THURSDAY, JULY 21, 1904.

THE MIND OF A GREAT THINKER.

An Autobiography. By Herbert Spencer. Two volumes. Pp., vol. i., xii+556; vol. ii., ix+542. (London: Williams and Norgate, 1904.) Price 28*s.* net.

A GREAT and peculiar interest attaches to these volumes, because in them Herbert Spencer has displayed the steps of the evolution in his own mind of that great scheme of universal evolution which has so profoundly affected modern thought, and has described the mental characteristics that conduced to the conception and the working out of that scheme. Spencer was peculiarly well fitted for the task of self-revelation, and it may safely be said that never before have the mental processes by which a great thinker has produced a vast system of conceptions been so clearly exposed.

The exposition is scattered through more than a thousand pages of matter, much of which is trivial or redundant, and it is perhaps worth while to set down consecutively, and in what seems the order of relative importance, the peculiarities of the philosopher's mind and character which, according to his own account, played a principal part in making the synthetic philosophy just that which it is.

Spencer rightly claims that he possessed in an exceptional degree the three great faculties (1) of deductive synthesis; (2) of analysis, leading to the discovery in complex and seemingly widely different phenomena of the elements or features that they have in common, and so to the inductive verification of large deductions; (3) "the ability to discern inconspicuous analogies."

The first of these was conspicuously manifested at every stage of the development of the system, the earliest considerable display of it being the deduction from the "law of equal freedom" of the conclusions as to political and social institutions presented in "Social Statics." The second was early manifested in the famous essay on "The Universal Postulate," which aimed "to identify the common elements of all those beliefs . . . which we regard as having absolute validity." The third was brilliantly exercised in the discovery of that celebrated analogy which has now become incorporated in common speech in the phrase "the social organism."

These three powers were certainly present in very high degree, and the deductive and inductive tendencies preserved a balance such as is by no means common. But it is possible that many minds have equalled Spencer's in these respects, and the exceptional development of these powers would not have sufficed to give us the synthetic philosophy in the absence of certain other very strongly marked mental traits that contributed to render Spencer's mind peculiarly effective in the carrying out of the great work that he accomplished. Among these the first place must be assigned to the effective belief in universal causation according to immutable laws, a belief early acquired and constantly fostered by the questions put to young Spencer by his father, who rightly considered the leading to a search after causes to be the most important function of the educator. "A constant question with him was,—'I wonder what is the cause of so-and-so'; —always the tendency in himself, and the tendency strengthened in me, was to regard everything as naturally caused." The "constitutional readiness to grasp the abstract necessity of causal relations" thus "rendered by practice unusually strong," Spencer himself seems to have regarded, probably rightly, as the most important feature of his intellectual equipment, just as the lack of development, and, in fact, the actual repression, of this tendency, strong in most children, was and still is the gravest defect of English education. Hardly less important was the supreme confidence in his own mental processes, amounting, indeed, to intellectual arrogance, which, at the age of twenty, rendered him desirous of making public "some of my ideas upon the state of the world and religion," and which, a much more exceptional fact, remained unimpaired throughout his long life. There can be no doubt that this was essential to his achievement; by the lack of such confidence many fine intellects are rendered sterile, and had Spencer not possessed it in a very remarkable degree, had he been ever so slightly infected with that diffidence which was so marked a trait of his friend, George Eliot, he would not even have embarked upon a literary career, or, if embarked, he must have remained comparatively unproductive.

Closely allied with this last, and still more closely allied with one another, were the three traits "disregard of authority," "the absence of moral fear," and the tendency to criticise rather than to appreciate, each carried to a very extraordinary pitch. These, generating a repugnance to every kind of statement based upon authority and not appealing to reason for its acceptance, seem to have determined the trend of intellectual activity from the earliest years, from the time when as a small boy Spencer refused to apply himself to the study of Latin or of other languages and at the age of thirteen years rejected the current definition of inertia, to the time when he set aside all religious authority, laid down Kant's "Critique of Pure Reason" rejecting his doctrine of time and space "at once and absolutely" after reading a few pages only, set himself in "Man *v.* the State" in unqualified opposition to the dominant trend of political change, and criticised adversely the frescoes of Michael Angelo in the Sistine Chapel, the compositions of Raphael and of Wagner, the dialogues of Plato and the architecture of Venice.

Important, too, was his persistency in the pursuit of any end, his "tendency . . . to be enslaved by a plan once formed," frequently displayed throughout life in things both large and small. Without this natural persistency he would not have gone far towards the completion of his great scheme in the face of serious pecuniary difficulties and in spite of disturbances of health which, whether they were serious or not, certainly diminished very greatly his capacity for work. In boyhood this persistency was displayed very remark-

ably when he walked from Hinton to Derby, a distance of more than one hundred miles, in three days almost without food or sleep, and its manifestation in later life is well illustrated by the statement that after the projection of the evolutionary system at the age of thirty-seven, "nearly everything I wrote had a bearing, direct or indirect, on the doctrine of evolution."

Among the characters of direct importance to his intellectual productiveness must be reckoned the freedom and spontaneity of his ideational processes. During boyhood trains of ideas were apt to occupy his attention for long periods excluding all awareness of his surroundings, and this seems to have been especially frequent during walking. He speaks of this free flow of ideas in boyhood as "castle-building," but names it "constructive imagination" when, in later life, owing to systematisation of interests, his ideational processes tended towards ends related to his general scheme of conceptions. This spontaneity of the ideational processes enabled him to reach his conceptions and conclusions with a minimum of voluntary effort and, indeed, his efforts were more often directed to the checking rather than, as with most of us, to the promoting of the flow of thought. The following passage describes this as well as another important mental trait.

"It has never been my way to set before myself a problem and puzzle out an answer. The conclusions at which I have from time to time arrived, have not been arrived at as solutions of questions raised; but have been arrived at unawares—each as the ultimate outcome of a body of thoughts which slowly grew from a germ. Some direct observation, or some fact met with in reading, would dwell with me: apparently because I had a sense of its significance. It was not that there arose a distinct consciousness of its general meaning; but rather that there was a kind of instinctive interest in those facts which have general meanings. For example, the detailed structure of this or that species of mammal . . . would leave little impression; but when I met with the statement that, almost without exception, mammals . . . have seven cervical vertebræ, this would strike me and be remembered as suggestive."

In this passage is indicated the last of the faculties of primary importance, the faculty of seizing upon facts or conceptions that were of significance for his scheme of thought, well illustrated by his adoption and extended application of von Baer's phrase "the change from homogeneity to heterogeneity." It was this subtle and ready working of selective attention that rendered unnecessary the storing in the memory of vast masses of facts, and enabled him to dispense with any very extensive reading. Spencer's "sporadic memory" was avowedly poor, and this fact, cooperating in youth with a constitutional idleness, a distaste for continued reading and an impatience of opinions with which he did not agree, and in later life cooperating with an incapacity for reading dating from the time of the writing of the "Psychology" (æt. 38), very effectively preserved him from that "accumulation of knowledge in excess of power to use it" which he deplored as one of the common results of the current educational methods and regarded as one of the principal sources of intellectual sterility in many able men. It is an interesting question, How would Spencer's work have been modified had he devoted much time and energy to reading in place of passing restlessly from place to place, unable to bear solitude, constantly seeking to kill time, as he tells us, by various trivial occupations? Would extensive reading have choked the springs of production? There can be no doubt that, had his mental digestion proved equal to the task, a greater acquaintance with the history of thought would have enabled him to raise his works to a still higher level than that they actually attained—to secure for them an even more solid and enduring fame.

Of the further qualities that especially contributed to determine the character of his political and ethical doctrines, we may note a love of freedom, a quick sympathetic resentment of all injustice, a high valuation of pleasure for its own sake.

As to the general impression of the man produced by this autobiography, it seems certain that it is unduly harsh and unfavourable, for Spencer persisted with almost painful honesty and in accordance with the principle he had adopted, in laying stress upon the distinctive or peculiar features, while neglecting those more amiable traits which he shared with men in general. The result is that, whereas most biographies, and even autobiographies, are of the nature of a portrait, in which the artist selects an aspect and idealises to some extent the features of the subject, this one resembles rather a harsh, crude photograph that reproduces with relentless accuracy, and even gives undue prominence to, the lines and the warts, all the asperities of nature and all the bruises of the battle of life. W. McD.

AMERICAN BIG GAME.

Musk-Ox, Bison, Sheep, and Goat. By C. Whitney and others. American Sportsman's Library. Pp. 284; illustrated. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1904.) Price 8*s.* 6*d.* net.

The Still-Hunter. By T. S. Van Dyke. Pp. viii+390; illustrated. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1904.) Price 7*s.* 6*d.* net.

THE members of the deer tribe, together with the pronghorned antelope, or prongbuck, having been described in an earlier volume of the same series, the work standing first in our list completes the account of the wild ruminants of North America. The names of the authors—Mr. C. Whitney for the musk-ox, Mr. G. B. Grinnell for the bison, and Mr. O. Wister for the mountain sheep and the white goat—form a sufficient guarantee that the text of this volume will combine that mixture of sport and natural history for which the true sportsman always looks in works of this nature, and a glance at its pages shows that such is really the case. From title-page to index the method of treatment and the style of writing are admirable, so admirable, indeed, that there is scarcely a sentence to which exception can be taken.

One admirable feature is that all three authors have

agreed to adopt one system of nomenclature, selecting that of Mr. Rowland Ward's "Records of Great Game." Not only is this satisfactory from the point of view of uniformity, but it indicates, in some degree at any rate, a tendency to revolt against the American practice of regarding every colour-phase of an animal as representing a distinct species. Accordingly we find all the American forms of wild sheep included under a single specific heading. In the case of the musk-ox, the author has indeed seen fit to depart from this admirable practice, classing the East Greenland animal as a species apart from the typical *Ovibos moschatus* of the Barren Grounds. Moreover, he is not justified in suggesting that the name *O. m. wardi* (first proposed in our own columns) should give place to Dr. Allen's *O. pearyi*. Doubtless Lieut. Peary has more claim to have a musk-ox named after him than has Mr. Rowland Ward, but if we are to disregard the rule of priority in regard to names of recent origin, zoology will soon be in a state of hopeless chaos.

Since the history of the bison has been written and re-written over and over again, the portion of the present volume dealing with the musk-ox has greater claims to novelty than have the chapters devoted to the first-named animal. Mr. Whitney's account of the extreme difficulties and hardships inseparable from an expedition into the Barren Grounds shows that musk-ox hunting is by no means holiday work, and that even when plans have been most carefully laid, a trip may result in failure even to sight the game. Perhaps it is not generally known that previous to the author's venture the only extensive trips that had been made into the Barren Grounds were those of the two Englishmen, Mr. Warburton Pike and Mr. H. T. Munn.

As a companion to the preceding excellent volume and its fellow in the same series, "The Deer Family," Mr. Van Dyke's "The Still-Hunter" may be heartily commended. Written more exclusively from the sportsman's point of view, it deals in considerable detail with the technique of stalking—or "still-hunting" as our American friends term this kind of sport—and is especially devoted to the pursuit of the white-tailed and mule deer and the prongbuck. As we learn from a statement on the back of the title-page and the preface, this volume is a new and illustrated edition of a work which originally appeared so long ago as 1882 or thereabouts. But it is none the worse for this, since it not only describes American deer-stalking in its palmy days, but is thoroughly up to modern requirements in the matter of rifles and other essentials of sport.

The illustrations, which are both numerous and artistic, are nearly all drawn for a special purpose, and serve to indicate both the impediments and the facilities with which the sportsman is likely to meet in the pursuit of his quarry. While the earlier chapters are devoted to a description of the manner in which to recognise good hunting grounds, and the various methods of tracking and shooting deer, the later ones treat more especially of rifles and how to use them, with a discussion on the type of bullet and the charge of powder best suited to this kind of sport.

If the big-game sportsman who intends to shoot in America be provided with the volume heading this notice and its companion on the "Deer Family," together with Mr. Van Dyke's "Still-Hunter," he may consider that, so far as literature is concerned, he is thoroughly equipped for his task. The first two volumes have, in addition, no small amount of interest for naturalists of all countries. R. L.

THE ORBIT OF A PLANET.

Grundriss der theoretischen Astronomie und der Geschichte der Planetentheorien. Zweite vermehrte Auflage. By Prof. Johannes Frischauf. Pp. xv+199. (Leipzig: Wilhelm Engelmann, 1903.)

THE title of this work is too comprehensive; an outline of theoretical astronomy might be expected to touch at least gravitational theory, even if other physical sections were omitted. Prof. Frischauf's work—the first edition of which appeared in 1871—is engaged almost exclusively with the geometrical problem of finding an orbit from observation, and with a detailed history of Kepler's search for the true form of a planet's orbit. It is intended as an introduction, and is not ambitious for completeness; indeed, it omits many things a student might well be told, which would not have broken its attractive readable quality. For example, there are many better approximations for solution of Kepler's problem than that given on p. 6, and the well known graphical solution with the help of the curve of sines is not mentioned; this should not be omitted, for it is a method of real utility, and with proper care can be worked, as Bauschinger says, with an error not exceeding a tenth of a degree.

The author is well advised in following Gauss closely; it is almost inevitable that the work should be largely composed of excerpts from the *Theoria Motus*, and a writer serves his readers best who does not disguise them. But the numerical examples would have gained by being less faithful. The practice of astronomers in their reductions has undergone very great changes, and justice is not done to it by a note such as that at the bottom of p. 74, where, in reference to certain places of the sun extracted by Gauss directly from the tables—von Zach's presumably—Prof. Frischauf explains that our procedure is now less primitive.

Those who prefer to read Gauss and Olbers in the original, or in the masterly handbooks of Watson or Oppolzer, will find plenty to interest them in the third part of this work. Under a title of the history of the planetary theory, Prof. Frischauf gives, along with a cursory account of the rest of the history, a most interesting detailed story of Kepler's successive efforts to obtain the true form of a planet's orbit. Prof. Frischauf remarks that there are few more interesting pieces in the history of science; yet very few authors have allowed themselves space to do it justice. Dr. Frischauf, as professor at Gratz, is the appropriate man to write upon Kepler, for Kepler himself was a lecturer on mathematics at Gratz, and there made his name as an astrologer. The penetration of the older theories deserves more recognition than it gets; it is but little known how

well true elliptic motion can be simulated by an eccentric circle *and* Ptolemy's equant. The equant is a point about which motion in the circle appears uniform. In elliptic motion it may be easily seen that the empty focus is approximately such a point. Using the equant, the maximum error in longitude is only one quarter the square of the eccentricity—8′ only for Mars, and for the other planets, except Mercury, less than 2′. But if any reader wants to know all the equant can possibly be made to do before it must be condemned, let him read this account of Kepler's efforts.

OUR BOOK SHELF.

The Fourth Dimension. By C. Howard Hinton, M.A. Pp. viii+247; with coloured frontispiece. (London: Swan Sonnenschein and Co., Ltd., 1904.) Price 4*s.* 6*d.*

A BOOK bearing the present title may be reasonably expected to contain certain things. In the first place it should have a clear exposition of Descartes's applications of algebra to geometry, and conversely of geometry to algebra, the logical conclusion of which consists in the removal of all restrictions as to the conceivable number of dimensions of space. In the second place it should contain clear, concise, and exactly worded statements of the peculiar and distinctive geometrical properties which are characteristic of spaces of two, three, four, or more dimensions respectively. Among these peculiarities might be cited, as examples, the number of possible regular figures corresponding to the five regular polyhedra of three-dimensional space, the number of independent motions of a rigid body, the properties analogous to those of the shortest distance between two lines, the symmetry of crystals, and, in short, any results calculated to convince the reader that the study of space not only of four, but of *five, six*, and generally *n* dimensions leads to the discovery of geometrical theorems no less interesting than those of ordinary plane and solid geometry.

Now such things as these are either entirely absent from the book or else they are mixed up with such a mass of irrelevant and discursive matter as to render it often quite impossible to make out what the author is driving at. The notion of a fourth dimension is associated with the belief in a higher world with electricity and magnetism, with organic life, with logic and philosophy, with the nature of the human soul, and with a variety of other ideas only calculated to mislead the reader as to the real use of such inquiries. It is doubtful whether any tangible idea of the "eight cell" or any other four-dimensional figure can be gained by mere playing with coloured squares or cubes. The proper way to realise the nature of such figures is by studying their projections on pairs of coordinate planes, and four-dimensional space has the great advantage over three-dimensional in that any figure formed of points can be completely represented by projections on two sheets of paper, whereas for a three-dimensional figure one sheet is insufficient and two sheets are too much.

There is a certain class of individual, far too common in this country, who busies himself in pestering his mathematical friends with long and rambling letters on such questions as "What is the fourth dimension?" or "What is the ether?" Such people very rarely know anything about the three dimensions of the space they live in, but Mr. Hinton's book will, it is to be hoped, give them something to think about which will at least amuse them and keep them occupied. The great misfortune is that such books are believed by the general public to be descriptions by a mathematician of the work of other mathematicians. Consequently, mathematicians obtain a reputation for being unpractical which they certainly do not deserve.

