THURSDAY, FEBRUARY 4, 1904.

AFRICAN GAME.

Big Game Shooting and Travel in South-East Africa. By F. R. N. Findlay. Pp. xii+313. (London: T. Fisher Unwin, 1903.) Price 15*s.* net.

THERE is a great deal of interest to the zoologist and botanist in Mr. Findlay's book on his experiences as a hunter in Portuguese South-East Africa and in Zululand. The area visited by this sportsman in Portuguese East Africa was the country in the basin of the Pungwe River (to the north-west of Beira). His journeys in this direction extended northwards to the verge of the Cheringoma Forest, which is not many days' journey south of the Lower Zambesi. This country is very similar in appearance to the lowlands of British Central Africa, that is to say, it is quite tropical, and is without any aridity or absence of vegetation. The wild Hyphæne and date palms are excellently illustrated by the author's photographs, so also are the huge baobab trees. A very good idea of the woodland of these countries (a tangle of wild date palms, acacias, and timber trees of evergreen foliage) is given on p. 75. The Hyphæne (*H. crinita*) appears in many photographs, noteworthy among which are those on pp. 27, 38, and 106. The palms given on pp. 105, 107, and in one or two other illustrations are probably the *Borassus flabellifer*; like so many other palms of this group, they have a bulge in the central portion of their lofty stem. A fine specimen of a baobab tree is given on p. 83.

Besides the many chapters on sport, there is one on game-preserving and on the possibility of domesticating and training African beasts. The author puts in a plea that further attempts should be made to domesticate the African elephant. Probably all the readers of NATURE would be agreed that every effort should be made—must be made—to prevent the extermination of this biggest of living land mammals, but the question of its domestication and usefulness to man is a very doubtful one. It is relatively easy to obtain young African elephants and to tame them in a few days or a few weeks. It is also easy to train them to bear burdens on their backs or to perform other simple tasks, but it cannot be said as they grow up that they evince the same docility that is characteristic of the Indian elephant, while after the males have reached maturity they are positively dangerous. Something might be done with the adult female African elephant. The Romans certainly exported the African elephant (which in Roman times still inhabited parts of Mauritania) to Rome for the sports of the circus and for wild beast shows, but it is much more probable that the war elephants of the Carthaginians were derived from India by way of Syria. Still, the experiment with the African elephant has never been properly tried, and is worth trying, though of necessity something like half a century must elapse before its results can be considered conclusive, owing to the slow rate of growth of the elephant. This calculation is based on the assumption that supplies of domesticated African elephants will only be obtained by catching the young animal between one and two years old, and rearing it in captivity. Of course, if it were possible to work the keddah system and capture and tame the adult animal, a very few years would decide the practicability of the plan.

There is a good deal said about the hippo in this book which is worth reading. The author describes the present condition of the hippopotamus in Zululand, where it still lingers in some of the rivers. He affirms that the white rhinoceros is still existing in Zululand between the forks of the White and Black Umvulosi Rivers, where it will soon, probably, be exterminated completely by colonists from Natal; for, as the author points out, the European natives and settlers of South Africa—the true Afrikanders—are utterly pitiless regarding the wild game, and take no interest whatever in the idea of its preservation, the only exceptions to the rule being the late Mr. Rhodes and one or two enlightened men of Dutch descent, whose herds of gnu and eland have very probably been destroyed during the recent South African war. The absolute extirpation of the magnificent fauna of South Africa, mainly at the hands of British sportsmen and colonists (though the Boers made a good second) will probably remain to all time an ineffaceable stain on the reputation of the Anglo-Saxon—a racial designation which as accurately includes the Dutch as the English. Of course, it was not to be expected that these vast herds of game would be left in sole possession of a country which is adapted in many respects for the white man's habitation, but it is inconceivable that South African and Imperial statesmen could during the whole of the nineteenth century have been so utterly without an appreciation of zoology as to have made no provision in the establishment of reserves for the retention of a fauna whch made South Africa one of the most interesting countries in the world. It is true that some fifty years ago a plea was put in for the preservation of the lion in the Orange Free State, but this was so that the lions might prey on the immense herds of gnus and zebras which were devouring all the grass. One inducement to exterminate the antelopes, zebras, and quaggas lay in the value of their hides, which at one time formed an important article of export from Cape Colony. In 1860, when the late Duke of Saxe-Coburg visited the present Orange River Colony, a big hunt was organised. A thousand natives assisted in driving the game, and it was computed that something like 25,000 antelopes, zebras, and ostriches were driven before the Prince and his staff, and that the battue, in which many Europeans and natives took part, resulted in the slaughter of more than 6000 head of game. The story is much the same throughout our self-governing colonies—Canada, Australia, New Zealand, British Guiana, and Fiji take no heed of the local fauna, and witness its extirpation with apathy, if not with a kind of foolish triumph over nature, while with childish assiduity they attempt to domesticate the birds and beasts of Europe.

Though the writer of this book preaches so effectually in the cause of saving what still remains of

the South African fauna, and offers excellent suggestions for the purpose, he is nevertheless somewhat in the position of Satan reproving sin. He appears to have spared but little in the way of buffaloes, antelopes, zebras, or hippopotami that came in his way, and his beautiful photographs—over and over again—of his trophies make one wince at the shocking and needless extirpation of creatures more wonderful or beautiful, in their physical aspect, than their destroyer. A typical instance of this may be seen in the illustration on p. 227, and it must be borne in mind that this collection of trophies refers to the already sorely diminished game of Zululand.

An interesting chapter contributed to the book by Mr. Cronwright Schreiner deals with the marvellous migrations of the springbuck, which until recently used to pour down at intervals from the northern regions (Bechuanaland and Transvaal) over the more settled districts of South Africa. These movements, Mr. Schreiner thinks, are due to drought in the hinterland forcing the springbuck to move in enormous numbers in search of fresh pasture. Mr. Schreiner himself computes the number that he saw in 1896 in one of these extraordinary migrations at 500,000. An excellent photograph is given of these migratory springbuck on the trek. Of course, on these occasions, the creatures were so massed together that flight from human beings, leopards, or lions was impossible. There have even been occasions when men on foot, overtaken by one of these surging crowds of antelopes, have been knocked down and trampled to death. Mr. Findlay puts in a very strong and valid plea for a gigantic zoological gardens to be created by the State at Pretoria, taking advantage of its genial climate, its abundant water supply, and the fact that so much of the local vegetation is of a semi-tropical character.

