THURSDAY, OCTOBER 15, 1896.

THE BERTILLON SYSTEM OF IDENTIFICATION

Signaletic Instructions, including the Theory and Practice of Anthropometrical Identification. By Alphonse Bertillon. Translated from the latest French edition. Edited under the supervision of Major R. W. McClaughry. Pp. xx + 260, and plates. (Chicago: The Werner Company. London: Kegan Paul and Co., Ltd., 1896.)

THERE is much that is both interesting and instructive in Major R. W. McClaughry's translation of Bertillon's last book of 1893; for it contains an account, revised up to date, by M. Bertillon himself, of the system as at present in work in Paris. Its contents may conveniently be divided into three parts: *first*, the anthropometric definition of individuals, whereby what may be called a *natural name* is given to each person measured, based upon five principal measures (but there is some want of definiteness about this), which can be classified and looked for, just as a real name is classified and can be looked for in an alphabetical directory. There are, of course, many persons who have the same "natural" names, just as there are many Smiths; still, the knowledge that the name of a person is Smith, is a very important help to further differentiation. The *second* portion is of a hybrid character, partly subserving the same purpose as the first, to an extent and in a way that is not clearly described, and partly as affording particulars whereby it may be positively affirmed whether any, and, if any, which, of all the "Smiths" is the right man. This second portion includes photographs and the verbal descriptions briefly worded or symbolised, of a great variety of personal characteristics, as of forehead, nose, chin, hair, eyes, ear, eye brows and lids, mouth, wrinkles, &c., and finally of cicatrices and body-marks. It is not clearly stated how much of all this is generally entered on a prisoner's card; but the total entries on the specimen signaletic card (Plate 78) contains, as well as I can count them, 12 measures, 58 separate details in a sort of shorthand, and 193 facts concerning marks and scars, also in shorthand, so that the whole of this extraordinarily complex description, containing some separate 263 notations, packs into small space. The *third* portion somewhat trenches on the second, as the second did upon the first. It endeavours to show how a verbal portrait may be built up out of specified materials. Let us say, for brevity—forehead No. 3, nose No. 4, lips No. 1, and so on, and there you have the picture. It is, at all events, an amusing game to try how far, with a box of specimens, like a kindergarten box, a recognisable face might be built up. I would suggest that toy manufacturers should study this part of the book, and bring out a box in time for the forthcoming Christmas parties.

As said already, it is difficult to gather how far this enormous amount of labour is bestowed upon each prisoner; in any case, the success of the Paris *bureau* is certainly very great. It has the peculiar advantage of being worked under special conditions, all prisoners being taken to the same measuring-place, where numerous clerks, under careful inspection, working day by day, have acquired a remarkable degree of sureness and deftness in their work.

The modern French system of giving what is described above as "natural names," differs from the modern English in that it as yet attempts no *classification* by finger-prints. In the English plan a primary subdivision of the cards is made on the first of the above methods, using five measures, and these subdivisions are themselves to be subdivided by classifying the finger-prints. It is to be regretted that the volume under review takes but scant and imperfect notice of the now pretty widely-known method of finger-prints, which in my own, perhaps prejudiced, opinion is far more efficient for classification, and incomparably more so for final identification, than the whole of the second of the above portions, while the finger-prints are much more surely and quickly put upon paper than they are. They afford, moreover, the only means of surely identifying growing youths. It is true that the prints of the thumb and three fingers of the right-hand are at length introduced into M. Bertillon's cards, as shown in the specimen (Plate 79*a*), but there is a regrettable error in the date of the circular (p. 259) drawing attention to the innovation. The date is entered as 1884, and not as 1894, as it should have been (see note, p. 14), and conveys the idea that the use of finger-prints in Paris is much older than it really is, and previous, instead of subsequent, to its use in England.

The practical question arises as to how far the method of M. Bertillon is suitable for adoption in its entirety, or otherwise, in other countries than France. The publishers of this volume state, in a preface, that it is in use "to some extent" in about twenty prisons and seven police departments in the United States. Mr. Bertillon says: "The countries which at the present time have officially adopted the system of anthropological identification are the United States, Belgium, Switzerland, Prussia, most of the Republics of South America, Tunis, British India, Roumania," &c.

I fear the words "to some extent" must be emphatically applied to many of these, besides the United States. So far as I can hear, the only Presidency in British India that has officially taken up the system is Bengal, where it has "to some extent" been on trial for some years and with considerable success, under the condition of a more laborious system of inspection than can easily be maintained. I will quote what is doing there now from the latest circular of Mr. E. R. Henry, Inspector-General of Police, dated Calcutta, January 11, 1896.

"The weaknesses of the anthropometric system are well known. Notwithstanding the improvements introduced, the error due to the personal equation of the measurer cannot be wholly eliminated, and as hundreds of measurers have to be employed, it is inevitable that errors due to careless measuring and to incorrect reading and description of results should occasionally occur. A system based on finger impressions would be free from these inherent defects of the anthropometric system, and for its full and effective utilisation it would only be necessary to take the impressions with the amount of care needed to ensure that the prints are not blurred. It may be added that a considerable gain as regards time would result from the change of system, there being no difficulty in taking the impressions of the fingers of half-a-dozen persons in less than the time required to complete the measurements of one."

"At present a duplicate Criminal Record is being kept, *i.e.* a record based on anthropometric measurements *plus* thumb-marks, and also separately a record based solely on the impressions of the ten digits. A system of classifying the latter is being worked out, and if after being subjected to severe tests it is found to yield sufficient power of differentiation to enable search to be unerringly made, it seems probable that measurements will gradually be abandoned as data for fixing identity, dependence being placed exclusively upon finger impressions."

It seems, therefore, that the following phrase of M. Bertillon requires modification: "We may safely say, then, of this new edition, that it is final in its main outlines and in most of its details, and that any future edition, if such there should be, will differ from it very little." A perfect system is one that attains its end with the minimum of effort, and that certainly cannot be affirmed of the French system. In my own opinion, the present English system (which includes full-face and profile photographs) much more nearly fulfils that definition.

FRANCIS GALTON.

SCIENCE AND THEOLOGY.

A History of the Warfare of Science with Theology in Christendom. By Andrew Dickson White, LL.D., &c., late President and Professor of History at Cornell University. 2 vols. Pp. xxiv + 416, xiv + 474. (London: Macmillan and Co., 1896.)

TWENTY years ago Dr. White published a little volume, entitled the "Warfare of Science," to which the late Prof. Tyndall contributed a brief preface. Out of that volume has grown the present book, which, though very much more learned, has lost something of the freshness that characterised its predecessor. We should like to have said that the one had made the other needless, but, as ecclesiastical dignitaries still accept men like Dr. Kinns for authorities in science and champions of orthodoxy, we fear that Giant Pope—using the title in a wider sense than Bunyan did—is hardly dead yet. This book is melancholy reading, for it tells, again and again, of the miserable mistakes that have been made by good men with the very best intentions. Here and there, perhaps, Dr. White a little magnifies these mistakes and overlooks extenuating circumstances; is, perhaps, a little too ready to accept witnesses on his own side, as when he assumes it proved that man existed on the Pacific slope of America in the Pliocene age. The acute theologian also might sometimes have his chances of breaking the windows in the house of the man of science, for the latter occasionally talks wildly when he trespasses on the other's province. But we must sorrowfully admit, that Churchmen and Nonconformists alike—the most extreme Protestants as well as the most ardent Romanists—have distinguished themselves too often by their unwise and ignorant opposition to scientific facts and scientific progress. The former adversaries have not been less illiberal than the latter; indeed, of late years they have perhaps been more so. They have not persecuted so actively, simply because they have not so often had the power; as to the will, the less said the better.

Dr. White discusses the various branches of his subject in separate chapters. The first, entitled "From Creation to Evolution," is not the least interesting, though we think that in these words he needlessly gives a point to an assailant; for to a theist evolution might appear only a mode of creation. But special creation is obviously meant, so that we may pass on. This chapter gives a very interesting summary of opinion, ancient and modern, ending with the story of the storm raised by the publication of Darwin's "Origin of Species." Here, as in several other places, Dr. White's book is of great though indirect value, because of its plain speaking. The spirit of saint worship lingers in most religious bodies. It is deemed almost profane to admit that good and well-meaning men could make great mistakes, and thus produce serious mischief; could use absurd arguments, utter intemperate language, and do unjust actions. But Dr. White is no believer in this policy. Bishop Wilberforce of Oxford, even Pusey and Liddon, with firebrands like Dean Burgon and Archdeacon Denison, are dealt with in a spirit of refreshing candour; and even Mr. Gladstone occasionally comes in for not unkindly criticism, though his courtesy to theological antagonists receives its due meed of praise.

Then the author passes on to geography, with the absurd figments of Cosmas Indicopleustes and that deadly heresy of the existence of the antipodes; to astronomy, with the denunciation of the heliocentric theory of the planetary system, and the story of Galileo. Next we come to the battles over geology, the antiquity of man, anthropology, and the discoveries in Egyptian and Chaldæan history. Magic and demonology, with the development of chemistry and physics, follow next, together with the spread of scientific views on medicine and hygiene. Here theologians are charged with having opposed inoculation, vaccination, and the use of anæsthetics. As regards the second, they might now retort that its present opponents, as a body, are not specially distinguished either for orthodoxy or for religious zeal. Next come chapters on lunacy and demoniacal possession, a subject more difficult than appears on the surface, and concerning which, we may be sure, the last word has not yet been said. After chapters on the origin of language and the Dead Sea legends, the book concludes with a sketch of the development of modern ideas as to the function of inspiration and the duty of criticism.

Dr. White's book is a very exhaustive survey of this unreasonable conflict, which we may hope is coming to an end, and will be valuable as a work of reference. It should be carefully studied by all tutors in theological colleges, who would do well to give the substance of it in lectures to students preparing for the ministry, lest perchance they make the same mistakes as did their forefathers.

T. G. B.

OUR BOOK SHELF.

A Manual of Botany. By J. Reynolds Green, Sc.D., F.R.S., F.Z.S., Professor of Botany to the Pharmaceutical Society of Great Britain. Vol. ii. Classification and Physiology. (London: J. and A. Churchill, 1896.)

THE second volume of Prof. Green's "Manual of Botany" concludes a work, the usefulness of which will be recognised by students and teachers alike. The present part is devoted to the treatment of taxonomy and physiology, and opens with an account of the general principles of classification, and of the leading systems which have severally left their mark on the progress of the science.

It is not possible, within the narrow limits of a small text-book, to present an adequate picture of the tribes and orders of the Cryptogams, and this is especially true for the Algæ and Fungi. Hence the treatment accorded to the last-mentioned groups is of necessity somewhat sketchy. But, nevertheless, the author has managed to include a considerable amount of the most important information respecting them, illustrated in many cases by copies of Kny's admirable *Wandttafeln*. We notice, however, that the familiar drawing, after Sachs, of the structure of the mushroom is reproduced, in which the basidia are represented as bearing only two spores, although in the text the normal number is correctly given as four. It seems high time that this figure disappeared from our text-books; its chief function at present is to show how difficult a matter it is to get rid of a fiction which has once managed to pass itself off as a genuine fact. Whilst we are on the subject of illustrations, we cannot forbear to remark on the surprising group of Moss-antheridia represented in Fig. 860. No doubt in future editions the author will replace this by a more adequate drawing. Both the Vascular Cryptogams and the Angiosperms are, on the whole, admirably treated, but the Gymnosperms hardly receive the recognition due to their important position; we venture to think that the artificial key on p. 180 might well have been omitted.

In dealing with the Phanerogams the classification of Bentham and Hooker is adhered to, and much valuable information is given as to the uses and geographical distribution of the plants comprised in the various Orders.

But it is the physiological part of the book which impresses us most favourably. The student will find the most important facts and principles of this branch of the science most clearly and suggestively put before him. Nutrition is especially well handled; and it is not necessary to add that the chapters on reserve materials and ferments form a most valuable epitome of our knowledge respecting them, since the author is well known as a distinguished investigator in connection with these matters.

The book is, altogether, one of the best of our English intermediate text-books, and it is certainly one which no student ought to neglect.

Wool Dyeing. Part i. By Walter M. Gardner, F.C.S. Pp. 108. (Manchester: John Heywood.)

THIS little book is a reprint of a series of articles contributed to the *Textile Recorder*. In spite of the title, the subject of dyeing is not dealt with, being reserved for parts ii. and iii., and only the operations previous to dyeing are treated of in the present volume. The divisions of this subject are: (1) The Wool Fibre; (2) Wool Scouring; (3) Wool Bleaching; (4) Water for Technical Purposes. The treatment, although not exhaustive, is fairly thorough and quite up-to-date, and no important feature of these subjects, either chemical or mechanical, is left untouched. The book can hardly be described as attractive reading for an outsider; but it will doubtless prove useful to teachers and students in technical classes, and should be helpful also to those engaged in the dyeing industry—happily a growing number—who wish to understand the principles underlying the operations they conduct, and who may be led by it to the study of some more exhaustive work.

It is to be regretted that in appearance the book is hardly worthy of its subject-matter; the paper employed has a very uninviting aspect, and the few illustrations are of little value. This being the case, we must demur at the author's claim to cheapness. One more complaint: to those whose chemical knowledge is but slight, one or two misprints may cause perplexity, and we can imagine a student inquiring in bewilderment why the hardness of water should be expressed in terms of the $CaCO_1$ (*sic*) contained therein.

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.*]

Osmotic Pressure.

IN the October number of the *Philosophical Magazine* will be found an interesting paper, by Prof. Poynting, which explains the phenomena of the osmotic pressure of solutions by the hypothesis of chemical combination between the solvent and the dissolved matter. I wish to direct the attention of your readers to one point in the paper, and to a development of it which seems to me to be worthy of notice. Any successful theory of solution must explain the fact that the osmotic pressure obeys the usual laws of gaseous pressure—those of Boyle and Avogadro—and, moreover, has the same absolute value as that of the pressure which the dissolved molecules would exert in the gaseous state, when filling a volume equal to that of the solution. It has always been clear that, whatever be the ultimate cause of the osmotic pressure, the gaseous laws must be obeyed by dilute solutions. The molecules of any finely-divided matter must be, in general, out of each other's sphere of influence, so that each will produce its effect independently of the rest. But this is all that is necessary for Boyle's law and Avogadro's law to hold, so that these, as well as the mere existence of osmotic pressure, are explained by chemical combination just as well as by molecular bombardment. On the other hand, no good reason has been hitherto given why chemical forces should be so adjusted that the osmotic pressure of the dissolved molecules should have the same absolute value as that of the pressure which the same number of gaseous molecules would exert when filling an equal volume.

Prof. Poynting supposes that each molecule of dissolved matter combines with the solvent to form unstable compounds, which continually exchange constituents. The molecules of solvent thus combined will be less energetic than the molecules of pure solvent, and thus may be unable to evaporate. Nevertheless, since they are always being liberated and re-combined, they will still be effective in retaining molecules of vapour condensing on the surface. The vapour pressure will, therefore, be reduced, and it follows that, if we make the additional assumption that one molecule of the dissolved substance unites with one molecule of the solvent, the fractional diminution of vapour pressure will be the same as that calculated from the osmotic pressure given by Van 't Hoff's law. We can, of course, working backward from this result, show that the osmotic pressure will have the gaseous value. If one dissolved molecule combines with two or three solvent molecules, the osmotic pressure would have double or treble its normal value. Although he does not explicitly say so, I fancy that Prof. Poynting means to suggest this as a cause of the abnormally great osmotic pressures shown by solutions of metallic salts and other electrolytes, and thus to do away with what he calls "the difficulties of the dissociation hypothesis."

Now the evidence in favour of the view that the opposite ions of an electrolyte are dissociated from *each other* is enormously strong, though there is no reason to suppose that the ions are not united to the solvent. Some of the chief points in favour of their freedom may shortly be summarised as follows: (1) The fact that the electrical conductivity of a dilute solution is proportional to its concentration; whereas, if the ions moved forward by taking advantage of collisions between the dissolved molecules and consequent rearrangements, it would vary as some power of the concentration higher than the first. (2) The confirmation of the values given by Kohlrausch as the specific velocities of the ions, the velocity of each ion being, in dilute solution, independent of the nature of the other ion present. (3) The successful calculation by Nernst and Planck of the coefficients of diffusion of electrolytes, and of the contact differences of potential between their solutions on the hypothesis that the ions migrate independently of each other.

Thus we cannot lightly give up the idea that the ions are free from each other, and it seems to me that a very simple extension of Prof. Poynting's theory will enable us to retain that view.

We have only to suppose that, in the case of electrolytes, the dissolved molecules are resolved into their ions, and that each ion so produced unites with one solvent molecule, or, at all events, destroys the mobility of one solvent molecule. A simple compound like NaCl, which is decomposed into two ions $\overset{+}{Na}$ and $\overset{-}{Cl}$, will thus produce double the normal effect on the osmotic pressure and its consequences the diminution of vapour pressure and the lowering of the freezing point. In the same way, a molecule like H_2SO_4, which gives three ions, will produce three times the effect which would be obtained if it were undissociated.

Thus Prof. Poynting's conditions would be satisfied, and at the same time the advantages of the dissociation theory would be retained. W. C. D. Whetham.

Trinity College, Cambridge, October 12.

Responsibility in Science.

As one who supposes himself a physicist, I wish to protest against some of Prof. Poulton's remarks in his recent British Association address, as given in Nature, September 24.

From the statements on p. 502, one would suppose that physicists as a body had long been tyrannising over geologists and zoologists, and that this reign of terror had remained unbroken until recently, save for some slight diversions afforded by mathematicians.

When it comes to details, the physicists seem to resolve themselves into two individuals, Lord Kelvin and Prof. Tait, and perhaps a third, von Helmholtz; all of whom, by the way, have an equally good claim to the title mathematician. Prof. Poulton apparently regards all physicists as committed to every theory propounded by every individual physicist. This would certainly be unlimited liability with a vengeance.

Personally I do not hold myself committed to the truth of any theory, past, present, or future, until such time as I have explicitly signified my assent to it. If one were explicitly to signify one's dissent from every physical theory, or every statement of physical facts, which one is not prepared to accept, there might be little time left to do anything else. Perhaps I can bring this home most clearly to Prof. Poulton by expressing my views as to one or two of his own statements.

On page 502 he says, "the earth, even when solid, will alter its form when exposed *for a long time* to the action of *great* forces" (italics mine). Here, and in the rest of the passage, is a strong flavour of the erroneous view that a solid is *rigid* in the mathematical sense, except when viscous under great and prolonged stress. It is surely time that scientific men in all departments grasped the conception of elastic strain and displacement.

On the same page are other imperfections in the statement of the arguments against deducing the time of consolidation of the earth from its present form. Prof. Poulton apparently considers it proved that the earth's angular velocity of rotation is diminishing, and that the only agent to be considered is the action of the tides. If, however, the earth's temperature is diminishing, and the material contracts in cooling—conclusions most generally accepted—the consequent diminution in the moment of inertia tends to *shorten* the period of rotation. Such shortening was in fact made the basis of his speculations by the eminent French mathematician Prof. E. Roche (Académie . . . de Montpellier, *Mémoires de la Section des Sciences*, vol. x., 1880–84, p. 232).

On page 503, we are told "there is some evidence which indicates that the interior of the earth in all probability conducts better than the surface. Its far higher density is consistent with the belief that it is rich in metals, free or combined. Prof. Schuster concludes that the internal electric conductivity must be considerably greater than the external."

When one considers the enormous pressures which existing theories point to in the earth's interior, and remembers how conspicuously less the accepted mean density is than that of the lightest of the heavy metals under atmospheric pressure, one can only recognise the inconclusiveness of the evidence from this source.

The reference to Prof. Schuster's conclusion is ambiguous. Does Prof. Poulton believe electrical and thermal conductivity necessarily to vary together? If so, then the fact that electrical conductivity diminishes in metals and ordinary alloys as the temperature rises, is one he ought to consider. In any case he might be well advised to allow for the possibility that Lord Kelvin's speculations do not possess a monopoly of physical uncertainties.

The direct experiments by Lord Kelvin (Nature, June 1895, p. 182) on the influence of temperature on thermal conductivity are very probably, in Prof. Poulton's opinion, not sufficiently varied, as regards either material or range of temperature, to form a substantial basis for wide conclusions. Still I should have expected him to refer to them, if only to mark his recognition of an attempt on Lord Kelvin's part to meet his critics with something better than surmises.

