THURSDAY, FEBRUARY 20, 1908.

CONTINUATION SCHOOLS.

Continuation Schools in England and Elsewhere. Edited by Prof. M. E. Sadler. Pp. xxvi+779. (Manchester: University Press, 1907.) Price 8*s.* 6*d.* net.

PROF. SADLER and his fellow-workers are to be congratulated on the production of a volume which is full of useful information and contains many valuable suggestions and expressions of opinion; moreover, it appears at a time when precise information of the kind given is urgently needed by educational authorities, merchants, manufacturers, workpeople, and teachers. For at the present moment two problems stand in urgent need of solution, and with both of them this volume is largely concerned. The first is how to meet the grave difficulty occasioned by the enormous development of machinery, which, though a good in itself, has brought in its train a grave loss, viz. the almost entire disappearance of the old apprenticeship system, which involved the careful training of the craftsman by his employer; and the second is how to deal with the large number of children who are employed as unskilled labourers at comparatively high rates of pay during their early years, who are subsequently replaced by similar children, and are then thrown on the labour market as unskilled labourers for whom there is not an adequate demand, and who go to swell the ranks of the unemployed.

Prof. Sadler and his colleagues give an account of the agencies which seek to solve these problems in this country and abroad, and of the legislative and administrative measures which we and other nations have adopted in order to cope with these difficulties. They show that, in so far as Great Britain is concerned, our success has only been partial, and, while giving full credit to all the improvements we have effected, they point out in what respects other nations are in advance of us; they instance, for example, the people's high schools in Denmark, and the enormous service they have done to the Danish nation, more particularly in so far as they have educated the agricultural population, and, *inter alia*, made possible cooperation among farmers, thus bringing about numerous improvements in Danish agriculture and conditions of rural prosperity which one would like to see in this country.

It is impossible to touch on all the various questions which the authors discuss; but there are four points which seem of more importance than the rest. In the first place there is the question of the "half-timer," which is dealt with by Mr. Sandiford in chapter ix., and by Prof. Sadler in the following chapter, which gives details as to the laws in regard to the employment of children in this country, Germany, and Switzerland. The evidence on both sides of the question is given in an impartial manner, and few unprejudiced persons will read it without being convinced that the continuation of the half-time system involves grave injustice to a not inconsiderable proportion of the child population of Lancashire and Yorkshire; for it is clearly shown that the mental, moral, and physical condition of the average half-timer is seriously injured by the large amount of overwork to which he is subjected. It is painful to read that these wretched children are awakened by the "knocker-up" between 4.45 and 5.30 a.m., that with short intervals for food they work until 12.30 p.m., and are then expected to learn something in the two and a-half hours which they spend in school in the afternoon. The result of this cruel treatment can readily be imagined; careful measurements have shown that the average half-time scholar between the ages of thirteen and fourteen is an inch less in height, and weighs more than 2 lb. less than the average full-time scholar of the same age. Moreover, the damage is not merely physical; we are told that the half-timers are undoubtedly duller than the full-time children, and that they rise less frequently to good positions in their industry.

Clear evidence is adduced to prove that the employment of half-timers is by no means necessary, as there are many successful mills in which no such persons are employed; it is to be hoped, therefore, that Parliament will soon awaken to this crying evil, and will absolutely forbid employment of this kind, which is sanctioned in scarcely any other civilised country in Europe.

The second question, concerning which this book provides valuable information, is the need for the improvement and development of our public elementary schools in directions likely to give a better preparation for industrial life in the case of boys, and domestic life in the case of girls. In the past, and to a large extent at the present time, the schemes of education set forth by the Board of Education have been devised, and their working inspected, mainly by persons trained on classical lines in the great public schools and at the older universities; the result has been that our elementary education has taken directions which are too bookish and not of a sufficiently practical character; if anyone doubts this, he need only examine, as a sample, the absurd questions in arithmetic set by the Board of Education for the so-called "Labour Certificate." As a consequence, our elementary schools have tended to encourage unduly the production of clerks, and to spread amongst the poorer classes the idea that manual labour is less honourable than clerical work. Experiments are being made to counteract this, experiments, unfortunately, in some cases, not too cordially assisted by the Board of Education.

In chapters xiii. and xiv. an account is given of certain trade schools and pre-apprenticeship schools, which shows the attempts that are being made to combine ordinary elementary instruction with the attainment of a reasonable amount of manual skill. The very few hours a week at present given to such work in our elementary schools are grossly inadequate, and a much better result would be obtained if boys between the ages of twelve and fourteen were allowed to devote a considerably larger fraction of their school time to practical training of a suitable character, and if, during the same period, girls were given a know-

ledge of domestic subjects much more substantial than the smattering which they now get in the very short periods devoted to this essential part of their education. The experiments in this direction which have been tried in Gloucestershire have shown that, while the amount of book knowledge which the children possess may be somewhat smaller, the larger amount of contact they have had with *things*, as distinguished from mere *words*, makes them, on the average, not less, but more intelligent.

In the third place, one of the collaborators, Mr. G. L. Bruce, deals in the third chapter with evening schools in London, and mentions incidentally the great drawbacks to evening work of a university character, which are unfortunately imposed by the new teaching university itself (see pp. 132 and 138). There is no doubt much truth in this complaint, and, if a consideration of the question leads us to be careful that, in the foundation and working of our newer universities, we do not hand over technical training too largely to the control of those whose experience in this kind of work is either wanting or small, we shall have learnt a good lesson. The most successful technical colleges in the world are probably the Technical High School at Charlottenburg (Berlin) and the Massachusetts Institute of Technology at Boston; neither of them is subordinate to an ordinary university, though in each case a flourishing university exists side by side in the same town. Both of them have the right to give degrees, but the basis on which these degrees shall be offered is determined by those primarily interested in technical education; this is by no means always the case in our English universities.

Lastly, the most important matter dealt with in the book is probably the problem as to whether or not the State ought to make compulsory further attendance in continuation schools after a child has left a public elementary school; and if so, whether it should require employers to offer facilities for such attendance so that the child can continue its education without undue pressure. The attitude taken by Prof. Sadler in regard to this matter is one which will commend itself to most thinking persons; he asks for no rapid or revolutionary change, but he indicates clearly that the time has come when a step should be made in the direction taken by our most successful Continental competitors; for he states:—

"I am convinced that in the end some form of compulsion to attend day or evening continuation classes between fourteen and seventeen years of age will be found desirable, not so much in the interest of the picked individuals as in that of the rank and file. Many of the present evils of unemployment may be traced to the lack of educational care and of suitable technical training during the critical years of adolescence. Compulsion, however, should be accompanied by reduction in the hours of juvenile and adolescent labour where those are now excessive."

A careful perusal of the facts and statistics given in this book ought to convince our legislators that a move forward should now be made. It is a well-known fact that many of the students attending our evening continuation classes are so tired when they arrive there that only very poor work can be obtained, or indeed expected, from them. No such classes are held in Prussia after 8 p.m.; many of them in this country only commence at this hour. Some wise employers (unfortunately comparatively few in number) allow their young people time in which to improve themselves, and so to become more useful citizens and better servants, but this practice is hardly likely to become general unless the State intervenes; that the employer and the nation would benefit in the end few can doubt.

No Government in this country is likely to attempt to deal with a matter of this kind until compelled to do so by public opinion. The volume under review should prove a powerful agency in stimulating the rapid growth of a healthy view of the matter; we therefore cordially congratulate Prof. Sadler on having once more taken a leading part in hastening an important educational and social reform.

J. WERTHEIMER.

ICELAND PAST AND PRESENT.

Island in Vergangenheit und Gegenwart. By Paul Herrman. Erster Teil, Land und Leute. Pp. xii +376. Zweiter Teil, Reisebericht. Pp. vi+316. (Leipzig: W. Engelmann, 1907.) Price, 2 vols., 15 marks.

THIS is an account of travel in Iceland in the summer of 1904 by a German schoolmaster. He made the journey in exceptionally favourable circumstances, for, in addition to four months' leave for the special purpose, and a Reise stipendium, the municipal authorities of Torgau provided a *locum tenens* at the gymnasium during his absence; while in Iceland he had the services of the guide who accompanied Thoroddsen on seventeen of his eighteen journeys.

A lover of Iceland and an ardent student of the mythology and folk-lore of northern lands, Herr Herrmann is rather inclined to dwell on the different parts of the country in their aspect as the scenes of this or that Saga. But beyond this, his observation is keen and thorough. Though the book claims to be "not a geological or geographical, but a popular work," we learn incidentally of the geology, geography, natural history, and botany of those parts of the island visited.

The work is divided into two volumes, the first dealling with "Land and People," the second being a full account of three months on the route along the south and east coasts, from Reykjavik to Akureyri. If the book is to be regarded as a "popular" work, it would be advisable to read vol. ii. first. Then, having gained from the detailed description of the journey through the most populous and typical parts of the country a clear idea of the land and its inhabitants, the reader can better follow vol. i., which deals with the land and people generally, and assumes some knowledge of them.

The voyage from Copenhagen to Reykjavik is described, mentioning, *en passant*, Edinburgh, the Orkneys and Shetlands, and the islands south of Iceland, with their myriad sea-bird life. From Reykjavik a trial expedition to Hvalfjördur, Reykholt, and Thingvellir was undertaken to prove the travellers' fitness for the longer distance along the south and

east coasts, a route, travelled now for the first time by a German, that includes the passage of many dangerous glacial rivers.

In vol. ii. is the account of the principal journey. The party, consisting of the author, his guide, and a student from Torgau, left Reykjavik, passed again Thingvellir, and the Geysir district, and made the ascent of Hekla. Then across the Ranga to Oddi Storolfshvoll and the many scenes of the Gunnarr Saga, Bergthorshvoll—of the Njáll Saga—to Vestur and Austur Skaptafells Sysla—the most difficult part of the journey; it is here that the coast is so dangerous, and so many fishing smacks are wrecked. The inhabitants of this district have but little communication with centres of civilisation, and have preserved the ancient characteristics almost unchanged. The travellers then continued through the Mula Sysla (Sudur and Nordur), and Thingeyjar Sysla (Nordur and Sudur), to Akureyri.

Every part traversed is minutely described; there is a good deal of scientific matter for the lay reader; and here it may be remarked that the author has an irritating habit of interspersing his reading matter with references—in addition to the many footnotes—and of placing the Icelandic of so many words in italics and parenthesis. This is a great hindrance to easy reading, especially as the same translation is given many times as the word recurs, and items of information are often repeated.

Vol. i. deals with Iceland's geological origin and formation, its volcanoes and glaciers, its geographical exploration, and traces its history from the earliest colonisation in the ninth century, as a free State, under Norwegian and Danish government, to the present day's self-government under the Danish flag.

The study and practice of medicine, the system of education, which is praised as perhaps the best in the world's history, the language and literature, are all considered, as are the ancient and modern industries and arts—wood-carving, embroidery, sculpture, painting, music, and the drama.

Much space is devoted to agriculture, and eighteen pages treat exclusively of sheep. The varied efforts of the State to encourage the farmers to obtain practical knowledge and to provide schools for their training and assistance are noted. The fishing industry also receives State help, and many statistics of this important branch are given. Much is made of the piracy of foreign fishing boats in Icelandic waters, English trawlers being specially attacked. But the author seems to have a prejudice against everything English; the British tourist is unmercifully criticised, and his manners, clothes, and food unfavourably compared with those of the German traveller. The one of our countrymen who joined the party for a short time must have been a very bad example of his kind, or there is another side to the story, which is given—as all else in the book—in detail.

The descriptions of Reykjavik and Akureyri are very full and explicit, and during his visit Herr Herrmann made the acquaintance of many Icelanders, and so gained, at first hand, information regarding the hospitals, schools, and many public and private social institutions and customs.

He sees everything generally *couleur de rose*, and prophesies a bright future for the island, expressing, nevertheless, the fear that the people, who, more than any other nation, have through centuries of civilisation preserved their ancient manners and customs, their pure language and literature, will, with their advance, lose in primitive charm. He urges philologists, while there is yet time, to make a thorough study of Icelandic.

We can hope, with Herr Herrmann, that he may add later a third volume to his book, dealing with the other parts of the island. If, at times, the personal element is too obtrusive, still the book leaves a very clear idea of Iceland, land and people, past and present, a result due partly to the many and excellent photographs, and numerous references, with which the author fortifies or supplements his own observations.

M. G. B.

ADVANCED ORGANIC CHEMISTRY.

Organic Chemistry for Advanced Students. By Prof. J. B. Cohen. Pp. viii+632. (London: Edward Arnold, 1907.) Price 21*s.* net.

THERE are several very excellent text-books upon the subject of organic chemistry in the English language, but although these meet the wants of the average student, the want of a more comprehensive book has been long felt. The book before us is intended to supply this want, and to a certain extent it undoubtedly will do so. The book, according to the author, is a series of essays prepared from notes of lectures delivered to senior students. The work is perhaps best described as being a series of monographs upon different branches of chemistry; as a consequence certain subjects have been exhaustively dealt with, and other subjects have been entirely ignored. Some students will therefore find all they require within the covers of the book, and others will search in vain for the branch of chemistry with which they are familiar or desire to become familiar. Of course, a book written in this manner is bound to a certain extent to lack sequence, and one has practically to commence *de novo* with each section of the book, that is to say, every section has its own historical introduction. For example, the first chapter is a more or less general introduction, but when we come to chapter ii., dealing with isomerism and stereoisomerism, there is again a long historical introduction. We are not objecting to the author treating the subjects historically; in fact, it is probably best to deal with each branch in this manner in order that the student may get a thorough and comprehensive grasp of the subject. This method of introducing and showing the gradual development of the subject is more likely to stimulate originality than the simple setting forth of a number of cut-and-dried facts.

There is, of course, a danger in treating organic chemistry in the form of a series of monographs dealing with different branches, because of a tendency to detachment and to an unnecessary division of the subject. But in giving a series of lectures to advanced classes in organic chemistry, there is practically no other way open than thoroughly to exhaust certain

branches, although at the same time it is well to connect and coordinate the groups as far as possible, just as examples in inorganic chemistry can often be made use of to elucidate certain facts in organic chemistry and *vice versâ*.

Chapter ii., upon isomerism and stereoisomerism, is written in a very interesting manner, and the subject can be made anything but interesting. The diagrams are good, and the explanations clear and not too overloaded with details. This chapter deals with isomerism of the lactic acids, van 't Hoff's and Le Bel's theories, mutarotation, &c., and the different action of dissolved substances, depending upon whether they are electrolytes or non-electrolytes. Certain of the sections, indeed, were it not for the full references, might be considered rather short. The next chapter treats of the stereochemistry of unsaturated and cyclic compounds (geometrical isomerism), and chapter iv. with the stereochemistry of nitrogen. The work of Pope and collaborators upon the optical activity of sulphur, selenium, and tin compounds is also included in this chapter, and also that of Kipping upon silicon compounds. It would certainly have been advantageous if this part of the section had been a little more fully gone into.

One of the best chapters in the book is that upon condensation. Here the various methods employed for condensations are elaborated and brought together in a manner which will be found extremely useful to students of chemistry and even to those who may consider themselves beyond the student stage. Not only are the methods themselves given, but the subject is also treated theoretically, as, for example, in the acetoacetic ester condensation and in Perkin's reaction. Another chapter is devoted to fermentation and enzyme action, which includes, beside an historical introduction, references to hydrolysis, oxidases, reductases, and the mechanism of enzyme action. The alkaloids, terpenes, camphors, proteins, and carbohydrates are dealt with in detail, but not colouring matters, either natural or artificial. Of course, the author does not pretend to cover all the branches of chemistry, and presumably his reason for omitting the colouring matters is that there is a special chair of chemistry dealing with this subject at the University of Leeds, and there are also other books on this theme.

As we have already stated, the book supplies a want, and we have pleasure in recommending it to all advanced students of chemistry; certainly all chemical libraries will require it. F. M. P.

OUR BOOK SHELF.

The Geology of the Leicestershire and South Derbyshire Coalfield. By C. Fox-Strangways. Pp. vi+373. (London: His Majesty's Stationery Office, 1907.) Price 6*s*.

THIS latest memoir contains a description of the joint coalfields of Leicestershire and South Derbyshire, commonly known as the Leicestershire coalfield. It is one of the smallest coalfields of the Midland counties, and is cut off from the Warwickshire and Derbyshire coalfields by an uplift of older strata. It includes an area of about sixty square miles in Leicestershire, and about sixteen square miles in South Derbyshire. Its exact limit has, however, not yet been proved. A large portion of the area is covered by Triassic rocks, so that the Coal-measures only come to the surface over twenty-four square miles. Although one of the smallest coalfields, it is one of the most ancient, having been worked to some extent from time immemorial. The earliest mention of coals being worked in the district is in the reign of King John in 1204.

The author describes the Coal-measures and the surrounding strata as far as it is possible from the evidence afforded up to the present time. He gives full particulars with regard to the productive measures, remarks on their probable extent beyond present workings, and a general account of the physical history and structure of the area. Brief accounts are also given of the associated rocks, including those of Charnwood Forest, of the Carboniferous Limestone and shales, of the Millstone Grit, and of the Permian and Trias. A chapter is also devoted to the superficial geology. The water supply, saline springs, pottery clays, whinstone, ironstone, building stone, and lime are touched upon in a chapter on the economic geology of the area.

The final chapter on the palæontology of the coalfield has been written by Mr. A. R. Horwood, of the Leicester Museum, who has made a special study of the subject.

There are three appendices—(1) a glossary of technical or local mining terms, (2) a bibliography extending from Camden's "Britannia" of 1607 down to publications in 1907, and (3) details of all the borings and pit sections accessible, covering 200 pages. Many of these sections were left in manuscript by the late Rev. W. Coleman many years ago, and it is gratifying to find the records of old workings, that would probably otherwise have been lost, thus preserved. The bibliography is very valuable and complete. In the list of authors, by an oversight, the titles of Sir William Fairbairn and Sir Arthur Rücker have been omitted. Sir C. Le Neve Foster's title, omitted in the index, is given correctly in the list of authors preceding the bibliography.