The Hill Towns of Italy. By Egerton J. Williams, jun. Pp. xiv+398; with illustrations from photographs and map. (London: Smith, Elder and Co., 1904.) Price 10*s.* 6*d.* net.

THE majority of English people who visit Italy confine their attention to large towns such as Florence, Rome, Naples and Venice. The mediæval towns of Etruria and Umbria constitute practically a *terra incognita* to the ordinary tourist. The author has done useful work in directing attention to a district full of historic associations, and the picturesque glimpses which he has given us both of towns and country may well tempt those who have the time and opportunity to go and visit the district themselves.

If there is one feature which lends itself to criticism, it is that a perusal of the book does not give one a mental picture so much of the towns themselves as of an American *traveler's* impressions of them. It is probably very hard for any writer to describe Italian life who has not spent several of his early years in Italy. So long as the writer confines himself to purely descriptive matter the facts are Italian enough, but where he endeavours to give colour to the scene, that colour hardly feels right. We may cite such sentences as "The exquisite grace and sweetness of the madonna hold the onlooker like a vise" (query *vice*); "One more ancient madonna greeted me as I passed out by the left aisle." It would also be interesting to know the author's authority for such spelling as Velathri and Thrasymene. Velitrae and Trasimene are certainly usual. Seeing, however, that the book was written as the result of only a sojourn of a spring and summer among the hill towns, we can but be surprised at the amount of interesting matter which it contains.

Our Mountain Garden. By Mrs. Theodore Thomas. Pp. 212. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1904.) Price 6*s.* 6*d.* net.

SUBURBAN gardeners sometimes attempt, with less or more success, generally less, to establish a mountain in the back garden. The author of this book has adopted the converse plan of establishing a garden on a New Hampshire mountain side. In this little book she tells us how she did it, what patience she exercised, what disappointments she experienced, what ultimate success she achieved.

The story is well told, and it is obvious that the gardener was not only successful, but that she deserved to be.

Nevertheless, her sympathies seem rather to be with the birds and wild animals to which she acted as hostess than with the plants she used for decoration. She seems to have looked on the plants as so many cakes of colour, useful for producing effect, but to have ignored the mental refreshment which a more thorough study of their peculiarities and of their manners and customs would have afforded.

Her "practical hints" are excellent, and will be serviceable to those disposed to follow her example and make a garden for themselves according to their own notions.

The list of shrubs, flowers, and weeds cultivated is disfigured by an unusual number of printer's "weeds," though it is scarcely fair to the "compositors" to attribute to them errors for which the author ought to be held responsible. If the book should, as is very likely to be the case, appear in a second edition, it is to be hoped that this list will be revised by someone familiar with the names of plants and with the way in which they should be spelt.

Guide to the Analysis of Potable Spirits. By S. Archibald Vasey. Pp. ix+87. (London: Baillière, Tindall and Cox, 1904.) Price 3*s.* 6*d.* net.

THE analysis of potable spirits has within recent time acquired increased importance on account of the attention now given by medical men and others to the characters of potable alcohol, and also on account of the action of inspectors under the Sale of Food and Drugs Acts in connection with the attempts which are being made by various local authorities throughout the country to put a stop to the misdescription of spirits. The Acts under which the Excise authorities work unfortunately contain no adequate definition of such articles as whisky and brandy, and this omission has undoubtedly facilitated the manufacture of factitious spirits. At the present time there is practically no official control over the sale of ardent spirits beyond ensuring to the customer, solely in the interest of the Revenue, that their alcoholic strength shall not be below a certain minimum. The Revenue authorities are not concerned to know whether what is called whisky is a pot-still or a patent still spirit, whether it is made from raw grain or malt, or whether it is old or new. To them it is a matter of little moment whether what is called brandy is genuine grape spirit, or whether it is a rectified spirit obtained from maize or potatoes, flavoured with so-called essence of brandy and coloured with caramel.

Those who trade in these things are, however, taking steps to ensure that purchasers who, in the words of the Act, are entitled to be supplied with articles "of the nature, substance and quality demanded," shall be served with genuine grape-spirit when they ask for "brandy," and the Sale of Food and Drugs Acts have been set in motion to secure this, and convictions under their provisions have already been obtained. Now that a decision of one of the higher courts has been given, confirming those of the courts below, the local authorities will doubtless continue to take action, and public analysts will probably be very busy with such cases. Mr. Vasey's book, therefore, appears at an opportune time, and may be recommended to the notice of all who are interested in the subject of differentiating spirits.

Forestry in the United Kingdom. By Prof. W. Schlich, F.R.S. Pp. 72. (London: Bradbury, Agnew and Co., Ltd., n.d.)

THIS book gives a very able exposition of the pressing need of extended and improved forestry in the United Kingdom. It deals with certain important points already discussed, as the author informs us, in lectures at various centres. Prof. Schlich sets forth a very strong case in favour of the better management of British woodlands. His arguments, supported by very convincing statistics, are such as should meet with the approval and support of all interested in the subject. The problem of how to utilise to the best advantage our enormous acreage of waste land is ably dealt with, and in our opinion settled by the author in chapter iii. This chapter contains a most interesting discussion on the conflicting interests of forests and game preserves; Prof. Schlich, however, shows how these may be reconciled. The chapter also contains numerous practical hints and yield tables showing the financial return to be expected from properly managed woods. We cannot close this notice without mentioning the excellent series of photographs illustrating the natural regeneration of beech, the production of high-class oak timber, and the proper density of spruce woods. The photographs have been judiciously chosen by the author, and included to show what result can be achieved when forests are treated in a rational and systematic manner.

Ready Reference Tables. Vol. i. Conversion Factors. Compiled by Carl Hering. Pp. xviii+196. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1904.) Price 10*s.* 6*d.* net.

THIS is the first of a series of reference tables which Mr. Hering has in course of preparation, and which are intended to contain all the data most generally required by engineers and physicists. The author has aimed not only at making the tables handy for reference, but also at making them complete and accurate to a degree not usually attained by pocket books. Thus in the present volume the conversion factors are given to six or more significant figures, their reciprocals are given, and also seven-figure logarithms. This is a degree of accuracy which can be but rarely required, and in deference, we suppose, to the practical engineer, the author has added approximate fractional values; everyone, therefore, should be able to find what he wants. All the values have been most carefully re-calculated and checked from the various legal definitions, thus making the data authoritative. The value of the book as a standard for reference cannot be questioned; the arrangement is more open to criticism, and we cannot help thinking that the method of tabulation adopted, which is to arrange all the tables in order of the size of the quantities, results in an unnecessary amount of repetition. For example, the same factor is repeated five times (with a change only in the position of the decimal point) for converting respectively milligrams, centigrams, decigrams, grams, and kilograms into grains. If this is really desirable, it should be consistently followed out; yet one finds the grain expressed only in terms of the milligram, centigram, and gram, the decigram only in terms of the grain and gram, and not otherwise mentioned in the table. The result is that one hardly knows where to look for what one wants, which considerably detracts from the merits of a compilation excellent in all other respects. M. S.

A Compendium of Chemistry (including General, Inorganic and Organic Chemistry). By Dr. Carl Arnold. Translated by John A. Mandel, Sc.D. Pp. xii+627. (New York: Wiley and Sons; London. Chapman and Hall, Ltd., 1904.) Price 15*s.* net.

THIS kind of book is perhaps more common and more popular, therefore, in Germany than in this country. It is neither a text-book nor a book of reference, but something between the two. Its aim seems to be rather to refresh the memory, if the word refresh can be used in this connection, than to train the mind. It is, in fact, a *multum in parvo* of information, which a student who had worried out his principles and theories beforehand, and merely required to marshal his facts and ideas, might use with advantage.

For example, the whole of chemical theory, including physical chemistry, is served up in the first hundred pages in a series of small doses of concen-

trated extract. There is a capsule of chemical statics, of dynamics, of physical mixtures, of thermochemistry, of electrochemistry, &c. The same concentrated form of diet is continued throughout the volume unrelieved by any historical references or illustrations of apparatus.

There are numerous little inaccuracies, both of author and printer, which it would be well to correct in a future edition. J. B. C.

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.]*

Residual Affinity.

SIR OLIVER LODGE and Prof. Frankland have indicated (pp. 176, 222) the way in which the electronic theory may afford an explanation of various chemical phenomena; notably so in the case of solutions: the apparent dissociation of the ions of the solute being a consequence of partial withdrawal of the bonds or electric charges uniting them, these bonds becoming occupied in connecting the ions with the molecules of the solvent, and dissociation into ions being thus a consequence of the chemical affinity of the dissolved substance for the solvent, instead of being a proof that no such thing as chemical combination exists in a solution.

I should like to point out that this view was developed by the writer nearly thirteen years ago in a paper entitled "The Theory of Residual Affinity as an Explanation of the Physical Nature of Solutions," which appeared in the *Berichte*, 1891 (pp. 3629–3447), and of which some account will be found in the last edition of Watts's "Dictionary of Chemistry" under the head of "Solutions," p. 495. The only difference in the explanation there given from that given by Sir Oliver and Prof. Frankland is that the atomic charges were spoken of as fluid charges surrounding the atoms instead of as Faraday bundles.

The view that the charge uniting atoms in a molecule is a variable quantity was developed by the writer at a still earlier date in a paper on atomic valency, read before the Chemical Society, December 3, 1885, but printed privately only; a further view was propounded in that communication that the bonds or charges of atoms of a different nature were not exactly equivalent to each other, and were not necessarily expressible by whole numbers. Such a view gives a somewhat striking explanation of many chemical facts which are otherwise difficult of explanation, but it is independent of the explanation of the nature of solutions given subsequently, and now put forward by Prof. Frankland, the basis of which is the mobility and divisibility of the atomic charges. SPENCER PICKERING.

Harpenden, July 10.

A Volatile Product from Radium.

IN the course of some recent experiments on the excited radio-activity from the radium emanation, some evidence has been obtained which points to the conclusion that the emanation X of radium at one stage of the changes which it undergoes after being deposited on a solid body is slightly volatile even at ordinary temperatures. The effect which gives rise to this conclusion was first noticed in some observations on the rate of decay of the part of the excited activity deposited on a plate of copper immersed for a short time in dilute hydrochloric acid, in which the activity from a platinum wire exposed for a time to the radium emanation had been dissolved. When the copper plate with its active deposit had been placed inside a testing vessel and removed after a few minutes, it was noticed that a temporary activity, in some cases equal in amount to one or two per cent. of the activity of the plate, was excited on the walls of the vessel. This activity increased to about three times its original value in the course of thirty minutes after the removal of the active copper, and then decayed regularly to zero.

The amount of this radio-active deposit that can be obtained from a given amount of the direct radium excited seems to be increased by the solution and re-deposit of the emanation X, but it can also be observed from a wire just removed from the radium emanation. If the active wire is placed at once in the testing vessel without having had its temperature raised in any way and removed in a few minutes, an activity about 1/1000 of the whole activity shows itself on the walls of the vessel. The decay of the activity of this deposit is the same as that of the deposit obtained from the active copper. The following table gives the rate of change of the radiation from the walls of a vessel in which an active wire had been left for three minutes after its removal from the emanation:—

Time after removal in minutes ...	1	5	10	20	25	30	35	40	50	60
Activity	40	61	75	96	99	100	98	95	88	78

The active wire retains this power of exciting secondary activity for only a short time after removal from the emanation; after ten minutes the amount it excites is almost inappreciable. Merely washing the wire in a stream of running water and drying it over a gas flame, as is frequently done to prevent any trace of radium emanation clinging to the wire, increases the amount of the secondary activity to about 1/200 of the whole.

It is evident, then, that some sort of volatile product is given off from the active wire for a time which can excite an activity the rate of decay of which would indicate two changes in the active matter deposited, one producing rays and the other not giving rise to any radiation (E. Rutherford, "Radio-activity," p. 269). It is found that this volatile substance responds to none of the three tests for an emanation, it is not itself radio-active, it cannot pass without sensible loss through material substances such as paper and cotton-wool, and the activity due to it is not concentrated on the negative electrode in an electric field, but distributes itself evenly over all surfaces exposed to it.

The decay of the excited activity from the radium emanation has been explained by Prof. Rutherford on the assumption that there are three changes in the emanation X after its deposit on a solid body. In these three stages one-half the matter is changed in 3 minutes, 21 minutes, and 28 minutes respectively. In the first and third stages the change is accompanied by ionising rays, but the second is a rayless change. Now if it be supposed that after the first change has taken place the matter becomes slightly volatile, and some of it is concentrated on surrounding objects, a deposit would be obtained which would present the two remaining changes. From the equations for the radio-activity of such a deposit ("Radio-activity," p. 271), it is found that the radiation would increase for about 34 minutes, pass through a maximum, and then decay at the ordinary rate. This is very similar to the behaviour of the deposit obtained in the above experiments.

Curie and Danne (*Comptes rendus*, March 21) have obtained deposits showing similar characteristics by heating a radio-active wire within a cylinder and measuring the rate of decay of the activity of the cylinder.

HARRIET BROOKS.

McGill University, Montreal, June 28.

The Traction of Carriages.

IT is a matter of general belief amongst drivers, owners, and builders of carriages that if the distance between the fore and hind wheels be increased so will the "draught" be heavier. I have put the following case before a builder: given two carriages weighing exactly the same, with the fore and hind wheels of each of the same height, but the body of one carriage much longer than that of the other, then the horse will have as much to do in the one case as in the other. The answer has been in more than one instance, the longer bodied carriage will be the heaviest to move. No reason has been given, nor can any explanation of the existence of this belief be offered. Can any of the readers of NATURE make any suggestion?

Ross, July 17. E. WILLIAMS.

UNIVERSITIES AND THE STATE.

THE deputation which was received by the Prime Minister on Friday last put forward a plea for the State endowment of universities which has been accepted by leading nations as a fundamental principle of progress. The influence of this principle upon the development of nations was shown by Sir Norman Lockyer in his address to the British Association last year, and the deputation was organised by the Association as the natural outcome of this address.

It would scarcely have been possible for a case to have received more impressive support than was given to it by the representatives of universities, industries, national and local interests who responded to the appeal issued by the British Association as to the need for recognition of the responsibility of the State for higher education and research. Of the four hundred people who expressed the sympathy of the bodies or organisations they represented with the manifesto sent out by the Association, only two hundred could be received by the Prime Minister, but these included leaders in many departments of national activity.

In introducing the deputation, the importance of the State endowment of universities was urged by Sir Norman Lockyer, as presented in his address. That university authorities hold the same view as the men of science and political leaders was shown by Prof. Pelham, representing Oxford; the Vice-Chancellor of Cambridge; and Mr. Chamberlain, who spoke for the new universities. The importance of applications of science was represented by Sir W. H. White and Sir W. Ramsay; the importance of the humanities by Sir R. Jebb; and the importance of research by Sir Henry Roscoe. Mr. A. Moseley spoke on American science and industry, and Mr. Bell, M.P., speaking in the absence of Mr. Burt, M.P., pointed out the importance of the reduction of fees and complete educational organisation, and showed by his presence that the State endowment of universities is approved by the artisan classes of the country.

In replying to the deputation, Mr. Balfour acknowledged that the endowment of universities assisted a nation in the industrial struggle, and that there is a great need, both in the new and the old universities, for help toward this object. The Chancellor of the Exchequer said that he would double the grant for university colleges this year, and he hoped to be able to redouble it next year; but before considering any larger contributions to university education he would like an exposition from the universities themselves as to the extent they were prepared to come under control if they received grants. He referred to the additional grant of 75,000*l.* a year to university colleges (representing a capital sum of 3,000,000*l.* at 2½ per cent.) as having already been given as the result of the appeal made last year by the president of the British Association. From this it seems quite clear that if the university colleges had been content to wait until the general appeal was made, the result might have been better all round—so far as the early grant of money is concerned.

As the general result of the deputation, we may therefore take it that the principle of State endowment of universities has been conceded, and that the Government is prepared to deal with the question in a liberal manner when the universities have expressed their views as to control, and the finances of the country permit large contributions to be made.

The manifesto issued by the British Association was as follows:—

Statement prepared by the president of the British Association and revised by a committee consisting of the Deputy Vice-Chancellor of the University of Oxford, the Vice-Chancellor of the University of Cambridge, Sir Oliver Lodge, principal of the University of Birmingham, Sir Michael Foster, M.P., and Sir Henry Roscoe.

THE NATIONAL NEED OF THE STATE ENDOWMENT OF UNIVERSITIES.

(1) The British Association has taken action regarding the State endowment of universities, because at the present juncture the highest education and research is a matter not merely of academic but of the gravest national concern.

There is now a general opinion that Britain is in danger of falling behind in the industrial competition now going on between the most highly civilised States.

The university no less than the primary school is in question, because we are in the midst of a struggle in which science and brains take the place of swords and sinews; the school, the university, the laboratory and the workshop are the battlefields of this new struggle, and the scientific spirit must not be limited to the workshop, since other nations utilise it in all branches of their administration and executive.