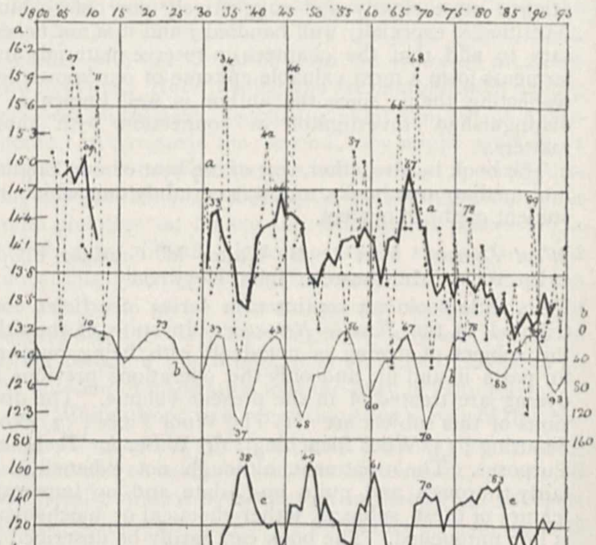
Our uncertainty as to the true value of the mean temperature gradient near the earth's surface might fairly, I think, have been adduced by Prof. Poulton. Observations have, in fact, been limited to comparatively small areas of the surface, and the results obtained have varied much. There are also sources of error whose elimination is difficult. Irregularities in the surface, the presence of the recording apparatus, and the disturbance caused by previous excavations, tend to alter the temperature it is intended to measure; while the conditions may prejudice the correct working of the apparatus. An instructive example of this last defect came under my notice recently. Very fairly accordant readings with two maximum thermometers in a deep boring full of water indicated an excess of some 30° F. in the bottom over the surface temperature. Direct experiment in a hydraulic press proved, however, that fully half the rise was fictitious, being simply due to the contraction of the bulbs under the pressure to which they were exposed. C. Chree.

September 28.

The Climate of Bremen in Relation to Sun-spots.

May I invite attention to the variation of mean temperature of the summer half (April to September) at Bremen, which seems to me to suggest sun-spot influence? The observations used are those given by Dr. Bergholz in his "Ergebnisse." They extend (with a break from 1814 to 1823) from the beginning of the century.

The dotted curve in the diagram (*a*) shows this variation. After smoothing with averages of 5, we have the continuous



a. Dotted curve, mean temperature April to September, Bremen. Continuous curve, smoothed with averages of 5. *b*. Sun-spot curve (inverted). *c*. Smoothed curve of rainfall, August and September, Bremen.

curve traversing the other. Below, (*b*), is the sun-spot curve, *inverted*, and a general agreement will be made out with the aid of the figures given; the wave-crests of the smoothed curve corresponding, more or less, with the minima of sun-spots. This result is in harmony with those of Köppen and others.

We may note the salient years (half-years) 1811, 1834, 1842 (1846), 1857, 1868, 1878, 1889; all near minima.

Representing the half-years as + or −, according as they are above or below the average, and selecting the sun-spot maximum and minimum years, I find five out of seven of those seasons in the former case (maximum) to be *below* average, and four out of six in the latter case (minimum) *above* average; also including (say) two of the following years in each case, a tendency to excess of − values in one case, and of + values in the other. If the amounts of excess and deficit be further considered, the average deficit in the one case, and excess in the other, is distinctly the greater.

(Two averages have here been used, dividing at 1870.)

We have considered six months of the year. But the same tendency may be discerned in individual months, and other combinations of months. June and August show it very well; also (less distinctly) the whole summer group (June to August).

If any one will take the trouble to compare smoothed curves of June temperature at a number of European stations, he will find, I believe, that most of these agree in the feature considered, and that one supplements another. Thus the correspondence with the sun-spot curve may fail somewhat at a particular point in the case of one station; but another curve agrees better at that point, and so on.

A comparison of six months' curves for other stations seems desirable. The Greenwich curve, I think, shows the influence, but less fully.

In such selections and comparisons of portions of the year and different stations, an analogy might be traced to what occurs in looking at something through a microscope. We screw the tube out and in, and at one point get a generally clear image; with another position, part of the image is blurred and part rendered more distinct; with still another, there is a general blurring, and so on.

The rainfall of Bremen, especially in the summer half, also presents interesting features in this connection (see *Met. Zeits.* for 1895, p. 120).

Several of the monthly curves show a tendency to high values near maximum sun-spots. I have here combined the rainfall of August and September in a smoothed curve (*c*). The maxima and minima, it will be seen, correspond pretty closely with those of the sun-spots.

Has not a too mechanical conception regarding sun-spots and weather prevailed in the minds of some? In view of the great instability and variability of weather, is it not rational to suppose that the thing to be looked for may be merely of the nature of an average effect, a tendency, a preponderance? The position, further, that if sun-spots affect weather, they must affect it everywhere in the same way, I believe to be untenable.

A. B. M.

An Antidote to Snake-Bites: "Scorpion-Oil."

I CAME across the following popular remedy last June, when at Kandersteg. Since my return to England I have written to the guide, Abraham Müller, and here give the substance of his answer to my request for more exact details.

Every year Italian scorpion-sellers traverse Switzerland, especially the mountain-valleys thereof; in the lower land and towns the remedy can be obtained at the chemists', and these buy their scorpions direct from Italy. It is usual to take, say, a half-litre of good olive oil (at the time he told me it was walnut oil; perhaps this is commoner and cheaper?), and throw therein about ten living scorpions. The scorpions are left in the oil until they die—say twelve or twenty-four hours. They are then taken out and thrown away, or the oil is poured from off them into a bottle.

In the case of poisonous snake-bites, or poisonous "*Insektenstichen*," the wound is first, if possible, washed out with salt water. The scorpion-oil is then rubbed in, and all round over the swollen part, the rubbing being towards the wound.

In the case of other "*giechtigen*[1] *Schnitten, Stichen, Guetschungen, gichtigen Geschwülste und dergleichen*," the oil is applied in like manner, only it is not poured into the wound, as it is too "*scharpf*."

The custom is centuries old, and (my informant believes) very widely spread in Switzerland. He could find out more details, if required, from a chemist.

In general the application is external only; but there are men who, when suffering from great internal pain of which they do not know the cause, drink some drops of the oil in camomile tea. (Result not stated!)

The scorpion-oil is used for men and animals alike.

[1] I think that *giechtigen* must be an error for *giftigen*; it cannot well be *gichtigen* when used with *Schnitten*. My knowledge of German does not enable me to translate *Guetschungen* or *Gnetschnungen*. I have given these few words in the German to avoid confusion.

It seems to me that, since the oil rubbed into the wound caused by a snake or an insect doubtless contains some scorpion poison, the above is of interest in connection with the recent experiments in inoculation. (NATURE, vol. liii. pp. 569, 592.)

R.N.E. College, Devonport. W. LARDEN.

Chameleonic Notes.

MR. BARTLETT writes me that they have no chameleon now in the Gardens, so that probably my little stranger is the only one in this country; and to the note on its habits, which you printed in your number of July 16, may I add the following: Little is known of these most interesting creatures, and the book knowledge is singularly discrepant. After being kept for nearly eight months under a large bell glass in my library, and fed with garden flies of all sorts, he began changing his skin. This, first, appeared to hang rather loosely in *milk-white folds* on his body, then he got rid of it bit by bit, squirming himself against the stick on which he was perched, and continually changing his attitude. He also used his feet *occasionally*, to help to rip off the old skin; and being very restless, this was all got rid of in one day. His general colour also changed from very light brown to very dark brown, then to light brown, and again to very dark brown, while the skin-shedding took place. He never seemed to care for any water all the time I had him. On being approached in a dark room at night, he appeared most conspicuously *white*, doubtless for protective purposes. I believe wild-fowl shooters are also in the habit of painting their boats and paraphernalia white in order to be less conspicuous. Turning the bright light of a lantern (with a powerful reflector) upon him, he immediately began *visibly* to darken, until in an extremely short space of time he had assumed the same colour as the brown twig on which he was sitting. These colour changes have, I think, never been satisfactorily explained; and their *rapidity* is not the least extraordinary phenomenon in these most curious creatures.

E. L. J. RIDSDALE.

Visual Aid in the Oral Teaching of Deaf-Mutes.

I MUST confess to being one of those unacquainted with Kœnig's invention, but the object of the interesting experiment described by Mr. Hawksley in NATURE of October 1 is sufficiently evident from the results.

Since the experiments of MM. Marey and Rosapelly, and more recently the phonograph, rendered it possible to reproduce in a graphic form the sounds of the human voice, the question of the practical application of such visual reproductions in the oral education of the deaf has frequently been mooted, but so far without any useful result.

As is well known, the speech of orally educated deaf-mutes is not usually so natural, and hence not so readily understood, as that of those who hear. This is chiefly due to the absence of the controlling action of the hearing; but if this could be supplied by visual means, much might be accomplished.

If, therefore, some physicist would devise a simple and efficient apparatus by which an orally taught deaf-mute could test his speech to ascertain how far it corresponded in inflection, &c., with that of his teacher or other hearing person, and to regulate it accordingly, a great practical boon would be conferred on the deaf and their teachers.

Doubtless, as Mr. Hawksley says, the principle of Kœnig's invention might be made useful to oral teachers, but a simpler application of it than is exhibited in his experiment would be desirable, and indeed necessary, before it could become generally available.

A. FARRAR, JUN.

October 2.

A Remarkable Lightning Flash.

THE "remarkable lightning flash" depicted by Mr. George G. Burch in NATURE for September 24, is to me interesting. Many years ago I witnessed what was probably a flash of the same kind, a phenomenon I considered at the time very extraordinary. In the early evening of a fine summer day, while sitting leisurely on a hedge on a comparatively high hill near to Llandyssul in the county of Cardigan, with an immense area of country within reach of my vision, there appeared, slightly above the horizon in the west, what seemed to be a perfectly endless flash, almost circular in shape, and exceedingly serrated.

There was not a single stray end to be seen, as in Mr. Burch's flash. I heard no thunder, and I knew from the faintness of the spark that it was at a great distance from me. This flash lasted for a longer time than any one I have seen since. I happened to be gazing at the actual spot when the flash occurred, and I saw it well.

The only explanation I can offer is this: that the spectator is looking along the axis of a spiral-shaped flash; the flash occurring from cloud to cloud. BENJAMIN DAVIES.

Liverpool, October 3.

Distribution of Galeodes.

It seems hardly worth while my interfering in this matter, but as Mr. Pocock, in his note on the distribution of Galeodes, in NATURE of August 20, omits Sind, I hasten to record it from that province, where I have often dug it out of Indus alluvium. I used to think that Galeodes was a desert animal, and was surprised to hear from friends that it is common along the Malabar coast south of Bombay and further inland, where the rainfall is heavy. F. GLEADOW.

Dehra Dún, September 14.

THE RECENT EARTHQUAKES IN ICELAND

On August 26, at 10.30 p.m. and next day, at 9.15 a.m., severe earthquake shocks were felt throughout the south-western part of Iceland. The seismic focus seems to have been situated in the neighbourhood of the volcanic ridge out of which Hekla rises, and the waves moved in a direction which they had formerly been observed to take, namely from north-east to south-west. According to reports to hand, these shocks were felt as far north-west as Ísafjord and as far north as the head of Skagafjord. Thus it appears they overran an area of more than 20,000 square miles, or half the island, for they also caused damage in the Westman Islands, which lie further south than the most southern point of Iceland. Even at sea the shock was felt. A sailing ship was so badly shaken, thirty-five miles from land, that the crew feared it had struck a rock, and began to lower the boats.

From this it is clear that these earthquakes spread their waves over an area unprecedented in extent in the history of the island.

After some minor and slighter shocks, the next severe ones occurred on September 5, at 11.30 p.m., and two and a half hours later, in the night, at 2 o'clock. These shocks were fully as violent as the first ones, but they were more local, and the seismic centre from which they proceeded seemed to be further to the south-west than in August. The shocks were preceded by heavy rumbling noises underground. Land-slides came down from the mountain-sides, destroying the green home pastures. Immense rocks were hurled down from their peaks, and the echoes of these convulsions of nature reverberated among the mountains. The turf and stone walls of the Icelandic farmhouses crumbled like card houses, but the people, being warned by the 11.30 shock, saved their lives through doors and windows. While many were bruised and wounded, and some were dug out of the ruins, only two are reported to have been killed. In the August shocks one man was killed in the Westman Islands, being crushed by a rock that tumbled down over a precipice.

While it is calculated that two to three hundred homesteads, each representing five to six houses, have been wholly or partially destroyed, it is singular to note that no timber house has fallen down, though some of them were actually moved out of their position. The inhabitants have since September 5 camped out, as best they could, in improvised tents and huts.

The violent vibrations in the crust of the earth have torn it open in places. Deep chasms yawn where the ground has been burst open, and a number of fissures have been formed. The largest of these is situated close by the Oelvus River, on its western bank. It is about six miles in length, but neither very broad nor deep, and half-filled with water.

Still more noteworthy than these longitudinal cracks in the ground are the new geysers, which have forced their way into the open. Some of the old hot springs have disappeared, and been displaced along with the stratum through which they issued. Of the new geysers, information has been gathered about three at the farm Hveragerthi, west of the Oelvus River, and one at Reykir. The largest of those at Hveragerthi has a basin measuring fifty-four feet by twenty-four feet. Its depth has not been ascertained. The column of boiling water rose at first thirty to forty feet into the air; but, according to the latest reports, its height is decreasing. The people of the two farms say that the crash, when the column of water first broke the earth crust open, was terrific and deafening.

Many other changes took place in the surface of the ground. High ground subsided, and became wet instead of dry. Low, miry ground became hard. In brooks and lakelets the water grew yellow and turbid. In fact, the whole appearance of the districts affected by these earthquakes has undergone a noticeable transformation.

The intensity of the vibrations caused by the shocks was greatest in the neighbourhood of the Oelvus River. Persons standing on level ground could not keep their feet. A farmer was literally thrown out of his bed on to the floor. The duration of each shock was from thirty to fifty seconds; in some cases less, but none of them seem to have lasted a whole minute, though the time appeared to be much longer than that to the frightened farm people waiting in anxious suspense for the fate of their houses.

No earthquakes comparable to these have occurred in Iceland, save in 1784. The severest shocks then took place on August 14 and 16, but were confined to a much more restricted area than the present ones, an area reaching farther north-east and less south-west than in 1896. These earthquakes lasted from the middle of August till December of the same year, and caused great damage to farmhouses, sixty-nine of which were totally broken down, while 372 were made almost uninhabitable. These earthquakes must, it is thought, have stood in some connection with the volcanic eruptions close to the glacier-covered volcano Skaptarjökul, which lasted on, with short breaks, from June 1783 to January 1784. The Icelanders draw the inference that earthquakes must be preceded, accompanied, or followed by eruptions. One glance at Thoroddsen's history of eruptions and earthquakes suffices, however, to disprove this popular fallacy. It is feared that the earthquakes will continue for months, unless the subterraneous fire breaks out and puts an end to them. One hears the natives earnestly wishing for an eruption ("eldgos," *i.e.* fire-spouting). Meanwhile they have saved all their cattle, with few exceptions, and wish to rebuild their farms.

The last news from Iceland is of date September 19. Slight shocks were felt from time to time. The severest of these was one on September 10, at 11.20 a.m. New fissures appeared in the ground, while some of those already formed were widened. Strange subterraneous noises resembling thunder have been heard, sometimes unaccompanied by shocks. To all appearances the earthquakes are not over yet, though it is to be hoped, for the sake of the suffering people in the districts of Rangarvalla and Árnes-sýsla, that the worst is past.

Some money has been subscribed, and the Government will contribute to the funds thus raised. The Czar has given £160, the Dowager Empress of Russia £100, and the King of Denmark and his family the same amount. The sympathy of Europe has been aroused for the brave people struggling for their existence amid frost and fire on the verge of the habitable world.

It has been stated that there are over 700 extinct craters in the peninsula of Reykjanes alone. The capital is situated on its northern side, and thus only fifty to sixty miles from the devastated districts. Some of the inhabitants of the town camped out, but none of its houses, which are mostly of timber, collapsed. The pictures hanging in the Parliament House were all thrown out of position, and rifts were visible in the plastered ceiling.

The eruption of February 27, 1878, is the last one recorded in the vicinity of Hekla. The craters, through which it took place, are situated about four miles to the north-east of Hekla, in one of its outlying spurs. This eruption was preceded by severe earthquakes in the adjacent districts. These, however, caused very little damage.

Mr. Th. Thoroddsen has given the only account and full list we possess of volcanic eruptions and earthquakes in Iceland within historic times. A *résumé* of it is found in the *Geological Magazine*, 1880, pp. 458-467. A much fuller translation, with a bibliography on the subject, is given by Mr. George H. Boehmer in the Smithsonian Report for 1885, pp. 495-541 (Washington, 1886). It appears that no earthquakes in the history of the island were experienced over such an extensive area as the present ones.

The earliest recorded earthquake in Iceland took place in A.D. 1013. Of fifty-five recorded earthquakes, more than one half were not preceded, accompanied, or followed by eruptions. The earthquakes of 1789 were most severe. The section of land between the chasm of Almannagjà and that of Hrafnagjà settled 60 centimetres, and new hot springs were formed. But the area was restricted to the district of Árnessýsla, and no volcanic eruption took place from 1783 to 1821. Thus it is probable that, though the present earthquakes may not discontinue for some months yet, they will not be followed by an eruption. The largest number of eruptions—fourteen—have taken place in the eighteenth century, and it will be observed that both earthquakes and eruptions are, in each period, concentrated in certain districts of the country, and that, in succeeding each other in time, they rarely make large jumps. It is only the want of seismographic stations which prevents Iceland from being an object-lesson in seismology such as Japan. Iceland, however, cannot any longer with justice be counted among the unexplored regions of the earth. Mr. Thoroddsen has, during the last sixteen years, systematically explored a part of the island every year, and now that he has reached the end of his labours, it is to be hoped that the scientific world will not have to wait long for the publication of the results of his explorations. They promise to be of the highest interest, and will modify in many respects geological views regarding Iceland. The geological map of Iceland, published by Dr. Konrad Keilhack in 1886, is not to be depended upon, for its German authors have put down as actual facts many things which then were only assumed and surmised. J. STEFANSSON.

THE GERMAN ASSOCIATION.

IN the presence of the Empress Frederick, and under the presidency of Geheimrath Prof. Dr. Hugo von Ziemssen, of Munich, the sixty-eighth meeting of the "deutscher Naturforscher und Aerzte," founded at Leipsic on September 18, 1822, was opened in the Saalbau, Frankfort-on-the-Main, on the morning of Monday the 21st ultimo. After the preliminary speeches by Prof. Moritz Schmidt and other citizens, the President briefly addressed the gathering; but the principal speakers were Prof. Hans Buchner, who devoted his address to "Biologie und Gesundheitslehre"; Dr. Neumayer, to Antarctic Exploration; and Prof. Lepsius, to "Cultur und Eiszeit." The gathering was then broken up into thirty sections, eleven of which were for the Naturalists, and nineteen for the various Medical and Surgical branches. The sectional meetings were held morning and afternoon (9 a.m. to 6 p.m.) till midday on Friday, and were well attended, there being, so far as could be estimated (the officials being unable to supply the precise figures), about 2500 gentlemen and 500 lady members. As there were some hundreds of papers under discussion during these days, and the titles of them alone would occupy several pages of NATURE, it will be sufficient here to mention only a few dealt with in some of the sections. Prof. Quincke opened the Physics Section with a paper "Ueber Rotationen im constanten elektrischen Felde," followed by Dr. Tuma, "Ersatz für den Ruhmkorff'schen Apparat." "Ueber Berührungselektricität," by Prof. Nernst; "Ueber den Vorgang bei langsamer Oxydation," by Prof. J. H. van 't Hoff; "Grundlagen seines neuen Systems der Elemente," by Dr. Traube; "Ueber die physikalische Isomerie," by Dr. Carl Schaum; "Demonstration einer Tafel des Systems der chemischen Elemente," by Dr. Wiechert; "Zur Elektrochemie des Kohlenstoffs," by Dr. Coehn; and "Ueber Kathodenstrahlen," by Prof. Lenard, were some of the communications discussed by the Physicists alone or with the Chemists. The Sections for Zoology, Pathology and Pathological Anatomy, and Physiology, joined in a discussion of the paper by Dr. Born, "Ueber künstlich hergestellte Doppelwesen bei Amphibien." The Section devoted to Ethnology, Anthropology, and Geography, had very little work to do, a day sufficing to get through it. Dr. Canheim had a paper on the Faroe Islands, and Dr. Rein on the North Coast of the Island of Hondo (Japan), and the Land and Sea Fauna of Kamaishi. With nineteen sections out of the thirty, the medical men were able to discuss a greater variety of topics than the physicists. Very interesting papers were read by Dr. Däubler on "Die Beri-Berikrankheit," and by Dr. Glogner, of Batavia, on "Neure Untersuchungen über den klinischen Verlauf und die Aetiologie der Beri-Berikrankheit," and by Dr. Plehn, from the Cameroons, on "Erkrankungen der schwarzen Rasse in Kamerun vom October 1, 1894, bis April, 1896." But the doctors' field-day was Wednesday, when the Medical Sections, and a considerable number of members from the Physical Sections, assembled in the Saalbau, under the presidency of Prof. His, to discuss the latest discoveries in brain investigations. Prof. Flechsig's subject was "Die Localisation der geistigen Vorgänge"; Prof. Edinger's "Die Entwicklung der Gehirnbahnen in der Thierreihe"; and Prof. Ewald's "Ueber die Beziehungen zwischen der motorischen Hirnrinde und dem Ohrlabyrinth." The closing general meeting was held in the same room on Friday morning, when Dr. Max Verworn discoursed on "Erregung und Lähmung"; Dr. Ernst Below, on "Die praktischen Ziele der Tropenhygiene"; and Prof. Carl Weigert, on "Neue Fragestellungen in der pathologischen Anatomie."