The value of the report is greatly enhanced by a small coloured map of the coalfield and six large folding plates of vertical and longitudinal sections.

Inorganic Chemistry. By E. J. Lewis. Pp. xxv+408. (Cambridge: University Press, 1907.) Price 5*s*.

THIS book, primarily intended for school use, deserves the widest recommendation as a sound and interesting introduction to the subject. It consists of a series of chapters or lessons in which the systematic part of the subject is happily blended with a considerable amount of theory. The treatment is thorough and painstaking without being dry. One is a little surprised, perhaps, after reading of the intended scope and purpose of the work, at the very large number of topics introduced which by tradition have come to be regarded as part of an advanced course. Thus, in part ii., the successive topics treated theoretically are mass action, thermochemistry, basicity of acids, relative strength of acids and bases, isomorphism, osmotic pressure, ionic theory of solution, and the periodic classification. The treatment, though simple, is satisfactory.

For the small number to whom chemistry is to become a life-study, there may be two opinions as to the wisdom of this brief inclusion at an early stage of so many topics of the advanced course, since thereby the latter is apt to be robbed of some of its freshness and novelty, and to lose in consequence its stimulus for the expanding intellect. But in so far as the course of instruction is intended to apply to

those, the vast proportion, who will have no subsequent regular instruction in the subject, the method and mode of treatment of the author may be heartily commended. It is, we learn, the outcome of actual class work, modified by experience and the mutual play of the minds of teacher and taught. The author has a belief in the especial value of "outdoor chemistry" as appealing to the interests of the learner, and there is an excellent chapter towards the end on plant respiration and nutrition.

One notices a few important omissions and errors. The use of the spectroscope in chemistry is nowhere alluded to. The mention of argon and its companions in the air should be amplified or omitted. As it is, it contains one of the few mistakes, in the statement that the density of argon is forty times that of hydrogen. Helium is not even referred to by name, surely a remarkable omission for an author addicted to "outdoor chemistry." We read, "The exact specific gravity of oxygen . . . is 15·88 (H=1). This makes the atomic weight of oxygen 15·88. . . ." But these few blemishes in no way detract from the general accuracy of the treatment.

It is a pleasure to notice a book of this description, for it indicates the serious and important place chemistry is taking in the school curriculum. It deserves a high place, not only in the school, but generally as an excellent introductory first course, understanding by this term not a mere smattering of the kind deemed sufficient only a few years ago, but a course in keeping with the true position of the science as a serious and profitable part of a good modern education.

Altitude Tables. Computed for Intervals of Four Minutes between the Parallels of Latitude 31° and 60° and Parallels of Declination of 0° and 24°, designed for the Determination of the Position Line at all Hour Angles without Logarithmic Computation. By F. Ball. Pp. xxxii+241. (London: J. D. Potter, 1907.) Price 15*s.* net.

THE main purpose of these tables is to facilitate the determination of the position line from an observation of any heavenly body and to eliminate, practically, the chance of errors of computation in the result. When the idea occurred to the Rev. F. Ball he consulted the Astronomer Royal, who consented to the employment of several of the Greenwich computers on the work, under the direction of Mr. Crommelin; the accuracy of the tables is therefore beyond suspicion. The tables are computed for intervals of every four minutes between latitudes 31° and 60° and parallels of declination 0° and 24°, and they enable the observer to determine the position line at all hour angles without having to solve any spherical triangle. This does away with the necessity for logarithmic computations, and so the probability of errors is eliminated. For altitudes less than 70° it is expected that the tables will give results accurate within 12″; for greater altitudes their use is not recommended. The author hopes soon to publish a companion volume for latitudes 0° to 30°.

Problems in Strength of Materials. By Dr. William Kent Shephard. Pp. vii+70. (London: Ginn and Co., n.d.) Price 6*s.*

Whittaker's Arithmetic of Electrical Engineering for Technical Students and Engineers. Pp. vii+159. (London: Whittaker and Co., n.d.) Price 1*s.* net.

To set students of applied science to work numerical problems involving thought in their subject is a good test as to whether they understand the principles involved. It is customary in many classes to associate the laboratory and lecture work with practice in solving such problems, and teachers will find in these volumes many examples suitable for the purpose. The first volume, in addition to 568 exercises, contains some useful tables, but little in the way of worked-out examples to guide the student is given and no answers are provided. The second book, on the other hand, contains seventy-two typical problems fully solved, and a set of answers.

An Essay upon Disease: its Cause and Prevention. By Dr. G. E. Richmond. Pp. 96. (London: H. K. Lewis, 1907.) Price 2*s.* net.

THE main object of Dr. Richmond's little book is to point out the large number of diseases either spread by food or directly due to impurities in food or articles in common use. It is surprising to find a confession in the preface to the effect that "the essay has been written rather hurriedly," and unfortunate that no index is provided.

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.]*

Radium and the Earth's Heat.

IT has been shown by the Hon. R. J. Strutt and other investigators that the materials composing the surface of the earth contain on the average about 10^{-12} gram of radium per gram, while about one-twentieth of this amount is sufficient to account for the heat lost by the interior of the earth by conduction. Mr. Strutt has therefore suggested that the interior of the earth contains less radium per gram than the surface. It is interesting to calculate what would happen if the whole earth contained 10^{-12} gram of radium per gram. If the specific heat of the interior of the earth is taken to be 0·1, and 1 gram of radium is supposed to generate 100 calories per hour, then it is easy to show that the temperature of the interior of the earth would rise by 10^{-5} degree C. per year if all the heat generated by the radium were used up in raising the temperature.

If the temperature of the interior rose 100° C., it is probable that the rise near the surface would be too small to be detected, so that observations extending over at least ten million years would probably be necessary to detect the effect of the heat generated by radium even if the whole earth contained 10^{-12} gram of radium per gram and all the heat generated went to raise the temperature.

I understand that geologists are inclined to think that the temperature near the surface of the earth has not altered much for many million years, but this is not inconsistent with a rise of 10^{-5} degree C. per year in the interior. It is, of course, quite possible that the specific heat of the earth is considerably greater than 0·1. The high pressure in the interior probably makes the specific heat larger than at the surface.

HAROLD A. WILSON.

I MENTIONED the possibility which Prof. Wilson discusses in my original communication on radium in the earth's crust in the Royal Society's Proceedings; but he certainly shows that it is more worthy of attention than I then thought it.

On this theory it becomes necessary to suppose that the primary stock of radio-active material in the earth—uranium—has not been in existence for a longer time than is required for the attainment of thermal equilibrium by conduction, for we know that the uranium is wasting away, and unless the supply is replenished it is clear that the gradient of temperature must diminish, instead of increasing as Prof. Wilson supposes. We cannot at present form any notion as to how the uranium could come into existence, so that any further development of the idea

would have too little contact with ascertained fact to be of much value.

I will take this opportunity of mentioning an alternative theory, which has the advantage of being amenable to experimental test. If we suppose that the rate of transformation of uranium is much diminished by increase of temperature, the quantity of radium and of all the other products will be diminished too, and with it the general rate of heat production inside the earth.

The effect of heat on radium and its products has no direct bearing on the problem. Everything is governed by the primary slow transformation—that of uranium.

There is no experimental evidence on this question so far as I am aware. It could probably be best attacked by comparing the ratio of formation of uranium X at various temperatures. The amount of uranium X which had grown in the course of a few days could be determined by β-ray measurements, which might be made after cooling. R. J. STRUTT.

Sunnyside, Cambridge, February 13.

Ground Ice.

I SEE in your issue of January 30, p. 295, a letter from the Rev. John J. Hampson asking some questions on the subject of ground ice. I should like to say that my father, the late Prof. James Thomson, read a paper on this subject at the Natural History and Philosophical Society of Belfast on May 7, 1862, and I think his paper answers most of the questions. Thus he writes, after reviewing and setting aside several older theories:—"My own view is that the crystals of ice are frozen from the water at any part of the depth of the stream: whether the top, the middle, or the bottom, where cold may be introduced, either by contact or radiation; and that they may also be supplied in part by snow or otherwise: and that they are whirled about in currents and eddies until they come in contact with some fixed objects to which they can adhere, and which may perhaps be rocks or stones or may be pieces of ice accidentally jammed in crevices of the rocks or stones: or may be ground ice already grown from such a beginning.

"That pieces of ice under water have the property of adhering to one another with a continually increasing firmness, and this even when the surrounding water is above the freezing temperature, has been shown in a set of very interesting experiments by Prof. Faraday. I think too that the ready adhesion to the bottom, or to ice already anchored there, may possibly be increased by the effects of radiation, but I am confident that the anchor ice is not formed by crystallisation at the place where it is found adhering."

This paper has never been printed *in extenso*, but I hope soon to bring it out in a volume of collected papers written by my father. JAMES THOMSON.

22 Wentworth Place, Newcastle-on-Tyne,
February 11.

The Stresses in Masonry Dams.

MR. MARTIN at first asserted that my reasoning was wrong on some general principle which I failed to grasp, whereas he has now fallen back on the order of the approximation, and appeals to what he terms an axiom of practical mathematics, which he illustrates by the statement that between 0 and π a parabola can be found "differing but little from sin x." If by the method of least squares a parabola be fitted to sin x, it will be found to differ by more than 30 per cent. from the ordinate of sin x when $x=5^\circ$; whether that difference is material or not depends entirely on what use is to be served by the correspondence.

In the memoir which has led to this controversy I showed that the equation for the stress function V, *i.e.* $\nabla^2\nabla^2 V=0$, was the same for a thin[1] slab and an actual dam. Since writing the paper I noticed that the third equation for the stresses was *apparently* not the same. I now see that this is only in appearance, for the terms which have a coefficient involving different functions of Poisson's ratio for the two cases are

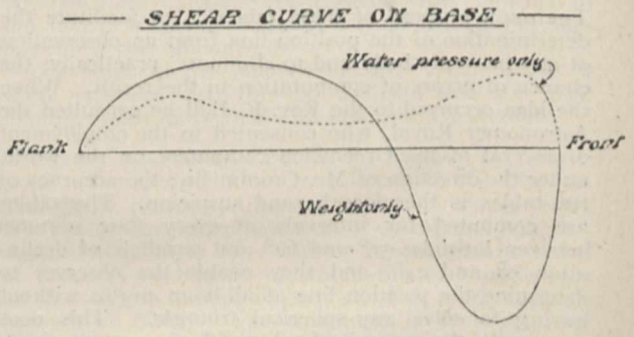
$$\left(\frac{d^2}{dx^2}+\frac{d^2}{dz^2}\right)\left(\widehat{xx}+\widehat{zz}\right),$$

and I find that this vanishes by means of the differential equation for V. Hence, as I stated in my memoir, thin plates can be used to find experimentally the stresses. Mr. Martin is therefore quite correct in his views on this point, although I cannot still agree with his demonstration of the principle.

There are, however, far more vital criticisms to be made of the memoirs recently read before the Institution of Civil Engineers than the mere question of whether the stresses in a slab and an indefinitely long dam differ by 10 per cent. or 20 per cent. A very little experimenting will suffice to show that dams when they collapse go by *stretching*, and partly at points where there may be no tension at all. The strains measured by Messrs. Gore and Wilson are not those in a real dam at all, and if we now accept the view that the stresses are the same, then we must ask Mr. Martin to allow that their stretches differ by 30 per cent. from those in an actual dam.

It was this point which I endeavoured to bring out in the criticism of the paper to which Mr. Martin has referred. If their strains correspond to those of a real dam, then their stresses differ widely; if their stresses are correct, then their strains, upon which ultimately rupture depends, will be very different from those of the actual dam. I must leave Mr. Martin to choose his own horn of the dilemma.

Again, there is another point which is physically very obvious. If a dam, reservoir empty, were split up by a series of vertical divisions parallel to its length, each plate would be of different height, and compressed under its own weight would be subjected to a different squeeze at the base of the dam. To bring these vertical sheets into contact at the correct points it is needful to suppose shear over the vertical planes at the base of the dam. In other words, there must be a distribution of shear over the base of the dam due solely to its own weight. Since the total shear over the base is zero, this distribution of shear, if the extremity of the toes be vertical, must take some such form as is shown in the diagram. Our experiments at University College showed that this base shear due to the weight of the dam only was as important as, and probably more important than, the distribution of shear due to the water pressure.



There is no evidence at all that I can see in Sir John W. Ottley and Dr. Brightmore's recent paper that they have paid attention to this point. They speak of the "original vertical lines on the model," and of measuring the displacement of these lines from "vertical lines on the glass." They speak of the return of the vertical lines on the model to the vertical lines on the glass on the removal of the water pressure. It would appear, therefore, that they have only measured the slide due to water pressure. But to deduce the stresses in the dam they must have the total shear, that due to the weight as well as that due to water pressure. I can find no evidence in their paper of any determination of the shear due to the weight of the dam. They say that the shear along the base is uniformly distributed. This, as Mr. Pollard and I showed in our memoir of last July, is *roughly*, but only roughly,

[1] Only thick plates can be properly used in dam experiments, for thin plates buckle and require a side support which destroys accuracy of experimental result. Even Messrs. Wilson and Gore's plates were at the toe as thick as they were broad.

true, if we confine our attention to water pressure. It is not true, and the base shear actually changes its sign, if the weight of the dam be taken into account as it must be. That there is no *tension* in dams of the Assuan and Vyrnwy types in the outer toe we showed in our memoir, but there is *stretch*, and on this final rupture in part depends. The existence of this stretch is also indicated, although not referred to, in the measurements of displacement given by Sir John Ottley and Dr. Brightmore. I may have misinterpreted these authors' mode of experimenting, but I can find no evidence in their paper of the manner in which they deduced the shear due to weight only, and without this knowledge I venture to think that the whole of the superstructure they base on a uniform distribution of shear fails to find any adequate foundation.

KARL PEARSON.

University College, London, W.C.

The Inheritance of "Acquired" Characters.

I AM loth to take part in barren controversy on this subject again, but I feel it is really necessary to say a few words in reply to the letter of "A. D. D." in NATURE of February 13. When that gentleman refers to the slightly dogmatic tone of his original article he is not doing himself justice; the article was as dogmatic as it could possibly be. Now he asserts that there is no sense in the distinction between acquired characters and innate ones with regard to inheritance, that all characters are both acquired and innate. This in the accepted meaning of the words is simply untrue. If a man takes a summer holiday and becomes sunburnt, the colour of his skin is an acquired character; a negro's colour develops without exposure to the sun; he is brown (not black) when he is born; that is an innate character. The supernumerary toe in a Dorking fowl is an innate character; it is not acquired in the accepted sense of that word. Acquired characters are those changes in the individual which are due to a change of external conditions, *i.e.* of stimuli; innate characters are those which develop without any stimulus, except what Dr. Reid calls the stimulus of nutrition.

When Dr. Reid says that a scar on the nose due to injury is as much innate as the nose itself he is merely quibbling; he means, I suppose, that the scar could not be formed if there was not an innate power of producing a scar in healing a wound. But the only important point is that the scar is the consequence of a wound as well as of the innate qualities; the nose is the consequence of innate qualities only. "A. D. D." appeals to Dr. Reid, but Dr. Reid has most distinctly recognised the distinction which "A. D. D." denies. They may be left to neutralise each other.

J. T. CUNNINGHAM.

Technical Research and the College System.

SINCE I made the proposal, some time ago (*Chem. News*, vol. xxxix., p. 2, and vol. xl., p. 230), that research boards should be instituted in our technical colleges, with the object of supplying the college departments with subject-matter for research of a more or less technical nature, and at the same time of keeping in touch with the old students, I have had the opportunity of discussing the matter with men who occupy important posts in the technical world. They generally hold the opinion that some such scheme is urgently needed.

Many observations are made in works and works' laboratories which for several reasons cannot be properly investigated within the factory, but are yet admirably adapted to serve as subjects for scientific investigation in the laboratories of our technical colleges. Research of such a character would be not only of real educational value to the students, but serve a special purpose in giving useful preliminary training in the investigation of problems such as they are likely to encounter in real life.

The attitude of teachers in our colleges towards such questions has been recently stated by Dr. M. O. Forster. He acknowledged that, as a teacher, it became more and more clear to him that professors ought to be educated in technology. As I previously pointed out, the suggestion, which he again brings to the front, that manufacturers should supply problems for the consideration of young chemists in the college, is one which can hardly be met in practice. The suggestion that manufacturers should supply raw materials for such trials is one that could easily be dealt with through ordinary channels if, and when, the subject-matter for research was available.

The suggestion that members of the college staff should enter the technical world for a time may be open to objection. Dr. Nichols, perhaps rightly, says that they could only return and "bring back to the students, and rehash to them, what was daily becoming obsolete." On the other hand, they would undoubtedly benefit from contact with the outside world, especially in acquiring broader ideas and in realising the way in which constant development occurs in technical processes.

I think it may be held that there is no training in our technical colleges, taken as a whole, which can compare with that given in the medical schools. Here the students actually come in contact with the work they will ultimately be engaged on in their daily routine, viz. the study of abnormal cases. Even in the departments of our more recently built colleges, which are almost small factories in their way, these necessary conditions are in the majority of cases still absent. The course simply deals with the routine work of the factory, as represented by everyday operations. This is equivalent to supplying medical students with a set of perfectly healthy men for examination, an example which well illustrates the point under consideration, for in both cases the students go out into the world to engage in actual practice. Medical men trained on these lines would hardly be tolerated by the public, yet the manufacturer is expected to receive students so trained with open arms.

To meet the conditions obtaining in the technical world, I have proposed that in every college of standing there should be constituted a research board composed of members of the staff, with possibly a few old students as advisory members.

Past students would have the opportunity to submit to these boards subject-matter for research arising out of their actual observations, and of such a nature that it can be freely investigated in a college laboratory by picked students, working under the supervision of the board. The results, if satisfactory, would be published under the names of the old and present students from the college address.