The more our legislators, administrators and executive officers possess the scientific spirit, and the more the rule of thumb is replaced by scientific methods, the more able shall we be to compete successfully with other countries along all lines of national as well as of commercial activity.

It is a question of an important change of front, of finding a new basis of stability for the Empire in face of new conditions; and since the full life of a nation with a constantly increasing complexity, not only of industrial but of high national aims, depends upon the universal presence of the scientific spirit, of brain-power, our whole national life is involved.

The Function of a University in a Modern State.

The men upon whom the nation must chiefly depend for aid under the complex conditions of the modern world must not be entirely untrained in the study of the nature and causes of the things which surround them, or of the forces which have to be utilised in our daily life; their training and education in humanities must also have been of the widest.

Such men cannot be produced either by a university which neglects science or by a technical college which neglects the humanities.

Hence the universities must be enabled to combine these two sides of a complete education, and they must also be enabled to foster research along both lines, for research is the highest and most important instrument of education, as well as its most valuable result. When science and its applications were of less importance than now the humanities sufficed and university requirements were small; rooms, books, and a small number of teachers of a small number of subjects comprised the essentials of the university. Modern university needs have been too much regarded from this old standpoint.

All this is now changed. For instance, in the most modern German university the buildings, all elaborate and all differing from each other, have already cost a million, and still the university is not complete. Books have to be supplemented by expensive instrumental equipments, which constantly have to be added to or replaced, and by utilising this new material the fruitful ramifications of learning have increased fifty-fold, and the teachers naturally in even greater proportion.

The extraordinary thing is not that a claim to meet

these new conditions is made now, but that we have waited so long for it in this country while other countries faced them long ago.

The Money.

Money is required at the present moment for :—

(1) Buildings and equipments for pure and applied science in both old and new universities.

(2) Pay and pensions of an increased number of professors, demonstrators, &c., in pure and applied science in both old and new universities.

(3) Strengthening of science teaching and research in all, and of the humanities in the new universities.

(4) Reduction of fees, and the wide educational enfranchisement of proved ability in all classes.

Hitherto universities have looked mainly to private endowments. Universities have been regarded too much as luxuries of the rich, and perhaps on this ground higher education has been treated by the Government as of trivial importance to the nation, as a thing it may properly disregard.

Judging from the action taken in other countries, it is safe to say that private endowment has not produced more than 10 per cent. of the money actually needed in Britain.

Nor can we rightly appeal to local rate-aid alone. It would be unjust to expect certain restricted localities to provide universities which, if we are to go on, must be utilised by the whole Empire.

We are driven then to the State. The other civilised States largely endow their universities; Germany, with an aggregate income less than ours, spends roughly a million a year on its universities. The University of Berlin alone received more than 168,000*l.* from the State in the year 1891–2. In the United States, in addition to 200,000*l.* a year received from the Government, the States supply 700,000*l.* in the aggregate and private endowment 2,000,000*l.* The University of Tokio receives 130,000*l.* a year from the Government of Japan.

These figures derive their chief importance from the fact that these magnificently endowed and State-aided universities are the institutions we are contending with in the production of men to do the nation's work along all the lines of its activities.

But the large sums available for the efficient working of the German and American universities are not alone in question. The number of universities in Germany is nearly double that of the British universities. The number of first-class universities in the United States, where, as Mr. Choate has told us, education is the chief business of the nation, is nearly four times that of the British universities.

Can we Afford to Spend Money on Universities?

Britain's great needs at the present moment are brain-power to invigorate our commerce, among other things, and sea-power to guard it, among other things. The State has recently spent 120,000,000*l.* to bring our Navy up to date; it has not yet spent a single million on our universities.

Sir Robert Giffen has stated that the yearly income of the people of the United Kingdom may be taken as not less than 1650 millions, and their aggregate expenditure a few years ago was not less than 1,400,000,000*l.*, including 30,000,000*l.* for education, which is less than 2 per cent. of the whole. The amount borne on the estimates for education is about 13,000,000*l.*

He writes :—" The country should be spending 100 millions where it now spends 30, or about 5 per cent. . . . Such sums are not really extravagant. Extensive diffusion of education and scientific knowledge and training are not only essential to the greater efficiency of labour and capital by which the means of living are provided, but they are equally needed for the conduct of life itself, for the health and comfort of the workers."

It cannot be doubted that the expenditure will be quickly remunerative. More efficient workers will produce more.

Money so spent is seed from which a harvest can be looked for; the plentifulness of the crop will depend upon the seed and the way it is sown.

One of our manufacturers who has been most successful in applying science to industry has stated that if we were now to borrow 10,000,000*l.* for university purposes we should get the money back in the course of one generation a hundred-fold.

The recent recognition of the fact that we have too few universities, and that those that we have are inefficient for want of funds, is similar to that awakening which occurred in 1888 regarding the Navy. In both cases we have to correct past mistakes lasting for years, and seeing that university buildings, as well as annual endowments, are required, some special provision should be made for their early erection.

The Universities in Relation to Secondary Education.

Now that the primary and secondary schools throughout the country are being coordinated, the time has arrived for making our universities and university colleges efficient. The teaching connected with the universities must be of the highest, and the chief function of the secondary schools should be to produce students possessing that general training in science and the humanities which will ensure the success of their subsequent careers, either inside or outside a university.

A system of leaving certificates and a reduction of fees would at once get rid of the tyranny of merely qualifying or selecting examinations which are the bane of education, and would enable the training of the poorest to be carried to the highest rung of an unbroken ladder.

The deputation which advocated these views included representatives from the universities and university colleges, and from county, municipal and other educational authorities in Great Britain and Ireland, Canada and Australia. The list of the deputation contained the names of some who intended to be present, but were prevented from attending. Lord Rosebery, for instance, was unable to attend as Chancellor of the University of London; but with the exception of Oxford, Cambridge, and London, the chancellors of all the universities appear to have formed part of the deputation. A very large number of members of Parliament were present; and it is not too much to say that every important body of opinion—social, industrial, and intellectual—was represented. Among the members of the deputation were the following :—

The Vice-Chancellor of Oxford University, the president of Magdalen College, the president of Trinity College, Prof. Poulton, Prof. Miers. The Vice-Chancellor of Cambridge University, Sir R. C. Jebb, M.P., Mr. A. E. Shipley, F.R.S., and Prof. Forsyth, F.R.S.

The Vice-Chancellor (Dr. Pye-Smith) of London University, Sir Edward Busk, Sir Arthur Rücker, Sir Henry Roscoe, and Prof. Unwin. Sir John Aird, Bart., M.P., Sir G. C. T. Bartley, K.C.B., M.P., Sir M. M. Bhownaggree, M.P., Lord Hugh Cecil, Mr. W. R. Cremer, M.P., Sir M. Foster, K.C.B., M.P., Mr. Ernest Gray, M.P., and Dr. T. J. Macnamara, M.P. The chairman of the London County Council, and the chairman of the Education Committee of the L.C.C. Masters and wardens of the Fishmongers', Goldsmiths', Skinners',

Merchant Taylors', Ironmongers', and Vintners' Companies. Lord Reay, Hon. W. F. D. Smith, M.P., Lord Edmond Fitzmaurice, M.P., Sir William Hart Dyke, M.P., Mr. James Bryce, M.P., Sir Donald Currie, and Lord Stanley of Alderley. The principal of University College (Dr. Carey Foster), the principal of King's College (Dr. Headlam), Lord Macnaghten, the Bishop of London, the Bishop of Rochester, Sir John Wolfe-Barry, K.C.B., F.R.S., Mr. A. H. D. Acland, and Mrs. James Bryce.

Durham University was represented by Lord Londonderry, Earl Percy, the Bishop of Durham, the Dean of Durham, Principal Gurney, Lord Armstrong, Hon. C. A. Parsons, F.R.S., and Sir E. Grey, Bart.

The Chancellor of Victoria University, Manchester (Earl Spencer, K.G.), the Lord Mayor of Manchester, Sir J. T. Hibbert, K.C.B., Sir William Houldsworth, Bart., M.P., Sir James Fergusson, Bart., M.P., Sir J. Hoy, Sir Frank Forbes Adam, Prof. Schuster, Prof. Dixon.

The Chancellor of Leeds University (Marquis of Ripon, K.G.), Lord Wenlock, chairman East Riding Council; Mr. Herbert Gladstone, M.P.

The Chancellor of Liverpool University (Earl of Derby, K.G.), Prof. Boyce, F.R.S., Sir J. T. Brunner, Bart., M.P.

The Chancellor of Birmingham University (Mr. Chamberlain), Sir Oliver Lodge, Sir A. Hickman, M.P., Lord Cecil Manners, M.P., Sir P. A. Muntz, M.P.

The Bishop of Hereford, president of University College, Bristol; Prof. C. Lloyd Morgan, F.R.S., the Right Hon. Lewis Fry, Sir Frederick Wills, Bart., M.P., and Mr. C. E. Hobhouse, M.P. Alderman J. Bright, J.P., chairman of council of University College, Nottingham; Lord Henry Bentinck, M.P., and Sir F. A. Milner, M.P. Mr. J. H. Benyon, president of University College, Reading. The Duke of Norfolk, K.G., president of University College, Sheffield; Sir Fredk. Mappin, Bart., M.P., Dr. Hicks, F.R.S., Sir W. H. Holland, M.P., and Sir Howard Vincent, M.P. The Duke of Wellington, K.G., president of Hartley University College, Southampton; and Lord Northbrook, chairman Hampshire County Council.

The Head Masters' Conference, Rev. Dr. Gow. The Head Masters' Association, Canon Bell, Dr. McClure. The Assistant Masters' Association, the chairman, Mr. G. F. Daniell; vice-chairman, Mr. R. F. Cholmeley; and others.

The British Association for the Advancement of Science, the president, Sir Norman Lockyer, K.C.B., and the treasurer. The Royal Academy of Arts, the president, Sir Edward Poynter, R.A. The Society of Arts, Sir W. de W. Abney, K.C.B., F.R.S. Institution of Civil Engineers, Sir William H. White, K.C.B., F.R.S. Iron and Steel Institute, the president. The Society of Chemical Industry, Sir William Ramsay, K.C.B., F.R.S. Associated Chambers of Commerce, the president. Association of Municipal Corporations, Sir Albert Rollit, M.P. County Councils Association, Sir John T. Hibbert, K.C.B.

The Vice-Chancellor of the University of Wales (Principal Griffiths, F.R.S.), Lord Rendel, Sir Lewis Morris, the Right Hon. Lord Kenyon, Prof. R. W. Phillips, Prof. W. Rhys Roberts, the Lord Lieutenants of many counties, the Right Rev. the Lord Bishop of Llandaff, the Right Rev. the Lord Bishop of St. David's, and the president of the Miners' Federation.

The principal of the University of St. Andrews (Dr. James Donaldson), the president of University College, Dundee (Earl of Camperdown), and Sir John Long, M.P. University of Glasgow, Prof. G. G. Ramsay, Prof. Thomas McCall Anderson, Sir John Stirling Maxwell, Bart., M.P., Sir Herbert E. Maxwell, Bart., M.P. University of Aberdeen, Sir George King, K.C.I.E., F.R.S. University of Edinburgh, the Vice-Chancellor and principal, Sir William Turner, K.C.B.

The Chancellor of the University of Dublin and Trinity College (Earl of Rosse, K.P., F.R.S.), Lord Rathmore, and the provost of Trinity College (Dr. Traill). The Vice-Chancellor of the Royal University of Ireland (Right Rev. Monsignor Molloy). The president of Queen's College, Belfast (Dr. Hamilton), the Lord Mayor of Belfast. The president of Queen's College, Cork (Sir Rowland Blennerhassett, Bart.). The president of Queen's College, Galway (Dr. Alex. Anderson). The president of University College, Dublin, Catholic University of Dublin (Rev. W. Delany, S.J.).

Principal Petersen, the McGill University, Montreal. Prof. A. Liversidge, University of Sydney.

Limitations of space will not permit the publication of a complete report in these columns, but the subjoined extracts from the speeches will convey an idea of the points raised. After the deputation had been briefly introduced by Sir Norman Lockyer, Prof. Pelham, speaking on behalf of the Hebdomadal Council of the University of Oxford, said :—

We are here to express our entire sympathy with the main object of this deputation. The older universities welcome this opportunity of standing in line with the newer universities which are growing up around us.

The Vice-Chancellor of the University of Cambridge (Dr. Chase) said :—

The council of the Senate of the University of Cambridge is deeply conscious, as, indeed, everyone must be who looks thoughtfully on the events of the time, how much that higher culture and that thorough scientific study and research which it is the province of a university to promote are needed for the service of the English nation.

It appears to us that the universities, in view of the increasing work which they are doing on behalf of the nation, are justified in asking for the sympathy and the cooperation of the State. We heartily join in the prayer that the Government would be pleased to regard the work of universities as of supreme national and imperial importance, and to give such aid as the several universities need and as wider considerations of national finance render possible.

Mr. Chamberlain, as Chancellor of the University of Birmingham, speaking on behalf of the new universities, said :—

Let me take Birmingham as an example and as a parallel to what is being done in Liverpool, Manchester, Wales, and Leeds. We have had to prepare the plan of a new scientific university, to deal only with that side of our work, at an estimated cost of 1,000,000*l.* sterling. Even then we shall not have fulfilled all our objects, for there will be many branches of higher scientific and practical education for which we have made no sufficient provision. In the case of Birmingham local subscription has produced about 450,000*l.*, and on the basis of that subscription we have put in hand what will amount to little more than one-third of the university requirements. We have called in aid the local rates, and the three counties of which Birmingham is the centre each contribute the sum of 500*l.* a year, and the corporation of the City of Birmingham has offered in aid a rate of ½*d.* in the pound, which will produce something between 6000*l.* and 7000*l.* per annum. Now, whatever may have been done, it is not enough, and we recognise that by our own unassisted resources alone we cannot provide the kind of education we believe the country requires. Already the State pays something like 13,000,000*l.* a year for primary education. Only a few thousands a year are found for the higher education to which we have learned to attach so great a value. I am not speaking merely as a Chancellor, but I have had some practical experience of the advantage which every statesman finds in discovering sources from which funds may be provided for all the admirable objects brought to his notice, and I do not press on you any particular figure or method of dealing with the important matter we have brought before you, but I hope we may have some crumbs from your table. I hope at least the present Government may be able to make a satisfactory beginning in recognising these new necessities. Possibly that beginning may not be wholly satisfactory to us, but we shall be always ready to take half a loaf until the time comes when we can get the whole, and I believe the initiation of such a policy on the part of any Government will be one of its best claims to the gratitude of the people of this country.

Sir William White, K.C.B., F.R.S., speaking as president of the Institution of Civil Engineers, and

as a representative of all branches of engineering, said :—

During the past year a committee representing all branches of engineering, and nominated by all the principal engineering societies of the country, has been considering the best system of training for engineers. Its work is still incomplete, but its investigations make it obvious that great extensions of existing universities and university colleges which provide for engineering education are needed in order to meet national requirements and to secure equality of conditions with those existing in other countries where industrial enterprise is making great strides.

British engineers consider that private enterprise and generosity should continue to play a leading part in the support of institutions for teaching the higher branches of their profession, but they hold that, in view of what is being done abroad, it is absolutely necessary that private efforts should be supplemented by substantial Government aid. Such a course on the part of the Government would undoubtedly tend to stimulate private generosity, and before long would place this country in a position of relative efficiency greatly superior to that which now prevails. With the rapid development of engineering now taking place in all directions, there is an absolute necessity for scientific procedure and a thorough knowledge of principles on the part of those employed therein. Unless immediate steps are taken to remedy needs that are universally recognised, the industrial position of this country must become increasingly unsatisfactory.

The importance of the application of science was urged by Sir William Ramsay, K.C.B., who, in the course of his remarks, said :—

In asking for a new departure—the State endowment of universities—we must inquire what information we can obtain from others who have previously made experiments. We find that on the Continent successful experiments have been made for many years. In these practical researches Germany has taken the lead ; but in all European countries, and in America, progress is being made on lines closely resembling those which have been found advantageous in Germany. We may note that almost all the proprietors of chemical works, or of works which depend for their success on the application of chemical principles, are either university men who have taken a degree in science or men from "Polytechnika," who have taken a diploma.

One reason for the almost universal spread of university education is the very small fees that are charged to students. By far the larger portion of the cost of university education is paid by the State—probably three-quarters. Ten pounds covers a year's education in fees, whereas forty pounds must be charged here in non-endowed universities.

This close contact between science and industry can be maintained only by a graduated and relatively high scale of pay for the professors in the large universities. Unless the prizes are sufficient to tempt men to choose a scholastic career instead of a commercial one, the ablest young men will choose commerce.

In America most of the chemists have either been educated in Germany—the older generation especially—or have been trained in copies of the German schools of chemistry. Hence America entertains much the same ideas as Germany as regards the importance of scientific training. Indeed, manufacturers engage the services of youths who have not finished their "college" career.