The book under review is well worth reading, and will be of permanent value as recording some excellent pictures of the South African buffalo, a form which, owing to the ravages of rinderpest and the attacks of sportsmen, is not very far off extinction.

H. H. JOHNSTON.

ENGINEERING SCIENCE.

Engineering Standards Committee. No. 3. Report on the Influence of Gauge, Length and Section of Test Bar on the Percentage of Elongation. By Prof. W. C. Unwin, F.R.S. Pp. 21, and 2 diagrams. (London: Crosby Lockwood and Son.) Price 2*s.* 6*d.* net.

Technical Mechanics. By Prof. E. R. Maurer. Pp. xvi+382. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1903.) Price 7*s.* net.

THE first of the volumes under notice is one of the reports published by the Engineering Standards Committee, which is doing such valuable work at the present time, and deals with the very important question of the proper dimensions for test bars in order that the percentages of elongation in different sets of experiments can be compared with one another. The report is written by Prof. Unwin, F.R.S., who carried out a series of original investigations for the committee in order that they might have definite experimental data before coming to any decision as to the proportions they would recommend for test bars.

A brief historical summary of our knowledge on this question from the first enunciation of Barba's law in 1880 up to the present is first given, and then the author describes in detail his own series of experiments on ship and boiler steel plates. In the body of the report are given summary tables of the results obtained, and in the appendices full details of the various tests, while the results are shown graphically in the diagrams appended to the report. It was clearly shown by one series of the tests that serious errors are introduced in comparing the ductility of bars when the width of the cross section is kept constant, and therefore the cross sectional area is allowed to vary.

In discussing the rules which might be laid down for standard sizes of test bars, the author points out the grave practical difficulties which arise in either varying the gauge length so as to keep the ratio $l/\sqrt{a}$ constant, or in keeping both gauge length and cross sectional area constant. He suggests that the best plan, from a scientific point of view, would be to keep to a gauge length of 8 inches, and a cross sectional area not exceeding 1 square inch for all plates from $\frac{3}{8}$ inch to $\frac{7}{8}$ inch in thickness, such plates constituting the great bulk of those tested for commercial purposes. As an alternative it might be advisable to specify a fixed gauge length of 8 inches and a width of test bar not to exceed 2 inches for plates lying between $\frac{3}{8}$ inch and $\frac{7}{8}$ inch in thickness, and then to draw up special rules for plates lying outside these limits of thickness. The author, it might be pointed out, has lately given a much more complete account of this piece of research work in a paper read before the Institution of Civil Engineers on November 10 last.

If the various reports of the Standard Committee are all carried out on the lines of those issued up to the present, they will prove of the utmost value to engineers and to the engineering trade of the country.

Prof. Maurer's volume is a text-book on theoretical mechanics for engineering students, the subjects treated having in all cases a direct bearing on engineering problems. It is divided into three sections—statics, kinematics, and kinetics—treated in the order in which they are given.

In dealing with statics, the author adopts freely both graphical and analytical methods, and we strongly approve of this plan, as it has always appeared to us most unwise to divorce these two methods of treatment of statical problems; if properly handled together they greatly assist the beginner in overcoming some of the notorious stumbling-blocks in this branch of mechanics. A particularly useful chapter in this section, both for teacher and student, is vi., in which a series of practical problems involving the application of the principles of equilibrium (worked out in earlier chapters) are dealt with both graphically and algebraically; the examples cover such cases as flexible cords in tackles, jointed frames, and friction in screws, pin joints, belts, &c.

Kinematics is treated mainly from the point of view

of its application in the third section on kinetics, but special attention is devoted to harmonic motion, a matter of great importance to engineers engaged in the design of valve gears, and the investigation of the valve motion due to any type of gear. In the introductory chapter to kinetics, the author discusses fully the difficulties due to the two systems of units adopted in dealing with "mass"; he realises that the gravitation system, or so-called "engineer's system," is not likely to be displaced in spite of the constant endeavours of reformers; it is, in fact, too convenient and enters too constantly into the ordinary engineer's everyday work to be lightly given up. He suggests a name for it—the gee-pound or the gee-kilogram—but we are afraid such names are never likely to be adopted generally; the present method of explaining it as the "engineer" unit is sufficient for all practical purposes, and the names suggested seem to us only to add to the existing confusion. This section is an exceedingly good one; the practical applications are well chosen, such as inertia of reciprocating parts in engines, vibration of springs, moments of inertia of solids of revolution, governors, balancing of rotating bodies, friction of pivots, &c.

In a series of appendices the author treats briefly of vectors, rates, dimensions of units and second moments of areas. The book will be useful to the private student of engineering who is striving to get clear ideas of the fundamental principles on which so much of his work is based, and will probably be adopted in many technical colleges as one of the standard text-books on mechanics. T. H. B.

THE GROWTH OF A FEDERAL EMPIRE.

Geographic Influences in American History. By Albert Perry Brigham, A.M., F.G.S.A., Professor of Geology in Colgate University. Pp. xii + 366. (Boston, U.S.A., and London: Ginn and Co., 1903.) Price 6*s*.

PROF. BRIGHAM, already known to geologists by a concise and clearly written text-book, here makes an appeal to the historian and the geographer. He does not start with generalisations as to the arrival of the first men on the American continent, or as to its situation between the two ends of the Old World; but he brings us at once to the adventures of Columbus, of Cartier, and then of the English settlers, who found Spaniards south of them and Frenchmen to the north, and who thereupon colonised the central seaboard. "America," in this compact treatise, is wisely limited to the United States, with so much of Canada as is inevitably mingled with their history. The style is direct and even vigorous; in Prof. Brigham's crisp sentences there is a continual mental stimulus, and it would be hard to find a redundant word. We do not like the poetry that is quoted in the book, for the benefit of the general reader, half so much as the author's own admirable prose.