In this way colleges would be supplied with the subject-matter now so urgently needed, and the old students would be kept in touch with their college in the best possible way.

The college staff would at the same time be relieved to a great extent from the burden of supplying subject-matter of a semi-technical nature, which, to be of real value, can only be suggested by those who are acquainted with modern technical problems.

The results of some such scheme might form the basis for grants from the Government in aid of research, and also supply a rough means of testing the comparative value of the training of the colleges.

I venture to put this matter forward for discussion. It is vitally necessary that a link between the colleges in this country, and the technical world should be found. On this point everyone is agreed. I fancy that some such link may be found in the above scheme.

Occasional lectures by old students who have specialised should be given at intervals during the session with the object of interesting students in modern technical developments.

Such points as these might be brought forward, in a more prominent way, by a federation of old students' associations, which should accomplish good work in many directions.

W. P. DREAPER.

Quilter Road, Felixstowe.

A Variation in Amœba.

WHILE looking at some *Amoebae proteus* received from Mr. Thomas Bolton, I noticed a condition of the protoplasm of several specimens which I cannot remember to have seen before. The ectosarc was deeply striated, the lines extending some distance into the endosarc, wherever pseudopodia were not being put forth. On the formation of the latter the striæ disappeared, but again became

visible if the pseudopodia were withdrawn. Perhaps some reader of NATURE who has studied these protozoa may be able to tell me whether these striæ are commonly met with (in which case lack of power of observation has caused me previously to overlook them), or whether they may be pathological, resulting from some debility in the organism. Certainly the Amœbæ in which I noticed the striated protoplasm seemed to be as lively as any without it. Like all those whose business it is to teach elementary biology, I have examined hundreds of Amœbæ, but to-day for the first time I saw the condition described. No text-book in my possession refers to or figures it. I shall be happy to send a drawing to anyone who may wish.

Eton College, February 12. M. D. HILL.

An Alleged Originator of the Theory of Atoms.

MOCHUS OF SIDON, the alleged precursor of Demokritus, is not so unknown to historians of science as Prof. See seems to think (February 13, p. 345), nor is Strabo the only ancient writer who alludes to him; see, for instance, Josephus, "Antiquities," i., 3, 9. But nobody takes him seriously. The book of Mochus is one of the numerous literary forgeries which appeared in Alexandrian times. So far as I can find, it is not mentioned by any of the doxographic writers, so it is probably not much older than the time of Posidonius. J. L. E. DREYER.

Armagh Observatory.

NOTES ON ANCIENT BRITISH MONUMENTS.[1]

V.—*Avenues* (*continued*).

SO far I have not referred to the avenues at Shap. Mr. Lewis, in a memoir "on the past and present condition of certain rude stone monuments in Westmorland,"[2] gives extracts from several authorities showing that in the long past these avenues were not inferior to any in Britain.

Thus Camden (middle of the sixteenth century) writes:—"Several huge stones of a pyramidal form, some of them 9 feet high and 4 feet thick, standing in a row for near a mile, at an equal distance, which seem to have been erected in memory of some transaction there which by length of time is lost." Dr. Stukeley, writing about the middle of the last century, says:—"At the south side of the town of Shap we saw the beginning of a great Celtic avenue on a green common; this avenue is 70 feet broad, composed of very large stones set at equal intervals; it seems to be closed at this end, *which is on an eminence* and near a long flattish barrow with stone works upon it, hence it proceeds northward to the town, which intercepts the continuation of it and was the occasion of its ruin, for many of the stones are put under the foundations of walls and houses, being pushed by machines they call a 'betty,' or blown up with gunpowder; . . . houses and fields lie across the track of this avenue, and some of the houses lie in the enclosure; it ascends a hill, crosses the common road to Penrith, and so goes into the cornfields on the other side of the way westward, where some stones are left standing, one particularly remarkable, called the 'Guggleby' stone[3] . . . . I guess by the celebrity and number of the stones remaining there must have been 200 on a side" (he says the interval between the stones was 35 feet, which would give about 7000 feet, or nearly a mile and a third, or, allowing for the thickness of the stones themselves, a mile and a half, as the length of the avenue); "near them in several places are remains of circles to be seen of stones set on end, but there are no quantity of barrows about the place, which I wonder at." Gough, in his edition of Camden (1806), says:—"At the south end of the village, on the common near the road-side [on the east side thereof] is an area upwards of half-a-mile long and between 20 and 30 yards broad, of small stones; and parallel to the road begins a double row of immense granites, 3 or 4 yards diameter, and 8, 10, or 12 yards asunder, crossed at the end by another row, all placed at some distance from each other. This alley extended within memory over a mile quite through the village, since removed to clear the ground; the space between the lines at the south-east end is 80 feet, but near Shap only 59, so that they probably met at last in a point. At the upper end is a circle of the like stones 18 feet diameter." This description is evidently taken by Gough from the "History and Antiquities of the Counties of Westmorland and Cumberland," by Joseph Nicolson, Esq., and Richard Burn, LL.D. (London, 1777), an extract from which has been obligingly communicated to me by Col. Hellard, R.E., the director of the Ordnance Survey, and from which the remark enclosed in square brackets has been taken.

Mr. Lewis informs us that "Camden also mentioned an ebbing and flowing well, which Gough said was lost, and that its peculiarity was purely fortuitous; still it might have been used for the advantage of the priesthood who probably set up the stones. . . . From the descriptions already quoted it would seem that the avenue ran northerly or slightly northwesterly."

With such assiduity were these memorials of the past removed that when the Ordnance survey was made the final examiner recorded in the parish name-book for Shap (1858):—"No one person in the parish of Shap can point out the site of the old avenue of granite stones, or can tell whether the small spot well known as 'Karl Lofts'[1] is the S. or N. end of the Monument. It is most likely the N. end, as about ½ a mile S. is a portion of a circle still to be seen, composed of huge granite boulders, and which probably is the southern turning of the Avenue. It would appear to have been preserved in Doctor Burn's time, but except 2 or 3 boulders, itself and all recollection of it, have faded from Shap."

In spite of this, I think it has been possible to make out the position and direction of the avenues from the few stones shown on the Ordnance 25-inch maps which Col. Hellard has been good enough to send me. Taking the stones of which at least three are in the same straight line, we get two avenues crossing to the E. of the turnpike and to the south of the village, as stated in the preceding descriptions. As measured on the 25-inch Ordnance sheet, the azimuths are S. 19° E. and S. 40° E. From measurements of the contours on the 1-inch map, the elevation of the horizon is about 1° 10′ in each case.

These data give us declinations 32° 32′ S. and 25° 54′ S. respectively.

In bringing together the information available about avenues, I have been greatly struck by the existence of several with an orientation of S. 20°–30° E. The first of this series which I came across, on the ground, were those at Challacombe, an imposing monument once consisting of eight rows of stones with an orientation of N. 23° 27′ W., or S. 23° 27′ E. ("Stonehenge," p. 158). The rows might have been used in the south-east direction to observe the rising of a southern star; on the other hand, in the north-west direction, they might have been aligned on the setting of Arcturus, warning the summer solstice sunrise in 1860 B.C.

As this date was near to those suggested by the

[1] Continued from p. 251.

[2] Journal Anthropological Institute, November, 1885.

[3] Twenty-six chains S.W. of St. Michael's church. It is about 8 feet high, of a wedge-like or conical shape, placed upright with the heavy end uppermost. (Ordnance surveyor's note.)

[1] About 47 chains S. by E. of St. Michael's church.

other Cornish and Devon monuments, I thought the north-west use was more probable for these avenues and other less imposing ones on Shovel Down with nearly the same direction.

The more recent inquiries, however, suggest that in this I was wrong. In the first place, the evidence now afforded by Mr. Falcon regarding the Assacombe avenue shows that, like those at Merrivale, the look-out to the rising-place was up hill. Again, as at Merrivale, oriented to the rising of the Pleiades, the western end has two large monoliths, ending the two lines of stones, and a single sighting stone at the eastern end is placed *between* the lines.

Now these are the conditions at Challacombe if we assume a south-east use; the view is up hill, and the directing stone is at the eastern end.

I next proceed to give a list of the avenues at present known to me which are roughly parallel with those at Challacombe, and where, possibly, southern stars were in question; curiously enough, this condition applies to the Kennet avenue at Avebury, and to those at Borobridge and Shap.

Challacombe, Dartmoor, lat. 50° 36′ *N.*
S. 23° 37′ E., horizon 4° 48′, dec. 31° 7′ S.
Avebury, Wiltshire, lat. 51° 30′ *N.*
S. 32° E., horizon 49′, dec. 31° 34′ N.
Borobridge, Yorkshire, lat. 54° 6′ *N.*
S. 25° E., horizon 1°, dec. 32° 15′ S.
Shovel Down, Dartmoor, lat. 50° 39′ *N.*
S. 25° E., horizon 0° 46′, dec. 34° 46′ S.
(Other alignments at S. 22° E. and S. 28° E.)
Shap, Westmorland, lat. 54° 33′ *N.*
Direction of avenue S. 19° E., horizon 1° 10′, dec. 32° 32′ S.
Crug yr Avan Avenue, S. Wales, lat. 51° 40′ *N.*
S. 23° E. and S. 24° E., sea horizon.

With regard to this last avenue, the Rev. J. Griffith informs me that the "stone of honour" ("directing stone"), now recumbent, is at the southern end, and that the land rises in that direction; it would have been on the sky-line as seen from the north end of the avenue.

It is as well to point out at once that some of the monuments included in the above list are the most remarkable in Britain. Challacombe is the only multiple avenue that I have seen in these islands which approaches those in Brittany. The south-east avenue at Avebury was, I take it, the most important feature at one time of that elaborate temple; while, again, the stupendous stones which I think are the remains of an avenue at Borobridge are among the largest monoliths in Britain. The remains at Shap I have not seen, but an avenue nearly a mile long and 70 feet broad, according to Camden and Stukeley, is certainly out of the common.

What, then, might have been the use of these avenues? If they were erected to indicate the rising place of a southern star, the only important one they could have dealt with was α Centauri, and that between B.C. 3000 and B.C. 4000. I give approximate dates where the measures are sufficient to enable me to do so.

Challacombe	D. c.	31° 7′ S.	... 3600 B.C.
Avebury		31° 34′	... 3500
Borobridge		32° 15′	... 3400
Shap		32° 32′	... 3400
Shovel Down		34° 46′	... 2900
Crug yr Avan ...		36° 00″	... 2700

Now if we take 3500 B.C., that is some thousand years before the time I have suggested to be indicated by the stellar alignments connected with the Cornish circles. This raises several interesting questions. Why have we circles in Cornwall and practically no avenues? Why have we avenues practically without circles in Brittany?

Was there a swarm of avenue builders who preceded the swarm that built circles?

In this connection it is worthy of notice that in my "Dawn of Astronomy" I made out that there is a series of Egyptian temples oriented to α Centauri, one of them being the Memnonia at Thebes; and long avenues, generally of sphinxes, were associated with all these temples, while circles were unknown.

FIG. 16.—The Avenue and Circle at Callernish. *Photo. by Prof. Thorpe.*

Another point is connected with the rise of the star and its use as a warner.

The rise of α Centauri would be preceded shortly by that of β, almost in the same azimuth.

At the time in question, 3500 B.C., they would serve as warners for the November sunrise, which was long afterwards accepted as the beginning of the year by the Celts.

Further, at the dates in question there were no first-magnitude stars rising near the north point of the horizon, as Arcturus and Capella did afterwards, by which the lapse of time during the night might be measured.

The two stars in the Centaur might have been used in this way, but their usefulness would be much restricted owing to the short time they would remain above the horizon.

It is well to note that while the nearly southerly avenue is accompanied at Avebury by a May-year alignment, the second avenue at Shap seems to have been a solstitial one, the sunrise at the Winter solstice being in question. This, however, cannot be considered certain until local observations of the height of the horizon have been made.

Mr. Goddard (NATURE, February 6) has raised objections to my statements concerning the Avebury

avenues on the ground that in some of the old descriptions, given while many more stones were standing, some are indicated placed in relation to the road passing through the southern part of the bank, as it exists at present, and quite out of the line of the Kennet avenue indicated by the stones shown on the Ordnance map. If the stones once near the road were associated with those shown on the Ordnance map, there would be no avenue at all in the sense I have always used that word in these notes, but a twisty road having no possible astronomical significance, and, I may add, no resemblance to the Beckhampton avenue, of which all the recorded stones are in the same straight line as near as we can now say; or to any of the others in the table I have given above.

It may be, indeed, that Stukeley was led into his snake theory by attempting to marry these two sets of stones, for he sees a snake even at Callernish, the perfectly straight avenue of which fortunately remains.

"I saw another at Shap, in Westmorland. . . . There is another, as I take it, at Classeness, a village in the island of Lewis between Scotland and Ireland. I took a drawing of it from Mr. Lwydd's travels; but he was a very bad designer . . . a part of the snake remains going from it, which he calls an avenue. He did not discern the curve of it any more than that of Kennet avenue which he also has drawn in the same collection as a straight line."[1]

If the conclusions I have expressed above be confirmed, namely, that Avebury was a going concern a thousand years before anything that now remains of Stonehenge was set up in its present position, or the avenues laid out, the use of the Kennet avenue to watch the rise of α Centauri as a warner of the November festival (while the sunrise in May was provided for in the Beckhampton avenue) ceased at least 4000 years ago. There has been ample time, therefore, to build the bank, to leave openings for wheeled traffic and to set up stones in many places. Indeed, the stones may have been removed from the avenue when the bank was built. That the bank came long after Avebury was first in use was, I take it, well known to Stukeley, as the following extract shows:—

"When Lord Stowell, who owned the manor of Abury, levell'd the vallum on that side of the town next the church, where the barn now stands, the workmen came to the original surface of the ground, which was easily discernible by a black stratum of mold upon the chalk. Here they found large quantities of bucks' horns . . . there were very many burnt bones among them. They were the remains of sacrifices."[1]

Mr. Goddard does not seem to have read my previous notes carefully. I never imagined the Kennet avenue going "over the bank and ditch," but going to the southern circle *before the mound was built*, as the Beckhampton went to the other, as a *via sacra*, throughout the whole length of which the rising star could be seen. Of course, the existence of the bank would have prevented any star rise being seen from the circle along the southern horizon, and what often happened in Egypt suggests that the bank was built because the avenue had become useless.

That the Kennet avenue was once used as a *via sacra* to observe the rise of α Centauri as the morning star warner of the November sunrise is all the more probable since the avenue from the southern end of the Kennet avenue to the "sanctuary" was an alignment to the November sunrise itself so far as can now be made out.

Since writing the above I have received from Captain Devoir, of the French Navy, some admirable surveys of several of the Brittany monuments. In one

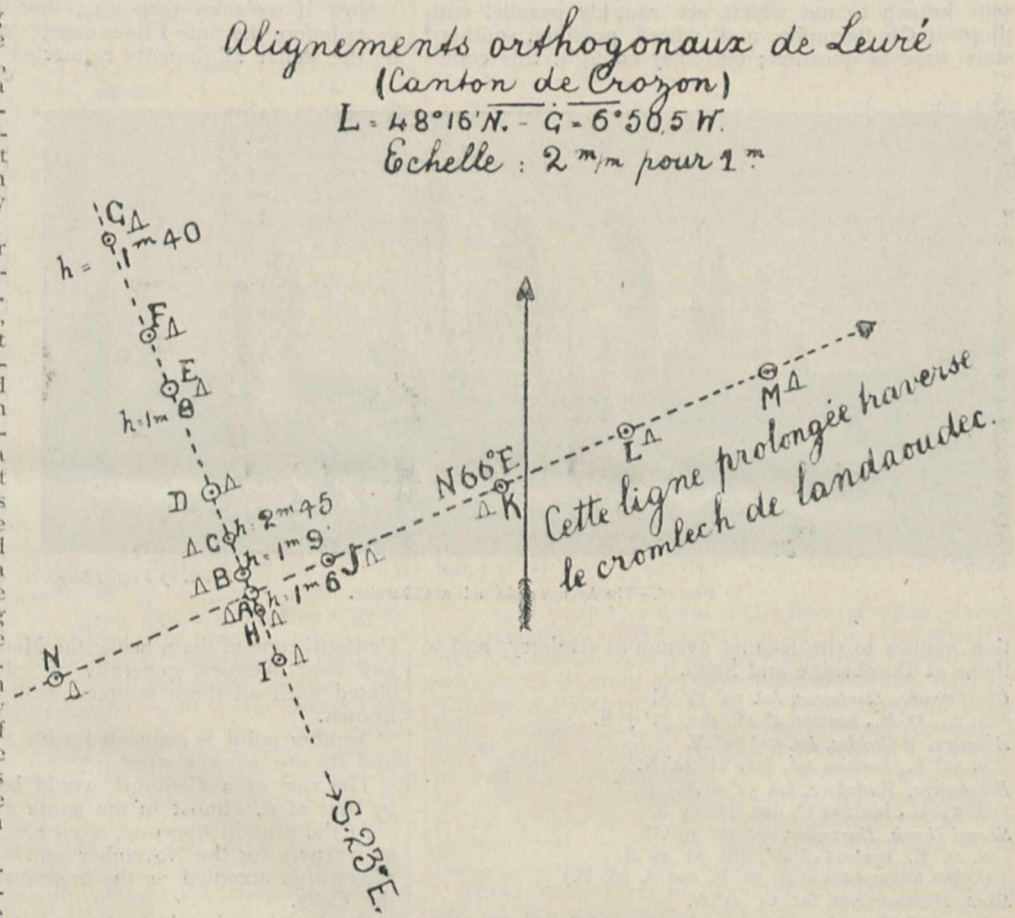


FIG. 17.—The alignments at Leuré from Captain Devoir's observations.

[1] Stukeley, "Avebury," p. 62.

