, and the third highest number since 1841. The highest shade temperature during the month at Greenwich was 95·6° on July 22, and the only two instances of a higher temperature at any period of the year are 97·1° on July 15, 1881, and 96·6° on July 22, 1868. There were seven days after July 20 with the thermometer in the sun's rays about 150°, and on July 22 the black bulb thermometer registered 161°. The duration of sunshine for the month was 331 hours, which is nearly 100 hours more than the average. No rain was measured until July 24, the period of drought being the longest in July since 1887. The aggregate rainfall for the month was 0·26 inch, which fell on three days. This is the driest July since 1864, and there is no other July so dry since 1841. At Bath, July was absolutely rainless. The reports received by the Meteorological Office give the following additional high temperatures:—On July 21 the thermometer registered 90° both at Oxford and Margate, on July 22 94° at Margate, on July 29 93° at Bath and 91° at Oxford. The type of weather was anticyclonic almost continuously throughout the month, and the region of high barometer readings extended over a large part of western Europe, where exceptionally high temperatures occurred almost throughout the month. At Rochefort the thermometer registered 93° on July 6, at Lorient 95° on July 7, 97° on July 8, and 99° on July 9. On July 14 the temperature at Rochefort was 100°, and at Stockholm 95°. Paris had a temperature of 96° on July 22 and 23, Frankfurt 100° on July 23. From July 24 to 29 several stations in France and Belgium had temperatures from 95° to 98°. Some exceptionally severe thunderstorms occurred during the month; on July 28 1·1 inches of rain fell in fifteen minutes at South Kensington, and on July 29 2·14 inches fell in 2½ hours at Kilkenny.

FOR the moment the remarkable archæological discoveries in Corfu have thrown other work in the eastern Ægean into the shade. But in various parts of this area, in the Greek mainland and islands, much progress has been made, the results of which are described in an interesting article in *The Times* of July 31. The Greek Archæological Society has restored the Propylæa on the Athenian Acropolis; repairs have been carried out at Mycenæ; and the museum at Olympia has been converted into a safe receptacle for its treasures. The French Mission at Delos has unearthed images of Egyptian and Syrian gods which illustrate the adoption of foreign cults into the religion of Greece; and some progress has been made at the island of Levkas (Santa Maura), which Dr. Dörpfeld believes to be the Homeric Ithaca. The British School has been at work on the Menelaion, the tomb of Menelaus and Helen at Sparta. Phylakopi, in Melos, the seat of an early trade in weapons of obsidian, has yielded some good vases imported from Crete. An appeal is now made for help towards the explorations in Macedonia, conducted by Messrs. A. J. B. Wace and M. Thompson, where important results in the examination of prehistoric, classical, Byzantine, and mediæval antiquities may be confidently expected.

PROF. CZERMAK, of the Brünn High School, who died on July 11 at the age of seventy-seven years, left, says the *Revue Scientifique*, a million crowns to the Vienna Academy of Sciences.

IT is announced in *The Times* that M. Ernest Mercadier, formerly director of studies at the École Polytechnique, died on July 27 in his seventy-sixth year. M. Mercadier entered the French telegraph service in 1859, and held the

post of director of telegraphs during the siege of Paris, when he likewise organised the military telegraph service. After the war he became professor of physics at the École Supérieure de Télégraphie, and in 1881 he was appointed director of studies at the École Polytechnique, where he remained until the end of the year 1903. He was an honorary member of the Institution of Electrical Engineers and of the International Society of Electricians.

We regret to learn that Mrs. Helena B. Walcott, wife of Mr. Charles D. Walcott, formerly director of the United States Geological Survey, now secretary of the Smithsonian Institution, was instantly killed in a railway accident at Bridgeport, Connecticut, on July 11. Mrs. Walcott had been ardently and actively interested in the scientific work of her husband. In 1888 she accompanied him to Newfoundland, where they worked out together the key to the succession of the Cambrian formations of the North American continent. They then crossed to Wales and studied the classical Cambrian sections. For eighteen seasons she accompanied Mr. Walcott on his expeditions in connection with geological researches in various regions of eastern and western United States and Canada. Since his appointment as secretary of the Smithsonian Institution she had been greatly interested in the development of the United States National Museum and in the general study of museum systems. Possessed of unusual charm of person and manner, Mrs. Walcott's death is a heavy blow to a large circle of friends and acquaintances.

The fifth annual meeting of the Italian Society for the Advancement of Science will be held in Rome on October 12–18, under the presidency of Prof. G. Ciamician. The sections of the association, with their presidents, are as follows:—mathematics, astronomy, and geodesy, Prof. G. Castelnuovo and Prof. A. Di Legge; physics, Prof. P. Blaserna; applied mechanics and electrotechnics, Prof. C. Ceradini; pure and applied chemistry, Prof. E. Paternò; mineralogy and geology, Prof. R. Meli; geography, Prof. E. Millosevich; zoology, anatomy, and anthropology, Profs. G. B. Grassi, F. Todaro, and G. Sergi; pure and applied botany, Prof. R. Pirotta; physiology, Prof. L. Luciani; pathology, Profs. A. Bignami and E. Marchiafava; history and archæology, Profs. G. Beloch and L. Pigorini; philology, Prof. I. Guidi; social science, Prof. M. Pantaleoni; philosophy, Prof. P. Ragnisco. Several lectures on subjects of wide scientific interest will be delivered to general meetings of the association as a whole, and others to joint meetings of sections concerned with related subjects. Full particulars may be obtained from the secretary, to whom contributions for the sections should be addressed, Prof. V. Reina, Via del Collegio Romano 26, Roma.

In the first part of the second volume of the Museum Journal of the University of Philadelphia we find an interesting account of an exploration of the remarkable ruined city of Chichen Itza, in Yukatan. The place is familiar to students of Central American archæology from the enthusiastic accounts of Stephens with Calderwood's drawings, the photographs and measurements of Maudslay, and the sketches of Holmes. These, however, only imperfectly represent the decoration scheme, and for the frescoes and wall sculptures the only existing record is the fine series of water-colour drawings by Miss Adela Breton, who with rare devotion has succeeded in reproducing the beautiful work of the ancient artists. These drawings are as yet unpublished, and all students of art will join in the hope that arrangements may soon be made for their publication.

It is a good omen for the scientific value of the reports of the recent census of India, which are now in process of compilation, that Mr. E. A. Gait, the census commissioner, has prepared for the use of the provincial superintendents an abstract of several important reviews by eminent Continental anthropologists of the report by Sir H. Risley on the census of 1901. These criticisms are of much importance, and direct special attention to certain problems for the solution of which the reports of the last census may be expected to supply valuable material. Of special interest are the suggestions of Herr Baelz on the peculiar skin patches which seem to be a race characteristic of the Mongolians; Walcher's review of the results of artificial changes in the skull form; and Surgeon Captain E. P. Maynard's remarkable discovery among some coolies at the tea gardens of Assam of a curious form of melanoglossia which seems to be peculiar to certain of the Munda tribes of Chota Nagpore, and may be of great importance in identifying the modifications of this ethnical type.

In vol. iv., part iii., of the Transactions of the Hull Scientific and Field Naturalists' Club Mr. T. Pickersgill describes a remarkable collection of Roman coins made at South Ferriby by the well-known Thomas Smith, locally known as "Coin Tommy," which has recently been acquired by the Hull Municipal Museum. South Ferriby, lying on the direct route between Lincoln and York, was obviously a place of considerable importance in Roman times, and the interest of this collection lies in the fact that its 2600 specimens practically cover the whole period of the Roman occupation of north Lincolnshire. It begins with a coin of the Emperor Trajan (A.D. 98), and extends to the time of Honorius (A.D. 395–423), in whose reign the Romans finally withdrew from Britain. The collection includes the coins of thirty-nine emperors and members of their families, several of the wives of the emperors being represented. Mr. Pickersgill gives a full catalogue of these coins, with details of their mintage, and supplies two sheets of photographic reproductions of the most typical specimens, a valuable monograph which will be of interest to all numismatists.

In *The Eugenics Review* for July (x., No. 2) Sir Thomas Oliver directs attention to the disastrous effects of lead-poisoning on the race, particularly among potters. Lead-poisoning, insufficient definitely to cripple the workers, has a disastrous effect on the reproductive organs; females who work in lead before marriage miscarry twice, and females working in lead after marriage miscarry three times, more frequently than those engaged in ordinary housework. A high percentage of children born alive to lead workers die shortly after birth and during the first few months of life. Some of the worst effects of lead-poisoning are to be seen among the small pottery manufacturers of Hungary, of which Sir Thomas Oliver gives a graphic account.

Under the title of "The Hunted Otter," the Animals' Friend Society, Kingsway, W.C., has published a pamphlet urging the total prohibition of otter-hunting. While all, we hope, will support the proposal to establish a close time during the breeding season, it by no means follows that public opinion will demand the entire abolition of the sport of otter-hunting.

The Victorian Naturalist for June contains an obituary notice of the late Mr. A. O. Sayce, who was appointed demonstrator and assistant lecturer in bacteriology in Melbourne University six years ago. In addition to bacteriology, Mr. Sayce devoted special attention to crustaceans, on which he wrote numerous papers, the most

important being one on the new malacostracous genus Koonunga. In recognition of the value of his work, Mr. Sayce was elected some years ago an associate of the Linnean Society of London.

IN the July number of *The Museums Journal* Mr. C. O. Waterhouse directs attention to the urgent need for a very great extension in the space allotted to the study series of insects in the natural history branch of the British Museum—a subject which appears to have been in some degree overlooked during the recent discussion with regard to the disposal of the ground at the back of the building. At present the collection is housed in rooms originally described as workshops, where it is crowded to an almost unimaginable extent. The writer pleads for two new galleries for the entomological study series, and gives two alternative plans for such extension. In the second of these it is suggested that the present main front of the building should be continued to Queen's Gate, and the continued galleries used for public exhibition, with a further extension from the present west tower, at first northward and then westward, so as to form an open quadrangle facing Queen's Gate, the entomological collections to occupy the second floor of the latter part of the extension.

Two incidents of prime importance are recorded in the report of the U.S. National Museum at Washington for the year ending June 30, 1910, namely, the practical completion of the new buildings and the transference of a large portion of the collections, and, secondly, the reception of the natural history collections made by the Roosevelt expedition to East Africa in 1909. The latter are estimated to comprise more than 11,000 specimens of vertebrates and a large number of invertebrates, as well as several thousand plants and a few ethnological objects. It is claimed that the collection of East African mammals is probably more valuable than any similar series in any other museum. "Its importance lies not so much in the number of new forms as in the fact that it affords an adequate basis for a critical study of the mammal fauna of East Africa, and the establishment or rejection of the large number of forms which have been described, especially in recent years, from insufficient material."

IN the July number of *The Zoologist* Prof. McIntosh, of the Gatty Marine Laboratory, St. Andrews, records the results of a number of experiments made in Ireland and Scotland for the purpose of ascertaining whether salmon and trout are liable to injury by the turbines so frequently used in Irish mills, many of which revolve at a very high rate of speed. So long ago as 1892 a number of similar experiments were instituted by Sir Thomas Brady, who was of opinion that very few fry survived an experience with a turbine, believing that the great majority were killed at once as they went through, their bodies dropping into the deep water as they were struck. The experiments of Prof. McIntosh give a much more favourable aspect of the matter from the point of view of the fish. It is stated, for instance, that "in all the experiments, which were twenty in number, one feature was marked, viz. the comparative ease with which healthy trout in the turbine-pits kept free from the vortex caused by the action of the turbine. They appeared to go through the turbine only when they pleased or by accident. Moreover, when circumstances were favourable, they swam out of the turbine-pit to the head-race, and thus . . . could have passed up-stream to the nearest by-wash, if such existed."

DIRECTING attention to the varying descriptions of the manner in which fruit dispersal is effected by species of Geranium, Prof. W. Sorensen communicates the results of his own observations in the current Bulletin (No. 2) of L'Académie Royale des Sciences et des Lettres de Danemark. The details commonly overlooked are the existence of an aborted ovule, the detachment of the seed, the position of the lines of dehiscence, and the devices by which in certain species the seeds are retained temporarily in the open pericarp. The species *sibiricum* and *molle* are described as illustrative examples of the two methods of pericarp shedding, and the peculiar features of *dissectum* are noted.

A CONSIDERATION of vegetative changes and the agencies inducing them, forming the subject of a presidential address delivered before the Association of American Geographers by Prof. H. C. Cowles, is published in *The Botanical Gazette* (March). Under physiographic agencies the author discusses regional and topographic successions; biotic factors are examined under the headings of humus, shade, and human agency. As an example of occasional plant plasticity, it is noted that the Douglas spruce may be a xerophytic pioneer, and then persist through successive stages of forest development, culminating in a mesophytic formation; throughout each stage it may be dominant, and yet it shows no striking change in leaf habit.

RICE cultivation in Siam provides the subject of an article contributed by Dr. C. C. Hosseus to the *Tropenpflanzer* (vol. xv., No. 6). Many varieties of rice are recognised by the Siamese, most of which fall under the common species *Oryza sativa*. In addition, three other species can be distinguished; *O. praecox* is a "wet" rice, yielding a grain very similar in its qualities to that of *O. sativa*, but is also cultivated on the mountain slopes; *O. glutinosa*, as its name implies, yields a glutinous grain, that is cooked by the tribes of the interior in bamboos, acquiring thereby a distinctive flavour; the fourth species is the "hill" rice, *O. montana*, less nutritious than ordinary rice, but preferred by the Laos tribes.

BEE-KEEPERS should find much to interest them in No. 447 of the Farmers' Bulletin, published by the U.S. Department of Agriculture, under the title "Bees," and written by Dr. E. F. Phillips, the official expert on bee-culture. Full instructions are given for the installation, equipment, and management of apiaries, with notes on the production of honey and wax; in fact, the bee-keeper will find information on all points connected with his trade or hobby.

THE mycologist of the Board of Agriculture, Trinidad, Mr. J. B. Rorer, describes a bacterial disease of plantains and bananas in the island (*Phytopathology*, i., No. 2, p. 45). The disease causes the leaves, progressively from below upwards, first to become yellow, then to droop, and finally to break off, and eventually the terminal bud is attacked, and the plant dies and rots down to the ground. The vascular bundles are filled with bacteria, pure cultures of which were obtained, and inoculations of them into healthy plants reproduced the disease.

THE flowers of Chaucer form the subject of an article by the Rev. H. N. Ellacombe now in course of publication in *The Gardeners' Chronicle*. In the issue of July 22 it is pointed out that although the box is an indigenous tree, it never had an English name, "box" being an Anglicised form of the Latin *buxus*. Chaucer mentions cedar, but apparently never saw a specimen. The same issue includes an illustrated account of the rock-garden in course of construction for the Royal Horticultural

Society at Wisley. The rocks are Wealden sandstone, some of the rocks weighing as much as a couple of tons. A large moraine forms one of the subjects of interest, below this being a bog-garden, watered from the source which supplies the moraine.

THE poultry investigations at the Maine Experiment Station are well known, and the recently issued bulletins will be read with interest by those engaged in similar work elsewhere. Messrs. Pearl, Surface, and Curtis have compiled an account of the common poultry diseases in a bulletin which must be regarded as one of the most useful yet issued for the practical man. The symptoms are clearly described, and such remedies as are known are indicated. In a more technical publication Dr. Pearl continues his discussion of the inheritance of fecundity in the domestic fowl.

THE Boyle lecture on the fertility of the soil delivered by Mr. A. D. Hall before the Oxford University Scientific Club has now been issued as a separate reprint. It is shown that Boyle and some of his contemporaries discussed the question of soil fertility, and especially the part played by nitre. The investigation was widened by Daubeny, professor of botany and rural economy in Oxford, and the real founder of a science of agriculture in this country, and in recent years has been shown to be even more complex by the intervention of the micro-organic flora of the soil. The factors determining fertility are, however, being slowly disentangled and brought under control.

THE German Mineralogical Society, which now consists of 158 members, under the presidency of Prof. F. Becke, of Vienna, at its annual meeting in September last decided on the publication of a journal, to be called the *Fortschritte der Mineralogie, Krystallographie, und Petrographie*, and the first number has just made its appearance, under the editorship of Prof. G. Linck, of Jena. It is an imposing volume of nearly 300 pages, and contains fourteen articles by distinguished members of the society. One of the earlier ones is by Prof. Baumhauer, on "Geometrical Crystallography," in which he deals with the "Law of the Complication and the Development of Crystal-faces in Zones rich in Faces," and discusses the most important recent contributions to crystallographical literature from this point of view. Then there are two articles by Prof. Mügge, of Göttingen, and Prof. F. Becke, the president, on "Twin-Crystals," in which many recent descriptions of new twin-forms are discussed and correlated, including the important work of Dr. Stefan Kreutz on twins of calcite. Another interesting and important article is that by Dr. Albert Ritzel on the "Rapidity of Crystallisation and Solution," in which the facts concerning the different speeds of growth of a crystal in different directions, and the corresponding differences in the times taken by a solvent in dissolving the material from the different faces of the crystal are carefully compiled from all the recent work on the subject, and the general results discussed. These examples will suffice to show the value of this new publication, which reminds us very much of the annual reports published by the Chemical Society, but goes further in including a considerable number of text-figures, and in embodying original results obtained by the authors themselves. We heartily congratulate the German Mineralogical Society on its venture, and shall look forward to seeing a continuation of these excellent articles, presenting in an interesting form the essence of the progress made in the subjects included in the purview of the society.

