THURSDAY, OCTOBER 22, 1908.

## INDUSTRIAL HYGIENE.

*Diseases of Occupation: From the Legislative, Social, and Medical Points of View.* By Dr. Thomas Oliver. Pp. xix+427. (London: Methuen and Co., n.d.) Price 10*s.* 6*d.* net.

THE present work deals with one of the most attractive branches of preventive medicine. It is the time of legislative interference between employers and workmen, and at no time has the health of the community been held in higher regard. If the regulation of the health of workpeople is to be effected in that practical manner which has always distinguished the progress of sanitary science in this country, it is urgently necessary that those in whose hands such regulation lies should be more thoroughly conversant with the medical side of the problem.

In a comparatively small book Dr. Oliver has succeeded in bringing together a vast amount of useful information on all sorts of subjects, ranging from mining to mountain sickness and from anthrax to the alkali manufacture. The most important section, occupying nearly one-fifth of the book, is that dealing with lead poisoning, in the suppression of which in this country Dr. Oliver has played so prominent a part. Very full treatment is also given to the effects of organic and inorganic dust, a matter which has to be considered in reference to a great variety of trades. Ankylostomiasis is dealt with in detail in the light of the author's own researches, and there is a long, though not altogether satisfactory, chapter on mining.

We do not find, however, any adequate discussion of several problems which concern nearly all trades alike—the question of the temperature of factories, &c., for example—and it is certainly time that someone undertook seriously the discussion of the influence of slightly vitiated atmospheres on the health of workfolk. The subject is throughout treated almost entirely from the point of view of the medical man and the pathologist. It is to be regretted that the actual manufacturing processes are not given more fully. A proper understanding of these is necessary both for the consideration of the scientific questions involved and to enable the medical man to adjust in some part his idealism to the needs of practical life. The solution of the difficulties presented by trade diseases must at any rate begin by some sort of compromise between the manufacturer and the doctor.

Such pleasant reading do Dr. Oliver's chapters make that one may not realise at the moment that the information one has absorbed is of a peculiarly elusive kind. The facts with which he has dealt are not drawn up in any very orderly array, and throughout one finds a certain vagueness which may well tend to make the reader feel that he is treading on ground too uncertain to bear definite action. Our knowledge of industrial hygiene is sadly defective, but the general principles which must underlie preventive measures are in many cases already sufficiently well assured to bear definite enunciation. We do not suppose, for example, that Dr. Oliver really believes that there is any multiplication of individuals in Ankylostoma outside the human body; yet he leaves this absolutely fundamental question vaguely unsettled. To laymen who are not acquainted with details, and therefore not in a position to form their own conclusions, this must be very unsatisfactory.

In some places where definite directions are given they are contradictory; thus in the chapter on rescue apparatus for use in mines we find (p. 406):—"Any person attempting to do rescue work should therefore be provided with not less than 1 cubic foot of oxygen per hour"—*i.e.* less than half a litre per minute, an altogether inadequate amount—and later (p. 408):—"A man about to undertake rescue work should be given a continuous supply of 2 litres of oxygen per minute." Written by a scientific man in part at least for the use of the "general reader," we should expect to find evidence that the scientific data were stated with particular care. Yet without looking beyond the same section (p. 407) we find that "liquid air contains 2 parts of oxygen to 1 part of nitrogen," the proportions, of course, being subject to considerable variation, and "in respiration only 4 per cent. of the oxygen inhaled is taken up by the blood," instead of about 20 per cent.

The chapter on compressed-air and caisson disease is perhaps the least satisfactory. The author appears to accept the "soda-water-bottle theory," but he dallies so long with the notions that a small excess of carbonic acid in the air, mechanical repletion of the visceral veins, and frictional electricity are important factors that one is almost compelled to agree that "there is still much to learn as regards the causes of caisson disease." As a matter of fact, the work of Paul Bert, Leonard Hill and others leaves no reasonable room for doubt that the "soda-water-bottle theory" is correct. To encourage any longer the theory of Snell that carbonic acid has any material influence in practice is to stimulate local authorities to waste huge sums of money upon extravagant ventilation of caissons.

The recommendations for the prevention of caisson disease are not only indefinite, but also very unsound. Dr. Oliver considers 3 or 5 minutes per atmosphere of pressure as a safe time to allow for decompression, and quotes the experience at the Bakerloo tunnel that the cases of illness were not diminished by extending the time of decompression from $1\frac{3}{4}$ to $6\frac{1}{2}$ minutes. The truth is that all these times are so much too short that one is not likely to be much better than another; some 30 to 60 minutes are required for real safety. Dr. Oliver commends, but fortunately does not detail, the Dutch regulations; these, in fact, prescribe that the rate of decompression should become quicker as the pressure falls, a procedure which, if applied to decompression from high pressures, would without doubt kill many people. In the pages devoted to diving, he states that divers should descend slowly; he does not explain why, perhaps because there is no reason except that a slow descent increases the risk.

The whole subject of trade diseases is in fact too large and too complicated to be handled by a single author, and it cannot be dealt with in generalities. The facts are difficult to come by and hard to interpret, yet it is upon accurate detail alone that preventive measures, involving as they may do such large interests, may with propriety be undertaken. Dr. Oliver has provided a very pleasant introduction to the subject, which should at any rate tend to promote cordial relations with his Continental confreres.

A. E. B.

## SCIENTIFIC EXPLORATION IN DAHOMEY.

*Mission scientifique au Dahomey.* By Henry Hubert. Pp. iv+568. (Paris: E. Larose, 1908.) Price 15 francs.

IN this work M. Hubert gives a very detailed description of the results of his various journeys in Dahomey, dealing principally with the meteorology, the action of surface waters and of the sea, and the geology. The volume is accompanied by an admirable geological map on the scale of 1 : 1,250,000, giving the broad structural features of the colony as far as Sansan-Haoussa, on the Niger, in approximately 14° N. lat. It is, of course, idle to expect entirely satisfactory conclusions at a comparatively early stage of investigation, but there is every reason to congratulate M. Hubert on the volume he has produced, on which much time and care have been lavished, and which constitutes a great advance in our knowledge of West African geology. M. Hubert mentions at the outset the characteristics well known to geologists on that coast, of a general simplicity of the main features, a complication in detail and a woeful scarcity of fossils.

As was already known, crystalline rocks occupy by far the greater part of Dahomey, and the coarse granitoid gneisses, banded gneisses, mica- and hornblende-schists, granites and pegmatites do not greatly differ from those of Kamerun and southern Nigeria.

Amongst the less common rock-types described may be mentioned an alkali-granite containing riebeckite, recalling the similar rocks described from Zinder and south of Chad; and some cipolins from the bed of the Zon (Savaloo region), associated at Zompa with a scapolite-hornblende-gneiss. In a somewhat brief account of the petrography these cipolins are described as containing diopside, forsterite and calcite, the first and second occasionally altered into antigorite.

Omitting for a moment the recent beds, M. Hubert finds the continuity of this great stretch of crystalline rocks is broken twice; first by the quartzites of the Atacora ridge, and secondly by the grits of the Gourma. The Atacora range traverses the colony obliquely from Kirtachi, on the Niger, to about the tenth parallel; and is, in M. Hubert's opinion, a prolongation of the northern and southern range, forming the central part of Togo Land, which twists southwestwards to reach the sea at Accra.

Additional information concerning the relations of the Atacora quartzites to the underlying gneiss and mica-schists would have been welcome, and we may incidentally remark that the word quartzite is used throughout the book for somewhat dissimilar rocks. The Atacora quartzites are probably quartz-schists, and when disturbed (they are generally horizontal) are folded with the underlying rocks. On very slender evidence M. Hubert provisionally maps these rocks as Silurian.

The Gourma grits occupy a tract of country much smaller than, but mapped as essentially parallel to, the Atacora range. The rocks extend from Kodjar to a point more than 100 kilometres south-westwards. These Gourma grits are surrounded by crystalline rocks, noteworthy for the abundance of basic types both amongst the schists and the eruptive series. In regard to age M. Hubert places these grits between the Atacora quartzites and the far more recent beds of the Niger basin, considering them nearer to the former than to the latter.

It is interesting to note the resemblance they bear to the Bandiagara and Hombori beds recorded by M. Desplanges.

Between the Gourma grits and the alluvium, "*terre de barre*," and other deposits now in process of formation, two areas are noteworthy as containing comparatively recent beds, and as helping towards a reconstruction of West African geography in late Cretaceous and Tertiary times. These are the grits of the Niger basin and the calcareous beds of Lama, which form a narrow strip crossing the colony obliquely to the south of Abomey in 7° N. lat. The ages of these deposits are not definitely fixed; the Niger beds are unfortunately unfossiliferous, and the fossils of the Lama region are not sufficiently characteristic to allow the Eocene age, suggested for them, absolutely to be proved. The identification is based on the occurrence of a Turitella, near to *T. eschi*, which in Kamerun is associated with undoubted Eocene fossils, and on the occurrence of *Dactylopora cylindracea*, Lamk. A photograph of a specimen of the shelly limestone and the general habit of the beds recalls the (? Upper) Cretaceous beds of the eastern province of southern Nigeria, and it appears at least possible that future investigation may show the Dahomey rocks to be rather older than was at first believed.

The very interesting question of the age of the Niger grits has to be left entirely open. They form the plateau on either side of the river between Sansan-Haoussa and Gaya, and have been cut through by the Niger, which thus exposes the crystalline rocks beneath. M. Hubert notices these beds as occurring as far south as Sakassi, in northern Nigeria, and somewhat similar rocks occur on the Jebba-Lokoja section of the river. Is it possible that these beds also are of Cretaceous age?

Nearly one-third of the book is devoted to a discussion of the meteorology and the action of superficial waters, while a few short chapters are concerned with the distribution of animal and vegetable types. Distribution of races as determined by geographical conditions greatly interests M. Hubert, and

the all too short notice he gives of the ethnography of the country is concerned with this question. Space only allows of the conclusions at which he arrives being given.

After noting the greater density of the population in the southern part of the colony, a result partly of the forcing seawards of the people by repeated migrations from the north, and partly of the exceptional fertility of the ground; he sums up rather unexpectedly for the remainder of the colony by saying, "tandis que les grandes rivières de l'intérieur font l'office de pôles répulsifs de la population, les montagnes ont été au contraire des pôles attractifs."

The book is essentially one for the geologist, and, if in some places the amount of detail given appears almost too great, we have in M. Hubert's work a most comprehensive and valuable description of an important West Coast colony.

In view of what M. Hubert has been able to do for Dahomey, and Drs. Esch, Solger, and others for Kamerun, it is somewhat dispiriting to find a less keen interest taken by geologists in England in regard to the investigation of the not insignificant British colonies and dependencies. J. P.

## THE SOLAR SYSTEM.

*The Solar System. A Study of Recent Observations.* By Charles Lane Poor. Pp. x+310; illustrated. (London: John Murray, 1908.) Price 6*s.* net.

IN putting into book form his lectures at the Columbia University, Prof. Poor has rendered a great service to those serious students who, unequipped with a technical vocabulary and a knowledge of mathematics, yet desire to become acquainted with our present-day knowledge of the solar system.

The book is distinctly different from the majority of astronomical text-books in respect to the relative importance attached to the various parts of the subject. Prof. Poor's lectures were evidently intended to supplement the available text-books, and difficult matters, generally given but brief notice, are treated more fully and so clearly that the general reader will find them now well within his limits. This characteristic of the book is noticeable from the beginning, where the author discusses the moon and the alleged variations of lunar features, the earth as an astronomical body, and the tides. The figure and mass of the earth, and their determination, the variation of gravity with latitude, the modifications undergone by the luni-solar tide ere it produces the effects seen round various coasts, and similar subjects are treated comparatively fully.

In the descriptions of the various attempts to measure the solar parallax (chapter iv.), the author refers to the 1900 observations of Eros as likely to afford trustworthy values, but does not appear to have included the preliminary results which have accrued from the Greenwich and Cambridge campaigns.

The chapter on the physical characteristics of the sun is more conventional in its treatment, the history, nature, and changes of sun-spots being discussed at some length. A striking illustration of the variation with latitude of the solar rotation is provided in the brief description of the relative displacement of land-masses which would follow did the earth but exhibit the same mobility; in a few days from the commencement of a rotation, South America would have displaced South Africa, whilst Sumatra would be directly south of New York. The explanation of the Lockyer-Janssen method of observing solar prominences leads up to the more recent photographic application of the principle in the spectroheliograph, and several of the Yerkes results are reproduced.

The brief descriptions of the instruments and methods whereby the sun's light and heat have been determined are especially clear, and should give every reader a very fair idea of the results achieved by the beautiful researches of Pouillet, Crova, Violle, Langley, and Abbot.

In the succeeding chapters the planets are discussed, first generally, as to their apparent motions, mutual attractions, &c., then *seriatim*. The relative certainty with which their various markings have been established is treated at some length, and some of the conclusions arrived at by Prof. Lowell come in for sharp criticism. But it must here be remarked that that observer has himself stated that the Venus markings are not so hard or regular, or so Martian in their appearance, as they were at first reported to be, whilst many of the theoretical arguments against, and practical negations of, the presence of water vapour in the Martian atmosphere will avail little against the spectroscopic evidence obtained at the Lowell Observatory by Mr. Slipher (see NATURE, No. 2002, March 12, p. 442) since this book was written.

The present-day rapid march of astronomical discovery is further illustrated in the chapter (xii.) on satellite systems, in which the author recounts the discoveries of three new satellites in as many years; yet the tale is incomplete, for, naturally, J viii is not in the list. After a chapter on comets and meteors, the book fittingly concludes with one on the evolution of the solar system, in which the author, after taking a brief historical survey of the various hypotheses, shows how the planetesimal-spiral hypothesis of Chamberlin and Moulton may be held to explain most satisfactorily the many, and sometimes apparently inconsistent, phenomena observed.

The volume is beautifully printed and illustrated, whilst its freedom from slips shows that the author has exercised the same minute care over the proofs that he has in the selection and exposition of the matter. WILLIAM E. ROLSTON.

## OUR BOOK SHELF.

*Handbuch der Pharmakognosie.* By Prof. A. Tschirch. Part i. (Leipzig: Chr. Herm. Tauchnitz, 1908.) To be completed in about 30 parts at 2 marks (2*s.*) each.

DURING the past twenty-five years there has been no lack, in Europe or in the United States, of text-books of pharmacognosy, most of which have been designed to meet the requirements of limited circles of students, and have doubtless more or less efficiently served their purpose. But Prof. Tschirch

intends his handbook of pharmacognosy to be a work of different character from any of these, of wider scope and higher aims, extending and deepening the scientific foundations of pharmacognosy, a field upon which Prof. Tschirch, assisted by his numerous pupils, has laboured for many years.

The author divides the subject-matter into general (or scientific) and special (or applied) pharmacognosy, and rightly insists that the former should be studied under a capable teacher at a properly equipped institution. General pharmacognosy is subdivided into two sections, the first of which deals with the problems of pharmacognosy, with the cultivation, commerce, history, and study of drugs, while the second treats of the sciences of botany, chemistry, zoology, physics, geography, history, &c., in so far as they directly relate to pharmacognosy. In the second subdivision of the work, viz. special pharmacognosy, each drug will be described separately, and, judging from the specimen issued with the first part, in the fullest conceivable manner, each account being a complete monograph of the drug. The grouping of these monographs is to be based upon the chemical relationship of the active constituents of the drugs which, it is hoped, will form a natural bridge to their therapeutical uses.

Comparing the scheme of the work with the plan of a classical English work on the same subject, the "Pharmacographia" of Flückiger and Hanbury, it will be seen that the chief differences lie in the separate treatment of general and special pharmacognosy, in the endeavour to base the grouping upon the chemical constituents, in the greater detail and in the extreme richness of illustration.

That the handbook of pharmacognosy will be one of the most voluminous and one of the most important works that has ever been produced on the subject cannot be doubted. The author's profound acquaintance with the anatomy of drugs is a guarantee that each description of the structure of a drug will be a masterpiece. The chemistry of drugs has also received his continuous attention for years; but whether our knowledge of their active constituents is sufficiently extensive to allow of the proposed classification being satisfactorily accomplished remains to be seen. The work contains the promise of rich stores of information, of abundant literary references, and of admirable illustration that will be invaluable to all who are interested directly or indirectly in crude drugs. HENRY G. GREENISH.

*Memories of Dr. E. Symes-Thompson, a Follower of St. Luke.* By his Wife. Pp. vii+195. (London: Elliot Stock, 1908.) Price 3*s.* 6*d.*

THE life of every physician who has attained and held for many years an acknowledged place in his profession necessarily includes in its scope something beyond his daily medical work. Some, like Sir S. Wilks and Gairdner in this country and Trousseu and Charcot in France, have left behind them a large addition to medical science, although now, with increased knowledge and specialisation, the clinician leaves a large part of the scientific field to others. Some, like Sir A. Clark, have been great teachers and public leaders in medicine; and others, again, without much of public recognition, have brought a detached and philosophic mind to bear on the problems of life and disease—and their teachings have exerted profound influence.

Dr. Symes-Thompson belongs to yet another class. A man of great industry, with ready insight and quick sympathy, the *practice* of medicine was his forte. To this it must be added that he was an earnest Churchman and one of the founders and a Provost of the Guild of St. Luke, and that he was possessed of an energy and rare social gifts which gave him a leading place in every cause that he espoused. He was for many years physician to the Brompton Hospital for Diseases of the Chest, and was one of the first authorities upon the effects of climate in the treatment of consumption, and contributed many valuable observations upon the influence of climates upon chronic disease.

As professor of physic at Gresham College for a long term of years, he assisted in that extension and popularisation of medical knowledge which in this country has accompanied the advance of education. Dr. Symes-Thompson will also be remembered as a leader in life-assurance medicine. He succeeded in gaining the confidence of the lay authorities in life assurance, and did much to advance our knowledge in this branch of medicine.

The present volume of "Memories," recently published by his wife, gives a charming account of Dr. Thompson's personal and family life, in London and at his country house. It includes also many tributes of affection from colleagues and old friends, and cannot fail to be of interest to the large number of persons who were brought into contact with him.

*Wax Craft: All about Beeswax. Its History, Production, Adulteration, and Commercial Value.* By T. W. Cowan. Pp. 172. (London: Sampson Low, Marston and Co., and *British Bee Journal* Office, 1908.) Price 2*s.* net.

BETWEEN theology and bee-keeping there is appa rently little connection. Yet whilst Luther and Zwingli were compassing the downfall of a Church, they were also preparing hardship for a rural industry. With the decline of Roman ritual the demand for candles and tapers slackened, and as a consequence the sellers of beeswax, whatever their religious leanings, had at least financial reason to mourn the advent of the Reformation.

Mr. Cowan touches on this and other historical matters in the introduction to his little book, which is devoted to a general description of beeswax. The secretion of the wax and the methods of "rendering" it are fully described, several illustrations of extractors and presses being given, with hints upon the best modes of manipulation. Refining and bleaching processes; the making of comb-foundation; distinctions between commercial varieties of wax; methods of adulteration and analysis, and the applications of beeswax in commerce, are all dealt with in turn; and the book concludes with a collection of technical recipes.

In some of the sections the treatment is too sketchy to be of much value to the technical reader. For instance, the chapters on the adulteration of beeswax and on the manufacture of wax flowers would not greatly assist the analyst or the modeller. Moreover, outside his own immediate province the author is not always a trustworthy guide—as witness the statement (p. 110) that paraffin wax is obtained by the distillation of naphtha. But the book as a whole is a useful one for bee-keepers, and is generally interesting.

C. S

*Educational Wood-Working for School and Home.* By Joseph C. Park. Pp. xiii+310. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1908.) Price 4*s.* 6*d.* net.

THIS book is intended primarily for use in the public schools of America, and it indicates for English readers to what extent manual training enters into the curriculum of such schools, and how the training in this branch of work is carried out. The book is

divided into seven parts or chapters, which deal respectively with the following subjects:—(1) The enumeration, description, and illustration of woodworking tools, such as benches, squares, chisels, saws, planes, brace and bits, &c.; (2) woodworking machinery, including band and circular saws, wood-planers, and wood-working lathes; (3) the classification, description, and properties of various woods; (4) fastenings, such as nails, screws, glue, dowels, cleats, &c.; (5) the finishing of wood surfaces by paints, stains, polishes, and varnishes; (6) in this part we have a graduated set of examples, with dimensioned drawings, of suitable objects to be made at the bench, beginning with simple knife-work and ending with a combination desk and bookcase; and in (7) instruction is given in wood turning, with examples for practice. There are three appendixes giving some problems in practical geometry, some useful tables and instructions, and a key for the identification of all the principal woods of North America.

As will be seen from the foregoing, the book is intended to be used under the direction of a skilled workman, who is responsible for giving instruction in the proper handling and manipulation of the tools. Teachers in this country will be well advised in consulting this excellent text-book.

## 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.]*

### On the Change of Colour in the Eyes of an Attis Spider.

ON Saturday, September 5, I found a small spider with light green, transparent legs and brown body with silver flutings. I bottled it quickly, and hurried up to my friend Mr. Strickland, and on examining it there under a magnifying glass observed a frequent change of colour in its eyes. I took it home, and on examining it for about six hours consecutively found it to have the faculty of changing the colour of its eyes at its own free will. In an instant it changed the honey-coloured eyes into shining black. While it changes the eyes, a bright dot or streak appears and vanishes all at once.

I am quite sure that the animal actually changed something inside the eyes. The cornea—as one may call it—is circular. The two corneas stand in a vertical plane so that they face the observer like a pair of gig-lamps, or, still better, as those in front of a railway locomotive. Behind each cornea is a conical sack, in shape much like an ordinary butterfly-net or a jelly bag. Taken together with the cones, the pair of eyes look like a pair of field glasses. The spider was found to wag the conical portion of the eyes every now and then. Fortunately, the head in this species being translucent, the mechanism by which the colour-change is effected can be easily seen by means of a good pocket lens. The spider itself was 6 mm. in length, and its conical eye one millimetre.