Not the least important features of the Congress were the facilities afforded for inspecting the technical high schools, and the chemical and other establishments in the neighbourhood. Praise is due to the several local committees for the excellent manner in which they carried out their duties, the entertainments having been arranged on a most liberal scale, every night being devoted to recreation. At the close of the Sectional meetings on Friday, Profs. von Ziemssen, König, and the principal members of the Society proceeded to Friedrichshof, by command of the Empress Frederick, while the general body broke up into some half-dozen parties, who were conveyed to as many places in the country—to Darmstadt, to inspect the Technical Institute; to Hochst, to see the Serum establishment, &c. About 500 members accepted the invitation of the town of Homburg to proceed there on Saturday to breakfast, drive to the ruins of the Roman fortifications of Saalburg to lunch, and to illuminations and fireworks in the Curhaus Gardens in the evening. A large party also went to Marburg on the same day. There was an abundance of literature specially prepared for visitors, and in addition to separate guides to Frankfort for the use of gentlemen and for ladies, Dr. Ziegler and Prof. König had published a large post quarto volume on "Das Klima von Frankfurt am Main" in which they discussed all available meteorological information, the letterpress occupying eighty-four pages, the tables fifty-one pages, and ten double-page diagrams. The records of ice on the river are complete from the year 1825, but prior to that date they are irregular, extending, however, as far back as January 1306.

Several rooms had been set apart for the exhibition of entomological collections; of Jenner relics (the centenary of inoculation for the small-pox); of Röntgen-ray photographs—of the manner in which the photographs are produced; and many other subjects of a scientific or medical character.

A large number of foreigners came to Frankfort to attend the meetings, those from England being Sir William MacCormac, Prof. Armstrong, Mr. Harries, and Drs. Semon and Thin.

NOTES.

THE Gatty Marine Laboratory, which is a continuation of the oldest Marine Laboratory in Britain, will be opened by Lord Reay on Friday, October 30. Invitations to the opening ceremony have just been sent out by the University of St. Andrews.

CABLEGRAMS from Australia report the death, at Melbourne, on October 9, at the age of seventy-one, of Baron Sir Ferdinand von Müller, the eminent botanist, who has added so much to our knowledge of the flora of our Australian Colonies. A German by birth, Baron von Müller had resided in Australia just half a century. He was a Fellow of the Royal Society, and Botanist to the Colonial Government.

THE death is announced of Dr. M. W. Drobisch, Professor of Philosophy in the University of Leipzig, and distinguished for his mathematical as well as his philosophical researches.

THERE seems to be no room for doubt that the company which has acquired the world-renowned Giant's Causeway, intends to prevent free access to it. The honorary secretary of the Ballymoney Sub-committee of the Defence Committee formed to assert public rights, having, in company with other members of the Sub-committee, visited the Causeway a few days ago, has received notice that a writ has been issued against him for trespassing upon the property of the syndicate.

PROF. MELDOLA, writing with reference to our note on wasps and flies (p. 549), says:—"I am glad you have again called attention to the useful part played by wasps in keeping flies in check. Many years ago, in an inn parlour on the Essex coast, I made a similar observation with Mr. W. Cole, who was with me at the time. We found hundreds of wings scattered about the window-ledge inside the room, and we were at first at a loss to explain the depredation. While watching, the mystery was solved. The upper part of the window had been left open a few inches, and a wasp came through, caught a fly on the glass pane, instantly clipped off its wings, and flew out of the open upper part of the window with the body. Other wasps followed and repeated the process. For about an hour we observed the continuous arrival of wasps, every one of which secured a fly before departing."

THE weather over the British Islands last week was unusually stormy; the reports issued by the Meteorological Office show that the atmospheric disturbances followed each other at short intervals, and were accompanied with heavy falls of rain in nearly all places. One of the most serious barometric depressions approached our islands from the south-westward on the 7th inst., and the disturbance moved during this and the following day along our extreme western coasts, causing heavy south-westerly gales and terrific seas in the west and north; over an inch of rain fell in twenty-four hours at several places, the amount measured at Holyhead, on the 8th, being 1·8 inches. During this severe gale the Daunt's Rock Lightship, near Cork, disappeared, with her crew of ten men. Notwithstanding the recent heavy rainfall, the reports show that there is still a deficiency of five inches from the average in the south-west of England since the beginning of the year, while the north of Scotland has had over six inches in excess of the normal amount.

LIVERPOOL lacks neither men nor societies devoted to the advancement of natural knowledge; what is apparently needed is the amalgamation of these societies for mutual assistance and support. Dr. H. O. Forbes, in an inaugural address delivered before the Biological Society of Liverpool on Friday last, urged the amalgamation of all Liverpudlian societies interested in biological science. He suggested that such a conjoint society, meeting in some central place and to be called, perhaps, the Biological Institute of Liverpool, or the Liverpool Institute of Natural Science, or if all the scientific societies could be induced to unite, the Royal Society of Liverpool, as was the suggestion, some ten years ago, of Prof. Herdman, might be instituted on the model of the New Zealand Institute. Such a combined society in Liverpool would command wider recognition, and contribute more to the advancement of science, than is at present possible with disjointed forces. Dr. Forbes also expressed the hope that two other scientific institutions of the highest educational value, urgently required in a city like Liverpool—a zoological garden and a resuscitated botanical garden under a trained botanist, both conducted in a thoroughly scientific manner—might be accomplished facts before the end of this century.

BLOWN-OUT shots are responsible for a large proportion of the explosions in coal mines. By a blown-out shot is meant a blast which has failed to effect a rupture of the coal owing to the hole for it having been drilled in a wrong position, or owing to the coal not having been properly prepared by holeing or under-cutting. The gaseous products produced by the combustion of the powder are driven violently into the roadways, mixed with the gas distilled from the coal; and this, with the clouds of dust raised at the same time, provides all the conditions for a disastrous explosion. The Commission appointed to inquire into the cause of the explosion at the Brunner Coal Mine, New Zealand, in March last, have, after full consideration of the evidence, concluded that the primary cause was a blown-out shot fired, contrary to the rules of the mine, in a part of the mine where no work should have been in progress. The coal-gas evolved from the surrounding coal is held to have been ignited as the result of the shot, and the flame then spread throughout the dry portions of the mine. The disaster was accentuated by the explosion of the coal-dust raised by the concussion along the main road and working-places, which explosion appears, in some cases, to have been locally intensified by small quantities of fire-damp. No direct evidence was obtained by the Commissioners that the explosion was commenced by an accumulation of fire-damp, or that its extreme violence was due to the combustion of fire-damp mixed with coal-dust.

PROF. A. RÒITI (*Rend. Acc. Lincei*) continues his observations on the cryptochroïsm or phenomenon corresponding to colour in Röntgen rays. In one of his experiments it was found that two plates of brass were equivalent in transparency to eight of aluminium, or sixteen sheets of tinfoil, but the same proportionality did not hold good in the case of certain other combinations of the three metals; thus proving that rays which have traversed a metal plate, differ from those directly emanating from the Crookes tube in their power of penetrating other plates of the same or different metal.

WHETHER high altitudes are productive of anæmia, or lead to an augmentation in the number of red blood-corpuscles, has long been a subject of controversy, the former view having been propounded by Jourdanet in 1863, and the latter by Viault in 1890. A series of observations bearing on this point are described by Dr. Kuthy in the *Atti dei Lincei*. Some of these observations were made on rabbits maintained in an artificially rarefied atmosphere, others on human subjects at high altitudes. In each case an apparent increase, both in the number of red corpuscles and in the percentage of hæmoglobin, was observed; but the author is inclined to regard this effect as due to a modification in the circulation of the blood, by which these constituents are brought to the surface of the body, rather than to a change in its actual constitution.

AN American correspondent writes, under date October 2:—"The albatross flying machine of Mr. William Paul came to grief last Saturday. After waiting nearly a month for a favourable wind, a start was made from the chute after two hours of labour in placing the machine in position; but the first start did not get the machine off the ways. It was replaced a second time and started, but a sudden sideways gust of wind struck and tilted it, turning it about and back on its course. It dropped rapidly from a height of about sixty-five feet, striking a clump of trees, and thence falling to the ground. Mr. Paul was stunned, but not seriously injured. He will build a lighter machine of well-seasoned bamboo during the winter."

THE most extensive and destructive West India cyclone on record swept across America on Tuesday and Wednesday, September 29 and 30, involving tremendous loss of life and property. The cyclone began on Sunday, south of Cuba. On Tuesday it struck the south-west coast of Florida, sweeping away almost the whole of the city of Cedar Keys, and passing through the State with great devastation. In the city of Jacksonville not a single building in the best residential quarter escaped serious injury. The storm inflicted great damage on the cities of Savannah and Brunswick on the coast of Georgia, with loss of life in both cities; and one hundred lives were lost on the sea islands along the same coast. Continuing northward, it spread a wide path of ruin through the country, including conspicuous destruction in Washington, and still more in Alexandria opposite to it, and in Baltimore, and through Eastern Pennsylvania. On Wednesday the storm raged in Michigan and extended to Milwaukee and Chicago, at which points great injury was done to shipping at wharves and outside, very many vessels having been sunk at the wharves in Chicago. The path of this storm was further west than that of the similar one in 1893, which devastated the sea islands and other localities, and the loss of life in this case was due more largely to the fall of débris than to the water.

THE suggestion that the mineral composition of a sedimentary deposit may, if the source of its materials can be traced, afford evidence of the climate that existed during its formation, is not a new one. It has, for example, been put forward by Indian geologists in dealing with the Permo-Carboniferous glacial deposits in the southern hemisphere. It appears to have been independently arrived at by Mr. G. P. Merrill, as a result of his investigations on the decay of certain crystalline rocks. Using the term *degeneration* to cover *all* the processes by which a massive rock is brought to the state at which its materials are easily transported, he distinguishes the physical and mechanical processes as *disintegration* from the chemical one of *decomposition*. The former may be said generally to predominate in its results over the latter in cold and in dry climates; though many qualifying considerations must be taken into account. Apart from this generally interesting conclusion, the two papers by Mr. Merrill, on the granitic rocks of the district of Columbia, and on a diabase dyke at Medford, Massachusetts (*Bull. Geol. Soc. America*, vol. vi. p. 321; and vol. vii. p. 349), contain most detailed mechanical and chemical analyses of these rocks in various stages of degeneration, with full discussions on the evidence so obtained. It is to be hoped that many similar analyses may be made in other parts of the world, in cases where the conditions of occurrence are equally favourable.

IN an elaborate communication by Prof. Bernhard Fischer, on the pollution of the water in the harbour of Kiel, some interesting determinations are incidentally given of the bacterial contents of several samples of sea-water made by Dr. Bassenge, on a voyage from Kiel to the Azores. Prof. Fischer himself made some time previously various examinations of sea-water selected from different places, and together the results furnish an interesting addition to our knowledge of marine-bacteriology. The average microbial contents of sea-water at some distance from land appear to be mostly under 250 per cubic centimetre, but in the English Channel, Skaggerack, Kattegat, and other more or less confined sea areas, the number reaches an average of 500 per c.c., and rarely rises above 1000 c.c. Near the coast and in sea harbours the number may be much higher; thus in Plymouth harbour as many as 13,320 per c.c. were found, although in the vicinity of Dartmouth only 800 bacteria per c.c. were obtained. Dr. Fischer attempts on these results to set up a numerical bacterial standard of purity for sea-water, and he has fixed upon a limit of 500 per c.c. as affording a safe index as to the unpolluted character of sea-water, whilst a higher figure should, he considers, be taken as a sure sign of contamination. With all due deference to Dr. Fischer's arbitrary standard, we think that there is too great a tendency at the present time to try and create bacterial numerical standards. Bacteriology does not admit of being dealt with on such a hard and fast basis, and whilst in some cases a large number of bacteria may mean nothing at all, and be without any further significance, on another occasion a far smaller number may be an index of danger. We have recently had an attempt to start a milk bacterial-standard; now we are to have a fixed sea-water microbial-measure, it only remains for our aërial surroundings to be bacterially standardised!

ANOTHER instance of the valuable work done at the Royal Gardens, Kew, in the organisation of botanical nomenclature, is afforded by the descriptive list of new garden plants of the year 1895, just issued as a *Bulletin of Miscellaneous Information*. To prepare and publish an annual list of the garden plants described in botanical and horticultural publications, both English and foreign, is no easy task; yet such a list, comprising all the new introductions recorded during last year, is now published. It hardly needs pointing out that lists of this character are indispensable to a correct nomenclature, especially in the smaller botanical establishments in correspondence with Kew. In addition to species and botanical varieties, all hybrids, whether introduced or of garden origin, with botanical names, and described for the first time in 1895, are included in the Kew list.

UNDER certain conditions, charcoal is liable to spontaneous combustion. The assertion has been made that charcoal used in building refrigerating chambers on shore and on board vessels has ignited spontaneously; but the evidence on this point appears to be quite insufficient to support this serious charge. The results of an inquiry into the alleged liability of wood charcoal to spontaneous combustion, by Mr. W. D. A. Bost, have been published in a slender volume by Mr. Alexander Gardner. The fact of the matter seems to be that though freshly-made charcoal—that is, charcoal which has not absorbed its moisture—and oxygen is liable to so-called spontaneous combustion; it is never liable to re-ignite after having been exposed to the air for a few days. In any case, it seems that if after a few days no fire shows itself, the charcoal may be regarded as safe. The scare arising from the supposed danger from the ignition of charcoal used in insulating refrigerating chambers may, therefore, be regarded as groundless.

THERE appears to be no grounds for the statement made by Herr Schmeltz in the *Internationales Archiv für Ethnographie*, and referred to in NATURE, July 9, p. 237, that the Government of New Zealand had developed a sense of prudery in regard to the ithyphallic idols and figures in the Auckland Museum. Mr. T. F. Cheeseman, the Curator of the Museum, informs us that no idols whatever have been mutilated since the Museum has been under his charge, and the ethnographical collections have been almost wholly formed since his appointment. There are two or three large mutilated figures in the Museum, but that was done long before they came into the Museum, and probably dates from the period of missionary activity in New Zealand. Mr. Cheeseman very much doubts the accuracy of Herr Schmeltz's statement respecting the restriction of the importation of the phallic chalk figures from New Zealand. For many years such specimens have been on exhibition at the Auckland Museum, without objections being raised by the Government or any one else.

AT the last meeting of the American Institute of Mining Engineers, held at Denver in September, one of the most interesting papers read was on the "Micro-structure of Steel and the Current Theories of Hardening," by A. Sauveur. Mr. Sauveur recognises only four constituents of steel, viz. ferrite or pure iron; cementite or Fe_3C, isolated by Abel in 1855; pearlyte, an extremely intimate mixture of ferrite and cementite, arranged either in lamellæ or granules; and martensite, the composition of which cannot be determined by the microscope. Martensite exists only in hardened steel at ordinary temperatures, and is converted into pearlyte in the process of annealing. It appears to correspond with Arnold's hypothetical subcarbide, $Fe_{24}C$; but inasmuch as it is of variable composition, containing as little as 0·12 per cent. of carbon in very mild steel after quenching, and as much as 0·90 per cent. in hard steel, it follows that no single formula can express its composition. Mr. Sauveur is also dissatisfied with the allotropic theory of the hardening of steel, mainly on two grounds. First, he observes that the allotropists say that the iron passes from the hard β to the soft α state on cooling through the critical point Ar_2, and consequently iron quenched between Ar_2 and Ar_1 should be soft, while Mr. Howe has shown that it is hard. Secondly, according to the allotropic theory, slowly cooled non-magnetic manganese steel should be harder than quenched carbon steel; while, on the contrary, it is far less hard than steel containing much carbon. Mr. Sauveur suggests that the absorption or evolution of heat at the critical points is due to the structural changes which occur at these points. This seems to differ hardly at all from the views of the allotropists, for it is next to impossible to exclude structural changes, accompanied by thermal disturbances, from the list of allotropic changes. Lastly, Mr. Sauveur attributes the hardening of steel to the existence of a network of minute plates of Fe_3C disseminated through the mass; a view which will assuredly not put an end to the violent controversy which rages round this point, if indeed it meets with any support at all.

THE reference, in our last issue, to the first number of *Il Naturalista Siciliano* should have been to the first number of *a new series* of that periodical, which has been published continuously since 1882.

MANY naturalists may be glad to know that Mr. R. H. Porter, Cavendish Square, London, has just published a catalogue containing nearly four thousand titles of new and second-hand books on natural history offered for sale by him.

WE have received the *Proceedings* of the Natural History Society "Isis" of Dresden, for 1895, which is almost entirely occupied by a paper by the editor, Dr. O. Drude, on the distribution of eastern plants in the Flora of the Saxon Elbe-valley.

THE Division of Vegetable Physiology and Pathology of the U.S. Department of Agriculture has issued an important paper by Mr. W. T. Swingle (*Bulletin* No. 9), on the use of "Bordeaux mixture," a mixture of copper sulphate and lime, as a fungicide for vegetable crops.

MR. J. W. MARRIOTT has taken all the questions contained in the papers set by the Department of Science and Art in Practical, Plane, and Solid Geometry since 1884, and has arranged them on a graduated scheme, so that they can be used as exercises upon the various sections of the departmental syllabus. This graduated arrangement under different headings, and the lithographed diagrams accompanying the questions, should be of assistance to teachers of the subject. The questions are published in two sets—Elementary and Advanced—by Mr. E. Coward, Blackburn.

THE Meteorological Institute of Copenhagen has just distributed an important summary of the meteorological observations made in that city during the years 1751–1893. This period embraces no less than 143 years; but from various causes, the results of several of the intermediate years are missing, and the observations have naturally been taken at various hours and localities. Since 1874 they have been made under the immediate superintendence of the Institute, and consequently these possess a much higher value than the earlier series. The annual temperature varied between 49·3° and 41·2°. The mean annual rainfall was 22·1 inches. The summer is the wettest season; the winter and spring being much dryer than the other seasons. The author (Mr. V. Willaume) discusses the data from various points of view, *e.g.* their possible connection with sun-spots, and the moon's influence.

THE *Proceedings* of the Rochester (New York) Academy of Science, Brochure i. of vol. iii. of which has lately come to hand, is a pleasing production, and is a proof that no pains or expense are spared to make it thoroughly attractive in appearance. The section before us is occupied by a paper by Florence Beckwith and Mary E. Macauley, assisted by Joseph B. Fuller, on "Plants of Munroe County, New York, and adjacent territory." The list aims at the inclusion of the names of plants growing without cultivation in Munroe and adjoining counties, and care has been exercised in the determination of specimens, the authors having excluded all those concerning which there have been reasonable doubts. A general comparison is given of the Munroe flora, with lists of plants covering territory east and west of the area under discussion, *i.e.* the territory of Buffalo and the area of Cayuga, and the result as given by them is as follows: The total number of species enumerated in the Buffalo list is 1289, that in the Cayuga flora is 1278, and that in the Munroe list is 1309. The paper is illustrated by a map of the region discussed, and by a diagram showing the stratigraphy of the same.