WORKS are now in operation for improving a section of the navigable channel of the Mississippi, and at the same time developing the water resources of the river by the construction of an hydro-electrical plant, consisting of a power-house designed to contain machinery driven by turbines capable of developing 120,000 horse-power. This power-station lies about midway between Kansas City and Chicago, and 140 miles north-west of St. Louis. The site of the works is at the foot of the Des Moines rapids. These rapids now are only navigable at high stages of the river, and at other times vessels have to pass round them by means of a canal having three locks. When the works are completed there will only be a single lock, of dimensions sufficient to accommodate vessels of much larger size than those which now navigate this part of the river. The works include a concrete dam 1560 yards in length and 40 feet high, and the pool above formed by the dam will constitute a reservoir extending for forty or fifty miles.

AN instructive study of the mouth of the Scheld by F. Müller appears in the June number of the *Zeitschrift für Erdkunde*, in which the form and character of the river mouth, its tidal conditions and its development during the past five centuries, are detailed. The various towns are described, and in some cases illustrated, to show their varying fortunes during the same period. Similar studies of some British coastal settlements would form a profitable object for geographical research in this country. In the same number Prof. K. Kretschmer describes a number of early manuscript maps in the Bibliothèque Nationale at Paris, and analyses them.

THE demarcation of boundaries in Africa continues steadily, one of the most recent being that between Tunis and Tripoli. A French party carried out a geodetic and topographical survey of a zone 10 kilometres wide from Ras Ajedir on the Mediterranean coast to Ghadames, of which the position was determined to be lat. 30° 7′ 48·7″ N. and long 7° 9′ 57·9″ W. of Paris, or some 27 kilometres east of Duveyrier's original determination; the mean altitude of the oasis was found to be 340 metres above sea-level. This information, given in the April number of *La Géographie*, is supplemented in the May number by a description of the route by L. Pervinquière, who was detailed to study the geology of the country traversed.

THE Survey of India has just published an account of explorations made by Kinthup, a native of Sikkim, in Bhutar, and on the lower Tsang-po, in 1886–7. He was despatched in July, 1880, with a Chinese Lama, from Darjeeling to Tibet by the late Captain Harman, and, after being detained in slavery in the Pemakoi country, finally succeeded in returning to India. He travelled along the Tsang-po, or Brahmaputra River, from the point where it turns southward towards India to the village of Mrii Padam, which he gives as about thirty-five miles from the British frontier. Though followed under very unfavourable conditions, the line of the river is probably indicated with fair accuracy, and goes part of the way towards filling the gap which has hitherto existed in our knowledge of the course of this great waterway.

NEW isothermal charts of Africa have been drawn for the atlas which is being prepared in the Survey Department of Egypt for use in Egyptian schools, and Mr. J. I. Craig gives those for January and July in the May number of *The Cairo Scientific Journal*. Temperatures have been reduced to sea-level, the gradient being taken as −0·6° C. per 100 metres in the equatorial zone, and as −1° C. per 100 metres in the drier region of North Africa, on the basis of kite observations at the Helwan Observatory. With the recent values employed the isotherms run somewhat differently from their courses as shown in earlier

charts. In July the highest temperature, 34° C., lies almost wholly to the east of the Nile, the greater part of the Sahara falling between that isotherm and that of 32° C.; and in Central Africa the isotherm of 26° C. extends southward to about latitude 17° S. in the basin of the Zambezi.

THE meteorological chart of the North Atlantic and Mediterranean for August (first issue, July 13), published by the Meteorological Committee, is of special interest in connection with the recent prolonged drought. The weather charts for July 6–12, and the useful summary which accompanies them, show that throughout that period a well-developed anticyclone dominated the situation over the eastern part of the ocean and western half of Europe; the temperature rose at places above 90°, and even to 84° in Iceland. For six out of the seven days this system of high barometric pressure lay practically motionless over these islands, and at the close of the period reports indicated the continuance of anticyclonic conditions of weather on the ocean.

IN an article in *Symons's Meteorological Magazine* for July, entitled "The Disappearance of Evening Cloud at Full Moon," Mr. W. Ellis, F.R.S., endeavours (owing to a recent reference to the subject) to refute the opinion held by Sir J. Herschel and others that the full moon possesses the faculty of clearing away clouds. This fallacy, like that of the artificial production of rain, is difficult to eradicate from the public mind. Mr. Ellis has shown from the Greenwich observations that a maximum cloudiness in the forenoon and a minimum in the evening represent the usual climatic variation. A change from a cloudy to a clear state in the evening sky is much more likely to attract attention when occurring near to full moon, and this is the opinion of leading meteorologists of the present day. Dr. W. N. Shaw (Quart. Journ. R. Met. Soc., April, 1902) suggests a physical explanation of the phenomenon, viz. that a floating cloud loses heat by radiating into space more heat than it receives from the earth beneath; the water globules consequently evaporate, and the cloud will vanish. "Any effect of direct radiation of the moon may be quite properly disregarded." A more recent opinion in the same sense (to which we have before referred) is contained in Mr. J. R. Sutton's paper on the lunar cloud period (Trans. South African Phil. Soc., December, 1907).

AN article by Mr. D. Owen in *The Electrician* for July 7 places in a very clear light the importance which now attaches to the "lively dance of bright spots," first noticed by the English botanist Brown, in any liquid containing minute particles in suspension when illuminated from the side. Sixty years ago the observation attracted little attention, but recently, through the improvements which have given us the ultra-microscope, the experiments of M. Perrin and the theoretical work of Dr. Einstein, the study of the Brownian movements has thrown considerable light on the properties and motions of the ultimate particles of which matter is composed.

SEPARATE copies of several of Prof. Righi's recent papers have reached us, and to one of them, which deals with the effect of a magnetic field parallel to the axis of a vacuum tube on the electric discharge through the tube, we should like to direct special attention. If such a tube with aluminium disc electrodes 15 cm. apart is covered outside with tin foil and placed in a magnetising solenoid, Prof. Righi finds that a potential difference of 3000 volts between the electrodes, which is insufficient to cause a measurable discharge in the absence of a magnetic field, will maintain a current through the tube with a field of 1250 gauss in the neighbourhood of the positive electrode, or a field of above 5000 gauss in the neighbourhood of the negative. He is disposed to attribute the phenomena to the production of electrons at the walls of the tube by the magnetic field, and is engaged in further work to test this hypothesis.

THE remarkable influence of borax in raising the rotatory power of mannitol has been known for nearly forty years, but the exact origin of this effect has been open to question, although the combination of the mannitol with the boric acid appeared the most probable explanation. It is therefore a matter of satisfaction that the compound should at last have been isolated and analysed. As described by Messrs. J. J. Fox and A. J. H. Guage in the June number of the Chemical Society's Journal, the compound is formed, according to the equation

$$C_6H_{14}O_6+H_3BO_3=H_2O+C_6H_{15}O_8B,$$

by dissolving mannitol and boric acid in hot alcohol, filtering, and allowing to stand. The mannitoboric acid slowly separates in compact, colourless prisms, melting at 89·5°, but dissociates again when attempts are made to recrystallise it.

THE tenth volume of the Transactions of the English Ceramic Society (part i.) contains as a frontispiece a portrait of the president, Mr. H. Johnson, whilst a portrait of the first president, Mr. William Burton, is issued as a frontispiece to vol. i. The new issue includes two important technical papers on electricity for potters' machinery, by Mr. Odelberg, and on liquid fuel, by Mr. Kermode; these may be regarded as additions to a series of papers of which those on gas-firing were noted in these columns recently. Attention may also be directed to a paper by Dr. J. W. Mellor on the constitution of the kaolinite molecule, and to a paper on colour and its measurement by Mr. J. W. Lovibond. The value of the work done by this society in emphasising the importance of scientific methods in one of the leading industries of the country can scarcely be overestimated.

THE extension of the system of multiple evaporation in the manufacture of sugar has been limited by the fact that whilst the evaporation may be effected safely under normal and reduced pressures of steam, the sugar begins to decompose when steam under pressure is used. A report on the effect of high temperatures on cane sugar in solution, by Noël Deerr, issued from the Experiment Station of the Hawaiian Sugar Planters' Association, describes an investigation of considerable technical and scientific importance. It is shown that sugar inversion begins to be important at 110°, but may be checked by the addition of alkali; this causes the juice to darken, but much of the colour disappears when the alkali is neutralised, and the coloration in no way corresponds with loss of sugar. The conclusion is drawn that the local juices may be relied upon to stand half an hour's heating at 120° without loss of sugar, whilst under careful control and observation a temperature of 125° (or even 130° for shorter periods) is permissible. This conclusion is important, not only by reason of economy in evaporation, but also because a temperature of 125° is sufficient to produce almost instant sterilisation, an effect that cannot be produced with any certainty at 100°. A point of considerable scientific interest, dealt with incidentally in the paper, is the reciprocal interconversion of dextrose and lævulose when the solutions are heated either alone or in presence of alkalis.

MESSRS. GEORGE ALLEN AND CO., LTD., are about to publish a work on "Bushman Folk Lore," by W. I. Bleek and L. C. Lloyd. The volume will be fully illustrated with numerous specimens of Bushman drawings, and will contain a preface by Dr. G. McCall Theal.

OUR ASTRONOMICAL COLUMN.

COMET 1911*b* (KIESS).—The numerous observations of Kiess's comet which appear in Nos. 4513–5 of the *Astronomische Nachrichten* agree in describing it as a nebulous mass some 2·5′ to 5′ in diameter, with a condensation some 40″ to 50″ across, but no definite nucleus. The estimates of the magnitude, as one would expect of such an object, vary considerably, but about July 10 the magnitude was approximately 8·0.

A forty-two minutes' exposure, made in a slit spectrograph attached to the reflector of the Königstuhl Observatory, on July 11, showed 390 $\mu\mu$ to be the brightest band. The radiation 388 $\mu\mu$ was fainter, and its companion of shorter wave-length fainter still. While the 390 $\mu\mu$ line extended to a distance of 1½′ from the condensed centre, the much fainter line 467–476 $\mu\mu$, with a maximum at 472 $\mu\mu$, extended only to about ½′. The bands 398–410 $\mu\mu$ and 423 $\mu\mu$ were extremely faint, and no continuous spectrum was shown on the plate.

Dr. Wolf adds that, as seen in the 12-inch refractor on July 8, the head showed a distinct dark space behind its centre, and a cone of matter was seen to be streaming out from the front of the coma. A brief observation by Herren Helffrich and Massinger showed a curved tail at least 1° long, but very faint.

Elements computed by Messrs. Einarsson and Meyer agree well with the corrected elements published by Dr. Kobold, and, with an ephemeris, appear in No. 4515. The following ephemeris is abstracted from that given by Dr. Kobold in No. 4514 :—

1911	α (true) h. m.	δ (true) ° ′	log r	log Δ	mag.
Aug. 3	3 49·7	+24 5·6			
,, 5	3 40·1	+21 29·4	9·9993	9·6711	5·0
,, 7	3 28·2	+18 6·0			
,, 9	3 13·0	+13 29·3	0·0226	9·5442	4·5
,, 11	2 52·8	+ 7 2·7			
,, 13	2 25·2	− 2 1·6	0·0452	9·4013	3·9
,, 14	2 7·2	− 7 43·6	—	9·3708	
,, 15	1 46·9	−14 15·8	—	9·3439	
,, 16	1 22·5	−21 16·9	—	9·3267	
,, 17	0 54·0	−28 26·1	0·0670	9·3212	3·6

The positions in regard to the surrounding stars are shown approximately on the accompanying chart, the bottom line roughly corresponding to the mean horizon for London; after August 17 the distance from the earth begins to increase, and the comet also becomes invisible in these latitudes, its declination on August 18 being 35° S.

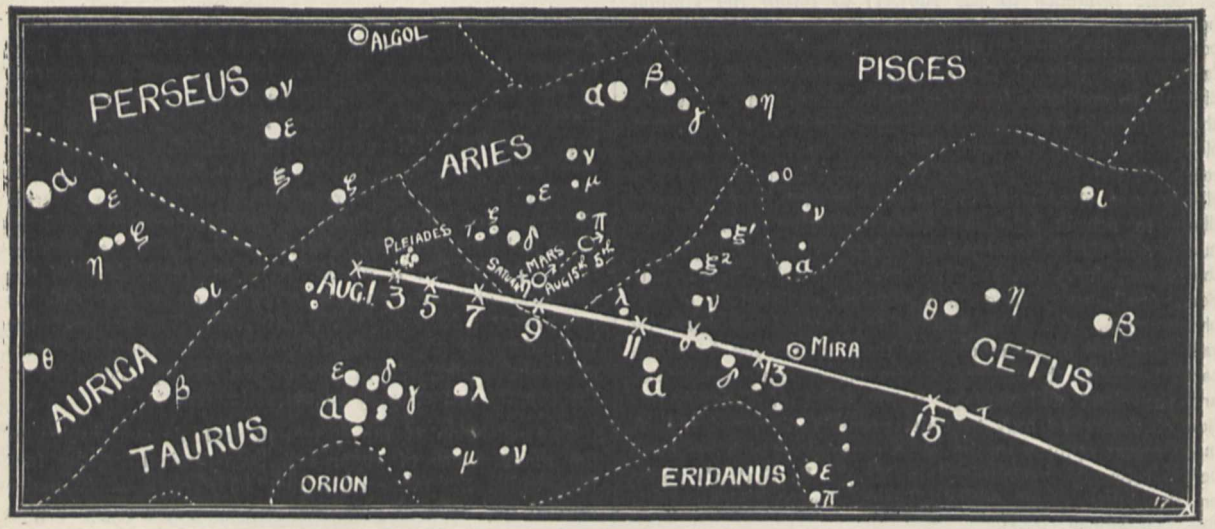
BROOKS'S COMET, 1911*c*.—Numerous observations recorded in No. 4515 of the *Astronomische Nachrichten* show that the magnitude of comet 1911*c*, during July 20–23, was about 10 or 11. Dr. Hartwig reports it, on July 22, as an irregular mass 2·5′ in diameter, with a faint 0·5′ condensation of the eleventh magnitude.

In the supplement Dr. Ebell gives provisional elements and a daily ephemeris extending to August 24. The elements give the time of perihelion as November 11, 1911, so that for some weeks we may expect the comet to brighten up, on account of both its decreasing distance and its increasing activity.

Ephemeris (12*h*. *M.T. Berlin*).

1911	α (true) h. m.	δ (true) ° ′	log r	log Δ	mag.
Aug. 4	21 56·4	+29 42·0	0·2760	0·0264	9·4
,, 8	21 48·8	+32 21·2	0·2632	0·0020	9·2
,, 12	21 39·7	+35 6·7	0·2500	9·9783	9·1
,, 16	21 28·7	+37 56·6	0·2363	9·9557	8·9
,, 20	21 15·6	+40 48 2	0·2221	9·9345	8·7
,, 24	21 0·2	+43 37·8	0·2074	9·9151	8·5

Not only is this comet becoming brighter, its position for observation in these latitudes is improving. Its apparent path is from Pegasus towards α Cygni, and the last position given here is very near ξ Cygni; thus for some time it will transit, with a small zenith distance, not far from midnight.



Apparent Path of Comet 1911*b*. August 1–17, 1911.

HORARY NUMBER OF METEORS VISIBLE.—Mr. Denning's publication, in No. 4515 of the *Astronomische Nachrichten*, of the horary number of meteors visible for every night in the year comes at an opportune moment, for the outstanding feature of his comprehensive table is the heavy preponderance of meteors per hour in late July and early August. The numbers are deduced from the Bristol observations made during 1866–1911, and give the horary number for one observer watching a clear, moonless sky uninterruptedly. From a glance at the table the average number per hour for the first six months of the year would not exceed six; but early in July an increase sets in, which culminates in sixty-nine per hour on August 10, and averages nearly twenty-four per hour for the whole month.

CHARTS FOR THE SOUTHERN HEAVENS.—Dr. Ristenpart announces in No. 4514 of the *Astronomische Nachrichten* the publication of charts of the southern heavens by the Santiago Observatory. Five series, including fifty charts, will cover the sky between the south pole and declination 19° S., and series 1 and 2 (30° to 67° south) are now ready.

THE CIRCUIT OF BRITAIN BY AËROPLANE.

THE most remarkable race the world has yet seen is over, and Naval-Lieutenant Conneau, flying a Blériot monoplane under the name of "Beaumont," has won the 10,000*l.* offered by *The Daily Mail* for the circuit of Britain—a total distance of 1010 miles in 22h. 28m. 18s. of actual flying time, or just under 45 miles an hour.[1]

The basic idea of the race was to test the trustworthiness of the competing aëroplanes. With this end in view, five parts of the machine and five parts of the engine were marked, viz. the wings, rudder, elevator and fuselage, two cylinders, and various portions of the crank-case.

Two of each of the five parts thus marked had to be in place throughout the race. The motor was marked with an electric needle, the fuselage with burnt-in letters, and the other parts with wired-on lead seals, their position being indicated with red paint on the fabric to assist the examiners at the various controls.

The course was divided into five sections, which were again divided, with the exception of the first and last, into controls, as follows:—*Section* 1.—Brooklands-Hendon (20 miles. *Section* 2.—Hendon-Harrogate (182 miles), Harrogate-Newcastle (68 miles), Newcastle-Edinburgh (93 miles). *Section* 3.—Edinburgh-Stirling (31 miles), Stirling-Glasgow (22 miles), Glasgow-Carlisle (86 miles), Carlisle-Manchester (103 miles), Manchester-Bristol (141 miles). *Section* 4.—Bristol-Exeter (65 miles), Exeter-Salisbury Plain (83 miles), Salisbury Plain-Brighton (76 miles). *Section* 5.—Brighton-Brooklands (40 miles).