[1] Stukeley, "Avebury," p. 27.

at Leuré we have two avenues, one S. 23° E. and another N. 66° E. (Fig. 17), avenues therefore practically parallel to the two at Avebury, and doubtless used for the same purposes.

NORMAN LOCKYER.

A STUDY OF THE RIVER TRENT.[1]

THIS little book is a clearly written popular account, in part amplified, and in part—rather unfortunately, we think—abbreviated, of the author's presidential address to the Lincolnshire Naturalists' Union. It deals with the geological structure and history of the Lindsey division of Lincolnshire, especially in relation to the vicissitudes, actual or supposed, of the river Trent.

The author is not the first, nor is he likely to be the last, to try conclusions with the intricate story of the Lincoln Gap, that sharp and sudden breach through the escarpment of the Lower Oolites by which the little strike-river, the Witham, abruptly doubles across into the fenlands of the Oxford, Ampthill, and Kimeridge clays, and so reaches the Wash.

Since the publication in 1862 of Jukes's epoch-marking paper on the river valleys of the south of Ireland, in which the cardinal principle of river-capture was enunciated, the Trent and its anomalous course has furnished a theme and an illustration to writers on our British rivers. Ramsey used it, Mr. Jukes Browne added much additional evidence and gave greater definiteness to our conceptions of the potentialities of river-adjustment, and Prof. Davis, in his splendid contribution to evolutionary potamology, adopted and amplified Mr. Jukes Browne's views. Still later Mr. Burton further extended the study of the Trent, and furnished data inaccessible except to a Trent-side resident. The earlier chapters of his book are devoted to an exposition of Prof. Davis's work, and his very convenient terminology is explained with all necessary clearness, though the general reader for whom the book is written will no doubt be puzzled by the reference without the necessary definition to a "peneplain."

The author attributes over-much of the levelling of the great plains of the Jurassic clays to the Trent, and seems to imply that while these valleys were in process of formation the escarpments by which they are bounded stood where we now see them, a confusion which he shares with many recent writers, who fail to recognise that escarpments are incessantly receding. On the other hand, it is satisfactory to find that he takes due account of the possibility that the Trent may have been captured by the Humber drainage in pre-Glacial times, have been restored to its primeval course through the Lincoln Gap in consequence of an ice-barrier across the Humber, and again in post-Glacial times re-captured by the Humber system, though not so decisively but that in seasons of flood it swept again across from the old elbow of capture at Newark and discharged its waters into the Wash. The Romans controlled this propensity by the erection of extensive floodbanks, but the degenerate moderns neglected to keep them in repair, so that in 1795, and twice in more recent times, the river has temporarily re-occupied its old course.

The later history and activities of the Trent are well described, and a special word of commendation must be bestowed upon the splendid half-tone illustrations, and in particular the two pictures of the bore or Ægir ("Sea-tempest is the Jötun *Ægir*, a very dangerous Jötun; and now to this day, on our river Trent as I learn, the Nottingham bargemen, when the river is in a certain flooded state . . . call it *Eager*; they cry out 'Have a care, there is Eager coming.'"—Carlyle). These are, we think, the finest pictures of this phenomenon that we remember to have seen. The excellence of the half-tone illustra-

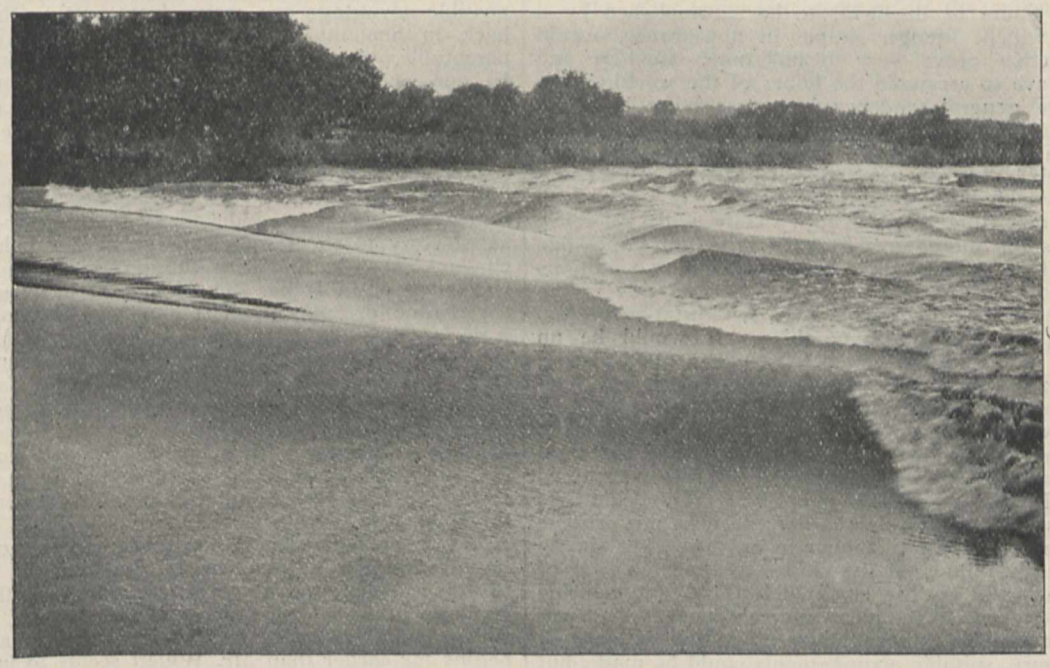


Photo. *E. W. Carter, Gainsborough.*

The Ægir, Gainsborough, October 12, 1904. Showing the after-waves, locally called "The Whelps." From "The Shaping of the Lindsey and Trent."

[1] "The Shaping of Lindsey by the Trent." By F. M. Burton. Pp. xii+59. (London: A. Brown and Sons, Ltd., 1907.) Price 2*s.* net.

tions stands in strong contrast to the very inadequate and unsatisfactory diagrams; that representing a section from the Trent valley to the coastal plain is about as misleading to the general reader as such a thing could be made; the vertical scale is nearly *one hundred times* the horizontal, and the dips are proportionately exaggerated, from the actual 2° or 3° to something like 65° or 70°. It is an aggravation of the offence to waste fine plate-paper on such a monstrosity.

Despite this and some minor blemishes the book is an interesting one, and should do something to stimulate an interest in the scientific study of the scenery of a region that is replete with beauty and charm.

THE SUN AND THE CLOCK.

LAST week a Bill was introduced into Parliament by Mr. R. Pearce, M.P., having for its object the better accommodation of the hours of business to the hours of daylight, to be accomplished by a device which, though simple in appearance, would in practice prove very troublesome. Custom and habit have so arranged the hours of the working day that the general tendency is to use more hours in the afternoon than in the morning. This unequal division is attended with many inconveniences, one of which is that we use artificial light for more hours than would be necessary if we would consent to divide our time more symmetrically with reference to the sun's meridian passage. It is not impossible but that greater economy and more healthy conditions for labour might follow, and so far as this is the purpose of the Bill, which owes its initiative to Mr. Willett, we can all sympathise. It would be an evident advantage to employ sunlight, which costs nothing, in the place of gas and electricity, which are expensive luxuries, and it is probable that it is this obvious benefit which has enlisted the good will of many well-known authorities to what on close examination seems to be rather a childish measure.

Mr. Pearce, who holds a brief for Mr. Willett, is anxious to begin the day earlier; he does not propose to curtail the hours of labour in any way, but simply to shift the hands of the clock so that for part of the year noon on the clock dial would not coincide with the transit of the mean sun. Since it is the clock and not the sun that regulates all affairs of business or pleasure, suitable arrangements could be made, but whether those proposed by the Bill are the most satisfactory is an open question. The Bill provides that on each of the first four Sundays in April standard time shall be advanced twenty minutes, making the clock gain on the sun eighty minutes in the course of the month. Ordinary office hours would therefore begin at 8.40 a.m. instead of ten o'clock, and, of course, end at 3.40 p.m. instead of five o'clock, as reckoned by the mean sun. In this way there would be approximately symmetrical distribution of the day on both sides of the meridian. In winter, when we use all the daylight available, nothing is gained by advancing the clock on solar time, and it is proposed to bring the clock and sun again into coincidence by putting standard time back twenty minutes on each of the first four Sundays in September.

This pushing the hands to and fro on the dial is, we are told, the whole cost of the scheme. Unfortunately, that statement is misleading. The hour chosen for this abrupt dislocation of continuity is two o'clock in the morning, an hour when very few people would care to make the necessary adjustment, and many a man on arriving at the station on Monday morning would find that his train had been gone twenty minutes, or that he had to wait twenty minutes before it was due, according as the time of the year was spring or autumn. This continual interruption of uniformity would be intolerable. One can more easily accommodate himself to a burden, however grievous, if the pressure be constant, than to the petty irritation arising from frequent change.

But we would seriously ask the supporters of Mr. Willett's scheme where is the necessity for this aggravating policy of perpetual alteration? We suspect, if we could get at the truth, that this constant interference is a concession to inherited instinct, and a desire not to depose the sun too hurriedly from that position of preeminence which he has hitherto enjoyed. The author of the scheme manifests a cautious hesitancy lest some mischief should arise from separating the clock and the sun by too great an interval, and thinks to appease the possible objections of more conservative minds by pointing out that it is only for half a year that the clock is wrong. It looks as though he were afraid of his own measure, for what possible advantage can accrue from putting the clock back in September? If the measure be wise and acceptable, why not boldly alter the time one hour by one and a final interruption? In summer we should get nearly the same advantage as that claimed for this policy of pin-pricks, and in winter we should be no worse off.

It is quite a different question to ask, is such a measure desirable? or, further, whether the proposed remedy is the most judicious? It might be more satisfactory to effect some change in our habits and customs more in line with those that obtain on the Continent or in India. The hours of business or of social functions may in those countries be dictated by a desire to avoid heat and glare, but the point is that we should do well to follow the example of those who have considered the sun as a factor in regulating their affairs. Such ends cannot, however, be accomplished by legislative action, but by the decision of Society with a big S. To ask a man to dine at six instead of at eight would be a drastic revolution that few would feel themselves competent to inaugurate.

The Astronomer Royal has raised a point of great importance, at the same time hinting that the authors of the scheme have thought too much of the convenience of their own order and too little of that of the great majority of the public, whose daily life begins far earlier than Mr. Willett seems to imagine. Where life is strenuous, in factory or workshop, in dock or on railway, toilers quit their homes soon after five o'clock by the sun. It is easy to conceive that earlier rising would entail a hardship. Those who minister to the comfort of Mr. Willett and his class accomplish much before the more leisured day begins. The handling of perishable articles and the distribution of food in great centres of population goes on all night. To shorten that night by an hour or more to get the same amount of work done in a shorter time would tax resources to breaking point.

There is, too, another consideration which is not without its weight. England has succeeded in securing the recognition of the Greenwich meridian as the origin of time throughout the world, and with something like uniformity time is reckoned from that meridian. Is it desirable to commence an agitation which involves a breach, though only nominal, of that uniformity? We have admitted that there are some advantages to be derived from the adoption of the scheme, but when weighed against the disadvantages arising from a fretful disorganisation, it may be "better to suffer the ills we have than fly to others we know not of."

IRISH FISHERY INVESTIGATIONS.[1]

THESE two volumes form the third and fourth reports upon the scientific investigations into fishery questions, which have been conducted for the Irish department responsible for the fisheries by Mr. E. W. L. Holt, the scientific adviser. They fully maintain the high standard set by their two predecessors both in the nature of their contents and in the manner in which they are printed and illustrated.

It is a matter for congratulation that the Irish Government has adopted so comprehensive and intelligent a view of the manner in which such investigations should be planned and carried out, and it is to be hoped that any narrow and uninstructed criticism, such as Mr. Holt appears to suggest has been made upon the work, may not be allowed to interfere in any way with its progress. "In my last report," says Mr. Holt in the volume for 1904, "I endeavoured to make it clear that the papers in the appendix, even if couched in unavoidably technical language, did actually contain information essential to the possibility of success in attack on practical fishery questions. The endeavour seems to have failed to some extent, but perhaps in the course of time it may be more generally surmised that if a due understanding of the minutiæ of habit and environment is of some use in agriculture, so may it also be in the direction of piscatorial enterprise, and that because an animal has an unfamiliar name it does not necessarily follow that it is of no importance."

The kind of criticism of which Mr. Holt here appears to complain would seem to be similar to that to which the work carried out by Prof. Herdman in the Irish Sea has recently been subjected. At a meeting last year of the Lancashire and Western Sea Fisheries Committee, a member of the committee, the Rev. J. E. Green, is reported by the *Liverpool Daily Post and Mercury* to have said "he thought they ought to manage to cut down the expense of the annual report. The printing came to about 70*l.* a year, and there was a quantity of verbiage in it which was not easily understood. For instance, they had a long list of Latin names which he had taken the trouble to try and translate, with the assistance of the latest work of Lewis and Short, but he had failed to do so. If the names were to be inserted, the translations should also be put by the side, for they were absolutely useless unless the Lancashire fishermen happened to be graduates of the Liverpool University."

The picture of the diligent committeeman seeking a translation of the specific names used by naturalists "in the latest work of Lewis and Short" has its humorous side. We fear his method might even be somewhat misleading in the case of such a simple specific name as *Homo sapiens*. Both Mr. Holt and Prof. Herdman must, however, take comfort from the fact that the difficulty of making the general public, or those who happen to occupy positions of authority, realise the importance of technical biological studies is one which most scientific investigators have to face, and for some unexplained reason is met with in a particularly aggravated form in the case of fishery work.

Mr. Holt's report for 1904 is followed by six, and that for 1905 by seven, appendices dealing with marine work, whilst in each case one appendix is devoted to inland fisheries. Of the former, one only deals directly with fishes, that by Holt and Byrne on the fishes of the Irish Atlantic Slope. This paper contains sixteen additions to the list of the fish fauna of the British-and-Irish area, which have resulted from the operations of the fishery steamer *Helga*.

The Crustacea, a group which is of such great importance from the point of view of the food of fishes, receive considerable attention. Dr. W. T. Calman records forty-eight species of Cumacea from the west coast of Ireland, of which nine are new to science. The latter are carefully described, and the details of their external characters are illustrated in eighty-six well-executed figures.

Mr. Tattersall treats in a similar way the Isopoda and pelagic Amphipoda from the same region, ten new species of Isopoda and four new species of Amphipoda being described and figured. Mr. Tattersall and Mr. Holt add a supplement to their former report on the Schizopoda, and Mr. Stanley Kemp contributes a useful review of the Decapod genus Acanthephyra. Miss Delap's notes on the rearing in an aquarium of *Aurelia aurita* and *Pelagia perla* are also of great interest.

The most important sections in the appendices on inland fisheries are Mr. Holt's reports on the artificial propagation of the Salmonidæ and Mr. Hillas's record of salmon-marking experiments.

The two volumes make it clear that a very large amount of most useful work is being carried out, the value of which will increase at a very rapid rate as the data accumulate from year to year.

[1] "Report on the Sea and Inland Fisheries of Ireland for 1904." Part ii. Scientific Investigations. Department of Agriculture and Technical Instruction for Ireland. Ditto for 1905. (Dublin: Published for H.M. Stationery Office by A. Thom and Co., Ltd., 1906 and 1907.) Price 4*s.* 4*d* and 2*s.* 1*d.*

NOTES.

IN the House of Commons on Monday, Mr. Mallet asked the Secretary of State for War whether he was aware of the public service rendered by a commission of the Royal Society, at the request of the War Office and the Admiralty, in discovering the cause of Malta fever, from which many hundreds annually of our soldiers and sailors on that island until recently suffered; and whether, in view of the importance of this discovery in the annals of preventive medicine, inasmuch as at the present moment the disease had been entirely stamped out, he would consider the desirability of giving the thanks of the Government to the Royal Society for this instance of the successful application of British scientific research? In his reply to this question Mr. Haldane said:—"I am aware of the great service rendered by the commission in question. The commission's investigations and the adoption of preventive measures as the outcome of its recommendations have been followed by the practical disappearance of Malta fever from the garrison of the island. I think that the Royal Society is well aware how genuine is the appreciation of the Government. We owe much to the Royal Society's commission for the successful issue of this remarkable investigation, and for the excellent results which have followed. These results illustrate the enormous importance of bringing science into our business of government."

WE announce with great regret that Lieutenant-General Sir Richard Strachey, G.C.S.I., F.R.S., died on February 12 at ninety-one years of age.

THE following have been elected honorary and foreign members of the Chemical Society:—A. E. J. Gautier, Paris; A. Haller, Paris; J. W. Hittorf, Münster; J. A. Le Bel, Paris; H. L. Le Chatelier, Paris; T. W. Richards, Cambridge, Mass., U.S.A.; and O. Wallach, Göttingen.

THE Paris Academy of Sciences has, says the *Revue Scientifique*, in cooperation with the Minister of Public Instruction, undertaken, at the invitation of Sir Norman

Lockyer, K.C.B., F.R.S., to form a committee of French men of science to assist in securing an important place for science in the forthcoming Franco-British Exhibition.

IT is stated in the *Pioneer Mail* that special subcommittees have been appointed by the Board of Scientific Advice for India to consider and report on proposals which have been submitted for the re-organisation of the Botanical Survey Department and the future organisation of the Economic Products Department.

WE learn from *Science* that Prof. W. Stratford, for forty-one years a member of the teaching staff of the New York City College, died on January 24. Prof. Stratford was a well-known member of the scientific organisations of New York, and was a recognised expert in biological microscopy. In his work in the City College he introduced laboratory methods and developed its museum, enriching it with the fruits of several palæontological excursions to the Rockies.