As regards the merits of universities and "Polytechnika," the main difference is that in the former students have been trained in methods of research, whereas in the latter they have been taught what is already known. I am informed by a leading German manufacturer that he prefers the university youths to those trained in "Polytechnika," because the former are more suggestive. The inventive power is recognised as the highest and most lucrative when applied to industry. I am convinced that the bestowing of money on the support of the university teaching of science, while desirable for its own sake, will be like casting bread upon the waters, it will be repaid a hundred-fold.

In referring to the needs of the younger universities in respect to literary studies, Sir Richard Jebb, M.P., remarked :—

It would be a serious national misfortune if our education should become one-sided. The humane studies—history, philosophy, language, literature—cultivate the imagination, enlarge the sympathies, widen the outlook upon life, aid in fitting people to understand one another and to cooperate intelligently ; in a word, they are essential elements in the formation of the efficient worker, whatever his line of work may be. That cardinal fact is thoroughly well understood in those countries where education, from the lowest to the highest grade, is best organised. Let us see to it that in our own country we do not overlook this fact. The men of science go heartily, I believe, with the men of letters in desiring that it should not be overlooked. The importance of maintaining such an equipoise in education might be urged on the utilitarian ground, as a condition of our holding our own in the competitions of the civilised world. But it must be urged also on a higher ground, as a thing essential to the intellectual and spiritual well-being of the nation and of the Empire.

Sir Henry Roscoe pointed out the influence of scientific research on our national well-being ; and in his speech he said :—

It is to the university that we must mainly look to raise the type of man who by training and character is fitted to prosecute research. Are our British universities at the present moment adequately equipped in men and material to enable them to carry out successfully this national work? A comparison of their capabilities with those of other countries shows a deplorable deficiency in both the above respects.

This state of things being generally admitted, we come before you as the head of the Government to ask you to bring about that closer connection between scientific method, scientific studies, and national industry, upon which you have so strongly insisted, by giving to our universities a State endowment which will not merely serve as a national insurance against attack from without, but is, unlike others, a productive insurance which will repay the nation, not merely once, but over and over again.

Speaking more especially as a business man who has noted the effect of applied science in the industrial world, Mr. A. Moseley, C.B., remarked :—

I am practically impressed with the necessity for those in training for commerce and industry to be thoroughly equipped with technical instruction of university rank, designed to bear especially upon the particular vocations that the rising generation intend entering. On the points mentioned we are distinctly behind both Germany and the United States of America. The success of the United States at present, and perhaps even more so in the future, is and will be due to the higher scientific and practical training her young people receive in her universities first and technical colleges afterwards.

Mr. Bell, M.P., speaking in the absence of Mr. Burt as the representative of artisan classes of the country, said :—

This question is one of vital importance. Unfortunately, my practical knowledge of universities is little. But hitherto a university training has been the luxury of the comparatively well-to-do. The aim is to open the door to the choicer spirits of the poorer classes.

Lord Kelvin wrote to the president of the British Association expressing his regret at not being able to be present and his hearty wishes for the success of "every effort for the much-needed improvement and strengthening of the universities of the United Kingdom."

In the course of his reply to the deputation, Mr. Balfour said :—

I do not suppose that there have ever before been congregated in one chamber so many representatives of learning in this country. We have been told that we have fallen far behind at least two great countries in our educational

facilities. But I do absolutely deny that there is the smallest sign that in the production of these germinating ideas of science we have shown any inferiority, either to our relations across the Atlantic or to Germany, which I may remind the assembly has for many generations pursued this State-endowing process of applying science to industry. That we are behind Germany in that way I do not deny. Germany had a technical university, or gave technical teaching, I think, as far back—I am refreshing my memory—as the end of the eighteenth century, if not before. Of course, the general system of thought in Germany, the habits of the people and the Government in this respect places them at a great advantage as compared with us as far as the endowment of universities can help a nation, as I doubt not it can, in the industrial struggle. But my point is that mere endowment of universities will not, I think, add greatly to the output of original work of the first quality. What, then, will it do? It will do, or may help to do, what is, perhaps, now more important. It will provide an education which will render fit for industrial work all persons who, without university education, would be very ill equipped indeed. I concur with all the speakers to-day that there is a great need—a great financial need—both in the new and the old universities for help towards this object. But I would beg to point out that there is even a greater necessity than a well equipped university—that is, that capitalists should be prepared to realise what we realise in this room—the necessity of giving employment to those whom these universities are to turn out. I was much struck by an observation of Sir William White's. He pointed out that we possess most of the ships of the world—that we are the largest shipbuilders in the world—and yet he said that Germany has an incomparably larger number of students, far better machinery for educating these students, and more men occupied in the shipbuilding yards; and what Germany has done the United States are doing. One of two things is clear. Either our shipbuilders think this qualified class is necessary or they do not think so; or else they find British students, even though turned out in smaller quantities, are sufficient for their purpose, or they employ American and German students for their works. Are our manufacturers convinced that they get a better man if they get one who has been to a university? Or do they think that if a young fellow wants to become one of the captains of industry he should begin early in life? I think there is some evidence to show that they prefer the older course; and I should suggest they are wrong; and if they are wrong you must convince them they are wrong, otherwise there will be no advantage in turning out qualified students, for they will be content to use the man who acquires his training by actual day-to-day labour on the ship, but is not qualified by these higher scientific attainments which are more and more becoming necessary.

One other thing we want, and that, I think, is the creation of positions which will enable a man who has exceptional gifts of originality in science to devote his life to the subjects of his predilection so as not to be driven to another kind of life in which he will not be able to render the full service of which he is capable to his country. In Germany certainly—I am not sure about the United States—such positions exist to a far greater extent than in this country. In the main they must be attached to the universities. I cannot conceive any more admirable use of any funds which the universities can command than the increase of the number of such positions.

In the course of his remarks, the Chancellor of the Exchequer said:—

It would be of some assistance to those who may have to decide in future when money is available if the universities would consider to what extent they are willing to come under control if they receive grants, to what extent the State is to have a voice in fixing the fees of the students, to what extent it is to direct or influence the teaching, whether it is to allocate its assistance to promote special branches of study, or whether it is desired to make every university complete in itself. Some further exposition of their views would make it easier to deal with this question when the time comes for dealing with it.

THE MEETING-PLACE OF EAST AND WEST.[1]

THE publication of Dr. Stein's preliminary report to the Royal Geographical Society and of his own personal narrative of his explorations among the "sand-buried ruins of Khotan" is one of the most important archæological events of the year 1903. For the full scientific publication of the whole of his discoveries by the Indian Government we must perforce wait awhile, but we have all that is needed to enable us to form a general idea of them in the interesting and well published volume which lies before us.

Chinese Turkestan hardly sounds as if it were a land of very great interest, yet, as a matter of fact, it is historically one of the most interesting countries in the world. It is not a comfortable country: merely a string of oases half overwhelmed by a devouring desert of shifting sands, the great Taklamakan, and barred off from the rest of the world by huge and impassable mountains, scorchingly hot in summer and frozen by Arctic cold in winter. Yet these remote wilds have seen one of the most interesting phenomena of history, the meeting together of the civilisations of China, of India, and of Europe; here the antique culture of China had in the early days of the Roman Empire already been brought into contact with Græco-Roman civilisation, and we see the result of the meeting of the two, or, including India, three streams of civilisation in the mixed culture of Turkestan in the early centuries of the Christian era, which Dr. Stein has brought to light.

In those days Chinese Turkestan was the bridge between west and east; from west to east journeyed Roman merchants to buy the precious silk of Serica, and Persian ambassadors or fugitive princes passed seeking the assistance of the mighty Emperor of China; from east to west Chinese armies marched through Turkestan into the basins of the Oxus and Jaxartes, and even reached the Caspian, and Chinese pilgrims, like Fa-hien and Hiuen-Thsang, passed the fanes of Khotan on their way to the holy places of Buddhism in India; traffic to and fro was continuous, and the oases of the Taklamakan could maintain many famous cities, rich temples, and monasteries of renown.

In those days of her importance, as still in these of her desolation, eastern Turkestan was under the political hegemony of China. Legends, indeed, ascribe a remote date B.C. to the first entry of the Chinese into Kashgaria, but since real history (as apart from annals which have not yet been critically sifted) can hardly be said to begin for China before the reign of the great reformer Tsin Chi-Hwangti (B.C. 250), "the burner of the books," we are probably right in assigning the first Chinese occupation to the early days of the Han dynasty, under the emperor Han Wu-ti (B.C. 100), and its first real conquest to the famous General Panchao, who is said to have carried the Chinese arms as far west as the Caspian, and to have attempted to open up direct relations with the Romans (about A.D. 100). Henceforward Kashgaria remained nominally tributary to China; but though individual emperors asserted their authority in the far west from time to time, the country does not seem to have been regularly organised as a Chinese possession until the reign of the great Emperor Tai-tsong, the first monarch of the T'ang (A.D. 634). Under his equally powerful son Kao-tsong we find Chinese viceroys installed in Turkestan, who entered into regular relations with the peoples of the west. The last Sassanian King of Persia, Yazdijird, communicated with them, demanding Chinese assistance against the conquering warriors

[1] "Sand-buried Ruins of Khotan; Personal Narrative of a Journey of Archæological and Geographical Exploration in Chinese Turkestan." By M. Aurel Stein. Pp. x+503. (London: Hurst and Blackett Ltd., 1904.) Price 7s. 6d. net.

of Islâm, who were now overrunning his kingdom, but Kao-tsong refused to attack the Arabs. Firuz, a son of Yazdijird, fled to the Chinese court at Si-ngan-fu, and Kao-tsong proclaimed him King of Persia after the murder of Yazdijird. He was, however, never able to enter into possession of his kingdom, the Arab conquerors of which sent a formal embassy to the Chinese Emperor four years later (A.D. 655).

Thus Chinese Turkestan served as a bridge between east and west in the days of the great T'ang.

Since the period of the T'ang, Kashgaria has always remained nominally subject to China, and, despite the victory of the western religion of Muḥammad over Buddhism, Chinese civilisation has always retained it in its *Kulturkreis*; the Chinese authority has always stood for order and for civilisation, and whenever, as in the years of independence under Yakûb Beg during the 'seventies of the nineteenth century, Islâm has succeeded in ousting the infidel rulers of the land, utter anarchy and barbarism has resulted. The defeat of the Muhammedans by the Chinese general Liu Kin-tang in 1878 was a victory for civilisation. To-day Chinese authority is more in evidence in Kashgaria and more firmly upheld than at any time since the days of the T'ang. The whole story of the retention of Kashgaria, not merely as an outpost of Chinese civilisation, but actually as a Chinese possession, throughout history, is an interesting testimony to the real civilised energy and organising power of the Chinese, as well as to their dogged persistence in pursuing their ends.

Chinese Turkestan is, then, a land of remarkable historical interest. Further, it is, like Egypt, a land in which archæological excavation would be likely to reap rich harvests, for here, as in Egypt, we have two factors which are of inestimable service in preserving the relics of the past intact—dryness and desert sand. The sand covers and protects, the dryness preserves. Hence it is that systematic excavations in the Egyptian manner, now for the first time essayed in Turkestan, have yielded such important results to Dr. Stein. Sven Hedin had already reported the existence of ancient remains in the Taklamakan, and Dr. Stein has explored and excavated them, bringing back with him an invaluable collection of relics of the early civilisation of this strange land, the bridge between west and east. His finds belong mainly to two distinctly marked periods, the third and eighth centuries A.D. The most important of the earlier sites is that in the desert north of Niya, away to the east of Khotan. Here was excavated a regular town of wooden buildings half buried in the sand, with the remains of the trees of its ancient orchards still standing around it. The date of the settlement is given by a document of the reign of the Emperor Tsin Wu-ti, of the Later Tsin (A.D. 265–290). Among the inhabitants Chinese officials were probably included, but the majority seems to have been of Indian origin. This is shown by the discovery of numbers of wooden tablets and parchments inscribed with Indian Kharoshthi writing. These are chiefly reports to the Indian rajas who governed the country. From this we see that the tradition of an Indian conquest of Kashgaria in remote days is founded on fact. That this Indian kingdom formed a road by which the culture of the west penetrated to the east there is no doubt. At Niya, indeed, has been found a striking confirmation of this; five hundred years after Alexander, we find in Turkestan an Indian letter sealed with a Chinese and with a Greek seal side by side! Greek intagli were in common request in this remote Chinese dependency, and the influence of the art of Gandhâra on that of Khotan is very evident from the numerous small objects collected by Dr. Stein on the site of Yotkan, the ancient representative of Khotan-town. The question as to how far Chinese art is really indebted, through the medium of Khotan and Gandhâra, to that of Greece has, apparently, yet to be worked out.

The other excavated sites are later in date. The miscellaneous antiquities from Yotkan partly bridge over the gap between the period of Niya and the period of Dandan-Uiliq, the most important of the later sites; and the great Rawak Stupa in the Yurung-kash district, which has yielded to Dr. Stein material of the most important kind for the history of early Buddhist art, belongs to the intermediate period. Ranged along the base of this *stupa* is a series of colossal stucco figures in alto-rilievo, representing Buddhas or Bodhisattvas (Fig. 1), and attendant Arhats, these last sometimes represented as grouped in

FIG. 1.—Rilievo Statue of Bodhisattva on South-west Wall, Rawak Stup Court. From "Sand-buried Ruins of Khotan."

the halo of a great Buddha. These remarkable examples of Buddhist art were mostly too bulky and delicate to be removed, and so were re-buried by the explorer after a complete series of photographs had been taken of them. Many of these are published as illustrations to chapter xxx. of Dr. Stein's book.

Dandan-Uiliq is a site outwardly much resembling Niya, which Dr. Stein afterwards excavated, and has yielded, like Niya, many written records, but of course of later date and written in different languages and scripts. In some cases these are still of Indian origin. When the script is Brahmi, the language is sometimes Sanskrit, sometimes an unknown tongue, no doubt the native Indo-Scythic of Turkestan, the language of the *Yue-tchi*. The writing is usually upon paper, less usually on wood. The contents of the Brahmi documents are religious. Civil records, analogous to the Kharoshthi tablets of Niya, are chiefly Chinese. The settlement was, in fact, a Chinese Buddhist monastery,

and its ancient name was Hu-kwo. The Chinese documents date to the end of the eighth century, long after the Indian kingdom was extinct, and when the Chinese dominion, which had been triumphantly re-asserted by T'ang Tai-tsong, was seriously threatened by the inroads of the "Ta-Fan" or Tibetans. Actual Tibetan relics were discovered at Dandan-Uiliq.

Larger antiquities were also discovered here, chiefly Buddhist reliefs of stucco, and, more interesting still, frescoes which give us an unlooked-for insight into the art of Khotan at this period. Exhibited in the Chinese section of the British Museum is a remarkable fresco from Dandan-Uiliq, one of the most important of Dr. Stein's discoveries, representing two equestrian figures, with their costume most carefully depicted. This is not illustrated in Dr. Stein's book, and the omission is to be regretted, as the picture is one eminently calculated to interest the general reader for whose use the "Sand-buried Ruins of Khotan" is chiefly intended.

Another site, beyond Niya, at Endere, has yielded remains of the same date as those from Dandan-Uiliq. This place, Endere, is the most easterly point which Dr. Stein reached in his explorations. It is distant from Khotan some 250 miles, and from Kashgar no less than 550 miles. This fact alone gives some idea of the extent of ground which Dr. Stein covered in his rapid journeyings. His explorations were indeed carried out with remarkable energy, and their great success is the fitting reward of this energy and pluck. For it must be remembered that much of Dr. Stein's work was carried out in the intense cold of a Kashgarian winter, when the thermometer often fell to below zero Fahrenheit in the explorer's tent, when it was hardly possible to hold a pen for the cold, and even sleep was sometimes banished by its intensity. Under these extreme conditions Dandan-Uiliq and Niya were excavated. If we add to these rigours the difficulties of the journey from India over the Pamir passes, we gain some idea of what Dr. Stein has done. His mission has succeeded beyond his own most sanguine expectations, and the Indian Government has indeed served the cause of science well in sending him to Turkestan.

FIG. 2.—Eroded Ranges of the Kuen-lun, seen from above Yagan-Dawan. From "Sand-buried Ruins of Khotan."

Incidentally Dr. Stein carried out very important surveys of the Kuen-Lun range (Fig. 2), and connected his own surveys with the trigonometrical survey of India, thus definitely fixing the exact geographical position of Khotan. Also he was enabled to do a great service to archæology by detecting and exposing the remarkable forgeries of ancient documents in "unknown scripts," the work of a clever rascal named Islam Akhun and a few confederates, which had been sold to travellers as genuine antiques, and had long mystified the learned into whose hands they had come. It was the appearance in India of these forgeries (together with a few genuine relics from Dandan-Uiliq, which had given the forger the idea of his deception) which first impelled Dr. Stein to the systematic exploration of the ruined "cities" from which they were said to have come. He has now cleared up the mystery: we now know what is genuine in the way of written documents from Turkestan and what is not. But, above all, Dr. Stein has discovered really new archæological material in the Kharoshthi tablets from Niya and in the Brahmi documents in a non-Indian tongue from Dandan-Uiliq. To students of Buddhism the relics of religious art from Dandan-Uiliq, the Rawak Stupa, and Yotkan will provide material for very important work.