The rise of New York is traced to the formation of the Erie Canal in 1825, whereby the grain of the central plains was brought through the Mohawk gap and floated down the Hudson. The Appalachians have long proved hard to traverse further south, the railways, some of them quite recent, crossing the range at heights of about two thousand feet. The story of the decay of agriculture in New England (p. 47) throws a somewhat melancholy light on the competition between east and west. The author (p. 64) believes that the decay is temporary, and that much of the farm-land in the east will relapse into beneficial forests. The possibility of a balance of mutual utility between districts one or two thousand miles apart affords a pleasant contrast with our tariff-bound Disunited States of Europe. When, however, Prof. Brigham asserts that North America was meant to be owned by one great nation, we think that he is reasoning backwards from the feelings of the present day. A strong Spanish race might long have held the west, a strong French federal republic might conceivably have occupied the plains, and a chain of custom-houses might have existed in the twentieth century on the rim of the Alleghany plateau. We suffer daily in the Old World from violations of geographical propriety, which far surpass anything that would have arisen from such a partition of America.

Prof. Brigham is, however, always willing to lay a proper stress on human enterprise and human individuality. The eastern States became divided (p. 75) as much by differences of "breeding" and ancestral habit as by geography; and the men whose modes of thought allowed them to work hard with their hands have naturally come best out of the struggle.

We have some suspicion that the author prefers Pittsburg to the blue-grass meadows of Kentucky, even when he pictures so charmingly (p. 102) the primitive backwoodsmen, brought up amid a "stable environment in a remote region." After all, the development of machinery has been the making of American agriculture, and it may be difficult, in such a country, to perceive that the growth of cities beyond a certain size and standard is as inimical to social development as is actual isolation in the fields. In the Old World we have so many interests, unconcerned with material prosperity, that we view the growth of Glasgow or Duluth (p. 137) with concern rather than exultation. There is plenty of romance, however, in the story of the capture of the French area on the Mississippi (p. 147) from its English overlords, and abundant cause for national fervour in the map given opposite p. 314, showing the progressive expansion of the United States. The most striking feature, perhaps, in this graphic epitome is the extent of the Louisiana territory, obtained by purchase from Spain in 1803, and stretching west from the Mississippi to the head-waters of the Missouri.

"The West," says Prof. Brigham (p. 308), "is the cosmopolitan part of America. A thousand miles is a short excursion, and across the continent is not an undertaking. Men who could not change their horizon without homesickness did not go west; they are independent of distance, they are accustomed to looking up to find their mountains, and their children are born into their wide, free life."

After remarking that the Pacific coast will "in coming days be commercially independent of the

East," our author endeavours, in chapter xi., to build up a theory of permanent unity on the commingling of diverse races in every portion of the union. But will the ethnographic product of these races, when immigration has been stopped by law, necessarily remain the same under all this variety of geographical conditions? If Sergi, to quote an extremist, is correct, the widespread Mediterranean race has already blossomed out into many "nations," with aspirations and rivalries of their own. It may hereafter be no loss to the great continent that diverse States, united in a federal peace, shall rival one another in an equal diversity of arts, an equal diversity of mental attitudes. Observers in Europe, who recognise the individual insight of the Latins, and the collective solidarity of the Slavs, may not regret, with Prof. Brigham (p. 329), "the decline of the Teutonic stream," and the growth of these two elements. England would be a poor country if the Teutonic stream had dominated her thought, and France owes her laws and manners to the Latins, and much of her early solidity to the Burgundian savages whom she absorbed upon the east. "The pervasive leaven of our American land and our Americanism" may be trusted to adapt the crudest strangers to their new geographical environment. If America has overcome the spirit of Cotton Mather, she will overcome the exuberance of a few Italian bandits, and the depression of the Poles, who are still seeking for a fatherland.

In conclusion, Prof. Brigham's book, allowing for some expressions in American, would be an admirable one for the higher classes of our schools. Read with a good map, and with reference to histories and encyclopædias during hours of preparation, it would provide our youth with a fine lesson in federal expansion, to lay beside those absorbed from, let us say, the intensities of Rudyard Kipling.

GRENVILLE A. J. COLE.

OUR BOOK SHELF.

A New Theory of Organic Evolution. By James W. Barclay (of Glenbuchat). Pp. vi+174. (Edinburgh and London: William Blackwood and Sons, 1903.) Price 3*s.* 6*d.* net.

THE purpose of this work, in the words of its author, is "to test by the common-sense that Huxley says is science, whether the Darwinian doctrine, that the evolution of life (*sic*) on our planet was brought about by natural selection and other secondary causes, accords with ascertained facts, or satisfactorily accounts for the natural phenomena it professes to explain, and, also, to submit a new theory that will explain satisfactorily the admitted facts of evolution." Mr. Barclay's fitness for the task he has undertaken may be judged by the following particulars. In a chapter on "Phases of the Embryo and Fragmentary Organs," he speaks of "the transformation of gills, visible at an early stage in the embryo of mammals, into lungs." In a subsequent chapter he asks, with reference to the whales, "Is it possible to conceive that transformations so great—one pair of legs into fins and the other pair into a tail—could have been brought about by natural selection, accumulation of beneficial differences, use or disuse, or changed conditions of existence? How, then, does Darwin's theory explain these changes?" We confess that we are not prepared with an answer to this question; probably, however, the author here intends his words to bear some other than their obvious meaning. When we find, a little further on, a reference to "Professor Weissman in his 'Germinal,'" it is easy to form a conjecture as to the author and treatise intended; but one may be pardoned for not at once recognising the co-discoverer with Darwin of natural selection under the designation of "Mr. Alexander Wallace." The author's "new theory" is simply the outworn hypothesis of special creation in a peculiarly irrational form.