A ROYAL Commission has been appointed to consider, among other matters, the materials or the processes used in the manufacture or preparation of whisky and other kinds of potable spirits manufactured in or imported into the United Kingdom. The chairman of the commission is Lord James of Hereford, and the members are:—Mr. L. M. Guillemard, C.B., Dr. W. E. Adeney, Dr. J. R. Bradford, F.R.S., Dr. H. T. Brown, F.R.S., Dr. G. S. Buchanan, Mr. J. Y. Buchanan, F.R.S., and Dr. A. R. Cushny, F.R.S. The secretary to the commission is Mr. A. V. Symonds, of the Local Government Board. The appointment of this commission arises out of the difficulties described in an article on "What is Whisky?" which appeared in NATURE of March 8, 1906 (vol. lxxiii., p. 441).

AT a meeting of copper and brass manufacturers, engineers and others, held in Manchester on February 13 (Mr. W. H. Johnson in the chair), it was unanimously resolved to form a Copper and Brass Institute having similar objects to those of the Iron and Steel Institute. It is not the intention of the founders to limit the institute to the copper and brass trades, but to include all those connected with the commercially important non-ferrous metals and their alloys, as lead, zinc, tin, aluminium, nickel, silver, gold, platinum, &c., and their alloys. A further meeting will be held in the Midland Hotel, Manchester, on Tuesday, March 10, at 4 p.m., to which all those interested are most cordially invited. Prof. H. C. H. Carpenter, professor of metallurgy, The University, Manchester, will receive the names of any persons who propose to attend or are interested in the formation of the institute.

THE meteorological observatory on Ben Nevis was again the subject of a question in the House of Commons on Monday, when the Chancellor of the Exchequer was asked whether he could hold out any prospect of a grant towards its upkeep. In the course of his reply, Mr. Asquith said that the only scheme which has up to the present been placed before him is one under which the whole cost of the re-equipment and maintenance of the observatories would be thrown upon public funds, and to this he does not feel justified in assenting. He is, however, quite prepared to consider the question of renewing the Government grant, which was for many years given to the Ben Nevis observatories through the Meteorological Council, provided that an adequate contribution towards their re-establishment and maintenance is forthcoming from other sources.

AT a meeting held in the Transvaal Museum, Pretoria, on January 13, it was resolved to form an association, to be called "The Transvaal Biological Society," with the object of promoting the discussion of scientific problems by biological investigation, to arrange for regular meetings for this purpose, and to publish the proceedings of the meetings. All persons are eligible for membership who are actually engaged in biological investigations and have published at least one scientific paper, or are working on such. Every member is expected to furnish at least one paper each year. The committee for the current year consists of Dr. Theiler, C.M.G., president; Mr. Burtt-Davy, vice-president; and Dr. L. H. Gough, secretary and treasurer. The new society will fill a long-felt want in Pretoria.

PROF. G. K. GILBERT, in his recent report to the United States Geological Survey, stated that the conditions of flow and erosion at Niagara Falls would soon cease to be natural, owing to the large amount of water diverted for industrial purposes. The correspondent of the *Times* at Washington, as we note in that journal for February 14, gives an abstract of the views of Dr. Spencer, of the Canadian Survey, which are far more specific and alarming. Dr. Spencer, it appears, looks forward to the practical disappearance of the American falls, through the utilisation of water-rights already conceded; and the correspondent suggests that Congress would be favourable to the incorporation of an agreement for the regulation of the waters of the Niagara River in the general treaty respecting questions pending between the United States and Great Britain.

IT was suggested by Mr. R. Pohl in a paper read before the German Physical Society in June last that the formation of gas bubbles in the glass of vacuum tubes, described by Mr. A. A. Campbell Swinton in a paper before the Royal Society (see NATURE, April 4, 1907, p. 550), is due to a metallic film caused by disintegration of the internal aluminium electrodes, and that if the aluminium be first completely etched away, then no bubbles are formed in the glass when it is subsequently heated. Mr. Swinton writes, however, to say that these conclusions are disproved by some further experiments recently carried out by him, in which a plentiful supply of bubbles was easily obtained in the glass of tubes which had been excited over prolonged periods by electrostatic induction from outside, and in which there were no aluminium or other internal electrodes to disintegrate and cause the metallic film to which Mr. Pohl attributes the effect.

SEVERAL interesting speeches were made at a dinner of the Physical Society held on February 11 at the Hotel Cecil, when the chair was taken by the president, Prof. J. Perry, F.R.S., and a number of distinguished guests and fellows of the society were present. In the course of some remarks, Sir William Ramsay dwelt on the relations of physics and chemistry. He pointed out that one of the chief difficulties of the chemist at the present time is the solution of the mathematical problems involved in chemistry, and there is a great opening for "tame mathematicians" who will hold themselves at the disposal of the chemist. In response to the president, Prof. E. B. Rosa, of the National Bureau of Standards, Washington, stated that he had been greatly interested in visiting the National Physical Laboratory, and observing the progress that had been made since his last visit five years ago. At the National Bureau of Standards satisfactory headway is being made, and it is hoped that the laboratory will shortly be equal to any national laboratory in the world. In the United States much money is being spent on the science of agriculture, because agriculture is a national asset. Prof. Rosa suggested that England similarly would

find it a profitable investment to devote the money spent in constructing one battleship per annum to the National Physical Laboratory instead of preparing for war. In responding to the toast of "The Physical Society," the president dwelt on the importance of research. At the present day there are many science teachers and many compilers of books who do no research. They are well up in the letter of science, but not in the spirit thereof, with the result that their writings lack a most essential quality which can be gained only by actual research. He appealed to the leaders of physical science to attend the meetings of the society, not for their own benefit, but from a sense of duty, for there is nothing so inspiriting to the younger members as contact with men who have carried out important work.

FROM Mr. F. L. Dames, of Berlin, we have received a catalogue of books and papers on entomological subjects (No. 96, *Bibliotheca Entomologica*).

No. 7 of Irish Fisheries Scientific Investigations for 1906 (1907) contains a report on artificial salmon and trout breeding for the season 1906–7, from which it appears that the total for salmon comes within about 500,000 of that of the previous season, and therefore is by about that number in excess of any previous year.

TWO papers on regeneration are included in vol. lxxxix., part i., of the *Zeitschrift für wissenschaftliche Zoologie*. In the first of these Mr. J. Nusbaum describes the processes occurring in one of the polychæte worms of the genus Nereis, while in the second Mr. J. Grochmalicki discusses the regeneration of the lens of the eye in bony fishes. In the case of one particular fish from which this organ had been extirpated, a new lens, differing slightly in form from the original, was developed in 187 days.

IN the course of an article on hermaphroditism in echinoderms, published in Nos. 6 and 7 of the *Travaux de la Société Impériale des Naturalistes de St. Pétersbourg* for 1907, the author, Mr. G. Gadd, argues that since this phenomenon is not uncommon in sea-cucumbers, more rare in star-fishes, and almost unknown in sea-urchins, we have a confirmation of the view that it is an attribute of the less highly organised members of the groups in which it occurs.

TO the *Museums Journal* for January Dr. H. C. Sorby contributes a paper on the best means of preserving marine invertebrates for museum purposes in such a manner that their natural colouring will be retained. As regards his own private collection, the author finds anhydrous glycerin —covered, when necessary, with a layer of almond oil— the most satisfactory medium, some specimens which have been preserved in this manner for fully five years displaying their tints with even more than normal brilliancy. The chief difficulty in the case of museum specimens would be in the use of large rectangular vessels, owing to danger of leakage.

THE *Lyttelton Times* (New Zealand) of December 3, 1907, contains a long summary of the results of the recent scientific expedition to Auckland, Campbell, and other islands lying to the southward of New Zealand. Mr. Speight, geologist to the expedition, claims to have discovered in Auckland, Campbell, Snares, and Disappointment (not apparently the island of the same name in the Low Archipelago, but one somewhere near the others) rocks indicating that these islands once formed a part of the Antarctic continent. The islands have also been extensively glaciated. Of insects, flies and tipulæ are the most numerous, but beetles and dragon-flies were also observed. A linnet-like bird from Campbell Island has not yet been identified; and successful photographs have been obtained of the skua, shag, mollymawk, gull, albatross, and penguin rookeries. On Snares Island the stench from the birds and seals is stated to have been almost intolerable, and the members of the expedition who visited the Campbell group suffered severely from the colds and wind.

A SPECIAL paragraph in the issue quoted above is devoted to Disappointment Island, which was visited by Dr. L. Cockayne, who devoted special attention to the vegetation. Although the number of species is small, the vegetation as a whole is comparatively luxuriant. Very striking is the large *Aciphylla latifolia*, a member of the carrot tribe, while the male flowers of the orange lily, *Bulbinella rossi*, are conspicuous "The most interesting feature of all is the natural rejuvenation of the vegetation that is going on. Cast your eye over the landscape, and you will see brown meadow dotted with white birds, which slowly but surely kill out all the plant-covering, and patches of vivid green. This latter arises from the presence of the Antarctic burr, or piri-piri, in enormous quantities; and it, a quite rare plant in a virgin meadow, has spread from thence and occupied the new ground, thanks to its colonising power, its spiky fruits adhering to the feathers of the young birds and so being spread broadcast. Here there is a splendid example of a plant of little importance becoming virtually a weed in a virgin vegetation. But finally tussock will resume the sway, and a gradual destruction and rejuvenation of the vegetation must go on, thanks to the mollymawks."

IN the February number of *British Birds* the editors discuss certain allegations against the black-headed gull which formed the subject of notice in the previous issue. Without entering into the controversy, we may notice that the allegations have induced two county councils in Scotland to strike gulls of all kinds out of the protected list. In another paragraph the editors refer to the subject of "luminous owls." In their opinion, the luminosity is most probably to be attributed to phosphorescent bacteria derived from decaying wood. It may, however, be due either to a phosphorescent feather-fungus (akin to one known to occur in geese) or to a diseased condition of the oil-gland, whereby the oil is more abundant than usual, and so abnormal in its nature as to become luminous on exposure to the air. Whatever be the true explanation, it is evident that the phenomenon is abnormal, and almost certainly due to the presence of foreign matter on the feathers.

THE reports on the botanic and experiment stations and agricultural education in St. Kitts-Nevis for 1906–7, besides reviewing the work for the year, summarise the progress made since the institution of the Imperial Department of Agriculture for the West Indies. The sugar industry has benefited by the introduction of the seedling canes B. 147 and B. 208; cotton cultivation has been developed since 1901, when trial plots were started, until an area of 5000 acres is now planted in the three islands St. Kitts, Nevis, and Anguilla. The cultivation of cacao proceeds more slowly, but gives promise of success. Rubber planting, chiefly with *Castilloa elastica*, is also receiving attention. The records of the experiment plots provide useful data with regard to growing tobacco, varieties of potatoes, cassava, yams, sweet potatoes, and other minor products.

ACTING upon the advice of Prof. H. J. Hamburger, it was decided to publish in the *Recueil de l'Institut botanique de Bruxelles* (vol. vii.) the course of lectures on molecular physiology delivered by the late Prof. Errera to students taking the botanical degree in the University. It is primarily a physicochemical course dealing with the properties of fluids and solids, and the special application of the laws regulating their action to various botanical problems. Surface tension of liquids, viscosity, properties of emulsions, circulation of gases and liquids in narrow tubes, and similar phenomena are treated with regard to their bearing in plants, and especially with reference to the two important subjects of osmosis and the ascent of sap in trees. Practical examples of calculations in connection with osmotic problems are given, and the discussion of the various theories put forward to explain the ascent of sap is illustrative of Prof. Errera's lucid exposition.

THE *West Indian Bulletin* (No. 3, vol. viii.) contains summaries of several of the papers presented to the famous agricultural conference of 1907. Mr. Gossett points out how valuable Indian cattle have proved in Jamaica; they are said to surpass all others as workers, and to be so remarkably hardy in constitution that they withstand the effects of the climate, of insects, and other pests, besides being able to subsist on coarse grasses and shrubs that other cattle would refuse. Another paper deals with the suitability of Jamaica for breeding horses, mules, and polo ponies. Mr. Cox discusses the prospects of tea production, and concludes that tea is a safe crop for a settler who lives within reach of a factory. Mr. Cousins contributes two papers, one on cassava starch and the other on agricultural education in Jamaica. He finds that cassava starch of high quality and commanding a good price can be produced in Jamaica at a cost which allows a very handsome profit. Other papers deal with Jamaica ginger and with the native timbers. The standard of the papers is very good, and all the authors are very hopeful about the future. They have good reason, for few of our possessions have better agricultural departments than the West Indies.

THE second number of the Bulletin of the Imperial Central Agricultural Experiment Station of Japan is to hand, and is in every way an excellent production. One paper deals with the behaviour of nitrate of soda in paddy soils. Nagaoka found some years ago that this fertiliser actually depressed the yields of rice, Sagittaria, and *Juncus effusus* when cultivated, as is usual in Japan, on swampy soils. He considered that the effect was due to denitrification, a process which would give rise, among other things, to poisonous nitrites. It is now shown that this view is correct. Another paper, by Uchiyama, deals with the influence of stimulating compounds such as manganese and iron salts, sodium fluoride and potassium iodide on crops, a subject to which considerable attention has been devoted in Japan. The general conclusion is that manganese sulphate at the rate of 20 kilos. to 50 kilos. per hectare increases the crop, but the actual amount of the increase depends on a variety of factors. The most favourable ratio of lime to magnesia in soils forms the subject of several papers. There is also an important synoptical list of Coccidæ of Japan, with descriptions of thirteen new species by Kuwana. The bulletin is profusely illustrated, and the illustrations are unusually good.

THE report of the chief of the U.S. Weather Bureau for the fiscal year ended June 30, 1906, has just reached us. In the department dealing with weather prediction, the distinctive work of the year was the study of atmospheric movements in the United States with the additional light afforded by reports from the Azores, western Europe, Honolulu, and other places, the result of which has been sufficiently encouraging to warrant a still further extension of area. The amazing figures connected with the receipt of telegraphic reports and the distribution of meteorological information were referred to in NATURE, vol. lxxvi., p. 300. There has been considerable increase of observing stations of various classes; the number now amounts to more than 4500. The report contains, *inter alia*, observations or summaries for a large number of selected places, and monthly and annual rainfall values for all stations, for the year 1905, the whole occupying 405 quarto pages. At Mount Weather Research Observatory systematic work is carried on in connection with the international kite experiments; the institution possesses a very complete instrumental outfit for the purpose. Among various other useful operations of the bureau, we may mention that efforts are being made to correlate and reduce to a uniform system the teaching of meteorology in the numerous colleges and schools; circular letters on the subject have apparently been addressed to a large number of educational establishments.

AN important paper on the smoke from metallurgical works, by Mr. W. D. Harkins and Mr. R. E. Swain, is contained in the Journal of the American Chemical Society (vol. xxix., No. 4). The work which led to the publication of the paper was the estimation of the amount of arsenic expelled from the greatest of the world's smelting works, a plant which has a capacity of 10,000 tons of ore per day, and a production estimated at 11½ per cent. of the world's output of copper. It has been found that not only are the trees and grass in the vicinity of works injured by the sulphur dioxide and sulphuric acid of the smoke, but the grass is also rendered poisonous by arsenic. By the erection of new works with huge settling chambers in place of the long flues of the old works, the loss of animals in the valley became very much greater than before. The velocity determinations and analyses of smoke set forth in the paper were undertaken with a view to determine the real efficiency of the great flues and stack, 300 feet high, built in order to prevent damage to the forests and crops. The velocity determinations were made with a Pitot tube, modified by Captain D. W. Taylor, which was found to give much more trustworthy results than the wheel anemometer. The results of the investigation show that while the great flue may be fairly efficient in causing the copper from the smoke to settle, a considerable amount escapes, while the amount of arsenic given off is very great. The arsenic is chiefly in the form of trioxide, but a small amount exists in the form of trisulphide and in the form of complex minerals containing iron. The dust from the flue near the stack or in the stack itself contains a considerable amount of concentrated sulphuric acid, while that from near the furnaces contains much less. To this sulphuric acid, together with the arsenic with which it is associated, is probably due much of the spotting of leaves which is so common in the vicinity of the works. The action of the flue dust is of far less importance than that of the sulphur dioxide in affecting the growth of plants, but the arsenic of the dust may affect to a greater degree the value of the grasses, since it renders them poisonous.

MESSRS. C. WOOLLISCROFT AND SON, LTD., Hanley, Staffs, ask for information as to an electrostatic separator for the purpose of extracting iron pyrites. An expert to whom we referred the inquiry has been good enough to

reply that the latest type of electrostatic separator is the Blake-Morscher, which was described in a paper read before the Institution of Mining and Metallurgy by E. A. Weinberg (Transactions, 1905, vol. xiv., p. 169). It is of American manufacture, and can probably be obtained from Fraser and Chalmers, of Erith. Earlier forms are exhaustively described in a paper read by H. C. McNeill before the Iron and Steel Institute (Journal, 1899, vol. lvi., p. 18). Machinery for the extraction of iron pyrites is made by the German "Humboldt Company," of Kalk, near Cologne.

THE *Verhandlungen der deutschen physikalischen Gesellschaft* for December, 1907, contains a communication from Prof. E. Wiedemann, in which he directs attention to two Arabic books of the thirteenth and fourteenth centuries, in the former of which the method of magnetising a steel needle by rubbing it on a natural lodestone is described, while in the latter instructions are given for mounting a needle so magnetised within a wooden fish, which when placed on water heads always to the north. This appears to be the first known mention of the compass, although the matter is treated as if it were common knowledge at the time.

VOL. iv. of "Contributions from the Jefferson Physical Laboratory of Harvard University" contains thirteen memoirs, five of which are from the pen of Prof. B. O. Peirce. Most of these memoirs are reprinted from vol. xlii. of the Proceedings of the American Academy of Arts and Sciences, 1906. There is one, on architectural acoustics, by Prof. W. C. Sabine, reprinted from the *American Architect* for 1900, which well deserves close attention from architects in this country. It is a thoroughly scientific attack on the problem of determining the acoustical properties of a room before it is built. The author describes his measurements of the absorbing powers of walls, screens, furniture, and audience, and shows how the constants thus determined can be used in calculating the amount of reverberation to be expected in a large number of cases. In each case direct measurement confirmed the result of the calculation.