H. R. HALL.

BRITISH ASSOCIATION MEETING AT CAMBRIDGE.

IN a former article (NATURE, April 21), a preliminary forecast was given of the local arrangements for the meeting of the British Association, to be held at Cambridge from August 17 to 24. The programme is now in an advanced state of preparation, and copies may be obtained after July 25 on application to the local secretaries at Cambridge. It may be of interest to give a short account of the arrangements in amplification of the incomplete summary already published.

It is expected that meetings of a sub-committee appointed by the International Meteorological Committee at Southport in September, 1903, to combine and discuss meteorological observations from the point of view of their relations with solar physics, will be held at Cambridge during the session of the association. The committee consists of twenty-two members, of whom eighteen represent the observatories or meteorological institutions of the Continent and America. The primary object of the meeting in Cambridge will be to constitute the organisation of the committee, and prepare a scheme of operations. The members of the committee will take part in the proceedings of Section A, particularly the subsection which deals with cosmical physics, under the presidency of Sir John Eliot, F.R.S.

The conference of delegates of corresponding societies will meet on Thursday, August 18, and Tuesday, August 23, at 3 p.m., in the large lecture-room, Gonville and Caius College.

Mr. Balfour will assume the presidency, and deliver an address in the Corn Exchange on August 17, at 8.30 p.m. A plan of the Corn Exchange may be seen in the reception room, and reserved seats secured up to 6 p.m. on Wednesday, August 17. For the con-

venience of visitors, a small number only of the seats will be allotted on Monday afternoon, and a considerable number of places in all parts of the building will be held in reserve for those who arrive on Wednesday, August 17.

At 3 p.m. on Thursday, August 18, the High Sheriff of Cambridgeshire will entertain the association at a garden party in the grounds of Emmanuel College, and at 5.30 p.m. the Registrary of the university will deliver a lecture at the theatre on the growth and origin of the university. At 9 p.m. there will be a reception of the association by the local committee in Trinity College.

On Friday afternoon, August 19, the mistress and resident staff of Girton College will entertain 500 members of the association at a garden party, and in the evening Prof. George Darwin will deliver a lecture in the theatre on ripple-marks and sand-dunes.

Saturday, August 20, will be devoted to excursions to places of interest in East Anglia. The local committee hopes that prominent members of the association will, so far as possible, take part in the excursions, which promise to be of considerable interest. A set of excursion guides and a map, which has been specially prepared by the Director-General of the Ordnance Survey, will be given to each member of the association.

The following is a list of the excursions:—

Audley End and Saffron Walden.—Audley End House will be visited by permission of the Lord Howard de Walden; the church and museum in Saffron Walden form other items in the programme.

Brandon and Didlington Hall.—The most attractive features of this excursion will be the flint knapping industry at Brandon, Lord Amherst's Egyptian collections, rare books and illuminated MSS. at Didlington Hall.

Cromer.—Mr. Clement Reid, F.R.S., has arranged an attractive itinerary for those interested in the geology of the Norfolk coast.

Dykes of Cambridge.—This excursion includes an inspection of the well-known Fleam Dyke and Devil's Ditch, under the guidance of Prof. Ridgeway; opportunity will also be afforded for botanising on the dykes. By the invitation of Mr. Richard Marsh, trainer to H.M. the King, tea will be provided at Egerton House, Newmarket.

Ely.—A visit to the cathedral, a building of exceptional architectural interest, under the guidance of the Dean, forms the most important feature of this excursion.

Wicken Fen and Upware.—Members will travel from Cambridge to Upware in steam launches. This excursion is likely to be of considerable interest to geologists, entomologists, and botanists.

Hatfield and St. Albans.—A visit to Hatfield House, by permission of the Marquis of Salisbury, visits to St. Albans Abbey, the site of Verulam, the sites of the battlefields of St. Albans, and the orchid houses of Messrs. Sanders, form the chief attractions.

Lincoln.—The exceptional architectural and archæological features of Lincoln seemed to the committee sufficient justification for arranging an excursion to this city, in spite of its distance from Cambridge. The Mayor of Lincoln invites members to tea in the Castle grounds.

Norwich.—The cathedral, the hospital of St. Giles, and St. Andrew's Hall are the most important buildings to be visited. Hospitality is offered by the Mayor of Norwich, and by Mr. and Mrs. James Stuart.

Sandringham, Lynn, and Castle Rising.—This excursion, which is likely to prove one of the most popular, includes visits to the Lynn churches, the castle and church at Castle Rising, also the grounds, kennels, stables, and dairy at Sandringham. Tea will be provided by invitation of H.M. the King.

Wisbech.—The Lord Lieutenant of Cambridgeshire has kindly invited members of the association to visit the old-world town of Wisbech, and facilities will also be afforded for inspecting the woad works.

The committee is greatly indebted to the authors the excursion guides for the full and interesting accounts which they have written of the places to be visited.

On Saturday the master and fellows of Peterhouse invite 600 members of the association to an evening party at 9 p.m.

On Sunday evening at 8.30 p.m., there will be a performance of unaccompanied sacred music by the combined choirs of King's, Trinity, and St. John's Colleges in the Chapel of King's College.

On Monday, August 22, the Lord Lieutenant of Cambridgeshire and the Mayor will entertain the association at a garden party in the Botanic Garden at 4 p.m. On Tuesday afternoon Mrs. Sidgwick, principal of Newnham College, invites 500 members to a garden party in the college grounds. The large room of the Cavendish Laboratory has been placed at the disposal of the committee for the exhibition of specimens. For information as to exhibits, application should be made to Mr. P. V. Bevan, the Cavendish Laboratory.

Arrangements have been made for members to have exceptional facilities for visiting the Botanic Garden, University Laboratory, the Observatory, the University Press, as well as college buildings and gardens. Cambridge schools and the Addenbrooke's Hospital may also be inspected at stated times, and visits have been arranged to several works in Cambridge, and to nursery gardens at Sawbridgeworth and Broxbourne.

In a subsequent article some account will be given of the sectional proceedings, together with a list of some of the colonial and foreign guests.

MODERN PRINTING PRESSES.

THE recent issue of M. A. Ducrot's "Presses modernes typographiques," published by the house of Gauthier-Villars, Paris (7 f. 50 c.), provides an opportunity for a short account of modern printing presses. The work is copiously illustrated, and describes, from a mechanical point of view, every kind of machine, from the small but handy platen to the awe-inspiring rotary, whilst the intermediate classes of cylinder machines are represented by many varieties, both of the single and double kind.

The only English work of a similar nature, devoted exclusively to machinery, is Wilson and Grey's "Modern Printing Machinery," published so far back as 1888, and therefore not up to date. This is to be deplored considering the great advance made in that department of the printing craft.

Although artistic printing was not altogether an unknown quantity during the nineteenth century, much progress was made in a general way during the latter part of that century, which also marked the introduction of machinery, but its general adoption was a matter of time. Through William Morris's work at the Kelmscott Press, much impetus was given to what may be termed the decorative side of printing, but the invention of the many processes of reproduction in connection with letterpress illustration, and the enormous development of such processes, have necessitated printing machinery of a different and much improved character in order to cope successfully with the demand for graphic literature.

That American engineers have in recent years taken the initiative in this direction will be admitted, but it is some consolation for English printers to observe that the home manufacturers are beginning to realise the situation, and are endeavouring to make amends and thus regain their position in the field.

In looking abroad it is customary to associate Messrs. Hoe's name with some of the best of American machinery, whilst for that of French origin the late M. H. Marinoni was looked upon as the best manufacturer of machinery especially adapted for newspaper or magazine work. To specify other names in either country would require space, although in fairness to Germany it must be said that many really good machines of various kinds are now before the trade and at work in this country.

To the lay reader it may be explained that the various classes of machinery used for letterpress printing are divided under certain heads, and may be broadly grouped as follows :—(1) rotary machines; (2) double cylinder perfecting machines; (3) single cylinder one-feeder machines; (4) single cylinder two-feeder machines; and (5) platen machines.

Commencing with the rotary kind, as its name implies, the action is that of continuous rotation whilst the machine is in motion. Although there are a few machines on the market with flat type beds that print from the reel, this class of machine generally prints from a surface made from either stereotype or electrotype plates, and curved to the cylinder similar to the one which gives the impression—the paper as it is unwound from the reel passing between the printing and impression cylinders continuously whilst the machine is running.

The paper is made to the required width and wound on reels; sometimes these webs contain paper two or three miles long, the length being regulated by the weight or thickness of the material. Such machines are used mostly for newspaper work, or magazines of a non-illustrated character, where a large number of copies are required, and each section or copy is cut and folded before it leaves the machine. They are also made in duplicate, quadruple, or even larger sizes, so that the machine is self-contained, and will produce just as many duplicate copies as it is constructed for.

It is true that illustrated work is now attempted on rotary machines, and whilst no doubt further improvements will be made in due course, the results are not altogether satisfactory so far, although illustrations in line are more successful than those produced by the half-tone process.

Perfecting machines have two cylinders, and are used mostly for newspaper or magazine work of shorter numbers, and occasionally for bookwork. These print both sides of the paper, which is in single sheets, before it leaves the machine, but the double impression is two distinct operations. Although this class of machine has been used for a great number of years, it is not adapted for the best class of bookwork owing to the difficulties of ink set-off. These machines, and all other than the rotary kind, print from a flat printing surface.

The single cylinder (one-feeder) is *par excellence* adapted for the best bookwork, whether illustrated or not. Of this class there is a great variety, the English make being called the "Wharfedale," and built on the stop-cylinder principle, that is, the cylinder over which the sheets of paper are carried, and which gives the impression to the printed sheet as it revolves, is stopped or locked on the return travel of the machine, when it is automatically released and revolves again as the type carriage or bed travels forward once more.

Other single cylinder machines are those of the two-revolution kind, that is, the cylinder revolves continuously in the same direction, once whilst the sheet is being impressed and again whilst the type bed is travelling back to its original position, thus making two revolutions for each copy printed. This class of machine is well represented by the Miehle and Century, both of which are of American manufacture, and are admirably adapted for high-class illustrated work of the magazine order because the inking facilities are so well considered.

Another kind of single cylinder machine is the two-feeder, and it may be described as being somewhat similar to the ordinary Wharfedale, but it has a longer travel for its type carriage, with an arrangement at both ends of the machine for inking and rolling the forme. Unlike the stop-cylinder of a single feeder machine, which is stationary on the return travel, the impression cylinder of the two-feeder immediately reverses on the completion of the revolution on the principle of the old "tumbler" machine. In doing this a fresh sheet is seized by a second set of grippers or fingers attached to the cylinder. By this method a sheet is printed at each propulsion of the machine in either direction.

Those of the platen kind are used for smaller work, mostly of a commercial character, and the action is somewhat similar to that of the old hand press, because both type and paper are impressed on the flat. They are made in many sizes, and some will print almost as large a sheet as the old hand press. Although one operator only is required, he will, with the aid of power, produce at least three or four times as much as two men at hand press with equally good results, provided the worker is a skilled hand.

CHAS. T. JACOBI.

CANCER RESEARCH.

AS Dr. Bashford remarks in his introductory note to the report of the Cancer Research Fund,[1] the solution of the problem of the cause of malignant disease in man is really the logical destination and centre towards which all channels of cancer research must converge, rather than the starting point thereof. The zoological distribution of cancer has therefore formed one of the first lines of inquiry to be undertaken by the Cancer Research Fund, founded about two years ago, for investigating this dire disease. By the willing cooperation of many workers, a most interesting series of tumours has been obtained from the various domestic animals, from the mouse and hen, and from three species of fish, proving that malignant disease is not confined to man. The malignant growths of man seem to be incapable of transmission to animals, but a malignant new growth from one animal may occasionally be transmitted to another individual of the same species. This has been carried out by Jensen, of Copenhagen, and by Borrel, of Paris. Through the kind collaboration of Prof. Jensen, a specimen of epitheliomatous tumour of the mouse was obtained and successfully transplanted into mice, but not into other animals, thus confirming Jensen's results.

The last half of the report contains an account of Dr. Bashford and Mr. Murray's investigations on the cytology of malignant growths, illustrated with a number of drawings. The results obtained are practically the same as those of Prof. Farmer, Mr. Moore, and Mr. Walker, already detailed in these columns (NATURE, vol. lxix. p. 319), viz. that in the cancer process there is a transformation of the normal

[1] "Scientific Reports on the Investigations of the Cancer Research Fund. No. 1. The Zoological Distribution, the Limitations in the Transmissibility, and the Comparative Histological and Cytological Characters of Malignant New Growths." (Taylor and Francis, 1904.)

adult tissues into modified reproductive or "gametoid" tissue. This, however, does not completely explain malignancy; there may possibly be in addition conjugation of cells or of nuclei. Let us hope that before long Dr. Bashford and his colleagues may give us further information on these and other points so necessary for the complete solution of the cancer problem.

The reports of the cancer research laboratories of the Middlesex Hospital [1] contain several papers which are, however, for the most part of purely medical interest, *e.g.* cancer in certain organs, and various methods of treating the disease. A report by Prof. Karl Pearson on cancer statistics collected by Messrs. Hillier and Tritsch is of considerable interest. For this the histories of 3000 cases of cancer were carefully analysed, and the results of Prof. Pearson's mathematical analysis are:—(1) as regards age incidence frequencies, that cancer is far more likely to occur in childhood in the male than in the female; (2) as regards a family history of cancer (that is, heredity in cancer), there seems to be a slight correlation between a case of cancer and a family history of cancer, but this is so slight as to be within the probable error of random sampling; and (3) that there is little or no relation between the presence of cancer and a tubercular family history, but there is a relation between the presence of cancer and the presence of tuberculosis.

The first report of the Liverpool Cancer Research Fund [2] has also recently been issued. This fund has been instituted by Mr. Sutton Timmis, who has vested in two trustees a sum of 10,000*l.*, which is administered by a committee empowered to spend 1000*l.* to 1500*l.* per annum until the fund is exhausted or the cause of cancer discovered. A cytolytic milk has been prepared by injecting a cow with carcinomatous material, but the cases treated with it are not yet sufficiently numerous to allow an expression of opinion as to its value. Investigations are also being made into malignant growths of man and animals by Dr. Albert Grünbaum, who has been appointed director of these researches.

Mr. Cecil H. Leaf in a booklet [3] discusses the clinical causes and prevention of cancer of the breast, with an analysis of 100 cases. Of the 100 cases, 84 were married and 16 single, and the author thinks that very early marriages and errors in lactation may act as exciting causes. In 35 of the cases there was a definite history of injury, and unsuitable corsets are suggested as taking some share in the production of mammary cancer. Diet, *e.g.* excessive meat eating, use of alcohol, and of salt, could not, as has been suggested by some, be ascribed as a cause of the disease. Finally, some suggestions are made with the view of prevention.

R. T. HEWLETT.

ELECTRICAL TRANSMISSION OF PICTURES AND SCRIPT. [4]

THE problem of distant electrical vision is one to which much speculation and experimenting have been devoted. Before this problem can be attempted with any hope of success, however, the preliminary one of the electrical transmission of photographs over a distance has to be solved. This problem, it may be stated at once, has been mastered, and it is now possible to transmit photographs in this manner, and successful results have been obtained over telegraph and telephone lines 800 kilometres long.

It does not need much consideration to see how important such a process would be for journalistic and police work if it could be industrially exploited, and it were possible simply to hand a sketch or photograph in at the telegraph office and send the same as one now sends an ordinary telegram. The evening papers would be able then to publish photographs taken at the seat of war in Korea on the same day. Unfortunately, with the apparatus at present to be had, the time taken to transmit a half-plate photograph is half an hour. The cost of the use of a telegraph line of any length for half an hour would be, it is needless to point out, prohibitive. The lessening of the required time of transmission is, however, simply a matter of further development, and no good reason can be seen why in a few years' time the process should not be an adjunct to every existing telegraph line.

The author of the present work has devoted considerable time to this subject, and his booklet consists of an exact description of the apparatus and processes he has worked out. The author is to be commended on the very precise and careful way in which he has described every detail, so that it would be possible for anybody, with the help of this book, to reproduce, without any original work, the same results as he has obtained himself.

The method shortly consists of the following:—A ray of light is made to pass systematically all over the transparent film to be transmitted. After passing through the film it impinges upon a selenium cell the resistance of which varies proportionally to the amount of light which passes through the photograph. These varying currents pass through the line and are received in a moving coil galvanometer the pointer of which, in moving, inserts or takes out resistance in a high tension circuit, according as the current flowing in the moving coil changes. In the high tension circuit a small vacuum tube is connected, and it follows that the illumination of this tube is proportional to the light passing through the plate at the transmitting end of the line. This vacuum tube now passes over the sensitised photographic paper in synchronism with the ray of light over the transmitted plate, and thus a reproduction of the same is obtained. The transmitted film and sensitised paper are each wrapped on a glass cylinder. These cylinders are rotated by motors, and synchronised once each revolution. Only one wire is needed for the transmission, with, of course, an earth return.