Provision was thus made for the competitors to experience every kind of country, while the climate provided, as the event proved, every kind of weather. Twelve hours' resting time on the ground in a control had to be taken in Sections 2, 3, and 4, and no competitor was allowed to start in any of the Sections 3, 4, and 5 unless the full resting time had been taken in the previous section. This wise provision was made to ensure that the competitors had some rest and were not over-driven in the round. The times were taken from the start from one control to the arrival at the next, any stoppages in between counting as flying time, while any resting time taken in any section over and above the twelve hours specified was also counted as flying time.

On Saturday, July 22, the start was made at 4 p.m. from Brooklands. Of the original thirty entrants, twenty-eight were possible starters on the day; but only twenty actually went to the post, and only seventeen got away. Lieut. Porte (Déperdussin monoplane) and F. C. Jenkins (Blackburn monoplane) both fell just after starting, smashing their machines, fortunately without injury to themselves, while Gordon England (Bristol biplane) could not get sufficient altitude to leave the ground. The rest reached Hendon, Védrines making the fastest time, 19m. 48s., winning thereby the right to go first on Monday.

Monday was perhaps the most remarkable day of the race. At the earliest dawn the machines began to fly away to the north, and when night fell they were scattered all along the line from London to Edinburgh. Before noon Védrines and "Beaumont" both reached Edinburgh, where Valentine (Déperdussin monoplane) landed soon after four in the afternoon. Hamel (Blériot monoplane) arrived at Newcastle, Cody (Cody biplane) at Harrogate, and the rest lay between Harrogate and Hendon.

Tuesday night saw both the leaders at Bristol, Valentine at Glasgow, Hamel at Edinburgh, and Cody near Durham. On Wednesday, at a few minutes past two in the afternoon, the race was won, "Beaumont" beating Védrines on time by 1h. 9m. 47s. This result was chiefly due to the fact that the latter mistook the way at Bristol and alighted on the wrong ground, breaking a stay in doing so, and much precious time was lost before he was able to reach the actual aërodrome. Both arrived with all their marks intact.

There is nothing astonishing in the fact that they so far outdistanced the rest of the competitors. They are both acknowledged pilots of the very first rank, with great experience in cross-country flying, while their machines and motors were the pick of their types.

[1] Up to the time of going to press no official times have been issued.

"Beaumont's" Blériot monoplane was of the usual cross-country type, fitted with a 50 horse-power Gnome motor and a Normale propeller. Its total supporting area is 17·5 metres; span, 8·9 metres; length, 7·65 metres; and weight, 230 kilos.

Védrines's Morane-Borel monoplane is very similar to the Blériot, except in its landing chassis, the arrangement of the elevator, and the camber of its wings. In plain view also its wing tips are rounded from front to rear instead of from rear to front like the Blériot. It was fitted with a 50 horse-power Gnome motor and an Intégrale propeller. Its total supporting area is 17·5 metres; span, 9·3 metres; length, 6·7 metres; and weight, 200 kilos.

As aviators steer their way by map and compass, the winner naturally had, owing to his nautical training, a considerable advantage. The chief landmarks to the flyer are rivers and lakes, roads, railway lines, the contours of villages and towns, and the masses of deep colour afforded by woods. Good artificial guides are smoke columns in isolated positions, kites or balloons carrying flags, and white-washed sloping roofs of prominent buildings. A good map must be masterly in its omission of unnecessary detail, and must show distinctly the varying heights of the country and the landing places. One difficulty is the absence of trustworthy news, from the aviator's point of view, as to the weather 100 miles ahead. The opinion of the average man, who has no conception of what constitutes good flying weather, and is not equipped with any apparatus for sounding the air, is quite worthless. As flying becomes commoner we shall, no doubt, see a national system of meteorological stations linked up by telephone or wireless telegraphy. Charts of the atmosphere will be in common use so soon as regular services from point to point are established. Profs. A. L. Rotch and A. H. Palmer have foreseen this, and have just issued a pioneer work giving charts of the conditions prevalent at various times of the year in the vicinity of the Blue Hill Observatory, Mass., especially designed for the use of aëronauts and aviators.

Compasses for aëroplane work have only recently been made practicable. One of the most trustworthy is that invented by Mr. E. H. Clift, and it was largely used by competitors. The difficulty hitherto has been the iron and steel work, the framing, motor, wire stays, and so forth that are used on every aëroplane. A deflection, sometimes as great as 30°, is consequently set up, which has to be corrected by "swinging," that is to say, the head of the machine is moved to every point of the compass in turn, and the errors noted and brought to their lowest dimensions by means of magnets and soft iron balls and bars. Errors are then tabulated and reduced to a curve, which can be plotted to accord with the direction of flight. From this it can be seen that compasses are still far from perfect, and are thrown out by the movement of metal parts, their breakage, or removal.

In reviewing the race, one is inclined to regret that the biplanes showed up so badly. The cry has gone out that the biplane is dead. This, of course, is sheer nonsense. One of the finest machines built is the Curtiss biplane; the Wright biplane holds all the duration records in America; the Bréguet biplane holds the record for weight-carrying; the Cody biplane may not be very fast, but it is stable and trustworthy; the Bristol biplane went round the European Circuit in very creditable time; and the Roe biplane has shown what can be done in the way of speed. The monoplane for scouting, for racing, and perhaps for ease of transport, has proved itself superior, but the biplane has many points in its favour which cannot be disregarded. Another machine one would have wished to see do better was the Etrich monoplane, flown by Lieut. Bier with Lieut. Banfield as passenger, which, as the outcome of years of labour, is probably the most scientifically constructed monoplane, both from the aëronautical and engineering point of view, in existence. It broke down, like many others, from engine trouble.

People viewing the race from a distance, or by the more convenient method of newspapers, are inclined to entertain the idea that man can now get up and soar away to the ends of the earth on his lawful occasions with very little trouble, but they reckon without all the vital factors

that make for success. First and foremost is the mechanic. Oily and dirty, often starving, usually exhausted to the point of collapse from want of sleep, he follows where the machine leads him. No other but he can tend his own machine; he knows its ways, its moods, and its weaknesses. The touch of his deft fingers removes all cause of complaint and freshens up every flagging part. Then he stands back, watching the white wings sail up into the sky; and they are scarcely out of sight before he takes the road again in his car to follow, anxious, fretful, but enthusiastic, to where his master leads. This is a side of flying as heroic as that of the pilot and as necessary, but gaining no applause and no glory.

A big race is won by everything being of the best—picked pilot, picked machine, picked motor, picked mechanics, and perfect organisation. If one fails, all fail. And here, perhaps, our English temperament fails. Nothing in flying is "good enough," as we are inclined to think; *it must be the best.*

THE BIRMINGHAM MEETING OF THE BRITISH MEDICAL ASSOCIATION.

THE proceedings in the Section of Electro-therapeutics and Radiography of the meeting of the British Medical Association, held in Birmingham on July 25–28, were of scientific as distinguished from purely medical interest. A form of treatment is being introduced in which the ions composing the drugs are sent into the diseased part—skin, nerve, joint—by means of the electric current, that is, by kataphoresis. For instance, a preparation of salicylic acid is ionised by the current, and thus introduced into a nerve —facial or sciatic—in a case of neuralgia with a directness and intensity not attainable by the method of solution in the blood. The consensus of opinion at the discussion was that this, the latest, form of medication was exceedingly useful, not only in neuralgia, but in many joint affections. The speakers agreed that we had yet a great deal to learn, as, for instance, how deeply the ions can penetrate and how many milliamperes it is best to employ.

The utility of this method in cases where the drug which has to be used would disturb digestion, is very obvious, and it is also probable that the drugs introduced by the method of ionisation act more energetically than if they had reached the part through the blood and lymph.

Sir Oliver Lodge addressed the section on the theory of electrical conveyance through solids, liquids, and gases. In solids, he said, the travelling electrons, which were negative in charge, moved through the solid matter; in liquids the electrons, which seemed to be charged negatively and positively in about equal numbers, travel along with the more mobile matter, whereas in gases the current seemed to consist of positive electrons moving independently of the molecules of the gas.

If we rarefy a gas—remove a great many of its molecules or allow it to expand until it fills a much larger space —the electrons are accelerated, and this acceleration is accompanied by a fine shimmer of light, and in certain cases by sound—a cracking noise. The kathode rays are due to the rush of electrons suddenly stopped by a metal plate or target. Sir Oliver concluded by demonstrating his well-known electric valve, a device whereby he permits electrons only of one sign to accumulate, and rejects the others by a series of ingenious "traps." In this way he can, for instance, dose plants with electricity of one kind only, a treatment which has given the most encouraging results in the ripening of wheat, tomatoes, and other vegetables on quite a large scale.

The joint meeting of the Section of Therapeutics and Dietetics with that of Anatomy and Physiology was for the purpose of discussing the problems associated with the work of Prof. Chittenden, of the department of physiological chemistry at the University of Yale, U.S.A. Prof. Chittenden holds, as the result of observations on a large number of persons selected at random, that the usually accepted quantity of protein food for the adult, 118 grams in the twenty-four hours, is excessive. One series of experiments extended over 130 days, so that the charge of insufficient data cannot be brought against the Yale researches. Prof. Chittenden gives about 70 grams, or less than half the German standard, as sufficient; and his contention is that, because the majority of mankind take much larger quantities of protein food, we have no right to assume that this has a scientific basis. He believes the time has come for dietetics, as for all else, to be studied by the methods applicable to other scientific problems.

It is admitted by the Yale school that the amount of nitrogen in food is no measure of our energy requirements, and that, provided we obtain from fats and carbohydrates the amount of potential energy necessary for the daily kinetic output, then the minimum of protein constitutes what we might also call the optimum. Chittenden's work is so well known in this country through his book "Economy in Nutrition" that it need only be said that, as regards analysis of the food and excreta, it is as careful and complete as could be desired. Although it may be proved that the subjects of his experiments were perfectly vigorous on their restricted diet, one failed to learn from Prof. Chittenden what were the bad results of taking more protein than the 70 grams. He said it "stimulated metabolism generally"; but, as one speaker pointed out, this is not in itself a bad thing, as the more active tissue-change is, within limits, the better is the physical and mental health of the individual.

Some speakers who followed in the discussion held that the usual quantity of protein ingested did no harm whatever, while others asserted that protein in excess of Voit's quantity of 118 grams gave rise to excessive intestinal putrefaction and toxæmia, with raised blood-pressure and gouty arterio-sclerosis.

The diets of poor Orientals are not to be quoted as exemplifying the benefits of a low protein intake, since they are indigestible and dietetically insufficient in many ways. The low stamina and frequent anæmia of these races is due to the deficiency in absorbable nitrogen, and an improvement is noticeable so soon as these people are able to afford the more generous *régime* of the European.

According to Dr. Provan Cathcart, the quality, and not the quantity, of the protein is the important matter physiologically, for the nearer the composition as regards the constituent amino-acids approaches that of the tissue-protein of the animal being fed, the less will there be of nitrogenous waste from that animal. Thus dogs wasted less nitrogen when fed on dog-flesh than on any other kind of protein.

In a paper by Dr. Fraser Harris on some physiological aspects of mine rescue apparatus, there were several points of scientific as distinguished from medical interest. For the last two years a committee of the South Midlands Coal Owners' Association has been investigating the various types of self-contained breathing apparatus for saving life in mines after explosions and underground fires. All the following types of apparatus were examined:—Aerolith, Draeger, Fleuss, Meco, Weg, Hall-Rees, and bellows and helmet. Each has its characteristic feature: in the Aerolith liquid air evaporates; the Draeger, Meco, and Weg supply pure oxygen, compressed under 120 atmospheres, at the rate of 2 litres a minute; in the Fleuss one breathes into a large bag in which sodium hydrate in sticks absorbs the carbonic acid gas. The Hall-Rees is used chiefly for submarine work, and in it oxygen is liberated from sodium-potassium peroxide, in which the carbonic acid gas is simultaneously absorbed.

A point for which the committee was not prepared was that the helmet is far from an ideal mechanism. To a person who has never worn a helmet or done hard work in a metal case, which entirely covers the head and face, the helmet seems the very thing required; but he soon finds that the face becomes excessively hot from the absence of ventilation, and the glass window becomes dimmed from the non-evaporated moisture, and, most serious of all, one's range of vision above and to the sides is very limited. This limitation of vision is particularly serious when one is crawling on hands and knees, which in mines it is often necessary to do. The enclosing of the whole head in a helmet diminishes one's power of hearing, a matter of some consequence, since the possible warning of falls from the roof cannot be heard. The committee favoured half-masks and nose-clips, with motor goggles rather than helmets. In order to make the helmets smoke-tight round the face, an indiarubber tyre has to be inflated, and in the

cases where this does not fit the wearer a good deal of pain is experienced from the pressure.

Physiological observations on men wearing different forms of apparatus were carried out during this investigation, as it was clearly important to discover whether the wearing of the apparatus and the doing of hard work in them for upwards of two hours at a time was or was not injurious to the volunteers. The investigations were conducted in the experimental mine attached to the mining department of the University of Birmingham. This represents on a reduced scale all the typical workings found in a mine, and it is so constructed that it can be filled with smoke and its atmosphere made irrespirable, or can have steam driven into it so as to saturate the air, but leave it respirable.

The men, then, worked in three sorts of atmospheres :—

(1) With air at the ordinary temperature.

(2) Hot, moist, and irrespirable atmospheres, in which the wet bulb was about 80° F.

(3) Hot, moist, but respirable atmospheres with the wet bulb about 90° F.

The men varied in age from twenty-five to fifty, in height from 5 feet 7 inches to 6 feet 6 inches, and in weight from about 55 to 89 kilos. The men were weighed naked before and after a test, and the gross loss of weight so ascertained. The losses in weight varied from such figures as 226 grams to 1700 grams in two hours; they bore no definite relationship to the body-weight in any given case.

The loss of carbonic acid gas was ascertained by weighing the regenerators, or absorbents, before and after the experiment, the increase in weight giving the moist carbonic gas absorbed. Such figures as 52·7 grams of CO_2 in 30 minutes and 180·5 grams in 130 minutes were obtained. The CO_2 excreted depends on such a large number of conditions—mass of body, temperature, temperament, amount of work to be done, nature of food, light or dark surroundings, &c.—that it is best to express it per kilo. of body-weight per hour, and when this is done it is seen that the weight of moist CO_2 excreted is represented by a figure not greater than 2, and rarely so low as 0·5 gram. In other words, the amount of carbonic acid gas eliminated in unit time per unit of tissue is very much the same for all the men (12) subjected to the same external condition. There was a remarkable uniformity in the average weights of the gas excreted in all the four types of apparatus worn in rotation by all the experimenters, thus :—in the Fleuss, 1·25; Meco, 1·28; Weg, 0·86; Draeger, 1·14.

The observations on the pulse did not elicit anything very interesting, for, as was to be expected, the heart-beat was markedly accelerated. The minimum number of beats added per minute was 16, the highest 58, but it was satisfactory to know that in all cases the heart had returned to its normal within fifteen to twenty minutes after the test was stopped.

As regards the respiration, nothing more than a physiological hyperpnœa was observed in any case; true dyspnœa was never seen, even at the end of two hours' hard working. No bad effects of the inhalation of pure oxygen as observed by some physiologists in the case of the lower animals were noticed. The very absence of dyspnœa under conditions of oxygen deficiency may become a danger. It is usual for men to suffer from violent and embarrassed breathing when their supply of oxygen begins to run out, but a small proportion, about 10 per cent., appear to be seized with cardiac syncope instead of dyspnœa. The importance of this is that, suppose such a man is the last of a team, then, if his oxygen runs short, he simply falls down unconscious without giving any warning to his companions. He may be left behind in the smoke, as he is unable to call out to them that anything is wrong. The members of the committee, in view of an accident of this kind, point out the danger of allowing only two men to form a rescue-team and enter an irrespirable zone. The committtee was greatly struck with the enervating effects of moist heat on the workers. The report contains the following sentence :—"We were impressed by the rapid onset of fatigue, particularly mental, in very hot and moist atmospheres (group 3). When the wet bulb is higher than 85° F. or so, a man, especially if he has hard work to do, is overcome by irresistible lassitude. He becomes irritable, as well as indisposed to mental exertion. We think this partial mental enfeeblement a fact of some consequence, inasmuch as a person fatigued by hard work in a rescue apparatus in a hot and moist atmosphere might, in some situation requiring promptness of decision, coolness of judgment, the accurate recollecting of instructions, plans, &c., not prove himself equal to the emergency.

The heat developed in the regenerators was such that the men had the skin of the back burnt on more than one occasion. Temperatures of more than 200° F. were registered in the regenerators, and 135° F. was attained by the outside of the bag of the Fleuss. Undoubtedly one of the sources of this heat is that from the chemical combination ($2NaOH+CO_2=Na_2CO_3+H_2O$) which is slowly dissipated in the hot atmosphere. The last point of interest is that the temperature of the circulating oxygen in hot atmospheres became so high as to burn the throat. Now this temperature was rarely higher than 100° F., and yet it produced great discomfort, while we know that the air in a Turkish bath can be breathed without discomfort even when the temperature is as high as 200° F. The difference is that in the rescue apparatus it becomes saturated, whereas in the Turkish bath it is kept as dry as possible. The dry, although hot, air allows the water to evaporate from the mucous membrane, and so carry off heat in a latent state; but the saturated air circulating in the apparatus permits of no evaporation, and consequently of no corresponding loss of heat.