No one thinks of editing a classical text without some knowledge of the language. But it seems that there are persons who are quite ready to publish their views on evolution without having mastered the alphabet of the subject. F. A. D.

Guide du Calculateur. (Astronomie, Géodésie, Navigation, &c.) By J. Boccardi, Privat-docent à l'Université, Chef de Service à l'Observatoire de Catane. Part i., pp. x+78; part ii., pp. viii+147. (Paris: A. Hermann; Catane (Italie): J. Pastore.)

THE author takes for his motto a sentence of Liagre, "Les plus grands géomètres de l'Allemagne, Gauss, Jacobi, Encke, Bessel, &c., n'ont pas dédaigné de descendre dans de minutieux détails de calcul." Part i. deals with rules for calculations in general, degree of exactitude necessary, choice of tables, discussion of various tables of logarithms, the use of Gauss's sum and difference logarithms, tables of squares, quarter squares, &c. It also deals with practical hints to computers, the use of graphic methods and the slide-rule, and points out the desirability of commencing addition and subtraction at the left. Chapter viii. ends with the excellent piece of advice, "Enfin, c'est une règle générale de ne pas se presser." The last chapter treats of the detection of errors. Part i. may be confidently recommended to all computers. Part ii. commences with remarks and exercises on interpolation, then follow examples of the method of least squares, astronomical calculations of frequent occurrence, the ephemeris, determination of an orbit from three observations, parabolic orbits, correction of an orbit by differential coefficients, and perturbations. The bulk of this part thus appeals to the astronomer. The last chapter describes some geodetic problems, but they are mainly not of a type used by British geodesists.

C. F. C.

Penrose's Pictorial Annual. The Process Year-book, 1903–4. Edited by William Gamble. (London: A. W. Penrose and Co.)

ONCE again it must be said that there is nothing but praise to be bestowed on the present issue, the ninth, of this beautifully got up volume. Paper, printing, letterpress, illustrations, cover and binding are all alike in excellence, and it seems difficult to conceive how the book could in any way be improved.

The editor, however, is not of the same opinion, for, speaking of the standard of process work, he says "we do not consider it is by any means so high as it might be." We learn from him, further, that "the methods by which these processes are worked are by no means the most exact, nor the most careful, and process work is yet but a young industry, which has hardly yet shaken off the trammels of haphazard experiment and rule of thumb work which must necessarily precede the settled conditions of sound practice based on good theory."

It is gratifying, therefore, to know that higher things may yet be attained, but nevertheless he who wishes to make himself acquainted with the present

state of process work will be astonished at the wealth and efficiency of methods that are at his service as shown by the admirable specimens which are included in this volume.

The present issue is considerably larger than its predecessors, both the articles and illustrations being more numerous; greater prominence is given also to the work of various technical schools and institutions.

Enough, perhaps, has been said to indicate the value of this book, which so beautifully portrays the present stage of advancement in process work.

Geometrie der Dynamen. By E. Study. Two vols. Pp. xiii+603. (Leipzig: B. G. Teubner, 1901 and 1903.)

THE title of this book is somewhat misleading. The object of the first two parts is the discussion of certain geometrical theorems. From these the laws for the composition of wrenches (Dynamen) can be deduced as particular cases. To this special application, from which the book takes its title, only pp. 116 to 121 are devoted. In the first part of the book the geometrical theorems (which deal chiefly with the composition of vectors, wedges, motors, &c.) are proved by purely geometrical methods, and the reader is assumed to have only a good working acquaintance with pure geometry, and in particular a knowledge of the theory of the composition of screws and translations (such as is supplied, for instance, in Schoenflies's "Krystallsysteme und Krystallstructur," pp. 326 to 340). In the second part the analytical proofs of the same geometrical theorems are given, but the author still confines himself to elementary methods. The third part, which contains the larger portion of the book, appeals to a more advanced class of readers who are familiar with the method of modern analysis and the theory of groups. Here the author seeks to supplement the work of Plücker, Ball, and Sturm, and to give a complete discussion and classification of linear line-complexes. A good index and table of contents are given in the second volume. H. H.

The Schoolmaster's Yearbook and Directory, 1904. Pp. lx+1030. (London: Swan Sonnenschein and Co., Ltd., 1904.) Price 5*s.* net.

THIS is the second annual issue of a very useful publication. It is, what on the title-page it professes to be, a reference book of secondary education in England and Wales. The book consists of two parts; the first contains general information and the second comprises lists of secondary schools for boys and of the masters who teach in them. The general information would have been more useful and more easily accessible had it been considerably condensed; for the essential matter in works of reference is to have the important facts clearly presented with a minimum of description. The "Yearbook" is, however, sure to be widely used, and deserves the popularity it has secured.

Junior Country Reader. I. True Animal Stories. By H. B. M. Buchanan, B.A., and R. R. C. Gregory. Pp. vi+121. (London: Macmillan and Co., Ltd., 1903.) Price 1*s.*

THESE tales, told in very simple language, are sure to please children of seven or eight years of age. The stories are founded on fact—some of them upon observations recorded from time to time in NATURE. The illustrations, from photographs by Mr. Charles Reid, are numerous and good. The book should serve excellently to awaken in children an interest in animal life.

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.*]

Destructive Action of Radium.

IT may interest some to know that radium destroys vegetable matter. I happened to replace the usual mica plates, used to keep in the small quantity of radium in its ebonite box, with a piece of cambric, so as to permit the whole of the emanations to pass out, mica stopping the α rays.

In four days the cambric was rotted away. I have replaced it now several times with the same result.

BLYTHSWOOD.

Blythswood, Renfrew, N.B., February 1.

Phosphorescence of Photographic Plates.

WITH reference to letters in NATURE of January 28 and preceding numbers, on "Phosphorescence of Photographic Plates," it seems to be not out of place to direct the attention of those interested in the subject to *Wiedemann's Annalen* of 1888, vol. xxxiv. There will be found, on pp. 918–925, information which may prove of use in further investigation. P. LENARD.