I put the spider in a small, thin, clean test-tube, and stopped the mouth of the tube with a little bit of cotton-wool. Having done this, I took the tube to a powerful table lamp and examined it with a pocket lens in that light against a white background. A thin strip of white paper serves very well as a background. When I first took it near the light the spider seemed to be startled and ran about. It was at this moment that I saw it wagging the conical part of the eye all the more. The spider ran a few paces, then stopped, and began moving the eyes very vigorously. On closer examination I found that the outer and larger end of the cone was a transparent honey colour. The inner tapering portion of the cone was jet black. The light and black halves were divided by a well-marked ring. The change in the colour of the eye is caused—as will be explained immediately—by the wagging to and fro of the two posterior cones. Reference to the diagram will show that the cones can be in such a position (A, A) that their axes are parallel to one another and in the line of sight of the spectator facing the cornea, or they can converge to a point just halfway between the two eyes in question (B, B), or the axis of one eye may converge while that of the other will remain unchanged. It is to be observed that the apices of the cones never diverge.

Roughly speaking, the black extends only one-third of the whole length of the cone from their tips. Consequently,

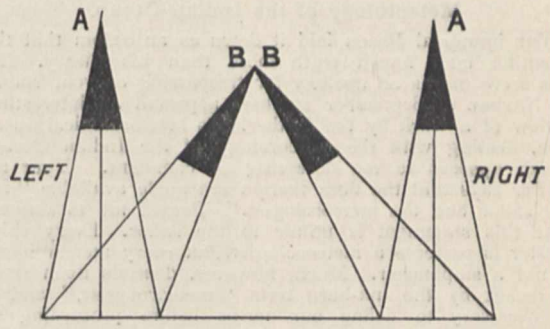


FIG. 1.—(1) Position A, A. Both the eyes of the spider now appear black, because the line of sight plunges into the black portion of the cone. (2) Position B, B. Both the eyes now appear honey-coloured, because both lines of sight cut the honey-coloured parts of the cones. (3) Position A (right), B (left). The right eye will appear black, the left honey-coloured.

when the spectator faces the eyes, and the axes of the cones are parallel, he sees into the depths of the two cones, and the eyes necessarily appear jet black. When the two tips of the cones converge the line of sight strikes the honey-coloured outer portion of the cones, and then the eyes in consequence appear honey-coloured. Lastly, the spider has the power to cause the tip of only one cone to converge inward, and then only that eye appears honey-coloured, while the other one remains black. It has been stated above that when the spider changes the colour of the eye a bright line or dot traverses the cornea. This is due to the ring formed where the black and honey-coloured portions of the cones unite traversing the cornea as the colour of the eye changes from light to dark, and *vice*

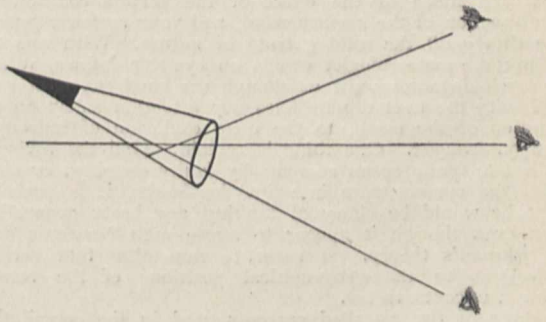

FIG. 2.

*versâ*. It must be well borne in mind that in all these cases the cornea of the eye remains perfectly unchanged and immobile, the change of colour being wholly and entirely due to the movement of the cones behind it.

When the line of sight from the observer's eye to the cornea is at right angles to the latter the eyes invariably appear honey-coloured. The reason is obvious, namely, that the line of sight strikes only the honey-coloured portion of the conical sack behind the eyes. Hence it follows that the axis of the cones must be either above or below the line of sight. But as a matter of fact it is above it. The proof of this is that if you look at the eyes a little

from below they appear black, whereas if you look at them from above they still remain honey-coloured. The accompanying diagram (Fig. 2) shows to demonstration that this can only be the case if the cones lie on an inclined plane with the apices a little above the plane which divides the cornea horizontally into two equal halves.

Thus the simple mechanism by means of which the change of colour is controlled by the spider (in at least six species of spiders, and most likely in many others) has been satisfactorily explained.

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### Meteorology of the Indian Ocean.

THE immortal Bacon laid it down as an axiom that the scientific man loveth truth more than his theory. Let this serve me as an apology for trespassing on your space. In NATURE of September 17 there appeared an interesting review of a work by the Netherlands Meteorological Institute, dealing with the meteorology of the Indian Ocean, which appears to me deserving of comment. Your reviewer says that the data therein are made available "for the sailor and the meteorologist." Permit me to suggest that this statement is unfair to the sailor. Every shipmaster is perforce a meteorologist, but every meteorologist is not a shipmaster. Much, however, depends upon what is meant by the ink-horn term "meteorologist," and it is necessary to define our terms before proceeding to argument.

The reviewer credits the Netherlands authorities with having omitted from their charts "unnecessary details or results of doubtful utility," including fog. I would submit that information with respect to fog probability is both necessary and useful for seafarers. Some shipmasters might stoutly assert that such information is to be preferred before average isobars. Rain gauges are not usually carried on board ship, and to calculate humidity from the large majority of the wet- and dry-bulb observations taken at sea would be but to court confusion. The readings of rain gauges and of wet bulbs on board ships under way are often destitute of scientific value by reason of the environment. Hence, in my opinion, the Netherlands charts gain in quality by the decrease of quantity under those heads.

The reviewer emphasises the contention that the average sea-surface current, in regions where the wind is fairly constant in direction, flows to the left of the average direction of the surface wind in the southern hemisphere. Surely such deviation is merely apparent! Current charts of the several nations differ *inter se*. Perhaps too much has been made of the effect of the earth's rotation on the direction of the surface wind, and your reviewer pushes the theory off the solid ground of nature. With one dip of ink the meteorologist dwells on cyclonic indraught and anticyclonic outdraught as though the earth were at rest, and with the next dip he fixes our attention solely on the rotation of the earth, to the utter exclusion of indraught and outdraught. One thing is certain. Had the reviewer helped to make ocean currents by faulty steering, or dealt with the current data in ships' log-books, it is probable that he would be chary of making any hasty generalisation even though it appear to agree with Nansen's drift or Ekman's theory. I seem to remember that serious objections to the geographical positions of the former remain uncontroverted.

Many of the so-called currents used in the compilation of the Netherlands charts are open to re-consideration. On p. 11, for example, the components of three alleged currents are +5 and −6, with a resultant of 2·6 miles in twenty-four hours. Either the currents were insignificant or they were contradictory. Had every difference between a ship's position by observation and by dead reckoning, which gave a resultant of five miles or less, been regarded by the compilers as "no current," as is usual in this country, a large proportion of the Netherlands current resultants must have suffered modification. Errors in steering, variation, deviation, leeway, distance run, and other items which are known to the sailor, are all dumped into the dead reckoning position, and even the position by observation of a heavenly body is not free from imperfection. Moreover, the seaman has a way of his own in keeping a log-book, and unless the log-books used by the Netherlands authorities were first carefully examined by nautical experts, the results obtained are probably misleading. The sea is full of secrets, and, as Longfellow sang, "only those who brave its dangers, comprehend its mystery."

The reviewer says that in the pressure charts not only the average isobars are drawn, but also the average pressure for each two-degree area is inserted; but I fail to follow his explanation of the latter innovation. Small departures from the normal barometer values in the tropics may be, as he suggests, monitors of an approaching cyclonic disturbance, but, depend upon it, the seaman pays far more attention to the action of his barometer, as regards interference with diurnal range, for example, at the instant. Granting your reviewer's argument to be sound, there does not appear to be any logical connection between it and the erratic differences of the individual means on the charts from the isobars. The Netherlands observations, as is evident from previous publications, are on zones which join the Cape with Sunda Strait and Perim with Acheh Head. Elsewhere the results are on an unsatisfactory foundation. In one two-degree area, for example, there may be a discontinuous series of six observations, in 1856, 1886, 1887, 1897, 1903, and 1904, respectively, nearly all of gale force; and in the adjacent rectangle six times as many observations, all in one year, from a single ship detained by light winds and calms. This explains the fallacy involved in the reviewer's inference.

Dr. Shaw, F.R.S., in his address at the British Association gathering in Dublin, pathetically referred to the ever rising tide of meteorological literature, and many are overwhelmed by it. Byron has well said that "a man must serve his time to every trade, save censure, critics all are ready made," but the above remarks are written to elicit the truth, and a long apprenticeship has been served by me in marine meteorology.

WM. ALLINGHAM.
"Saratoga," Clairview Road, Streatham, October 3.

MR. ALLINGHAM submits that information with respect to fog probability is both useful and necessary to the seafarer. I do not deny the usefulness; what I implied was that in the present state of meteorology no adequate information of fog probability could have been conveyed to sailors by making charts of fog from the observations for the region under consideration. The charts showed the northern limit of the region in which the sailor might expect fogs, and this was stated in my article.

I was aware of the fact that rain gauges were not usually carried on board ship, and that observations of the wet-bulb were not always made with the carefulness and precision necessary for humidity calculations. It was to stimulate interest in these important meteorological elements that I remarked on their absence from an important publication. It is not impossible to obtain really useful results for rainfall and humidity by observations made at sea.

With regard to the ocean currents, I was directing attention to a point worthy of further investigation. I did not push the theory anywhere. I commented on the fact, obvious on a comparison of the charts, that the wind and current were related in the way indicated by Ekman's theory.

It is useless for Mr. Allingham to attempt, by directing attention to the large and well-known possible errors of a single observation, to abolish the cumulative evidence of a long series of observations over a large part of the ocean surface. I made no hasty generalisation. The deviation of the current in the Indian Ocean to the left of the S.E. trade wind and of the W. to W.N.W. wind of higher southern latitudes is a real deviation.

The insertion of the mean value of the barometer reading was not intended to supplant the sailor's knowledge of the effect of diurnal variation or any other effect that would enable him to make a good forecast, but to supplement it. Its value is not destroyed by the existence of errors in some of the mean values.

E. GOLD.

## SOME CROMLECHS IN NORTH WALES.

### I.

IN a recent number of NATURE the Rev. J. Griffith, the acting secretary of the Society for the Astronomical Study of Ancient Stone Monuments in Wales, gave the detailed results of some recent measurements of cromlechs in Anglesey and Carnarvonshire.

FIG. 1.—The May-year Cromlechs at Plas Newydd.

I propose in the present article to refer to some general questions in relation to them.

In the first place, I may point out that it is not a little remarkable that all the cromlechs, which were taken at random—ease of getting at them being the only principle of selection adopted—fell into line; by which I mean that all the directions indicated were the same as those which had already been made out in Cornwall. With regard to the solar alignments, indications were found of observations of the May-year sun (dec. 16° 20′ N. and S.), of both solstices and of the equinox. I have already given curves (*ante*, p. 572) which show how closely the measures fit the computed azimuths in the latitude of Anglesey (53° N.), when the heights of the horizon are taken into account. Two things, however, have to be stated: First the observations were made with a clino-compass only, and many of them in a high wind and snowstorm, which made the measures very uncertain. The next point is one of more general interest. In Cornwall and elsewhere evidence is rapidly accumulating that the solstitial alignments were not made so frequently on the actual place of sunrise as on a point somewhere about a degree south of it for the summer solstice, and north of it for the winter solstice, so that warning of the coming event could be given, and a careful watch kept. It will be seen that the majority of the alignments now in question fulfil these conditions. If we assume that the cromlechs were erected about 1000 B.C., the sun's declination then was N. 23° 50′, according to Stockwell. The only exception is at Presaddfed, at which cromlech only an estimate of the azimuth was possible, as there were no surfaces to measure.

One interesting point connected with this practice of warning is that it explains the azimuth of the Friar's Heel at Stonehenge in relation to the avenue.

Mr. Thomas recently found that the practice was adopted in regard to three or more alignments connected with the Tregaseal circle in Cornwall.

The most massive cromlechs with large quoits supported by tremendous upright stones are connected with the May year; first among these come the double cromlech at Plas Newydd; and reasoning from what one has seen in Cornwall and South Wales of the different methods of building, they are the most ancient structures I have observed in North Wales. On the other hand, the equinoctial cromlechs, supported by horizontal layers or small stones, are the newest.

*Photo. by Lady Lockyer.*

FIG. 2.—The Equinoctial (? late) Cromlech at Lligwy.

Between these two sets come the solstitial cromlechs. Of them I give three illustrations showing greatly varying types. Of them all Byrn Celli Ddu is the most interesting, as there is a long *allée couverte* or creep-way, which is exceptional in Britain,

so far as "cromlechs" go, though many may be still hidden in "long barrows" such as New Grange,

*Photo. by Lady Lockyer.*

FIG. 3.—Bryn Celli Ddu (Summer Solstice), view looking S.W.

which, so far as I can make out, is oriented to the Winter Solstice. It is fortunate for students that the state of dilapidation of Bryn Celli Ddu just shows the earth of the barrow gone and many of the stones of the creep-way still *in situ*.

Mr. Neil Baynes, who has made a careful study of this monument and the literature connected with it, has been good enough to send me the plan of it, copied from the "Archæologia Cambrensis," in which the orientation is 35° out. He writes:—"The plan *was* made by Lukis, but I do not know who twisted it into the Arch. Cam.—certainly the arrow showing north was not Lukis'.

"The plan shows the creepway parallel with the S.E. stone, which was evidently the first set up, and the subsequent arrangement of the other stones. One can see how the second stone overlapped the first, and so on, until the entrance was reached."

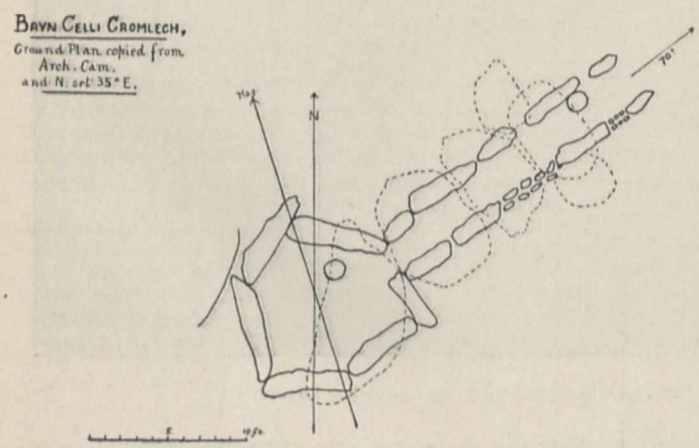


FIG. 4.—Plan of Bryn Celli Ddu, showing the true solstitial alignment of the S.E. stone and the creepway.

There is a feature on this cromlech of great interest. It consists of a cylindrical pillar shown on the plan. There can be no doubt, I think, that it once stood in the fairway of the *allée couverte* for the light to fall upon at the solstice—a kind of echo of the Egyptian ceremonial of the "Manifestion of Ra," the cylindrical stone replacing the statue of the god. Here we have one case out of many which might be named which suggests that what may be called the *furniture* of cromlechs is worthy of a close comparative study.

The cylindrical stone now in question seems to be the counterpart of other stones located in a similar way observed in other cromlechs. Borlase, in his account of New Grange,[1] writes as follows:—

"I am inclined to think . . . that we may accept as true the statement of Molyneux, that a 'slender quarry-stone, 5 or 6 feet long, shaped like a pyramid,' lay along the middle of the caye in the spot in which it is placed in his plan, and that his surmise is probably correct that it once stood upright. My view on this point is strengthened by the fact that a pyramidal pillar, shaped and rounded, was found standing upright within the chamber of the dolmen of Yr Ogof,

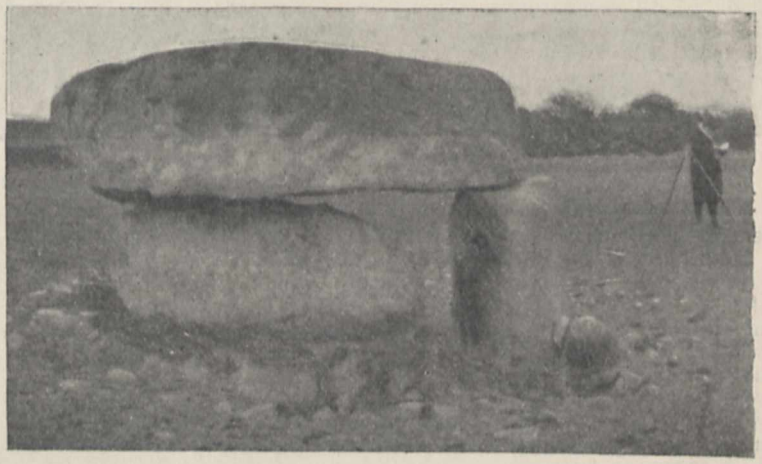

FIG. 5.—Cefn Isaf (Winter Solstice).

in Wales (see Archæol. Camb., 1869, p. 140), which in form closely resembled the pillar-stone called the Bod Fergusa, at Temair. Such a stone could readily have been removed through the passage, and its shape, so suitable for a gate-post or for building purposes, would supply the special motive for its abstraction."

Borlase (p. 450) gives a plan of Yr Ogof showing that that name is a variant of Bryn Celli Ddu. He also states that the plan was made in 1869 by a Captain Lukis, and therefore not by the Rev. W. C. Lukis, to whose accurate work in Cornwall I have on previous occasions directed attention.

In the plan of a "cairn" (L), at Lough Crew, given by Borlase on p. 325, another similar pillar is shown prostrate, but occupying the same position in the cromlech as the cylindrical pillar of Bryn Celli Ddu.

Another similar pillar is also suggested by the plan of the *allée couverte* at Mané Lud given by Borlase on p. 450.

Cefn Isaf—another solstitial cromlech—is to me

[1] "Dolmens of Ireland," p. 355.

very suggestive; it is to be regretted that one of the supporters has gone; with it in position and the quoit removed we have a great similarity to the leading feature in the Aberdeen circles, namely, a recumbent stone between two uprights. The similarity to a cove is also obvious.

NORMAN LOCKYER.

## HELIUM.

A LITTLE more than ten years ago this remarkable element was only known to astronomers through the medium of the spectroscope. Now it is not only to be found in all laboratories, but appears to occur in almost all constituents of the earth's crust and in amounts proportional to their radio-activity, except in beryl (Strutt). In some cases it occurs in quantities far from minute, as in certain minerals, particularly cleveite and monazite, where the number of litres of gas obtained is comparable with the number of kilograms of mineral treated. Again, it constitutes more than 5 per cent. of the gases evolved from some mineral springs, as at Maizières, and 1·84 per cent. of the vast supplies of natural gas at Dexter, Kansas, while it occurs everywhere as four parts in a million of the atmosphere (Ramsay). Its mode of occurrence and origin are too complex and still too uncertain to be treated adequately here, but it is apparently not liberated from minerals by grinding alone to an impalpable powder (Moss), and it certainly permeates quartz at temperatures above 220° C., and with a velocity rising with the temperature (Jaquerod and Perrot). Moreover, it appears to be frequently produced in the gradual breaking down of the uranium molecule and the various radio-active transformations of this into radium and other substances.

Helium was first known from its yellow line $D_3$, and was first detected on the earth by the same characteristic (Ramsay). In nitrogen or hydrogen it appears that a proportion of 10 per cent. can just be detected by its spectrum (Collie and Ramsay). Very shortly it was shown to be a very light, unreactive gas with monatomic molecules. Hence it was taken to be the lightest known member of the argon group. Later determinations have shown that its density cannot differ much from 2·0 (Onnes), and that the value of the ratio of its specific heats is 1·63 (Geiger), which confirms the earlier results.

The very simple character and small mass of the molecule are evident in all its properties; thus its refractivity $(n-1)$ is found to be very small, but various observers differ as to whether there is dispersion in the visible spectrum or not. Recent results give values of $3{\cdot}478\times10^{-5}+7{\cdot}6\times10^{-16}/\lambda^2$ (Burton), and $3{\cdot}47\times10^{-5}+8{\cdot}2\times10^{-16}/\lambda^2$ (Cuthbertson and Metcalfe), in excellent agreement for a value about one-quarter of that of hydrogen and with considerable dispersion. Measurements on the conductivity for heat $K=f\eta C_v$ show that it is greater than for other gases, and appear to indicate that $f$ has its theoretical value of 2·5. They are, however, complicated by the uncertainty as to the value of $\eta$, the viscosity. The viscosity with reference to air is given as 0·96 (Rayleigh). The diffusion of helium through a porous plug is faster than the simple theory would indicate (Ramsay and Collie), and this, together with the want of conformity in effusion results, may be partially due to its very low inversion temperature (Donnan).

The same characters are obtained under the influence of electric stimulus; thus ionic velocities of 6·31 cm./sec. for negative and 5·09 for positive $\alpha$ rays (Frank and Pohl) are larger values than those found for any gas but hydrogen. In the vacuum tube the dark space exhibits several distinct maxima showing long free paths (Aston).

The Zeeman effect is extremely simple and regular, the lines breaking up into normal triplets with dispersions $(d\lambda/\lambda^2)$ proportional to the fields up to 12,000 c.g.s. (Lohmann). Confirmatory observations with measurements of $e/m$ give values of this for $D_3$ $(\lambda=5876)$ of $11{\cdot}3\times10^6$ across and $12{\cdot}3\times10^6$ parallel to the field, somewhat higher values being found for two other strong lines, $\lambda=6678$ in the red and $\lambda=5016$ in the blue-green (Grey and Stewart).

Gaseous helium has a small negative magnetic susceptibility of 0·00175, less than argon (Tänzler), while its dielectric cohesion is the lowest known. All monatomic gases have low values, argon being 39 where hydrogen is 205, but helium is 18·3, so that 0·005 per cent. of the diatomic gas can be clearly detected (Bouty).

It would seem as if this property might be a certain and easily applied method of checking the freedom of helium from hydrogen. Other methods of testing its purity are determinations of density and spectrum analysis. The former is extremely accurate when great precautions are taken, but does not easily give an accuracy of more than 0·05 per cent.; however, with the spectroscope it seems that 0·008 per cent. or less of hydrogen can be seen (Onnes).