THE report for 1908 of the International Committee on Atomic Weights is printed in No. 335 of the Proceedings of the Chemical Society. From the data here given, and from those cited in previous reports, it is concluded that the entire table of atomic weights is in need of revision. The values assigned to potassium and sodium are too high; those given to chlorine and sulphur are too low, and these constants affect the determination of many others. They depend, however, on the atomic weight of silver, which is probably, but not certainly, as low as 107·88. It is well known that work upon these fundamental constants is now nearing completion in several laboratories, and within a few months it should be possible to enter upon a satisfactory revision of the table, a task which would be unsatisfactory if undertaken now. It is true that the present table contains inconsistencies, but they are small in amount, and are due to inconsistencies in the original data from which the values are derived. Since issuing the last report Prof. Moissan has died, and has been succeeded on the committee by M. G. Urbain. The report being drawn up in November last does not deal with the striking result obtained by W. Marckwald in the case of tellurium, which has been published since; this element has long held an abnormal position in the periodic arrangement owing to its appearing to have an atomic weight greater than that of iodine. According to Marckwald, its correct atomic weight is 126·85, that is, 0·12 unit less than the atomic weight of iodine, so that it now falls into line with the rest of the elements.

A SECOND edition of Mr. Arthur Whiting's "Retouching" has been published by Messrs. Dawbarn and Ward, Ltd.

A SECOND edition of the useful "Handbook to the Vivaria and Fresh-water Aquaria" at the Horniman Museum, Forest Hill, S.E., has been issued by the London County Council. Copies may be obtained through a bookseller, or directly from Messrs. P. S. King and Son, of Westminster; the price of the catalogue is one penny.

MESSRS. CROSBY LOCKWOOD AND SON have published a fifth edition of Dr. Bernard Dyer's "Fertilisers and Feeding Stuffs: their Properties and Uses," which contains also the full text of the Fertilisers and Feeding Stuffs Act, 1906, the regulations and forms of the Board of Agriculture, and notes on the Act by Mr. A. J. David. The new edition has been revised, and its price is 1*s.* net.

OUR ASTRONOMICAL COLUMN.

THE RECENT SPECTRUM AND MAGNITUDE OF NOVA PERSEI No. 2.—The results of Prof. Hartmann's more recent investigations of the spectrum of Nova Persei No. 2 (1901) appear in No. 4232 of the *Astronomische Nachrichten* (p. 113, February 8). Finding that when the magnitude of the star became less than 10·0 he was unable to photograph the spectrum with the large instrument used in the previous investigation, Prof. Hartmann devised a new spectroscope in which the collimator objective, of 40 mm. aperture and 60 cm. focal length, was made of U.V. glass, and the camera objective was made of quartz, having an aperture of 40 mm. and a focal length of 32 cm.; quartz prisms were employed, and the distance between Hβ and Hδ on the plate was 4·6 mm. This spectrograph was used in conjunction with the 80-cm. refractor, and a good spectrum was obtained with 8¼ hours' exposure on October 15 and 18, 1907, when the Nova's magnitude was 11·4. The main feature of this spectrum is its similarity to the spectrum of the Wolf-Rayet star B.D. 35°.4001. In both spectra the brightest line is at λ 4688, whilst Hβ, Hγ, and Hδ are more faintly shown. The fairly strong line in the spectrum of the W.-R. star at λ 4618 is comparatively faint in that of the Nova, whilst the trace of a line in the latter at λ 3890 is not to be found in the Wolf-Rayet spectrum. The chief nebular lines at λλ 5007 and 4959 are apparently absent from both spectra or are very faint.

Determinations of the magnitude of the Nova gave the following results:—1905, November 1, 11·2; 1906, November 24, 11·3; and 1907, October 13, 11·44.

THE HELIUM LINE, D_3, AS A DARK LINE IN THE SOLAR SPECTRUM.—In No. 393 of the *Observatory* (p. 94, February) Mr. A. A. Buss discusses the article by Father Cortie, which appeared in the January number, anent the presence of the dark, D_3, line of helium in the solar spectrum. From our previous note (No. 1995, p. 281, January 23) it will be remembered that Father Cortie discussed a photograph obtained by Mr. Nagaraja, on which both the dark and the bright line of helium, D_3, were supposed to be represented, and came to the conclusion that the identification was, possibly, a mistaken one. Mr. Buss now advances a number of arguments upholding the original view. In the first place, he points out that any arguments on this question suffer considerable uncertainty owing to different values being given for the principal lines under discussion. Thus Runge and Paschen give 5875·870 as the wave-length of the laboratory emission line, whilst in Young's revised list the wave-length of the chromospheric line is given as 5876; that the latter, compared with the laboratory line, suffers displacement towards the red is indicated by several different observations. Mr. Nagaraja's dark line lies almost exactly mid-way between the two, at λ 5875·930, therefore Mr. Buss considers that

it is, probably, the helium line. Other evidence and his own observations of the dark D_3 line in active areas outside the umbral regions of spots support this view.

A DETAILED STUDY OF THE PHOTOSPHERE.—In No. 1895 of NATURE (vol. lxxiii., p. 401, February 22, 1906) we published an article dealing with Prof. Hansky's study of the size and movements of the granules comprising the solar photospheric surface. Mr. Chevalier, of the Zô-sé Observatory, China, has for some time been engaged on a similar study, and publishes some very interesting results, with photographs, in No. 1, vol. xxvii., of the *Astrophysical Journal* (January, p. 12). The principal conclusions deduced from the results show that on comparing photographs taken at one minute or half-minute intervals the same photospheric granules may be easily recognised, although their shapes and brilliancies undergo considerable changes. A more detailed comparison shows changes in their relative positions, the magnitude of the changes differing greatly both in direction and velocity. The velocities obtained range from 0 to 30 or more kilometres per second, and, in the mean, are much lower than those obtained by Prof. Hansky.

SECTIONAL ADDRESSES AT THE CHICAGO MEETING OF THE AMERICAN ASSOCIATION.

BY the courtesy of Dr. L. O. Howard, permanent secretary of the American Association for the Advancement of Science, we have been favoured with copies of several addresses delivered by chairmen of sections of the association at the recent Chicago meeting, of which an account was given in NATURE of January 30. Subjoined are summaries of some of the points of interest in these addresses. A summary of the president's address appeared in NATURE of January 23.

Music and Melody.

In his address to Section B (physics) Prof. W. C. Sabine chose as his topic "Melody and the Origin of the Musical Scale," the discourse being a critique of views published fifty-five years ago by Helmholtz in his "Tonempfindungen." It is pointed out that in part ii. of that work Helmholtz gave a physical and physiological explanation of the harmony and discord of *simultaneous* sounds, and Prof. Sabine briefly quotes Helmholtz's description of the structure of the human ear, so far as it is required to explain why overlapping tones produce a sense of discord, thus leading to the necessity of a musical scale with regular intervals for the building up of harmonies. But in applying this principle to account for the origin of such a scale, Helmholtz was met by an apparent anachronism.

Up to the eleventh or twelfth century only homophonic music existed, this consisting merely in the progression of single-part melody. The existing music of the Oriental and Asiatic races belongs to this type, and Helmholtz, admitting that between sounds which reach the ear in discrete succession there could be neither harmony nor discord, nor beats, sought another explanation for the fact that musical scales were existent long before the introduction of polyphonic and harmonic music. Prof. Sabine now offers a new explanation of this particular point. When sounds are produced inside a closed space such as a building, they continue to reverberate for a certain interval after the exciting source has ceased to exist. In this connection Prof. Sabine gives (without, however, specifying the units) a list of the absorbing powers of different substances. It follows that as soon as melodies were performed inside buildings such as temples of worship, the consecutive notes became blended, and this overlapping produced all the conditions necessary for the production of the harmonies and discords discussed by Helmholtz in explanation of the chordal use of the musical scale. This proposed theory of Prof. Sabine's would (so it is claimed) account for the absence of a musical scale among the native tribes of Africa.

The Problem of Heredity.

It is a sign of the times that the addresses delivered before the American Association by Dr. D. T. Macdougal, a botanist, and by Dr. E. G. Conklin, a zoologist, are not about botany and zoology respectively, but that both deal with heredity; and it is evidence of the vastness of the topic with which they deal that, though they both treat of the mechanism of heredity, their two addresses do not overlap. Both addresses are admirable examples of what such addresses should be. Their opening sentences exhibit a breadth of view which, if we may say so, has not been a distinguishing feature of a great deal of recent American biological literature; and both addresses contain such a wealth of references to, and accounts of, new observations and experiments which bear on the interpretation of fundamental problems that the earnest biologist will do well to read them both.

Dr. Macdougal opens his address on "Heredity and Environic Forces" with some well-needed remarks on the assumption that the changes which ensue when a plant is transported to a violently different environment—as, for example, when a mesophyte is grown as a xerophyte—are adaptive changes. According to Dr. MacDougal, these are not only assumptions, but unwarrantable ones. Certain of the changes which accompany the transportation do undoubtedly benefit the plant in its new surroundings, "but results of the opposite character are encountered. Thus in my experiments with Roripa, the American watercress, it was seen to bear filiform, dissected leaves when submerged, linear dissected leaves when emersed, but when acclimatised at the Desert Laboratory developed broadly ovate, almost entire laminæ." Similarly etiolation, usually regarded as an adaptive change which enables the plant to lift its head above objects which keep the light from it, was found to occur in less than half the species tested, the majority "showing thickened organs and other useless alterations." Lastly, he cites the proof given by Lloyd that the movements of stomata are *not* adaptive or regulatory with respect to transpiration. We can heartily endorse Dr. Macdougal's conclusion on this part of his subject (as he happily phrases it in his native tongue), "that the entire matter of causal adaptations is in need of a basal re-investigation from an entirely new view-point."

But the most interesting part of this address is that which deals with the author's successful attempts to modify permanently the germ-plasms of plants by subjecting them to the influence of various chemicals. "It was found that the injection of various solutions into ovaries of Raimannia was followed by the production of seeds bearing qualities not exhibited by the parent, wholly irreversible, and fully transmissible in successive generations. One of the seeds produced by a plant of *Oenothera biennis* which had been treated with zinc sulphate differed so widely from the parental form that it could be distinguished from it by a novice. This new form "has been tested to the third generation, transmits all its characteristics fully, and does not readily hybridise with the parent even when grown so closely in contact with it that the branches interlock." Results as remarkable as this need confirmation, and it is to be hoped that similar experiments will shortly be undertaken in this country.

In his address on "The Mechanism of Heredity," Dr. E. G. Conklin suggests an answer to the question which always puzzles the philosophical biologist, "What exactly is the problem of heredity? How does it differ from that of development?" Dr. Conklin's answer is what at first sight would seem to be the natural and logical consequence of the acceptance of Weismann's doctrine of the continuity of the germ-plasm; it is, in fact, that there is little difference between the two problems. "Indeed, Heredity is not a peculiar or unique principle; for it is only similarity of growth and differentiation in successive generations. . . . In fact, the whole process of development is one of growth and differentiation, and similarity of these in parents and offspring constitutes hereditary likeness. The causes of heredity are thus reduced to the causes of the successive differentiations of development, and the *mechanism of heredity is merely the mechanism of differentiation.*" Having reduced the problem of heredity to this, Dr. Conklin goes on to consider the evidence for the view that the chromosomes are solely concerned in the process of differentiation, and expresses himself as definitely opposed to that view. He is not

content with holding that the phenomena of differentiation may be the result of the interaction of nucleus and cytoplasm, but he goes on to assert that, as the animal pole of the egg becomes the animal or sense pole in all animals, and the cytoplasm in this region gives rise to the ectoderm of the developing animal, and as this polarity can be traced far back into the ovarian history of the egg, and in some cases is probably continuous from generation to generation, that "we have here an important character which is inherited through the cytoplasm and not through the nucleus." Dr. Conklin's final conclusion is that at the time of fertilisation the hereditary potencies of the two germ cells are not equal, because all the "early development, including the polarity, symmetry, type of cleavage, and the relative positions and proportions of future organs," are determined solely by the cytoplasm of the egg-cell.

Anthropology of California.

In his address as president of Section H (anthropology) of the American Association, Prof. A. L. Kroeber reviewed the progress of anthropology in California. Commencing with language, he pointed out that Powell's arrangement of about twenty linguistic stocks had not been disturbed by later investigations. The loose statements formerly made that the number of unrelated dialects of each stock was often very great, and that these dialects showed a gradual continuous change from one end of the territory occupied by a stock to another, have been found to be entirely erroneous. There are some loan-words common to contiguous stocks, but these are few, and the peculiarity of the linguistic problem lies in the fact that each form of speech occupies a well-defined area. So far, three great groups—north-western, south-western, and central—have been clearly traced, and the similarities between them, which up to the present have been ascertained, are not of such a nature as to be of bearing on the consideration of their genetic unity. Some progress has been made towards explaining this remarkable distribution of languages. In some cases it appears to have originated from mere divergence, continued until practically all traces of original relationship have become obliterated. At any rate, nothing has ever been discovered to support the so-called "fish-trap" theory, according to which the multiplicity of languages in California is due to the successive crowding, into this more desirable habitat, of waves or bands of unrelated immigrants from less favoured regions, to which none of them ever desired to return. This differentiation of speech, again, seems to be casually related to other factors, cultural and historical, and only indirectly physical and environmental.

Much the same is true of the relations of culture and environment, but the latter has been influenced by a long historical development. While, as compared with the rest of America, California forms a well-marked region, on a broader view its distinctive characters largely disappear, or are seen to coincide with such as are typical of the whole of the northern continent. In the north-west the culture seems to be an extension of that of the Pacific coast, while that of the centre and south is of a diverse type.

Archæological investigation, so far as it has been pursued, does not establish the origin of this culture in Quaternary times or the geological antiquity of those finds which are unquestionably of human origin. The civilisation seems to have remained practically unaltered for some thousands of years; but, at the same time, owing to the prevalence of the practice of cremation, the record of physical anthropology is very incomplete. In the domain of culture much remains to be done, particularly in tracing the relationship of analogous rites among the local tribes. What is needed in all branches of the anthropology of this region is more knowledge, and this can be gained only by more work on the lines of linguistic and anthropological investigation, which it is the main object of this address to illustrate and define.

Progress in Experimental Medicine.

An address on "Tendencies in Pathology" was given by Dr. Simon Flexner, chairman of Section K (physiology and experimental medicine). Dr. Flexner pointed out that the causation of disease is manifold, the reaction to abnormal influences is varied. The forces which divert the normal functions and bring disease into being are only in part external at the time of their operation. All parasitic plants and animals are essentially extrinsic agents of injury. Occupation diseases, so-called, are at present only slightly understood, and probably act, not only by increasing susceptibility to infections, but also through direct chemical and physical mal-influences. There is, however, a class of diseases which results, in part at least, from errors and disturbances of balance in the development of the animal organism or in the correlation of its functions. The peculiar control which the adrenals exercise over the tone of the vascular system, the degeneration of the aorta in rabbits produced by injection of adrenalin, and the association between sclerosis and atrophy of the kidneys and arterial hypertension and degeneration, suggest that the renal and the arterial disease are parts of one pathological complex. Other instances might be given, *e.g.* the association of disease of the pancreas with diabetes.

Lately an experimental method has been devised whereby portions of organs and tissues may be transferred from one animal to another, and thus the influences exerted by a new environment on certain organs, or of the transplanted organ on a new host, investigated. For example, it has been found that arteries may be successfully transplanted even after keeping aseptically in a refrigerator for twenty or thirty days after extirpation.

The phagocytic function of the leucocytes, whereby infecting microbes or worn-out somatic cells are ingested and disposed of, is well known, but this function of the living leucocyte is supplemented by its power to yield upon dissolution active proteolytic enzymes of considerable potency, which may have a considerable influence on various pathological processes, *e.g.* inflammation.

Until recently little progress had been made regarding tumour formation, and we are still ignorant of its cause, but the study of transplantable tumours of mice and rats has already yielded important results concerning the biological conditions underlying tumour growth. Such tumours are highly specific; they are transplantable only to individuals of the same species and race, never to animals of another species, and often not to those of another race of the same species. The existence of a form of immunity to tumour cells has been demonstrated, which may be restricted to one region of or may be general to the whole body. This immunity Ehrlich terms *atrepsy*, and he conceives it to be an expression of deprivation of the peculiar nutritive stuff required for tumour growth.

As regards bacteriology, one important phenomenon of recent recognition is that of the *microbe carrier*, an individual who harbours disease germs while himself apparently suffering no ill effect. This has been known for some time in the case of the diphtheria bacillus, but has recently been found to hold good for the typhoid bacillus, and for dysentery, plague, cholera, and a host of protozoan infections.

We are now learning, too, that while the forces of immunity may be in active operation, so far as tests made outside the body with the blood indicate, the very bacteria from and against which they have developed may still be surviving in the body.

The discovery of the opsonins in the normal blood, and their increase in states of induced immunity to bacterial and other infections, has added greatly to our knowledge of some of the complicated phenomena of the immune state.

The body infected with bacteria or other pathogenic micro-organisms, although it may survive the infection, may not be rendered more resistant—it may even be rendered more susceptible to the infecting agent or its products. From the diverse reactions of the body to foreign substances and parasitic organisms, phenomena have been discovered, some desirable and beneficial, others objectionable and injurious, and it becomes the quest of the future to secure for medical practice those effects that may be beneficial, and to eliminate those that may be injurious.

COPPER MIRRORS.

METALLIC mirrors have been known from very early times, and references to them are scattered through ancient literature. They were frequently elaborately decorated, and many of them possess the greatest interest as objects of art. Looking-glasses coated with an amalgam of quicksilver and tin came into use about the middle of the fifteenth century, but it is not known by whom they were originally invented. The details of their manufacture were, for long, carefully guarded as trade secrets, and were not made public until about a hundred years later. The process then described is in all essentials that still employed, wherever it has not been abandoned on account of the danger to workers from mercurial poisoning. Tin amalgam mirrors were most extensively used during the latter half of last century, but at the present time in England and Germany they are no longer made, as mirrors obtained by the actual deposition of metallic silver upon glass have displaced them.