Kiel, January 31.

The French Academy.

WHAT Mr. J. Y. Buchanan says (p. 293) about the French Academy is to me much more wonderful than the revelations of radium. It appears that there is a happy land close by where a scientific man of recognised standing can indulge in the luxury of original research, and then send in an account of his work, *not* to have it rejected by the opinion of, say, a couple of fellow-men, but actually to have it published as a right! This seems impossible. It is the encouragement of original research. Perhaps it is hopeless to expect such freedom in this stick-in-the-mud country, which is so much in love with tradition and antiquated forms. Without any desire to be "contumelious," I would say that our Royal Society reminds me of the House of Lords in many respects. OLIVER HEAVISIDE.

January 31.

Ambidexterity.

IN certain schools, notably, for instance, in Mr. Liberty Tadd's art schools in Philadelphia, children are taught to become ambidextrous, at least to a considerable extent. The advantages of this plan have seemed to be evident, but Mr. Wm. Hawley Smith, the well-known writer on educational topics, has lately (*School and Home Education,* March and October, 1903) argued against it. In a letter just received from him, his views are concisely summed up as follows:—"My notion is, that it is not worth while to try to make *all* our children ambidextrous. I believe that it is *far* wiser to follow nature's lead, with each individual child, and develop them in the use of their hands as they naturally wish to use them. . . . I am sure that, in most cases, we shall fail to secure real skill with *either* hand if we strive to train *both* to do the same work." Mr. Smith further argues that it is hard enough to train one hand to do the more complicated kinds of work, and that it does not pay to waste energy trying to accomplish the more difficult feat of training both. Of course the validity of this argument depends largely upon the assumption that the lack of coordination ordinarily seen in adults is inherent, and not the result of acquired habit, or not largely so. It is perhaps allowable to suggest that this point has not yet been fully decided. It is also a question whether the relative inability of one hand is correlated with an inefficiency of the opposite side of the brain, or putting it another way, whether the extra muscular activity necessary to train two hands instead of one involves a similar increase in mental activity.

There is, however, a third possible plan to follow. While I am in nearly all respects right-handed, I draw with my

left hand, and have always done so from earliest childhood. Without being able to prove it, I have believed that this specialisation of the hands was advantageous. With my right hand I cannot draw at all, nor can I write with my left, except, of course, as anyone can, very badly. If it is a fact that to train the left hand for special purposes, such as drawing, is advantageous, this is worth knowing. Its theoretical explanation would agree very well with the views of Mr. Smith, and it seems to me that there is enough probability in the idea to make it worth following up. Perhaps some of your readers may be able to throw light upon it. T. D. A. COCKERELL.

Colorado Springs, Colo., U.S.A., January 13.

Science at Oxford and Cambridge.

IT is very surprising to find Prof. Perry charging Oxford with fearing and hating natural science.

Nearly thirty years ago I was engaged in a cave research which involved geology, zoology, and archæology, as bearing on the cave, its fauna, and objects of human workmanship. One of my colleagues was Mr. W. Bruce Clarke, and I derived valuable assistance from Prof. Boyd Dawkins. Both these gentlemen took first classes in natural science at Oxford. Some years afterwards I investigated the dentition of Aplysiæ. This work was subsequently taken up and completed by another Oxford man, Mr. Walter Garstang. I had been myself much assisted by the Rev. T. R. R. Stebbing, F.R.S., formerly tutor of Worcester College, Oxford.

So far as Cambridge is concerned, in two other subjects I took up, viz. sea-waves and petrology, there was no need to go outside the university, and I may say that the greatest authority on the dentition of gastropods is the Rev. Prof. H. M. Gwatkin, who cannot be persuaded to publish a line on the subject, to the very serious loss to science.

From what I can observe the training of both Oxford and Cambridge is so excellent that the better men are fit to do first-rate work in almost any branch of natural science. As I have said, Prof. Gwatkin is the authority on the dentition of gastropods, while the author of the treatise on molluscs, in the "Cambridge Natural History," is the Rev. A. H. Cooke, a senior classic.

Then we find a senior wrangler, who was not a chemist, setting up a laboratory at home and discovering argon. Then again, we had that wonderful professor of mathematics, the late Sir G. G. Stokes, illuminating every physical subject he approached. I had two correspondences with that illustrious worker, in one of which he conducted me to the very edge of the known, and concluded with the sentence (referring to a paper), "You will be able to judge how far what you have observed may be additional to what is there given." I think that is the distinction between Cambridge research and much modern work. The latter is greatly a matter of text-books and the opinions of authorities. The Cambridge man has conducted you to the absolute front before you know where you are, and there he leaves you to work alone. That has happened to myself repeatedly. The modern school is a little apt to give and take opinions. It is as hard to get an opinion out of a typical Cambridge man as a direct answer from a Quaker. Cambridge has no use for opinions. A. R. HUNT.

Curious Shadow Effect.

IN connection with the "Curious Shadow Effect" mentioned by your correspondent, Mr. H. M. Warner (NATURE, January 28, p. 296), may I be permitted to direct your attention, and his, to a somewhat peculiar "species" of Brocken which I attempted to describe some years ago in the *Scottish Mountaineering Club Journal* (vol. ii. pp. 32–33, 1893)? I ask this, not with any idea of replying to Mr. Warner's inquiry, but to ask another question which perhaps may be answered at the same time. Referring to the above mentioned note, I ask the question, "How was it that more than one image was visible to each of our party?" "Standing close together, all five or six images were visible, all within the wide outer halo; but of course, not one of us saw more than one set of concentric rainbow bands or circles—R.O.Y.G.B.I.V.—and at the lower limbs of the halos nothing of our reflections could be seen, because we were standing slightly *below* the dip of the ridge."

The time of day was between 11 a.m. and noon, and the date was November 24, 1903. In Mr. Warner's case the date was still nearer to mid-winter, and the time of day "near setting" (*i.e.* "within an hour of setting"), and therefore considerably after noon, as shown in the sketch of position. How are the rays affected by refraction and reflection?