It is, however, in its character of the most perfect known gas that helium has the most obvious usefulness, and this in two directions. At all temperatures below 100° C. a constant-volume helium thermometer is the most convenient and accurate known because the corrections are very small and regular. Determinations of the mean pressure coefficient from 0°·0 C. to 100°·0 C. gave values of 0·00366241 and 0·00366270 for a normal thermometer (760 mm. at 0°·0 C., Travers and others). These values, when corrected and re-calculated to the international scale (1000 mm. at 0°·0 C.), appear as 0·0036616 and 0·0036613, the former of which agrees exactly with a direct determination at this pressure (Onnes). To obtain these corrections use has been made of isotherms observed at 0°·0 C., 20°·0 C., and 100° C., and the corrections of the helium thermometer to the absolute scale are deduced from isotherms at the values given. They are $-0°{\cdot}006$ at $-103°{\cdot}57$ C., $+0°{\cdot}002$ at $-182°{\cdot}75$ C., and $+0°{\cdot}01$ at $-216°{\cdot}56$ C., while in later measurements of the boiling point $+0°{\cdot}2$ is assumed at $-268°{\cdot}6$ C. $=4°{\cdot}5$ K., if absolute zero $=-273°{\cdot}10$ C. (Onnes). The isotherms indicate that there is no minimum until about $-253°$ C., so that the Boyle point, where $(d(pv)/dp)_t=0$, appears to lie at about this temperature, and hence the Joule-Kelvin inversion temperature, for small pressure differences, will lie at about twice this, or 40° K. The isotherm for $-258°{\cdot}82$ exhibits a distinct minimum at about 10 atmospheres, as can be seen by plotting the following values for $pv$ against $p$; $p=0$, $pv=0{\cdot}05222$; $p=40{\cdot}012$, $pv=0{\cdot}06150$; $p=46{\cdot}222$, $pv=0{\cdot}06559$; $p=53{\cdot}326$, $pv=0{\cdot}07063$; $p=58{\cdot}797$, $pv=0{\cdot}07531$.

The value of the critical temperature, which had been variously given from 8° K. (Dewar) to 2° K. (Olszewski), and about 1° K. (Onnes and Keesom), was settled by these isotherms as not greater than $5°{\cdot}3$ K., and later observations of the liquid fixed it as little above 5° K. with a correspondingly low critical pressure of 2·3 atmospheres (Onnes). Liquid helium boiling normally at $4°{\cdot}5$ K. is very mobile, with an extremely small apparent surface tension and a density of 0·15, and is only eleven times denser than the vapour above it (Onnes).

In mixtures of helium and hydrogen the gaseous helium sinks in the liquid hydrogen at about 40 atmospheres (Onnes), which opens up a wide field of

theoretical and practical investigation. The value of $b$, in van der Waals's equation, was assumed to be 0·0005 with a negligible $a$ (Onnes and Keeson), and this is in agreement with the value of 0·000432 calculated from the isotherms at and above $-217^{\circ}$ C. (Onnes). From the observations on the liquid, however, it would seem that the value of $b$ should be 0·0007 there, and that $a$ must have a positive value of 0·00005 (Onnes). Lastly, the lowest steady temperature known was obtained by boiling helium at a pressure of not more than 1 cm., at which the temperature could not have been much above 3°·0 K. The liquid was mobile and perfectly clear, and no trace of solid was visible, so that a still lower steady temperature is clearly attainable (Onnes). FRANCIS HYNDMAN.

## THE INTERNATIONAL CONGRESS ON ROADS.

THE first International Road Congress was held in Paris during the week which ended on Saturday last, October 17. On the whole the congress may be pronounced a success, chiefly on account of the large number of interested visitors present, and from the fact that on certain points there was a strong consensus of opinion that roads can now be constructed to stand modern automobile traffic at slight additional cost, and that the two nuisances dust in summer and mud in winter can be greatly minimised in their extent.

The congress, though not wholly official, received the support of the French Government. The letters of invitation and explanatory circulars were sent out from the general secretary of the Ministère de Travaux publics; consequently the invitations were not confined to delegates sent by the Governments of the various countries represented, but were sent to representative public bodies, road authorities, automobile clubs, and to engineers and other members of the public who are likely to have knowledge and be interested in the great question of road communications.

The attendance at the meetings was generally very good; the rooms were crowded. As is usual, the hospitality shown by the French in the way of *fêtes* and excursions made the week very enjoyable to the French provincial visitors as well as to the foreign visitors. The first reception was at the Sorbonne, afterwards a grand evening reception at the Hôtel des Invalides, a gala performance at the Comédie Française, and a final sitting at the Sorbonne on Saturday morning announcing the results obtained.

The general procedure was as follows. Early in the year requests were sent to all the interested countries that contributions should be submitted in the form of short papers, which would be printed and circulated previous to the congress, the substance of which would be collected by a reporter of each of the groups, and on which discussions would take place. The subjects on which these memoirs were invited were the following:—General reports on the construction and maintenance of existing roads, special reports on the cost of road-bed and methods of construction of roads; special reports on maintenance questions—on this group of construction and maintenance of roads thirty-two papers were received, of which seven were by English contributors.

The second group of questions related to that part of road construction and maintenance which was rightly named at the congress "the present struggle against the wear and the dust." These included methods of cleaning and washing, and questions were specially put asking for experience in the use of tar or similar insoluble binding materials. Twenty-two papers were received in this group, five of them by English authors. Another group was on the roads of the future. On this question fifteen papers were received, none of them by English authors.

The remaining questions were those relating to traffic, damage caused to the roads by speed or by the weight of the vehicles, by pneumatic tyres, anti-skidding devices and similar matters. To this question sixteen papers were specially addressed, half of them by Englishmen. Then came seven papers, all by Frenchmen, on road signalling and milestones; and finally six papers on public vehicles used on the roadway, including tramway services. Five of these were by Frenchmen and one by a Spanish engineer.

Altogether ninety-eight papers were contributed, printed and circulated previous to the congress to all the subscribing members. This part of the work was splendidly done. The papers were sent in in their original language; in many cases they were completely translated; in some cases summaries were made in more than one language. It will be seen that about one-fifth of the whole of the papers came from England.

The discussions were divided into two sections, first those chiefly relating to road construction, and second those relating to the use of the roads and the vehicles running on them. They were held in the old tennis court at the corner of the Tuileries Gardens next to the Place de la Concorde, and on the plateau immediately surrounding this building were grouped a large number of modern appliances used on the roads, such as road rollers, road repairing machines, machinery for brushing and watering by horse-power and by automobile power, and, lastly, a long array of machines for distributing tar or other bituminous compounds on the road to render it waterproof and dustless. Inside the building a number of smaller exhibits were shown of various road materials and specimens cut out of existing roads, the latter being chiefly found on a collective English exhibit.

As stated at the commencement of this article, the success of the congress laid chiefly in the interest which it excited, and in the fact that for the first time a large number of road engineers and of those interested in the use of roads were brought together in a very pleasant manner, and, as is usual at these meetings, a great many useful friendships were formed which will undoubtedly lead to the better circulation of new ideas on road construction.

The number of English professional visitors was very large. Among the English visitors were found chairmen of the county councils, many of the most prominent county engineers, with a large sprinkling of municipal men and of surveyors of the various rural districts. As might be expected, a very considerable number of these gentlemen were not sufficiently familiar with French to follow the debates, which for the most part were conducted in French.

At an early stage it became evident that the knowledge possessed by some of the English visitors was very valuable to the congress, but that there was a great risk of their experience being lost, so that it was decided to hold supplementary meetings of the English-speaking, *i.e.* the English and American, visitors, previous to the regular meetings, and this course, although at first sight it might have seemed as if the English-speaking races wished to be exclusive, turned out to be of use. The results of the discussions by the English-speaking sections were delegated to one or two speakers, who afterwards communicated them during the main debates. In this way some useful resolutions were carried which cannot now be given, as they were not printed or agreed to in detail when the writer left Paris immediately after the final sitting on Saturday; but, speaking generally, it may be said that a great many of

these resolutions are of but small importance to us in England, as they relate to such well understood and generally agreed to subjects as the necessity of providing substantial concrete foundations underneath paved roadways, a form of construction which has been generally adopted in England for the last quarter of a century, and to methods of drainage and similar matters equally understood by us.

On a matter, however, of common interest, that is, the substitution of tar or bituminous binding material in place of the water hitherto used to consolidate and hold together the road material, and which is conveniently dealt with under the French name "*Goudronnage*," the congress practically gave a unanimous answer. This was to the effect that if *goudronnage* be properly carried out; if the tar or similar material be chosen with reasonable care to avoid matter soluble in water, such as ammoniacal liquor remaining mixed in the tar so that it can be subsequently washed out by the rain or dried out in the form of crystals which might afterwards form an irritating dust; if the tar be put on in the correct quantity, and this quantity the smallest required to hold the individual stones of the road metal firmly in position, so that they never roll or move in relation to one another, and their upper surfaces are allowed to wear themselves bare of tar, it is not a difficult matter to obtain, at quite a moderate expense, a waterproof road which will not do any damage to vegetation, which will be practically dustless if it be swept at reasonable intervals from horse droppings or dust blown upon it from the adjoining land, and which need not be slippery, either to horse or to automobile traffic, whether the surface be wet or dry.

It appears certain also that by so dealing with the roadways their wear can be so greatly reduced that the annual cost of upkeep of roads so treated will be considerably less than the cost of the existing water-bound roads, of which so much of the material is lost by being blown away as dust in summer or washed away as mud in winter.

There can be no doubt that all engineers, English and Continental, are at one on this important question, and this in spite of the fact that many paragraphs, obviously inspired by those who wish to recommend other binding materials, were widely circulated in the journals during the progress of the congress. It had been roundly asserted that tar was a palliative, but that on the whole its defects were greater than its advantages. Those who were present at the congress know that this is an incorrect statement; that such damage as has occurred to trees and vegetation, or inconvenience to passengers, such as irritation of the eyes and throat, which followed on the early applications of tar to the French roads during the Grand Prix race, was due to well understood causes, that is to say, to the use of crude tar and its application to a road surface which had already broken up, both of which faults the congress unanimously condemned.

It may be here remarked that owing to the cautiousness, and hence the reticence, of some of the most important of our road authorities, the true position of England, which now possesses the greatest lengths of carefully waterproofed roads of any country in the world, was not put forward so much as might have been the case.

It was interesting to converse with American engineers, who, on account of the importance of road development in America, are studying this question very closely, and to hear from them how much more they could learn by visiting our English roads than anywhere in France, at any rate near the capital. French engineers, although they have practised *goudronnage* to a considerable extent, have not been careful enough in excluding the ammoniacal liquor, and in many cases have put on the tar irregularly and in far too great a quantity; wherever this is the case softening in hot weather and slipping in wet weather is likely to follow.

Before the congress of last week closed the question of the next congress was talked of, and it appears likely to be held in Brussels in about two years' time.

As regards that section of the congress relating to the influence of the vehicles themselves on the road, some of the papers were very valuable; but curiously enough the French, who above all other nations were the first to appreciate the great advantages of large wheel diameter, in their draft resolutions fixing the maximum weights to be carried per unit width of wheel left out the important factor of the influence of wheel diameter, though, luckily, owing to the influence of the English-speaking delegates, it is probable this factor will be reinstated in the form in which it exists in our own very well-considered regulations issued by the Local Government Board.

## *SCIENCE AT THE UNIVERSITIES.*

THE proceedings at the academic ceremonies held in Oxford on October 8 to celebrate the fiftieth anniversary of the opening of the University Museum, described in our issue of last week, and especially the address delivered by the Vice-Chancellor, Dr. Warren, President of Magdalen College, may well serve as an encouragement to the older men of science who have for many years been unwearying in their insistence that science should occupy a high place of honour among the branches of learning cultivated at the universities. The statement of progress at Oxford during the last fifty years, which the Vice-Chancellor and Dr. Vernon Harcourt presented, should act as an inspiration to the present distinguished staff of scientific teachers to whom the world is looking to develop in connection with their university a centre of scientific activity unsurpassed at any ancient or modern seat of learning.

How complete the change of attitude towards science has been at Oxford may be gathered from the description of the state of things immediately preceding the building of the museum which the Vice-Chancellor gave at the beginning of his address:—

> Science was not a stranger to Oxford before the first stone of the museum was laid, but her existence was somewhat precarious and her progress intermittent. The period just before the establishment of the museum was, like the night before the dawn, a somewhat dark age. It is, I believe, recognised in physiological science that the history of the embryo repeats the history of the race. It appeared to be so with science at that time. She was then in the condition of the cave dwellers among primitive men. At any rate, she lived underground. Her teachers, like those of the early Church, wandered about in "caves and dens of the earth." There was a cellar under the Ashmolean where science was taught. If I remember right, my old friend, whom I much wish we could have seen here to-day, Prof. Story-Maskelyne, was both taught, and instructed himself, in that underground chamber. There was another cellar, or series of cellars, in Balliol College, where my wife's father, Prof. Brodie, used to pursue chemistry; but it would not be fair to represent this as the whole history of science in Oxford even at that time. Dr. Daubeny at my own college, Magdalen, and Dean Buckland, as he afterwards was, at Christ Church, had already done pioneer work. To-day things are very different. Natural science has now, as you will see this afternoon, a palace with many chambers and apartments, well and, it may be said in some instances, beautifully equipped. That is not everything, and will not alone

secure success. Much of the very best work, as we all know, in science has been done in very inferior quarters and with very poor appliances.

Dr. Warren's personal acquaintance with the work of the museum, extending as it does over about two-thirds of the fifty years of its existence, his well-known strong interest in natural science, and his full appreciation of the paramount influence the scientific method exerts on every form of human activity, make his sketch of the work accomplished by the great men of science who have been associated with the museum especially valuable. He said :—

I have seen the museum, then, and its work, growing and advancing for something over thirty years. I can recall the individual characteristics and work of the eminent professors who have served it in its different departments during this period, the brilliant zoological series of Rolleston, Moseley, Lankester, and Weldon, and the brilliant geological series of Philips, Prestwich, and Green. I can remember the introduction of physiology and the epoch-making advent of Sir John Burdon-Sanderson. All along the line there has been continuous, steady, and healthy growth. I do not know how the number of students or the departments of the museum now would compare with that of the numbers when I was an undergraduate. I will take one simple test. I find that in 1872, the year I came to Oxford, the number of names in the natural science honours list is ten. The number of names last term in the corresponding list is seventy-four, seven times as many. When I was an undergraduate the Oxford Medical School was a shadow of a mighty name. The medical student was a *rara avis*. My impression is that there was one, or at the most two, a year at Balliol when I was there, and in the whole University I should doubt whether there were a dozen. In the strict sense there were hardly any. That is to say, there was scarcely a student studying medicine in any of its branches within the University. Now all that is changed. We have been singularly fortunate in our series of medical professors, Sir Henry Acland, Sir John Burdon-Sanderson, Dr. Osler. It would be difficult to show a more brilliant trio or a trio more suited to complement and supplement each other's labours. I have always held, and I think that experience has justified the belief, that a strong medical school would be for the advantage of pure science in Oxford. Out of practical schools, if properly administered, research work grows, just as again research gives ever new life to practical studies. I think the same is true of practical studies like forestry, which we have recently introduced; agriculture, a still later introduction; and engineering, which I am rejoiced to think is just going to commence its work here. It will be seen, then, that science has made an immense advance in Oxford.

We welcome this advance, and we look forward hopefully to the future in store for science in the University of Oxford. We acknowledge frankly and gratefully that the serious Oxford student realises fully the beneficial influence which the earnest pursuit of the methods of scientific inquiry in a university has upon other studies. We know that many Oxford professors and students of other subjects acknowledge that the adoption of the methods perfected by men of science to problems in their particular domains have led to unprecedented results. But it is still true that the average Oxford man leaves his Alma Mater profoundly ignorant of the scientific method, and with a scarcely veiled contempt for natural knowledge; and it is the ordinary university man, who remains undistinguished from the academic point of view, who eventually exerts a predominating influence in Parliament, and in county and municipal affairs.

In his address the Vice-Chancellor dealt with these facts, and his wise words foster the hope that steps will be taken to ensure that no man ignorant of the fundamental principles of science shall leave his university with any sort of academic diploma.

With all this activity in its own field, natural science does not really affect, as it should, the minds of the rank and file of our able young students here. It is not brought home to them; they do not appreciate or understand it. They either still retain some of that old prejudice and contempt which regarded science at schools as an *extra* or a *fad*, or else they are indifferent to it. Some few years ago I remember Prof. Lankester complaining that our statesmen and public men generally reared in our public schools and at the old universities were insensible of, indifferent to, the claims of science. I think that while he spoke strongly, as he often does, I think he also spoke as he not seldom does, even when he speaks strongly, with reason. This ought not to be the case. It is the scientific attitude and frame of mind, the scientific outlook on the world, as a part of general culture, which is, I think, what is wanted in education, and particularly in Oxford education, to-day. Oxford has many great intellectual traditions. Some of them are less strong than they were, but they are still potent. The old scholastic tradition, partly theological, partly philosophical, partly logical, is still potent with us. Our predominating school, even if it is now only *prima inter pares*, is the philosophical school of *Literae Humaniores*. It affects insensibly and indirectly even those who never read for it. It is an admirable tradition. So again is the more literary tradition of our classical scholarship. I hope that these traditions will always be maintained. I think they do to some extent affect the scientific student here. I should like to see them affect him more than they do, and I believe that I should carry many of the leading men of science with me in that desire. But what I should also like to see is the classical and the literary, the philosophical and the theological student, more affected by science. I should like to see science an element in our general education both in our schools and in the universities, and we are told, and I believe it is true, that if we wish to have it in the schools, we must insist on having it in the university. It is not so much that I think the small amount of actual knowledge which would be acquired by the individual student would be of great value, but I think it would conduce to the creation of this general atmosphere which I desire to see created.

Fortunately it is becoming recognised increasingly that the object to be aimed at in every sphere and stage of education is the inculcation of the scientific spirit, a patient training in the methods of science, which leads a person, whatever the problem with which he is confronted, courageously to look facts in the face, and after a broad survey of the conditions so far as available processes of inquiry make possible, humbly to endeavour to trace the causes of the effects which have been accurately and honestly recorded. Science has before now been taught, not only in schools, but in the universities themselves, in such a manner as to obscure rather than elucidate the attitude of the true man of science, but the Vice-Chancellor made it clear that this danger is fully appreciated at Oxford. As he remarked :—

The real lessons of science do not, I think, consist in knowledge of facts. . . . They consist in the recognition of the importance of truth, of absolute scrupulous accuracy in matters great or small; that nothing happens without a cause and without a consequence; that matter, however mutable it may be, is indestructible; that the same elements, or many of them, as are found in our earth may be found, for instance, in the sun, and probably pervade the universe; that energy in the same way is imperishable; the general scientific conception of force, of atoms, of gravitation, of resistance, of mass, of proportionate combination, and of the methods by which these truths were discovered and can be again demonstrated—these are the things which ought to be part of our common heritage and knowledge. I hope the next era will see, not the decay or the obliteration of the old traditions, but the addition of the new.

Thus to urge the claims of science as a valuable instrument of education of the kind necessary to train

our legislators and administrators is in no way to belittle other kinds of knowledge. As the Rector of the Imperial College of Science and Technology said in a recent address, "the scientific man is, after all, first a man and then a man of science, nothing which leaves out of sight his obligation to rule his life in accordance with the highest standards of health, of religion, and of morals, can fairly be called a good education." The student of science, then, must not ignore that great body of humanistic learning which has always been held in high esteem at our ancient universities. There is every reason why the man of science should be so far as practicable also a man of letters. Humanists and men of science alike must remember, indeed they are remembering, that culture is something broader and higher than mediæval schoolmen imagined. The scholar steeped in classical lore, yet ignorant of nature and her laws, is, we are beginning to realise, an uneducated pedant. The specialist in science, sublimely unconscious of the beauties of literature, and knowing nothing of the ideas of ancient and modern poets and philosophers, is a hopeless Philistine. How much the man of science may learn from the man of letters, and how beneficial to scientific work the influence exerted by literature may be, the Vice-Chancellor showed convincingly towards the end of his address.

I think no less that the man of science has much to learn from the man of letters. It has certainly been the case that the best men, or many of the best men, of science have been men full of the love and spirit of letters, keenly sensible of the beauty and attraction both of poetry and of prose. It was the case, as we all know, with Huxley and with Tyndall. It was so with Helmholtz, whose intellectual relation to Goethe is a most interesting episode. The fact is not so generally recognised, but it was the case with Darwin. It may seem a paradox to say that Darwin was a "man of letters," but I am almost prepared to maintain it. Too much has been made of the well-known passage in his autobiography in which he describes how he lost, through atrophy, his love for poetry, and not enough has been made of the warmth and the keenness of that love in his earlier days. He was a boy at Shrewsbury in the ultra-classical days of that very classical school, and was rebuked by Dr. Butler, the headmaster, who called him a "*pococurante*" because he worked at chemistry. But he tells us that he was very fond at school of the "Odes" of Horace; and when we find him, in that delightful book, the "Voyage of the *Beagle*," quoting in a few consecutive pages lines from the "Third Aeneid" of Virgil and from Shelley in the most natural and spontaneous manner, I think we may assert that his love of letters was lively and deep, and likely to have a permanent effect on himself. I have always thought some of the pages of the "Origin of Species"—for instance, the concluding pages—among the most poetical pieces of prose in the English language, and I think the secret of that style is to be found partly in the hereditary gift of his family, and partly in the early cultivation which it received. Again, few things are more fascinating to the thinker than the history of early Greek philosophy—those wonderful guesses (afterwards passed on to the Romans) with which the Greek thinkers anticipated in an intuitive and in exact manner the theories and demonstrations of later science. I would have the student of Dalton familiar with the guesses of Democritus and their repetition by Lucretius, and familiar, if possible, with them in their place in history. I would have the student of Aristotle read Darwin, and the student of Darwin read, as Huxley did, his Aristotle.

Dr. Warren's address, as we have said, may well fill men of science with hope as to the future of our old universities. It has often been our duty to point out in these columns how the nation has suffered from the erroneous ideas which have prevailed at Oxford and elsewhere as to the educational needs of students destined to become members of Parliament or civil servants in high places. Again and again insistence has been laid on the fact that the kind of education suited to the conditions of the days of the Renaissance is not in harmony with present-day needs. The work of men of science in the last hundred years has revolutionised life, but it is only now that it is beginning to be understood that the education given by our universities and by our schools of every grade must be adapted to present and coming needs.

Recent years have witnessed in many of our great provincial cities the growth of new universities fired with modern ideals; universities which look to the union of the scientific spirit with all that is best in humanistic learning to produce men cognisant of modern needs and conditions, and fitted to grapple with the difficulties inseparable from the administration of a great empire. The increasing competition among the great nations for pride of place, whether in industrial warfare, in intellectual rivalry, or in the contest to secure the most satisfactory social conditions, will be decided eventually in favour of the people most able to apply the methods and conclusions of science. In other words, that nation will prevail which succeeds in best educating at its places of higher learning the men in whose hands its destinies must be placed.