This gradual but complete transformation of an important industry had its origin in an observation made by Liebig when investigating the properties of aldehyde, which he had recently discovered. He found that if a solution of silver nitrate to which some drops of ammonia had been added was warmed with the new compound, the silver oxide was immediately reduced, and that the reduction was accompanied by a peculiar phenomenon, the metal attaching itself to the glass in the form of a thin reflecting layer.

Liebig apparently did not at the time realise the importance of his discovery in relation to mirror making. This was first done by Thomas Drayton, of Brighton, who eight years later, in 1843, patented a process for manufacturing looking-glasses by a similar reduction of a silver solution by oil of cloves. His process did not prove a commercial success, and was soon abandoned in favour of one worked out by Liebig, in which milk-sugar was used as the reducing agent, and by various modifications of which all mirrors are now made.

Drayton's method at the time, however, excited widespread interest, and Faraday lectured upon it at the Royal Institution, silvering a number of large glass vessels during the lecture, to the great delight of his audience.

Faraday about this time made the interesting observation that a mirror-like deposit of copper upon glass could be obtained by heating plates of glass in a liquid made by dissolving a little oxide of copper in olive oil. Copper mirrors obtained thus are generally lacking in brilliancy, and if of any size are liable to be stained and discoloured in patches by decomposition products of the oil. Further, as the deposition of the metal only takes place at a temperature above that at which the oil decomposes, the process is excessively disagreeable to carry out, and as the oil is spoiled it is somewhat costly.

The writer has recently discovered[1] that copper can be deposited upon glass from aqueous solution in a film as brilliant as a similarly deposited silver one if a suitable reducing agent be employed. Such a reducing agent is found in phenyl hydrazine, which has the power of readily abstracting oxygen from copper oxide, leaving the copper in the metallic state, and being itself oxidised to benzene, nitrogen, and water.

To obtain a copper mirror by this process it is best to heat a mixture of one part of freshly distilled phenyl hydrazine and two parts of water until a clear solution is obtained, and to add about half its bulk of a warm saturated solution of cupric hydroxide in strong ammonia. Nitrogen is freely evolved during the addition, and the cupric is reduced to cuprous hydroxide, which remains dissolved in the ammoniacal liquid, and does not undergo any appreciable further reduction until heated. A hot 10 per cent. aqueous solution of potassium hydroxide is next to be added until a slight permanent precipitate of cuprous hydroxide is produced. If the colourless or pale yellow liquid thus made be cautiously heated in contact with a perfectly clean glass surface, metallic copper is deposited upon it in the form of a thin, coherent, perfectly reflecting lamina.

As nitrogen is evolved during the reduction, and as tarry bye-products are formed in small quantity and float with the benzene produced to the surface of the liquid, if flasks or tube are to be coppered, devices must be adopted to keep the inner surfaces completely covered by the liquid from which the metal is being deposited, whilst allowing the gas to escape.

To obtain a film of sufficient thickness to be permanent, it is best to allow it to remain for an hour or so in contact with the warm reducing fluid, and not to pour off the latter until it has cooled to the temperature of the air. The surface of the deposited copper should then be well washed, first with water and afterwards with alcohol and ether, and finally should be protected from the slow oxidising action of the air by one or two coats of some quick-drying varnish.

The mirrors thus formed are very beautiful, for they show the splendid red colour of copper, and are more perfect in reflecting surface than the most highly polished metal. They are, moreover, if properly protected from the air, absolutely permanent. It is interesting to note that the copper is in the monovalent or cuprous state in which it is analogous to silver when it shows a similar capability of being deposited upon glass.

The surface on which the metal is deposited undoubtedly plays an important part in the process, since both silver and copper are deposited much more easily upon surfaces which have not been exposed for any length of time to the action of air or of water, and upon blown than upon polished glass.

It seems probable that the glass surface itself acts as a catalyser, and locally accelerates the reducing action.

F. D. CHATTAWAY.

[1] "A Method of Depositing Copper upon Glass from Aqueous Solutions in a Thin Brilliantly Reflecting Film, and thus producing a Copper Mirror." Read before the Royal Society, November 21, 1907

GEOLOGICAL SURVEY OF CANADA.

SEVEN reports just received from the Geological Survey of Canada afford evidence of the valuable work that is being done in investigating the mineral resources of the Dominion. In Report No. 949 Mr. D. B. Dowling describes the Cascade coal basin, Alberta. He gives an outline of the geology and topography of the coalfield, and a detailed account of the character of the coal, thickness of seams, and extent of the measures. The report is accompanied by eight folding maps. The area illustrated on the map sheets lies within and to the east of the summit of the Rocky Mountains, the formations exposed giving a continuous section from the highest remaining beds of the Cretaceous down to the bottom of the Carboniferous. The coal is of Cretaceous age. In the hills south of the Bow River ten or eleven seams, more than 4 feet thick, have been found, while north of Bankhead, on the slope of Cascade Mountain, fourteen possibly workable seams occur. At the Bankhead colliery the coal is an anthracite, admirably suited for domestic purposes. A screening plant handling 1000 tons a day has been erected. In Report No. 953 Mr. H. S. Poole describes the barytes deposits of Lake Ainslie and North Cheticamp, Nova Scotia, and gives notes on the production, manufacture, and uses of barytes in Canada. Report No. 958 is devoted to Dr. G. C. Hoffmann's review of the work done in the laboratory of the survey during the year. It covers seventy-one pages, and contains a large amount of material of chemical and mineralogical interest. In Report No. 968 Mr. D. D. Cairnes gives an account of the geology of the Moose Mountain area of the disturbed belt of southern Alberta. Coal has been found in several places within this district, and natural gas has been found to the north, south, and east of this area in the same formations as those within it. In Report No. 977 Mr. R. W. Ells gives an account of the geology and natural resources of the area included in N.W. Quarter-sheet No. 122 of the Ontario and Quebec series, comprising portions of the counties of Pontiac, Carleton, and Renfrew. A lengthy list of fossils from the Chazy, Black River, Trenton, and Pleistocene formations comprised within the area, compiled by Dr. H. M. Ami, is appended. The minerals of economic value met with include iron ore, of which there is a workable deposit at Bristol mines, galena and zinc blende, mica, asbestos,

gold, building stone, molybdenite, brick clays, ochre, and shell-marl. Report No. 971 is devoted to Mr. E. D. Ingalls's statistical review of the mineral industries of Canada for 1905. Although, unfortunately, somewhat belated, this report, which covers 174 pages, gives complete and revised information for the year 1905, advance provisional mineral statistics of which were issued on March 2, 1906.

The grand total of the mineral production of Canada is valued at 13,905,034*l*. The most valuable mineral product is coal, which accounts for 25·2 per cent. of the whole. Metallic minerals contributed together 54 per cent., structural materials 14 per cent., and other non-metallic minerals 5 per cent. Compared with the previous year, substantial increases are shown by all the leading industries, except in the case of gold, due to the continuous decrease of the Yukon placers. An interesting feature is the remarkable increase in the output of cobalt. The large supply of this metal rendered available as a result of the discoveries at Cobalt, Ontario, had, however, a depressing effect on the market, and caused a very marked decrease in price. Lastly, Report No. 1017 is devoted to a summary of the work done by the department of mines, Geological Survey, during the year 1907. It covers 132 pages, and its prompt publication deserves special commendation. There were in the field twenty parties, and the summary reports indicate that a large amount of valuable work was carried out, one of the chief results being the determination of enormous quantities of available bituminous coal in the Yukon region.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ST. ANDREWS.—After a delay of more than a quarter of a century, at last, by the munificence of Mrs. Bell Pettigrew, the widow of the late professor of medicine and anatomy, a sum of 6000*l*. has been generously offered for the new museum of natural history of the University in which her husband laboured so long. The present museum was erected by the Government in 1846, and whilst its exterior is in keeping with the other substantial buildings in the quadrangle, its mode of lighting and its cases are far behind date. Moreover, its crowded shelves not only render proper exhibition of the specimens impossible, but interfere with classification. In all probability a new lecture-room, a practical class-room, and rooms for curator and workers will be attached to the museum.

CAMBRIDGE.—The essays for which the Smith's prizes are adjudged are as follows (the names are arranged in alphabetical order):—"Problems in the Wave-motion of Viscous Liquids," W. J. Harrison, Clare College; "On the Asymptotic Behaviour of Integral Functions of Zero Order, and Allied Problems," J. E. Littlewood, Trinity College; "On the Solution of Ordinary Linear Differential Equations having Doubly Periodic Coefficients," J. Mercer, Trinity College. The adjudicators are of opinion that the following essays are deserving of honourable mention, viz.:—"On Energy Accelerations and Partition of Energy," C. W. Follett, Trinity Hall; "On some Problems in the Theory of Metallic Reflection," H. R. Hassé, St. John's College; "The Geometry of Apolar Triads," W. P. Milne, Clare College; "Perpetuant Syzygies of the *n*th Kind," H. T. H. Piaggio, St. John's College; "The Reflection of Plane Waves of Light at the Surface of a Medium of Special Periodic Character," C. J. T. Sewell, Trinity College.

J. B. Hubrecht, Christ's College, has been elected to the Isaac Newton studentship, tenable from April 15, 1908, to April 15, 1911. The student will carry on a course of research in solar physics.

H. H. Arnold-Bemrose, Clare College; W. F. Sheppard, Trinity College; J. R. Sutton, Sidney Sussex College; and A. Young, Clare College, have been approved by the general board of studies for the degree of Doctor in Science.

The Vice-Chancellor has announced to the Senate that donations of 1000*l*. each, in memory of the late Mr. Walter K. Foster, have been promised towards the building fund of the new museum of archæology and of ethnology by Mrs. Walter K. Foster, Mr. E. Bird Foster, Mr. C. F. Foster, and Mrs. E. Rawlings. Mr. Foster, in whose memory this munificent gift has been made, bequeathed to the University in 1891 an extensive collection of prehistoric and Anglo-Saxon antiquities.

LONDON.—Dr. H. T. Bovey, F.R.S., has been appointed Rector of the Imperial College of Science and Technology at South Kensington. Dr. Bovey was educated at Cambridge. He was twelfth wrangler in 1873, and was elected a fellow of Queen's College. Before going to Canada in 1887 as professor of civil engineering and applied mechanics in McGill University, Montreal, he practised as a civil engineer, being engaged on important works on the Mersey. Under Dr. Bovey's direction the civil engineering department at McGill University acquired a considerable reputation both for undergraduate and research work. Recently a course of study in transportation was added to the seven other engineering courses. The work in this subject is liberally supported by the great Canadian railway companies. In 1888 Dr. Bovey was appointed dean of applied science in McGill University. It is well known that McGill University is excellently equipped both for engineering and applied science. In the chemistry department, for example, there are special laboratories for organic chemistry, physical chemistry, electrolytic analysis, iron and steel analysis, fire assaying, water analysis, determinative mineralogy, petrography, and photography. Dr. Bovey's experience both in engineering and science is therefore exceptionally wide. His literary output includes works on applied mechanics, theory of structures and strength of materials, and hydraulics, in addition to a number of scientific papers. He was elected a Fellow of the Royal Society in 1902.

The London County Council proposes to make a grant of 5000*l*. for the current year to the Imperial College, without, however, pledging itself to contribute 20,000*l*. a year in the future, as was intended if the original scheme for the college, by which it was proposed to establish a well-equipped institution for higher work in applied science and technology, independent of other institutions at South Kensington, had been carried out.

BY the will of the late Mrs. Rylands, the Victoria University, Manchester, will receive the sum of 50,000*l*.; Owens College, Manchester, 25,000*l*.; and Mansfield College, Oxford, 10,000*l*.

THE *British Medical Journal* announces that Prof. Wilhelm Erb has given the University of Heidelberg a donation of 5000*l*., one half to be applied for the benefit of students and assistants and their maintenance in hospital when required, the other towards the promotion of scientific research by students.

WE have received from Messrs. Swan Sonnenschein and Co., Ltd., copies of the 1908 issues of "The Public Schools Year-book and Preparatory Schools Year-book" (price 3*s*. 6*d*. net), and "The Schoolmasters Year-book and Directory" (price 7*s*. 6*d*. net). Both books have become well known to educational workers as useful volumes of reference. The annual dealing specifically with the public schools, those, that is, which are connected with the Headmasters' Conference, provides details concerning the public schools which a parent seeking a school for his boy wishes to know. But the book contains much other useful information about preparatory schools, scholarships available, and the public examinations which qualify for entrance into the professions. There is, in addition, a section dealing with the various professions themselves which should prove invaluable to fathers whose sons have completed their school careers. The second volume appeals more directly to schoolmasters and others concerned in the administration of education. The extensive organisations throughout the country for the administration of secondary education are summarised; there is a chronicle of educational events during 1907; and particulars are given about educational societies and publications, examinations and inspecting bodies, and miscellaneous matters. More than half the volume is devoted to a very complete directory providing detailed information concerning the qualifications and experience of masters teaching in secondary schools.

MANY of the numbers in the "Statistics of Public Education in England and Wales, 1905–6–7," recently published (Cd. 3886) by the Board of Education, give useful information as to the condition of our national education during the year 1905–6 and the years immediately preceding. On August 1, 1906, accommodation was provided in the public elementary schools of all grades for 7,068,641 children, of which number of places 3,543,760 were in "council" schools, or, as they were formerly called, "board" schools. In ordinary elementary schools, that is, omitting every kind of "special" school, there were 5,994,490 pupils on the registers and 5,303,229 in average attendance. These children were taught by 31,893 head teachers, 93,130 assistant teachers, and 49,056 "other" teachers. The Government grant to meet expenditure in respect of elementary education during 1906–7 reached 11,248,794*l*., and in 1905–6 was 10,829,396*l*. In addition, 92,328*l*. was paid in 1906–7 on account of allowances and pensions for teachers, and 552,894*l*. for the training of teachers and pupil-teachers. In secondary schools in receipt of grants from the Board of Education, which in 1905–6 numbered 689, there were in that year 65,994 boys and 49,694 girls, and on 66,014 of these pupils—for grants were only paid on children between twelve and sixteen years of age taking an approved course of work—the sum paid in grants amounted to 246,220*l*. A serious falling off in the number of pupils in secondary schools between the ages of twelve and sixteen years is shown in the statistics. To take one example, the number of boys (about twelve to thirteen years of age) taking an approved course and doing the work of the first year was, in 1905–6, 12,238; doing the second year's work, 9,924; the third year's work, 4,907; and the fourth year's work, 2,397. It would seem that less than 20 per cent. of the boys who at twelve years of age begin the approved course of work remain at school until sixteen years of age, and the same proportion seems to be true in the case of the girls.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society. November 14, 1907.—"On the Result of Crossing Round with Wrinkled Peas, with Especial Reference to their Starch-grains." By A. D. **Darbishire.** Communicated by Prof. J. Bretland Farmer, F.R.S.

The facts so far brought to light are:—

(1) That, although roundness is dominant over wrinkledness in peas, the starch-grain of the F_1 generation (the round or *r*-grain) is a blend between the type of grain of the round pea (the potato-shaped or *p*-grain) and the type of grain of the wrinkled pea (the compound or *c*-grain) in respect of three characters:—

(*a*) It is intermediate in shape as measured by its length-breadth index—that of the *p*-grain being 66, that of the *c*-grain 92, and that of the *r*-grain 85 (neglecting decimals).

(*b*) It is intermediate in the distribution of compoundness, inasmuch as some of the *r*-grains are compound and some single.

(*c*) It is intermediate in the degree of compoundness, inasmuch as amongst those *r*-grains which are compound the most usual number of constituent pieces is three, whereas in *c*-grains it is six.

(2) In a subsequent generation—F_2—the homozygote round peas contain *p*-grains; the heterozygote round peas contain *r*- or intermediate grains. But both *r*- and intermediate grains may be associated either with a high or with a low degree of compoundness.

(3) *p*-Grains occasionally occur in wrinkled peas in F_2, and the evidence suggests that the existence of these grains in wrinkled peas tends to make them less wrinkled.

(4) A wrinkled pea takes up more water when it germinates than a round one. The hybrid between a round and a wrinkled pea is intermediate in respect of this character between its two parents.

(5) But this intermediateness of the hybrid in absorptive capacity is not occasioned by the intermediateness of the starch-grain of the hybrid, because, in F_2, peas containing *r*-grains *and peas containing* p-*grains* both have the same absorptive capacity as the F_1 pea.

(6) When, therefore, we cross a round with a wrinkled pea, we are dealing with *four* separately heritable characters:—

(i) The shape of the pea—whether round or wrinkled.

(ii) The absorptive capacity of the pea—whether low or high.

(iii) The shape of the starch-grain—whether long or round.

(iv) The constitution of the starch-grain—whether single or compound.

"On the Inheritance of Eye-colour in Man." By C. C. **Hurst.** Communicated by W. Bateson, F.R.S.

An examination of the eye-colours of a number of parents and their offspring in a Leicestershire village shows that there are at least two discontinuous types of iris in man:—

(1) The duplex type, with both anterior and posterior pigments, as in ordinary brown eyes.

(2) The simplex type, with posterior pigment only, the anterior pigment being absent, as in clear blue eyes.

In heredity the simplex type behaves as a Mendelian recessive to the duplex type, which is dominant. The unit characters concerned are evidently presence (duplex) and absence (simplex) of anterior pigment on a basis of posterior pigment, presence being dominant.

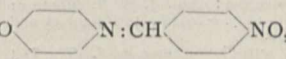
The duplex and simplex types can be distinguished at any age. Various pigmental and structural changes take place in the iris during childhood and youth, the extent of which is not yet known. Few families with living parents and offspring, all adult, are to be found in one village. Consequently, it has not yet been possible to determine the genetic relations between the various shades of the duplex type.