In the case of the transmission of handwriting and half-tone illustrations, the same are got up on metal foil with electrically non-conducting ink. A conducting point then travels over the metallic foil, and closes and opens the sending circuit according as it is travelling on a marked or an unmarked place. The receiver used by the author is a modification of that described above, the essential point being the use of the vacuum tube fed with the Tesla currents. The speed reached is 500 written words per hour. For a half-tone illustration a strip ½ cm. wide and 10 cm. long can be sent in 100 seconds.

It would seem that there is not very much practical value in the transmission of handwriting; the type printing telegraph of to-day fulfils all ordinary requirements, and it would be only very seldom that a transmission of handwriting would be required. It is to be hoped, however, that this electrical "distant photography" will make rapid progress.

C. C. G.

1 "Archives of the Middlesex Hospital. Vol. ii. Second Report from the Cancer Research Laboratories." Edited by Alex. G. R. Foulerton, F.R.C.S. (Macmillan and Co., Ltd., 1904.)

2 "First Annual Report of the Liverpool Cancer Research (The Mrs. Sutton Timmis Memorial Fund), Albert S. Grünbaum, M.D., Director." (University Press of Liverpool, 1904.)

3 "The Clinical Causes of Cancer of the Breast and its Prevention." By Cecil H. Leaf, M.A., M.B., F.R.C.S., Assistant Surgeon to the Cancer Hospital. Pp. 64. (Archibald Constable and Co., 1904.) Price 2*s.* net.

4 "Elektrische Fernphotographie und Aehnliches." By Dr. Arthur Korn. Pp. 66. (Leipzig: S. Hirzel, 1904.) Price 1 mark.

NOTES.

WE deeply regret to see the announcement that Dr. Isaac Roberts, F.R.S., died at Crowborough on Sunday last.

THE monument erected in the Place Breteuil, Paris, to the memory of Pasteur, was unveiled on July 16 by President Loubet. The ceremony was attended by the members of the diplomatic body, by prominent men of science, and by representative Government officials. Speeches eulogising the services rendered to science by Pasteur were delivered by the French Minister of Public Instruction, the Prefect of the Seine, and the president of the Paris Municipal Council. Prof. Herrera, of the University of Brussels, spoke in the name of the foreign subscribers. The monument is the work of M. Falguière.

THE Postmaster-General introduced into the House of Commons on Monday a Bill for the regulation of wireless telegraphy. The Bill makes no attempt to create a State monopoly in wireless telegraphy, but merely aims at regulating its use in the country in a way that shall prevent the undue clashing of conflicting interests. The Government has at present no jurisdiction over telegraphy unless both ends of the system are within the United Kingdom or within the three-mile maritime limit. It is proposed to deal with the matter by means of licences. It is obvious that the peculiar conditions under which wireless telegraphy is worked, particularly the fact that neighbouring installations cannot at present be operated without interfering with one another, make it very desirable that the Government should be able to exercise a certain amount of authority in such questions, for example, as the selection of sites for transmitting stations. The great strategical value of wireless telegraphy to the Navy makes the matter of still more importance.

IN connection with wireless telegraphy, we note that Mr. Duddell has recently been carrying out some experiments for the Post Office in Bushey Park with the new thermo-galvanometer which he exhibited at the recent Royal Society soiree. This instrument is capable of directly measuring the current received by the aërial at the receiving station, and thus affords a means of making scientific experiments on many of the problems connected with the subject which have long waited for a satisfactory elucidation.

THE weather report issued by the Meteorological Office for the week ending July 16 shows that from the beginning of the year the rainfall has equalled or exceeded the mean in all districts except the north-east and east of England and the midland counties, where it is still an inch below the average. In the north of Scotland the fall is 4½ inches above the mean. The temperature for the week was above the mean in all districts, amounting to 6° in the midland counties, where the maxima reached 85°. The same value was recorded in south and east England. On Sunday last the maxima were still higher, reaching 91° in parts of Hertfordshire. Thunderstorms have occurred in many places.

THE Bombay branch of the Royal Asiatic Society will celebrate its centenary on January 17, 1905.

THE International Botanical Congress will meet in Vienna in 1905 from June 12 to June 18.

THE deaths are announced of Prof. Albert Rilliet, of Geneva; of Prof. V. Merz, formerly of Zürich; and of Prof. Karl Bopp, formerly of Stuttgart.

THE death is announced of Prof. F. Knapp at the age of ninety-one. Prof. Knapp was for many years professor of applied chemistry in the Chemical Institute at Brunswick. He was a former student and son-in-law of Liebig.

SIGNOR PIETRO BLASERNA has been elected president and Signor Francesco d'Ovidio vice-president of the Reale Accademia dei Lincei, of Rome; Prof. Giuseppe Gabrielli has been appointed librarian.

DR. E. RUPP, of Marburg, and Dr. F. Dolezalek, of Berlin, have been raised to the rank of professors; Prof. F. Schilling, of Göttingen, has been appointed at the technical school of Danzig, and Prof. von Margold, of Aachen, has also been appointed there, both as professors of mathematics.

THE specimens and other material collected by the Scottish Antarctic Expedition have arrived at the headquarters of the expedition in Edinburgh. The *Scotia*, with the members of the expedition on board, is expected to reach the Clyde to-day.

PROVISIONAL arrangements have been made by the American Society of Civil Engineers and the Canadian Society of Civil Engineers for the forthcoming visit of members of the Institution of Civil Engineers to the United States and Canada. Broadly, the visit will commence with a week spent in New York and the neighbourhood. Thence, a journey will be made to Montreal by a special train placed at the disposal of the party. A week will be spent in Canada, for which similar special travelling facilities will be provided; and this part of the tour will be concluded at Chicago, whence the party will proceed (again by special train) to St. Louis, which is expected to be reached on September 30. The party will leave Liverpool by the Cunard ss. *Etruria* on September 3, and may expect to reach New York on September 10.

THE following is an abridged summary of the prizes offered by the Belgian Academy for 1904 and 1905:—For 1904, in mathematics and physics, critical phenomena in physics, viscosity of liquids, study of n-linear forms where $n>3$, thermal conductivity of liquids and solutions, each a prize of 600 francs; unipolar induction of Weber, 800 francs. In natural sciences, the Cambrian rocks of Stavelot (Belgium), 800 francs; modifications produced in minerals by pressure, 600 francs; development of Amphioxus (see *Bulletin*, 1904, No. 4, for corrected announcement), 1000 francs; effects of osmotic pressure in animal life, and Devonian flora of Belgium, each 600 francs; heterœcism of parasitic fungi, 800 francs; and physiological action of histones, 1000 francs. All memoirs to be written in French or Flemish, and sent in before August 1, 1904. For 1905, in mathematics and physics, combinations of halogens, 1000 francs; physical phenomena accompanying mutual dissociation of liquids, 800 francs; linear complexes of the third order, 600 francs; principal terms in the periodic deviations of the vertical, 600 francs. In natural science for the same year, effect of albuminoids in nutrition, reproduction of Dicyemidæ, formations intermediate between the Bruxellian and Tongrian in Brabant, geological age of certain Oligocene deposits in Belgium, sexuality of the individuals resulting from division of a single ovum in certain diœcious plants; prizes, 1000 francs for each of these five subjects; silicates of Belgian rocks, &c., 800 francs. In addition to these ordinary prizes the academy will award the following:—June 30, 1905, a Charles Lemaire prize relating to public works; June 30, 1904, a Louis Melsens prize for applied chemistry or physics; December 31, 1904 a Charles Lagrange prize for

terrestrial physics; on May 1, 1906, a Selys Longchamps prize for researches on the Belgian fauna; on December 31, 1904, a Théophile Gluge prize for physiology; and in 1906 a François Deruyts prize for higher synthetic or analytic geometry.

MR. BALFOUR presided on July 14 at the annual dinner of the Royal Economic Society, of which he is vice-president. In proposing the toast "The Royal Economic Society," he said in the course of his remarks:—"If a man of science once lets the public think that he is speaking not in the interests of his science, but in the interests of his party, if he once allows the view to get abroad that his expression of opinion may have its origin in his scientific views, but has a double parentage, and that the scientific views are in some sense moulded in conformity with our political differences, his whole authority from that moment will absolutely vanish. So far as political economy is a science at all—and I am the last person to deny it that proud title to distinction—it must be absolutely international in its character. People talk of an English, a German, a French, or an American school of political economy. In so far as they talk in that way they show conclusively that politicai economy to that extent has not yet thoroughly earned its title to a position among the sciences. There is no such thing as English physics as distinguished from German physics, or German mathematics as distinguished from French mathematics. I do not say there may not be certain schools having the impress of great teachers belonging to one or the other nationality, but *qua* science and as a science political economy must be, and is, and will be, absolutely international in its character. Let everybody who has the chance, not only treat economic problems in a strictly objective spirit, but let him make it clear that that is the spirit in which he is trying to treat them. Thus and thus only will the student and the investigator obtain that authority over the changing forces of ordinary public opinion which it should be the proudest boast of men of science to obtain, which if they truly pursue science in a scientific spirit they have always obtained in the past, and I cannot doubt for a moment they will always obtain in the future."

The second part of vol. v. of *Annotationes Zoologicae Japonenses* contains the description of a new deep-sea polychæte annelid by Prof. A. Isuka, additional notes on Japanese cicadas by Prof. S. Matsumura, and the first part of a biological and geological essay on the island of Hokkaido by Mr. E. Klocke.

IN reply to a question of Mr. Morrell, not answered orally in the House of Commons, Sir W. Anson stated that the Board of Education is aware that those interested in agricultural investigation recognise the value of the drift maps prepared by the Geological Survey as a basis for soil maps. Superficial deposits are being mapped in all districts where work is going on in connection with the survey. Thirty-five 6-inch maps of North Staffordshire have been published with drift, and others of South Wales and of the area around Leicester are in course of preparation for publication. The board does not contemplate the publication of drift maps on the 6-inch scale for the entire country, but manuscript maps of any part surveyed on this scale may be obtained at the cost of copying, and whatever information with reference to superficial deposits the officers of the survey have shown upon their field maps of other parts of the United Kingdom is available for reference at the offices of the Geological Survey.

IN *La Nature* of July 9, M. J. R. Plumandon, of the Puy de Dôme Observatory, contributed an interesting article on the dryness of the air. "Relative humidity," or the percentage of saturation of the air with aqueous vapour, plays a more important part in meteorology than "absolute humidity"; its variations produce or dissipate clouds, and give rise to fine or wet weather, it is always irregularly disseminated in the atmosphere, its diurnal variation following inversely the range of temperature, and its annual variation generally exhibits a maximum in winter and a minimum in summer. But almost everywhere it exhibits another minimum in spring-time which frequently exceeds that of summer. The minima, or in other words the periods of dryness of the air, present the greatest interest, owing to their irregularity both as regards date and intensity. M. Plumandon shows by means of very clear diagrams that the annual minimum is more marked, and occurs at varying periods, according to the greater altitude of the station. Near Paris, at a height of 50 metres, it always occurs in spring, while on the summit of the Pic du Midi (2859 metres) it occurs at all seasons. At Toulouse (194 metres) the greatest dryness of the air occurs nearly always in summer, but sometimes also in spring. At Clermont-Ferrand (338 metres) it occurred in spring in twenty-one years out of twenty-five, and at the summit of the Eiffel Tower (also 338 metres) it occurred in March or April in seven years out of eleven. On the Puy de Dôme (1467 metres) it took place in twenty-one years out of twenty-two during the cold season, between September 20 and March 1. The diagrams also show the intensity of the minima in the various months.

M. POTIER has presented a large and valuable collection of pamphlets and works on physics to the French Physical Society for distribution among any members of the society who are interested in the particular branches of which they treat.

IN several recent numbers both in this and last year's volumes of the *Bulletin international* of the Cracow Academy, Prof. Ladislaus Natanson discusses the phenomenon of accidental double refraction in liquids and its connection with the theory of relaxation. The author further criticises papers by M. St. Zaremba, who also contributes a number of writings on the same subject to the same journal.

IN the June number of the *Journal* of the Royal Microscopical Society, Mr. Keith Lucas describes a microscope in which the usual planed sides of the body-tube and limb are replaced by geometric slides. The instrument thus involves an adaptation to biological and other microscopes of a device the use of which has hitherto been generally restricted to measuring microscopes.

FROM Messrs. Ulrico Hoepli, of Milan, we have received the latest issue of their "Biblioteca scientifico-politecnica," a catalogue extending to more than three hundred pages, and comprising scientific and technical works and periodicals published both in Italy and in other countries, up to the end of 1903. In all cases where foreign works have been translated into Italian the translation is mentioned in this catalogue.

A SECOND and enlarged edition has been issued of Prof. Augusto Righi's small book on "La moderna teoria dei fenomeni fisici," in which the author describes modern views on radio-activity, ions, and electrons. The book forms the third of a series published by Nicola Zanichelli, of Bologna, under the title "Attualità scientifiche." It extends over 165 pages, and contains a fairly complete bibliography of the subject.

In a paper on "Edge Corrections in Condensers," communicated to the *Proceedings* of the American Academy of Arts and Sciences, Mr. J. G. Coffin works out a number of electrostatical problems in two dimensions by the conformal transformation of Schwarz and Christoffel. The problems here considered include as particular cases many of the cases solved in Prof. J. J. Thomson's book, and they have application to condensers, such as one formed of two silvered glass plates, the capacities of which have not previously been determined.

In his presidential address to a joint meeting of the American Physical and Mathematical Societies, delivered in February last, Mr. Arthur G. Webster chose as his subject "Some Practical Aspects of the Relations between Physics and Mathematics." The address has been reprinted in the *Physical Review* for April, and deals with the work of the late Prof. Willard Gibbs, the endowment of research, and the relative parts played by mathematical and physical teaching and general culture in the education of the physicist in schools and colleges.

Some interesting properties relating to the polarisation of electrodes are described by M. E. Rothé in the *Bulletin* of the French Physical Society, No. 214. In particular the author obtained a deposit of hydrogen on a platinum wire with a single Daniell cell when the anode was a large lamina, although 1.7 volts would be required to decompose water in ordinary circumstances. This deposit ceased when the anode became polarised by the absorption of oxygen. It thus appears that gas may be deposited on a *single* electrode when the electromotive force is just sufficient to overcome the counter-electromotive force of that electrode alone.

An account of the department of international research in terrestrial magnetism of the Carnegie Institution is given in *Terrestrial Magnetism and Atmospheric Electricity*, ix., 1. The object of the department will be to investigate such problems of world-wide interest as relate to the magnetic and electric conditions of the earth and its atmosphere, not specifically the subject of inquiry of any one country but of international concern and benefit. Among the problems suggested are a magnetic survey of ocean areas and unexplored regions, international observations of the variations, including the establishment of secular variation or repeat stations throughout the globe, observations in ocean depths and atmospheric regions (for which the first step consists in devising suitable instruments), and other problems.

At the recent show of the Royal Agricultural Society, the new Just-Hatmaker process for drying milk was exhibited. The milk is fed continuously on two cylinders, one-eighth of an inch apart, and revolving inversely. These are heated by superheated steam within, and have a surface temperature of 110° C. The milk passing between the revolving cylinders forms a thin layer on each, becomes evaporated to dryness, and is stripped off as a thin sheet of milk solids, all within a single revolution. The thin sheets are reduced by sieving to a powder, which can be compressed into tablets. Mixed with warm water the powder immediately forms a liquid having all the properties of boiled milk. The advantage to travellers of having milk in a concentrated form—the powder contains only 6 per cent. of moisture—is obvious. Moreover, the dry milk as it leaves the machine is completely sterilised. With rennet or acid we find that the mixture of dried milk and water curdles, but the curd is not coherent, a property which may add to its digestibility but destroys its value for certain culinary purposes. Owing to its cooked taste, the new product can never replace fresh milk, so that its introduction is no menace to the British milk industry; on the contrary, farmers should benefit if the milk supply associations they deal with possess this apparatus for drying any surplus over the daily requirements. The public will find that discrimination is necessary in the purchase of the dried milk, as it can be made from either whole or separated milk.

We have received a copy of the fifth annual report of the Plymouth Municipal Museum and Art Gallery, in which an unusually large number of presentations to that institution are recorded.

In the July issue of *Bird Notes and News* the Society for the Protection of Birds directs attention to the extent of the trade in cage-birds, and the evils attendant on the capture and maintenance in captivity of such birds. The subject is emphasised in the case of the linnet by a special leaflet, "A Linnet for Sixpence," in the course of which it is stated that sixty per cent. of these birds perish during the first week of captivity, in addition to others killed in capture and the number of hens wantonly destroyed by their captors. The practice of selling in London cock-linnets in paper-bags for sixpence is specially deprecated.

The *Popular Science Monthly* for July contains an illustrated account by Prof. Bashford Dean of the zoological station at Misaki, Japan. The station, which was removed to Misaki in 1897, now contains two buildings with convenient workrooms, for which fittings and books are periodically sent from Tokyo in accordance with the needs of investigators. The great feature of the station is the crew of fishermen, who are accustomed to carry on their trade in deep water, with lines which may be as much as a mile in length, and often bring up rarities. The shallow water of the bay yields numerous interesting types—among others a giant Balanoglossus—while from deep water further out are obtained the remarkable shark Mitsurikina, perhaps identical with the Cretaceous Scapanorhynchus, the frilled shark (Chlamydoselachus), and one of the Port Jackson sharks, in addition to numerous interesting invertebrates, such as swarms of glass-sponges and specimens of the stalked crinoid Metacrinus.