These truths are understood at our new universities, and modern requirements are shaping their regulations, their courses of work, and their general administration. Dr. Warren's address leads us to believe that the aims and objects of the new universities are appreciated at Oxford, and that it is intelligently and completely known by the university authorities that no slackening of effort and no fainting by the way must be permitted in the work which has been so successfully begun of making Oxford a great scientific university.

## *FIBRES FOR PAPER-MAKING.*

THE Agricultural Department of the United States is investigating various fibrous waste materials with a view to their conversion into paper-makers' pulps or "half-stuffs." The *Times* of October 17 publishes a note giving some results of the experimental treatment of maize stalks, which are pronounced satisfactory.

The matter is of considerable importance. There exist a certain number of waste materials, such as megasse, cotton-seed hulls, flax and hemp straws of non-textile quality, which contain fibres useful for paper-making, and are available in concentrated areas in adequately large quantity to furnish "half-stuffs" in such volume as to be a serious factor in the determination of the world's supply, and therefore in controlling the ultimate cost of paper.

In considering these sources of supply, it is important to draw a sharp distinction between technical success and commercial success. All the above wastes have been, not once, but many times over, successfully worked up into papers of good quality. But for one reason or another the economic conditions for their industrial development have been lacking. A notable exception to this list of failures is the fibre of the cotton-seed hull. Within the last two years a definite industrial success has been recorded with this fibre, as the result of a treatment which is mainly mechanical. The fibre, purified from the adherent particles of shell, is now on the market under the name of "Virgo fibre."

Megasse, bamboo, and Para grass are being treated in Trinidad on practical lines; the half-stuffs and resulting papers are of remarkable quality, and the promises of industrial development are not unfavourable.

Flax and hemp straws constitute an attractive material, but all attempts to treat them on chemical lines have necessarily proved uneconomical. There is, however, every reason to expect that their successful exploitation, by the mechanical separation of their useful fibres in the districts where they are grown, is not far distant.

## NOTES.

THE 200th anniversary of the birth of Albrecht von Haller—anatomist, physiologist, botanist, and poet—was celebrated on Friday of last week by the unveiling of a statue in his native city of Berne. The celebration was made the occasion of a public holiday, and was participated in by the State and municipal authorities, as well as by the professors and students of the University. It was also attended by delegates from numerous universities and learned societies, especially those with which Haller had been connected, the Royal Society being represented by Dr. Arthur Gamgee and the Royal Society of Edinburgh by Prof. Schäfer. An account of the proceedings will be given in a future number of NATURE.

WE are glad to notice that the King has appointed a Royal Commission to make an inventory of the ancient and historical monuments and constructions connected with or illustrative of the contemporary culture, civilisation, and conditions of life of the people in England from the earliest times to the year 1700, and to specify those which seem most worthy of preservation. The commission is constituted as follows:—Lord Burghclere (chairman); Earl of Plymouth, C.B.; Viscount Dillon; Lord Balcarres, M.P.; Sir H. H. Howorth, K.C.I.E., F.R.S.; Sir John F. F. Horner, K.C.V.O.; Mr. E. J. Horniman, M.P.; Dr. F. J. Haverfield, Camden professor of ancient history in the University of Oxford; Mr. L. Stokes, vice-president of the Royal Institute of British Architects; Mr. J. Fitzgerald, assistant secretary to H.M. Office of Works; and Mr J. G. N. Clift, hon. secretary to the British Archæological Association. The secretary of the commission is Mr. H. Duckworth, 35 Charles Street, Berkeley Square, W.

M. HENRI POINCARÉ has succeeded the late M. Henri Becquerel as president of the French technical commission on radio-telegraphy, appointed by a decree of March 5, 1907.

M. VIOLLE has been appointed president of the Bureau national scientifique et permanent des Poids et Mesures of Paris, in succession to the late M. Mascart.

PROF. T. L. WATSON, professor of economic geology in the University of Virginia, has been elected director of the Virginia Geological Survey, and Dr. J. S. Grasty has been appointed assistant geologist.

WE are requested to state that the annual "fungus foray" of the Essex Field Club will be held at Theydon Bois, Epping Forest, on Saturday, October 31. Mr. George Massee, of the Kew Herbarium, will act as principal referee, assisted by many botanists. Any botanist wishing to attend the meeting should write to Mr. W. Cole, hon. secretary, Buckhurst Hill, Essex, who will be glad to send programmes.

THE Gunning prize, 1908, having the value of about 40*l.*, will be awarded for an essay on "The Attitude of Science towards Miracles." The last day on which essays can be received for competition is March 31, 1909. Full particulars of the conditions can be obtained from the secretary of the Victoria Institute, 1 Adelphi Terrace House, London, W.C.

THE death is announced of Prof. Adolf Wüllner, at Aix-la-Chapelle, at the age of sixty-three years. Wüllner was known for his work on the specific heat of liquids and gases, vapour tension, refractive indices, and the variability with temperature and pressure of absorption and emission spectra. He was the author of a standard "Lehrbuch der Experimentalphysik," which reached a fifth edition.

THE death is announced of Mr. R. B. Smith in his seventieth year. Mr. Smith was formerly an assistant-master in Harrow School, and was a keen field naturalist. Among his published works is one entitled "Bird Life and Bird Lore," containing a number of interesting articles upon birds and their habits.

THE fourth annual fossil-hunting expedition of Amherst College, Massachusetts, has just returned from a successful visit to the plains of Wyoming and Nebraska. It has collected between 3000 and 4000 Indian relics, a full skeleton of an extinct species of camel, parts of a skeleton of a huge rhinoceros, the jaws of a prehistoric dog, and other bones of the progenitors of the horse, dog, camel, cat, deer, beaver, peccary, &c. The expedition was led by Prof. Frederick B. Loomis.

PROF. G. HELLMANN, president of the German Meteorological Society, asks us to announce that a prize of three thousand marks (150*l.*) is offered by the society for the best essay upon the meteorological results obtained in the exploration of the atmosphere by the international kite and balloon ascents. The prize is open to all nationalities, but the essays must be written in German, French, or English, and must be sent in before December 31, 1911. Further particulars can be obtained from Prof. G. Hellmann, Berlin W. 56, Schinkelplatz 6.

WE learn from the *Times* that an International Fire Prevention Conference was opened on October 14 at the Conservatoire of Arts and Crafts, Paris. The conference has had under consideration the formation of a permanent French fire and accidents prevention committee, resembling the British Fire Prevention Committee, and the equipment of a testing station near Paris. Numerous technical matters relating to fire protection have been discussed, including the standardisation of the preventive measures of the European countries.

A SHORT time ago we directed attention to an appeal for a fund, formed under the auspices of Mr. H. M. Taylor, F.R.S., of Trinity College, Cambridge, with the object of assisting in the publication of works of a scientific nature in embossed type for the use of the blind. The sum of about 525*l.* was subscribed, and the managers of the fund have agreed that the first three books in the publication of which they undertake to assist shall be "Sound and Music," by Mr. Sedley Taylor; "A Primer of Astronomy," by Sir Robert Ball, F.R.S.; and "An Introduction to Geology," by Dr. Marr, F.R.S.

THE council of the Royal College of Surgeons at its quarterly meeting on October 16 adopted resolutions which will in future admit women to the examinations of the conjoint examining board in England, to the examination for the diploma in public health, to the examinations for the fellowship, and to the examinations for the license in dental surgery. This decision brings to an end an agitation which has been carried on for some twelve or

thirteen years. The next steps are to arrange the necessary alterations of the bye-laws and to secure the approval by the Privy Council and the Home Secretary of the revised bye-laws.

THE report for the year of the English branch of the League for the Preservation of Swiss Scenery was presented at the general meeting held at the Royal Society of Arts on October 21. The report shows that there has been no slackening of the league's efforts in the direction of securing the preservation of the beauties of the Alps. The society has caused the circulation of a petition against the Matterhorn Railway, and has obtained nearly 70,000 signatures to the protest. Steps have been taken to formulate a scheme of protected areas. Opposition is to be offered to the proposed mode of constructing the railway through the Schöllenen Gorge by iron bridges, which would destroy the charm of the Teufelsbrücke. It is proposed, if possible, to prevent the sale abroad of the important collection at St. Moritz, illustrative of Swiss life and culture during four centuries, known as the Engadiner Museum. The league is keeping itself informed of the concessions applied for, and taking all possible steps to prevent needless and unprofitable interference with the grandeur of Swiss mountain scenery.

WE regret to see the announcement that Dr. Daniel C. Gilman, first president of the Johns Hopkins University, Baltimore, and afterwards head of the Carnegie Institute, Washington, died on October 14 at Norwich, Connecticut, at seventy-seven years of age. Educated first at Yale and then at Cambridge and Berlin, he was in 1856 appointed professor of geography in Yale University. He became president of the University of California in 1872. Five years later he went in the same capacity to the Johns Hopkins University. His work there, which lasted until 1901, secured him a place among the foremost American educators. In 1891 Dr. Gilman left Baltimore for Washington, where he spent three years organising the Carnegie Institute. In addition to the work of his various university appointments, Dr. Gilman was appointed by President Cleveland to act as commissioner in the Venezuela and British Guiana boundary dispute. He acted also as executive officer of the Geological Survey of Maryland. He was president of the American Oriental Society, and a prominent member of various learned societies and institutions. His many publications include a memoir of Dana the geologist, and "Science and Letters in Yale University."

WE regret to see the announcement of the death of Lieut.-Colonel Charles Thomas Bingham, late Bengal Staff Corps and Conservator of Forests, Burma, in his sixty-first year. During his long residence in India and Burma, he devoted much of his attention to natural history, and formed large collections, which he distributed liberally among museums and private naturalists, both in India and England, and many recent works on the natural history of India and Burma were largely based on these collections. Colonel Bingham interested himself greatly in all branches of natural history, and his earliest papers on the subject which we find noticed relate to birds, and were published in "Stray Feathers" from 1876–81. In some of these early papers he was assisted by the late Allan Hume. At a later period Colonel Bingham gave most of his time and attention to insects, especially Hymenoptera and Lepidoptera. From 1894 onwards a long series of important papers on Hymenoptera, chiefly those of the Indian region, appeared in various journals, and in 1897 and 1903 two volumes on the Hymenoptera of India, Ceylon, and Burma in the "Fauna of British India." These included the wasps, bees, ants, and cuckoo-wasps. On Colonel Bingham's final retirement from his official work he settled in London, devoting all his time and attention to his two favourite authors. In 1905 appeared the first volume on butterflies in the "Fauna of British India," and when, shortly afterwards, Dr. Blanford died, he was succeeded by Colonel Bingham as general editor of the series. In 1907 appeared the second volume on butterflies, and Colonel Bingham was engaged in the preparation of the third and concluding volume at the time of his death. He will be widely regretted by all who knew him, not only as a great naturalist, but also as a dear and valued friend.

THE inaugural meeting of the winter session of the London School of Tropical Medicine was held at the Royal Society of Medicine on October 14, under the presidency of Lord Crewe. The secretary reported that 849 students had passed through the school since its opening in 1899. Lord Crewe in his address alluded to the part taken by Mr. Chamberlain in the foundation of the school, to the interest of the Colonial Office in the schools of tropical medicine, and the important work these were doing for the State in fighting the scourge of disease in tropical countries. Sir Clifford Allbutt also addressed the meeting, dealing with variation in disease, the distribution of disease by traffic, and the importance in infection of the reaction of the host towards the parasite. Sir Patrick Manson, in moving a vote of thanks to the chairman and Sir Clifford Allbutt, said that the profession as a whole has had an enormous leavening by the students of tropical medicine. There is great difficulty in imparting even to the post-graduate mind anything like a knowledge of tropical medicine by a three months' course. Nothing is so gratifying as the support of the Government for the school. There is now a scheme on foot to attack one of the gravest medical problems affecting the inhabitants of the tropical world, namely, ankylostomiasis, a disease which, in consequence of the enormous number of people affected, is one of prime importance.

MANY naturalists will regret to learn that Mr. W. Saville-Kent died at Bournemouth, on October 11, from heart disease following an operation. Mr. Saville-Kent will perhaps be best remembered by his sumptuous work on the Great Barrier Reef of Australia, published in 1893. The remarkable photographs reproduced in that volume were unique in their beauty, and with the text they provided the scientific world with extensive and accurate information about coral reefs as represented by the largest existing coral structure. Mr. Saville-Kent also devoted great attention to oysters and oyster fisheries of Queensland, and in his presidential address to the Royal Society of Queensland in 1890 he urged the establishment of a well-appointed biological station on Thursday Island, which is the central depôt of the Torres Straits pearl and pearl-shell, and the *bêche-de-mer*, fisheries. In 1892 he exhibited at the Royal Society his photographs and colour sketches of coral reefs, coral animals, and the marine fauna generally of the Great Barrier district of Australia. He showed at the same time a pearl of fine quality and considerable size that he had caused the mother-of-pearl shell animal to produce by means of a delicately manipulated operation on the living animal. While engaged in 1893 as Commissioner of Fisheries to the Government of Western Australia, Mr. Saville-Kent sent to London a large collection of the stony corals peculiar to the

Australian coast-line. These specimens, added to the extensive series indigenous to the northern and eastern districts of Australia previously contributed by him to the Natural History Museum, constitute the most complete collection of Australian Madreporaria yet brought together. We understand that in recent years Mr. Saville-Kent's attention was given to the artificial cultivation of pearls in the large pearl-oyster.

OCTOBER 17 was the 300th anniversary of the election of Francis Bacon as treasurer of Gray's Inn. The tercentenary celebration took the form of a luncheon at the inn, when the Benchers entertained a party of distinguished guests. The first night of term, November 2, is to be observed by the members of the inn as a Bacon anniversary, and later a marble statue of Bacon is to be erected in one of the open spaces of the inn. Mr. Duke, K.C., the treasurer, presided at the luncheon, and the American Ambassador was the principal guest. Among the party were Sir C. Allbutt, F.R.S., Sir Robert Ball, F.R.S., Sir J. Dewar, F.R.S., Prof. Frankland, F.R.S., Sir W. Huggins, K.C.B., O.M., F.R.S., Sir William Ramsay, K.C.B., F.R.S., Sir Henry Roscoe, F.R.S., Lord Strathcona, F.R.S., and other men of science. In proposing the toast to "The Immortal Memory of Francis Bacon," Mr. Duke dwelt at greatest length upon Bacon's connection with the legal profession, though he referred to his contributions to science and literature. The American Ambassador, in responding to the toast of "Our Guests," said:—"No man ever held a more extraordinary position than Bacon. It had been given to very few men in the world to change the whole intellectual current and tendency of their age and of succeeding ages. The whole effect of what had been called the Baconian philosophy was, according to his own statement of it, to look for fruit. It was essentially practical; and one of his acutest critics had said of him, his philosophy began in observation and it ended in words."

PARTICULARS of the auroral display on September 29, as seen by Mr. J. H. Elgie from Roundhay Park, Leeds, are given by him in *T.P.'s Weekly* of October 15. "Shortly before nine o'clock a fan-shaped series of auroral streamers appeared under the western side of Boötes and the tail of the Bear. One magnificently defined shaft of light immersed Cor Caroli, which glittered vertically under the star at the tip of the Bear's tail. Cor Caroli was almost extinguished. For about an hour after that the northern sky remained quiescent, but that mystical glow continued. So light, indeed, was it, that at 9.25 I could distinctly see the time by my watch. The last of the display occurred at five minutes past ten, when a very beautiful streamer pierced Corona Borealis, and when it had died out the luminous suffusion died out with it." The display was referred to in a note which appeared in NATURE of October 8 (p. 575) upon two magnetic storms observed at the National Physical Laboratory.

A COMPLETE change of weather has set in over the British Isles during the past week, and the temperature has fallen lower than at any time during the present autumn, the day and night readings towards the close of the period being in fair agreement with the average conditions for the time of year. For the first half of the present month the mean temperature in London was about 10° above the normal, and other parts of the country were similarly warm. Rain has now fallen in most parts of the United Kingdom, but the remainder of the month will have to be exceedingly wet if October is to have its normal rainfall. In London the aggregate measurement of rain for the forty-two days from September 4 is 0·51 inch, whereas the average for October is 2·73 inches. At Spurn Head the total rainfall this month to October 20 is 0·16 inch, whilst the average is 2·26 inches. At Nottingham the aggregate to October 20 is 0·28 inch, at Dover 0·31 inch, and at Jersey 0·38 inch. A region of high barometer readings has maintained a fairly fixed position over north-west Europe, and this has fended off the inroads of the moving disturbances from the Atlantic, compelling them to follow a more northerly track than usual. The type of weather, however, seems to be gradually assuming the conditions normal to autumn, and lower temperatures may now occur at any time.

THE celebration of the tercentenary of the birth of Torricelli, to which we referred on July 9, ended on October 15. The following notes may be of interest to some of our readers; for amplification of them we may refer to meteorological text-books, and more particularly to Prof. Hellmann's article on the origin of meteorological observations and instruments in *Himmel und Erde* (vol. ii., parts iii. and iv.). Torricelli, the discoverer of the "Torricellian tube," afterwards called the barometer by the Hon. R. Boyle, received his first education at Faenza, and continued it at Rome. Some of his works on mechanics having attracted the attention of Galileo, the latter invited him to Florence, where he became the pupil of that great master. The constructors of a pump for the Duke of Florence having applied to Galileo for an explanation of the reason of the water not rising higher than about 32 feet, his cynical reply was that "nature abhors a vacuum"; but this reply apparently did not satisfy him. After Galileo's death Torricelli took up the subject, and assuming that the real cause of the water rising was the pressure of the air, he hit upon the idea of substituting mercury for water, and communicated his plan to his friend Viviani, who first carried out the experiment in 1643, and obtained similar results (allowing for difference of density). After this experiment Torricelli immediately declared the true cause of the phenomenon; in 1644 he also stated that the instrument would show certain variations in the weight of the air. The actual experiment of the decrease of pressure with altitude was made by Perrier on the Puy de Dôme in 1648, at the request of Pascal. Apparently Torricelli, who died in 1647, was too much occupied with his mathematical studies to take up the ultimate improvement of the instrument, which at that time had only an arbitrary scale.

IN the October number of *British Birds* reference is made to the occurrence in Romney Marsh, at no very great distance from Lydd, of three American kill-deer plover in April last. All were shot. These bring the number of British-killed specimens to six; there is no reason to doubt that these were truly wild birds.

FISHES from Hawaii and Fiji form the subject of a paper by Dr. D. S. Jordan and Miss Dickerson published as No. 1625 of the Proceedings of the U.S. National Museum. A flying-fish is described as new, while *Scomber brachysomus* is made the type of the new genus Rastrelliger.

AN interesting communication on the systematic position of the Palæozoic brachiopods of the genus Camarophorella is given by Mr. J. E. Hyde in the Proceedings of the Boston Society of Natural History (vol. xxxiv., No. 3). Hitherto the single known representative of the genus has been associated with Pentamerus, but the discovery of a second species enables the author to state that this is incorrect, its real affinities being with Meristella.

IN the annual report of the Sydney Technological Museum for 1906, a copy of which has just reached us, attention is specially directed to the building stones and ornamental marbles of New South Wales, which are stated to be fully equal to those of any other part of the world, although at present only a small portion of them is worked. A large series of specimens is exhibited in the museum. The report also refers to the exhibits sent by the Sydney Museum to the New Zealand International Exhibition of 1906.

ALMOST entirely new ground appears to have been covered, so far as the alcyonarian zoophytes are concerned, by the dredging of the U.S. Fisheries steamer *Albatross* in Hawaiian waters in 1902. According to an account by Prof. C. C. Nutting, forming No. 1624 of the Proceedings of the U.S. National Museum, out of sixty-eight species of these organisms collected in those waters during the cruise, no fewer than thirty-nine proved to be new. The order Gorgonacea, as might have been expected, was the most abundantly represented, comprising forty-seven species, while the Alcyonacea, which are chiefly Arctic, although abundant in Australian waters, comprised but five.

THE agricultural departments in the various sugar-producing countries are doing a great amount of work on the sugar-cane, and much confusion has arisen in the nomenclature of the many varieties now in cultivation, so that two stations may be working on one and the same variety under totally different names. By way of directing attention to this state of affairs Messrs. Deerr and Eckart recently issued a report from the experiment station of the Hawaiian Sugar Planters' Association giving lists of synonymous canes and discussing the origin of some of the better known varieties. There are numerous references to the literature of the subject, and the report promises to serve a very useful purpose.

IN Bulletin No. 66 of the Agricultural Experiment Station of New Mexico, attention is directed to a very important factor in connection with the fertility of the soil in countries where intense farming is not yet practised. It is well known that excessive cattle grazing is injurious for several reasons. The herbage deteriorates in value. The kinds of grass or other plants preferred by the animals get eaten before they have time to seed, and therefore die out, leaving only less valuable plants. The soil becomes so compacted by the treading of the animals, especially in the neighbourhood of the drinking places, that rain-water will not sink in, but flows over the surface in time of storm. Direction is given to the flow by the paths trodden by the animals, and from these small beginnings a great amount of land erosion may take place, with much consequent injury to the agricultural prospects of the country.

A PAPER of considerable interest dealing with the embryology of *Gnetum gnemon* is contributed by Prof. J. M. Coulter to the *Botanical Gazette* (July). The author fails to confirm the development, as described by Lotsy, of a compact tissue in the antipodal end of the embryo-sac, but observed a definite pavement tissue below the sac. The paper also contains details that were wanting of the early stages of the embryo. A long branched suspensor-like development of the fertilised ovum is formed, at one end of which a cell is cut off that gives rise to the embryo.

ARISING out of his extensive studies of African floras, in the course of which he has had occasion to note very numerous plant associations, Dr. Engler has sought to devise a general system of symbols for indicating plant formations in tropical and subtropical countries on maps or charts. The colour schemes present the most fundamental and important features. Generally, brown is used to signify saline habitats, green represents verdure and moisture, yellow the partially dry localities, red infers a high altitude, and black signs indicate very dry conditions. Dr. Engler's explanation, together with a chart of his proposed symbols, is published in his *Botanische Jahrbücher* (vol. xli., part v.).

IN the *Economic Journal* for September, under the title "Appreciations of Mathematical Theories," Prof. F. Y. Edgeworth discusses certain mathematical aspects of the much debated problem of "free trade" in a criticism of previous papers and reviews by Mr. Bickerdyke.