THE additions to the Zoological Society's Gardens during the past week include two Lions (*Felis leo*, ♂ ♀) from North-east Africa, presented by Mr. C. A. Osborne; two Globose Curassows (*Crax globicera*, ♂ ♀) from Central America, presented by Mrs. Sedgwick; a Whinchat (*Pratincola rubetra*), a Redstart (*Ruticilla phœnicurus*), a Blackcap (*Sylvia atricapilla*), a Swallow (*Hirundo rustica*), British, presented by Mr. John Young; a Cape Viper (*Causus rhombeatus*) from South Africa, a Rufescent Snake (*Leptodira rufescens*) from East Central Africa, presented by Mr. F. V. Kirby; a Smooth Snake (*Coronella lævis*), European, presented by Mr. A. E. T. Jourdain; two Hairy Armadillos (*Dasypus villosus*) from La Plata, a Peba Armadillo (*Tatusia peba*) from South America, deposited; two Maguari Storks (*Dissura maguari*) from Chili, three Laughing Gulls (*Larus atricella*) from North America, purchased; two Collared Fruit Bats (*Cynonycteris collaris*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL SOCIETY OF WALES.—We have received the *Journal* of this Society for September, and find it contains some useful information for amateurs. Besides current notes and some short contributions from various members, a brief description is given of the conditions under which Mars is now visible. This is accompanied by some illustrations, among which is an excellent map of Mars, by Schiaparelli. We notice in the table given at the end, describing "The Heavens" for October, that the period of the variable star η Aquila is given as two days nine hours; this is evidently incorrect, being the time from a minimum to a maximum. A variable star period is generally reckoned either from minimum to minimum, or from maximum to maximum, and its length in the case of this star is, roughly, seven days four hours.

THE ELEMENTS OF COMET 1885 III.—Both Messrs. W. W. Campbell and Gallen Müller have calculated the elements of the orbit of this comet, discovered by Mr. W. R. Brooks at Phelps, New York, on August 31, 1885. These computations were made independently of one another. Mr. Campbell's work led us to believe the orbit of this comet to be an ellipse, with a period of revolution of 495·7 years; while Mr. Müller gave us two orbits, one elliptical with a period of 403·2 years, the other a parabolic orbit. It seems that the observations used as a basis for the calculation, both include one made at Dun Echt by Dr. Copeland on October 5. This observation forms the last placed position in both calculations. On this the value of the eccentricity obtained entirely depends. Owing to this uncertainty, the observation has been replaced by three observations by M. Bigourdan, which had not been published when the calculations were commenced. These latter observations get rid of this difficulty, and give us the means of ascertaining whether the eccentricity is real or not. The computation has been undertaken by Mademoiselle Klumpke, at the request of Prof. Schulhof, and is published in the *Bulletin Astronomique* for September. The investigation shows that the new elements deduced give a period of revolution of 247·5 years. This period is, as Mademoiselle Klumpke says, with certainty relatively short. It takes a fifth place among those comets, the time of revolution of which is greater than a hundred years. Mademoiselle Klumpke further suggests that the theory of the capture of comets would attribute the elliptical character of this orbit to the action of Jupiter, the minimum distance between the two orbits being 0·22. The following are the elements finally deduced:—

Final Elements.

$$T = 247^\circ\ 36'\ 57''{\cdot}65$$
$$\Omega = 204\ 45\ 24{\cdot}52$$
$$i = 59\ 6\ 35{\cdot}43$$
$$\log q = 9{\cdot}8745682$$
$$e = 0{\cdot}9822627.$$

THE LEANDER MCCORMICK OBSERVATORY.—The *Alumni Bulletin* of the University of Virginia contains an account of the principal work in hand at the Leander McCormick Observatory. At present the chief work is the observation of the relative positions of the satellites of Saturn, and the discussion of the measures for the purpose of improving our knowledge of their motions.

The orbits of Titan and Japetus are fairly well known, so special attention is given to the remaining satellites. All of these are faint, and a powerful telescope is needed to observe them accurately. The most easily observed are Rhea, Dione, and Tethys, and a fine series of relative positions of these has already been secured, from which it is hoped to obtain greatly improved orbits of those bodies. Mimas, the satellite nearest to the ring, is very faint, so that it can be observed only under favourable atmospheric conditions, and only when near the points in its orbit where its apparent distance from Saturn is greatest. As a result the inequalities in its motion are not at all well known, and further observation is desirable. The same is true to a less extent of Enceladus, the next satellite beyond Mimas. The orbits of both these satellites are useful in determining the mass of Saturn's ring. Hyperion is also extremely faint. The motion of this satellite is greatly affected by the attraction of Titan, and the determination of its orbit involves difficulties that render it one of the most interesting problems of the solar system.

The observations of these satellites are being published from time to time in the *Astronomical Journal*. Their discussion has occupied the attention of the Director during a large portion of the past year. The investigation is of great importance, and the results obtained will lead to the gradual solution of the mechanical problems involved in the motions of the Saturnian system.

THE SOLAR ROTATION.—The great amount of material that we now possess with regard to solar phenomena has led many to form theories of the rotation of the sun, which differ among themselves both in the method of treatment employed and in their value. Of those more recent, that which we owe to E. J. Welczynski, is published in the current number of the *Astrophysical Journal* (August 1896). The author commences by forming the hydrodynamic equations of Lagrange, by assuming the coordinates of any point of a fluid, and the position of this point at a certain time ($t = 0$). A fourth equation is obtained further by differentiating with regard to the time, the product of the density of the fluid at the initial position, and a determinant containing (in rows) the differential of the coordinates of the first point to those of the second. He then proceeds to rotate the whole mass round the axis of z, where ω is the angular velocity of rotation depending on the coordinates of the point $t = 0$. The equations then become simplified, and it is found that the square of the angular velocity is a function of the distance of the moving point from the axis of rotation, or, in other words, ω depends only on the value of r. The equations of Lagrange thus become further simplified, and conditions are inserted for the case in which the fluid is a gas, and the absolute temperature not constant throughout. The equation arrived at finally is

$$4\pi\rho + c\Delta T + c\Delta \log \rho = 2\omega^2 + r\frac{d\omega^2}{dr}.$$

Welczynski then identifies this rotating mass with the sun, which he assumes spherical. Since ω depends on r, he imagines the sun's axis the common axis of a series of cylinders, so that the velocities of points on the surfaces of each of these would be constant for each cylinder, the surfaces rotating as if they were solid. "But from one cylinder to another ω changes according to a certain law, $\omega = f(r)$, which, according to (10) [equation given above] depends upon the distribution of temperature and pressure in the sun's interior. Since we know nothing of these qualities it is impossible to deduce theoretically a formula for the solar rotation." He remarks further that it is important to note that "if $\omega = f(r)$ is known from observation, equation (10) gives a condition which the temperature and density of the solar interior must satisfy. If it were possible to find a second condition of this kind, it would be possible to find the laws according to which these quantities vary from point to point." He suggests that such an equation would follow if the periodicity of the sun-spots be a hydrodynamic phenomenon. The paper concludes with a reference to the position of the faculæ with reference to these spots. The faculæ being further from the centre of the sun than the spots, the former, even on the same heliographic latitude, would move faster, as the velocity of rotation increases the greater the distance from the sun. In fact a means is afforded here of determining the difference in the altitude of spots and faculæ, this difference being stated to be "considerable, almost 1/60 of the solar radius."

THE HUXLEY LECTURE.—RECENT ADVANCES IN SCIENCE AND THEIR BEARING ON MEDICINE AND SURGERY.[1]

I.

WHEN fifty-four years ago the school of Charing Cross Hospital gathered itself together for its winter work, among the new comers was a pale-faced, dark-haired, bright-eyed lad, whose ways and works soon told his fellows that he was of no common mould. To-day I am about to attempt the fulfilment of the duty, which the authorities of the school have done me the honour to lay upon me, of delivering the first of the series of lectures which the school has wisely instituted to keep alive, in the minds of those to come, the great services which that lad's strenuous and brilliant life rendered to the healing art. The trust of the Huxley Lectureship provides that the lecturer shall dwell on recent advances in science, and their bearings on medicine and surgery. I venture to hope that I shall be considered as not really departing from the purpose of the trust, if I attempt to make this first lecture a sort of preface to the volume, or rather the volumes of lectures to come. And since a preface bears a different paging, and is written in a different fashion from that which it prefaces, I shall be so bold as, with your permission, to make the character of my lecture to-day different from what I suppose will be that of the lectures of my successors. It will, I imagine, be their duty to single out on each occasion some new important advance in science, and show in detail its bearings on the art of medicine. Each succeeding lecturer will, in turn, be limited in the choice of his subject, and so assisted in his task by the choice of his predecessors. I to-day have no such aid. It seems fitting that, for the purposes of this initial lecture, the word "recent" should be so used as to go back as far as the days of Huxley's studentship. If it be so used, I am brought to face advances in science affecting medicine and surgery, so numerous and so momentous that any adequate treatment of them as a whole would far exceed not only the time at my disposal, but also, what is more, my powers to treat and your patience to hear. I will not dare so hopeless a task. Nor will I attempt to select what may be deemed, or what may appear to me, the most important of these advances, and expound the bearings on medicine of these alone. I venture to hope I shall best fulfil the duty laid upon me, and meet with your approval, if I single out and dwell on one or two general themes suggested by the history of science during those fifty odd years.

The first theme is one suggested by a survey of the studies which engaged young Huxley in the school here in 1842. This will bring before us a special bearing, on our profession, of the advance of science, which, though it may not be evident at first sight to every one, is nevertheless real and important.

Each case of illness is to the doctor in charge a scientific problem to be solved by scientific methods; this is seen more and more clearly, and acknowledged more and more distinctly year by year. Now it is true that each science has to a certain extent its own methods, to be learnt only in that science itself; and from time to time we may see how a man eminent in one branch of science goes astray when he puts forward solutions of problems in another branch, to the special methods of which he is a stranger. In nothing is this more true than in an applied science like that of medicine. At the bedside only can the methods of clinical inquiry be really learnt; it is only here that a student can gain that kind of mind which leads him straight to the heart of disease, that *genius artis*, without which scientific knowledge, however varied, however accurate, becomes nothing more than a useless burden or a dangerous snare. Yet it is no less true that the mind which has been already sharpened by the methods of one science takes a keener edge, and that more quickly, when it is put on the whetstone of another science, than does a mind which knows nothing of no science. And more than once inquiry in one science has been quickened by the inroad of a mind coming fresh from the methods of a quite different science. For all sciences are cognate, their methods though different are allied, and certain attitudes of the mind are common to them all. In respect to nothing is this more true than in respect to the methods of medicine. Our profession has been the mother of most of the sciences, and her children are ever coming back to help her. In our art all the sciences seem to converge—physical, chemical, biological methods join hands to form the complete clinical method. This is the real justification for that period of preparatory scientific study, which each enactment of the authorities makes longer and harder for the student of medicine. It is this, and not the mere acquirement of facts. The facts, it is true, are needed; every day the doctor has to lay hold, for professional use, of mechanical, physical, chemical, biological facts. But facts are things which the well-trained mind can pick up and make use of as it goes along at any time and in any place. Whereas the mind which is not well-trained will miss the facts or pick up the wrong ones, or put to a wrong use even the right ones which it has in hand.

Now the ideal training to be got from any science is that of pursuing inquiry within the range of the science, according to the methods of the science; in that way only does the spirit of the science fully enter into the man. But such an ideal education is impossible. We are fain to be content in merely making the student know what truths in each science have been gained and how they have been gathered in, such a teaching becoming more and more effective as a training, the more fully the student is made to tread in the very steps, and thus to practise the methods of those who gained the truths.

The more complete the body of any one science the more useful does that science become as a means of training, and hence it is that advance of science has a double bearing on the medical profession. As each science grows, not only does its new knowledge bring to the doctor new facts and new ideas, new keys to open locked problems, and new tools to use day by day, but the incorporated knowledge gains greater and greater power as an instrument to train his mind rightly to use all the facts which come before him.

Let me, in the light of this view, call your attention for a moment to the yoke of compulsory studies under which the young Huxley had to bend his somewhat unruly neck, and compare it with the like yoke which presses, heavily it seems to some, on the neck of the young student of to-day.

I have not been able to find an exact record of the course of studies pursued by Huxley himself at Charing Cross in the years 1842–5, but I have been privileged to examine the stained and tattered schedule of the College of Surgeons, duly "signed up," for the years 1844–7, belonging to one who, during some of those years, sat by Huxley's side, who was then, and afterwards, his friend, and who has won honour for himself and for your school, under the name of Joseph Fayrer.

I find that young Fayrer attended during his first year a course of at least 140 lectures with 100 demonstrations on Anatomy and Physiology, a course of not less than 70 lectures on Materia Medica, a course of lectures on the Practice of Surgery, and a course of "The Practice of Physics," each of not less than 70 lectures, and a course of Hospital Practice in Surgery of not less than nine months. In his second year he again attended the 140-lecture course on Anatomy and Physiology, and the 70-lecture course on the Practice of Surgery, and again Hospital Practice in Surgery, taking as well a 70-lecture course in Chemistry, a like course in Midwifery and Hospital Practice in Medicine. In his third year he once more attended the 140-lecture course in Anatomy and Physiology, but no other systematic lectures; the rest of his time was devoted to Hospital Practice. To these demands of the College of Surgeons we ought to add, in the case of the ordinary student, the demands of the Company of Apothecaries; but the main addition thus caused would be a course of Botany.

Such a curriculum differs widely both in nature, extent, and order from that in force at the present day. But I venture to think that if we examine the conditions of the time, we shall find that the authorities of that day were as wise as, possibly wiser than, we of to-day. In judging such matters as these, we and, perhaps, especially they who would drive the student on into learning by the goad of compulsion, must bear in mind that legislative enactments, such as those prescribing a curriculum of study, always exhibit a long latent period; they come into visible existence long after the stimulus which begat them has been applied, long after the need of those things being done which the enactments strive to do has been felt. So long, indeed, is the latent period, that often new needs have arisen calling for yet other regulations before the old ones appointed to meet the old needs have got into working order. Bearing this in mind, we shall find that the course of study prescribed in Huxley's time was wisely chosen to meet the needs of, at least, the time immediately preceding that, if not, indeed, the time itself.

It will be observed that the study of physics, or as it was then more commonly called natural philosophy, finds no place what-

[1] Delivered at Charing Cross Medical School, on October 5, by Prof. Michael Foster, Sec.R.S.

ever in young Fayrer's schedule, and that the one short course of chemistry, without any practical instruction, which he attended was taken in his second year—in the middle, as it were, of his curriculum, when he was already advanced in his clinical studies.

At the present time the sciences of physics and chemistry have each of them developed into a body of logically coordinate truths, furnishing an instrument of peculiar value for the training of the scientific mind. Moreover the methods of teaching have developed in no less a degree, so that in the laboratory the student follows, at a long distance, it is true, but still follows the steps of those who have made the science, and has at least the opportunity of catching something of the spirit of scientific inquiry. In this educational value of these sciences, even more than in the practical utility of a knowledge of the mere facts of the sciences, great as that may be, lies the justification of the authorities when these, desiring to improve the profession by introducing artificial selection into the struggle for existence, insist that all to whom the lives and health of their fellow men are to be entrusted, should have learnt at least something of the sciences in question.

In the time of Huxley's studentship both these sciences were in a very different condition. The time, it is true, was one of great awakening. In physics men's minds were busy opening up the hidden powers of electricity; some ten years before Faraday had made an epoch by discovering induced currents; he and others were still rapidly extending our knowledge, one practical outcome of which was the introduction of the telegraph in 1837. But how great has been the onward sweep in electric science since then; how great the advance in all branches of physics! To realise the great gap which separates the physics of to-day from the physics of then, one has only to call to mind that the world had yet to wait some years before Mayer, and Joule, and Helmholtz, and Grove had said their say; in the books which taught young Huxley the laws of physics he found not a word of that great law of the conservation of energy, which like a lamp now guides the feet of every physical inquirer, whatever be the special path along which he treads.

In chemistry much, too, was being done. That science was in the first flush of success in its attack on the mysteries of organic compounds. Liebig, Dumas, and others were rapidly making discoveries of new organic bodies, and dealing with types and substitution, were beginning to make their way into the secrets of chemical constitution; but then, as indeed for a long time afterwards, progress was taking the form of the accumulation of new facts interesting and eminently useful, but still mere facts, rather than of the gaining of insight into those laws of chemical change of which the facts are but the expression. And the brilliant success of purely organic chemistry was somewhat prejudicing those inquiries in regions where physics and chemistry touch hands, which in these latter days are producing such striking results.

In the days of Huxley's studentship neither of these sciences presented such a body of truths as could be readily used as an engine of mental training, nor had the educational mechanism for thus employing them been developed; a chemical laboratory for the student was as yet hardly known, a physical one wholly unknown. The profession turned to these sciences chiefly for the utility of the facts contained in them. The facts of physics, with the exception of those of mechanism, were but rarely appealed to, and if those of chemistry were in more common use, it was because they threw light on the mysteries of the Pharmacopœia, rather than because they helped to solve the problems of the living body. Hence the authority, not without cause, demanded of the student no physics at all, and asked for chemistry only in the midst of his course, when its facts might help him to understand the nature of the drugs which his clinical studies were already bidding him use.

As regards the biological sciences, the time was also one of change, or rather of impending change; the causes of the change were at work, but for the most part were at work below the surface; their effects had not yet become obvious.

In natural history, in what we sometimes now call biology, in botany, zoology, and comparative anatomy, the activity in systematic and descriptive work was great. The sun of the great Cuvier was setting, but that of our own Richard Owen was at its zenith; new animal forms, recent and extinct, were daily being described, the deep was giving up its treasures, new plants and new beasts, brought home by energetic travellers, were being duly investigated. But this was only a continuation of what had been going on long before.

Of the great biologic revolution which was about to come, there was not so much as even a sign in the skies when Huxley took his seat on the Charing Cross benches, though Charles Darwin was already brooding over the ideas which had come to him in his long voyage.

Two great changes, however, were already beginning—one due to new ideas, the other to improved methods.

The morphological conceptions, of which von Baer, in his "History of Development," had laid the foundations, destined to make a new science of animal forms, were being carried forward by Johannes Müller in Germany, though, save for the expositions of Carpenter, they had made but little way in this country. Nowhere, indeed, had they progressed far. The man who, perhaps to Huxley himself, was to advance them most, Gegenbaur, was as yet a mere student. Nor in spite of the beginning made by von Baer himself, by Allen Thomson, and by Rathke, had embryology made much progress. Kölliker, to whom the science owes so much, had as yet written no line. Still the new ideas were beginning to push.

Of no less importance was the impulse given by the improvements in the microscope. Only ten years before Sharpey, discovering that eminently microscopic mechanism ciliary action, found that a simple lens was a much more trustworthy tool than the then compound microscope. But in the ten years a great change had taken place, and during the latter part, especially, of the decennium, improved instruments yielded a rich harvest of discovery in animal and vegetable life. Prominent among the new additions to truth was increased knowledge of the mammalian ovum, in acquiring which Wharton Jones, Huxley's teacher at Charing Cross, did much. But the most momentous and epoch-making step was the promulgation of the cell-theory by Schwann and Schleiden as the decennium drew to its close, and more or less connected with that step was the accurate description by von Mohl of the structure of the vegetable cell, and his introduction of the word, which, next to the word cell, has perhaps had the most profound influence on the progress of biologic science—I mean the word protoplasm.

Of this wide field of general biologic knowledge the College of Surgeons at that time took no heed, or at least made no formal demand. It is true that part of it found its place in the lectures on Anatomy and Physiology, and in the consequent examinations, but only a small part. It is also true that the lecturer on Materia Medica had by custom license to roam over almost the whole of nature, and the student in learning the nature and use of drugs took doses of heterogeneous natural history; the mention, for instance, in the Pharmacopœia of Castoreum being made the occasion of a long disquisition on the biology of the beaver.

But in this the end in view was the acquisition of facts, not training in scientific conceptions and ways of thought.

The botany, it is true, which unasked for by the College of Surgeons, was insisted upon by the Company of Apothecaries, though made compulsory on utilitarian grounds, as an appendage to and introduction to the Pharmacopœia, did serve the student in an educational way, teaching him how to appreciate likenesses and differences, even small ones, and how to distinguish between real and superficial resemblances. But the time he spent on this was too brief to make it—save in cases where a special enthusiasm stepped in—of any notable effect.