Mathematical Society, February 13.—Prof. W. Burnside, president, in the chair.—A proof that every algebraic equation has a root: Dr. H. A. de S. **Pittard.**—Note on *q*-differences: F. H. **Jackson.**—An extension of Eisenstein's law of reciprocity (second paper): A. E. **Western.**—Conformal representation and the transformation of Laplace's equation: E. **Cunningham.**—The uniform approach of a continuous function to its limit: Dr. W. H. **Young.**

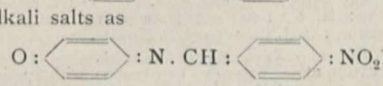
Physical Society, January 24.—Prof. J. Perry, F.R.S., president, in the chair.—Observations on recalescence curves: W. **Rosenhain.** Referring to the importance of the accurate study of recalescence phenomena in metals and alloys, the author describes the two principal methods employed for obtaining recalescence curves. These are known as the "inverse rate" and "differential" methods respectively. In the former method the times occupied by successive equal decrements of temperature are observed and plotted against the temperature of the cooling body, thus giving a curve the ordinates of which are temperature (t) and dT/dt (T = time) respectively. In the differential method the difference of temperature between the body under observation and a neutral or "blank" body cooling under approximately the same conditions is observed and plotted against the temperature of the body. The physical interpretations, in terms of quantity of heat evolved and of rate of evolution of heat of these two kinds of curves, are discussed by reference to the fundamental curve representing the time-temperature relations of one or two cooling bodies. Finally, the author describes a recalescence first observed to occur somewhat mysteriously in the body of certain furnaces at a temperature of 580° C. This was ultimately traced to a transformation occurring in crystalline silica, whether free or in admixture with porcelain or fire-clay. The author points out that this recalescence in crystalline silica coincides with certain points in the iron-carbon diagram of Roberts-Austen and of Carpenter and Keeling, and suggests that the recalescences observed by those workers may have arisen from silica in their furnaces.

Society of Chemical Industry, February 3.—Dr. J. Lewkowitsch in the chair.—Nitroglycerine and its manufacture: Lieut.-Colonel Sir F. L. **Nathan** and W. **Rintoul.** The discovery and properties of nitroglycerine were described, and particulars were given of improvements which have been effected in methods of manufacture.

Chemical Society, February 6.—Sir William Ramsay, K.C.B., F.R.S., president, in the chair.—The metallic picrates: O. **Silberrad** and H. A. **Phillips.** The water of crystallisation and properties of the commoner picrates have been definitely established.—Some physicochemical properties of mixtures of pyridine and water: H. **Hartley,** N. G. **Thomas,** and M. P. **Applebey.**—The constitution of umbellulone, part iii.: F. **Tutin.** A refutation of Semmler's recent statements (*Ber.*, 1907, xl., 5017) respecting the constitution of umbellulone.—Colour and constitution of azomethine compounds, part i.: F. G. **Pope.** The nitrohydroxyazomethine compounds show an entirely different absorption spectrum from that of their alkali salts when the nitro- and hydroxyl groups are in the *para* position to the azomethine group, and from the similarity of the .N : CH. grouping to the .N : N. grouping it would seem that the alkali salts of these compounds could be formulated on a di-quinonoid basis, the free hydroxyl compounds being represented thus:—



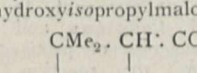
and the alkali salts as



(compare Hewitt and Mitchell, Trans., 1907, xci., 1251).—The preparation of *l*-benzoin: A. **McKenzie** and H. **Wren.**—Organic derivatives of silicon, part v., benzylethylsilicone, dibenzylsilicone, and other benzyl and benzylethyl derivatives of silicane: R. **Robison** and F. S. **Kipping.** Descriptions of these silicon derivatives are given.—The residual affinity of the coumarins and thiocoumarins, as shown by their additive compounds: A. **Clayton.** The coumarins and thiocoumarins combine with mercuric chloride, forming compounds of the type R_2HgCl_2, where R is a coumarin or a thiocoumarin.—The influence of foreign substances on certain transition temperatures, and the determination of molecular weights: H. M. **Dawson** and C. G. **Jackson.** The changes investigated were:—

(1) $Na_2S_2O_3,5H_2O \rightarrow Na_2S_2O_3,2H_2O$ at 48°·1;
(2) $NaBr,2H_2O \rightarrow NaBr$ at 50°·67; and
(3) $CaCl_2,6H_2O + 2MgCl_2,6H_2O \rightarrow CaCl_2,2MgCl_2,12H_2O$ at 22°·4.

Constants representing the depression of the transition temperature when one gram-molecule of the foreign substance is contained in 100 grams of the saturated transition solution have been calculated. From a knowledge of these constants, the corresponding invariant points may be utilised for the purpose of obtaining the molecular weights of dissolved substances.—The bromination of *p*-hydroxydiphenylamine: Miss A. E. **Smith** and K. J. P. **Orton.**—The decomposition of ammonium dichromate by heat: W. M. **Hooton.** If the salt is decomposed slowly by heat, the final product is hydrated chromium dioxide, $2CrO_2,H_2O$, a glistening black powder which when heated yields oxygen, water, and chromium sesquioxide. If ammonium dichromate is heated in absence of oxygen, the final product is a dull, greenish-black powder having the composition $H_2Cr_2O_4$.—The effect of constitution on the rotatory power of optically active nitrogen compounds, part ii.: H. O. **Jones** and J. R. **Hill.**—Malacone, a silicate of zirconium: A. C. **Cumming.** The author finds that the formula ZrO_2,SiO_2 corresponds more closely with the observed composition of malacone than does the formula $3ZrO_2,2SiO_2$ assigned to it by Kitchin and Winterson (Trans. Chem. Soc., 1906, lxxxix., 1568).—The reducibility of magnesium oxide by carbon: R. E. **Slade.** The isolation of magnesium by direct reduction of the oxide by carbon has been effected at temperatures above 1700°. Rapid evacuation of the vessel in which the reaction occurs, absorption of the magnesium by molten copper, and reduction of magnesia in presence of aluminium or in a swift stream of hydrogen have all proved useful in preventing the reverse reaction, which occurs between magnesium and carbon monoxide.—The crystal form of halogen derivatives of open chain hydrocarbons with reference to the Barlow-Pope theory of structure: F. M. **Jaeger.** In accordance with the theory of Barlow and Pope, it is found that tetrabromo-ββ-dimethylpropane, 1 : 3 : 5-hexatriene, di- and tetra-bromide, and tetraiodoethylene exhibit a close morphotropic relationship.—The determination of the rate of change by measurement of the gases evolved: F. E. E. **Lamplough.**—The temperatures of spontaneous crystallisation of mixed solutions, and their determination by means of the index of refraction. Mixtures of solutions of sodium nitrate and lead nitrate: Miss F. **Isaac.**—Contributions to the chemistry of the terpenes, part iii.; some oxidation products of pinene: G. G. **Henderson** and I. M. **Heilbron.**—A β-lactonic acid from acetone and malonic acid: A. N. **Meldrum.** When malonic acid and acetone are mixed with acetic anhydride and a little sulphuric acid, the β-lactone of β-hydroxy*iso*propylmalonic acid,



is formed.

PARIS.

Academy of Sciences, February 10.—M. H. Becquerel in the chair.—The spectra of non-dissociated compounds: Henri **Becquerel.** A reply to a recent note of M. A. Dufour, and pointing out the connection between the results of M. Dufour and certain phosphorescent and absorption spectra.—The alcoholysis of linseed oil: A. **Haller.** The author has applied his method of saponification with alcoholic hydrochloric acid to the preparation of the methyl esters of the fatty acids contained in linseed oil. These methyl esters were submitted to fractional distillation under reduced pressure, and the distillates caused to crystallise at −7° C. In this way the methyl esters of stearic, palmitic, and arachic acids were separated in a pure state.—Parthenogenesis at Roscoff and at Berkeley: Yves **Delage.** A controversial paper in reply to Loeb.—The dispersion of light in interstellar space: Charles **Nordmann.** A sketch of a new method for determining if rays of different wave-lengths all travel in interstellar space with the same velocity, based on the monochromatic photometry of a variable star. The experimental results will be given in a later paper.—Observations of the transit of Mercury of November 14, 1907, made at the Royal Observatory of Belgium: M. **Lecointe.** Results are given for the observations of the contacts, the form of the disc, and observations of position and of physical appearance.—Theorem on Taylor's series: Michel **Petrovitch.**—The approximate integration of differential equations: Émile **Cotton.**—The diminution of the rolling of ships: V. **Crémieu.**—A new series of ammoniacal ferric salts in which the iron is masked: P. **Pascal.** A description of some complex salts formed by the addition of ammonia to solutions of sodium ferripyrophosphate.—The silicide of magnesium: Paul **Lebeau** and Robert **Bossuet.** Alloys of magnesium and silicon containing from 0·38 per cent. up to more than 50 per cent. of silicon were examined micrographically. From the results of this examination it appeared that there exists only one magnesium silicide containing less than 40 per cent. of silicon. Aqueous solutions proved to be useless for the isolation of the silicide from the ingot, and the excess of magnesium was removed by the action of ethyl iodide and ether. The compound thus isolated was $SiMg_2$, and gives hydrogen free from hydrogen silicide when acted upon by water. Hydrochloric acid attacks it energetically, a mixture of hydrogen and spontaneously inflammable hydrogen silicides being produced. The compound is completely dissociated in a vacuum at 1100°–1200° C., the magnesium being volatilised.—The colloidal properties of starch, and on the existence of a perfect solution of this substance: E. **Fouard.** The starch solution was filtered through a membrane of collodion, and its properties were totally different from ordinary starch solutions. The strength of the solution was 2·74 per cent. of starch; it was clear and perfectly transparent, and an intense light bundle after passing through the solution showed no trace of polarisation. The viscosity of a 1 per cent. solution was of the same order of magnitude as water or 1 per cent. sugar solution, and only one-twelfth that of a 1 per cent. starch solution made in the ordinary way.—The state of the camphocarbonates of the fatty and aromatic amines in solution, as shown by the rotatory power: J. **Minguin.**—Researches on the physical

modifications of gelatin in presence of electrolytes and non-electrolytes: J. Larguier **des Bancels.** In presence of certain salts gelatin dissolves in water at the ordinary temperature. At equal concentrations, salts of divalent metals exert a more powerful solvent action than salts of monovalent metals. For the same metals nitrates exert a more energetic action than chlorides. Certain non-electrolytes, such as alcohol or acetone, also attack gelatin more easily than pure water.—The rapid estimation of potassium bichromate in milks: M. **Gouère.**—The preparation of dithymol: the action of bromine on dithymol. H. **Cousin** and H. **Hérissey.** The oxidation of the thymol is carried out with ferric chloride in aqueous solution; the yield is from 25 per cent. to 30 per cent.—γ-Oxytetrolic acid: MM. **Lespieau** and **Viguier.** This is prepared by the interaction of propargyl alcohol and ethylmagnesium bromide, the reaction product being treated with carbon dioxide. The addition products with bromine have been studied.—Researches on a method of preparing the cyclic aldehydes: M. **Savariau.** Phenylmagnesium bromide reacts with chloral hydrate to give the compound $C_6H_5.CH(OH).CCl_3$, and this is converted into benzaldehyde by boiling with a solution of an alkaline carbonate. The method appears to be general, and may be useful in preparing small quantities of rare cyclic aldehydes.—The action of alcohols upon sodium benzylate: Marcel **Guerbet.** The action of sodium benzylate upon benzyl alcohol at 225° C. gives rise to stilbene, dibenzyl, toluene, and benzoic acid.—The chemical constitution and biological properties of the protoplasma of Koch's bacillus: Jules **Auclair** and Louis **Paris.**—Tyrosinase and racemic tyrosine: Gabriel **Bertrand** and M. **Rosenblatt.**—The genus Seuratia and its connections with Capnodium: Paul **Vuillemin.**—The intramolecular respiration of the aërial vegetative organs of vascular plants: G. **Nicolas.**—The multiplication *in vitro* of *Treponema pallidum*: C. **Lebailly.**

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 20.

ROYAL SOCIETY, at 4.30.—Notes on the Application of Low Temperatures to some Chemical Problems. (1) Use of Charcoal in Vapour Density Determination. (2) Rotatory Power of Organic Substances: Sir James Dewar, F.R.S., and Dr. H. O. Jones.—On the Osmotic Pressure of Compressible Solutions of any Degree of Concentration. Part II. Cases in which both Solvent and Solute are Volatile: A. W. Porter.—Effects of Self-induction in an Iron Cylinder when traversed by Alternating Currents: Prof. Ernest Wilson.—(1) On the Refractive Indices of Gaseous Nitric Oxide, Sulphur Dioxide, and Sulphur Trioxide. (2) On the Dispersion of Gaseous Mercury, Sulphur, Phosphorus, and Helium: C. Cuthbertson and E. Parr Metcalfe.

ROYAL INSTITUTION, at 3.—Wood: its Botanical and Technical Aspects: Prof. W. Somerville.

INSTITUTION OF MINING AND METALLURGY, at 8.—The Alloys of Gold and Tellurium: Dr. T. K. Rose.—A Method of Settling Slimes, as applied to their Separation from Solution in Cyanide Treatment: H. G. Nichols.—Two Deterrents to the Dissolution of Free Gold in the Cyanide Process: D. Simpson.—A Rapid Method for the Estimation of Arsenic in Ores: H. E. Hooper.—The Indian Mint Assay of Silver Bullion: F. T. C. Hughes.

LINNEAN SOCIETY, at 8.—Experiments with Wild Species of Tuber-bearing Solanums: A. W. Sutton.—The Life-history and Larval Habits of Tiger Beetles (Cicindelæ): Dr. V. E. Shelford.—On a Possible Case of Mimicry in the Common Sole: Dr. A. T. Masterman.—*Exhibit*: Stereoscopic Photographs of Alpine Plants in Natural Colours: T. Ernest Waltham.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Electrical Power in Railway Goods Warehouses: H. Henderson.—Electric Power in Docks: C. E. Taylor.

CHEMICAL SOCIETY, at 8.30.—The Action of Thionyl Chloride and of Phosphorus Pentachloride on the Methylene Ethers of Pyrocatechol Derivatives: G. Barger.—The Preparation of Conductivity Water: H. Hartley, N. P. Campbell and R. H. Poole.—Derivatives of *para*-Diazoiminobenzene: G. T. Morgan and Miss F. M. G. Micklethwait.—A Study of the Diazo-reaction in the Diphenyl Series: G. T. Morgan and Miss F. M. G. Micklethwait.—Organic Derivatives of Silicon. Part VI. The Optically Active Sulphobenzylethylpropylsilicyl Oxides: F. S. Kipping.—A Simple Manometer for Vacuum Distillation: N. L. Gebhard.

FRIDAY, FEBRUARY 21.

ROYAL INSTITUTION, at 9.—The Ether of Space: Sir Oliver Lodge, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Annual Meeting.—Tests of a Live Steam Feed-water Heater: Prof. J. Goodman and D. B. MacLachlan.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Currents as a Cause of Coast-erosion: G. O. Case.

MONDAY, FEBRUARY 24.

ROYAL SOCIETY OF ARTS, at 8.—The Theory and Practice of Clock Making: H. H. Cunynghame, C.B.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Travels in the Old Kingdom of Congo: Rev. Thomas Lewis.

INSTITUTE OF ACTUARIES, at 5.—A Review of the Investments of Offices in Recent Years, with Notes on Stock Exchange Fluctuations and the Future Rate of Interest: P. L. Newman.

TUESDAY, FEBRUARY 25.

ROYAL INSTITUTION, at 3.—Membranes: Their Structure, Uses and Products: Prof. W. Stirling.

ROYAL SOCIETY OF ARTS, at 4.30.—Irrigation in Egypt under British Direction: Sir Hanbury Brown, K.C.M.G.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Montenegrin Manners and Customs: Miss M. Edith Durham.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The New York Rapid-transit Subway: W. B. Parsons.

FARADAY SOCIETY, at 8.—Hydrolysis as Illustrated by Heats of Neutralisation: Dr. V. H. Veley, F.R.S.—A Study of the Sulphur Anion and of Complex Sulphur Anions: Dr. J. Knox.

WEDNESDAY, FEBRUARY 26.

ROYAL SOCIETY OF ARTS, at 8.—The Problem of Road Construction with a View to Present and Future Requirements: H. S. Hele-Shaw, F.R.S., and Douglas Mackenzie.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.—Address by Prof. H. H. Turner, F.R.S.

THURSDAY, FEBRUARY 27.

ROYAL SOCIETY, at 4.30.—*Probable Papers*:—The Influence of Temperature on Phagocytosis: J. C. G. Ledingham.—On the Maturation of the Ovum in the Guinea-pig: Prof. J. E. S. Moore and Miss F. Twort.

ROYAL INSTITUTION, at 3.—Wood: its Botanical and Technical Aspects: Prof. W. Somerville.

SOCIETY OF DYERS AND COLOURISTS, at 8. The Deterioration of Modern Dyed Leathers: M. C. Lamb.—A Note on the Germicidal Value of Petroleum Benzine: F. J. Farrell and F. Howles.

FRIDAY, FEBRUARY 28.

ROYAL INSTITUTION, at 9.—Explosive Combustion, with Special Reference to that of Hydrocarbons: Prof. W. A. Bone, F.R.S.

ROYAL SOCIETY OF ARTS, at 8.—The Removal of Dust and Fumes in Factories: Dr. J. S. Haldane, F.R.S.

PHYSICAL SOCIETY, at 5.—Contact Potential Differences Determined by Means of Null Solutions: S. W. J. Smith and H. Moss.—An Experimental Examination of Gibbs' Theory of Surface Tension as the Basis of Adsorption with an Application to the Theory of Dyeing: Mr. Lewis.

CONTENTS.