UNDER the auspices of the faculty of science of the University of Rome, a movement was set on foot to commemorate the contributions to physical science of Prof. Alfonso Sella, who died on November 25 of last year. A marble bust of Prof. Sella, by M. Ezekiel, was unveiled on June 9 of this year in the presence of a large number of subscribers and representatives of different universities, and a small memorial pamphlet has been published (Rome: G. Bertero and Co.) containing an account of the proceedings and a list of Sella's works.

IN issuing a supplementary list of drawing cases, &c., Mr. W. H. Harling, Finsbury Pavement, London, E.C., has taken the opportunity to send out a pamphlet dealing with slide rules. The brochure, in addition to giving prices and illustrations of instruments, explains the theory and use of the slide rule, and should prove of service to purchasers of this useful aid to calculation.

WE have received a very complete catalogue of bacteriological apparatus, surgical appliances, and hospital sundries from Messrs. Townson and Mercer. Many of the illustrations of the more complicated pieces of apparatus are accompanied by full descriptions and practical hints for using the instruments. In fact, some pages, like those concerned with biological incubators, read like parts of a laboratory manual. The catalogue, which is well produced, is arranged in such a manner that reference to it is easy and expeditious.

MESSRS. WRATTEN AND WAINWRIGHT, LTD., of Croydon, have issued a descriptive list of photographic dry plates, filters, and safelight screens they are prepared to supply. The catalogue directs special attention to the new X-ray plate, and in describing the many kinds of plates manufactured by the firm gives many useful, practical hints to enable photographers to secure the best results. Among other photographic requisites dealt with in the list may be mentioned screens, both orthochromatic and contrast; a series of safelights to give the greatest possible intensity of light with reasonable safety; and dark-room lamps.

A NEW list of meteorological instruments has been published by Messrs. C. F. Casella and Co., Rochester Row, S.W. Among new instruments described in the catalogue are some interesting forms of rain gauges. The "insulated Snowdon rain gauge" is of simple construction, and in it provision is made to protect the collected rain from freezing in winter and evaporation in summer. The "totalising rain gauge" is of the self-registering kind, and the principle underlying its construction is that of the tilting bucket, and it is claimed that a great advance has been made in the registering mechanism. The catalogue also includes a description of "Mountain's recording rain gauge," and particulars of balloons, kites, and accessories for the investigation of the upper atmosphere.

## OUR ASTRONOMICAL COLUMN.

COMET MOREHOUSE, 1908c.—A new ephemeris for comet 1908c, computed from the following elements and covering the period October 8 to December 7, is published by Herr Ebell in No. 4276 of the *Astronomische Nachrichten* (p. 61, October 9); these elements were calculated by Prof. Kobold, and appeared in No. 4275 of the same journal :—

T = 1908 December 25·8116 (M.T. Berlin).
$\omega = 171^\circ\ 39'\ 41''.7$
$\Omega = 103^\circ\ 11'\ 56''.7$ } 1908·0
$i = 140^\circ\ 11'\ 7''.4$
$\log q = 9.975278$

According to the new ephemeris, the comet will attain its greatest brightness on October 24, and will then be about 5·6 times as bright as when discovered.

From notes in the *Gazette astronomique* (No. 10, p. 78) we learn that the comet was seen with the naked eye by several observers, at Antwerp, on September 29, the estimated magnitude of the head being 6·2, whilst the tail was 2° in length.

On October 18, at 8 p.m., the comet was seen as a naked-eye object at Chiswick, whilst with a 1½-inch opera-glass, magnifying three times, it was quite a good object on October 14 and 18, the direction of the tail being made out quite easily. Photographs taken at the Solar Physics Observatory, South Kensington, with the 36-inch reflector and the 6-inch Dallmeyer camera, show that the tail is a complex structure of some five or six streamers.

COMET TEMPEL$_2$-SWIFT, 1908d.—Observations of the apparent position of comet 1908d were made at the Nice Observatory on September 29 and 30 and October 2 and 3 by M. Javelle, using the large equatorial of 760 mm. aperture, and M. Giacobini, using the equatorial *coudé* of 400 mm. aperture.

Comparing the observed apparent positions with the ephemeris positions (T = September 30·88) given by M. Maubant in No. 4269 of the *Astronomische Nachrichten*, it is seen that the corrections to the latter are about −14m. and +1° 24′. A further extract from the ephemeris is given hereunder :—

*Ephemeris 12h. M.T. Paris.*

| 1908 | α h. m. | δ ° ′ | log r | log Δ |
|---|---|---|---|---|
| Oct. 20 ... | 8 20·5 ... | +26 18·9 ... | 0·0719 ... | 9·8501 |
| 24 ... | 8 32·7 ... | +25 13·2 ... | 0·0762 ... | 9·8524 |
| 28 ... | 8 43·9 ... | +24 7 1 ... | 0·0812 ... | 9·8544 |
| Nov. 1 ... | 8 54·1 ... | +23 1·5 ... | 0·0867 ... | 9·8562 |

The positions determined at Nice are published in No. 4276 of the *Astronomische Nachrichten* (p. 61, October 9).

A BRIGHT METEOR.—Mr. Denning writes :—"I saw a conspicuous meteor on October 14 11h. 3m., =first magnitude, shooting exactly from β Andromedæ to between β and η Pegasi. Bright streak. The meteor was evidently an early Orionid, as the direction is from the usual radiant point at 91°+15°.

"I think this well-known October shower continues from the 9th to the 29th of the month, and I have never been able to trace the slightest change of position in the radiant, though I have watched the display very closely with the special purpose of ascertaining whether or not any displacement occurs."

VORTICES IN THE SUN'S ATMOSPHERE.—In No. 10 of the *Comptes rendus* M. Deslandres discusses the "long flocculi," or filaments, shown on spectroheliograms in the neighbourhood of sun-spots and disturbed regions. From a study of the spectroheliograms taken at Meudon, combining the results obtained with the spectroheliograph with those obtained with an instrument indicating the radial velocities of the particular solar vapours observed, he arrives at the conclusion that the filaments are in reality *tourbillons* with horizontal axes, parallel to the solar surface. Six drawings, from photographs, accompany the paper, and show the extent and direction of some of these filaments on various dates. In some cases the actual filaments are accompanied by "*alignements*," and are continuations or sections of them, whilst in others similar alignments are shown alone. In general, the latter are double and approximately parallel, including between the components an area a little less bright than the surrounding regions. These alignments generally intersect at faculic areas, and, if the latter be considered as cyclones having vertical axes, it is comprehensible that the former mark the lateral inrush of solar vapours to the cyclonic area. M. Deslandres considers that when the vertical movement is the more intense a spot is formed, and when the horizontal motion is the greater a dark filament, such as shown on Prof. Hale's recent photograph, results. He further urges the importance of a consistent research on these lines, and suggests that the results may prove valuable in the solution of problems relating to analogous movements in the terrestrial atmosphere.

THE ORBIT OF 42 COMÆ BERENICES (Σ 1728).—New elements of the orbit of the binary system 42 Comæ Berenices are published in No. 4276 of the *Astronomische Nachrichten* (p. 55) by Dr. Doberck. This system is of special interest, as the apparent motion is in a straight line, the plane of the orbit lying in the line of sight. Dr. Doberck finds that the period is 25·335 years, and that the eccentricity of the orbit is 0·4965, the apparent length of the semi-major axis being 0″·674.

THE RIO DE JANEIRO OBSERVATORY.—From the Minister of Industries we have received a copy of the "Annuario" published by the Rio de Janeiro Observatory for the current year. The volume contains a number of useful tables relating to astronomical and meteorological reductions, several calendars, tables for the conversion of measures from one system to another, and tables relating to cosmical physics, general physics, and chemistry.

## THE FIRST INTERNATIONAL CONGRESS ON REFRIGERATION.

IN an assembly which included ministers of railways and of agriculture, professors of physics, cold-storage engineers, fishery experts, fruit importers, and traffic managers, one naturally expected a very varied type of communication. A considerable portion of the available time was devoted to questions of such general importance as the settlement of units and the various legal matters in which cold storage, transport, and similar questions are getting involved. There were also a large number of purely scientific papers dealing with the production of cold, the determination of conductivity, and similar problems. Prof. H. K. Onnes gave, by special request, an account of his recent work on hydrogen and helium. He was followed by Prof. Mathias, who pointed out that, in the determination of the critical volume by his well-known straight-line law, substances did not follow, as a whole, the law of corresponding states. However, when divided up into groups, the correspondence was very perfect in the group. Prof. Onnes expressed the view that the divergencies must be ascribed to a difference of compressibility of the molecules themselves, or to a different distribution of potential round them. M. R. Pictet opposed strongly the view of ascribing an apparent volume to the molecules, and gave an interesting paper on the uses of low temperatures.

M. J. Becquerel communicated some of the results of the magneto-optic measurements he has made recently at Paris and Leyden. Particular interest was taken in the discovery of a phenomenon, resembling Zeeman's, in solutions and crystals. As a consequence, the section suggested that the nations should unite to construct a large electromagnet without iron to study such questions more effectively.

Oxygen is made from air in considerable quantities in Paris now by the Linde and the Claude processes. In principle there is not much difference, Linde employing pressures of about 60 kg. and Claude 20 kg. per sq. cm. There is a more economical distribution of pressure in the Claude method, a process which admits of the collection of nearly pure nitrogen. By an extension of the same method Claude is able to obtain neon and helium from the atmosphere, which is an interesting application of the principle of continuous fractional distillation for the purpose of obtaining what may be considered as traces of impurities.

It is arranged that an international bureau will be established for the purpose of regulating investigation and promoting uniformity in the methods of testing both machinery and products under the action of cold. The necessity of some such bureau was conclusively shown in the discussion on units. Certain people were desirous of introducing other than the C.G.S. units, and of stereotyping such units as the "frigorie" by a definition other than the present one of a negative calorie. It was felt, however, that these questions were too large for the section to discuss, and impossible for a full congress, so that they were left for the projected commission or bureau.

A question of prime importance in connection with the congress is that of a knowledge of the properties of the various non-conductors of heat used in practice. Up to the present most of the determinations published have been either on too costly materials or else on common materials in other conditions than those used in practice. The determination of coefficients of conductivity is one of no small difficulty, and an interesting review of various methods was given by Mr. W. D. A. Bost. A large series of careful measurements of the coefficients of conductivity of material in the form of thin plates has been made by M. A. Desvignes, using Lodge's modification of Forbes's method. Since the temperature coefficient for such bad conductors appears to be very small, the error introduced by applying such numbers to temperatures lower than the ordinary at which they were determined can only be one or two per cent. Much greater uncertainty is introduced owing to the different physical conditions of materials in practice, and also to the length of time before materials of considerable thickness really arrive at a steady state with regard to the flow of heat, and thus come into the condition in which the coefficients determined as above are applicable. From his own measurements Mr. G. Voorhees stated that as much as six days was necessary, even with thicknesses of the order of a decimetre, before the conductivity was proportional to the thickness. Again, nearly all non-conducting walls are composite, either being built up by bricks or slabs, or in several layers with an air space between, or both combined. The conductivity is thus much more complicated, and it is very questionable whether any satisfactory conclusions could be arrived at without more complete investigation on these various questions.

On the production of cold there were several interesting papers describing the various methods used and summing up their efficiency.

New elements were introduced by the description of a novel rotating machine using sulphur dioxide, invented by M. Singrün. In this machine the outside of the hermetically closed condenser is kept in continual rotation, the inner parts being hung and kept in place by their weight. Some small machines were in actual work, and certainly produced ice very rapidly and easily with an apparently small consumption of power; but no figures were given or indicators used to show exactly what was happening. There seems no doubt that the principle is new and most useful for small machines, as there is little lubrication and no taps to get out of order. In the case of the usual compressors, considerable economy can be gained by the use of the multiple-effect method. In this case the same cylinder is used for two or more pressures at the same stroke by a proper system of ports and connections. The result is that the usual indicator diagram, which has a very sharp peak, for such machines, is much broadened there, and the same plant has thus a considerably higher working value.

The sections devoting themselves to the application of refrigeration to food were concerned with the construction of cold stores of all descriptions, about which there was nothing of general interest. The effect of different degrees of cold and humidity is being studied very carefully by the United States Department of Agriculture, and some of the results were given by Miss E. Pennington. Experiments on chickens varied in length from a few hours to four years, both on chickens bought in the open market and with those the history of which was known. It was found that, as would be expected, the various bacilli were more numerous in the former class, and their numbers appeared to increase up to about a year, and then to decrease. Even at the end of four years there were some living. These long periods are not often employed in practice, about five months being the average at present. Very interesting photomicrographs were exhibited showing the gradual breaking down of the muscles, owing to the intrusion of foreign matter which increased with the time. In some cases the breakage was sharply at right angles to the muscle, which rendered the material very brittle. The material was also examined chemically, the changes which occurred being much greater in the open market class, and all tend to prove that the action is due to enzymes and not to bacteria. The loss of water, though great, was not of any dietetic importance, though it would affect the commercial value, but this might be controlled to a large extent.

One interesting point was the occurrence of mould at the end of very long terms. There seemed no reason to suppose that the mould had appeared after removal from the cold store, as the time was so short before examination. This is important in connection with the present position of the authorities in England and France with regard to moulds, those on rabbits and meat being assumed to render them unfit for food, while they are allowed on hams, &c.

Similar investigations on a less elaborate scale, with other food-stuffs and either frozen (−9° C. to −12° C.) or chilled (−1° to −2° C.), were given by other investigators. The results point to the necessity of finding the most suitable temperature for each material and of care in thawing, and also of using pure water for this proceeding. Under modern conditions and for reasonable times, there seems to be no appreciable decrease in the nutritive effects of food materials due to refrigeration; in fact, many harmful parasites are less likely to be present in frozen than in unfrozen meat and other foods.

In the production of flowers for market it is of great advantage to be able to have them as early as possible. It appears that in many cases the time of flowering can be advanced nearly two months by checking the foliage at a critical time. The investigations are only in their infancy, but promise very important results.

The use of dry air is of importance in many industries at the present time, and the employment of considerable cold appears to be the most convenient and economical means of obtaining it. This is markedly the case in the production of pig-iron in the blast-furnace, where the usual amount of humidity in the air leads to a considerable loss. It is said that by reducing the humidity to 6 grains per cubic foot, an increase of output of 26·4 per cent. and a saving of fuel of 13·4 per cent. has been obtained.

In the section devoted to legislation it became clear how extremely important it now is to have united effort in refrigeration matters, and its great importance to the British Empire was emphasised. In view of this importance it is remarkable, and entirely characteristic, that the British Government, in marked distinction to other countries, paid no attention to the congress.

In addition to the sectional meetings, congress lectures were given by Profs. von Linde and d'Arsonval. The former enlarged on the use of cold in dwelling houses, and took as his text the saying that the use of cold would advance civilisation in the tropics in a manner similar to that in which the temperate regions had been advanced by the employment of means of heating. Prof. d'Arsonval lectured on the science and industry of cold, reviewing our present position, and in this way closed a successful congress, in which nearly 4000 people, drawn from the whole world, took part.

It was decided to hold the next congress at Vienna in 1910, after which they will be triennial.

## *LOCAL ASSOCIATIONS FOR PROMOTING EUGENICS.*[1]

I PROPOSE to take the present opportunity of submitting some views of my own relating to that large province of eugenics which is concerned with favouring the families of those who are exceptionally fit for citizenship. Consequently, little or nothing will be said relating to what has been well termed by Dr. Saleeby "negative" eugenics, namely, with hindering the

[1] Address to a meeting of the Eugenics Education Society at the Grafton Galleries, on October 14, by Francis Galton, F.R.S.

marriages and the production of offspring by the exceptionally unfit. The latter is unquestionably the more pressing subject of the two, but it will soon be forced on the attention of the legislature by the recent report of the Royal Commission on the Feeble-minded. We may be content to await for awhile the discussions to which it will give rise, and which I am sure the members of this society will follow with keen interest, and with readiness to intervene when what may be advanced seems likely to result in actions of an anti-eugenic character.

The remarks I am about to make were suggested by hearing of a desire to further eugenics by means of local associations more or less affiliated to our own, combined with much doubt as to the most appropriate methods of establishing and conducting them. It is upon this very important branch of our wide subject that I propose to offer a few remarks.

It is difficult, while explaining what I have in view, to steer a course that shall keep clear of the mud flats of platitude on the one hand, and not come to grief against the rocks of over-precision on the other. There is no clear issue out of mere platitudes, while there is great danger in entering into details. A good scheme may be entirely compromised merely on account of public opinion not being ripe to receive it in the proposed form, or through a discovered flaw in some non-essential part of it. Experience shows that the safest course in a new undertaking is to proceed warily and tentatively towards the desired end, rather than freely and rashly along a predetermined route, however carefully it may have been elaborated on paper.

Again, whatever scheme of action is proposed for adoption must be neither Utopian nor extravagant, but accordant throughout with British sentiment and practice.

The successful establishment of any general system of constructive eugenics will, in my view (which I put forward with diffidence), depend largely upon the efforts of local associations acting in close harmony with a central society, like our own. A prominent part of its business will then consist in affording opportunities for the interchange of ideas and for the registration and comparison of results. Such a central society would tend to bring about a general uniformity of administration the value of which is so obvious that I do not stop to insist on it.

Assuming, as I do, that the powers at the command of the local associations will be almost purely social, let us consider how those associations might be formed and conducted so as to become exceedingly influential.

It is necessary to be somewhat precise at the outset, so I will begin with the by no means improbable supposition that in a given district a few individuals, some of them of local importance, are keenly desirous of starting a local association or society, and are prepared to take trouble to that end. How should they set to work?

Their initial step would seem to be to form themselves into a provisional executive committee, and to nominate a president, council, and other officers of the new society. This done, the society in question, though it would have no legal corporate existence, may be taken as formed.

The committee would next provide, with the aid of the central society, for a few sane and sensible lectures to be given on eugenics, including the A B C of heredity, at some convenient spot, and they would exert themselves to arouse a wide interest in the subject by making it known in the district. They would seek the cooperation of the local medical men, clergy, and lawyers, of the sanitary authorities, and of all officials whose administrative duties bring them into contact with various classes of society, and they would endeavour to collect round this nucleus that portion of the local community which was likely to be brought into sympathy with the eugenic cause. Every political organisation, every philanthropic agency, proceeds on some such lines as I have just sketched out.

The committee might next issue, on the part of the president and council of the new society, a series of invitations to guests at their social gatherings, where differences of rank should be studiously ignored. The judicious management of these gatherings would, of course, require considerable tact, but there are abundant precedents for them, among which I need only mention the meetings of the Primrose League at one end of the scale, and those held in Toynbee Hall at the other end. Given a not inclement day, an hour suitable to the occasion, a park or large garden to meet in, these informal yet select reunions might be made exceedingly pleasant, and very helpful to the eugenic cause.

The inquiries made by the committee when they were considering the names of strangers to whom invitations ought to be sent, would put them in possession of a large fund of information concerning the qualities of many notable individuals in their district, and their family histories. These family histories should be utilised for eugenic studies, and it should be the duty of the local council to cause them to be tabulated in an orderly way, and to communicate the more significant of them to the central society.

The chief of the notable qualities, to which I refer in the preceding paragraph, is the possession of what I will briefly call by the general term of "Worth." By this I mean the civic worthiness, or the value to the State, of a person, as it would probably be assessed by experts, or, say, by such of his fellow-workers as have earned the respect of the community in the midst of which they live. Thus the worth of soldiers would be such as it would be rated by respected soldiers, students by students, business men by business men, artists by artists, and so on. The State is a vastly complex organism, and the hope of obtaining a proportional representation of its best parts should be an avowed object of issuing invitations to these gatherings.

Speaking only for myself, if I had to classify persons according to worth, I should consider each of them under the three heads of physique, ability, and character, subject to the provision that inferiority in any one of the three should outweigh superiority in the other two. I rank physique first, because it is not only very valuable in itself and allied to many other good qualities, but has the additional merit of being easily rated. Ability I should place second on similar grounds, and character third, though in real importance it stands first of all. It is very difficult to rate character justly; the tenure of a position of trust is only a partial test of it, though a good one so far as it goes. Again, I wish to say emphatically that in what I have thrown out I have no desire to impose my own judgment on others, especially as I feel persuaded that almost any intelligent committee would so distribute their invitations to strangers as to include most, though perhaps not all, of the notable persons in the district.

By the continued action of local associations as described thus far, a very large amount of good work in eugenics would be incidentally done. Family histories would become familiar topics, the existence of good stocks would be discovered, and many persons of "worth" would be appreciated and made acquainted with each other who were formerly known only to a very restricted circle. It is probable that these persons, in their struggle to obtain appointments, would often receive valuable help from local sympathisers with eugenic principles. If local societies did no more than this for many years to come, they would have fully justified their existence by their valuable services.

A danger to which these societies will be liable arises from the inadequate knowledge joined to great zeal of some of the most active among their probable members. It may be said, without mincing words, with regard to much that has already been published, that the subject of eugenics is particularly attractive to "cranks." The councils of local societies will therefore be obliged to exercise great caution before accepting the memoirs offered to them, and much discretion in keeping discussions within the bounds of sobriety and common sense. The basis of eugenics is already firmly established, namely, that the offspring of "worthy" parents are, *on the whole*, more highly gifted by nature with faculties that conduce to "worthiness" than the offspring of less "worthy" parents. On the other hand, forecasts in respect to particular cases may be quite wrong. They have to be based on imperfect data. It cannot be too emphatically repeated that a great deal of careful statistical work has yet to be accomplished before the science of eugenics can make large advances.

I hesitate to speculate farther. A tree will have been planted; let it grow. Perhaps those who may thereafter feel themselves or be considered by others to be the

possessors of notable eugenic qualities—let us for brevity call them "Eugenes"—will form their own clubs and look after their own interests. It is impossible to foresee what the state of public opinion will then be. Many elements of strength are needed, many dangers have to be evaded or overcome, before associations of Eugenes could be formed that would be stable in themselves, useful as institutions, and approved of by the outside world.

The suggestion I made in the earlier part of this paper that the executive committee of local associations should cooperate, wherever practicable, with local administrative authorities, proceeded on the assumption that the inhabitants of the districts selected as the eugenic "field" had a public spirit of their own and a sense of common interest. This sense would be greatly strengthened by the enlargement of mutual acquaintanceship and the spread of the eugenic idea consequent on the tactful action of the committee. It ought not to be difficult to arouse in the inhabitants a just pride in their own civic worthiness, analogous to the pride which a soldier feels in the good reputation of his regiment or a lad in that of his school. By this means a strong local eugenic opinion might easily be formed. It would be silently assisted by local object-lessons, in which the benefits derived through following eugenic rules and the bad effects of disregarding them were plainly to be discerned.