Of the then conditions of that biologic science which comes closest to the profession of physiology, I will venture to say a few words, though I will strive to curb my natural tendency to dwell on it at too great a length.

A great master—Johannes Müller—had a few years before written a great work, "The Outlines of Physiology," a work which the wise physiologist consults with profit even to-day, noting with admiration how a clear strong judgment may steer its way through the dangers of the unknown, and the still worse perils of the half-known. A study of that work teaches us the nature and extent of the advanced physiology, which at that day an accomplished teacher like Wharton Jones might put before an eager student like Huxley, and we may infer what the ordinary teacher put before the ordinary student, each perhaps then, as since, eager neither to give nor to take more than the statutory minimum.

When we look into the past of science, and trace out the first buddings of what afterwards grow to be umbrageous branches, it sometimes seems as if every time, and almost every year, marked an epoch; it seems as if always some one was finding out something which gathered into greatness as the following years rolled on. But even bearing this caution in mind, the end of the thirties and the beginning of the forties of the present century do seem to mark a real epoch in physiology. All along the line, accurate careful observation, quickened by the rapid growth of the cognate sciences, was taking the first steps to replace by sound views the sterile discussions and scholastic disquisitions which had hitherto formed too large a part of physiological teaching. The first steps had been taken, but the most marked advance was yet to come.

Though the observations of Beaumont had a few years before, by proving that gastric juice was a real thing, and demonstrating its properties, shown the nature of digestion in its true light, the older fermentative and other theories were not yet abandoned by all. Though the conversion of starch into sugar had been recognised, and pepsin had been discovered, the exact action of the digestive juices had yet to be learnt; that of pancreatic juice was almost unknown, and bile still reigned as the king of enteric secretions.

In the physiology of respiration the view that the carbonic acid of expired air was formed in the lungs by the oxidation of the carbon of the blood, still found strenuous support; for Johannes Müller found it necessary to argue at great length that the researches of Magnus on the gases of the blood had placed the matter in its true light. It had been suggested that the red corpuscles were in some way also special carriers of oxygen from the lungs to the tissues, but Müller could not regard this as anything more than a mere supposition.

When it is borne in mind that injection with mercury was the one method employed for tracing out the course of the lymphatics, it will be readily understood how imperfect was the then knowledge of the lymphatic system. And when it is also remembered that though Dutrochet had long before used osmosis to help in the interpretation of the movements of liquids in living tissues, the exact researches of Graham had yet to come, it will also be understood why, when questions of absorption and cognate questions of secretion came under consideration, they were dealt with as questions in such a condition are dealt even nowadays; much was said about them because little was known.

Though Poisseuille, taking up the matter where it had been left by Stephen Hales in the foregoing century, had begun, and the brothers Weber were just continuing, the work of placing our knowledge of the mechanics of the circulation on a sound and exact basis, and though the then teaching of the mechanical working of the heart did not differ widely from that of to-day, the gap which separates the then knowledge of the circulation, even in its mechanical aspects, from that which we possess to-day, is seen in all its width when I remind you that Carl Ludwig's first paper was not published until Huxley had ceased to be a student—until the year 1845. As to all that great part of the physiology of the vascular system which concerns its government by the nervous system, I will only say that in Müller's great work may be read the pages in which he deals with the conflicting opinions and indecisive observations as to whether the brain and spinal cord have any influence over the heart-beat, and in which, marshalling with logical force the arguments for and against the opinion that the blood-vessels have muscular fibres in their walls, finally decides that they have not.

In the physiology of the nervous system a momentous advance had been made some few years before, in the early thirties, by the introduction, through Marshall Hall, of the idea of reflex action. This was rapidly supplying the key to many hitherto unsolved physiological and clinical problems. The special functions of the several cranial nerves were being worked out by Majendie, Reid, and others. The former (with Flourens) was also making many experimental researches on cerebral lesions; and, in another line of inquiry, Bidder and Volkmann were preparing the way for discoveries to come by their important studies on the sympathetic system. The physiology of the senses was being vigorously pushed forward by Johannes Müller; but the reader to-day of Müller's volumes cannot but be struck with the smallness of the space (if we omit all that deals with the senses) which he allots to the nervous system, when we compare it with what is demanded in the present day. And no little part of even that limited space is taken up with a consideration of the laws of those "sympathies" which gave to the sympathetic nerves their name, but which have long since dropped out of sight.

Lastly, it must be remembered that many of the speculations of the preceding part of the century had remained barren, and many investigations had gone astray through lack of knowledge of the minuter changes which lie at the bottom of physiological events. Those minuter changes could not but lay hidden, so long as there was no adequate knowledge of minute structure. I have already referred to the improvements of the microscope taking place in the thirties, and this soon bore fruit in the rapid growth of that branch of biologic science once called general anatomy, later on microscopic anatomy, and now best known by the name of histology. It is well-nigh impossible to exaggerate the importance of a histological basis for physiological deductions; it is one of the chief means through which progress has been made, and must continue to be made. In the earlier days of physiology, the grosser features of structure forming the subject-matter of ordinary anatomy guided the observer to the solution of problems about functions; but after a while these became exhausted, having yielded up all they had to yield, and in due time their place was taken by the finer features disclosed by the microscope. These show as yet no signs of exhaustion, and we may look forward in confidence to their standing us in good stead for years to come. We may expect them to last until we pass, insensibly, from that molecular structure which makes itself known by optical changes, to that finer molecular structure which is only revealed by, and inferred from its effects, which is an outcome of the ultimate properties of matter, and which is the condition, and so the cause, of all the phenomena of life.

The early forties of the present century may be taken as marking the rapid rise of histological inquiry. It is true that, even before this, the labours of Henle had gone far; that in this country the brilliant Bowman had already (in 1840) given to the world his classic work on the structure of striated muscle, and a little later (1842) his hardly less important work on the structure of the kidney; that the sagacious Sharpey had embodied, in "Quain's Anatomy," a whole host of important histological observations; and that many others were at work. Nevertheless, one has only to remember how closely the progress of histology is bound up with the name of Kölliker, and to call to mind that Kölliker's first paper was not published until 1841, to see clearly how much of our present knowledge of histology, and all that that brings with it, has been gathered in since Wharton Jones taught it to the young Huxley.

If the gap which parts the physiological learning of that time from the learning of to-day is great, still greater is the gap in the teaching. Though at Charing Cross and in some other schools a course of physiology was given, apart from that of anatomy, this was not separately recognised by the College of Surgeons; it demanded simply a course of anatomy and physiology, of which the lion's share fell undoubtedly to anatomy.

In accordance with this, in most schools, at all events the greater part, and perhaps the sounder part of the physiology taught, was that which may be deduced from anatomical premises. Where the teacher went beyond this, he in most instances at least wandered into academical disquisitions and sterile discussions. Only in rare hands, such as those of Wharton Jones and William Sharpey, was the subject so treated as to be of any real use as a mental training for the medical student preparing his mind to view rightly biological problems. The science was not as yet sufficiently advanced to be an educational engine which could be safely entrusted to the ordinary teacher's use. And the method of teaching it, happily recognised now, which alone ensures the salutary influences of the knowledge acquired, that of following out in the laboratory the very steps along which the science has trod, was then wholly unknown. It was as a brilliant favourite pupil that young Huxley was encouraged by Wharton Jones to use the microscope himself, and study among other things the structures of hairs; he was not led to it, as one of a flock, in a practical course.

Indeed one kind of knowledge only was at that time demanded of the medical student, in such quantity and in such a way as to render the study of it a real mental training. Not in one year only of his course, but in each year—in his first, his second, and his third year—was the student, who hoped to obtain the diploma of the College, compelled to attend lectures, each course consisting not as in other subjects of seventy, but of double that number of lectures, on what was styled anatomy and physiology, but was in the main what we now call anatomy. Moreover, the student learnt even then his anatomy in the same way that he is bid to learn all other subjects now, not merely by listening to lectures, or even by witnessing formal demonstrations, but by individual labour in the laboratory, in that laboratory which we call a dissecting-room. Nowadays it may seem strange to insist that the student should be studying anatomy during all the three years of his curriculum, down to the very end of his studentship But we must admit the wisdom of it then. At that time human anatomy was the one branch of knowledge which had achieved anything like complete development, and which successive generations of able teachers had shaped into an engine of mental training of the highest value. It was then the mainstay of medical scientific teaching. It was in the dissecting-room that the student, of the time of which we are speaking, acquired the mental attitude which prepared him for the bedside. He there learnt to observe, to describe, to be accurate and exact, and the time spent there was wisely judged to be the most precious of his apprenticeship; the shaping of his mind by help of orderly arranged facts was perhaps even of greater value than the mere acquisition of the facts, important as this might be.

The authorities of the time were, I venture to repeat, in my opinion wiser in their generation in making this well-developed, adequately taught science of anatomy the backbone of the medical student's education; they were wise in making relatively little demand on the student in respect to the other sciences cognate and preparatory to medicine, the value to him of which consisted then chiefly in the facts which they embodied; they were also wise in giving him leave to defer his study of them until his knowledge of something of the needs of his future profession should have opened his eyes to the value of those sciences as mere records of facts.

I also, however, venture to think that the advance of these sciences since then has greatly changed their bearing towards the medical student, no less than towards medicine. What was wisdom in the forefathers is not necessarily wisdom in us the children. I have no wish to take advantage of the occasion of this lecture to make an excursion into the troubled land of medical education. But I feel sure—indeed I know—that I am only saying what the man whose name these lectures bear always felt, and indeed often said, when I suggest for consideration the thought that while some choice out of that advancing flood of science which is surging up around us, and all of which has some bearing on the medical profession, some choice as to what must be known by him who aspires to be the instrument of the cure and prevention of disease is rendered necessary by the struggle for existence—a decided and even narrow choice, lest the ordinary mind be drowned in the waters which it is bid to drink. In making that choice, we should remember that an attitude of mind once gained is a possession for ever, far more precious than the facts which are gathered in with toil, and flee away with ease. This should be our guiding principle in demanding of the medical student knowledge other than that of disease itself.

The usefulness, and so the success, of a doctor is largely dependent on many things which belong to the profession viewed as an art, on quickness of insight, promptness of decision, sleight of hand, charm of manner, and the like—things which cannot be taught in any school. But these are in vain unless they rest on a sound and wide knowledge of the nature of disease, on a sound and wide grasp of the science of pathology; and this can be taught. By a sound and wide grasp, I mean such a one as will enable him who has it to distinguish, as it were by insight, among the new things which almost every day brings to him that which is a solid gain, from that which is a specious fallacy. Such a grasp is only got by such a study as leads the mind beyond the facts into the very spirit of the science.

But what we call pathology is a branch—a wide and recondite branch, but still a branch of that larger science which we call physiology; it employs the same methods, but applies them to special problems. So much are the two one that it would doubtless be possible to teach pathology to one who knew no physiology; such a one would learn physiology unawares. But at a great waste of time. For physiology, in its narrower sense, being older, has become organised into an engine which can be used for leading the mind quickly and easily into the spirit and methods of true pathological inquiry. The teaching of it as an introduction to pathology is an economy of time. That, I take it, if compulsion be justifiable at all, is the justification of its being a compulsory study.

Further, the methods of physiology, in turn, are the methods of physics and of chemistry, used hand in hand with other methods special to the study of living beings, the general methods of biology. And here again it is an economy of time that the student should learn these methods each in its own science, and this is the justification for making these sciences also compulsory. But in all the regulations which are issued concerning these several ancillary sciences, this surely should be kept in view, that each science should be taught not as a scientific accomplishment of value in itself, but as a stepping-stone to professional knowledge, of value because it is the best means of bringing the student on his way to that.

(To be continued.)

CHEMISTRY AT THE BRITISH ASSOCIATION.

THE meeting of the Chemical Section of the British Association at Liverpool was not signalised by the announcement of any sensational discovery. Papers were, however, read on a number of the subjects which are at present occupying the attention of our foremost chemists, and it is to be hoped that the discussion on chemical education may help in attracting the attention of the public to that most important subject.

After the President's very interesting address, which, as was pointed out by Sir F. Abel, dealt with an industry of which the development had been mainly due to the labours of English chemists, many of whom worked in the immediate neighbourhood of Liverpool, the ordinary business of the Section was commenced with a paper on "Reflected Waves in the Explosion of Gases," by Prof. H. B. Dixon, E. H. Strange, and E. Graham. The rate of propagation of an explosion in a gaseous mixture can be ascertained by photographing the flash, as it passes along a short glass tube, on a sensitive film revolving at a known rate, and then measuring the angle through which the image has been rotated. A number of photographs of this kind were exhibited. They reveal the existence of a second wave, which passes back along the tube in the opposite direction to the flash, and at a much slower rate. This wave is probably set up by the explosion wave when it reaches the end of the tube, and by measuring its velocity the authors are enabled to estimate the maximum temperature of the gases immediately in the wake of the explosion wave. The maximum temperatures, obtained with a number of different mixtures, lie between 3000° and 4000°, and are thus of the same order as those found by Bunsen, by Berthelot, and by Mallard and Le Chatelier for the temperature of the explosion itself.

Sir G. G. Stokes expressed the opinion that the luminosity which accompanied the reflected wave might be due, not to any chemical action, but to the temporary compression of the gases, which had only cooled slightly below their point of luminosity.

The only paper on the subject of the Röntgen rays which found its way into the Chemical Section was one in which Dr. J. H. Gladstone and Mr. W. Hibbert drew a contrast between the action of metals and their salts on ordinary light and on the new rays. All the metals, except in exceedingly thin films, are opaque to light, whilst their compounds with electronegative radicles—the metallic salts—are transparent, or only exhibit a selective absorption. With the Röntgen rays the relations are quite different. The metals exhibit all degrees of opacity towards these rays, lithium being almost transparent, platinum and gold practically opaque, whilst the opacity of the other metals seems to follow the order of their atomic weights. In the salts the metals seem to retain their own absorptive power, and the absorption of a solution of a salt appears to be the sum of the absorptions of the metal, the acid radicle, and the solvent.

A paper on the "Limiting Explosive Proportions of Acetylene, and Detection and Measurement of this Gas in the Air," was read by Prof. F. Clowes. The possibility of the introduction of acetylene as an illuminant renders a knowledge of these factors of considerable practical importance. The detection and estimation of the gas in air can be carried out by the well-known flame-cap test, so small a proportion as 0·25 per cent. being readily distinguishable. A convenient portable apparatus was exhibited for carrying out the test at any desired place. All mixtures of air and acetylene which contain from 3–82 per cent. of the latter are explosive, this being a wider range of explosibility than is shown by any other gas. Carbon is deposited during the combustion of all mixtures containing more than 22 per cent. of acetylene. In a later communication the author showed that the flame cap test can also be applied to the detection and estimation of carbon monoxide in air, with about the same degree of sensitiveness as with acetylene. A short note on "The Accurate Estimation of Oxygen by Absorption with Alkaline Pyrogallol Solution" was also read by Prof. Clowes.

Dr. A. W. Titherley, of University College, Liverpool, gave a short account of his work on the "Amides of the Alkali Metals and some of their Derivatives." The amides of sodium, potassium, lithium, and rubidium have been prepared in the pure state. They all readily dissolve the corresponding metal, forming blue solutions. Their melting points do not vary regularly with the atomic weight of the metal, since lithamide melts at 380–400°, sodamide at 155°, potassamide at 270°, and rubidamide at 285°. The potassium and sodium compounds do not yield the nitride when heated, as has been stated by previous investigators. Analogous derivatives of the alkyl amines have also been prepared, and promise to be of great interest.

Several communications on physical chemistry were received by the Section, the first of which was a paper by Prof. Oscar Liebreich, on "Diminution of Chemical Action due to Limitations of Space." Certain reactions take place much less readily near a liquid surface than in the interior of a liquid, and the author terms this region of diminished action the "dead space." This remarkable fact has led the author to the conclusion that liquid friction is of influence on the phenomena of chemical action, and that in small enclosed spaces—spaces in which the fluid is, as it were, solidified—the reaction is retarded.

Dr. Wildermann read a paper supplementing that which he brought before the Association at its last meeting on "The Velocity of Reactions before perfect Equilibrium takes place." For a number of cases of crystallisation of liquids and solutions he has now been able to obtain experimental evidence which establishes the complete applicability of the thermodynamic equation to the rate of reaction, as well as to provide a statical explanation for the well-known fact that the velocity of a reaction is independent of the amount of a solid substance present, which cannot readily be explained on kinetic grounds.

In a short note on "The Behaviour of Litmus in Amphoteric Solutions," Dr. T. Bradshaw opposed the view that the violet colour produced when a mixture of sodium dihydrogen phosphate with the ordinary disodium hydrogen phosphate is added to a solution of litmus is due to a special compound, probably an acid salt, of the litmus acid. The author considers that the violet colour is caused by the simultaneous presence of small amounts of blue and red litmus, the shade varying with the proportions of the two sodium salts which are present, whilst taken separately one of the salts has an acid, and the other an alkaline reaction to litmus.

Prof. Max Bamberger read a short paper on "Excrescent Resins," and described a number of crystalline substances which he had succeeded in extracting from them. Messrs. A. G. Green and A. Wahl contributed a paper on "The Constitution of Sun Yellow or Curcumine and allied colouring matters." These substances have been supposed by Bender to contain the azoxy-group —N<(O)>N—, but this does not account for the great stability of the compounds towards oxidising agents, nor for the difficulty of reduction to diamidostilbenesulphonic acid. These properties are better explained by supposing that one of the nitrogen atoms is present as an azine group, whilst the other acts as a pentad and is combined with oxygen, the characteristic ring,

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C=NO—C
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C=N———C
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being therefore present. It appears probable that oxyphenine, chloramine yellow, and other dyes have a similar constitution.

Dr. F. E. Francis read an interesting paper on "Abnormalities in the behaviour of Ortho-derivatives of Orthamido- and Orthonitro-benzylamine," in which he drew attention to the remarkable influence on the behaviour of certain compounds of the presence of substituted groups in the ortho-position. Thus, for example, whilst most of the derivatives of orthamidobenzylamine yield a triazine when treated with nitrous acid, no such compound can be obtained from the orthamidobenzyl derivatives of orthotoluidine, orthanisidine, and orthochloraniline. A number of other instances were also adduced.

In a paper on "Nitrates: their Occurrence and Manufacture," Mr. W. Newton, after describing the ordinary method of extracting sodium nitrate, drew attention to the fact that the rocky stratum overlying the caliche contains 15 to 20 per cent. of nitrate, and that, although this has to be broken through before the caliche can be removed, the whole of the nitrate in it is at present neglected. The total production of nitrate, which was only 58,000 tons in 1860, amounted to 1,218,000 tons in 1895.

Prof. Ramsay gave a detailed account of the very remarkable and abnormal properties of helium. When this gas is fractionally diffused through a piece of pipe-stem, it may be separated into two portions, which differ in density, one of them having the density 1·874 and the other 2·133. These two portions nevertheless show exactly the same spectrum when they are examined under the same conditions, the difference between the spectra of the two fractions, which was observed by Runge and Paschen, being due to a difference of pressure. The refractive indices of the two portions are directly proportional to their densities, whilst this relation does not hold for other gases. A further abnormality exists in the rates at which the two fractions diffuse. The relative rate of diffusion of each fraction, compared with hydrogen, is about 15 to 20 per cent. more rapid than that calculated from the density, according to Graham's law. No satisfactory explanation has yet been arrived at, and the author proposes to submit other gases to fractional diffusion, in order to see whether they also yield two fractions of different density. Such a result would seem to point to the conclusion that the atoms of any substance are not all alike in weight, but vary about an average value, as suggested by Crookes. In the discussion which followed, Prof. Dixon pointed out that Graham's law of diffusion is based solely on experiments made with gases composed of polyatomic molecules. The President suggested that, as both helium and argon have no chemical affinities, it is not extravagant to look upon them as the first examples of a new kind of matter, differing in many respects from ordinary matter.

Dr. F. Hurter, in a paper on the "Manufacture of Chlorine by means of Nitric Acid," touched upon a phase in the development of the chlorine industry which had only been lightly treated in the presidential address. The principle of all the methods proposed for this purpose is the decomposition of hydrochloric acid by nitric acid, with the ultimate production of an oxide of nitrogen and free chlorine. The oxide of nitrogen is then reoxidised to nitric acid, and the process thus rendered continuous. All the methods hitherto proposed for this purpose labour under the fatal disadvantage that the treatment involved necessitates the concentration of a very large amount of sulphuric acid, the expense connected with which is fatal to the economical conduct of the process. The great difficulty of finding a material which will withstand the strong acids employed was brought forward by Mr. E. K. Muspratt as a further objection to the process.