At an honorary degree celebration of the University of Birmingham on Thursday, July 27, a number of distinguished persons received honorary degrees in connection with the visit of the British Medical Association, and the following speeches were made by the principal (Sir Oliver Lodge) in presenting them to the Vice-Chancellor :—

The president of the Royal College of Physicians of Edinburgh, physician to the Royal Edinburgh Infirmary, lecturer on medicine in the Extra Academical School of Medicine, and reader of the address in medicine at the present meeting of the British Medical Association, Dr. Bramwell is the author of many splendid works on medical subjects, in particular of a monumental atlas of clinical medicine, which have made his name known all over the world and will perpetuate his memory. An indefatigable worker, a brilliant clinical teacher, and one of the best known and esteemed physicians in the British Islands, I present for the honorary degree of Doctor of Laws

BYROM BRAMWELL.

The city of Birmingham has for many years believed strongly in local self-government and strenuous civic administration. Recently it has assumed enlarged responsibility, and in this expansion it gratefully acknowledges the assistance and high encouragement it has received from the President of the Local Government Board a man who, during his term of office, has consistently shown active and practical and powerful sympathy with the struggling period of more than one expanding or federating municipal enterprise; while the future housing of many a community will benefit by his energetic insistence on foresight in planning and thoroughness in drains.

We of this University, closely connected as we are with the city, wish to join in expressing to him our cordial good feeling and gratitude.

Fortunately the present occasion gives to this feeling an opportunity of expression quite apart from any kind of political or social controversy. For the medical faculty represented to the Senate that in his capacity as head of the department which is concerned with the sanitary administration of this country, the Member for Battersea has constantly cooperated with the medical profession in their efforts to improve public health and has given his powerful assistance to those municipalities which are trying to ameliorate the sanitary conditions of the areas under their control. A man of exceptional vigour and of health, both in mind and body, which he devotes without stint to the service of the community, I present to you for the honorary degree of Doctor of Laws

THE RIGHT HON. JOHN BURNS.

The presence of Dr. Chittenden in our midst enables us to offer a welcome to a representative of our great kindred across the seas, with whom we are on terms of the most affectionate alliance—strengthened as it is, or as we trust it soon will be, by a permanent treaty of arbitration dealing with any and every difficulty such as may sometimes arise even between close friends.

Dr. Chittenden is professor of physiological chemistry at Yale, and director of the Sheffield Scientific School of Yale University, where his researches have led him to advocate a much less plentiful diet than is usually found to give satisfaction. He was for ten years president of the American Physiological Society. He is already Doctor of Philosophy and Doctor of Science, and is well known as the author of important works on the physiology of nutrition, which have been based on researches to which he has devoted the labour of many years. He has come to Birmingham by invitation to open a discussion in the Section of Therapeutics, which has attracted much interest.

Prof. Chittenden is welcome as a distinguished representative of American university teachers, and we are honoured by enrolling his name on the list of our honorary graduates. I present to you for the degree of Doctor of Laws

RUSSELL HENRY CHITTENDEN.

Among all the movements of our time fraught with benefit for the human race, surely the conquest of the broad belt of the earth from the diseases which ran riot there, and the fitting for white habitation of those sun-favoured regions, is among the most promising.

We do not forget that our Chancellor has exerted himself to promote the activity of officers of the Crown in this direction, and to-day we have the pleasure of welcoming one of the enthusiastic pioneers in this endeavour.

Sir Francis Lovell, Baronet, C.M.G., Fellow of the Royal College of Surgeons, has held high office in our colonies, especially in the West Indies, and has been entrusted with various missions on sanitary questions for the Colonial Office. He served his country first in the then deadly district of Sierra Leone, and subsequently was for many years chief medical officer and president of the General Board of Health and member of the Council of the Government, first of Mauritius, and then of Trinidad and Tobago. His active services abroad lasted from the early 'seventies into the present century, and now continue during his holidays, for he devotes his well-earned leisure to the promotion of the study of those diseases which render tropical climates fatal to Europeans and cause a high rate of mortality among the native populations.

As dean of the London School of Tropical Medicine, and as president of the Section of Tropical Diseases at this meeting of the British Medical Association, I have special pleasure in presenting

FRANCIS HENRY LOVELL.

James Alexander Macdonald is Doctor of Medicine of the Royal University of Ireland and physician to the Taunton and Somerset Hospital. He is the chairman of council of the British Medical Association, and was for three years chairman of the representative meeting of that body. He is also a member of the General Medical Council, in which he sits as a direct representative of the medical profession. His work in the association, and the important offices he has so ably filled, mark him out for the distinction which the University desires to confer upon him. For the honorary degree of Doctor of Laws I present to you

JAMES ALEXANDER MACDONALD.

The University rejoices at the opportunity of welcoming on this occasion many representatives of foreign nations, with all of which we cordially desire to be, not only at peace, but to be linked by ties of friendship and mutual effort—all harmoniously working together for the increase of civilisation and the welfare of the human race. Two of these representatives I shall have the honour of presenting on this occasion. Dr. Oppenheim, Doctor of Medicine and titular professor of the University of Berlin, is a neurologist of great distinction and the author of many important books on his subject. He has opened a discussion in the Section of Neurology at this meeting. His reputation extends all over the world and is of the highest kind. He is the author of a text-book which has been translated into many languages and is accepted as a standard work. His standing and repute as a scientific physician are such that no honour we can confer can enhance his dignity. I present for our honorary degree

HERMANN OPPENHEIM.

Of the self-governing Dominions of the Crown we welcome a representative in Dr. R. A. Reeve, Bachelor of Arts, Doctor of Medicine, who is professor of ophthalmology in the University of Toronto, and was for many years dean of the faculty of medicine there. He enjoys a wide reputation in Canada as a specialist in diseases of the eye, and the position he occupies is sufficiently attested by his having been elected president when the association met in Toronto in 1906. As a distinguished representative of the Dominion of Canada, the University is proud to add his name to its roll of graduates. I present to you

RICHARD ANDREWS REEVE.

In the person of the eminent surgeon Dr. Strassmann we recognise another representative of a great and friendly nation, and to him the introductory remarks prefixed at the presentation of our honorary graduate Dr. Oppenheim equally apply.

Dr. Strassmann is titular professor and assistant to the chair of obstetrics and gynæcology in the University of Berlin, the author of many monographs on various subjects in his department, and an accomplished operating surgeon. He is visiting Birmingham by invitation to take part in the proceedings of the Section of Obstetrics and Gynæcology, in which he has this morning opened a discussion. The University welcomes him as a shining example of sterling ability in his branch of practice, and empowers me to present for the honorary degree of Doctor of Laws

PAUL STRASSMANN.

The professor of pathology in the University of Cambridge is a friend of many of us, and a man regarded with affection wherever he is known, whether in Edinburgh, in Cambridge, or in Birmingham; for Sims Woodhead is no stranger to this University, which he has indeed served in the capacity of an external examiner. He is an M.D. of Edinburgh, the editor of *The Journal of Pathology*, the author of a manual of practical pathology, and for some years was superintendent of a research laboratory in Edinburgh University. Moreover, he is a member of the Royal Commission on Tuberculosis, and has carried out an enormous amount of experimental research in connection with that subject. Little of this work is known to the public, and the University is glad to recognise it by enrolling among its honorary graduates the name of

GERMAN SIMS WOODHEAD.

SCIENTIFIC ASPECTS OF THE UNIVERSAL RACES CONGRESS.

IT appears that the idea of a Universal Races Congress first originated with Prof. Felix Adler, of New York, but its realisation is due to the untiring energy and enthusiasm of Mr. Gustav Spiller. The avowed object of the congress was "to discuss, in the light of science and the modern conscience, the general relations subsisting between the peoples of the West and those of the East, between so-called white and so-called coloured peoples, with the view of encouraging between them a fuller understanding, the most friendly feelings, and a heartier cooperation." Invitations to attend the congress were scattered profusely, and delegates were appointed by a very large number of Governments and institutions, and there was an attendance of more than two thousand members. Rarely, if ever, have so many different nationalities and varieties of mankind been gathered under one roof. From this point of view the congress was an undoubted success; the bringing together of this heterogeneous assembly was no small task, and it cannot be doubted that the spirit of friendliness that permeated the congress, and the introduction to one another

of varied peoples with similar or analogous aims, were all to the good, and will have permanent beneficial results.

The main work of the congress consisted of speeches and resolutions, as well as of the papers which were published before the meeting in a volume of nearly five hundred pages entitled "Inter-racial Problems" (P. S. King and Co.). These were taken as read, but many of the writers had a further opportunity of stating their views. The official meetings of the congress were held on July 26–29 in the large hall of the University of London, a room which, unfortunately, has bad acoustic properties. As a very large number of persons were invited or volunteered to speak, the time given to each was necessarily limited, and in consequence most of them spoke very rapidly, and often not distinctly; various languages were employed, and the oppressively sultry weather made it difficult to concentrate attention. The conditions were not favourable to a real discussion, and the proceedings were necessarily more of the nature of orations, sometimes perfervid, on a multiplicity of topics. On the previous Tuesday, however, an attempt was made to organise discussions on "The effects of miscegenation on intelligence and character," and "The influence of environment in forming and changing racial characteristics." These two problems and "the general problems of the conditions of progress" were also discussed on the Wednesday morning.

Prof. F. von Luschan in his printed paper states that "As long as man is not born with wings, like the angels, he will remain subject to the eternal laws of Nature, and therefore he will always have to struggle for life and existence. . . . Nations will come and go, but racial and national antagonism will remain; and this is well, for mankind would become like a herd of sheep if we were to lose our national ambition and cease to look with pride and delight, not only on our industries and science, but also on our splendid soldiers and our glorious ironclads." In his speech he humorously admitted that he was swimming against the stream of the congress, which was certainly the case. Dr. Haddon maintained that Dr. von Luschan had only partially stated the case; he assumed that it was largely on account of his weakness and social habits that man diverged from the other anthropoids; the least advanced peoples are, if anything, over-socialised, and all through human history progress depends upon the balance between individualism and collectivism, between self-help and mutual aid. Mr. John Gray, in opposition to the sentiments of many present, frankly stated that all men were not equal and never would be, nor was it desirable that they should be; but, on the other hand, equal opportunities should be given to all, so that the more capable should not be stifled. Drs. von Luschan and Haddon agreed that there were practically no pure races still existing, and that a discussion of races was not suitable for a congress such as this, as it was mainly of academic interest; the former went so far as to state that the old Indo-European, the African, and the east Asiatic all branched off from the same primitive stock, perhaps hundreds of thousands of years ago, "but all three forming a complete unity, intermarrying in all directions without the slighest decrease of fertility." This does not, however, mean, as some would have liked to believe, that there is no racial difference between men.

Prof. Lyde printed an informing paper on the climatic control of skin-colour. Most anthropologists admit this control, which, however, has not yet been sufficiently studied, nor are the very numerous exceptions yet accounted for. Colour has long been recognised as but a very secondary factor in race discrimination, and it was distinctly pointed out that the question of race was a purely zoological problem, and must be solved by zoological methods. Nearly every speaker confounded peoples with races, but perhaps this is inevitable among those who have not had a biological training; this confusion of terms is manifest in the first printed paper on the meaning of race, tribe, nation, by Dr. Brajendranath Seal, who speaks of a "national race" of complex elements. He also says "We may arrange the types of physical race . . . (1) . . . by a modified genealogical tree (with devices for intercrossing and retrogression), or by symbols and formulæ analogous to those of organic chemistry (as in arranging isomers, polymers, &c.) . . . (2) . . . in space (or more simply on a plane surface) the distance along different directions marking the degree of affinity as estimated by three (or two) groups of correlated characters. . . . A third way would be to conceive an ideal type as the goal towards which the normal development of the organism is tending, and to place the actual types round this as a centre, at distances corresponding, more or less, to their approximation to the ideal." Anyone who has tried to make an arrangement of human types on a plane surface will appreciate how impossible it is to do so in anything like a satisfactory manner; but who is to decide what is "the ideal type" (or does he mean "ideal types"?) "to which the normal development of the organism is tending"? He adds:—"Though the third method is not quite feasible, an occasional application of this test of normal or standard development is a useful corrective."

It is scarcely to be expected that this suggestion, if it were carried out, would lead to much precision, as we cannot be sure of what we are going to develop into. A classification of existing types must necessarily be static, a phylogeny (assuming that the requisite data are available) is dynamic, an ideal type is mainly a matter of sentiment, a goal is prophecy which belongs more to the domain of philosophy than to that of science. Later he says "No view of civilisation is sound or adequate which considers Race and Racial types statically, and not dynamically as growing, developing progressive entities"; however this may be, ethnologists will not entirely agree with Principal Seal when he says "There are other phenomena which are abnormal, pathological, implying degenerative transformation of structure or function. Cannibalism, promiscuity, Morgan's consanguineous marriage, group marriage, infanticide, black magic, &c., are of this class. In the first place they are far outside the line from the ape to the civilised man . . . and secondly, natural selection would ruthlessly weed out stocks in which such impulses would be normal. It follows, therefore, that, when such phenomena appear, as they undoubtedly do, among savages or primitive folk, they are not part and parcel of their normal physico-psycho-social type, but are phenomena of degeneration or retrogression in those peoples."

There are one or two other papers dealing with anthropological subjects, among which may be noted a valuable essay by Dr. C. S. Myers on the permanence of racial mental differences. Prof. Earl Finch writes on the effects of racial miscegenation, and he presents "some facts tending to prove that race blending, especially in the rare instances when it occurs under favourable circumstances, produces a type superior in fertility, vitality, and cultural worth to one or both of the parent stocks." This view was maintained, on the whole, in the preliminary discussion on the Tuesday, the manifest exceptions to the statement being explicable mainly by the unsatisfactory social conditions of half-breeds—in other words, the problems of miscegenation are sociological rather than physiological. In a paper on the instability of human types Prof. Franz Boas summarises his observations on European immigrants into New York, to which the attention of readers of NATURE has already been directed. He makes the very remarkable statement that "the child born in America, even if born only a few months after the arrival of the parents, has the head-form of the American born." The investigations of Prof. Boas were referred to by others as demonstrating the uncertain character of physical traits in racial problems and the rapid effect of the environment; a tendency, however, is observable for others to go beyond the conclusions arrived at by Prof. Boas. It was pointed out that so far Prof. Boas has not given us his methods, nor has he stated what precautions he has taken to control the personal equation of his numerous assistants; a further possibility of error lies in the working up of the statistics. Doubtless this information will be given in his final report.

The ethnologist will find various interesting facts and conclusions in some of the other papers, more especially those dealing with the negro in Africa and America. A lantern demonstration on the methods of racial discrimination and classification was given by Dr. Haddon on Thursday evening. There was also organised in connection with the congress an exhibition of nearly two thousand photographs, &c., representing a large number of peoples, and including a series of coloured drawings of types painted

expressly for the occasion by Mr. Norman H. Hardy. A large number of books and pamphlets dealing with ethnological subjects were also on view. The exhibition of illustrations and literature was a great attraction, and was of great educational value. Considering the very few people connected with the congress who knew or cared about scientific matters or methods, the scientific results may be considered as fairly satisfactory.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE summer meeting of the Institution of Mechanical Engineers was held at Zurich and northern Switzerland, commencing on Monday, July 24. In addition to the meetings for the reading and discussion of papers, an extensive programme of visits to works and hydro-electric power stations had been arranged, and formed an important part of the meetings. The works visited included those of Brown Boveri, Esher Wyss and Co., Oerlikon Machine Works, Sulzer Brothers, and the Swiss Locomotive and Machine Works. The power stations at Rheinfelden, Laufenburg, Wangen, Schaffhausen, Beznau, and Löntsch were also included. The institution dinner was held on July 25. Brief notices of the papers read are given below, and a fuller abstract of a paper on high-pressure water-power works will appear in a later issue.

A paper on electric traction in Switzerland was presented by Mr. E. Huber-Stockar, of Zurich. It may be found astonishing that progress in electric traction has not been greater in Switzerland when one considers that it is necessary to buy all the coal supply from foreign countries, and that a large amount of water-power is still undeveloped. Further, Switzerland has had certain railways electrified at a comparatively early date, and might have been expected to go onward on this basis, especially as applied electricity is highly developed in the country generally. Economy of operation is having a decisive weight, and makes the problem, as it is presented, difficult. The railways already electrified, or about to be electrified in the near future, are such that the smoke nuisance would be an almost prohibitive feature with steam traction, as in the case of the Simplon tunnel, or where the capabilities of steam are near exhaustion, as in the case of the St. Gothard Railway. There are two gauges in use, 1·435-metre "normal" and 1-metre "narrow." There has been but slow progress in normal-gauge railways since 1883, and rapid progress in narrow-gauge railways since 1887.

The author describes very fully several typical Swiss railways and the methods of operation. Reference is made to the valuable scientific work which has been carried out by the Schweizerische Studiencommission für electrischen Bahnbetrieb. This society has investigated such problems as the elucidation of the question of general railway electrification under Swiss conditions. The merits of the several systems, the cost of plant and of operation, and the comparison of steam and electricity for definite lines or groups of lines. The electrification of the St. Gothard Railway, to be carried out in the near future, has been well prepared by the work of this society.

Railway electrification is making noteworthy rather than rapid progress in Switzerland. As regards system, single-phase current of low periodicity (15) and high contact-line voltage, varying from 5000 to 15,000, according to circumstances, is being sanctioned by experience and by authority. All electrification in Switzerland is directly connected with the utilisation of water-power. The heavy variations of load and the rapid seasonal variations in the fresh-water supply make water storage desirable, and even imperative.