The power of social opinion is apt to be underrated rather than overrated. Like the atmosphere which we breathe and in which we move, social opinion operates powerfully without our being conscious of its weight. Everyone knows that governments, manners, and beliefs which were thought to be right, decorous, and true at one period have been judged wrong, indecorous, and false at another; and that views which we have heard expressed by those in authority over us in our childhood and early manhood tend to become axiomatic and unchangeable in mature life.

In circumscribed communities especially, social approval and disapproval exert a potent force. Its presence is only too easily read by those who are the object of either, in the countenances, bearing, and manner of persons whom they daily meet and converse with. Is it, then, I ask, too much to expect that when a public opinion in favour of eugenics has once taken sure hold of such communities and has been accepted by them as a quasi-religion, the result will be manifested in sundry and very effective modes of action which are as yet untried, and many of them even unforeseen?

Speaking for myself only, I look forward to local eugenic action in numerous directions, of which I will now specify one. It is the accumulation of considerable funds to start young couples of "worthy" qualities in their married life, and to assist them and their families at critical times. The gifts to those who are the reverse of "worthy" are enormous in amount; it is stated that the charitable donations or bequests in the year 1907 amounted to 4,868,050*l*. I am not prepared to say how much of this was judiciously spent, or in what ways, but merely quote the figures to justify the inference that many of the thousands of persons who are willing to give freely at the prompting of a sentiment based upon compassion might be persuaded to give largely also in response to the more virile desire of promoting the natural gifts and the national efficiency of future generations.

## ZOOLOGY AT THE BRITISH ASSOCIATION.

### *The Rule of Priority in Zoological Nomenclature.*

MR. G. A. BOULENGER expressed disapproval of the extreme application of the rule of priority in zoological nomenclature on the ground that it had already produced much mischief under the pretence of arriving at ultimate uniformity. The worst feature of the abuse of this rule is not so much the bestowal of unknown names on well-known animals as the transfer of names from one to another, as in the case of Astacus, Torpedo, Holothuria, Simia, Cynocephalus, &c., so that the names which were uniformly used by Cuvier, Johannes Müller, Owen, Agassiz, Darwin, Huxley, and Gegenbaur would no longer convey any meaning; very often they would be misunderstood, and the very object for which Latin or Latinised names were introduced would be defeated. While considering uniformity in the future, it was surely important to have some consideration for the past; the speaker suggested that names with which all general zoologists are familiar should be protected from the revisers of nomenclature, and that it might be possible for committees to be appointed to determine, group by group, which names are thus to be respected, not necessarily on the ground of their earliest date or their correct application in the past, but as having been universally used over a long period in a definite sense. Mr. Boulenger's proposals were supported by several subsequent speakers, and the section agreed that a resolution, in the sense of and containing the manifesto published in NATURE, vol. lxxviii., p. 395, be communicated to the principal British zoological societies, to Section C, and to the British representative on the committee of nomenclature of the International Congress of Zoology.

### *The Determination of Sex.*

A discussion, jointly with Section K, on the determination of sex, was opened by Mr. L. Doncaster. After briefly reviewing some of the recent work on the nucleus in this connection, he proceeded to describe a series of breeding experiments with the moth *Abraxas grossulariata* and the rare variety *lacticolor*, and concluded that the explanation of the results which he had obtained must be as follows:—(1) the sex determinants behave as Mendelian characters, maleness and femaleness being allelomorphic with one another, and femaleness dominant; (2) all females are heterozygotes, carrying recessive maleness, and producing male-bearing and female-bearing eggs in equal numbers; all males are homozygous, carrying only maleness and producing only male-bearing spermatozoa; (3) the *grossulariata* character cannot be borne by a female-bearing gamete.

Mr. W. Heape insisted that external circumstances, such as nutrition and general metabolism, could alter the proportion of the sexes in the young born.

Miss N. M. Stevens described her work on the spermatogenesis of several insects, devoting particular attention to the heterotropic chromosomes, in regard to which she confirmed Wilson's conclusions.

Prof. Bateson described Miss Durham's experiments with the cinnamon canary. When a cinnamon male is paired with a green female, all the males are cinnamon and the females green, but when a cinnamon female is paired with a green male all the offspring, of both sexes, are green. He then proceeded to consider a similar but less simple case, investigated by himself and Mr. Punnett, namely, the silky fowl, in which two pairs of allelomorphic characters are concerned in addition to the sex determinants. Both these cases are explicable on similar lines to those suggested for Abraxas. He gave instances of sex-limited inheritance, such as colour-blindness and hæmophilia in man, in which the males are affected and can transmit, while unaffected males cannot, but unaffected females may do so, the explanation being that the disease is dominant in the male and recessive in the female.

Dr. Copeman mentioned experiments which seemed to suggest that chemical factors may be important in sex determination, and a subsequent speaker referred to some sixty cases of old hen pheasants assuming male plumage as supporting the view that here it is the female which is heterozygous in sex, the male being homozygous, as no case of a male bird assuming female plumage was met with.

### *Account of the Recent Expedition to Lake Qurun.*

Dr. W. A. Cunnington gave an account of the results of the investigation, by Mr. C. L. Boulenger and himself, of the Birket el Qurun in the Fayum province of Egypt. The lake, though still of considerable size—twenty-five miles long and five or six miles in maximum breadth—is much smaller than formerly; raised beaches are seen in many parts, and the water is shallow (nowhere more than 4 to 5 fathoms deep) and brackish. The lake was found to be well stocked with animal life, although the

number of species is not large. The large quantities of Entomostraca—principally copepods and Cladocera—doubtless form the food supply of the fishes, which occur in astonishing abundance; fifteen species of fish were obtained, all of which are well-known Nile forms. The swampy pools on the margin of the lake yielded ostracods, hydrachnids, and spiders. The Mollusca obtained belong to eleven species—two only of which are lamellibranchs—all of which are Nilotic forms. *Paranais littoralis*, a small oligochæte, was the only aquatic worm obtained, no leeches or Turbellaria being seen. Cordylophora was found growing in great abundance in the lake, an interesting fact, as it has not previously been recorded from Africa. Of especial interest are the presence in the lake of (1) a gymnolæmatous polyzoon with a circular lophophore and eight tentacles, and (2) a medusa and the associated hydroid stage—*Moerisia lyonsi*—which appear to bear a resemblance to Sarsia. Mr. Boulenger added further details regarding Mœrisia, and discussed its importance in relation to the possible former history of the lake.

*Structure of* Dendrosoma radians.

Prof. S. J. Hickson and Mr. J. T. Wadsworth conclude that the bodies described by Kent as the "exogenously produced germs" of Dendrosoma are epizoic, or possibly parasitic, Acinetaria belonging to the genus Urnula. The only true reproductive bodies of Dendrosoma are the so-called internal buds or gemmulæ, first described and figured by Levick. The micronuclei of Dendrosoma are 4 $\mu$ in diameter when they have reached their full size; when in division the length of the spindle is 24 $\mu$, and the chromosomes are numerous and minute. No centrosomes were seen, nor has conjugation been observed.

*Haematozoa from Ceylon Reptiles.*

Miss Muriel Robertson described several Hæmatozoa from Ceylon reptiles. The multiplication of *Haemogregarina nicoriae* takes place in tortoises (Nicoria and Emyda), and the transmitting host is a species of Branchellion, in the alimentary canal of which the hæmogregarine becomes motile. *Trypanosoma vittatae* and *Haemogregarina vittatae* are found in *Emyda vittata*, and the transmitting host of both is a species of Glossiphonia. Other hæmogregarines, trypanosomes, and a Hæmocystidium were described from lizards (*e.g.* Hemidactylus). (Other papers on trypanosomes and Piroplasma were given before a joint meeting of Sections D and I; for an account of these see "Physiology at the British Association," NATURE, October 8, p. 593).

*Giant Nerve Cells and Fibres of Halla.*

Dr. J. H. Ashworth described the structure and histology of the giant nerve cells of the polychæte *Halla parthenopeia*. These cells, of which there are usually fifteen to eighteen in each worm, are distinguished by their large size (they may attain a diameter of 150 $\mu$) and thick sheath. Fine chromophilous granules are present in the protoplasm (except in a peripheral zone, from which they are almost or quite absent) in varying amount in different giant cells. They are found in greatly increased mass in a specialised perinuclear zone, the outer edge of which is bounded by the perinuclear network of neurofibrillæ, which is thus in a position which facilitates its rapid nutrition. In the general protoplasm of the cell there is a network of neurofibrillæ, generally wider meshed and more slender stranded than the perinuclear network. From the intracellular network slender, primitive fibrils pass towards the giant fibre, and several stouter fibrillæ—six to ten from small cells, twelve to thirty from large cells—each formed by the fusion of several primitive fibrils, pass into the giant fibre, forming a bundle which occupies from one- to three-fourths of the lumen of the fibre. The fibrillæ in the giant fibre are generally of the same thickness, but occasionally one, two, or three fibrils are thicker than the rest. The contents of the giant fibre are equivalent and have a similar structure to the axis cylinder of a medullated nerve fibre, except that in the former there is nothing comparable to the nodes of Ranvier of the latter.

*The Vascular System of Stylodrilus.*

Mr. R. Southern directed attention to certain features of the vascular system of a new species of Stylodrilus from the River Annalee, co. Cavan. This differs from all other species in the presence of simple contractile saccular appendages on the posterior portion of the dorsal vessel, a condition intermediate between that seen in normal lumbriculids and that in the aberrant genus Stylodrilus. The relations of the dorsal and ventral vessels to the intestinal blood sinus were also described, and shown to differ considerably from those usually met with in oligochætes.

*The Respiration of Land Isopods.*

Mr. E. E. Unwin pointed out that woodlice are derived from aquatic ancestors, and, having taken to terrestrial life, have adapted their respiration to their altered environment. The different kinds of woodlice are, according to the speaker's experiments, suited to different degrees of dryness; *e.g. Trichoniscus pusillus* soon dies unless kept very damp, while *Porcellio scaber* can live four or five days in a dry box. *Ligia oceanica, Trichoniscus pusillus, Oniscus asellus, Porcellio scaber,* and *Armadillium vulgare* are arranged in order according to their habitat, and the structure of their respiratory organs shows a corresponding gradation from simple gills to gills supplemented by air tubes ramifying through some of the abdominal exopodites.

*The Distribution of Irish Fresh-water Mites.*

Mr. J. N. Halbert contributed some notes on the distribution of Irish fresh-water mites (Hydrachnida), pointing out that they may be divided, like the fresh-water mites in general, into two great faunistic groups:—(1) a group containing those widely distributed species which inhabit standing and slowly flowing waters of a comparatively high temperature, and (2) a group embracing those forms which are found in waters of a constantly lower temperature, especially those of cold highland lakes and streams.

*Arctic and Antarctic Collembola.*

Prof. G. H. Carpenter pointed out the comparative richness of the collembolan fauna of the remote northern and southern lands. The Poduridæ and Isotominæ are believed to be nearest to the primitive stock of the order, while the Entomobryinæ, the Tomocerinæ, and the Symphypleona are more highly specialised. It is suggestive that in both Arctic and Antarctic faunas the primitive genera are well represented, while the specialised genera have very few species. Two Arctic isotomines are present in our own islands—*Agrenia bidenticulata*, found last year in Irish and Scottish mountain streams, and *Proisotoma beselsii*, which inhabits the Arctic regions of both the Old and New Worlds and the coast of Scotland. "Bipolarity" in the Collembola is shown by Wahlgren's record of the latter species from Tierra del Fuego; a closely allied form is present in the South Orkneys. Such distribution indicates a high antiquity (probably Mesozoic) for this form. Several genera are apparently confined to the southern regions; for instance, Cryptopygus is represented by identical or nearly allied species in Tierra del Fuego, Graham Land, South Shetland, South Orkneys, and South Georgia, while *Isotoma octo-oculata* is present in Graham Land, South Shetland, South Orkneys, and Kerguelen, and the Isotoma of South Victoria Land is closely allied to a Fuegian species. Such distributional facts suggest the considerable geological age of the springtails and a former wide extension of the Antarctic continent. The National Antarctic (*Discovery*) Expedition collected from moss at Granite Harbour, South Victoria Land, a remarkable springtail, referable to the Poduridæ, but showing some striking affinities to the Isotominæ, which is apparently the most southerly terrestrial animal yet known.

*Mimicry in Lepidoptera.*

Dr. F. A. Dixey pointed out that when Fritz Müller put forward, in 1879, his theory of common warning colours, or the assimilation of one distasteful form to another for the sake of mutual protection against insectivorous enemies, he recognised the probability, or

even certainty, that the approach would not necessarily be one-sided, but might be convergent, each form in some respects advancing to meet the other. This suggestion, however, was never developed by Fritz Müller, for although he mentioned a few instances in support of his view, he did not attempt to trace the supposed mutually mimetic process in any detail. Dr. Dixey showed that there is much evidence that such reciprocal approach, or interchange of obvious characters—for which the term diaposematism has been proposed by Prof. Poulton—does actually occur, and he exhibited some cases of mimicry the peculiar features of which are difficult to explain on any other hypothesis.

Prof. E. B. Poulton exhibited and described specimens illustrating mimicry in the butterflies of North America, and then proceeded to give an account of some recent investigations upon the African swallowtail, *Papilio dardanus* (*merope*), as an example of mimicry.

Mr. J. C. Moulton exhibited four groups of South American butterflies to illustrate the Müllerian theory of mimicry. In the Venezuelan group the general warning pattern consists of a chestnut background relieved by transverse black bars and yellow apical markings on the forewings. In the other groups the pattern is modified in various ways according to the environment; for example, in the Trinidad group yellow takes the place of the chestnut background, while the group from Ega, on the Upper Amazon, presents a more mottled and richer brown appearance, and in the fourth group, from Ecuador and Peru, the bars and mottled markings have given place to a dark background relieved only by a broad, oblique chestnut band.

*The Development of Littorina.*

Mr. W. M. Tattersall briefly described the development of several species of Littorina. The eggs of *L. littorea*, each enclosed in a hat-shaped capsule, are laid freely on the shore, and not aggregated together in a gelatinous mass. The larva leaves the egg as a trochosphere, and passes through a veliger stage to the adult. *L. littorea* lives low down on the shore among Laminaria and *Fucus serratus*. *L. obtusata* lives in a higher region of the shore, in the zone of *Fucus vesiculosus*; its larva leaves the egg as a veliger. *L. rudis* and *L. neritoides*, both of which live near high-water mark, are viviparous. Thus within the limits of a single genus there are presented three stages in the evolution of land Mollusca from marine forms, showing specialisation in reproduction and gradual abbreviation and final suppression of larval stages, correlated with successive stages of specialisation of habitat.

*Gastrulation in Amphioxus.*

Prof. E. W. MacBride pointed out that two theories have been advanced as to the mode in which the germinal layers are formed in Amphioxus:—(1) that the invagination is a simple process, and that the whole of the invaginated layer is endoderm from which notochord and mesoderm take their origin by a process of folding (as held by Kowalevsky, Hatschek, Samassa, and MacBride); (2) that the invagination is a double process; on the ventral side of the blastopore the cells are true endoderm, while on the dorsal side they are ectoderm (as held by Cerfontaine), and that the ectodermic roof of the archenteron becomes used up in the formation of the notochord and mesoderm, which are cut out of the wall of the archenteron by the upgrowth of the true endoderm cells at the sides. Prof. MacBride's observations lead him to conclude that all the intucked cells are endoderm, that the mesoderm originates from a dorso-lateral fold of the endodermic wall, which becomes cut into anterior and posterior halves by the growth of a septum; both halves of the fold remain open into the gut. The front half becomes eventually closed off, and corresponds to the mandibular head-cavity of other vertebrate embryos and to the collar-cavity of Balanoglossus. The posterior division, corresponding to the lateral plate of mesoderm of other vertebrate embryos and to the trunk cavities of Balanoglossus, retains its connection with the gut for a longer time; from its front end the somites of the body are cut off. The head cavities arise still later as a single median invagination of the anterior gut wall, which, before it separates from the gut, begins to be divided into right and left halves. The speaker concluded that, with some slight modifications, the simple view of the development of Amphioxus held by Kowalevsky and Hatschek was to be maintained.

*The Early Development of Dasyurus.*

Prof. J. P. Hill gave an account of the early development of the native cat (of southern Australia)—*Dasyurus viverrinus*. The uterine ovum is of large size as compared with the ova of Eutheria, is enclosed in a shell membrane, and exhibits a marked polarity, its lower pole consisting of dense, finely granular cytoplasm in which the pronuclei are situated, and its upper pole of a delicate reticulum with fluid-filled meshes. Prior to cleavage this latter portion of the ovum is separated off and takes no further part in development. The fluid material in this non-formative portion of the ovum is to be regarded as the product of an abortive attempt at the formation of a solid yolk-mass. By its elimination the potentially yolk-laden telolecithal ovum becomes converted into a secondary homolecithal homoblastic one. The first three cleavage planes are meridional; the resulting eight blastomeres are of equal size, and form an equatorial ring. The ensuing divisions (fourth cleavage) are parallel to the equator and are unequal, each of the eight blastomeres becoming divided into an upper, smaller, and clearer cell with relatively little deutoplasm, and a lower, larger, and denser cell with well-marked deutoplasmic contents. A sixteen-celled stage is thus produced in which the cells are arranged in two superimposed rings, each of eight cells. The descendants of these two cell-rings gradually spread towards opposite poles in contact with the thickened shell membrane, and constitute the cellular wall of the blastocyst, which is unilaminar, and remains so until the vesicle attains a diameter of 4–5 mm. The upper cell-ring is regarded as furnishing the formative (embryonal) portion of the vesicle wall—the homologue of the embryonal knot of the eutherian blastocyst—from which are derived the embryonal ectoderm and the entire endoderm, while the lower ring gives rise to the extra-embryonal portion of the vesicle wall, the trophoblastic ectoderm. The markedly different mode of formation of the blastocyst in the Eutheria was regarded as correlated with the complete loss of the shell membrane in the course of their phylogeny.

*The Wild Ancestors of Domestic Horses.*

Prof. J. C. Ewart gave an account of the wild ancestors of domestic horses, dealing particularly with (1) *Equus sivalensis* of northern India, a long-limbed form with the face strongly bent downwards; (2) *E. prejvalskii*, the horse which still lives in a wild state in Mongolia; (3) *E. robustus*, the remains of which occur at the Palæolithic settlement of Solutré, north of Lyons; and (4) *E. gracilis*, of the Auvergne and other French Pleistocene deposits, which seems to have given rise to *E. caballus libycus* (Ridgeway) of north Africa and to the Celtic pony (*E. caballus celticus*) of north-western Europe. Dr. Scharff mentioned that the horse remains found in the Irish crannogs, bogs, and caves bore out Prof. Ewart's view that a wild horse formerly existed in Ireland, of which the present-day Connemara pony seems to be the direct descendant.

*Feeding Habits of British Birds.*

Mr. C. Gordon Hewitt advocated the institution of an inquiry into the feeding habits of British birds, and urged that, in order to obtain as accurate a conception as possible of the economic status of any species of bird, it was necessary to examine and record the contents of the crop and stomach of a large number of individuals killed, not only in different months of the year, but also in different localities. Such evidence would provide the only safe guide to the protection of wild birds.

Dr. C. J. Patten gave an account of the migratory movements of certain shore birds, especially the sanderling and turnstone, as observed on the Dublin coast, and showed skins illustrating the phases of plumage changes according to sex, age, and season.

Prof. W. A. Herdman gave some natural-history notes

on the Ceylon pearl oyster. These dealt with (1) the kind of ground on which the oysters live and the objects to which they are attached; (2) the oyster-eating fishes and other enemies which affect the life of the oyster; and (3) the different types of oyster and the question of their constancy.

Dr. A. Smith Woodward gave a lecture on the evolution of fishes. Prof. R. J. Anderson gave details respecting (1) the epiphyses of long bones, chiefly in sauropsids, and (2) measurements of the maxilla in Mammalia. Prof. Alexander Fraser directed attention to some points connected with the alimentary canal of the higher mammals, and Dr. H. E. Roaf gave a summary of his experiments on the physiological action of the digestive enzymes of certain invertebrates, but these communications cannot be summarised in the space here available.

J. H. ASHWORTH.

## *ENGINEERING AT THE BRITISH ASSOCIATION.*

THE president of the section of engineering, Mr. Dugald Clerk, is so well known for his researches on the gas engine, and has done so much to place the theory of gas-engine work upon a true scientific basis, that it was only to be expected that the work of Section G should be largely concerned with gas-engine practice and allied industries. The president in his address gave an instructive and valuable summary of the early history of the study of thermodynamics, and of the application of its principles to engine design.

After the presidential address on Thursday, September 3, only one paper was dealt with, that by Mr. G. Stoney, on recent developments in steam turbines. At the York meeting in 1906 Mr. Stoney read a paper on the same subject, and the present paper, which was a continuation of the former, showed conclusively how rapid the progress had been during the past two years. The author first dealt with the changes in the design of continuous-current dynamos to adapt them to the high speed of the turbine, and stated that now as much as 1500 kw. was put into a single armature. In turbo-blowers for blast-furnace work there had been a great advance; a blower to deliver 20,000 cubic feet of air per minute only weighed 25 tons, against 450 tons for the ordinary reciprocating engine of the same capacity. The use of the exhaust steam from non-condensing reciprocating steam engines in turbines, which took in their steam at atmospheric pressure and exhausted it into condensers, was then dealt with, and such refinements as mixed-pressure turbines, where a high-pressure turbine using boiler steam comes automatically into action when the low-pressure steam supply fails. Improvements in condensers to increase the available vacuum—such a very important matter in turbine economy—were then touched upon, and, finally, the wonderful advance in the application of the turbine to marine work was briefly discussed—in eight years the horse-power so utilised had increased from 25,000 to 1,750,000.