In No. 10 of vol. ii. of the *Circulars and Agricultural Journal* of the Royal Botanic Gardens, Ceylon, the director, Mr. J. C. Willis, gives an account of the history of the institution; originally simply a botanic garden at Peradeniya, it has gradually developed into one of the greatest botanical and agricultural establishments in the tropics, comprising six botanic gardens with a cultivated area of 256 acres in different climates and elevations, three experiment stations of a total cultivated area of 360 acres, and forest reserves for scientific purposes of 850 acres. There is a European staff of nine, including four botanists, an entomologist, and a chemist, and well equipped laboratories, library, museum, and herbarium, all open freely to workers from abroad. No less than twenty-two scientific men have visited Peradeniya for purposes of original research during the last seven years, and the institution now publishes a botanical journal devoted to pure research.

"The Fungous Diseases of Fruits in Michigan" forms the title of a special *Bulletin* prepared by Mr. Longyear and issued by the Michigan State Agricultural College. The author has brought into a small compass the diagnoses of fungal pests which attack common fruit trees and plants, together with hints as to preventive or remedial treatment.

Seeing that no comprehensive account of the flora of Norfolk Island has been published since Endlicher's "Pro-

dromus Floræ Norfolkicæ," which came out in 1833, the contribution to this subject presented by Mr. J. H. Maiden to the Linnean Society of New South Wales last year is eminently useful. The paper begins with a critical enumeration of the flowering plants and cryptogams, in which the author deals with a number of synonyms and doubtful references, besides adding several new records for the island. A somewhat novel feature for a flora is a separate list of plants of economic and horticultural value. The author reserves for a second part his observations as to origin and distribution.

SOME interesting ecological observations of certain swamp areas in Michigan and Arkansas counties, U.S.A., are recorded by Dr. S. M. Coulter in the fifteenth annual report of the Missouri Botanical Garden. On the island of North Maniton, in Lake Michigan, a small lake, having no outlet, is being filled up by the encroaching vegetation. The pioneer plants are the peat-mosses, followed by cranberry and leather leaf, *Cassandra calyculata*; tamarack, *Larix Americana*, and black spruce crowd on the shrubs, and as the ground gets drier deciduous trees obtain a foothold. In the swamp region of the St. Francis River two characteristic trees are found, the tupelo gum, *Nyssa uniflora*, distinguished by having a continually increasing dome-shaped base, and the bald cypress, *Taxodium distichum*, which develops a conical butt and peculiar "knees."

DR. N. ZARUDNY has returned from his last journey to Persia, and has brought back rich ornithological collections.

WE learn from the *Bulletin* of the Russian Society of Naturalists of St. Petersburg that the biological station which has been established near Alexandrovsk, on the

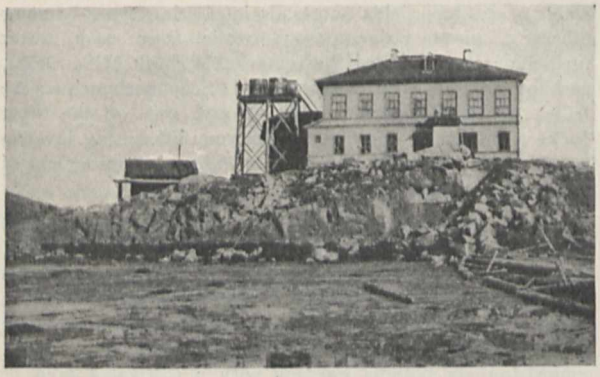

FIG. 1.—The biological station on the Norman coast of the Kola peninsula, North Russia. View from the north-west, at low water. The pumping machinery and a covered sea-water basin are shown on the left.

Norman coast of the Kola peninsula, is now in working order. It is provided with all the necessary apparatus for pumping sea-water to a basin and an aquarium, as well as with a special sailing boat and all apparatus required for fishing and dragging. During last summer the exploration of the bay and its nearest surroundings proved that both yield rich material for research. The sea-bottom opposite the Dog's Cape of Catherine Island is covered with Lithothamnium, upon which there are many annelids (*Nereis pelagica, Glycera capitata*, &c.), numerous worms, the *Cucumaria frondosa* and *C. calcigera, Psolus phantapus*, many Ophiuridæ, Planariæ, Nemertinæ, a variety of crustaceans and molluscs, two Actiniæ, one of which is the *Actinoloba dianthus*, the deep-water medusa, *Pectyllis arctica*, and many other forms of life. Altogether it appears that within a distance of less than one and a half miles from the station there is already a deep-water fauna which lives at the comparatively small depth of from 20 to 70 fathoms.

IT has been generally considered that the naphtha wells of the Kuban province of north-western Caucasus take their origin in the Sarmatic and Mediterranean layers of the Tertiary deposits of that region. The mining engineer, W. I. Wind, brings forward (in the *Bulletin* of the St. Petersburg Society of Naturalists, 1904, No. 4) some data tending to prove that naphtha in Kuban originates also in deeper lying Tertiary strata which consist of a dark, almost black clay, containing enormous quantities of remains of fishes (chiefly Meletta), as well as thin layers of carbonised plants.

A NEW instalment of "Flora Caucasica critica," by N. Kuznetsoff, N. Busch, and A. Fomin (fascicules 3 to 6), appears in the *Memoirs* (*Trudy*) of the St. Petersburg Society of Naturalists, vol. xxxii., part iii. A special fascicule of the same volume is devoted to the memory of A. Beketoff, and contains the following works:—"The Influence of the Concentration of Solutions on Respiration and Exchange in Plants," by V. Palladin and Mme. A. Komleva; "The Influence of Wounds on the Formation of Unassimilable Albumens and Nucleo-proteids in Plants," by I. Kovshoff; "The Vegetation of the Povyenets District of Olonets," by E. Ispolatoff; "On the Vegetation Covering the Sands in Taurida," by the same author; "The Influence of Exterior Conditions on the Division of Nuclei in the Roots of *Vicia faba*," by V. Sablin; and "On the Influence of Saccharose on the Respiration of Seeds," by S. Woicehowski.

A NEW edition of Dr. H. R. Mill's "Elementary Class-book of General Geography" has been published by Messrs. Macmillan and Co., Ltd. The book, which first appeared in 1889, was largely re-written in 1900, and has again been thoroughly revised. Recent political changes and colonial developments have been noted, and all statistics have been brought up to date by reference to the returns of the censuses of 1900 and 1901, and to recent official publications.

A SELECTION of the brilliant lectures and essays of the late Prof. W. K. Clifford, together with a biographical sketch of the author, has been published by Messrs. Macmillan and Co., Ltd., in their sixpenny series. In their cheap form these essays and addresses should be widely read, and there is every reason to hope that Clifford's influence will be increased greatly by the publication of his teachings at this small cost.

WE have received from Messrs. John J. Griffin and Sons, Ltd., a copy of a new issue of their illustrated catalogue dealing with apparatus for the study of magnetism and electricity. Among other novelties, particulars of which are given in the catalogue, we notice moving coil voltmeters and ammeters which can be obtained at a reasonable price, and apparatus for showing Prof. Elihu Thomson's experiments on the electromagnetic repulsion between an alternating electro-magnet and a conducting ring. The convenient arrangement of the catalogue and the large number of illustrations it contains should render the publication of real service.

A NINTH edition of the late Prof. Babington's "Manual of British Botany" has been published by Messrs. Gurney and Jackson. The book has been enlarged from the author's manuscripts and other sources. The work of editing the new edition has been done by Messrs. Henry and James Groves. Species, varieties, additional characters and remarks which have been inserted by the editors are printed in smaller type, and where introduced in the text

are enclosed in square brackets. A fresh account of the genus Hieracium has been drawn up by Miss R. F. Thompson and included in the book. A conspectus of the groups and species from the "Handbook of British Rubi," by the Rev. W. Moyle Rogers, has, by permission, been added as an appendix.

SINCE its publication in 1894, Preston's "Theory of Heat" has been regarded as a standard work on the subject. Teachers and students will welcome the new edition which has just been published by Messrs. Macmillan and Co., Ltd. The revision, necessary in view of the recent progress made in this branch of physics, has been done by Mr. J. Rogerson Cotter, of the University of Dublin. Among the changes in the new edition may be mentioned the transference of the section on the dynamical equivalent of heat from chapter viii. to chapter iv., a few unimportant omissions, and the addition of some hundred pages of new matter. The additions have been enclosed in brackets. Mr. Cotter has succeeded in bringing the book well up to date, and in this way has ensured a continued popularity for an excellent treatise.

AN interesting and simple mechanical model devised for the purpose of illustrating to students the gas laws and the nature of Carnot's cycle is described by Dr. F. B. Kenrick in the May number of the *Journal of Physical Chemistry*.

WE have received a copy of the *Chemikalien-Zeitung*, a new journal to be published fortnightly under the editorship of Dr. R. Pauli, Berlin. The journal will be devoted to matters relating to the manufacture and application of chemical substances in the industries. One of the chief objects of the promoters is to produce by means of the fortnightly publication a work of encyclopædic character dealing with this aspect of technical chemistry.

WE have received vol. i., No. 1, of the *Memoirs* of the College of Science and Engineering, Kyoto Imperial University, a publication containing original papers by members of the university. Among other papers worthy of notice are "Synthesis of Indigo and its Methyl Derivatives," by M. Kuhara and M. Chikashigi, and "Defects of Uncarburetted Water Gas as Fuel for Laboratory Use," by M. Chikashigi and H. Matsumoto.

IN the *Physikalische Zeitschrift* (No. 12, 1904), Messrs. Elster and Geitel describe a new form of electroscopic apparatus for the investigation of feebly radio-active bodies. With this a large number of different kinds of earths, minerals, lavas, and water deposits has been examined. The activity of the sedimentary deposits from the hot springs at Baden-Baden is remarkably high, the sludge deposited at the source having approximately the same activity as uranyl potassium sulphate. As the distance of the deposited matter from the source increases, its activity falls off rapidly.

SOME recent experiments by M. Henriet communicated in the *Comptes rendus* (vol. cxxxviii. p. 1272, 1904) show that formaldehyde is present in considerable quantity in the atmosphere. The method of estimation consists in aspirating the air through a tube containing red oxide of mercury heated to 250°, in which the formaldehyde is oxidised to carbonic acid, which is then absorbed in potash bulbs. The carbonic acid already present in the original air has to be subtracted from the amount thus found, and the difference corresponds to formaldehyde. In 100 cubic metres of normal air formaldehyde is present to the extent of 2–6 grams.

IN view of the high atomic weight of radium and the remarkable ionising properties of the salts, it would not have been surprising if the electrolytic properties of radium bromide had been altogether abnormal. That this is not the case is clearly shown by the recent measurements of Kohlrausch and Henning, published in the *Verhandlung* of the German Physical Society (vol. v. pp. 144–6, March 15). The electrical conductivity is perfectly normal over the range from N/20 to N/12,000, and closely resembles that of the corresponding barium salt. The molecular conductivity rises from 100·0 to 123·6 over this range of dilution, and the limiting value is given as 125. The mobility of the radium ion is therefore 57 as compared with 56 for barium, and 53 for strontium and calcium. It is of interest to note that Runge and Precht's value for the atomic weight would give an altogether abnormal value, 67, for the ionic mobility.

WE find in the *Bulletin* of the Society of Naturalists of St. Petersburg (1904, No. 3) an interesting paper, by N. Karakash, based on a recent journey of A. Zhuravskiy and on previous exploration, giving some idea about the little known eastern portion of the tundras of Arkhangelsk, which is known as the Bolshezemelsk tundra, and lies between the Petchora and the northern Urals and the Pai-hoi Range. This portion of the tundra has not the flat and marshy character which it has in the west, but it is covered with mounds, hills, and narrow low ridges of Boulder-clay, reaching a height of 100 and occasionally 200 feet, and a length of from 12 to 20 miles. Between these mounds and hills are found countless lakes, marshes, and spaces which can be described as true patches of the tundra. All these hills are undoubtedly of morainic origin, the Boulder-clay having only been washed by water on its surface and covered here and there with sand. As to the boulders, they consist of granites, porphyrites, gneisses, and various metamorphic slates, as also of limestones and sandstones. The latter contain Devonian, Carboniferous, and Carbo-Permian fossils, such as are well known from the western slopes of the Urals, as also Permian and Jurassic fossils, such as are known further south in the basin of the Petchora. Traces of a post-Glacial sea have only been found near the shores, but it is known from the previous researches of Barbot-de-Marny, Tchernysheff and others that large spaces of north-eastern Russia, up to a level of about 120 metres, were covered by the sea during the post-Glacial period.

OUR ASTRONOMICAL COLUMN.

RADIAL VELOCITY OF THE ORION NEBULA.—From the measurement of a series of spectrograms of the three brighter stars in the trapezium of Orion, Messrs. Frost and Adams have determined the radial velocity of those parts of the nebula located by these stars. Seven plates of the star θ^1 Orionis (October, 1903, to February, 1904) gave a mean velocity for the nebula of +19·3 km., three plates (December, 1903, January and February, 1904) of the star Bond 640 gave 18·0 km., and one plate (March 8, 1903) of the Bond star 619 gave +14 km. The general mean was +18·5 km., which is slightly higher than the values obtained by previous observers, *e.g.* +17·7 km. obtained by Keeler in 1890–91. Surprise is expressed as to the low value determined for the last named star, as the plate measured was an exceptionally good one, but the observers hesitate to draw conclusions from the results obtained from one plate.

The radial velocities of the stars themselves were also determined from the dark-line spectra on the same plates, and the provisional values are given for the two Bond stars. Regarding θ^1, the peculiarities of the spectrum and the binary character of the star will necessitate the study of a much greater number of plates before definite values can be obtained. For Bond 640 a mean value of +20 km. was determined, whilst for Bond 619 a value of +48 km., strikingly greater than that of the nebula, was obtained.

The same observers also publish the results of similar

observations of four stars of the Orion type (9 Camelopardi, κ Cancri, μ Sagittarii, and δ^1 Lyræ) which have variable radial velocities (*Astrophysical Journal*, No. 5, vol. xix.).

MASS AND SHAPE OF JUPITER.—At the June meeting of the Royal Astronomical Society, Mr. Bryan Cookson read a paper giving the results of a series of heliometer observations of Jupiter's satellites made by him at the Cape Observatory during 1901–2.

Within two months of the opposition of the planet he made 783 observations of the satellites in distance and position angle. The values obtained for the mass were

$$1 : 1047{\cdot}69 \pm 0{\cdot}09 \text{ and } 1 : 1047{\cdot}66 \pm 0{\cdot}06$$

during 1901 and 1902 respectively. These agree very well *inter se*, but differ considerably from Prof. Newcomb's adopted value of 1 : 1047·35, a difference which has yet to be explained or eliminated.

The value for the compression-constant of the planet was also different from the adopted value, being 11 per cent. greater. As determined in the paper, the ellipticity is 1 : 15·8, but direct measurements of the equatorial and polar diameters gave 1 : 16·5. Part of this difference may be real, but part may be due to the difficulty experienced in measuring the planet's diameter (*Observatory*, No. 346).

"REVERSALS" IN SUN-SPOT SPECTRA.—In a paper appearing in No. 5, vol. xix., of the *Astrophysical Journal*, Mr. W. M. Mitchell, of the Princeton (N.J.) Observatory, publishes the results of four sets of observations, made during March and April with a Rowland grating spectroscope (20,000 lines) attached to the 23-inch refractor of the Halsted Observatory, of the lines reversed in sun-spot spectra in the region λ 6770 to λ 4915. The number of lines more or less affected in this region was more than 270, and Mr. Mitchell gives a table containing about 70 lines which were found reversed, and 6 lines which were thinned. In the region C–D about 35 per cent. of the lines affected were seen reversed, whilst for a further 5 per cent. the appearance of reversal was too uncertain to give definite results. The C line was observed partially reversed on April 8, but the *b*, E, and D groups were never affected. D_3 was not seen at all.

ESCAPE OF GASES FROM THE EARTH'S ATMOSPHERE.—In a communication to the *Philosophical Magazine* (June, 1904) Dr. Johnstone Stoney directs attention to a recent letter from Mr. S. R. Cook, published in NATURE (March 24), on the "Escape of Gases from Atmospheres." After stating that he arrived at the same conclusion as Mr. Cook, by the same methods, thirty or forty years ago, and has since had to abandon that conclusion, Dr. Stoney shows that the flow of helium from springs into the earth's atmosphere is from 3000 to 6000 times more than can be accounted for by the minute quantity dissolved by the rain in falling, yet the relative quantity of helium in the atmosphere apparently remains constant. Therefore, he says, helium *is* escaping from the atmosphere, the rate of escape being equal to that of the influx. Further, Dr. Stoney also shows that theoretically the conditions under which the flights of gaseous molecules take place in the upper atmosphere sufficiently explain the outflow, as it would only be necessary for the chance of escape for each molecule to occur once in several days in order to account for the amount received by the atmosphere from the earth.