Prof. J. Dewar gave an interesting account of several points in connection with "Low Temperature Research." Owing to the relative pressures of oxygen and nitrogen in the air, these two gases, although possessing different boiling-points, condense at almost exactly the same temperature when air is cooled. The method employed for measuring low temperatures consists in using a system of five thermo-junctions, so arranged that three of them are kept at 0°, whilst the other two are of the same metals but in the inverse order, so that when one of them is cooled, the other must be heated in order to preserve equilibrium. The low temperature to be observed is thus balanced by a high temperature which can easily be read off. Helium appears to be less easily condensible than hydrogen, and, moreover, possesses an abnormally low refractivity and real molecular volume. It is a remarkable fact that fluorine, the most active of all the chemical elements, in these respects resembles helium, the least active of all. The ratio of the refractivity of hydrogen to that of chlorine is almost the same as that of helium to that of argon, and it is quite possible that a substance may yet be discovered which will be intermediate between these two elements, just as fluorine is intermediate between hydrogen and chlorine.

A new and convenient form of Schrötter's apparatus for the estimation of carbon dioxide was exhibited by Dr. C. A. Kohn, who also, in conjunction with Dr. T. L. Bailey, showed an aspirator worked by a small electric motor. Dr. J. Haldane gave an interesting demonstration of his colorimetric method of estimating small amounts of carbon monoxide in the air, which has recently been described in NATURE (vol. liv. p. 207). Chemists will be interested to learn that the continued inhalation of a small proportion of the gas is much more dangerous than the momentary reception of a large quantity of it into the lungs. The best antidote is the inhalation of oxygen. Rapid motion almost always produces collapse when more than 30 per cent. of the blood has been saturated with the gas.

Chemical education formed the subject of no less than three communications to the Section, almost the whole of one sitting being devoted to this important question.

Sir H. E. Roscoe, in opening a discussion on "Chemical Education in England and Germany," laid emphasis on the necessity for a training in the methods of research for those who were to be the leaders of industry. He also pointed out that, although great industries have in the past arisen and are now developing in England, our manufacturers do not show the same appreciation of the value of a thorough scientific training as those of Germany. A further difficulty is offered by the inefficiency of many of our secondary schools. A number of speakers took part in the discussion, agreement with Sir H. E. Roscoe's position being generally expressed. Some difference of opinion existed, however, as to where the reform was to originate; many speakers being in favour of calling in parliamentary aid, whilst others advocated the gradual training of public opinion on the point.

The subject of "Science Teaching in Elementary Schools" was dealt with by Dr. J. H. Gladstone, on behalf of the Committee appointed to investigate this question. Continued progress is being made in the teaching of science subjects in elementary schools. The Committee is strongly of opinion that the time has come when the educational authorities should lay down a scheme of elementary experimental science to be taken by every scholar before he is allowed to specialise into the various branches of science. An all-important point is to train teachers to regard science teaching as a means of mental culture, and to teach accordingly.

In practical illustration of the requirements laid down in the last sentence of the report, Miss L. Edna Walter read a paper, in which she recounted her experience of the teaching of science in girls' schools. The system of instruction is practically a continuation of the kindergarten system, applied to elementary scientific notions. The children are taught by being made to perform, and even to originate, simple physical measurements and experiments, and are encouraged to form their own notes into books of reference. After passing through such a preliminary course, the children are introduced to a course in practical chemistry such as that suggested by Prof. Armstrong, or that adopted by the Association of Head Masters.

Several of the Committees of the Association presented important reports of the work carried out during the past year. Mr. C. F. Cross read the report of the Committee on "The Constituents of Barley Straw," The results obtained make it appear probable that the furfuroid constituents of the cereals are not, as has hitherto been supposed, secondary products of assimilation, but are directly built up by the plant. The furfuroids appear to form a very large group, comprising a number of different substances, which differ in their susceptibility to yeast, and yield osazones of different melting-points. The cereal plants are distinguished by the great proportion of grain which they produce, the amount being no less than 40 per cent. of the weight of the entire plant. It appears probable that during the period of production of seed, part of the necessary material is derived from the tissues of the stem and leaves.

Prof. Bedson presented the report of the Committee which has been engaged in the examination of the "Proximate Constituents of Coal." Ordinary coal is practically insoluble in all reagents, but can be converted by treatment with dilute hydrochloric acid and potassium chlorate into soluble products, the composition of many of which has been ascertained. By repeated treatment, no less than 75 per cent. of the coal can be dissolved. Brown coal appears to behave in a similar manner.

The Committee on "The Isomeric Naphthalene Derivatives" reports that work has now been begun on the important subject of isomeric change, especially in the sulphonic acids and other derivatives of the naphthols.

The report of the Committee on "Quantitative Methods of Electrolysis" is of very great practical value, and comprises four distinct papers. One of these deals with a very convenient arrangement of the necessary electrical instruments, whilst the others treat of the determination of bismuth, antimony, and tin. The separation of the last two can only be satisfactorily accomplished when there is less tin than antimony present.

The Committee on the "Action of Light on Dyed Fabrics" has also been active during the past year, a large number of dyed fabrics having been tested in this respect.

Advantage was taken of the favourable position of Liverpool to inspect several of the more important chemical works in the district.

GEOLOGY AT THE BRITISH ASSOCIATION.

THE President of this Section devoted his address mainly to stratigraphical geology, and we may well follow his example, and consider the papers presented to the Section in a similar order. Beginning with the oldest rocks, the first paper to claim attention is that by Sir W. Dawson, on pre-Cambrian Fossils. A valuable portion of this paper summarised our knowledge of the succession of Canadian rocks of high antiquity. He regards Matthew's *Protolenus* zone of New Brunswick as the equivalent of the *Olenellus* zone, and beneath this occurs a mass of greenish slates and conglomerates with a few doubtful fossils, such as brachiopods, ostracods, and protozoans. These Etcheminian rocks rest on the Huronian rocks, which contain worm-burrows, sponge spicules, and laminated forms comparable to *Cryptozoon* and *Eozoon*. Under these comes the Grenvillian system, or Upper Laurentian rocks, with *Eozoon* in the limestones, and at the base the orthoclase gneiss and hornblendic schists, which constitute the Lower Laurentian. The author exhibited a series of lantern slides showing the structure and composition of *Eozoon canadense*, amongst them being many very beautiful decalcified specimens, which none of those who criticised the paper attempted to explain.

Dr. G. F. Matthew's paper, which followed, endeavoured to recognise the larval characters of entromostraca, brachiopods, and trilobites in those faunas which preceded that of *Paradoxides*. He showed that in the young of trilobites from the *Paradoxides* beds the following larval characters were striking: (1) the predominance of the cephalic over the caudal shield; (2) the long, narrow, parallel-sided glabella; (3) the absence of eyes; (4) absence of movable cheeks; (5) absence or smallness of thorax; (6) the pygidium is at first small and of one segment. Such larval characters are to be observed in pre-Paradoxidian trilobites, and the author particularised *Ptychoparia*, *Solenopleura*, and the trilobites of the *Protolenus* fauna, such as the type-genus, *Ellipsocephalus*, and *Micmacca*. Similar conclusions were arrived at with regard to the Obolidæ, and to such ostracods as *Beyrichonia* and *Hipparicharion*.

Sir Archibald Geikie referred to some rocks, hitherto described as volcanic agglomerates, in Anglesey. Although the material of which the rocks were composed is volcanic, he now regards the brecciated and conglomeratic structure as due to earth-movement. The hard bands have been broken and rounded into fragments, the softer crushed and stretched out into a broken slate or phyllite.

Mr. Greenly dealt with a similar subject, and he referred to the quartzite lenticles, which about Beaumaris vary from one-quarter of an inch to one foot in length, but at Pen-y-parc attain a length of 700 feet, to the action of earth-movement. They were originally beds, but had been crushed and pinched off till they formed mere lenticles. The same author announced the discovery, in Central Anglesey, of bands of Sillimanite gneiss occurring where the gneiss is traversed by sills and bands of granite, to which there are no chilled edges. These Sillimanite gneisses are like those described by Mr. Horne and the author from Eastern Sutherland, where they are also associated with hornblendic gneiss of Hebridian aspect.

Ancient rocks of a very different character were dealt with by Mr. W. W. Watts, who gave some notes on his recent work in Charnwood Forest. The volcanic rocks had been mapped in detail on the six-inch scale, and the divisions correlated from one part of the country to another. Their age was still in doubt, but was not likely to be newer than Cambrian, while the unlikeness to the Cambrian system is shown at Nuneaton, and the direction of movement in the anticline pointed to a greater antiquity. A set of views was shown to illustrate the remarkable character of the scenery produced by the old rock, whose features dated back to pre-Triassic, and probably pre-Carboniferous, times. The old hills and valleys were beautifully preserved under a mask of Triassic marl, which was only now being slowly removed in places.

Messrs. Howard and Small made a very interesting communication on the rocks of Skomer Island, likewise illustrated by views of the coast and microscopic slides shown by means of the lantern. Indeed, it is to be hoped that the use of the lantern will in future be encouraged by the Section; so many of the papers gained new interest and importance from the bringing into the room, so to speak, of the sections described by authors. Both igneous rocks and sediments were described; the former appeared to include rhyolites, often with magnificent nodular structure, and basalts, both occurring as lava flows with accompanying beds of tuff and ash. The age of the rocks appears to be about equivalent to the Bala or Llandovery rocks of the mainland. The microscopic aspect of the felsites, basalts, porphyrites, and clastic rocks was also described.

In his paper on the "Geology of the Isle of Man," intended as an introduction of the subject to those members who journeyed thither on the following Thursday, Prof. Boyd Dawkins dealt first with the Ordovician massif, its crush-conglomerates, slates, and grits; next he passed to the Carboniferous Limestone, which in the south is associated with lavas, ashes, and intrusive dykes. The red sandstone and conglomerates to the east of Peel he regarded as Permian, and not of Lower Carboniferous or Old Red Sandstone age. Four borings through the drift of the north part of the island were next described: one of these reached Triassic marls with salt, of which a total thickness of 33 feet had been penetrated; the other three reached Carboniferous Limestone at depths varying from 168 feet to 947 feet, two of them passing through Permian strata, and one through Yoredale sandstones and shales.

Mr. Garwood presented a report on the work on Carboniferous zones, containing a plan of campaign and a list of observers who had undertaken to collect carefully from each horizon of the rock, in order to ascertain whether it was possible to break up this great division on palæontological lines. Mr. G. H. Morton, in his paper on the distribution of Carboniferous fossils, did not give much encouragement to this Committee, for he showed that, taking what are at present regarded as species of brachiopods and mollusca, they appear to have a very wide range through the four main divisions of the limestone in Llangollen, Flintshire, and the Vale of Clwyd. In this paper he dealt with rare and common species, and showed that it was only the latter which would be of any real use in identifying zones, on account of the rarity and sporadic distribution of the former.

Passing to newer rocks, Mr. H. C. Beasley referred to footprints from the Trias in the neighbourhood of Liverpool. A slab of sandstone in University College contains about ninety-five prints in an area of about three square feet. Prints of webbed feet appear to be rare; a recently discovered footprint may belong to a chelonian. Other forms have been recently described by the author in a paper published by the Liverpool Geological Society. Mr. Morton described a boring near Altcar, which showed that the New Red Marl in this district was not less than 971 feet thick, but no salt or saline springs were met with. Another boring, on the west of Bidston Hill, showed only 454 feet of Red Marl, and 244 feet of Keuper sandstones; it then passed into a fault, and penetrated the upper soft sandstone of the Bunter from 133 feet.

Mr. Montagu Browne described the true bone-bed of Aust Cliff, and the *Pullastra arenicola* bed which occurs above it; the latter he considered to be the equivalent of the so-called bone-bed of Westbury and Penarth, but the bone-bed of the Spinney Hills in Leicester he considered to be the same as that of Aust, a suggestion which was strengthened by the occurrence of *Ceratodus* in both. *Sphenonchus*, hitherto recorded from the Lias, has now been found in the bone-bed at Aust Cliff and at the Spinney Hills. The third and final report of the Committee on the Stonesfield Slate gives the following corrected section through these beds:—

		ft. ins.
Great Oolite	Limestone with corals ... ... Limestone and marls (oyster beds)	17 3
	Stonesfield Slate	5 3
Fullonian ...	Fawn-coloured (Chipping Norton) limestones, about	18 0
Inferior Oolite	Sandy limestones with some marl Lower limestones with vertical plant markings (Lower Estuarine Series	11 0
	Clypeus grit zone of *A. Parkinsoni*	13 0

About 12 feet of inferior Oolite strata can be made out below.

Mr. H. B. Woodward communicated some notes on sections along the London extension of the Manchester, Sheffield, and Lincolnshire Railway between Rugby and Aylesbury: Lower, Middle, and Upper Lias, Estuarine Beds, Great Oolite, Oxford Clay, and Boulder Clay are exposed in different cuttings; the agent which produced the last, had evidently been forced over a Great Oolite surface.

A large number of papers dealing with Glacial Geology were presented, and Monday was devoted to the discussion of them. The Erratic Blocks Committee reported that the Yorkshire Boulder Committee, and the Committees of Lincolnshire and of the Belfast Field Naturalists' Club had continued their systematic work. Special attention had been paid to the distribution of the Ailsa Crag rocks around the Irish Sea, to the Shap boulders down the Yorkshire coast into Lincolnshire and about Doncaster, and to the Norwegian erratics south and east from Staithes. A block of Shap granite had been found in the estuary of the Mersey. Mr. A. Bell described the Tertiary deposits of North Manxland, and attributed the shells in them to the period represented by the gravels of Wexford, Aberdeen, and Iceland; these are probably of Weybourn Crag age, and belong to the Pliocene period. Mr. Kendal gave an illustrated account of certain river valleys in Yorkshire which have changed their direction in part since the Glacial period. The Derwent flows west instead of east, the Swale and Wiske appear to have been formerly tributary to the Tees. The Nidd flows through a new gorge at Knaresborough and Plumpton, its old valley from Ripley past Brearton into the Vale of York having been dammed by drift, while the Wharfe has been similarly diverted into a gorge from Wetherby to Tadcaster; these diversions appear to have been due to drift deposited on the flank of a great eastern glacier. The same author, in conjunction with Mr. Lomas, described the glacial phenomena of the Clwyd Valley. There appears to have been no glacial submergence. The earlier drift seems to have been formed by Welsh ice, which was powerful enough to flow over even the Moel Fammau range; this was afterwards overpowered by ice bringing northern erratics, and compelled to divide into two streams, one of which escaped westwards by the Menai Straits; the other eastwards into the Midlands. Clay and shells like those of Lancashire occur in the northern part of the vale. Mr. J. Smith dealt with the marine shells in high-level drifts in Ayrshire, describing the order of succession, and giving a list of the shells, most of which are fragmentary. The Clava Committee described the shell-bearing clays in Kintyre, which had been investigated by borings carried out by the aid of grants from the Royal Society and the British Association. The wide extent of the clay was proved, a list of the shells given, and the composition and character of the deposit ascertained and accurately described. Dr. Callaway adhered to that interpretation of the superficial deposits of Shropshire, which attributes to them a marine origin. He laid special stress on their similarity to littoral deposits, their abundant marine fauna, and the ripple-marking so common in the sands. Chalk flints are abundant, and the author had found a Cornbrush fossil in the sands of Wellington. The hills and crags of the area do not present a glaciated outline.

The Hoxne Committee dealt with the very full exploration, undertaken by Mr. Clement Reid and his colleagues, into the palæolithic deposits of this place. They succeeded in establishing, by borings and excavations, that the boulder clay had been cut out into a valley of which no signs now appeared at the surface, as it had been filled with some remarkable lacustrine deposits in which plant remains had been found. The earliest of these indicated a temperate climate, the plant beds culminating in a bed of lignite. Succeeding these beds comes a black loam with the remains of arctic plants, and on the top of this is the sand, loam, and gravel in which palæolithic remains occur. No traces of human workmanship have yet been found beneath this upper layer, and hence the known human relics in this area are separated by two important climatic changes from the period of the boulder clay; the first from arctic to temperate, and the second back from temperate to arctic conditions. The work of this Committee appears to be well worthy of imitation, for it was undertaken and completed with great energy and a good deal of hard work within a year, and its results appear to admit of but one interpretation, that the human relics found here have nothing whatever to do with the Glacial period, with which they were once supposed to have been connected.

The last Glacial paper that we need notice is that by Prof. Hull, who suggested that the great uplift of the West Indian Islands might have contributed to cause the cold of the glacial period by compelling the Gulf Stream waters to flow directly into the North Atlantic without passing into the Gulf of Mexico. By thus shortening its journey, the author calculated that the water would be delivered into the North Atlantic ten degrees colder than was at present the case. The author also referred to the amount of high land in the northern hemisphere as another contributing cause; and in both these suggestions he was supported by Sir William Dawson, who spoke in the discussion on the paper.

Mr. Mellard Reade gave evidence of land oscillation near Liverpool, derived from river-channels buried in drift, which itself often has an eroded surface covered by estuarine deposits, in turn overlaid by forest-beds made up of the remains of oak, Scotch fir, and birch; the latter are now just at the sea-level, or even a little below it. Three land surfaces appear to be present—one pre-glacial, the second post-glacial, and a third, still later, represented by the peat beds and submerged forests. Mr. Morton, dealing with the sea-coast of Wirral, showed that near the Leasowe embankment the sea had encroached 85 yards between 1871 and 1896, and at Dove Point the erosion was about 4 or 5 yards per annum from 1863 to the present. Mr. H. N. Ridley has not yet been able to begin excavations in the Singapore caves, but he has seen the white snake which inhabits them and is said to feed on bats; it is not blind, but has large eyes.

On the subject of Palæontology there is little to record, and in that of Petrology still less. Short interim reports were presented by the Eurypterid, Phyllopod, Moreseat, and Type Specimen Committees. Prof. Seeley described a skull of *Diademodon*, brought from Wonder Boom by Dr. Kannemeyer. The reptile possesses ten molar and premolar teeth, and its post-frontal bone differs from that of *Ornithorhynchus* in its different relation to the small brain cavity, and in contributing to form the circular orbit of the eye. Mr. Seward announced that *Glossopteris* and *Vertebraria* had been found near Johannesburg, associated with specimens of *Lepidophloios*. A similar association has lately been recorded by Prof. Zeiler in Brazilian plant-bearing beds.

Dr. Johnston-Lavis criticised the interpretation placed by Messrs. Weed and Pirsson in an igneous mass in the Highwood Mountains, Montana. Square Butte is a laccolite in Cretaceous sandstone, composed of an outer and upper layer of basic rock, called *Shonkinite* by them, and a core of syenite. Dr. Johnston-Lavis gave several reasons for supposing that the interpretation of this by differentiation on the spot was an error. Such differentiation would not result in a curved plane of separation, nor in the denser rock occurring at the top. He preferred to think the two rocks were separate intrusions, perhaps from the same magma originally, but that the upper part had been intruded first, and had acquired its basic character by absorption in passing through limestone or other basic rock walls. By the time the later intrusion of the syenitic magma took place, the rock walls had absorbed so much silica that little further change in its composition occurred. Dr. Busz recorded the discovery of corundum as a product of contact metamorphism on the southern flank of the Dartmoor granite, and amongst other minerals described the occurrence of cassiterite inside crystals of andalusite similarly produced.

A number of papers dealing with problems in physical and dynamical geology were presented. Prof. Seeley described the occurrence of false bedding in clays of Reading age, and also in similar rocks of Wealden date. Mr. Logan Lobley gave evidence to show that lava could not be derived from any great depth down in the earth's crust, and also that the shrinking of the globe since Cambrian times was a practically negligible factor in the contortion of rocks. Dr. Walther inquired, in general terms, whether evidence of fossil deserts was not likely to be obtained in the geological record. The Coral Boring Committee had to record that, in spite of two attempts, the site chosen for the operations, Funafuti in the South Pacific, had proved unsuitable; a mixture of quicksand with great coral blocks resisted all attempts made to bore through it. Time had not allowed of the transfer of apparatus and observers to another island, and consequently the project had been abandoned. Much good observational work in zoology and anthropology had, however, been carried out by the members of the expedition.