I have never seen nor heard of a quite similar Brocken, so I named him "The Brocken of Tarduff" (Hill in Stirlingshire). JOHN A. HARVIE BROWN.

Dunipace, Larbert, Stirlingshire, N.B., January 29.

Subjective Images.

IN corroboration of Prof. Herbert McLeod's observation (p. 297) as to the bright red appearance of printing when the eyes were exposed to the glare of a white chalk road, will you allow me to record an effect I have several times seen when walking over snow while facing bright sunlight? On such occasions every dark object on the snow, and even the shadows in small deep depressions in the snow, have all appeared to me of a vivid blood-red colour.

As to an allied point, I should be glad to be allowed to ask whether the experience of other observers coincides with my own as to the tint of objects seen when the eyes are unequally illuminated. If one eye, right or left, is in full light, and the other shaded (the hand will give shadow enough), then, by closing the eyes alternately, I always find that the field of vision of the shaded eye is of a distinctly warmer tint than that of the eye in full light. If, as Sir Michael Foster says, both eyes respond equally to a stimulus applied only to one, then the explanation which naturally suggests itself, that the difference in the tint of the light seen is in some way dependent on the differing expansion or constriction of the two pupils, becomes inadmissible.

Kew, January 30. E. HUBBARD.

Use of the Kinematograph for Scientific Purposes.

BY means of the kinematograph it is possible to show to the eye the whole course of a visible phenomenon, either at the rate at which it actually happened or at any faster or slower rate that may be desired.

Already it has been made use of to exhibit many phenomena the actual rate of happening of which is too rapid to admit of direct visual perception, as in the case of sound waves and the flight of bullets, but there would seem to be as great possibilities of useful application to render the progress of *slow* motions perceptible. For example, the changes in a cloudy sky are usually so gradual that it is difficult even for a close observer to form a definite mental picture of what has happened in the upper air during, say, a few minutes or a few hours. This difficulty is due not merely to the slowness of the changes, but to their complexity. But suppose that under favourable conditions a good cloud-scape could be photographed, say, 500 times in an hour, and the results put through a kinematograph in one minute, it could hardly fail to help the meteorologist to get a clearer idea of what really happens above us, especially as for purposes of study the *same* phenomenon could be made to pass before the eyes of the student as often as he might desire. Perhaps our meteorological observatories may carry this method far.

Again, suppose a similar application made to the growth or flowering of a plant. I imagine that few botanists have the patience and power of concentration that would be required to get as clear and definite an idea of such a process by direct observation as one could easily acquire by the aid of the kinematograph, and even supposing a botanist possessed a perfect mental grasp of the process, if he wished to describe it to an audience would he not find the kinematographic representation of it an invaluable aid?

No doubt many other possibilities will suggest themselves at once to the reader. R. F. M.

OBSERVATIONS ON THE NATURE OF CANCEROUS GROWTHS.

MUCH of the advance made within recent years in our knowledge of the nature of disease can fairly be traced to the general recognition of the principle that pathological problems can be resolved in the first instance into cell problems. Not only is the modern practice of aseptic surgery founded on this principle, but it also forms the basis of rational as opposed to merely empirical therapeutics.

It is not, however, always easy to interpret the evidence drawn from a study of the cells, for though they may be described as the units of bodily organisation they are themselves extremely complex. Thus it happens that the explanation of this or that series of phenomena is often reached by a roundabout route.

Amongst the diseases in which the cellular aspects of the case thrust themselves prominently into the foreground, few are perhaps more remarkable than those malignant tumours popularly grouped under the general term of cancer. These growths are very numerous in character, they appear in widely different regions of the body, and they produce more or less profound disturbances in the organism in which they occur. They are not restricted to mankind, but, as means of investigation are improved, they are shown to afflict members of very different groups of animals included in the Vertebrata, and it may be expected that they will probably be identified in invertebrate animals also when a systematic search is made for them.

But however diverse these growths may be, both as regards the animals in which they occur and in the gross structure which they exhibit, they nevertheless present one important feature in common. They all essentially consist of cells that are multiplying in a manner uncoordinated with the requirements or advantages of the remaining cells and tissues of the animal affected. The growth as a whole behaves as a parasite—a foreign organism which lives at the expense of, and exercises a destructive influence on, the cells of the normal tissues it invades. The growth itself also betrays, in a greater or less degree, an organisation of its own, and its cells can commonly be readily distinguished from those of the host on which it preys. This independence on the part of the malignant growth has long been recognised, and it is often coupled with a power of dispersal in the body that produces new centres of infection and consequent spread of the disease. This is especially clearly shown in the case of a carcinomatous growth in mice, which can, as Jensen has shown, be transferred to the bodies of other mice by inoculation, and his results have been abundantly confirmed by Bashford and Murray in this country.

Although the cellular symptoms are for the most part not difficult to recognise, the causes that determine the origin of the neoplasm are still to seek. It is clear, however, that they operate in producing some change in cells that previously were not distinguished from those other units of which the body is composed.

Numerous theories and hypotheses have, from time to time, been advanced to account for the phenomena, but it is only when the nature of the altered structure itself is understood that we can expect to be in a position to investigate seriously the nature of the causes that produce it, and thence to bring the latter under control.

It has been suggested that a micro-organism is concerned in the production of some toxin that is more directly responsible for the mischief. Sporozoa, yeasts, psorosperms, and bacteria, have at different times been identified as the exciting causes, but careful examination has failed to confirm these statements; whilst in a number of cases it is certain that normal cell constituents themselves have been mistaken for the supposed parasites. A modification of the parasite theory assumes that the organisms are so small as to be beyond the range of microscopic vision, but that the virus they produce suffices to provoke that cell-proliferation which is so characteristic of the growth. Such a view does not appear to advance matters very much, for the supposed virus has not been isolated, nor have the organisms credited with its production been procured. It may well be that a stimulus of a chemical nature underlies the whole process; indeed, it is difficult to escape the conviction that it must do so. But the first useful stage in the inquiry would seem to consist in the obtaining of a definite conception as to the nature of the cellular changes themselves.