A short survey of the practical development of the Diesel oil engine up to the present day was given by Mr. F. Schubeler, of London. It will be remembered that the characteristics of the Diesel principle are compression in the working cylinder up to the ignition temperature of the fuel (about 500 lb. per square inch and about 1000° F.) and the use of an independent multiple-stage air-pump for raising the pressure of the injection air to 600 or 850 lb. per square inch; the injection air is used for the introduction of atomised air into the cylinder. The extreme high pressures and temperatures of the Diesel process put a limit to the dimensions of the cylinders, which will scarcely exceed 30 inches in diameter. Assuming 150 revs. per min. and the ordinary Otto cycle, this corresponds to an approximate cylinder output of 300 to 400 horse-power. It is not desirable to have more than six cranks; hence, in dealing with large powers, it becomes necessary to seek means of increasing the specific cylinder output. For this there are three possibilities:—(1) by carrying out the single-acting Otto cycle machine as a double-acting one; (2) by adopting the single-acting two-stroke cycle process; (3) by adopting the double-acting two-stroke cycle process. The first method approximately doubles the cylinder output; the second produces the same result, but necessitates the provision of special scavenging pumps; the third theoretically quadruplicates the cylinder output, but in practice about 3·4 may be secured.

For small and medium size units the single-acting Otto cycle takes the preference. Such machines have worked for periods of six to eight weeks without interruption, even in cement factories and mills. The two-stroke cycle shows a somewhat higher consumption of fuel, amounting at least to the percentage of the energy absorbed by the air-pump; it has, however, a more favourable turning moment, and guarantees better starting and better conditions for regulation, which is specially important for direct coupling with alternators. The space required is smaller, and the engine is lighter and cheaper. There are many difficulties involved in the problem of the double-acting Diesel engine, and the author deprecates the proceeding at once to the double-acting two-stroke cycle without first gaining experience with the single-acting engine. Some firms have already claimed to be able to carry out a double-acting two-stroke marine engine. The results obtained with such engines are unknown to the author, and he feels somewhat doubtful whether success has already attended such efforts. Attempts have been made to build Diesel locomotives. The adoption of the Diesel engine for motor-cars and aëroplanes does not seem to be very promising.

Dr. Alfred Amsler, of Schaffhausen, described two new types of transmission dynamometers. The first of these is of the torsion type, and is intended for measuring the power transmitted to or from high-speed machines. The dynamometer couples the shaft of the driving engine direct to the driven machine, and consists essentially of a shaft the angle of twist of which gives a measure of the torque. To measure the angle of twist three discs are used, one fixed to one end of the shaft and the other two fixed to the other end. A transparent celluloid rim is attached to the first disc, and has divisions cut on it; each of the other two discs has a radial slit. The scale divisions are strongly illuminated, and may be clearly read through the slits when the shaft is running. An impression is given to the eye every revolution, and at high speeds these impressions become a continuous stationary image.

The other type of dynamometer is intended for use with slow-running machines of variable resistance. Two pulleys are placed close together on a common shaft, one being fixed to the shaft and the other pulley runs loose. The pulleys are connected by means of two cylinders fitted with pistons and charged with oil. The drive from the source of power is communicated to one pulley by belt, and the machine under test is driven by belt from the other pulley. In operation, the oil in the cylinders is put under pressure corresponding to the torque being transmitted. The shaft is hollow, and serves to make communication between the cylinders and a pressure gauge, the readings of which give a measure of the torque.

A paper on rack-railway locomotives of the Swiss mountain railways was read by Mr. T. Weber and Mr. S. Abt, of Winterthur. Switzerland has a total of 120 steam locomotives, as well as 45 electric locomotives and motor coaches arranged for working with rack gear. The total length of the rack railways is 87 miles. The whole of the systems of racks which are in use have been designed in Switzerland. The Abt system has been most adopted, and consists of flat-toothed plates, of which two or three, according to the tractive power, are bolted together on chairs in such a way that the tooth of one plate in regard

to the other is displaced one-half or one-third of the pitch. The pitch is 4·7 inches, and the rack ensures a quiet motion and permits the trains to work at high speed.

A paper descriptive of the Zoelly steam turbine was presented by Mr. H. Zoelly, of Zurich. This turbine is of the impulse type, and as made at the present time has eight stages for turbines running at 3000, twelve stages for 1500, and sixteen stages for 1000 revolutions per minute. The first diaphragm plate of the high-speed turbines has nozzles which extend for a portion of the circumference only in the bottom half of the diaphragms, whilst in the other diaphragms the nozzles usually extend completely round the circumference. In the case of large units, steam is admitted through channels extending completely round the circumference for all stages. Governing is effected by throttling the live steam. The efficiency of this type of turbine will be evidenced by the following results for a 4000-kw. turbine:—steam consumption per horse-power-hour at full load, 9·36 lb.; at about three-quarter load, 9·58 lb.; at almost half load, 9·84 lb.; at about one quarter load, 10·12 lb. A set of two marine Zoelly turbines, each of 7500 horse-power, has been installed recently in the torpedo-boat destroyer G. 173 of the Imperial German Navy.

Prof. Franz Prášil, of Zurich, communicated the results of some of his tests on Francis turbines and on Pelton turbines. It is of interest to note that both types have developed in the direction of increase of horse-power per unit since 1900, and have now reached as high as 16,000 horse-power per wheel. The Francis turbine is applied with success to falls of 3·3 to 492 feet, the Pelton wheel to falls of 131 to 3116 feet. There has been steady improvement in the construction of the turbines, in the efficiency of the automatic governing, and in the safety mechanism.

In the case of four Francis turbines in open-wheel pits and working under heads of 4·4 to 10·4 metres, the efficiency was found to be more than 85 per cent. at about 80 per cent. of full load. Five Francis turbines in spiral wheel cases gave results showing that efficiencies of 85 per cent. and more are attainable in this style of turbine. The heads in the latter case ranged from 42 to 147 metres.

Four Pelton wheels were tested under falls ranging from 90 to 850 metres. At about 55 per cent. of full load all four turbines showed efficiencies lying between 84 and 85 per cent. The most favourable efficiencies varied between 84 and 89 per cent. The efficiency was lower than 80 per cent. only under loads which were 25 to 30 per cent. of the full load.

In regard to efficiency, there is not to be expected much further advance in the future. The problem of governing can still be considered as not yet completely solved, since there still appears in view a series of applications which will influence the further development of this problem.

THE BELFAST HEALTH CONGRESS.

THE annual congress of the Royal Sanitary Institute, which was held at Belfast on July 22–29, proved a great success; and if the papers dealing with the scientific research side were few, those dealing with the administrative side of preventive medicine amply made up for this deficiency. It is only possible in this short article to indicate those contributions which were of special interest and importance.

In a paper upon the non-nitrification of sewage in sea-water, Messrs. Purvis, McHattie, and Fisher recorded the results of many experiments, which demonstrated:—"That even after seventy days' incubation of 10 per cent. sewage in sea-water, with every facility for complete aeration, there was no production of nitrates or nitrites, and that the free-ammonia figure was increased in the sewage and sea-water at the end of forty-two days. The most obvious explanation of these facts is to assume that the sea-water destroys the useful nitrifying organisms. With regard to the continuous presence of free-ammonia, even after fifty-two days' incubation, it is of interest to note that it supports the suggestion of Kenwood and Kay-Menzies as affording a valuable clue to the contamination of sea-water by sewage."

Drs. T. Houston and T. Rankin contributed an important paper upon the diagnostic value of blood reactions in epidemic cerebro-spinal fever and allied conditions, and they maintain that their observations show that the cerebro-spinal cavity is the proper place to attack the causal organism—the Meningococcus—by means of an anti-serum.

Dr. Williams, the medical officer of health of the Port of London, contributed a paper on plague precautions in reference to the destruction of rats. After discussing the various means of destroying rats aboard of ships, and testifying to the unsatisfactory results obtained from pathogenic bacterial methods, he records the results of experiments on the lethal qualities of air containing 3 per cent. sulphur dioxide gas. These experiments indicate that rats and beetles are killed within from two to three hours of exposure to such air.

In a paper on the viability of *B. typhosus* in water and its isolation therefrom, Drs. J. Wilson and C. Dickson conclude that uncultivated *B. typhosi* (viz. those actually present in the urine and fæces of "carriers") may be recovered from water after a period of three weeks and two days, when conditions closely resembling those found in nature are imposed. "Dr. Houston was unable to recover uncultivated typhoid bacilli from water at a later period than one week from the time of addition, and states that 'less than a month's storage of a raw river water is apparently absolute protection against typhoid fever.' Our experiment shows that Dr. Houston's statement should be accepted with reserve."

Dr. King-Kerr, in an interesting and suggestive paper on the prevention of typhoid fever, dealt with the experience of Belfast. As recently as ten years ago the death-rate from typhoid fever in Belfast was a very high one (1·04 per 1000 in 1901), whereas for the past three years the rate has been only 0·05. Dr. King-Kerr explains that several factors were found to have exercised a powerful influence in this reduction, and that their coming into operation was followed by a marked, definite, and even immediate fall in the death-rate. These factors were the substitution of water-closets for privies, the stoppage of the sale of cockles, the establishment of an additional fever hospital, the sterilisation of the infected hospital sewage, and the more complete isolation of typhoid patients. The decline in the typhoid, zymotic, and general death-rates coincides with these operations.

In a paper on municipal hospitals, Dr. P. Boobbyer directed attention to experiments extending over fifteen years, which had been carried out at Nottingham, to test the value of the open-air treatment for all classes of acute specific diseases, including small-pox, scarlet fever, diphtheria, measles, whooping-cough, pneumonia, erysipelas, and even enteric fever. He was moved to make this experiment in the first instance by the reputed liability of isolation hospitals to favour the spread of many (and often complicated) cases in confined atmospheres. "During the past few years it has been our constant practice to nurse the more severe cases of the diseases mentioned above, as far as possible, in the open air, in bell tents with open sides, in the freely ventilated corridors between the various ward blocks of the hospital, or in the covered approaches to the latter. Cases of an acute and septic character certainly clear up more speedily in the open air than in closed wards. In no single instance, so far as I have been able to discover, has any untoward result accrued from the exposure."

The State endowment of motherhood, a paper by Dr. Eric Pritchard, aroused considerable interest. He advocated that the mother should be endowed in her capacity of mother in order to mitigate the evil effects of poverty and labour upon the woman advanced in pregnancy; and he impressed the importance of the adequate provision and training of midwives in the principles and practice of infant feeding and management. The whole object of maternity endowment should be centred in efforts to safeguard the interests of the infant before and immediately after birth, and these interests would be best studied by an efficient midwifery service, supplemented by the domiciliary visits of properly trained health visitors, both before and after birth; and both midwives and health visitors should be empowered to dispense free benefits of food, clothing, or other necessity which they might think proper for the welfare of the State's new citizen.

Mr. A. J. Martin's advocacy of a "National Health Week" met with much acceptance. We cannot expect

to awaken all at once a sustained interest in matters of health, but it is practicable during one week in the year to secure for them a fair measure of public attention. "Health week" may fittingly start with Health Sunday. "If the clergy will but awaken and stir the conscience of the nation, and bring home to all their congregations a sense of their personal responsibility for their own health and that of their families and neighbours, the Press and other agencies for moulding public opinion may be trusted to do the rest. The Press of this country has again and again given proof of its readiness to work for the public health. Only a few months ago one of our great papers devoted columns day after day to a campaign against tuberculosis. Still more recently leading journals have taken a strenuous part in the agitation for wholesome bread.

"Our local authorities are largely occupied with health work. Let them for one week in the year take their constituents into their confidence. Let them hold one or more public meetings to discuss the special needs of the town or district, the work already accomplished, and that which still remains to be done.

"And then the schools. Throughout Health Week let the regular teaching in hygiene be supplemented, at least for the elder children and their parents, by one or more lectures from local medical men—lectures, not crammed with dry scientific facts, but brimful of that romance in which the pages of sanitation abound.

"I would also enlist the aid of the trade unions, the cooperative societies, the friendly societies, the funds of which are so cruelly depleted by preventable disease—every body of men, in short, who care for the well-being of their fellow men, and are willing to work for it."

The difficulties to be overcome should not be underestimated, but they need not be exaggerated. Hospital Saturday and Hospital Sunday in this country, and Tuberculosis Sunday in the United States, have shown the way. From small beginnings they have grown into great national institutions; and if the cure of disease has a claim on our sympathy and support, how much the more has its prevention?

THE FIFTH INTERNATIONAL DAIRY CONGRESS.

THE fifth International Dairy Congress met at Stockholm on June 28, and was closed on Saturday, July 1. There was a large attendance of members, and some interesting discussions arose on the various subjects contained in the programme.

The meetings were held in the two chambers of the Houses of Parliament, and to facilitate the procedure, the subjects under discussion were divided into two sections. In Section 1 the production of milk was the main subject of discussion, whilst in Section 2 attention was directed to the treatment and use of milk. It is not possible to follow in detail the discussions which took place on practically all the subjects which were dealt with by the two sections, so a short account of the questions placed before the congress, and a *résumé* of the conclusions or recommendations arrived at, will be given. The first question was on the effect of the different fodders on the quality of milk and dairy products; six reports had been presented, and abstracts published and issued to members. The discussion of this subject made it clear that there is still a great deal of uncertainty as to whether or not food can cause an increase of fat in milk. Kellner (Möckern—Leipzig) reported that feeding experiments which had been carried out under his direction proved that the use of palm-nut cake meal caused a rise in the amount of fat in the case of cows with a high milk yield.

Böggild (Copenhagen) recalled the experience of Danish farmers some twelve or fifteen years ago, when it was found that palm-nut cake meal raised the percentage of fat in milk. The rise was not maintained and the use of palm-nut cake meal fell. The influence of the season should not be overlooked in these cases, for in some years the increase in the fat content of milk seemed to be due to this factor.

Further evidence of the possibility of increasing the fat in milk was given by several speakers, and Nils Hansson, in a very able paper, pointed out that it may be necessary to abandon the view that food has no quantitative influence upon the fat of milk. The part played by foods in influencing the flavour of milk was discussed, and particularly the bacteria from feeding stuffs. The entrance of organisms into the milk, either directly or indirectly, through fæcal matter, was considered important.

The interest displayed in this subject resulted in a *résumé* being prepared by Martini, Kellner, and Ostertag, and communicated to the next day's meeting. The final conclusions of the congress were that it is evident from practical observations and from scientific researches, particularly those of Kellner, that certain foods exercise an influence upon the quantity of fat in milk in the case of cows having a high milk yield, but that the following questions still need an answer:—(1) From what period does the influence of the food make itself felt? (2) To what degree is this influence maintained? (3) Does the addition of certain foods exercise an equal influence upon the quantity of fat? (4) Is the quantity of fat obtained by the use of these specific foods remunerative?

The second question dealt with the influence of the different fertilisers on forage plants with regard to the quality of milk and dairy products. Orla Jensen (Copenhagen) gave an account of a long series of experiments which he had conducted. The results proved, however, to be largely negative, and in spite of slight and irregular changes in the milk salts, and the coagulation of the milk, it was concluded that the chemical effect of the fertilisers was very little indeed. The effect of bacteria coming from fodder upon milk, particularly when associated with digestive disturbances, is very considerable and of far-reaching influence, in the making of cheese particularly. This being the case, the necessity for the strictest cleanliness in the cowshed and in the dairy, the adequate cooking of the milk, and the retention of healthy cows only, become once more the recommendations of those best fitted to advise. Unfortunately there was little discussion upon this question; in all probability the subject had not been investigated by others.

The third question dealt with a subject which is much discussed at the present time in this country, and the conclusions of the congress as noted below ought to prove conclusively that we are neglecting one of the best means of improving our milk supplies at practically no cost. The question was as to the importance of control associations (milk record societies) for the production of milk. Benno Martini (Gross Lichterfelde) criticised the manner in which these associations are generally run, and the conclusions which are often drawn from the results; but he agreed as to their usefulness in bringing the importance of the careful testing of each cow in the herd before the farmer himself, and this in many cases was first done when a travelling tester visited the farm. Every other speaker, and they were of all nations, had praise for the control associations, and if any evidence were needed that their operations resulted in the rise in quantity and quality of milk, it was furnished in abundance.

Funder (Christiania) reported on a condition of affairs in Norway which somewhat resembles that in England, namely, the reluctance of the farmers, especially the smaller ones, to join the associations, and the objection to the travelling tester staying at the farm.

The opinion of the congress is well expressed in the following resolution, which was passed:—

"Judging from the good results obtained in Sweden, Denmark, Germany, Finland, and Austria, the fifth International Dairy Congress declares that milk record societies exercising a control of the feeding of the cows furnish one of the best methods of raising good animals of a milking strain, and assist in the reduction of the cost of milk.

"The congress directs attention to the great importance of such control societies in initiating a rational, economical, and balanced mode of feeding, and in propagating the sound experience which has been gained in the keeping of animals."

The veterinary control of live stock as regards the production of milk was the fourth subject dealt with, and the discussion showed that very strong views were held as to the necessity of veterinary inspection of cows. The question of the food for cows from which special

"infants'" milk is obtained, and the tests to which the milk should be subjected, were also discussed. It was agreed that when a change from dry to green food was made, it must be done gradually, and also that the milk from cows on good pasture was permissible for the feeding of young children, and could be recommended. The congress did not, however, feel that there was unanimity in the proposals which had been made, so it was finally decided that a special commission should be appointed to draw up regulations for the veterinary control of milk, and to submit them to the next International Dairy Congress.

The following were elected to the special commission:—Poels, Rotterdam; Regnér, Stockholm; C. O. Jensen, Copenhagen; Martel, Paris; Trotter, Glasgow; Bougert, Berlin; Ostertag, Berlin; Winkler, Vienna; Zschokke, Zurich; Malm, Christiania; Happich, Dorpat; Fettick, Budapest; Fiorentini, Milan; with power to add to their number.