FORTHCOMING RETURN OF ENCKE'S COMET.—In No. 6, vol. i., of *Knowledge and Illustrated Scientific News*, Mr. Denning publishes a few notes in reference to the return of Encke's comet during the coming autumn. Due at perihelion on January 4, it should be observable in large telescopes about August or September, and will be nearest the earth, at a distance of about 35,000,000 miles, in the third week in November. On October 4 it will apparently be about half-way between β Andromedæ and α Trianguli, thence, travelling westward, it will arrive at about 5° N.E. of β Pegasi on November 1.

The present period, according to Prof. Seagrave, is about 1206d. 20·25h., and during the coming apparition the favourable conditions of 1805, 1838, and 1871 (period 33 years) should be repeated. It is possible that early in December, when close to Altair, the comet may be visible to the naked eye.

THE UPPER CHALK OF ENGLAND AND ITS ZONES.

WE have received two important contributions to our knowledge of the Upper Chalk in this country. The one on "The Upper Chalk of England" is the third and concluding volume of Mr. Jukes-Browne's memoir on the Cretaceous rocks of Britain, issued by the Geological Survey (price 10*s*.). It is a goodly volume of 566 pages, in which the stratigraphical features of the Upper Chalk and the fossils of the successive zones are very fully dealt with. As in previous volumes, Mr. William Hill has contributed particulars of the microscopic structure of the Chalk. The ample topographical and palæontological descriptions of the Chalk will enable the student readily to ascertain what is known, and the author has been fortunate in being able to embody the results of a great part of the recent work accomplished by Dr. Rowe. In one chapter he discusses the bathymetrical conditions during the formation of the Upper Chalk, pointing to facts presented by the Chalk rock-beds which indicate a general upheaval of the British area. Later on, during the period of the Micraster and Marsupite zones, evidence of subsidence is afforded, and this was probably succeeded by re-elevation during the time of the Belemnitella zone. This volume contains a general account of the economic products of the Chalk, including water-supply, and reference is made to the bournes or nail-bournes, notable examples of which, as at Croydon and elsewhere, have recently manifested themselves. The Chalk escarpments and other features of Chalk districts are described. There is also a general list of all the known fossils from the Chalk of England, with references to zones and localities, and there is a full bibliography. Mr. Jukes-Browne is to be congratulated on the completion of this exhaustive work. We only wish that it had been somewhat better illustrated.

Turning to the other work, "The Zones of the White Chalk of the English Coast, part iv., Yorkshire," by Dr. Arthur W. Rowe, we find a work of a little more than a hundred pages, with twenty-two beautiful photographic plates and other illustrations, issued by the Geologists' Association (vol. xviii., part iv., price 3*s*.).

The previous portions of Dr. Rowe's work on the zones in Kent and Sussex, in Dorset and in Devon, have been already noticed in NATURE. The present part is the result of "42 days of steady work" on the cliff-sections and adjacent chalk-pits of the coast near Flamborough Head. The time seems limited (as the author observes), but as he went fortified with the accumulated knowledge and experience of many years' assiduous study, and was accompanied, as before, by Mr. C. D. Sherborn, he was ready and able to make the fullest use of his time. When he refers to the region as "a veritable *terra incognita*" we can hardly agree with him, despite his own saving clauses. But that he has enriched our knowledge to a very large extent, as he invariably does, was inevitable, and all geologists will rejoice.

The essay itself fills the reader with enthusiasm, for it is written with vigour and with a heartiness that is contagious. The work proved less easy, though not less interesting, than was anticipated. The record of the fauna was found to constitute "a veritable zoological romance."

It was "wholly impossible to institute any valid comparison between this marvellous coast and any of the sections which we had previously described." The variations in the distribution and range of the species, the rarity of zonal guide-fossils, the hardness of the rocks, to say nothing of the difficulties of getting at the strata, were alike remarkable. At the same time the results of Dr. Rowe's work afford "overwhelming proof of the validity and homogeneity of the zonal theory," and we cordially commend the work to all students. In an appendix Mr. G. W. Lamplugh contributes some notes on the conditions of accumulation of the Yorkshire Chalk, and refers to the finding of an ammonite, 3 feet in diameter, beneath which was an agglomeration of small fossils, evidently protected from decay by the huge ammonite. He remarks that a considerable portion of the Chalk was probably due to the pulping-down of calcareous bodies by lowly organic agencies. Referring back to Mr. Jukes-Browne's volume

(p. 343), we learn also from Mr. W. Hill that "As a whole the amorphous material of the Upper Chalk appears to be made up almost entirely of the débris of calcareous organisms."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. HAROLD A. WILSON has been elected senior lecturer in physics at King's College, London, and Mr. S. C. Laws junior lecturer.

ON July 27 Sir Thomas H. Elliott, K.C.B., Secretary to the Board of Agriculture, will open the extensions of the Midland Agricultural and Dairy Institute at Kingston-on-Soar.

PROF. CHANTEMESSE has, at his own request, been transferred to the chair of hygiene at the University of Paris, vacant through the death of Prof. Proust. The chair of experimental pathology thus vacated has been filled by the appointment of Dr. Roger to succeed Prof. Chantemesse.

WE learn from *Science* that Mrs. Henry Whitman, of Boston, has made public bequests amounting to more than 40,000*l.*, including 22,000*l.* to Radcliffe College and 2000*l.* to Harvard University; and that Mr. George Ehret, of New York, has given 2000*l.* to the permanent fund of Hamilton College.

MR. H. A. CLARK, late assistant lecturer in engineering at the University of Leeds, has been appointed head of the engineering department of the Northern Polytechnic Institute, London. Mr. Clark was Ramsbottom scholar at Owens College, Manchester, a Whitworth scholar, and is an associate of the Royal College of Science.

THE first annual report of the University Extension Guild has now been published. The object of the association, which was founded last December, is "to promote among all classes, at times convenient to all, the extension of university teaching." The report states that the work accomplished and the influence exerted by the guild have been considerable, and give great hopes of success in the future. The honorary secretary of the guild is Mr. Max Judge, 7 Pall Mall, S.W.

THE Montgomery County Council recently discussed a resolution, passed at the Swansea conference of county council delegates, recommending to county councils the establishment of schools of forestry, and the giving of grants to existing colleges. The chairman said all are agreed that planting is a very desirable agricultural improvement, and that the management of woods in many cases leaves much to be desired. It would be, he continued, for the advantage of the country if the council provided forestry instruction in addition to the instruction they had provided in other branches of rural pursuits, and at his suggestion delegates were appointed by the council to attend a conference to be held for the purpose of discussing the question.

THE Prince of Wales, who was accompanied by the Princess of Wales, on July 16 laid the foundation-stone of the new buildings of the Working Men's College, which was founded by F. D. Maurice. The plans of the new buildings show a hall to accommodate 250 persons, common rooms, club rooms, and gymnasium for the students, a library fitted for 10,000 books, and a museum. There are added electrical and chemical laboratories, with which the old college was not equipped. Altogether there is teaching space provided for 700 students. Replying to an address—read by the principal of the college, Prof. A. V. Dicey—the Prince of Wales expressed his cordial sympathy with the aims and objects of the college, which are to bring within reach of the working classes the means of knowledge and culture. As the Prince of Wales said later, "the Working Men's College has seen its aims fulfilled and its pioneer work taken up and extended by those numerous and great institutions for commercial and technical instruction which have been established in the capital and in all parts of the Empire."

THE importance of establishing a national school of forestry was recently urged by the Association of Chambers of Commerce. The following reply has been sent to the association by Sir Thomas Elliott, on behalf of the Board of Agriculture:—"The President of the Board of Agriculture and Fisheries fully recognises the importance which attaches to the question of afforestation and to the provision of a national system of instruction in forestry. Steps have already been taken in more than one direction to give effect to the recommendations of the departmental committee which was appointed in 1902, under the chairmanship of Mr. R. C. Munro Ferguson, M.P., to inquire into the subject. Through the agency of the Commissioners of Woods and Forests a school of forestry has been established in the Forest of Dean, and a movement is on foot for securing a suitable area of land in Scotland for the purpose of demonstrating scientific forestry. The Board has taken steps to secure the establishment of at least two lectureships in forestry in England, and some of the leading universities and agricultural colleges have been giving attention to proposals under this head. The agricultural departments of the University College of North Wales, Bangor, and of the Durham College of Science, Newcastle-upon-Tyne, appeared to offer special advantages as centres of instruction in forestry, and grants in aid of the establishment of schemes of education in the subject will be made by the Board to those institutions. The Board hopes that the arrangements thus made will result in a considerable improvement of the facilities available in this country for the acquirement of a knowledge of practical forestry."

THE following are among the awards of Carnegie research fellowships, scholarships, and grants for the academic year 1904–5, under the Carnegie trust, for the universities of Scotland:—FELLOWSHIPS.—*Physical*, D. B. McQuistan; *Chemical*, C. E. Fawsitt, Dr. J. C. Irvine, W. Maitland; *Biological*, J. Cameron, Dr. F. H. A. Marshall, H. J. Watt; *Pathological*, C. H. Browning, J. C. G. Ledingham, S. A. K. Wilson. SCHOLARSHIPS.—*Physical*, P. D. Innes, H. W. Malcolm, J. H. Maclagan Wedderburn, J. R. Milne; *Chemical*, Adam Cameron, W. A. K. Christie, F. W. Gray, J. Johnston, F. J. Wilson, J. Wood; *Biological*, Margaret T. Hamilton, W. D. Henderson; *Agricultural*, S. F. Ashby, C. Carter; *Physiological*, J. S. Rose; *Pathological*, C. M. Campbell, R. D. Keith, W. G. Rodger. GRANTS.—*Physical*, G. A. Carse, Prof. MacGregor, T. Oliver, W. Peddie; *Chemical*, Prof. G. G. Henderson and Dr. Gray, Dr. A. N. Meldrum; *Biological*, Dr. J. H. Ashworth, Dr. J. Beard, Cyril Crossland, Prof. J. Cossar Ewart, Prof. Paterson, Dr. John Rennie, W. G. Smith, Dr. D. Waterston, Dr. J. H. Wilson, Prof. R. Patrick Wright and A. N. M'Alpine; *Anatomical*, E. B. Jamieson; *Pharmacological*, Prof. R. Stockman; *Pathological*, Dr. J. K. Love, E. Bramwell, Prof. Carstairs C. Douglas, A. H. Edwards, Dr. A. Goodall, J. M. Kirkness, Prof. Robert Muir, Peter Paterson, W. B. Inglis Pollock, B. P. Watson, Dr. J. M. Bowie, Dr. James Scott, D. C. Watson. The twenty-four scholarships, twelve fellowships, and thirty-five grants awarded for 1904–5 amount in all to 5300*l.* The amount expended by the trust under this scheme for 1903–4 was 3400*l.*

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 19.—"On the Liquefied Hydrides of Phosphorus, Sulphur, and the Halogens as Conducting Solvents." Parts i. and ii. By D. **M'Intosh**, B. D. **Steele**, and E. H. **Archibald**. Communicated by Sir William Ramsay, K.C.B.

In this paper the behaviour of phosphuretted hydrogen, sulphuretted hydrogen, hydrogen chloride, bromide, and iodide as conducting solvents has been investigated, and, in order to try and explain certain abnormalities in the variation of conductivity with concentration of their solutions, the following physical constants have been determined. (1) The vapour pressure curves from which the melting and boiling points are obtained. (2) The densities at various temperatures. (3) The molecular surface energies; from these it is seen that the hydrides of phosphorus and chlorine when liquefied are more or less associated to form complex molecules, whereas the remaining compounds occur as simple molecules. (4) The viscosity temperature coefficient. This was measured in order to compare with

the temperature coefficient of electrical conductivity. (5) Solubilities and conductivities. A large number of substances were examined, and it was found that many organic compounds containing oxygen or nitrogen dissolved readily in HCl, HBr, HI, and H_2S, and formed solutions which conducted well.

Inorganic substances, on the other hand, did not dissolve, or if so only in the merest traces. An exception to the latter generalisation occurs in the case of H_2S dissolved in HBr; these liquids mix in all proportions, but the mixture does not conduct the current.

June 16.—"On Flame Spectra." By Charles de Watteville. Communicated by Arthur Schuster, F.R.S.

In order to obtain the spectrum of any substance, it has generally been considered sufficient to introduce a small quantity of it into an already formed flame. In the course of a photometrical investigation of flames which had been coloured by injecting the spray from saline solutions into the gas to be burnt, M. Gouy discovered in the spectra of the flames several new lines belonging to the metal contained in the solution (*Annales de Chimie et de Physique*, 5th series, vol. xviii., 1879). Instead of appearing throughout the whole flame, as did the previously known lines, these new lines were only emitted in the vicinity of the inner blue cone—the origin of the Swan spectrum.

The method employed by the author is, in short, that which has been introduced by M. Gouy.

The lines in the spectra obtained under the conditions of his experiments are very much more numerous than is the case when all the portions of the flame do not participate in the production of the phenomena. Moreover, the flame spectra extend sufficiently far into the ultra-violet in order to enable the line 2194 of tin to be observed.

The lines which are found in the flame spectrum are those which are the strongest lines in the arc spectrum. In certain cases, some of the more intense arc lines are absent, whereas less intense arc lines are to be found in the flame spectrum. On the other hand, none of the characteristic lines of the spark spectrum are ever seen in the flame spectrum.

There is a most striking similarity between the flame spectra of iron, of nickel, and of cobalt, and the oscillatory spark spectra of the same metals in the region included between about 4300 and 2700 Angström units. The similarity of the two spectra is so great that, except for very small differences of intensity, the oscillatory spark spectrum, which is photographed as a comparison spectrum in the centre of the flame spectrum, appears to be a prolongation of the latter. In the ultra-violet the spectrum of the flame appears to fade away a little more rapidly than that of the oscillatory spark, but it is probable that this difference would be reduced by prolonging the time of exposure, since it is, of course, the radiations of the shortest wavelength which are most absorbed by different media.

It is very probable that the reason for this similarity between the spectrum of the flame and the spectrum of the oscillatory spark is entirely a question of temperature. On the one hand, the increase in the number of lines of the flame spectrum obtained by the use of the sprayer may be attributed to the fact that the hottest regions of the flame take part in the production of the phenomena, and, on the other hand, the diminution in the number of lines in the spark spectrum when the spark becomes oscillatory is due to a diminution of its temperature.

NEW SOUTH WALES.

Royal Society, May 4.—Prof. F. B. Guthrie, president, in the chair.—Prof. F. B. **Guthrie** delivered the presidential address, in which he gave a *résumé* of the condition of chemistry and chemists in the State. Of the teaching institutions, the university made ample provision for teaching chemistry; about 300 students were in attendance at lectures, and about 150 doing practical work in the laboratories. In conclusion, stress was laid upon the necessity for centralising chemical research work. At present there existed the opposite tendency—to decentralise it as the departmental work grew. Personally, he would like to see established a central scientific institute, where all the scientific work could be conducted. Failing this, a great deal could be done in consolidating scientific work and increasing its efficiency by the creation of a controlling science department, which would administer the different scientific establishments under departmental control. This would be of great advantage in research, especially where it required the cooperation of more than one branch of science. Investigation into subjects of national importance could then be carried out in continuity.

June 1.—Mr. C. O. Burge, president, in the chair.—Possible relation between sun-spots and volcanic and seismic phenomena and climate: H. I. **Jensen.** This paper is a sequel to the author's note communicated to the Royal Society of New South Wales on June 4, 1902. The paper is divided into two parts. In the first part it is shown that while there has been a marked rise in solar activity since the middle of 1902, seismic and volcanic disturbances have fallen off on the earth, both in violence and frequency, almost to a minimum. In the second part of the paper various sun-spot and meteorological theories are considered. The climates of Australia and Mauritius are discussed, and the occurrence of heavy rains at sea during drought periods, the retreat of glaciers during cold winters, and the diminution in the number of cyclones during sun-spot minima are ascribed to the same cause, namely, the feebler circulation of the atmosphere due to the diminution in the amount of heat received from the sun during sun-spot minima. An index to literature and tables of earthquake and eruption statistics follow.—On the absence of gum, and the presence of a new diglucoside in the kinos of the Eucalypts: H. G. **Smith.** In this paper, which is the first of a series dealing with Eucalyptus kinos, the author shows that the supposed gum occurring in many Eucalyptus kinos is not gum, but a peculiar tannin diglucoside.—On some natural grafts between indigenous trees: J. H. **Maiden.** The author obtained from George's River a composite log which in bark and timber showed the absolute fusion of white or cabbage gum (*Eucalyptus haemastoma*, variety *micrantha*) and stringybark (*Eucalyptus capitellata*). The red timber of the former contrasts well with the pale brown of the latter, and the fusion of the two timbers is perfect. Such instances of the organic union of two species of the same genus have been rarely recorded.

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