A second theory assumes, as its foundation, the existence of cells that have become displaced, or have withdrawn from active cooperation in the process of building up the organism during the early stages of embryonic life. These may be cells that should have been destined to give rise to the so-called "germinal epithelium," or to ordinary somatic tissues. In any event, they retain the characters and properties of embryonic cells, and are ready to start into new growth when appropriate conditions awaken them from their dormant state. But in such circumstances they are, of course, freed from the correlating influences that should and would have directed and controlled their multiplication. Thus they come to exhibit in a marked degree that potential independence which is, perhaps, possessed by every unit of nucleated protoplasm.

But this view of the existence of latent germs, scattered over the body fails to account for the remarkable nuclear peculiarities presently to be described, and indeed it seems to savour rather of a *petitio principii*, since it involves the assumption that the very occurrence of a malignant (or other) growth necessarily postulates the pre-existence of a latent germ at any spot at which the disease has made its appearance.

A third view of the nature of cancer, which may perhaps be appropriately designated as the "gametoid" theory, has quite recently been put forward. It is perhaps easily confused with the "embryonic" theory just outlined, but in reality it is essentially different from it. The gametoid theory, whilst taking account of the parasitic nature of the growth, is mainly founded on the discovery of certain quite peculiar nuclear divisions that normally only occur in connection with the formation of the sexual cells, or of their immediate precursors, in the life-history of the organism.

In the first instance it was during an investigation into the cytology of anomalous growths of ferns, on which the present writer, in conjunction with Mr. Moore and Miss L. Digby, was engaged, that certain peculiarities, previously noted, by the two observers first mentioned, on nuclear divisions in epitheliomata assumed an unexpected significance. A renewed investigation of the cytological processes obtaining in malignant growths seemed desirable, and this work was much facilitated by the additional cooperation of Mr. C. E. Walker.

As the nuclear transformations are somewhat complicated it may be well to explain more fully the relevant facts, such as may be demonstrated in any ordinary animal or plant, and then to indicate the bearing of these on nuclear divisions characteristic of malignant growths.

When an ordinary cell of the animal or plant is about to undergo division, certain definite and constantly

recurring changes become visible in the nucleus. Delicate strands make their appearance, and these finally segment into a number of rod-like or V-shaped bodies termed chromosomes. The number of chromosomes thus appearing in any nucleus of the ordinary body or somatic cells is quite constant for any species of animal or plant, though different species possess different numbers of these chromosomes. In man, for example, there are thirty-two, whilst in a lily there are

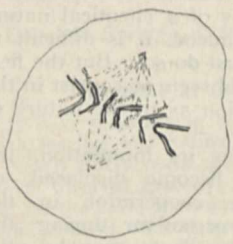

FIG. 1.—Normal Somatic Mitosis.

FIG. 2.—Heterotypical Mitosis.

twenty-four in all the body- or somatic-cells. The chromosomes become arranged in a very definite manner on a spindle-like structure, and then each of them divides longitudinally into two halves (Fig. 1). The two halves then separate, each travelling to opposite poles, and furnish the material out of which the chromosomes of the two daughter nuclei are constituted.

Although the process, as thus given in the barest outline, is constantly met with in all the somatic cells and may be traced back to the earliest divisions in the fertilised egg from which the individual has sprung, a stage sooner or later is reached in the life-history when certain cells become more or less sharply delimited from their fellows, and they finally undergo a nuclear division which is very different in character from that met with in the other cells of the body. To this particular mitosis the term Heterotype has been applied, and its onset marks a radical change that affects the organisation of the descendants of every cell that has passed through it.

The features by which the heterotype can be distinguished from all other mitoses are as follows:—The nuclei grow to a relatively larger size, and the strands from which the chromosomes arise exhibit a very characteristic "bunched" appearance at a particular stage in the process. Furthermore, the chromosomes only appear in half the numbers characteristic of the somatic nuclei. In man, for example, where the somatic number of chromosomes is thirty-two, only sixteen appear in the heterotype division. This reduction is due to the cohesion in pairs of the normal chromosomes and not to any elimination of them from the nucleus. The heterotype chromosomes further differ from the somatic ones in form, and this difference is equally marked in both animals and plants. They present the form of rings, loops, &c. (Fig. 2), instead of the familiar V-shaped figures; and, furthermore, when arrayed on the spindle each divides, not longitudinally but transversely.

Whilst this is not the place to discuss the significance of the remarkable peculiarities that distinguish this heterotype mitosis, it is essential to realise that it marks the point at which the somatic and reproductive elements diverge from each other in their future structure and development. At each succeeding division all the descendants of a cell that has once divided heterotypically retain the reduced number of chromosomes, but in other respects the normal somatic mitoses are closely simulated (Fig. 3). These post-heterotype mitoses are all distinguished as homotype.

Thus the appearance of the heterotype mitosis marks the definite segregation of a sexual series of cell generations. These may be few as in animals, where, after a single homotype division, the sexual elements are at once differentiated. In plants, on the other hand, it commonly happens that all the descendants of the heterotype generation do not actually become differentiated into sexual cells, and in any case the latter are only formed after the occurrence of a number of intervening post-heterotype divisions. These, however, are all characterised by the reduced number of chromosomes (homotype), which, as in animals, is similarly retained in the nuclei of the sexual cells. It is only on the union of ovum and sperm in fertilisation that the full somatic number is restored.

It is perhaps unnecessary to insist that the heterotype mitosis and its consequences are restricted to the reproductive tissue, at least, in the normal body; the somatic cells of the latter, in so far as they continue to divide, present the same features as before.

The general bearing of the foregoing description will become evident when it is stated that both the heterotype and homotype mitoses have been, during the recent investigations, recognised as occurring in certain cells of malignant growths.