A recommendation was made to the milk associations of the various countries to appoint committees, which should work with the object of getting the control system introduced into all public and private ventures.

The fifth subject dealt with the supervision of the milkers and attendants, and the visiting of them in their homes by a regularly appointed medical man was urged. Cleanliness in the habits of dress of the milkers was also strongly recommended.

In the second section of the congress the subjects dealt with have a more practical and less scientific bearing, with the exception of the seventh subject, noted below. The sixth subject, for example, treated of what demands should be made in the case of new milk intended for direct consumption, of condensed milk, and of dried milk. The congress passed a number of strong recommendations, which, if they could only be carried out, would be of the greatest possible benefit to the consumer, but to the producer they would necessitate a heavy expense and a consequent increase in the cost of the milk.

Subject number seven placed before the section was a question dealing with analytical methods to be employed in testing milk and dairy products. In addition to the ordinary fat determination, and the taste and smell, it was advocated that a test for dirt should be made also the reductase test (Barthel), the fermentation test (Walter), and the leucocythemia test (Walter) and the catalase test. The alcohol boiling test and a determination of the acidity were also advised.

No unanimous resolution was adopted, but the general feeling of the congress seemed to be that the above-mentioned tests could be used with most satisfactory results, whether the milk was intended for direct consumption or for the manufacture of butter, cheese, &c.

The ninth subject, which dealt with cheese control, attracted a large amount of attention from representatives of countries exporting cheese. It was resolved by the congress that it should be left to the next congress to fix what can be regarded as the normal amounts of dry matter and fat in cheese. The permanent committee was charged with the task of undertaking the necessary preliminary work. It was also recommended that margarine cheese should not be made up in form of the ordinary types of commercial cheese.

The question of the training and instruction of the *personnel* of dairies was closed with an invitation to the societies of each nation to draw up methods and conditions of instruction.

Finally the congress resolved that it is absolutely indispensable, for the avoidance of misunderstandings, that in all dairy publications the metric units of measure and weight should be used, and for temperatures the degrees centigrade.

At the conclusion of the congress most of the members paid a visit to Orebro, where the twenty-first General Swedish Agricultural Exhibition was held. These exhibitions are held once in five years in different parts of Sweden. The show, somewhat spoilt by rain on the first day, was excellent. The members of the Dairy Congress had then an opportunity of taking part in one of four different excursions. Those who were interested chiefly in agricultural and educational matters visited Ostergötland and Scania, and were rewarded by a most interesting and instructive trip.

THE BRITISH PHARMACEUTICAL CONFERENCE.

THE forty-eighth annual meeting of the British Pharmaceutical Conference was held at Portsmouth on July 25–27 under the presidency of Mr. W. F. Wells. The presidential address dealt mainly with pharmaceutical legislation, incidentally directing attention to the fact that the laws regulating the practice of pharmacy in Germany and France afford better protection and greater privileges for pharmacists than the British and Irish laws. Mr. Wells deprecated the practice of Irish boards of guardians of purchasing drugs of inferior quality at competitive prices, and expressed the opinion that a large proportion of the damaged drugs imported from abroad went to public institutions, the governors of which paid more attention to price than to quality.

For the first time in its history, the meeting was this year divided into two sections, the "science section" and the "practice section." In the former section eighteen papers were contributed, the larger number of which were of purely pharmaceutical interest.

Mr. H. Finnemore and Mr. G. E. Town contributed a short note on *Bartsia odontites*, a very common wayside plant of the natural order Scrophulariaceæ. It is well known that this plant is avoided by cattle, and bearing in mind the haphazard methods in which our knowledge of the use of medicinal plants has emerged, and also the fact that plants botanically related often contain similar chemical constituents, it occurred to the authors that this relative of digitalis might possibly be worthy of pharmacological and chemical study. A quantity of the plant was extracted with alcohol, but Dr. Laidlaw, who tested the action of the solution on frogs, found that it had no poisonous or digitalis-like effect. A crystalline matter which separated from the alcoholic solution was identified as mannite.

Mr. H. J. Henderson described an experiment in peppermint culture in the shade. The plants were grown on the bank of a stream at Hitchin, and some of them reached a height of 50 inches; the stems were stout, and the leaves correspondingly large. It was found, however, that the lack of sunlight, due to the shadow cast by the trees on the opposite bank, prevented the production of the hairs bearing the oil cells, and reacted powerfully on the yield of oil, this being only 0·1 per cent. from the fresh herb. The yield of oil from ordinary plants grown on the same farm was 0·409 per cent.

Mr. E. H. Farr and Mr. R. Wright contributed a paper in which they described experiments carried out with the view of testing the accuracy of the statement, which is frequently made, to the effect that in the conversion of opium into extract or tincture the quantity of morphine shown by the official assay of a sample of opium is always greater than the amount found in the finished product. The authors find this statement to be correct. In seven samples of opium worked upon, the loss of morphine varied between the limits of 0·8 per cent. and 9·0 per cent. of the whole, with an average for the whole series of 4·78 per cent. The loss appears to be due to occlusion of the alkaloid, rendering its complete extraction by water or alcohol a matter of practical impossibility, or to some other factor which has hitherto escaped recognition.

Mr. H. Deane, in a communication on extract of Indian hemp, demonstrated the variability of this extract as supplied by the manufacturers. He suggested a modification of the official process of manufacture by which an extract consisting practically of pure resin would be obtained.

Mr. R. R. Bennett suggested that an iodine standard should be officially adopted for *Thyroideum siccum*. The majority of pharmacologists are agreed that the activity of thyroid is dependent upon the combined iodine present, but the author finds that the combined iodine present in commercial preparations varies considerably. The percentage of iodine in dry thyroid prepared from a series of sheep's thyroids obtained direct from the slaughter-house varied from 0·21 per cent. to 0·096 per cent., the average value being 0·158 per cent. The author thinks that an iodine standard of 0·15 per cent. might be adopted without unduly harassing the manufacturer.

Mr. John C. Umney contributed a note on *Podophyllum emodi*. At the request of the Indigenous Drugs Com-

mittee (Calcutta) he conducted a series of experiments upon the drug, collected under different conditions and at different seasons. He finds that the resin obtained from the rhizome collected after flowering is much richer in podophyllotoxin than the sample he examined some years ago, and that it contains about twice as much podophyllotoxin as the resin of *P. peltatum*.

A paper on the composition of diabetic foods, by Mr. F. W. F. Arnaud, gave rise to a vigorous discussion. The author gave the results of the analysis of twelve different samples of gluten bread and flours, the products of seven manufacturers, which showed that the products of one manufacturer alone were satisfactory. Nine of the products contained from 40 per cent. to 70 per cent. of starch. The author cannot confirm the statement, frequently made in advertisements, that the starch has been altered, either by the qualitative iodine test or the microscope. A sample of an expensive diabetic food was found to consist of ordinary flour which had merely been heated. In the course of the discussion it was suggested that the conference should take some action with a view to the repression of the sale of ordinary bread and flour as specially prepared diabetic foodstuffs, and it was finally decided to refer the paper to the executive with the object of considering whether the attention of the British Medical Association should be directed to the facts disclosed.

In a paper on white precipitate, Mr. G. D. Elsdon described a method for the estimation of mercury. He confirms the statement made on previous occasions that the sulphide method gives results that are sometimes too high, but contends that the process is, in respect to its accuracy, no worse than the others in general use, and is to be preferred on account of its speed and simplicity. He also described a method of analysing white precipitate ointment for the purposes of the Sale of Food and Drugs Acts.

Mr. H. Finnemore communicated a brief note on solution of sodium ethylate. This liquid becomes brown on keeping, the change in colour being due to the action of the alkali on the acetaldehyde present in absolute alcohol. The use of methyl alcohol in place of ethyl alcohol is suggested; a sample of solution of sodium methylate showed no trace of discoloration after two years.

Other papers read in the science section included a note on the constitution of commercial bismuth subchloride, by Mr. J. B. P. Harrison; notes on arsenates of strychnine and strychnine hypophosphite, by Mr. D. B. Dott; and a paper on the moisture and ash contents of medicinal extracts, by Messrs. K. C. Allen and T. Brewis.

In the Practice Section a paper on the education of the pharmacist was read by Dr. F. Beddow. He expressed the opinion that the present system of educating the pharmacist is not an ideal one from the teacher's point of view, since a large majority of students do little or nothing until they are old enough to sit for their final examination; they try to compress all their work into a few months, the result being a process of cramming. So far as possible, educationists would like to minimise the importance of the examination and increase the importance of the education; and in Dr. Beddow's view the proposed pharmaceutical curriculum (NATURE, February 23, p. 564) is a step in this direction, for it substitutes to some extent proof of education for examination.

A paper was also read by Mr. E. F. Harrison on secret and proprietary remedies, and at the close of the discussion a resolution was passed calling upon the Government to institute an inquiry into the sale of these products. The position of pharmacists under the proposed national insurance scheme was also discussed.

Sir Edward Evans was elected president for the ensuing year, and an invitation to hold the next meeting of the conference at Edinburgh was accepted.

THE SCENTS OF BUTTERFLIES.[1]

AMONG all the country sights of spring, summer, and early autumn, I suppose there is none more familiar than that of the common white butterflies. They are to be seen, as we know, everywhere; haunting woods, hedgerows, lanes and gardens, crossing heaths and meadows, and visiting at times not only parks and squares, but even streets in the heart of London. Of these insects there are in this country, as is no doubt known to many of you, three especially abundant kinds. One of these is the large cabbage white; the other two species are smaller. These two latter kinds are much alike when seen on the wing; but on a closer view they are easily distinguished, the most obvious mark of difference being the presence in one of them of greyish-green streaks, following the course of the so-called "veins" or "nervures," on the under surface of the hind wing. From this character the form in question gets its common name of the "green-veined white." If anyone will capture a male green-veined white (easily distinguished from the female by the much slighter spotting of the male's upper surface), and will brush the upper surface of the fore or hind wing with a camel-hair pencil, he will become conscious of a strong agreeable odour like that of the so-called "lemon-plant." On further examination he will find that this perfume emanates from the wings of the butterfly, and is strongly perceptible on the brush with which the wings were rubbed. The rubbing process has, of course, dislodged large quantities of the minute scales with which the wings of this insect, like those of butterflies and moths in general, are clothed; and these dust-like scales, adhering to the brush, have in some way or other carried with them the characteristic odour of the butterfly. A similar scraping or rubbing of scales from the under surface of the wings does not emit the odour, nor is it found in association with any scales from either surface of the female.

We find, then, that in this butterfly the perfume attaches to the scales in one particular situation, namely, the upper surface of the wings of the male insect. This fact obviously suggests that we should examine these particular scales in order to find out whether they present any differences from the scales which appear to be odourless. On applying the microscope to the scraping which carries the scent, we find at once an answer to our question. The great majority of the scales are of the ordinary well-known kind, consisting of an elongated flattened lamina, provided at one end with a short quill-like footstalk by which they are attached to the membrane of the wing, and frequently showing at the other extremity a more or less marked indentation. But among these will be found certain scales of an entirely different appearance. These latter scales in the insect before us are somewhat heart-shaped, carrying a long footstalk which ends in an almost circular disc, and tapering at the other extremity to a point. But the greatest peculiarity of these special scales is to be found in the plume-like structure which crowns their apical portion. Under a low power of the microscope the appearance is that of a tuft of fine transparent hairs, strongly suggestive of the vibratile cilia which are so familiar in animal and vegetable histology; but these hair-like processes, unlike the cilia, have no faculty of active movement, and under a high power they bear rather the aspect of minute tubes, in many cases seeming to be open at their free extremity. On examining a similar scraping from the under surface of the male, or from either surface of the female wing, we find only scales of the ordinary kind; the special "plume-scales," as they have been called, being invariably absent. Inasmuch, then, as the characteristic fragrance is found only in scrapings which contain the plume-scales, we are justified in concluding that these remarkable structures act as carriers of the perfume.

So far we have considered only one species of butterfly, the common green-veined white; but the question will naturally be asked—what about other butterflies, the other common whites, for example? Is this flowery perfume a peculiarity of one species only, or is the property of emitting a fragrant odour shared by other related insects? In order to answer this question, let us suppose that we make a series of trials on the second species of smaller common white, the small cabbage or garden white, as it is usually called. Here, again, no trace of a flowery odour is discoverable in the female or in scales from the lower surface of the wings in the male; but, as before, the upper surface of the wings in the latter sex will be found to be scented, and, also as before, the scent will be found to adhere to the scales removed by scraping or brushing from the upper surface. Examining the scented scraping microscopically, we find that here, too, are a number of plume-scales mixed in with scales of the ordinary type. These

[1] Discourse delivered at the Royal Institution on Friday, March 3, by Dr. F. A. Dixey, F.R.S.

plume-scales bear a family resemblance to those of the previous species, but are easily distinguishable from them. In fact, it is quite as easy, perhaps easier, to discriminate between the two species of the common white by comparing two scales measuring not much more than one-tenth of a millimetre in length, as it is to tell them apart by examining entire specimens of both insects.

We conclude, then, that the scent-producing function is essentially similar in the two kinds of smaller common white. But it is to be observed that the endowments of the two in this respect, though similar, are not identical. The scent of the green-veined white (*Ganoris napi*) is, so far as my experience goes, always present and easily recognisable, this being the reason why I chose it for first mention. But with the common garden white (*Ganoris rapae*), the case is different. You will probably find some male specimens with no appreciable scent at all; others with the scent so faintly developed that you may be doubtful about its presence; in none, probably, will the scent be nearly so strong as in the case of the green-veined white that we began with. Moreover, the character of the perfume differs. It has been not inaptly compared to sweetbriar, and it is at all events quite distinct from that of its near relation *Ganoris napi*. Extending our observations to the large cabbage white (*Ganoris brassicae*), we find a plentiful supply of plume-scales of quite a different aspect, these being very much longer, tapering gradually from base to apex, and showing none of the elegant heart-shaped outline that we saw in the other two species. The regularly disposed fringe or plume of the smaller whites is here also replaced by a kind of untidy bundle. These scales, again, are present only in the male, and only on the upper surface of fore and hind wing. What about the scent? It cannot be said to be entirely non-existent, but it is certainly the case that anyone of average olfactory powers may examine many male specimens of the large white without being able to detect any characteristic odour whatever. In some individuals, however, it is unquestionably present, though it is, as a rule, only to be appreciated with difficulty. But when detected it is like a faint whiff of violet powder, or, as has been happily suggested by Dr. Longstaff, orris-root.

There is in Africa a well-marked genus of white butterflies which goes by the name of Mylothris. The members of this group are in many respects much like the common whites of our own country; they are, however, as a rule somewhat brighter in appearance, many of them having a touch of vermilion, orange, or some shade of yellow at the base of the wings close to the body. This is more frequent on the under surface, but in many cases it is seen on the upper side as well. The genus also differs from our common whites in usually possessing a distinct marginal row of dark spots. The figures shown on the screen, which were photographed in colour from nature, were prepared for another purpose; they give, however, a good idea of the general features of the group.

Now all the species of Mylothris which I have had the opportunity of examining during life possess a strong and fragrant odour, which is developed under just the same conditions as in the butterflies we have already discussed. That is to say, it belongs to the male alone, and in that sex is confined to the upper surface of the fore and hind wings.

The scent of *Mylothris agathina*, a species which is abundant in many parts of Africa south of the Sahara, appears to me to be exactly that of sweetbriar. It is a good deal like that of our garden white (not the green-veined species), but very much more intense. Indeed, so powerful is it, that I have more than once perceived it when the butterfly was held in the hand at some considerable distance.

There is a pretty species of Mylothris which I found rather common at East London (South Africa). It has been named *trimenia*, after the distinguished naturalist who presided for many years over the South African Museum at Cape Town. It has a graceful, floating flight, and the hindwings in the male are of a delicate lemon-yellow. The general attractiveness of this insect is increased by its pleasant fragrance. This is quite different from the odour of its congener *agathina*, though at least equally powerful. It is not easy to describe, but may perhaps best be compared to the scent of sweet-pea or clover, with a suggestion of orange-peel or lemon. The females of both these species of Mylothris are destitute of odour. The curious shape of the male scent-scales, which is tolerably uniform throughout the genus, is shown in an outline diagram.

In a couple of months' time our country lanes will be enlivened by the presence of a butterfly known no doubt to many of you as the "orange-tip." This very pretty insect is much like one of our common whites, but may be distinguished by the elaborate green mottling of portions of the under surface—a feature of colouring which causes the butterfly to be almost invisible when it settles with closed wings on the head of an umbelliferous plant. This green mottling is found in both sexes, but the male has in addition a large patch of bright orange at the apex of the forewing. Whether this butterfly is scented I am unable to say, as I never happen to have had the opportunity of examining live specimens since I began to search for butterfly odours, but the male certainly possesses plume-scales of the same general character as those of the common whites, though differing, as will be seen by reference to the diagram, in points of detail. I should be glad to receive information as to its power of scent-production from any of you who may make the acquaintance of the butterfly during the coming spring.

Though I have at present no information on this point as to our English orange-tip, I have been able to test several foreign species which are somewhat like it in aspect, and are not very far removed from it in point of affinity. These belong to the genus Teracolus. One of these Teracoli, called *omphale*, common in Africa, has a scent which I compare to that of Philadelphus, commonly called "Syringa," or perhaps more exactly to that of the white lily, together with a more aromatic constituent suggesting at one time chocolate, at another, musk. A second African orange-tip, *Teracolus achine*, has a scent, not always present, which reminds me of honeysuckle. The scent of a third African species, *Teracolus auxo*, in which the general coloration is yellow instead of white, recalls that of jasmine or Philadelphus.