Mr. Vaughan Cornish illustrated the different types of ripple-marking produced by the sea (symmetrical and knife-edged), by streams (symmetrical and rounded), and by wind (unsymmetrical). Mr. Wethered gave an account of the general character of the ocean depths at different geological epochs, alluding mainly to the chief types of lime-secreting organisms found in each great limestone mass. He described with lantern illustration many of the encrusting organisms, such as *Girvanella* and *Mitcheldeania*. Mr. Kendal pointed out the effects of solution on organisms with aragonite, and on those with calcite shells; he concluded that the readier solution of the former was the cause of the bathymetrical limit defining the extent of Pteropod ooze. In a separate communication the same author concluded that the disappearance of aragonite shells from the Upper Chalk, and the preservation of calcite organisms, argued that this rock was deposited at a depth of at least 1500 fathoms, a conclusion supported by Dr. Hume and Mr. Jukes-Browne from entirely different standpoints. Prof. Milne gave a minute report on his seismological observations during the year in the Isle of Wight. His instruments enabled him to feel the larger earthquakes at great distances, even right through the earth. From his observations on August 31, he concluded that there must have been a violent earthquake at some spot about 6000 miles distant from his observatory; a distance which probably indicates that the site of the earthquake was Japan. News of such a shock has been received, but of its intensity we at present know nothing.

It only remains to notice that the Photographs Committee recorded about 200 new geological photographs as received during the year; but that still many portions of the British Isles are woefully ill-represented in the collection which, although now lodged at Jermyn Street, still hopes to receive marked increases during the next few years.

GEOGRAPHY AT THE BRITISH ASSOCIATION

THE Geographical Section was perhaps more largely attended at Liverpool than at any previous meeting of the Association, a result due in some measure to the convenient situation and beautiful construction of the large hall set apart for its meetings, and also due in part to the numerous lantern exhibitions of photographs of little-known regions. The number of papers and reports read was thirty-four, considerably more than usual, and meetings were held on five days. It was impossible, owing to the private arrangements of the gentlemen who read papers, to arrange for a proper classification of the work of the various days, and, therefore, in the following notes the strict order of the papers is not followed.

The presidential address, by Major Darwin, dealing with the scientific principles by which the development of Africa for commercial purposes should be directed, was particularly adapted for the place of meeting, on account of the very close relations between Liverpool and West Africa. Mr. G. F. Scott Elliot, in a communication on the influence of African climate and vegetation on civilisation, made an effort to generalise on the same subject from a different side. He divided Africa into four regions: (1) *The wet jungle*, which is marked roughly by the presence of the oil or coconut palm, numerous creepers —especially the Landolphia (rubber vines)—and such forms as Sesamum, *Cajanus indicus*, and Manhihot as cultivated plants. This region is characterised by great heat and continuous humidity, without a season sufficiently dry to leave a mark on the vegetation. (2) *The deserts*, characterised by xerophytic adaptations, by Zilla, Mesembryanthemum, *Capparis sodada*, &c. The climate is distinguished by possessing no proper rainy season whatever. (3) *The acacia and dry grass region*, characterised by acacias, tree euphorbias, giant grasses, or frequently grassy plains in which each tuft of grass is isolated. The climate is marked from all the remaining regions by distinct dry and wet seasons; the dry season occupies from five to nine months, and leaves a distinct mark on the vegetation. This region occupies practically all Africa between 3000 feet and 5000 feet, and also extends below 3000 feet wherever the above climatic conditions prevail. (4) *The temperate grass and forest area* is distinguished by having at no season of the year such drought as leaves a permanent mark on the vegetation, by a moderate rainfall, by moderate heat, &c. The grass resembles the turf of temperate countries, and the forest shows the same sorts of adaptation as occur in temperate countries. This region is found between 4600 feet and 7000 feet. Of these regions the wet jungle is everywhere inhabited by small tribes of a weak enfeebled character, and in the lowest stage of civilisation. The desert, on the contrary, is the home of exceedingly healthy and vigorous tribes. The Acacia region is everywhere rather densely populated, but no emigrations in large numbers have taken place from it. The temperate grass and forest regions above 5000 feet are the only places in Africa that have acted as swarming centres of population. The character of the native races inhabiting them is vigorous and turbulent, and raiding is often carried on. The differences in climate, vegetation, and abundance of wild and domestic animals, explain why it is that these races only have, except in one instance, resisted both Arab and European.

Sir Charles Wilson gave an able and most timely discourse on the geography of the Egyptian Sudan, dwelling especially on the resources of the country, and the importance of opening out trade-routes between the Sudan and the sea; the best method of doing which appeared to him to be the construction of such a line as the Berber and Suakin railway. Lieut. Vandeleur read an interesting account of his recent journey from Uganda to the Upper Nile country, giving an excellent idea of the physical geography and resources of the region, and dwelling in particular on the difficulties to navigation caused by the floating vegetable carpet or *sudd* which frequently blocks the rivers. Amongst other slides he showed the first photographs which have been taken of the Murchison Falls on the Victoria Nile. The Rev. C. H. Robinson gave an account of his experiences amongst the Hausa in the Niger district; and Mr. H. S. Cowper gave some account of a second short journey made in March 1896, in the Tarhuna and M'salata districts of Tripoli. During his visit he examined or noted about forty additional megalithic ruins of the type called by the Arabs Senam. The route taken was by the Wadi Terr'qurt, a fine valley running parallel to the Wadi Doga, by which he entered the hills in 1895. He then proceeded to the districts of Ghirrah and Mamurah, south of Ferjana, through which runs a great wadi, the Tergilat. This reaches the sea at Kam, twelve miles south-east of the ruins of Leptis Magna, and is undoubtedly the Cinyps of Herodotus. On reaching the coast a week was spent at the ruins of Leptis and the Kam district, and the return journey was made to Tripoli by sea.

The Committee on African Climatology (President, Mr. E. G. Ravenstein; Secretary, Mr. H. N. Dickson) presented a full and satisfactory report, giving abstracts from twelve stations in tropical Africa. In recognition of the useful work done by this Committee, it was reappointed with a small grant.

Next to Africa the Arctic regions naturally commanded a large share of the attention of the Section. Preliminary accounts of three expeditions were given. Mr. J. Scott Keltie, who had just returned from taking part in the Norwegian welcome to Dr. Nansen, described his impressions of the explorer and his companions, gave an outline of the work they had done, laying special stress on Prof. Mohn's high estimate of the value of the meteorological and magnetic observations, and announced that Dr. Nansen would probably visit this country in November in order to give a full account of his great journey before the Royal Geographical Society. Mr. Montefiore Brice gave an interesting report on the progress of the Jackson-Harmsworth expedition, and showed by the lantern a number of photographs taken in Franz Josef Land, including some of the arrival of Dr. Nansen at Mr. Jackson's headquarters. He stated that next year it was probable that the expedition would be reinforced by two ships to push forward exploration in the sea north of Franz Josef Land. Sir W. Martin Conway described his experiences in crossing the interior of Spitzbergen last summer, the soft condition of the snow and the marshy character of the land having interposed obstacles which could not have been foreseen from the observations of earlier travellers. Mr. Frederick W. Howell and Dr. K. Grossman exhibited a number of striking pictures of the scenery of little-known parts of Iceland, the former dealing mainly with glacial, the latter with volcanic forms.

Other descriptive papers, in all cases admirably illustrated, were contributed by Mr. W. A. L. Fletcher, on his journey across Tibet from north to south, on which he accompanied Mr. and Mrs. St. George Littledale; by Mr. H. W. Cave, on the ruined cities of Ceylon; and by Mr. A. E. FitzGerald, on his crossing of the Southern Alps in New Zealand. Mr. FitzGerald announced that he was about to a lead a party to the Southern Andes, where he hoped to make the first ascent of Aconcagua.

Sir James Grant gave an eloquent address on the gold discoveries in Canada, and Mr. E. Odlum, of Vancouver, described the contested territories on the borderland of British Columbia and Alaska. These papers attracted the greater attention on account of the approaching visit of the British Association to Toronto. Mr. Ralph Richardson initiated a short discussion on the boundary lines in British Guiana, attributed to Sir Robert Schomburgk.

The geography of the British Islands was not lost sight of at the meeting. The Rev. W. K. R. Bedford described some old tapestry maps of parts of England, woven at Weston in the last quarter of the sixteenth century, now preserved in the Bodleian Library at Oxford, and in the Chapter-house at York. They are on the scale of about four inches to one mile, and show some features which do not appear on the maps in contemporary atlases. Dr. H. R. Mill called attention to his scheme for a geographical memoir to accompany the maps of the Ordnance Survey, on a specimen of which he is now at work. Dr. Gulliver, of Harvard, gave an interesting discussion of the coast-forms of Romney Marsh, dwelling on the origin of the cuspate foreland of Dungeness, and pointing out the importance of treating such problems according to the genetic cycle. Mr. B. V. Darbishire showed by a series of maps of the South Wales coal-field, how the physical structure of the country controlled the distribution of population, and the construction of lines of communication.

There were several papers dealing with physical geography. Mr. John Coles gave a demonstration of two methods of photographic surveying, exhibiting the cameras used for each. He expressed his conviction that photographic methods were bound to take a very important place indeed in the surveys of the immediate future. Prof. J. Milne discussed earthquakes and sea-waves, with special reference to recent occurrences in Japan; and Mr. H. N. Dickson gave a short account of the work which he has in progress on the temperature and composition of the water of the North Atlantic. Mr. A. J. Herbertson exhibited some of a series of maps of the mean monthly distribution of rainfall for the world, which he is at present engaged in compiling, in collaboration with Dr. Buchan. They present the facts of the distribution of rainfall for the first time in a form admitting of the study of seasonal variations.

Mr. Vaughan Cornish contributed one of the most valuable and original papers read to the Section, in the form of a practical study of the formation and distribution of sand-dunes. He said that in the sorting of materials by wind the coarser gravel is left on stony deserts or sea-beaches, the sand is heaped up in dune tracts, and the dust (consisting largely of friable materials which have been reduced to powder in the dune district itself) forms widely-scattered deposits beyond the limits of the dune district. Three principal factors operate in dune tracts, viz. (1) the wind, (2) the eddy in the lee of each obstacle, (3) gravity. The wind drifts the fine and the coarse sand. The upward motion of the eddy lifts the fine sand, and, co-operating with the wind, sends it flying from the crest of the dune. The backward motion of the eddy arrests the forward drift of the coarser sand, and thus co-operates with the wind to build the permanent structure of the dune. Gravity reduces to the angle of rest any slopes which have been forced to a steeper pitch either by wind or eddy; hence in a group of dunes the amplitude cannot be greater than (about) one-third of the wave-length. This limit is most nearly approached, owing to an action which the author explained, when the wind blows alternately from opposite quarters. Gravity also acts upon the sand which flies from the crests, causing it to fall across the stream lines of the air. To the varying density of the sand-shower is due the varying angle of the windward slope of dunes. When there is no sand-shower the windward becomes as steep as the leeward slope. When the dune tract is all deep sand the lower part of the eddy gouges out the trough, and, when the sand-shower fails, the wind by drifting and the eddy by gouging, form isolated hills upon a hard bed. In a district of deep sand, negative dunes ("Suljes") may be formed. The encroachment of a dune tract being due not only to the march of the dunes (by drifting), but also to the formation of new dunes to leeward from material supplied by the sand-shower, it follows that there is both a "group velocity" and a "wave velocity" of dunes. Since the wave velocity decreases as the amplitude increases, a sufficiently large dune is a stationary hill, even though composed of loose sand throughout. Where material is accumulated by the action of tidal currents, forms homologous with the ground plan of dunes are shown upon the charts. The vertical contours and the movements of subaqueous sand dunes are conditioned by the different tactics of sand-shower and sand-drift.

The educational aspect of geography was brought forward on several occasions. The interim report of a Committee on Geographical education in this country appointed last year was read; the material collected by its Secretary (Mr. Herbertson) is very voluminous, but being still incomplete, its final consideration was postponed until next year. Mr. Herbertson also showed an ingenious piece of apparatus designed to explain the theory of map projections by a shadow of a skeleton hemisphere made up of wire meridians and parallels thrown on a sheet of paper by a candle, the position of which can be varied by sliding it along a bar. Mr. A. W. Andrews, of Malvern Wells, gave a thoughtful paper, from the standpoint of a practical teacher, on the importance of combining geographical and historical teaching in schools. A very similar subject was treated, with philosophic thoroughness, by Mr. G. G. Chisholm, under the title of "the relativity of geographical advantages." In his opinion geographical advantages may be considered: (1) As relative to the physical condition of the surface of a country, *e g.* the extent of forests, marshes, &c. The former and present relative importance of Liverpool and Bristol may be explained, in part at least, by changes that have taken place under this head. Also the difference in direction by some of the great Roman roads and those of the present day, and the consequent fact that some important Roman stations in Britain are not now represented even by a hamlet. (2) As relative to the political condition of a country and of other countries. (3) As relative to the state of military science. Under these two heads the difference in the situation of the Roman wall between the Tyne and Solway and the Anglo-Scottish boundary suggests some considerations. Also the difference in the situation of some important Roman towns or stations and their modern representatives (Uriconium, Shrewsbury; Sorbiodunum, Salisbury). (4) As relative to the state of applied science—well illustrated in this country in the history of the iron and textile industries. (5) As relative to the density of population—another impotrant consideration in the industrial history of our own country. (6) As relative to the mental attitude of the people where the geographical advantages exist. Many Chinese travellers and students of China have recognised the excessive reverence for ancestors in that country as one great hindrance in the way of turning the advantages of the country to account.

Taken altogether the proceedings of Section E show that geography, viewed as a science, is in a progressive and healthy condition in Great Britain at the present time. Increased attention is being devoted to the theoretical aspects, while there is certainly no diminution in the enterprise of explorers or in their power of conveying a clear idea of the new lands and seas they visit.

SCIENCE IN THE MAGAZINES.

DURING the last twenty or thirty years there has been a very large increase in the number of insane under detention in asylums. This increase, Mr. Thomas Drapes argues with much force in the *Fortnightly*, is mainly due to accumulation of chronic cases, and does not in itself necessarily indicate any increase in insanity in the sense of increased liability to mental derangement on the part of the community. In fact, the number of insane under care could double itself in the course of a comparatively short period of years without the addition of a single case to the number of those annually attacked. For these reasons, and because lunacy statistics only show a rise of 0·3 per 10,000 (from 4·5 to 4·8) of first admissions in twenty years, Mr. Drapes holds that no alarming increase has occurred in liability to insanity in England.

Twelve months ago, Dr. A. R. Wallace brought together, in the *Fortnightly*, a number of interesting facts which seemed to show that mouth-gesture was the chief factor in the origin of language. He pointed out that a considerable number of the most familiar words are so constructed as to proclaim their meaning more or less distinctly by movements of various parts of the mouth used in pronouncing them, and by peculiarities in breathing, or in vocalisation. Mr. Charles Johnston meets Dr. Wallace on his own ground by asking him, in this month's number of the *Fortnightly*, the purport of a quatrain of which two lines are:—"Jambvâmraloddhrakhadira—sâlavet rasamâkulam, Padmakamalakaplaksha—kadambodumbarâortam." This is a part of a highly-coloured description which has been the admiration of centuries, and Dr. Wallace is invited to declare the meaning it expresses. But Mr. Johnston does not confine himself to setting conundrums; he shows how very difficult it is to reach any fixed principle on the lines laid down, how extremely fugitive and contradictory the expressiveness of words is. It is suggested that more sound conclusions as to the beginnings of language will be derived from the study of "The World's Baby-Talk." Just as embryology has shown that each individual climbs up his own genealogical tree, so, by watching the development of speech in a baby, we can see the first steps in articulate language. Mr. Johnston elaborates this idea, and shows that certain languages, chosen for their extreme phonetic simplicity, exhibit a striking analogy with baby-talk.

A third article in the *Fortnightly* is by Mr. H. G. Wells, and the title is "Human Evolution, an Artificial Process." Starting from well-known biological facts, suggestive conclusions in ethics and educational science are reached. "Assuming the truth of Natural Selection," says Mr Wells, "and having regard to Prof. Weismann's destructive criticisms of the evidence for the inheritance of acquired, there are satisfactory grounds for believing that man (allowing for racial blendings) is still mentally, morally, and physically, what he was during the later Palæolithic period, that we are, and that the race is likely to remain, for (humanly speaking) a vast period of time, at the level of the Stone Age. The only considerable evolution that has occurred since then, so far as man is concerned, has been, it is here asserted, a different sort of evolution altogether, an evolution of suggestions and ideas." Taking the average rate at which rabbits breed, something like two hundred generations would descend from a single doe in a century, and would be subjected to the process of Natural Selection, whereas only four or five human generations would be amenable to the same process in the same time. "Taking all these points together, and assuming four generations of men to the century—a generous allowance—and ten thousand years as the period of time that has elapsed since man entered upon the age of Polished Stone, it can scarcely be an exaggeration to say that he has had time only to undergo as much specific modification as the rabbit could get through in a century." The difference between civilised man and the Stone Age savage arises from the development of speech and writing, so that, to follow the argument, civilised man represents (1) an inherited factor, the natural man, who is the product of natural selection, and (2) an acquired factor, the artificial man, the highly plastic creature of tradition, suggestion, and reasoned thought. Obviously, then, education should aim at the careful and systematic manufacture of the latter factor.

An article by Mr. W. K. Hill, in the *Contemporary*, may be taken as an expression of the general opinion that the development of the "artificial factor," referred to by Mr. Wells, is not carried out on intelligent lines. "In the secondary school the great Scholarship Steeplechase is the chief occupation. In the university the spirit of examination, like a huge cuttle-fish, is gradually winding its multiple tentacles around every effort at original thought and ideal culture." Geometry is studied, says Mr. Hill, as an abstract concatenation of puzzles, instead of as a means to educate the faculty of reasoning. "We teach always, but seldom educate, and yet 'Instruction,' as Locke truly observes, is but the least part of education. We do not try to develop mind—we only try to stuff brain." But while men of science have regretfully to confess that the indictment has much evidence to support it, they may point, at the same time, to the growth of a better system of instruction in many of our schools and colleges—a system which makes the pupil investigate for himself natural phenomena and laws, and develops his faculties of observation and reasoning.

From mediæval history Mr. Boris Sidis has drawn a number of instances of mental epidemics which spread from one end of Europe to the other, and left thousands of people struggling in convulsions of hysterical insanity, and performing acts as if their voluntary movement had been lost, or greatly limited. To this class of mental epidemics belong the pilgrimage mania, Crusade mania, and dancing manias. These epidemics, and others, are described in the *Century*. In experiments in suggestion made by Mr. Sidis in the Psychological Laboratory at Harvard College, he found that when the attention, in perfectly normal people, was concentrated on one point for some time, say twenty seconds, commands suddenly given at the end of that time were very often immediately carried out by the subjects. Concentration of attention upon one point appears, therefore, to be highly favourable to suggestibility, and Mr. Sidis is of the opinion that—"The mediæval man was in a similar state of light hypnosis. This was induced in him by the great limitation of his voluntary movements, by the inhibition of his will, by the social pressure which was exerted on him by the great weight of authority to which his life was subjected. . . . Bound fast by the strings of authority, mediæval men were reduced to the state of hypnotic automata." All the conditions were thus favourable for the production and wide extension of mental epidemics. Mr. Sidis thinks that these epidemics, religious manias, political plagues, speculative insanities, financial crazes, and economical panics, from which society in general, and democracy in particular, continually suffer, point to the extreme suggestibility of gregarious man.

Another article in the *Century* is the third paper made up of extracts from the journals of the late Mr. E. J. Glave, and it offers some very interesting glimpses of a part of the journey of this young explorer from the mouth of the Zambesi diagonally north-west across Central Africa to the mouth of the Congo.

The new series of *Science Progress* begins with the October number. Mr. G. J. Symons traces the early history of scientific weather forecasting in the new number; and Mr. Alfred Harker surveys some of the modern aspects of petrology in relation to igneous rocks, only considering in the present paper the distribution of the rocks in time and space. In a paper on recent work upon visceral and allied nerves, Dr. T. Gregor Brodie gives a long account of the present state of knowledge of the subject. Some brief notes on parasites are contributed by Mr. A. E. Shipley. Dr. K. Gœbel deals with "Teratology in Modern Botany," discussing in his paper the origin of malformations, and the bearing of these upon the problems of the origin of the organic forms. Prof. Sydney J. Hickson writes on "The Nervous System of Cœlentera," and Mr. A. C. Seward on "Palæobotany and Evolution."