Friday, September 4, was entirely devoted to a joint discussion with Sections A and B of the first report presented by the committee of the section on gaseous explosions, which was appointed at the Leicester meeting in 1907. This report not only summarised in a convenient form for reference what was known up to the present time on the subject, but also described the experimental work which had been carried out by various members of the committee. While Boyle's law might be considered holding under all the conditions met with in gaseous explosions in the gas engine, it had long been realised that it was probable that the law $PV=kT$ did not hold at the high temperatures reached in such explosions. The experimental work on this question was divided in the report into three classes:—(*a*) constant-pressure experiments; (*b*) constant-volume experiments; and (*c*) experiments in which both volume and pressure were varied; those carried out by Mr. Dugald Clerk fell into this last class. The results obtained by the various experimenters were fully discussed in the report, and from data obtained from several of the best-known experiments curves were drawn showing the relation between the temperature in degrees centigrade and the energy in calories per gram molecule. As a result of its investigations the committee had prepared a table giving the energy at four different temperatures in calories per gram molecule of air, $CO_2$, $H_2O$, gas-engine mixture, and ideal gas, and curves were drawn for the gas-engine mixture and the ideal gas. In the form of an appendix to the report was a valuable note, by Prof. H. L. Callendar, on the deviation of actual gases from the ideal state, and on experimental errors in the determination of their specific heats. Prof. Callendar showed that there was a possible systematic error inseparable from experiments made by Regnault's methods, due to the fact that the correction required for the flow of heat by conduction from the heater to the calorimeter had to be based upon experiments made with no gas passing. A long and interesting discussion took place, the chief speakers being Dr. Harker, Prof. Harold Dixon, who has done such excellent work in the determination of the specific heats of gases at high temperatures, Prof. Dalby, Prof. Coker, who described the method by which he had determined the fluctuation of temperature on the inner surface of the cylinder wall of a gas engine, and Prof. Bernard Hopkinson, who stated that in his experimental work he had discovered that the gases at the moment of combustion were able to radiate a considerable quantity of heat. The discussion was closed by the president of Section G, who expressed the view that the experimental work which is now being carried out by Prof. Callendar and Prof. Dalby, which was referred to by the latter gentleman in the discussion, would be of very great importance. Prof. Callendar and Prof. Dalby in their experiments on the determination of temperatures inside gas-engine cylinders used an extremely fine platinum wire, and withdrew it from the cylinder during the time the temperature was at its maximum, and, as a result of their work, they believed they had obtained temperatures accurate to within 1° C.; if the temperature is known accurately at one point of the indicator card, it could certainly be calculated for other points.

On Monday, September 7, the first three papers were devoted to peat and producer gas. Captain Sankey read the first paper, on the utilisation of peat for the making of gas or charcoal. He stated that the subject was one of great importance to Ireland, and was of interest in view of the fact that a Bill had been passed by Parliament sanctioning works to produce gas from peat, and to use this gas for making electricity by means of gas engines and dynamos, and to distribute the power thus generated to works which would be established in the neighbourhood of the power station. The Bill had given power to utilise a portion of the bog of Allan, near Robertstown, on the Grand Canal, about twenty-five miles from Dublin. Earlier attempts to utilise peat had failed, because they were based on the use of dry peat, that is, peat containing 25 per cent. of water, and the cost of such drying and of converting the dry material into briquettes was too great to allow it to compete with coal, and, further, there was no recovery of by-products. The proposed scheme proceeded on different lines; the peat would only be partially dried, that is, to about 60 per cent., and it would then be used in producers for generating gas, and the by-products would be recovered. It was hoped that the profits on these would cover the cost of procuring and drying the peat. Great progress had been made in Germany in the utilisation of peat, and the author described several plants he had seen at work. The peat could be obtained by four different methods:—by hand labour entirely, by cutting by hand and then shovelling it into an elevator, or by digging it and spreading it for drying by a machine, or, finally, the peat could be dug by means of an ordinary grab, which was the method adopted at Schelecken, in Prussia. Probably the grab method would be the best for the proposed power scheme, and the drying might be carried out by means of Dornberg presses. The principal by-product in the manufacture of peat gas is sulphate of ammonia, and the proposed power station would probably be able to produce about 3000 tons per annum. Other important by-products are acetate of lime, methyl alcohol, and tar; an excellent waggon grease can be made from this tar. The author estimated that the monetary value of these

additional by-products would be equal to that of the sulphate of ammonia, and he stated that a good charcoal could be made direct from peat and the by-products recovered, and that a satisfactory process had been in operation in Oldenberg for more than ten years.

The second paper, on producer gas, by Mr. Emerson Dowson, was noteworthy from the fact that the first paper on this subject by the author was read at the York meeting in 1881; the present paper contained a summary of the progress which had been made during the last quarter of a century. In concluding his paper, Mr. Dowson dealt briefly with the two types of producers now utilised for engine work. The suction plant cost less and occupied less ground space, but the gas made in it was not so strong as in the older form of pressure plant—in some cases this advantage of the latter is important. He stated that the fuel consumption per horse-power hour and the labour required were about the same in both types of plant, provided the steam required was raised by means of an independent boiler.

The third paper, by Mr. Robson, was entitled "The Production of Cheap Power by Suction Gas Plants." The author stated that the figures he was able to produce showed that the modern gas engine and suction producer could give power to small users and to large users more cheaply than could be obtained by any other process. In the form of a table he gave three typical examples, one, where the installation was 450 B.H.P., the total cost per B.H.P. hour, allowing for depreciation and interest on capital, worked out at 0·205*d*., and where the size of the installation was only 20 B.H.P. the cost was 0·745*d*. Up to the present suction producers had been made to work on a commercial scale only with non-bituminous fuels, and fortunately such fuels were easily obtainable in the industrial centres of this kingdom. The tar difficulty had been the chief trouble in making a successful suction producer work with bituminous fuels, as the apparatus required for the cleaning of the gas both increased the frictional resistance of the passage of the gas from the generator to the engine and destroyed the simplicity of the arrangement. The author discussed several methods by which this difficulty might, he considered, be overcome.

In the discussion on these papers, Mr. W. Crossley, the well-known gas-engine maker, gave some interesting figures his firm had obtained as the result of experiments they had been carrying out on the utilisation of peat with a peat containing 2·2 per cent. of N; they estimated that a profit of 5*l*. 12*s*. per ton would be obtained from the sulphate of ammonia, and with 1·6 per cent. of N (about the average figure for Irish peat) the profit would still be 4*l*. 1*s*. per ton of sulphate of ammonia produced; this practically meant that the power which would be generated would cost nothing, and could, therefore, be retailed at a cost which would ensure the establishment of industries requiring a large amount of power at a low cost.

The concluding paper for the day was by Mr. W. Rosenhain, on the study of breakages. The author, after emphasising the need of a careful study of every case of breakage, if engineers were to obtain information which would enable them to prevent the recurrence of such breakages, stated that the causes of failure might be classed into three different groups:—(1) those due to defects arising from the manufacture of the material of construction; (2) those arising from incorrect treatment of the material during the process of construction; and (3) those from defects arising during the life of the structure or machine. Mr. Rosenhain illustrated these three cases by examples selected from investigations which had been carried out at the National Physical Laboratory. The first case was that in which the inner tube of a large gun had failed by internal cracks, and the microscopic and mechanical tests showed that the failure was probably due to a defect in the original steel ingot, viz. to its contamination to an undue extent with enclosures of slag. The second case was a fractured locomotive crank pin; here the microscopic investigation pointed to the conclusion that a material of an originally satisfactory character had been spoiled by a too severe hardening process; this example was a direct testimony to the value of microscopic observations in giving a clue to the thermal history of a specimen of steel. The third case was a broken shaft, where the investigation showed that the coarse structure of the material in the central portion of the cross-section of the shaft, which was undoubtedly the cause of the fracture, had been present in the steel as supplied by the manufacturer, and could not have been produced as the result of vibration or working stresses. Mr. Rosenhain's paper was an extremely valuable one, and indicated the good work which is being and can be carried out in such an institution as the National Physical Laboratory.

A paper by Prof. E. Wilson, describing his further experiments on the electrical conductivity of light aluminium alloys as affected by exposure to London atmosphere, was taken as read.

The section opened its proceedings on Tuesday, September 8, with a paper by Mr. F. W. Lanchester on the laws of flight. The paper was illustrated by a number of interesting experiments with model aëroplanes. Mr. Lanchester has been working on the subject for a number of years, and has evolved mathematical expressions for the path which is followed by a ballasted aëroplane and for its stability; generally speaking, the path is undulating, and under certain conditions the aëroplane will describe complete loops in the air. The mathematical investigations into the stability of aëroplanes showed that the velocity of flight must be considerable when the machine was a large one, and therefore a large plane required more power per lb. of weight than a small one, thus limiting the weight of flying machines of the aëroplane type. Mr. Lanchester directed attention to the fact that there was not much to be gained from the study of the flight of birds, carried out in the haphazard fashion which had hitherto characterised such work; he pointed out, in particular, that it was only rarely that the observer had ever recorded the weight of the birds the flight of which he had been studying. In the course of the discussion Mr. Lanchester stated that, in his opinion, the engine problem would not be simplified in the case of large-sized aëroplanes, and he thought that the engines would require to be air-cooled; he had himself built a considerable number of such engines, which worked quite successfully. At the present time he was of opinion that the best results would be obtained with a machine weighing, with its driver, not more than half a ton.

The next paper was by Mr. F. A. Royce, on the causes of wear in motor vehicle machinery; the author dealt with his subject under three heads:—(*a*) design; (*b*) material and workmanship; (*c*) lubrication and attention. To illustrate his first point examples of defective designs in bearings were discussed and criticised, and in connection with lubrication the importance of devices for retaining the oil on parts subjected to friction, and of always maintaining a film of oil between the rubbing surfaces, was strongly emphasised.

The last paper of the day was one by Sir Howard Grubb, on clock-driving mechanisms for telescopes; for spectroscopic and photographic work with telescopes it was necessary that the clock-driving mechanism should not only drive the telescope at its normal rate, but also correct any errors of position which might occur and would accumulate. The problem—always a difficult one—had been solved most satisfactorily by the use of electrical control, and the author described the method adopted by him for the 24-inch equatorial at Oxford University; the mechanism is, briefly, epicyclic gearing, which is operated electrically, the necessary electrical contacts being controlled by a pendulum. In the discussion Dr. Rambaut, of Oxford University Observatory, stated that the delicacy of the adjustment obtained by this device was remarkable; the tube of the telescope was 22 feet 6 inches long, hence a second of arc was represented by a linear measurement of less than 1/100 millimetre, while in their photographic work they aspired to keep the position of the images true to 1/12,000 millimetre, and not only was the delicacy of the adjustment so perfect, but the simplicity was equally remarkable; it was quite unusual for any adjustments to be required.

Owing to the number of papers presented, the section sat again on the morning of Wednesday, September 9,

when three papers were read. The first, by Mr. J. Brown, F.R.S., and Prof. Maurice Fitzgerald, described a series of experiments they had carried out on rotating discs. The discs were rubber—one solid, 12 inches in diameter, with its thickness tapering from 2½ inches in the middle to ½ inch at the edge, and the second 12 inches in diameter, ⅜-inch thick at the edge, and 3 inches thick in the middle, where it was pierced with a 1½-inch hole. In the first disc the thickness varied uniformly from the centre to the edge; in the second the cross-section of the disc formed a hyperbolic curve. The object of these experiments was to determine, by measurement of the strains set up when the discs were rotating, whether the formulæ usually employed in the calculation of stresses in the revolving discs of steam turbines were reasonably trustworthy. The discs were carried at the lower end of a vertical shaft, which was driven at a high speed by an electric motor; photographs were taken of the revolving disc, and strain measurements were thus possible. As a result of their experiments, the authors were of opinion that the ordinary formulæ did not give results which were approximate enough for ordinary use. Of course it is well known that these formulæ are only approximate, but it is doubtful whether the experiments of the authors are sufficiently conclusive to prove that the formulæ are as untrustworthy as was suggested in the paper.

The next paper was by Mr. Douglas Fox, on general urban and interurban transportation and rail-less electric traction. This paper contained, in the form of tables, an exhaustive analysis of the costs, working expenses, receipts, &c., of some seventy-one tramway installations in the United Kingdom. The examples selected by the author embraced towns having combined generating stations for traction and electric lighting, and towns which had separate generating stations for their tramways and their lighting. Details were also given of several installations of electric road traction on the Continent, where overhead wires were employed and there were no rails; one of the latest of these was at Mulhausen, in Alsace, where it had been decided to adopt rail-less electric cars in order to connect up the suburbs with the existing electric tramways in the city proper. Mr. Fox was of opinion that in many of the municipal tramways ordinary business principles had been neglected and that the public had been allowed to travel at the expense of the ratepayer, fares being too low to allow, after working expenses had been defrayed, of the setting aside of a reasonable sum for depreciation and renewal.

The section concluded its proceedings with a paper on the strength of solid cylindrical, round-ended columns, by Prof. W. E. Lilly. In previous papers by this author the importance of secondary flexure and its influence on the strength of columns had been demonstrated, and as a result of his researches he had suggested the revision of the formula at present in use for the design of columns. The modified formula which the author had suggested required certain constants, and the object of the experiments described in the present paper was the determination of the value of these constants. Experiments had been carried out on columns of cast tool steel, Bessemer steel, mild steel, wrought-iron, and cast-iron, and the results obtained were given by the author in the form of a table; the constants in this table were for use with the well-known Rankine Gordon formula.

## *AGRICULTURE AT THE BRITISH ASSOCIATION.*

THE Dublin meeting of the British Association was marked by the resuscitation of the subsection of agriculture, which, after a previous temporary existence as a dependent of botany and some fitful appearances as a branch of chemistry, now became associated with economics. As was appropriate in these circumstances, and with Sir Horace Plunkett as president, the work of the subsection was mainly concerned with the economic, or rather with the sociological, side of agriculture.

Thursday morning was occupied with the presidential address, in which, at the outset, Sir Horace said that he spoke neither as a man of science nor as a practical farmer, but as a man of affairs whose way of life had brought him into close touch with the conditions, human and material, which it will be the aim of the subsection to improve. His purpose was to establish the claim of agriculture to a new position in the domain of science, for reasons that are primarily neither scientific nor practical, but political. It does not appear to have been sufficiently considered how far the ethical and physical health of the modern city has been due to the constant influx of fresh blood from the country. At present the town makes an irresistible appeal to the spirit of enterprise, to the growing craving for excitement, to the desire to live where there is most life. But sooner or later, if the balance of trade in this human traffic be not adjusted, the raw material out of which urban society is made will be seriously deteriorated, and the national degeneracy will be properly charged to those who failed to foresee the evil and treat the cause. If the problem has not yet received the proper attention at the hands of the sciences, its urgency is growing in the public opinion and stirring the centres of government. The influence of the British Association upon national life must depend, not upon its highest achievements in the region of pure science, but upon the degree in which it establishes and maintains a mutually helpful relationship between science and productive effort. He did not suggest that agriculture had not shared in the benefits with which science, physical and social, had richly endowed the whole field of industrial effort, urban and rural. But there is surely a marked disparity between the attention given to urban and rural affairs by those engaged in the application of science to the advancement of mankind. A great gulf, no doubt, separates the agriculture of Vergil from that of Sir John Lawes, but how insignificant it is beside the ocean of knowledge which stretches between Archimedes and Lord Kelvin. In his work in Ireland he had been in the habit of employing a rough formula to indicate the three-fold character of the constructive work that is needed in rural life—*better farming*, *better business*, and *better living*. To each of these three divisions the sciences ought to be most helpful; the natural sciences to the first, economic science to the second and third, educational science to all three. Sir Horace then proceeded to emphasise in greater detail the necessary part played by research, by economic investigation, and by education in rural reconstruction. Lastly, he proceeded to plead for the more adequate recognition of agriculture by the association; he demanded that it should be accorded the dignity of a section instead of being left in its present unstable condition, without any organisation to secure the continuity of even a subsection from year to year. The association might thus help to "counteract tendencies through which preceding empires, after they had arrived at a stage very similar to that which we occupy to-day, hastened to their decline and fall. Be this as it may, it would hardly be an exaggeration to say that modern civilisation has joined the rural exodus. Let it be the high aim of the British Association, leading science and practice hand in hand, to call it back."

In the afternoon following the presidential address, Sir Oliver Lodge described some of the experiments, which are being made on a large scale near Worcester, on the effects of a high-tension electrical discharge over a growing crop. While carefully guarding himself from any speculation as to whether the seat of the action was in the soil or the plant, whether a stimulus action or an inflow of energy, there seemed to be a positive result which was quite outside the domain of experimental error. Mr. J. H. Priestley, who has been associated with the experiments, gave some further details, and explained the investigations he had in hand to elucidate the nature of the action of the electricity. Then followed a paper by Prof. J. R. Campbell, of the Irish Department of Agriculture, in which he lucidly explained the educational work of that department, where the following of a carefully considered policy has achieved much happier results than the wasteful English method of leaving each county council to go as it pleases. Education was also the text of the next paper, by Dr. Carroll Dunham, of Harvard, in which he compared the systems of agricultural education prevailing in the United States, according as their aim was to prepare

the students for business as farmers or for teaching and research.

Two more purely scientific papers were also taken on the first day; Dr. G. H. Carpenter described some of his work upon the warble-fly and its attacks, and Mr. H. Hunter explained the results of the long and systematic trials of barley varieties that have been made in Ireland by the cooperation of Messrs. Guinness with the Department of Agriculture. These trials have established beyond any doubt the general superiority of "Archer" to other barleys, both from the farmers' and the brewers' standpoint, thus confirming the results of the very similar trials made in Denmark.

Friday was given over to papers and discussions on breeding and on the light which science is beginning to throw on the problems of the stock raiser. Mr. Bateson opened the proceedings by a luminous exposition of the Mendelian standpoint, with illustrations of how the work of the raiser of new varieties of plants or the improver of breeds of animals could reduce his work to something like certainty, and work by design instead of by chance. Mr. W. Heape, F.R.S., who followed, pleaded for the establishment of experimental farms devoted to the solution of breeding problems; attention is at present exclusively given to the raising of crops, forgetting the enormous importance of our live-stock business. To Ireland such experimental work would be specially valuable. Mr. Punnett then gave an account of some of the more special applications of the Mendelian principles to stock questions, and Prof. J. Wilson showed how the facts of colour inheritance in cattle led to certain conclusions concerning the original races of cattle which have gone to make up the breeds now prevailing in the British Islands.

On the Monday the section resumed its previous economic point of view, and gave itself up to a very animated discussion of the factors which make for the success of small holdings. Mrs. Wilkins (Miss Jebb) opened the proceedings with a paper in which she sketched the very various conditions under which success had been achieved in England, and the necessity of certain collateral developments, such as cooperation, if any considerable numbers of small holders have to support themselves upon the land. She maintained that the fact that small tradespeople and mechanics rather than agricultural labourers are at the present moment chiefly applying for small holdings is really a good omen for the success of the movement, since such men are, as a rule, better able to make an economic use of the land than men who would be forced to depend wholly upon their small farming.

Mr. Christopher Turnor insisted on the importance of guiding the small holder in his methods of work and cropping, even to the extent of establishing in each district one or two model holdings cultivated for demonstration purposes. Mr. F. Impey gave some account of the work that had been done in Great Britain in obtaining small holdings of recent years, and Mr. Beach Thomas described the evidence he had received as to the widespread desire of city workers to get back to the land. An animated discussion followed, a little political, perhaps, at times, and not wholly devoid of rhetorical heat, but still informing; the general impression which seemed to emerge was that success is being attained by market gardening and fruit growing rather than by small farming. The president showed that in many cases, especially in Ireland, it is the community rather than the individual who should be the small holder, thus automatically ensuring cooperation both in the work and the trading.

The last meeting was held jointly with the parent section of economics to hear various papers of a more general economic character. Dr. Graham Brooks discussed the moral effects of cooperation upon the workers, and Dr. Moritz Bonn, of Munich, examined the statistics relative to Irish agriculture to ascertain if the last twenty years of land reform had begun to effect any improvement in the productive power of the Irish occupier. Statistically he could detect but little change, a view for which he was somewhat fiercely taken to task by the politicians present. Statistical papers by Prof. J. Wilson and Mr. W. G. Adams terminated a very successful session of the subsection, at which the interest and attendance had been maintained from the first day until the last.

## METEOROLOGY IN AUSTRALIA.[1]

THE Commonwealth Bureau of Meteorology, Australia has now been in existence more than a year, and issued its first Bulletin a few months ago. This is an article on the "Climate and Meteorology of Australia," and is written by the Commonwealth meteorologist, Mr. H. A. Hunt. It contains some very interesting data with regard to the climate of the various capitals, and indicates that Adelaide is the driest and sunniest, and that Brisbane is the hottest, capital. The hottest region is in the northern part of West Australia, near the Marble Bar and Nullagine goldfields, where the maximum shade temperature often exceeds 100° for days and even weeks continuously.

The Northern Territory and Queensland receive their rain in the summer from the monsoonal depressions from the north-east. The southern parts of West Australia and South Australia benefit from the Antarctic depressions in winter. In Victoria and Tasmania the seasonal change of rainfall is not strongly marked. New South Wales gets most of its rain in the later summer and autumn.

The wettest place is Geraldton, in north-east Queensland, with an average yearly fall of 145 inches; the driest region is round Lake Eyre, where 10 inches in one year is exceptional, 5 inches being the average.

In discussing cyclones and storms, mention is made of the "Willy Willies" which afflict the north-west parts of West Australia. These are severe cyclones which apparently originate in the Cambridge Gulf and travel south-west and south along the line of the coast, or they cross the continent towards the Australian Bight. These storms cause great havoc, and are marked by torrential rains.

The "Southerly Burster" is peculiar to the eastern parts of Australia, and is a cold wind which always follows a period of hot weather. It is usually associated with the V-shaped depression between two anticyclones. These storms are usually first noted on the extreme south coast, and they travel northward at the rate of about twenty miles per hour. The velocity of the winds varies, sometimes reaching eighty miles per hour.

Winds of similar character to "Bursters" are the "Bora" on the east coast of the Adriatic, the "Mistral" in France, the "Northers" of Texas, and the "Pampero" in the Argentine. South Africa also has a wind of like nature and origin.

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—On the occasion of the visit of the members of the International Conference on Electrical Units, the Public Orator (Dr. Sandys) spoke as follows in presenting on October 17 the several distinguished recipients of the degree of Doctor of Science *honoris causa*:—

(1) Scandinaviam hodie nobis quasi praesentem reddit Upsalae et Holmiae alumnus insignis, qui "electrolysis" (ut aiunt) praesertim in provincia investigatorum omnium dux et signifer merito existimatur; qui scientiae chemicae in regione physica inter conditores praecipuos numeratur; qui e scientia illa praemium orbi terrarum toti propositum reportavit, cuius laudis inter participes illustres et Cancellarium nostrum et rei physicae Professorem nostrum esse gloriamur. Idem solis ipsius naturae inter exploratores patientissimus, tempestatum inter augures perspicacissimus, (ut Aristophanis verbis paullulum mutatis utar) τῶν νῦν μετεωρολογούντων quasi princeps iure optimo esse fertur.