Closely allied to these tropical and subtropical orange-tips is a group in which the orange apical patch is replaced by a brilliant crimson. The South African representative of this group has a scent which comes nearest to the garden heliotrope, commonly called "cherry-pie." In yet another group we find, instead of orange or crimson, an apical patch of glossy purple. The only species of purple-tip which I have had an opportunity of examining in the living condition is also possessed of a sweet, flowery scent somewhat different from that of the last.

Many more examples of these perfumed white butterflies could be given, but I should only weary you by multiplying cases. For our present purpose it is sufficient to say that among the butterflies that are fairly close relatives of our common whites, the odours, though not universal, are very frequently present; that they vary much in character and intensity, though possessing in common an agreeable quality and a likeness to the perfume of certain vegetable products, particularly to the scent of flowers. They are almost without exception confined to the male sex, and to the upper surface of the wings, and they are almost invariably found in connection with the peculiarly specialised scales that we have learned to distinguish as "plumules." The only exception to the latter statement that I know of among this particular assemblage of butterflies is the yellow African orange-tip, *Teracolus auxo*, in which I find no plume-scales, though it has a flowery odour which in some specimens is really strong.

Apart, then, from a few possible exceptions, we have certainly established a relation between the presence of plume-scales and the emission of a flower-like odour. What is the nature of this relation? To answer the question let us examine the plume-scale itself a little more closely. This diagram shows a typical form of plume-scale taken from one of the common African whites, *Belenois thysa*. This butterfly, which somewhat recalls one of our common whites, though generally larger, and still more closely resembles *Mylothris agathina* lately mentioned, has a strong, sweet odour like that of roses. The scale consists of a flattened plate, or lamina, rounded at the base and sharp at the apex. At the middle of the base is attached a slender footstalk, at the end of which furthest from the lamina we find another flattened structure, in this species shaped like a cheese-cutter, which may be called the "acces-

sory disc," or simply the "disc." From the apex of the lamina arise the cilia-like processes, which may conveniently be termed the "fimbriæ." This may serve as an example of a form of plume-scale commonly found in the white butterflies or Pierinæ, but the scale in all its parts is liable to considerable modification; and, indeed, it may be said with truth that in no two species are the scent-scales exactly alike. The diagrams will show how very diverse are the forms assumed by the plumules of these white butterflies; but in all of them may be observed under various shapes the lamina, fimbriæ, footstalk, and accessory disc. The scale is formed of chitin, a substance which constitutes the outer covering, or external skeleton, as it is called, of many insects, and which when met with in bulk is of a hard and horny consistence, as may be seen, for instance, in the forewings or "elytra" of beetles. Chitin is practically a dead material, and there is no trace to be found in the scale of any protoplasmic or living matter. The granules which are present are probably pigment granules, the presence of which in the ordinary scales imparts to the wings their characteristic colour. So far we have discovered no apparatus to which we may attribute the production of perfume.

But now let us examine the means by which the scale is attached to the membrane of the wing. The point, or rather surface, of attachment is the accessory disc, which fits into a cup-shaped depression in the wing-membrane, which cavity, however, is generally not large enough to admit the whole of the disc. In many species can be seen an orifice in that part of the disc which is enclosed, when the scale is *in situ*, within the cup-shaped cavity or socket just mentioned. And when the fimbriæ are examined with a very high power, an appearance is seen in many species which suggests that their free extremities are not closed, but open; that they are, in fact, minute tubes which put the interior of the scale into communication with the outer air. Now can we discover any means by which, say, a vapour entering the disc by the orifice in its buried portion can be conveyed through the scale and find its way out through the patent extremities of the fimbriæ? It certainly appears that we can. Within the disc there is generally visible a chitinous structure which often bears the appearance of a convoluted tube; the footstalk which forms a bridge between disc and lamina is apparently not solid, but pervious. The lamina itself consists of two delicate chitinous layers, one of which may be called dorsal and the other ventral, enclosing a flattened cavity which contains a certain amount of interstitial material. This latter takes various forms in different species, but very often presents the appearance of a longitudinal striation, which in all probability betokens the existence of fine parallel channels or passages traversing the interior of the lamina side by side from base to apex. This longitudinal striation is frequently obscured by the accumulations of granular pigment; but in many cases there is a comparatively clear area near the apex where the striæ can be fairly well made out, and where they can be seen to correspond in number and position with the individual fimbriæ. There is, then, much reason to suppose that the cavity of the lamina is more or less completely divided into channels which communicate in one direction with the fimbriæ, and so, through the orifices of the latter, with the outer air; and in the other direction through the footstalk with the disc, and so through the aperture of the disc with the socket of the wing-membrane and its underlying structures. We have, therefore, some warrant for considering the scale to be a piece of apparatus not indeed for the manufacture, but for the distribution of scent; and to get some insight into the mode of production of the latter, it is evident that we must pursue our researches into the structure of the wing itself.

It was noticed by Weismann more than thirty years ago, and more recently by Günther, that in the hypodermis, as it is called, or cellular layer immediately underlying the homogeneous surface-membrane of the wing, there occur certain cells which appear to be specialised for the production of a secretion. These cells were described and figured by Günther under the name of "Drüsenzelle," or "gland-cells." In this diagram, which is copied from one of Günther's figures, we see two of these "gland-cells" in direct connection with the sockets in the wing-membrane into which fit the footstalks of two scales partly seen in section. These scales are not plume-scales, for they possess no disc; but if secreting cells are found, as here, in connection with scales of the ordinary kind, there seems to be no reason why we should not also find them in relation with plume-scales, supplying in that position the living and working protoplasmic element by means of which the scent-bearing secretion is elaborated. The clear spaces in these cells of Günther's figure are rather suggestive of the oil or fat vacuoles seen especially in growing cells of adipose tissue; and it may be conjectured that the scent-bearing secretion is of the nature of a volatile oil. In the case of the ordinary scales the secretion may still be oily. Probably most of us know how difficult it is to wet a butterfly's wing with water. This is no doubt partly due to the mechanical conditions involved in the coating of minute scales, but it is possible that, as in the case of the plumage of aquatic birds, some additional power of resistance to wet is afforded by the presence of an oily secretion, which may be conveyed to the surface by the scales of ordinary character. It is also possible, as has been suggested by Weismann, that the secretion formed in connection with the ordinary scales may bear an odour, though of a different nature from that of the plume-scales, and, at least in many cases, imperceptible by our senses. All this is a matter of more or less probable conjecture, and it is very clear that there is a good deal more work to be done before we can be sure that we know all about the various functions of the scales and their associated structures.

Before we go on to the next part of our subject I should like to call your attention to some figures that will be thrown upon the screen of various forms of plume-scales. In these figures the chitinous sculpturing of the scale will be seen. It differs in character from species to species, but in all there is more or less visible a longitudinal striation of the lamina, which we have seen reason for interpreting as an indication of channels along which pass the odoriferous secretions or exhalations from the gland-cells buried in the substance of the wing to the fimbriæ and so into the open.

The question will no doubt have occurred: are these plume-scales the only structures by which the scents of butterflies are distributed? They are by no means the only ones. There are many other methods of distribution of these flower-like odours, some of which we can find without going beyond the group of so-called white butterflies, or Pierines. Visitors to the south coast of England in the late summer and autumn months can hardly have failed to notice a very active butterfly of a fine bright orange colour with a dark border, which is especially given to haunting fields of lucerne and clover. This is the butterfly commonly called the "clouded yellow," one of the most conspicuous of the whites, or, as we ought rather to say, the Pierine butterflies. In this insect we should search for plume-scales in vain; but on examining in a male specimen the front edge of the hindwing where it is overlapped by the forewing, we find on the upper surface a patch of scales distinguished from their surroundings by their lighter colour. The microscope shows that these scales are of a different shape from those of the rest of the wing, and are packed much more closely together; moreover, instead of lying nearly flat upon the wing, like the tiles on a roof, they are set up on end, sometimes almost at a right angle. When the wing membrane is denuded of scales and examined with a high power, the situation of the patch is easily recognisable by the crowding together of the sockets for the insertion of the footstalks, and also by the fact that tracheæ, or air-tubes, are seen to be leaving one of the main "veins" of the wing and supplying this particular area, breaking up into smaller branches as they go.

In ordinary circumstances the scent of the clouded yellow is not easily detected; but if in a living specimen the scales be scraped off one of the patches that have just been described, they will in many cases be found to have an odour which is somewhat like that of the garden heliotrope, or "cherry-pie." The South African clouded yellow, which is much like ours, though quite distinct, has a similar patch and a similar odour. The scent-producing apparatus in these clouded yellow butterflies presents many features of interest; in the first place, the scent-scales are crowded together into one small area, instead of being generally distributed over the wing-surface as in the com-

mon whites. Then the scales are quite unlike plume-scales, having neither fimbriæ nor accessory disc, while the footstalk is short and quill-like, instead of being long and flexible as in the plume-scales. They are, indeed, quite of the type of the ordinary scales, except that they differ a little in size and shape from the scales of their immediate surroundings. The distribution of tracheæ, or air-tubes, to the site of the scent patch is noteworthy, and so also is the fact that in ordinary circumstances the patch is covered by the overlap of the forewing, which acts like a sliding lid. It may reasonably be conjectured that this arrangement ensures economy of the perfume. The production of the scent is confined to a limited area, and its escape is prevented under ordinary conditions by the overlapping edge of the forewing. When emission of the scent is required, a slight separation of the fore and hind wings gives it exit. The special distribution of tracheæ may be a provision for pumping air into the patch from below, and so supplying a *vis a tergo* to assist the escape of the perfume.

Many other butterflies possess similar patches of scent-distributing scales. They are generally, though not always, so placed as to be covered up in the ordinary position of the insect. In some instances there are two patches on each side, one on the upper surface of the hindwing, the other on the under surface of the forewing, these being so arranged that they exactly cover one another when the butterfly holds its wings in the normal position. It is to be observed that in these patches the rule is for the scent-scales to be of the same general character as the ordinary scales of the wing, though they may differ much from the latter in shape, size, and arrangement. The patches seldom contain plume-scales, and, when fitted with a sliding lid, I believe it would be correct to say that they never do.

The question may be asked: is it not necessary that the scent should be economised in the case of the plume-scales quite as much as in the case of the definite patches? No doubt it is; and a little further consideration of the typical plume-scale may show us how this is effected. The plume-scales, it is true, being as a rule generally distributed over the wing, cannot be shut down under a lid; but they are frequently scattered among ordinary scales which are a good deal longer and larger, and which may act as coverings to the individual scales, though there is no general covering for the whole. Then again, as we have seen, the plume-scale has an accessory disc and a long footstalk. The disc with its internal chitinous structure may act as a reservoir for the scent; it will be remembered that in many cases it appears to contain a convoluted tube. The footstalk seems to be flexible, and it often shows one or more sharp bends in its course. These bends may impede the passage of the scent from the reservoir in the disc to the lamina and fimbriæ, and the butterfly may be able, by some movement of its wings, to bring about a straightening of the footstalk and a consequent liberation of the odour. At any rate, it is probably significant that the apparatus of accessory disc and long flexible footstalk belongs to the plume-scale alone.

There is a handsome butterfly, common in Africa, which is not far removed in affinity from our well-known "brimstone." This butterfly, which is known as *Catopsilia florella*, has in the male a strong fragrant scent. Now *Catopsilia florella* possesses on the hindwing a patch of special scales which is somewhat similar in aspect and position to the scent-patch in the clouded yellow. But, curiously enough, the characteristic scent appears to proceed, not from the patch on the hindwing, but from another structure altogether. This is a beautiful silky fringe of long hair-like scales which are set along the edge of the forewing on its underside, and are covered as a rule by the overlap of the hindwing. When the wings are parted and the fringe spread out, a scent is exhaled which appears to both Dr. Longstaff and myself to be like that of jasmine or tuberose. The portion of the wing which forms the seat of this silky fringe, as well as that underlying the scent-patch of the hindwings, is furnished, like the patch in the clouded yellow, with a plentiful supply of air-tubes, proceeding to it from the adjacent "vein." In the case of the patch in *Catopsilia florella*, the ramifications of these air-tubes seem to form a fine polygonal network, each mesh of which surrounds the socket of a scent-scale. A similar appearance may be seen in the scent-patch of one of the Teracoli (*T. fausta*), and probably in that of others.

Sessile scent-patches, which may or may not be accompanied by silky fringes, occur in many other species of the brimstone-like section of Pierines, and in several of these, including both Asiatic and American species, a flowery odour has been detected both by the late Mr. de Nicéville and by Dr. Longstaff. An observation which would be of great interest, but which, so far as I am aware, has not yet been made, would be to compare the odour diffused by the fringes with that conveyed by the sessile patches in those species where both these forms of apparatus occur together.

An accumulation of hair-like scales, no doubt serving as scent-distributors, may also be seen in another genus of Pierines (*Dismorphia*) which is remote in affinity from those butterflies which have just been considered. But these odoriferous tufts or fringes are by no means confined to the Pierines. In the very different group of Satyrines, to which our common brown hedgerow butterflies belong, the males of some species possess fringes or tufts which are clearly similar in function to those of their distant cousins, the Whites. In one of these, an African species, I found that the odour produced was like that of vanilla chocolate. Another species of the same genus, a native of India, was named by Wood-Mason and de Nicéville *suaveolens*, from its pleasant fragrance. The vanilla odour was found by the same two observers in several other Indian butterflies belonging to different groups.

Some Satyrines have plume-scales which are not unlike those of the Pierines, but differ in seldom, or perhaps never, possessing an accessory disc. At the utmost they may show a slight dilatation of the articulating end of the footstalk. Plume-scales much like those of the common browns are also found in the Fritillaries, which belong to the great group of Nymphaline butterflies.

There is yet another kind of scent-scale, specialised in form. This is the well-known "battledore" scale, present in the male of many of the small blue butterflies belonging to the subfamily of Lycænids. These battledore scales are provided with apertures on their general surface which no doubt serve, like the apertures of the fimbriæ in the plume-scales, for the escape of the odour into the outer air. The ribs apparent in the "battledore" are in all probability homologous with the longitudinal channels seen in the Pierine plume-scale. These in Mylothris, as we have seen on the screen, take the form of ribs as definitely marked as those of the Lycænids.

So far, all the scents with which we have been concerned are of a kind that is agreeable to our own senses. But there is another sort of odour which is also commonly present, especially in the butterflies of tropical and sub-tropical regions, and which, instead of being pleasant to the human sense, is disagreeable or even repulsive. The Acræas, which are mostly reddish or brownish butterflies with small dark spots; the Euploeas, large butterflies which often show a brilliant purple gloss like that of our own purple emperor; the Papilios, of which a good example is the black and yellow swallowtail butterfly of the Cambridgeshire fens, have many of them an odour which may be called disgusting. Musty straw, stable litter, rabbit-hutches, acetylene, bilge-water, these are some of the substances to which the odours of these unsavoury butterflies have been compared. In some cases, as in the instance of the agreeable perfumes, the seat of these evil-smelling odours has been found in patches or tufts of specialised scales or hairs; in others the scent appears to be emitted from the general wing-surface. But in no instance, so far as I am aware, has any structure like a plume-scale been found guilty of emitting anything but a pleasing fragrance. A very remarkable difference between the scents pleasant and the scents unpleasant is this: that the former kind usually, though not invariably, is confined to the male sex; while the latter kind is common to both sexes, being often, indeed, stronger in the female.

It has, no doubt, occurred to you to ask: has the presence of these scents any particular significance with regard to the needs of their possessors; and if so, what? And why should the agreeable scents be so commonly confined to the one sex, while the repulsive odours are shared by both?

The second question helps us to answer the first. With regard to the scents of the disagreeable kind, which are

probably often accompanied by a nauseous flavour, there is good reason to suppose that they are in effect a means of protection from insect-eating enemies. We have much actual evidence bearing upon the point. Evil-smelling butterflies, like the Acræas or the well-known *Limnas chrysippus* (a large brown butterfly common throughout many parts of Africa and Asia), are often conspicuous, slow-flying, and given to courting observation rather than to avoiding it. These are all marks of butterflies which are more or less immune from attack by birds; and it may be added that the frequency with which many of them are copied by other butterflies gives further reason for the conclusion that they enjoy protection in virtue of their distasteful qualities—a protection which other butterflies are enabled to share by resembling them in outward appearance.

Now, granted that the avoidance of attack by birds is the object of the repulsive scents, we should, of course, expect to find them present not in one sex only, but in both alike. And this is precisely what we do find; moreover, since it is well recognised that the preservation of the life of the female is more important than that of the male for the welfare of the species, we should expect that if there is a difference between the sexes in the intensity of the odour, that difference would be in favour of the female. This, again, is borne out by observation in a number of cases. Where both sexes are repulsive, the female, as a rule, is the more repulsive of the two, and therefore (as a consolation) the safer from attack.