Attention may profitably be called to a few general articles in the reviews. Dr. George M. Dawson, Director of the Geological Survey of Canada, writes on "Canada as a Field for Mining Investment," in the *National*. In the *Contemporary*, Mr. J. Allanson Picton discusses the Report of the Vaccination Commission, and the same review contains a narrative of travel in Sumatra, by Mr. Claes Ericsson.

Among the popular articles on scientific topics in the magazines received are the following:—Mr. W. H. Hudson, in *Longman's*, writes enthusiastically on the song of the wood-wren, with the laudable object of attracting more attention to that somewhat obscure bird. *Chambers's Journal* contains an article on after-damp in coal-mines, based upon Dr. Haldane's Blue-Book on the explosion at the Tylorstown Colliery in South Wales.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

Cambridge.—Prof. Bradbury has been appointed assessor to the Regius Professor of Physic; Prof. Allbutt, F.R.S., an elector to the Downing Professorship of Medicine (Pharmacology); Prof. Macalister, F.R.S., an elector to the chair of Zoology and Comparative Anatomy; Sir G. G. Stokes, F.R.S., and Prof. Darwin, F.R.S., electors to the Isaac Newton Studentship in Physical Astronomy; and Mr. H. M. MacDonald, of Clare, with Mr. G. T. Bennett, of Emmanuel and St. John's, moderators in the Mathematical Tripos o f1897.

Mr. W. S. Adie, bracketed senior wrangler in 1894, and Mr. E. T. Whittaker, bracketed second wrangler in 1895, have been elected to fellowships at Trinity College; Mr. H. S. Carslaw, bracketed fourth wrangler in 1894, has been elected to a studentship of £120 for advanced study and research.

The new regulations for advanced study and research appear to have become widely known and appreciated. Over a score of "advanced students" have already been admitted to the several colleges, and have commenced their post-graduate courses in a large variety of departments, scientific and literary.

A fire has destroyed the main building of Mount Holyoke College, including all the dormitories, and involving a loss of 100,000 dollars.

The lamp of science is to shed its beams (through lantern slides) in East London this winter. The Rev. H. N. Hutchinson will lecture at the Whitechapel Free Public Library Museum, on November 10, upon "Extinct Monsters," and on December 8, Mr. G. R. Murray will discourse upon "The Meadows of the Sea." Admission to the lectures is free by ticket, to be obtained in the Museum and Lending Library.

The following awards of entrance exhibitions and scholarships in medical schools have been announced:—King's College: Sambrooke exhibitions of £60 and £40, respectively, to Arthur Edmunds and W. W. Campbell; Warneford Scholarships of £25 each for two years, to J. A. Drake and C. J. Galbraith. Charing Cross Hospital Medical School: Livingstone Scholarship, 100 guineas, Mr. C. Jerome Mercier; Huxley Scholarship, 55 guineas, to Mr. F. B. Pinniger; Epsom Scholarship, 110 guineas, Mr. L. C. Badcock; University Scholarships, 60 guineas each, Mr. H. S. Clogg and Mr. R. J. Willson; Entrance Scholarships are also awarded to Mr. W. B. Blandy, 60 guineas, and Mr. Charles H. Fennell, 40 guineas.

The following are among recent announcements:—Dr. H. Minkowski, professor of mathematics in the University of Königsberg, has been called to the Zürich Polytechnic Institute; Prof. Erismann has, for political reasons, had to resign the chair of Hygiene in the University of Moscow; Mr. F. B. Loomis to be assistant in biology, and Mr. E. S. Newton assistant in chemistry at Amherst College; Mr. P. C Nugent to be instructor in civil engineering, and Mr. R. E. Dennis to be instructor in chemistry at Lafayette College; Miss A. M. Claypole to be instructor in zoology, and Miss J. Evans instructor in botany at Wellesley College; Miss M. E. Maltby has been appointed acting professor of physics at the same college during the absence of Miss S. F. Whittinghead.

A provisional Committee has been formed to obtain funds and make the preliminary arrangements to establish a county museum for Hertfordshire. Earl Spencer has generously offered a site in St. Albans adequate to the erection of the proposed museum, on the conditions that a representative body of the county and of St. Albans were favourable to the scheme, and that sufficient funds to erect and maintain it were raised. The Committee hope to raise a sum of about £5000, about £3000 of which should be expended upon a building and fittings, and the remainder be invested as an endowment fund. It is suggested that when completed, in order to secure perpetuity to the museum, it should be vested in the hands of the County Council, and its management given to a Committee chosen from representatives of the County Council, the Hertfordshire Natural History Society, and the St. Albans Architectural and Archæological Society, and other gentlemen interested in the Arts, sciences, and archæology of the county.

The Cheshire Agricultural and Horticultural School has just been formally opened. The County Council have secured Saltersford Hall, and farm of 100 acres, on a lease of forty-two years, and have spent £10,000 in the requisite alterations and additions, stocking the farm and garden, and furnishing the house and school. The hall will provide accommodation for sixty students with the necessary teaching staff. A schoolroom, laboratory, lecture room, and workshops have been built and furnished with all the essentials of a large educational establishment. Three glass-houses will be devoted to the growth of grapes, peaches, nectarines, and similar fruit. There are also three other detached greenhouses, and these are to be utilised for the cultivation of tomatoes, melons, flowers; while an orchard has been planted to provide instruction in fruit culture. A herd of fifteen or sixteen cows will be kept, comprising Ayrshires, Jerseys, and Herefords, in order to bring under the attention of the students the merits of various breeds. It is intended that the College shall afford means for a thorough practical and technical training for students of agriculture and horticulture.

Speaking on Saturday, at the opening of the new session of University College, Liverpool, Sir William Priestley said: "One of the most striking features in the organisation of the several colleges comprising the Victoria University is the great and laudable generosity and public spirit displayed by local benefactors, who have subscribed largely to endow them with appliances for successful teaching. I believe there is latent public spirit in London, but if it exists it does not take so distinct a form. What is everybody's business becomes nobody's business, and great institutions like University and King's College are languishing for want of funds, while the provincial colleges find generous benefactors concentrating attention upon them, and giving endowments and donations which are the envy of their metropolitan sisters. Government aid is urgently needed both in the London and provincial colleges, in view of the increased cost of scientific education and the necessity of making it as cheap as possible to the students. It is the Government aid in Germany and elsewhere on the continent which enables the great teaching institutions there to compete at such advantage with the universities and colleges of this country, and to outdistance them in scientific and industrial products."

STUDENTS of the Royal College of Science, South Kensington, have reason to be proud of the heritage to which they have succeeded. Huxley took the greatest interest in the College, with which he was connected until his death; and there he introduced the system of teaching which has revolutionised the methods of training in biology. Prof. J. W. Judd dwelt upon this fact in the course of an address delivered to the students of the College on Wednesday in last week, and his words should make them all feel that they are connected with a great institution, whose interests they should watch over, and whose position they should endeavour to sustain, by keeping the aims and work of their late noble Dean in view. Five years has yet to elapse before the College celebrates its first jubilee. Nevertheless, if the students remember how recent has been the recognition of that culture in which scientific training takes a leading part, as distinguished from that derived from purely literary pursuits, they may indeed be proud of the position which the College occupies. The prizes and medals won in the College this year were distributed as follows:—Royal Scholarships: First year's, J. W. Barker, C. E. Goodyear, E. R. Verity, and E. T. Thomas; second year's, W. H. White and E. Smith. The Edward Forbes' Medal for Biology, E. C. Horrell; the Murchison Medal for Geology, E. E. L. Dixon; Tyndall Prize for Physics, E. T. Harrison; Bessemer Medal for Mining, J. Crowther; and Frank Hatton Prize for Chemistry, G. T. Morgan.

THE Technical Education Board of the London County Council are evidently determined to provide instruction for all the sorts and conditions of men and women in the metropolis. We are glad to see the completeness of the arrangements they have made for the present winter. The most exacting critic will surely find it difficult to point to any class of the community which has been forgotten. The perusal of recent numbers of the *Technical Education Gazette* shows that the workers of London can have the benefit of instruction from the leading professors of the metropolitan colleges at merely nominal fees—for nothing indeed, in not a few cases. At the Central School of Arts and Crafts, the teaching will be specially adapted to those employed in the different parts of the building trades, for workers in glass, bronze, and lead, enamellers, and the various branches of the gold and silver trades. No attempt will, however, be made, to meet the requirements of the amateur. It must be noted that there is no lack of attention to the necessity of providing a sound scientific foundation on which to build up a particular technical knowledge. The advanced evening science classes, which are being held both at University and King's Colleges, will be of immense value, and it will be a cause for the profoundest regret, if these courses are not well attended. It will soon be impossible to find any part of London where there is no thoroughly equipped and properly staffed technical school, and such a fact speaks volumes for the energy and wisdom of the Board's advisers.

SCIENTIFIC SERIALS.

Symons's Monthly Meteorological Magazine, September.—The first daily weather map, sold in the Great Exhibition of 1851. Mr. Symons publishes a reduced copy of a series of such maps issued daily from August 8 to October 11, 1851, Sundays excepted, indicating the conditions of the atmosphere in several parts of Great Britain at 9h. a.m. Twelve years later, in September 1863, M. Le Verrier issued his weather maps from the Paris Observatory, which are now continued in an extended form by the Paris Meteorological Office.—Dry periods. On August 1, Mr. Symons wrote to the *Times*, pointing out that at Camden Square, London, the rainfall of the first seven months of this year (8·27 inches) is only 60 per cent. of the average for the thirty-seven years 1859–95; during the ten years 1887–96 the average for the same period was only 11·65 inches, while for the twenty-eight years 1859–86 it was 14·24 inches. Commenting on this, Mr. J. M. Fraser, of Lochmaddy, Hebrides, states that the average rainfall for the first eight months of the twelve years 1884–95 is 27·78 inches, and the average for the same period in 1890–95 was 30·11 inches, while this year the total for the first eight months is 34·86 inches. It is noteworthy that the deficiency in the south of England should be made up by a heavy yearly increase in the opposite extreme of the kingdom.

The papers of most general interest in the numbers of the *Journal of Botany* for August, September, and October are:—On the new genus of Commelynaceæ (*Spatholirion*), from the Malay Peninsula, by Mr. H. N. Ridley, with a plate; on the displacement of species in New Zealand, by Mr. T. Kirk, especially the crowding out of native species by naturalised plants, and the changes caused by cultivation, the introduction of parasitic diseases, and other human agencies; on Algæ from Central Africa, by MM. W. and G. S. West, with illustrations, and diagnoses of several new species of desmids; on new or critical marine Algæ, by Mr. E. A. L. Batters; a revised list of the British Caryophyllaceæ, by Mr. F. N. Williams; with continuations of Mr. Rendle's paper on African Acanthaceæ, including diagnoses of many new species, and of a new genus *Lindauea*; and of Dr. Schlechter's on African Asclepiadeæ.

SOCIETIES AND ACADEMIES.

MANCHESTER.

Literary and Philosophical Society, October 6.—Prof. Osborne Reynolds, F.R.S., Vice-President, in the chair.—Prof. F. E. Weiss communicated a paper on *Rachiopteris cylindrica*, by the late Mr. Thomas Hick. The name of Rachiopteris was given by Williamson to some plant remains from the Lower Coal Measures of Halifax, which he thought might be true ferns, and described in the *Philosophical Transactions*, 1878. Mr. Hick describes in detail some further specimens, partly belonging to the Cash Collection at Manchester Museum. In considering the cortical tissues, special reference is made to the presence of small black bodies within the cortical cells, the presence of which is characteristic for Rachiopteris, but the nature of which is still very doubtful. Considerable attention is paid to the division of the stele, as indicating the dichotomous manner of branching; and mention is made of the presence at the points of bifurcation of endogenous organs, probably of the nature of roots. From the knowledge of the anatomical details, Mr. Hick concludes that Rachiopteris cannot possibly be a root, but is probably a stem or leaf structure of a plant having more affinity with the Filices than with the Lycopodiaceæ.—On the structure and contents of the tubers of *Anthoceros tuberosus*, by J. H. Ashworth. The tubers of *Anthoceros tuberosus* are described in Gottsche's "Synopsis Hepaticarum" as oval bodies containing a farinaceous mass within a deeply-coloured envelope. The author finds that these tubers, which lie beneath the thallus, and are connected to it by a stalk, have a wall formed of three or four layers of corky cells, some of which are produced into hair-like processes. Within these protective layers lie closely-packed cells containing granules and fluid oil drops. The granules are not starch, but give all the reactions for proteids, and appear to be aleurone grains. Besides these stalked tubers there are similar tuberous masses formed in the thallus, which have not been previously described. These, which are rather smaller in size than the tubers, are formed between the upper and lower layers of the thallus, and are composed of cells exactly like the inner cells of the stalked tubers. The tubers may be regarded as gemmæ, in which the inner cells have become stored with food material, and are protected by the corky layers against being dried up, *Anthoceros tuberosus* being found on the banks of the Swan River in Western Australia, where it is exposed to severe drought.

PARIS.

Academy of Sciences, October 5.—M. A. Chatin in the chair.—Researches on the explosive properties of acetylene, by MM. Berthelot and Vieille. Details of experiments carried out with a view of seeing what precautions, if any, are necessary in the preparation, compression, and storage of acetylene for commercial uses. It has been known for some time that the decomposition of acetylene by a heated wire, by mercury fulminate, or by the electric spark, is not propagated any considerable distance if the gas is under atmospheric pressure. At pressures of two atmospheres and over, however, the decomposition is complete, the explosive pressure produced rising so rapidly with the initial compression, that the effects produced by detonation of the liquefied gas resemble those of ordinary explosives.—Remarks on an experiment of M. Birkeland, by M. H. Poincaré. A mathematical study of the deflection of the kathode rays by means of a magnet.—On the infections caused by the bacilli of the *Proteus* group, and on the agglutinating properties of the serum in these cases, by MM. Lannelongue and Achard.—The truffles of Greece: *Terfezia Gennadii*, by M. Ad. Chatin. Three specific types have been found in Greece: *Terfezia Claveryi*, *Terfezia Gennadii*, and *Terfezia Leonis*.—Correction to a preceding note on the homogeneity of argon and helium, by Profs. W. Ramsay and J. N. Collie. (See NATURE, October 8, p. 546.)—The cave of La Mouthe, by M. E. Rivière. This note, the fifth on this subject, deals with the drawings on the sides of the cave. There seems to be no doubt of the great antiquity of these drawings, many being covered up with stalagmitic deposits.—On algebraic systems, and their relations with certain systems of partial differential equations, by M. H. E. Delassus.—On the region within which a summation of Taylor's series is possible, by M. E. Borel.—Antistaphyloccic serotherapy, by M. Capman. With the filtered toxines from staphyloccus cultures, dogs were successfully rendered immune; the serum from these dogs, taken about three weeks after the injection, amply protected the rabbit and the guinea-pig against a toxic injection. The curious fact was established, that shortly after injection in the dog there was a temporary increase in toxicity, the serum taken two days after the commencement of the fever being five times the toxic strength of the toxine inoculated.—On beans, by M. Balland. A study of the physical and chemical properties of beans of various origins. Analyses are given showing the composition of the whole bean, the skin, and the cotyledons with the germ.—Neuro-psychosis, by M. Boukteïeff.

NEW SOUTH WALES.

Linnean Society, August 26.—P. N. Trebeck in the chair.—On the Australian *Bembidiides* referable to the genus *Tachys* (fam. *Carabidæ*), with the description of a new allied genus, by Thomas G. Sloane.—Descriptions of two new species of *Prostanthera*, from New South Wales, by R. T. Baker.—Eucalypts and Loranths in their relations of host and parasite, and as food-plants, by J. J. Fletcher. The object of this paper was mainly to evoke discussion on a subject which is not devoid of interest. The propositions brought forward may be summarised as follows:—Even a cursory investigation of the relations subsisting between some of the most characteristic forms of Australian vegetation—*e.g.* Proteads, Acacias, and Eucalypts—and the animals (more particularly insects) to which they serve as food-plants, shows a state of affairs in harmony with Mr. Wollaston's axiom "that the most peculiar insects of a region are usually to be found either dependent on or inhabiting the same area as its most peculiar plants" (*Trans. Ent. Soc.* (3), i. 1862-64, p. 136). Among the plants mentioned, the Eucalypts, in point of both variety and number of the species dependent upon them, stand conspicuously first; being preyed upon by a goodly assemblage of forms, including phytophagous mammals, insects of almost every order—phytophagous, xylophagous, juice-feeding and gall-making, not to speak of anthophilous forms—as well as Phytoptids. Nor is it merely individual plants that suffer; for there are not wanting recorded instances in which species have been locally threatened with xtinction by reason of the depredations of phalangers, coleoptera, lepidopterous larvæ, phasmids, &c. Eucalypts have now become extensively acclimatised in other parts of the world, where, by way of contrast to the state of things sketched above, it is interesting to know that on the whole the attitude of insects towards them is one not of indifference merely, but in some cases even of positive antipathy. In cases like that of the Laurel- and Euphorbia-infesting animals referred to by Mr. Wollaston, and the Eucalyptus-infesting animals of Australia, the opinion was expressed that the adaptation of the animals to their food-plants—which contain more or less abundant stores of chemical substances ordinarily distasteful to animals—was one requiring a long period of time for its acquirement, and for the development of hereditary tastes; perhaps also the stimulus of stern necessity. As to whether, as has been supposed, the association of Loranths and Eucalypts is to be looked upon as a case of mimicry, it was pointed out that the association is at most—over and above any gain accruing from parasitism—but of partial and local benefit to the former; that in times past it was profitable; but that now, on the whole, it is a possible case of true mimicry in the later stages of becoming bankrupt and played out.

DIARY OF SOCIETIES.

LONDON.

TUESDAY, OCTOBER 20.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.—Half-tone direct from Nature: Wm. Gamble.

WEDNESDAY, OCTOBER 21.

ENTOMOLOGICAL SOCIETY, at 8.—New Hymenoptera from the Mesilla Valley, New Mexico: T. D. A. Cockerell.—A Monograph of British Braconidæ, Part vii.: Rev. T. A. Marshall.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Photo-micrographic Camera designed chiefly to facilitate the Study of Opaque Objects: J. Butterworth. On the Occurrence of Endocysts in the Genus Thalassiosira: T. Comber. —On the Measurement of the Apertures of Objectives: E. M. Nelson.

BOOKS AND SERIALS RECEIVED.

BOOKS.—A Sketch of the Natural History of Australia: F. G. Aflalo (Macmillan).—The Elements of Electro-chemistry; Prof. M. Le Blanc, translated by W. R. Whitney (Macmillan).—Notes of the Night, &c.: Dr. C. C. Abbott (Warne).—The Romance of the Sea: F. Whymper (S.P.C.K.). Peasblossom: C. Pridham (J. Heywood).—An Egyptian Reading-Book for Beginners: Dr. E. A. W. Budge (K. Paul).—Elementary Geology: Prof. G. S. Boulger (Collins).—University College, Bristol, Calendar 189⁶-7 (Bristol, Arrowsmith).—Die Principien der Wärmelehre: Dr. E. Mach (Leipzig, Barth).—Examples in Electrical Engineering: S. Joyce (Longmans).—Stanford's Compendium of Geography and Travel (new issue) Asia, Vol. 2, Southern and Western Asia: A. H. Keane (Stanford).—A Text-Book of Bacteriology: Prof. E. M. Crookshank, 4th edition (Lewis).—Diagrams of Terrestrial and Astronomical Objects and Phenomena: R. A. Gregory (Chapman).

SERIALS.—Internationales Archiv für Ethnographie, Band ix., Heft 4 (Leiden, Brill).—Reliquary and Illustrated Archæologist, October (Bemrose).—Essex Institute Historical Collections, Vol. xxxii. (Salem, Mass.). —Strand Magazine, October (Newnes).—Journal of the Royal Statistical Society, September (Stanford).—Lloyd's Natural History—Birds, Parts 5 and 6: Dr. R. B. Sharpe (Lloyd).—American Journal of Science, October (New Haven).—Science Progress, October (Scientific Press).—Engineering Magazine, October (Tucker).—Zeitschrift für Wissenschaftliche Zoologie, lxii. Band, 1 Heft (Leipzig, Engelmann).—Annals of Scottish Natural History, October (Edinburgh, Douglas).—Papers and Proceedings of the Royal Society of Tasmania for 1894-95 (Hobart).—Journal of Physical Chemistry, No. 1 (Ithaca, N.Y.; London, Gay).—American Journal of Mathematics, Vol. xviii. No. 4 (Baltimore).—Mind, October (Williams).

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