Ergo Scientiarum Doctor hodie merito creatur scientiae chemicae in provincia physica Instituti Nobilis Scientiarum in Academia Regia Holmensi Rector, SVANTIUS AUGUSTUS ARRHENIUS.

(2) Francogallorum respublica maxima, nobis vicina, nobis amicitiae vinculis indies artioribus coniuncta, viri desideratissimi in vicem, successorem eius misit dignissimum, qui non modo inter Germanos sed etiam inter Francogallos educatus, Parisiensium in Universitate iam per annos duo et viginti scientiam physicam praeclare

[1] "The Climate and Meteorology of Australia" (Reprinted from the "Year Book of the Commonwealth of Australia." Bulletin No. 1, issued March, 1908.) By H. A. Hunt.

professus est. Rerum Naturae quidem studiosis non ignotum est electrometron illud ab eodem inventum. Etiam plurium oculis obversatae sunt imagines illae pulcherrimae in quibus lucis auxilio et colores varii et luminis ipsius spectrum (ut aiunt) accuratissime redduntur. Peritioribus autem nota sunt volumina, quae ab eo et audiendi et videndi rationi universae explicandae dedicata sunt, quae et vim caloris et vim electricam modulosque eius ordine lucido enuclearunt. In his modulis sollertissime metiendis, iuvat recordari Cancellarii nostri cum rationibus hospitis nostri hodierni rationes minutissime quadrare. Ceterum de re tam subtili non nostrum est hodie fusius disputare; oratoris vestri ex animo nondum excidit monitum illud Horatianum :—

"metiri se quemque suo modulo ac pede verum est."

Praesento vobis Francogallorum Instituti socium illustrem, GABRIELEM LIPPMANN.

(3) Etiam e republica maxima trans aequor Atlanticum, nobis coniunctissima, ad nos advectus est vir insignis, Washingtonii in urbe illustri mensurae et ponderis provinciae praepositus, qui pecuniae publicae summam ingentem sibi liberaliter creditam, et scientiae ipsius et populi industrii maximo cum fructu, his rebus omnibus ad normam accuratam redigendis dedicavit; qui quantum operariorum industriae scientiarum exquisita cognitio conferat, luculenter demonstravit. Non inter antiquos tantum sed etiam nostro in saeculo trans aequor Atlanticum cognitum est, Mercurio, Atlantis nepoti, negotiatorum omnium numini, Divam Minervam, scientiarum omnium reginam, sororem esse omnium dignissimam. Animi nostri fraterni in testimonium, eo libentius hodie salutamus virum eloquentem, quem etiam ipsum Atlantis nepotem facundum nominaverim, SAMUELEM WESLEY STRATTON.

(4) Olim Altonae natus, a Berolinensibus educatus et ab eisdem scientiae physicae ad cathedram revocatus, adest sonitus in aëre clausi velocitatis investigator clarissimus, qui itineris sui inter comites insigniores etiam Cancellarium nostrum numeravit. Idem rei magneticae phaenomena illa perquam impedita expedivit, quae Professor quidam noster postea *Hysteresis* nomine nuncupavit. Denique scientiae physicae Imperii totius Germanici Instituto celeberrimo praepositus, virorum magnorum successor magnus merito esse existimatur. Inter Doctores nostros honoris causa olim HELMHOLTZIUM numeravimus: hodie successorem eius recentissimum ordini eidem libenter addimus.

Doctorum nostrorum seriem claudit hodie scientiae physicae honoris causa Professor Berolinensis, AEMILIUS WARBURG.

A large number of specimens of timber, grown, many under forestry conditions, on the Brocklesby Estate, Lincolnshire, has recently been sent by Lord Yarborough to the forestry museum, which is temporarily housed in the botany school. No fewer than seventy-seven species of trees are represented in this donation. Although forestry, as a subject of instruction at Cambridge, only dates from October, 1907, the collection of timbers already acquired is considerable, and includes both home-grown and foreign specimens, some of which are extremely rare, as that of the Servian spruce, an almost extinct species, which is confined to the valley of the Drina, between Servia and Bosnia.

The Gedge prize has been awarded to E. Mellanby, of Emmanuel College, for his essay entitled "Creatin and Creatinin."

Prof. Pope announces a valuable gift of apparatus and chemicals which has been made to the university chemical laboratory by the master and fellows of Gonville and Caius College and the master and fellows of Sidney Sussex College upon the closing of the chemical laboratories in the two colleges.

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A CONFERENCE of fruit-growers will be held at the South-Eastern Agricultural College, Wye, Kent, on November 27, under the chairmanship of Mr. C. W. Radcliffe Cooke, president of the National Association of English Cider-makers. Insecticides will be discussed by Mr. Spencer Pickering, F.R.S., spraying and spraying machinery by Mr. E. S. Salmon, grading and packing by a representative from British Columbia.

SOME two years ago the governors of the Sir John Cass Institute decided, in view of the great importance of the fermentation industries and the fact that there was very little methodical instruction available in London for those who were occupied in breweries and distilleries, to institute a course upon the chemistry of fermentation, and they appointed Mr. Arthur R. Ling to conduct this course. They have now broadened the basis of the work; and over and above the laboratory course in brewing and malting Dr. A. Harden will, during the winter, give a course of instruction in the micro-biology of the fermentation industries, which will consist of lectures and demonstrations. The first of this course was delivered on October 6, when Dr. Horace Brown, F.R.S., occupied the chair. In his opening remarks the chairman alluded to the value of scientific research, and said that there appears to be a considerable amount of misconception in the lay mind as to the meaning of the treatment of scientific research, and perhaps a still greater misconception in the methods employed in furthering it. The popular belief at present in vogue is that the scientific worker, in the first place, looks round for some great problem which calls for solution, and then proceeds by a series of experiments af trial and error to cut deep into the heart of the subject. Occasionally this method, if carried out, may lead to results, but he would rather suggest that research consists in finding some loose thread in the frayed edge of a piece of embroidery and in patiently following up the slender clue wheresoever it may lead, thus gradually revealing the elaborate pattern and the manner in which it is interwoven. Dr. Harden in his lecture first traced the history of the progress of knowledge with regard to alcoholic fermentation, referring to the work of Lavoisier Liebig, Pasteur, and Buchner. Working with Mr. Young at the Lister Institute, he found that phosphates gradually increase the rate of fermentation, a definite chemical reaction taking place in which the amount of carbonic acid exactly equivalent to the phosphate added is evolved, the phosphate itself entering into combination with the second molecule of sugar. Finally, a short account was given of recent work on the fermenting complex present in yeast-juice. Dr. Harden and Mr. Young consider this to consist of two distinct substances—the enzyme and co-enzyme—the cooperation of which is necessary to produce fermentation when added to a solution of sugar and a phosphate.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, June 4.—"Note on a New Sounding Machine for use on Lakes and Rivers without a Boat." By Prof. E. J. **Garwood**. Communicated by Prof. T. G. Bonney, F.R.S.

The sounding machine was designed specially for use on mountain lakes and rivers where boats cannot be obtained, but it can also be used with a boat, in which case it has the advantage over the sounding machines usually employed, since it registers the position as well as the depth of each sounding.

The instrument consists of two posts which are erected on opposite sides of a lake or river; between them a line is stretched, the ends of which are wound on drums carried by the posts. By alternately winding this line on each post a float is drawn backwards and forwards across the lake, the position of the float at any moment being automatically registered on the post worked by the observer. The float carries a pulley over which the plummet line travels, the end of this line being wound on a second drum attached to the observer's post. In this way rows of soundings can be taken across the lake, one of the posts being moved each time that the float reaches the shore until the whole lake has been charted.

By a mechanical device one counting machine is made to register both the depth of each sounding and the distance from the shore at which it is taken; it is also engraved with a double set of figures counting in opposite directions, so that observations can be taken in whichever direction the float is travelling. The instrument is supplied with a check and also a stop brake, and mechanical devices are provided to insure the constant tension of the line, and for preventing unequal piling of the line on the two drums.

There is also a special lever, by means of which the counting discs can be disengaged and returned rapidly to zero, the lines meanwhile remaining at rest. An important point in the practical working of the instrument is the fact that all mechanism is confined to the observer's post, so that any unskilled assistant can be utilised.

The instrument is portable, and can be carried by one man even in mountainous districts.

June 18.—"The Giant Nerve Cells and Fibres of *Halla parthenopeia*." By Dr. J. H. **Ashworth**. Communicated by Prof. J. C. Ewart, F.R.S.

An anterior and a posterior series of giant cells are present in Halla; the following statement refers to the anterior series. Primary giant cells are formed in segmental couples—one couple in each of the anterior ganglia of the nerve cord—until a maximum of eight couples is attained. Secondary giant cells are also formed at the anterior end of the nerve cord, and occasionally in one or more ganglia already possessing a primary couple. There is a progressive increase in the size of the primary giant cells until the worm has attained a length of 30 cm. to 40 cm. Yellow granules, probably insoluble products of metabolism, are present in the giant cells. Chromophilous granules occur in great abundance in a specialised peri-nuclear zone, distinguishable in the living cell by its greater refringency.

The neurofibrillar network in the giant cell is divisible into a peri-nuclear network, situated at the margin of the peri-nuclear zone, and a more extensive, wider meshed, and generally more slender stranded network in the general protoplasm. From this network slender primitive fibrils pass into the cone of origin of the axone, whence stouter fibrils, each due to the fusion of several primitive fibrils, pass into the giant fibre. The bundle of neurofibrillæ occupies from one-fourth to three-fourths of the internal diameter of the giant fibre.

The anterior giant cells of *Aglaurides fulgida* agree in the main features of their arrangement and structure with those of Halla.

**Entomological Society**, October 7.—Mr. C. O. Waterhouse, president, in the chair.—*Exhibits*.—W. G. **Sheldon**: Butterflies from Andalusia taken in the spring of this year. They included *Anthocharis belemia* and var. *glauce*; *A. tagis*, low-level and high-level forms; *Zegris eupheme*, var. *meridionalis*; *Melitaea phoebe*, var. *occitanica*; *M. deione*, a very large and well-marked form; and *Melanargia ines* with one striking aberration showing a strong melanic tendency.—Dr. Herbert **Charles**: Remarkable aberration of *Dryas paphia*, taken in the New Forest in July. With the exception of the borders and the bars, all the upper sides of the wings were suffused with deep velvety-brown triangular patches, the maculations being entirely absorbed therein.—Hugh **Main**: living larvæ of *Blatta germanica* to illustrate their colourless condition on first emergence.—H. St. J. **Donisthorpe**: Examples of (*a*) *Agrilus biguttatus*, F., from Sherwood Forest, not taken in Britain for about thirty years; (*b*) *Pyropterus affinis*, not uncommon in Sherwood Forest, July; (*c*) a species of Phora, with pupæ bred from larvæ which came out of the body of a *Clerus formicarius* taken alive in Sherwood Forest, July, with the Agrilus, and probably parasitic on it; (*d*) *Trogolinus anglicanus*, Shp., a specimen taken at Bembridge, August 3, with a specimen from Plymouth, only known before to occur in New Zealand and at Plymouth; (*e*) *Phyto melanocephala*, Mg., bred from wood-lice taken at Bembridge, Isle of Wight, August, with pupæ, and a wood-louse with dipterous pupa *in situ*. The life-history of the fly was hitherto unknown, though the larvæ of *Rhinophora atramentaria*, Mg., a nearly related species, have been recorded as parasitic on *Oniscus asellus*.—A. **Harrison**: A gynandromorphous example of *Pieris napi*, bred from parents taken in north Cornwall this year.—E. R. **Speyer**: Rare and interesting dragon-flies taken in the British Isles in 1908, including *Sympetrum fonscolombii*, Selys, ♂ and ♀, taken in Hertfordshire on June 24 and July 27 respectively; *Somatochlora metallica*, Lind., a ♂ captured in Sussex on August 4, being the first authentic record of this insect in England; and *Libellula quadrimaculata*, Linn., four specimens, showing the remarkable difference in the amount of suffusion on the wings in individuals.—Norman **Joy**: Examples of Coleoptera new to the British list.—H. M. **Edelsten**: Specimens of *Aeschna isosceles* and *Libellula fulva* from Norfolk Broads, taken in June, and *Orthetrum caerulescens* from Chagford, taken in July.—W. J. **Lucas**: A spike of the grass *Molinia caerulea* with dead Syrphids, *Melanostoma scalare*, Fabr., attacked by the parasitic fungus *Empusa muscae*, found on Esher Common, October 3. Many or most were attached by the point of the head only in a very peculiar manner, and apparently all were females.—O. E. **Janson**: A specimen of *Cryptamorpha desjardinsi*, Guér., found by Mr. F. C. Selous at Barton-on-Sea, Hants. This beetle is recorded as living on banana plants in Mauritius and Madeira, and may have been introduced here in the banana fruit.—W. **West**: Specimens of the following insects:—*Aleochara crassiuscula*, Sahlb., taken at Great Yarmouth in May; varieties of *Donacia dentipes* and *D. simplex*, from Caistor Marshes; *Nabis boops*, Schiödte, taken at Esher in August; and *Idiocerus scurra*, Germ., taken at Blackheath, Kent, in September.—L. W. **Newman**: Specimens of (*a*) *Crymodes exulis* from the Shetlands, including one of the very rare female; (*b*) *Callimorpha dominula*, two yellow aberrations bred from east Kent ova; and (*c*) a varied series of *Camptogramma fluviata*.—Dr. F. A. **Dixey**: A number of Central and South American butterflies belonging to six different subfamilies, but all showing the same obvious character of a diagonal reddish band on a general dark surface.—*Papers*.—Bionomics of butterflies: Dr. G. B. **Longstaff**.—Some additions to the Perlidæ, Neuroptera-Planipennia, and Trichoptera of New Zealand: L. J. **Hare**.—The larvæ of *Hamanumida daedalus*, Fab., *Hoplitis phyllocampa*, n.sp., and *Sulophonotus myrmeleon*, Feld, with descriptions of the imagines of the two Heterocera: Roland **Trimen**.—Revision of the Australian and Tasmanian Malacodermidæ: A. M. **Lea**.

**Institution of Mining and Metallurgy**, October 15.—Mr. Alfred James, president, in the chair.—The separation of metallic ores by jigging: A. **Taylor**. A description of a modification of the ordinary mechanical jig, devised by the author, in which a vibrator is substituted for the usual plunger. The vibrator consists of a shaft provided with discs or fly-wheels so constructed that their centres of gravity do not coincide with that of the shaft to which the hutch is attached; consequently the revolution of the shaft and hutch carrying the screen, in accordance with the law which compels a rapidly revolving mass to rotate around its centre of gravity when uncontrolled by fixed bearings. In this case the whole apparatus is hung on springs, allowing of free vibration in any direction. The paper contains also a description of the ores for the special treatment of which the apparatus was primarily designed.—Laboratory routine in modern smelters: H. T. **Waller**. A brief description of methods found useful by the author in connection with copper blast-furnace smelting. These include the analyses of slags and matte, and determinations of copper, iron, silica, lime, aluminium oxide, zinc, and sulphur.—Reinforced concrete foundations for stamp batteries: S. J. **Truscott** and J. P. **Fuller**. A detailed account of the replacement of the original wooden mortar blocks of the stamp battery at Redjang Lebong, Sumatra, by others constructed of reinforced concrete, with notes on the composition of the materials used and the cost of the work.—The estimation of sulpho- and ferrocyanides, &c., in cyanide solutions containing copper: L. M. **Green**. This paper deals with the complications arising from the presence of copper in solutions obtained in the cyanide treatment of silver and gold ores in regard to the determination of sulpho- and ferrocyanides. Cupric and cuprous double cyanides exercise a reducing action on permanganate in acid solution, and precipitate both sulpho- and ferrocyanides, so that an ordinary method of determination is often impossible. The paper describes some of the reactions and tests to be adopted in these circumstances.—Mine sampling devices: H. E. **Hooper**. Two devices, a hanging sampling chair for use in winzes, and a catching bag for employment in conjunction with the chair, are here briefly described and illustrated.

PARIS.

**Academy of Sciences**, October 12.—M. Bouchard in the chair.—A statement of the conditions under which the Bonaparte fund will be applied.—The application to man of an anti-tuberculous serum: MM. **Lannelongue, Achard,** and **Gaillard.** The serum is prepared from horses and asses, after submitting the animals to the action of a toxin extracted from the tubercle bacillus. Preliminary experiments on animals appeared to show some beneficial effects, and an account is now given of the treatment of human tuberculous subjects with this serum. The experiments have lasted more than a year, more than fifty subjects affected with various tuberculous diseases having submitted to the treatment. The serum is well tolerated, and can be used without danger; it is without curative influence on cases of advanced tuberculosis, but in less advanced cases forms a useful addition to the usual therapeutic treatment. In some cases the number of tubercle bacilli was shown to diminish and even disappear.—Cultural bud mutations in *Solanum Maglia*: Edouard **Heckel.** This variety offers certain advantages over *Solanum tuberosum* in its resistance to mildew, does not require a soil specially resistant to drought, and accommodates itself to soils containing large amounts of clay and lime.—The Tempel-Swift comet: MM. **Javelle** and **Giacobini.** Observations of the comet were made at Nice on the nights of September 29, 30, and October 2 and 3. The mean positions of the comparison stars and the apparent positions of the comet are given.—Remarks on a note of M. Lebedew relating to the dispersion of light in interstellar space: Charles **Nordmann.**—Systems of families of surfaces cutting along conjugate lines: S. **Carrus.**—The extraction of the rare gases of the atmosphere: Georges **Claude.** A description, with diagram, of a modification of the commercial apparatus for separating oxygen and nitrogen by fractional distillation for the purpose of extracting the lighter gases of the atmosphere. The modified apparatus gives a continuous flow of a gaseous mixture consisting of nitrogen with at least 50 per cent. of neon, helium, and hydrogen. Another modification gave a gas with a density of 0·68 that of air; since the density of neon is 0·69, the gas thus obtained is extremely rich in neon. Approximately pure neon can in this way be obtained in any quantity.—Researches on the diffusion of gaseous ions: Edouard **Salles.**—The method of calculation of the atomic weights: Louis **Dubreuil.** A discussion and modification of the methods of Hinrichs.—One of the causes modifying the dominant forms in crystals, and on solid solutions: Paul **Gaubert.** It is shown that in the crystallisation of phthalic acid the addition of small quantities of liquids to the solvent causes modifications in the form of the crystals separating on cooling. It is known that a crystal, growing in a liquid, can absorb molecules of another crystalline substance, and to this must now be added the molecules of the solvent itself or of another liquid present in the solvent.—Katafa, Geaya, and Macrocalyx, three new Madagascan plants: M. **Costantin** and H. **Poisson.**—The skeleton of the anterior member of *Bradypus torquatus*: A. **Menegaux.**—The phenomena of phagocytosis and autodigestion in the course of the regression of the ascidiozoids in the Diplosomideæ (compound ascidians): Antoine **Pizon.**—Crossing in the Amphibia from the cytological point of view: E. **Bataillon.**—Anatomical orientation in radiography: A. **Rieffel** and Maxime **Ménard.** The incorrect placing of the Crookes's tube may result in apparent displacements, deformations, or lesions, or, conversely, may mask these if present.—Contribution to the study of audition: M. **Marage.** A comparison of the theory of Helmholtz and that according to which all the nerve centres are equally impressed; the latter theory is held to correspond most closely with the most recent anatomical and pathological knowledge.—The resistance at 100° C. of the hæmolysins of prepared serums. The separation of alexine and its sensitiser by filtration through collodion: Albert **Frouin.**—The treatment of trypanosomiasis in horses by orpiment alone or associated with atoxyl: A. **Thiroux** and L. **Teppaz.** *T. cazalboui* and *T. dimorphon* have been successfully treated by the combination of orpiment with atoxyl, all the three horses treated being cured. It is possible that m'bori is also curable by this treatment. Two horses suffering from souma have been treated with success by orpiment alone.—The persistence throughout Corsica of a zone of abnormal contacts between the eastern and western region: M. **Deprat.**—Disturbances in the electric charge of the earth: Albert **Nodon.**—Variations of latitude and earthquakes: M. de Montessus **de Ballore.**

## DIARY OF SOCIETIES.

*THURSDAY*, OCTOBER 22.

CHEMICAL SOCIETY, at 8.30.—The Passage of Hydrogen through a Palladium Septum, and the Pressure which it produces: D. Tsakalotos.—The Relationship of Colour and Fluorescence to Constitution, Part ii., Rhodamines of Mellitic Acid: O. Silberrad and C. S. Roy.—Constitution of the Fluorescences of Mellitic and Pyromellitic Acid: O. Silberrad.—A New Form of Gas Burette: A. E. Hill.—A Molecular Compound of Trinitroacetaminophenol and β-Naphthol: R. Meldola and J. G. Hay.—Reduction Products of Azoxybenzene, Preliminary Notice: L. H. Berry.—Constitution of the Salts of the Phthaleins, and the Cause of Colour in the Triphenylmethane Series: A. G. Green.—Chlorination of β-Nitraniline: B. Flürscheim.—Relation between Absorption Spectra and Chemical Constitution, Part x., Unsaturated Acids of the Benzene Series: E. C. C. Baly and K. Schaefer.—Condensations with Monochloromethyl Ether, Part i., Condensation of Monochloromethyl Ether with Ethyl Malonate and Ethyl Isopropyl Malonate: J. L. Simonsen.—Relation between Chemical Constitution and Physiological Action in Certain Substituted Aminoalkyle-ters: F. L. Pyman.—Effect of Constitution on the Optical Rotatory Power of Optically Active Nitrogen Compounds, Part iii.: R. W. Everatt and H. O. Jones.

*FRIDAY*, OCTOBER 23.

PHYSICAL SOCIETY (National Physical Laboratory), at 3.30.—Demonstrations of Work in Progress in the Laboratory.

*WEDNESDAY*, OCTOBER 28.

SOCIETY OF DYERS AND COLOURISTS, at 8. Some Recent Improvements in Dyeing and Cleaning: F. J. Farrell.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.—Annual Meeting.

## CONTENTS.