So much for the odours unpleasant. Now let us turn to the other kind, the fragrant flower-like perfumes with which we dealt at the outset. These, we saw, are frequently associated with specialised scales which are the exclusive property of the male sex. We cannot say quite so much for the odours themselves, for though in the great majority of cases they belong to the males alone, yet the females are not left entirely destitute. Fritz Müller many years ago found evidence of sweet scent in a female white butterfly, and since then Dr. Longstaff has detected in the females of several species a fragrance not unlike that of the male, but usually much weaker. Still, we may certainly say, speaking generally, that the pleasant odours show a vast preponderance in favour of the male. This suggests that they must have some significance in regard to the relations between the sexes; and, indeed, there can be little or no doubt that, as was first pointed out by Fritz Müller, these scents are employed by the males in courtship as a means of attraction; they may also perhaps serve as a means of recognition. That their employment is occasional, and not constant, appears from the fact that they are so often furnished with a provision for keeping them confined until wanted. There is, so far as I am aware, no direct evidence that they are more plentifully liberated during courtship; but to anyone who has observed the persistent fluttering of white butterflies about and around each other under those circumstances, it can hardly fail to occur that the fanning wing-movements of the male must have the effect of encouraging the evaporation and diffusion of the odour; also perhaps of aiding its escape from the disc through the footstalk and so into the lamina of the plume-scale. The flowery scents would thus come under the head of those features which have been called by Prof. Poulton "epigamic"; characters, that is, which, like the splendid plumage of some cock-birds, are believed to further the cause of matrimony. If this interpretation be correct, it is most interesting to find that the æsthetic preferences of butterflies in the matter of scents are so much like our own. In other insects, as well as in many of the higher animals, we find attraction exercised by odours that to our senses are disgusting. Butterflies themselves are not exempt from a depraved taste where food is concerned; the best bait for the purple emperor is well known to be a piece of putrid meat. But in matters of love-making, the butterfly seems to resort for his means of fascination to methods which recall the human lover with his gifts of flowers and boxes of vanilla chocolate.

The evil odours tend to be somewhat persistent. In some cases they may be detected for a long time after the butterfly is dead and stiff. The agreeable scents, on the other hand, are usually evanescent, becoming imperceptible very soon after the insect has ceased to live. On one occasion I was able to detect the lemon-plant odour of a green-veined white when the butterfly had been dead for eleven days, but this is probably an extreme case. Both kinds of odour may be present in the same species; when this is so, it is commonly found that the first impression given by the butterfly is a disagreeable one, the pleasant constituent only becoming apparent when its distributing apparatus is specially exposed. These cases of a double odour follow the same rule of repulsive scents being common to the two sexes, and agreeable perfumes being confined to the male.

This finishes what I have to say on the subject of the scents of butterflies. I am conscious that I stand in need of your indulgence; as, from the force of unavoidable circumstances, I have had but a short time in which to prepare this lecture. But, "qui s'excuse, s'accuse," and I trust that in spite of its sketchy and imperfect character the discourse to which you have just listened may have succeeded in quickening the interest that most of us feel in these very attractive objects of nature, and in giving fresh emphasis to the fact that the study of insects in general, and of butterflies in particular, is capable of shedding light upon questions of high importance in the science of biology.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. HUGH GUNN, formerly Director of Education of the Orange Free State, has accepted an invitation from the Government of Western Australia to act as adviser and organiser for the university which that State is founding at Perth.

MR. W. H. MCMILLAN has been appointed to the newly founded chair of mining at University College, Nottingham. Prof. Heaton has been appointed principal of the college in succession to the Rev. J. E. Symes, who has resigned.

AMONG the bequests of M. Marino Corgialegno, a naturalised British subject, who died on April 26, are:—40,000*l.* to institute a school at Athens on the lines of Eton or Harrow, "sharing in the desire expressed to me by his Majesty King George that education in Greece should be rendered more perfect by the establishment of a public or secondary school upon the model of the English public schools, where boys will receive a regular course of teaching as well as of good breeding"; 40,000*l.* for a school for craftsmen at Argostoli, in the island of Cephalonia; 15,000*l.* for technical scholarships; 10,000*l.* each for a school for girls in Cephalonia, for schools or gymnasia in Argostoli, for a public library at Argostoli, for the Agricultural Society at Athens, for a polyclinical hospital in Athens, and for the Society for the Propagation of Useful Books.

THE Educational Science Section of the British Association will meet at Portsmouth, under the presidency of the Right Rev. J. E. C. Welldon, Dean of Manchester. The president in his inaugural address, which will be delivered in the section on Thursday, August 31, will treat of educational problems of the day. His address will be followed by a discussion on the overlapping between secondary schools and universities and other places of higher education, which will be opened by Prof. A. Smithells, F.R.S., and Prof. R. A. Gregory. On Friday, September 1, there will be a discussion on the place of examinations in education, with papers by Mr. P. J. Hartog, Miss Burstall, Dr. T. P. Nunn, and Mrs. Dr. White. The discussion will be opened by Mr. A. A. Somerville and Mr. W. D. Bentliff. A discussion on grammatical terminology will be opened by Prof. E. A. Sonnenschein and Mr. P. Shaw Jeffery. On Monday, September 4, the subcommittee on mental and physical factors involved in education will present its report, which will deal with the question of feeble-mindedness in children. There will be a discussion on the diagnosis of feeble-mindedness, with papers by Dr. Abelson, Dr. C. W. Saleeby, and Dr. Tredgold, followed by a discussion on the education of feeble-minded children, with papers by Mrs. Burgwin, Miss Dendy, and Dr. Auden. Prof. J. A. Green will also read a paper on backward children. On Tuesday, September 5, there will be a discussion on practical education in the Dockyard and Naval Schools, with papers by Mr. George Dawe, headmaster of the Dockyard School, and Mr. W. H. T. Pain, of H.M.S.

Fisgard. The discussion will be opened by Dr. C. W. Kimmins. A paper on the study of German will also be read by Mr. G. F. Bridge, and a paper on school books and eyesight by Mr. G. F. Daniell.

A "MEMORANDUM on Physical Training in Secondary Schools" has just been issued by the Board of Education, and is obtainable from Messrs. Eyre and Spottiswoode, price 2*d*. That physical education at the secondary-school age is of primary importance scarcely needs to be insisted on, but it is well to have the large generalities of such education set forth, as here, in a coherent exposition. The secondary school covers the adolescent age of boys and girls—the age when growth is very rapid and the transit to manhood and womanhood demands all the care and knowledge that the best informed teacher can provide. The present memorandum does take some account of this, but does not emphasise it quite so much as the trainers of male and female youth might properly expect. Under the "objects of physical training"—it is a pity that the term "physical education" is not uniformly used—Sir George Newman gives a good summary of the nervous basis of training and the value of training in promoting "habits of discipline, obedience, ready response, and self-control." Doubtless, physical education, being a special department of mental education, *can* be used to generate such "habits"; but why insist on the merely passive aspect of education? The end of education is not to produce habits of obedience or ready response except as means to the greater end of personal self-sufficiency and independence of character. Self-development is as important as self-control, and presupposes it. But Sir George Newman is not unaware of this, for he says, "undue emphasis should not be laid upon the disciplinary effects of physical training." He justifies the Swedish system on the whole. He gives general directions as to length of lessons, the place of physical education in the time-table, and the qualifications of the teachers. "Especially as regards children and young people, physical training is not a mere matter of technical expertness." "Girls should, of course, be taught by women." Any system should be practised under the general supervision and with the constant cooperation of the medical officer of the school. The memorandum is really a memorandum, and should be to every secondary-school teacher a constant reminder of the principles and risks of physical education.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 24.—M. Troost in the chair.—H. **Deslandres**: Remarks on the movements of the solar prominences. The author regards the upper layer of the solar atmosphere as being ionised and under the action of a magnetic field. This field causes movements in the solar ions, especially those rising and falling. The theory explains easily all the observed peculiarities of the velocity of rotation in the prominences and the upper layer. In the present paper some further consequences of this theory are developed, and a scheme of research suggested for its control.—A. **Laveran** and M. **Roudsky**: Concerning the action of oxazine (triaminophenazoxonium chloride) on trypanosomes. The selective action of the centrosomes of the trypanosomes for oxazine, noted by Werbitzki, takes place both *in vitro* and *in vivo*. The disappearance of the centrosomes in *T. brucei*, and the fact that this morphological modification can be transmitted by heredity, is confirmed. Other species are similarly affected, but to varying degrees. The virulence of the trypanosomes submitted to the action of oxazine is reduced.—R. **Zeiller**: A Triassic flora discovered at Madagascar by M. Perrier de la Bâthie.—Emile **Belot**: The period of rotation of Venus. The observed period of rotation of Venus has been recently given by M. Bigourdan as twenty-nine hours. The author points out that in a communication to the academy in 1906 he gave a general formula from which this period was deduced to be 28h. 12m.—M. **Giacobini**: Observations of the Brooks comet (1911*c*) made at the Observatory of Paris. Data given for July 22 and 23. The comet appears as a rounded nebulosity 35″ to 45″ diameter, with a well-defined central nucleus. Magnitude 11·5 to 12.—L. **Picart** and F. **Courty**: Observations of the Brooks comet (1911*c*) made at the Observatory of Bordeaux with the 38 cm. equatorial. Data given for July 22 and 23. Comet showed a clear nucleus about tenth magnitude.—Witwold **Jarkowski**: An approximate law for the ascent of an aëroplane.—Marcel **Brillouin**: Polymorphism and molecular orientation.—G. **Sagnac**: Some paradoxes concerning the optical actions of the first order of the translation of the earth.—A. **Cotton**: Circular dichroism and rotatory dispersion.—G. **Bruhat**: The study of rotatory dichroism of a definite organic compound (diphenyl-*l*-bornyldithiourethane).—E. **Besson**: The asymmetry of the positive and negative ions relatively to the condensation of water vapour. An attempt to record photographically the results described by C. T. R. Wilson.—H. **Buisson** and Ch. **Fabry**: The amount of energy necessary to produce the unit of luminous intensity. Working with a Heraeus quartz mercury vapour lamp, the number of watts radiated per mean spherical candle was found to be 0·31 for the violet (4538), 0·018 for the green (5460), and 0·031 for the yellow (5780).—M. **Herschfinkel**: The action of the radium emanation on thorium salts.—Ettore **Cardoso**: The densities of the coexistent phases (orthobaric densities) and the diameter of sulphur dioxide in the neighbourhood of the critical point. Part of a series of researches on the law of the rectilinear diameter at temperatures near the critical point. The influence of agitating the liquid under experiment is clearly shown in the results.—L. **Tchougaeff** and P. **Koch**: An anomaly of the molecular refraction in the series of the substituted gloximes.—L. **Gay**: The notion of an expansibility pressure.—Victor **Henri**: Study of the ultra-violet radiation of quartz mercury vapour lamps. The ultra-violet rays from a mercury lamp increase very rapidly with the watts used, this increase being especially rapid in the neighbourhood of 209 watts. The action on citrate of silver papers is parallel with the bactericidal action upon the coli bacillus, and the yield of such a lamp when used for sterilising purposes may be very conveniently controlled by such papers.—G. **Massol** and A. **Faucon**: The latent heat of fusion and specific heat of the fatty acids. The discrepancy previously noted between the latent heats of fusion and solidification of formic, acetic, and propionic acids is now shown to occur with lauric acid. The possible causes of this difference are discussed.—G. **Darzens** and F. **Bourion**: The action of thionyl chloride upon metallic oxides. In numerous cases in which the action of thionyl chloride upon metallic oxides was studied the chloride behaved as a mixture of chlorine and sulphur dichloride. Since the latter is easier to prepare and purify, its use for chlorinating oxides is preferable.—Marcel **Guichard**: The extraction of the gases from copper by a chemical reaction, and the estimation of oxygen. Methods are described for converting copper either into the iodide or oxide, and recovery of the gases contained in the metallic copper. The limits of error of the two methods are indicated.—Georges **Dupont**: The catalytic preparation of some substituted ketohydrofurfuranes. Some examples of the hydration of some acetylenic pinacones by the catalytic action of a dilute solution of mercuric sulphate.—Frédéric **Reverdin**: The nitration of the ortho-, meta-, and para-nitrobenzoyl-*p*-anisidines.—Marcel **Delepine**: The sulpho-ether salts or thionic esters R.CS.OR′.—H. **Colin** and A. **Sénéchal**: The action of acids on the catalytic oxidation of the phenols by ferric salts.—R. **Locquin**: α-Methyl-laurenone, a new ketone derived from camphor. Baeyer and Villiger have shown that one of the products of Caro's reagent on camphor is a lactone, $C_{10}H_{16}O_2$. A compound $C_9H_{14}O$ has been isolated in the course of researches made to determine the constitution of this lactone, and this compound is shown to be a tetramethyl-*cyclo*pentenone. It is a methyl derivative of the laurenone previously described by Tiemann.—Th. **Nicoloff**: The ovule and the embryonic sac of the Plataneæ.—A. **Guilliermond**: The formation of the chloroleucites at the expense of the mitochondria.—P. A. **Dangeard**: Complementary chromatic adaptation in plants.—A. **Magnan**: The digestive surface of the ventricule and the muscular

arrangement of the gizzard in birds.—Jacques **Pellegrin**: The distribution of the soft-water fishes in Africa.—Paul **Marchal**: Spanandria and the obliteration of sexual reproduction in Chermes.—M. **Bordas**: Considerations on the reagents employed for the determination of blood stains in legal medicine. Remarks in confirmation of the views put forward in a recent paper by A. Sartory on the unsatisfactory nature of various colour reactions in use for the detection of blood stains.—Y. **Manouelian**: Researches on the pathogeny of arterio-sclerous lesions.—L. **Launoy** and C. **Levaditi**: Mercurial treatment of experimental syphilis of the rabbit and of Brazilian spirillosis.—Albert **Berthelot**: Researches on the intestinal flora. Isolation of the micro-organisms which specially attack the ultimate products of the digestion of proteids.—Em. **de Martonne**: The principles of morphological analysis of erosion levels applied to the Alpine valleys.

CALCUTTA.

Asiatic Society of Bengal, July 5.—B. C. **Mazumdar**: The Stambhesvari. Mr. Mazumdar identifies the goddess Stambhesvari, whose name is to be found in the copper-plate inscriptions of Kulastambhadeva and Ranastambhadeva, with a goddess still worshipped by some aboriginal tribes.—D. **Hooper**: Phosphorus in Indian foodstuffs. This paper is the result of an inquiry, made in collaboration with Major E. D. W. Greig, into the diet of patients suffering from epidemic dropsy in Calcutta in 1909–10. The amount of phosphorus in the form of phosphoric anhydride is given in several samples of rice, wheat, and other cereal grains, as well as in animal foods, farinaceous foods, vegetables, nuts, and fruits consumed in India.—W. **Kirkpatrick**: Folk songs and folk lore of the Gehara (Kanjars).

CAPE TOWN.

Royal Society of South Africa, June 21.—Dr. Marius Wilson in the chair.—E. P. **Phillips**: A note on the principal systematic work and publications dealing with the South African Proteaceæ. The first recorded publication of a member of this order was by Clusius in 1605. In 1720 Boerhaave attempted a systematic study of the order, but it was not until 1809 that a really scientific monograph was published by Salisbury; in the following year appeared the classic work of Robert Brown. The standard work on the order is a monograph by Dr. Meisner, which appeared in De Candolle's "Prodromus" in 1856, where 279 species are described. The writer undertook to revise the order, and has recorded between 300 and 400 species of the genera Diastella, Salisb., and Orothamnus. Pappe, sunk by Meisner, have been re-established, and one new genus, Spatallopsis, Phillips, founded.—J. **Moir**: The spectrum of the ruby, part ii., and the artificial ruby. By examination of the ruby with better instruments, the complete spectrum of eight hair lines has been discovered; they are best seen in the artificial ruby, which is identical with the natural ruby in all respects, and when free from flaws is actually superior to the natural gem.—J. **Moir**: Notes on the spectrum of the precious emerald, and other gem stones. The emerald spectrum contains three very distinct hair lines in the red. Sapphires have no hair lines in their spectrum. Artificial emeralds are green sapphires, and have an indefinite spectrum, as is also the case with the following:—rubellite, spinel, amethyst, fluor, aquamarine, rose-quartz, lepidolite, and topaz. The almandine spectrum has been re-examined.—J. R. **Sutton**: A note on the land and sea breezes of South Africa.

FORTHCOMING CONGRESSES.

AUGUST.—Centenary of the Foundation of the University of Breslau.

AUGUST 12–18.—First International Congress of Pedology. Brussels. President: M. Alexis Sluys. Secretary: M. Vital Plas, 35 Avenue Paul de Jaer, Brussels.

AUGUST 13–20.—Prehistoric Society of France. Nîmes.

AUGUST 31–SEPTEMBER 6.—British Association. Portsmouth. President: Sir William Ramsay, K.C.B., F.R.S. Address for inquiries: General Secretaries, Burlington House, W.

SEPTEMBER 4–6.—Centenary of the University of Christiania. President of Festival Committee: Prof. Brögger.

SEPTEMBER 9–20.—International Congress of the Applications of Electricity. Turin. President of the Committee of Honour: H.R.H. the Duke of the Abruzzi. Honorary Secretary of the Committee: Signor Guido Semenza, Via S. Paolo 10, Milano. International Secretary: Col. R. E. Crompton, C.B., R.E., Crompton Laboratory, Kensington Court, W.

SEPTEMBER 12–15.—Celebration of the Five-hundredth Anniversary of the University of St. Andrews.

SEPTEMBER 18–23.—International Conference of Genetics. Paris. President: Dr. Viger. Secretary: M. Philippe de Vilmorin.

OCTOBER 2–7.—Third International Congress of Hygiene. Dresden. General Secretary: Dr. Hopf, Reichsstrasse 4, Dresden.

OCTOBER 12–18.—Italian Society for the Advancement of Science. Rome. President: Prof. G. Ciamician. General Secretary: Prof. V. Reina, Via del Collegio Romano 26, Roma.

OCTOBER 15–22.—Tenth International Geographical Congress. Rome. President: Marquis Raffaele Cappelli. General Secretary: Commander Giovanni Roncagli, Italian Geographical Society, Rome.

DECEMBER 27.—American Association for the Advancement of Science. President: Dr. C. E. Bessey, University of Nebraska. Permanent Secretary: Dr. L. O. Howard, Smithsonian Institution, Washington, D.C.

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