If the advancing edge of an actively enlarging tumour, such as an epithelioma, be examined, many cells will be found to be in various stages of division. Near the margin the nuclei commonly exhibit mitoses typical of somatic cells (Fig. 1), whilst others will be encountered that show irregularities of various kinds. An excessive number of chromosomes is not uncommon (Fig. 4), and here and there pluripolar figures (Fig. 5) of a remarkable character may be observed. The latter occur somewhat unevenly distributed and owe their

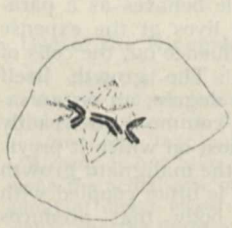

FIG. 3.—Homotypical Mitosis.

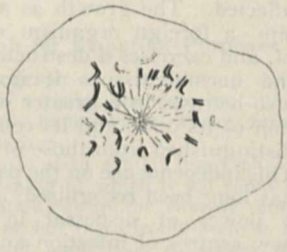

FIG. 4.—Somatic Mitosis, Polar View.

FIG. 5. Pluripolar Mitosis.

origin, at least in part, to the simultaneous division of a group of adjacent nuclei on a common spindle apparatus. Yet other cells will be met with in which the process of nuclear division is of a type less complex than the normal, and it may be so reduced as to consist in the mere drawing apart of the original nucleus into two similar or even unequal halves, with a more or less complete absence of all differentiation of chromosomes.

But in spite of these irregularities that tend to obscure the more important facts, the heterotype division can be recognised with certainty in every malignant growth so far examined; and it is precisely similar in character to the normal heterotype that occurs in the sexually reproductive cell series. The same peculiarities in the early differentiation of the chromosomes culminating in the production of rings, loops, &c., the same reduction in the number, and the same transverse division of each one when attached to the spindle, reappears in these cells with the greatest uniformity.

This peculiar mitosis seems to be confined in tumours to those of a malignant character, for it has not been observed up to the present in any benign growth. It would thus appear to serve as a means of distinguishing between the two classes of growths.

Following upon the heterotype division, the homotype stage is reached, but it very soon becomes unrecognisable in most cases owing to the occurrence of the irregularities above mentioned.

The conclusion to be drawn from the above account is that, in a most important respect, some of the cells of a malignant growth have gone through a change similar to that which in normal tissues is confined to the production of the generations ending with the formation of the sexual cells. Such a conclusion is further supported by considerations derived from other sources.

It has already been pointed out that whereas in animals the differentiation of the sexual elements follows closely after the occurrence of the heterotype mitosis, this is not the case in most plants. Thus in a fern, the whole prothallium is composed of post-heterotype cells, and the sexual elements only arise from a relatively small number of them. Similarly in the embryosac of a flowering plant, there are certain post-heterotype cells that are not normally destined to give rise to sexual structures. But it is a matter of considerable interest to find that cells that fail in this respect not seldom exhibit marked irregularities in their modes of further division. Sometimes direct fission of the nuclei may occur with suppression of chromosome differentiation; in other cases the chromosomes may appear, but in quite irregular numbers.

The similarity of these irregularities to those already indicated as present in cancerous growths will at once be obvious from what has already been said.

The investigations of Bashford and Murray have served to confirm the statements previously made as to the occurrence of heterotype and homotype mitoses in the human subject. These investigators have identified the same divisions in malignant growths that occur in other mammals, in reptiles, and in fish. Whether, therefore, the explanation advanced to explain them, which involves the admission of an essential similarity as existing between the malignant growths and sexual reproductive tissue, be accepted or not, it is a fact that will have to be reckoned with.

It has been held by some persons that a transformation of somatic into reproductive tissues cannot occur, and it is, therefore, necessary to examine briefly the grounds on which such an opinion rests.

In plants the difficulty does not really arise, for a large number of cases are known in which cells that have long discharged somatic functions may revert to an embryonic condition, and then, after a heterotype division, produce from amongst their descendants the sexual elements that take part in fertilisation. This fact robs the objection of any *a priori* force it might have had. It is, however, true that amongst animals the conversion does not normally occur, but the existence of the diagnostic mitosis described above as appearing in the malignant growths affords cogent evidence for regarding them as representing such a changed condition, the true nature of which is, however, masked by the invariably pathological features that accompany it.

It is not urged that the cancer cells are functionally active sexual elements, but rather that they are homologous with such; it has, therefore, been proposed to express this idea by applying the term "gametoid" to them.

But whilst the existence of the heterotype mitosis emphasises the gametoid nature of the cells that have just passed through it, there are other phenomena that suggest the interpretation may possibly be carried on to another and further stage. Just as the true gametes (sexual cells) may fuse, so, too, cases of nuclear fusion are not very uncommon in the post-heterotype cells of malignant growths. It would be premature at the present juncture to attempt to do more than indicate that there may be something beyond a mere abnormality latent in these fusions. It is, however, a fact that in individual cases the fusion figures strongly recall instances of normal fertilisation. Should the suggestion turn out to be well founded, and many instances apparently support it, much that is still difficult of explanation will immediately become clear. The irregular nuclear divisions, for example, will be no more surprising than are those so frequently to be seen in the endosperm of an angiosperm, or even in the more abnormal results consequent on polyspermy. The independence of the neoplasm and its parasitic habit, to which attention has already been directed, would be still quite explicable, for in a general sense it may be stated that a new generation habitually preys on its forbears whenever continued association with them admits of it.

But the problems that especially invite attack are those concerned with the causes of the transformation of somatic, into reproductive, cells and tissues. These fall within the scope of the physiological chemistry of the cell. Something has already been done in this direction so far as plants are concerned; and, indeed, it would seem that the lower members of the vegetable kingdom offer a more convenient material for investigation than animals. They are comparatively easy subjects of experiment, and their simpler specialisation avoids the difficulties consequent on the presence of complicated subsidiary mechanisms. The ease with which Spirogyra, for example, can be directed into either the reproductive or the vegetative phase is a case in point, and it is only one out of many that could be cited.

J. B. FARMER.

SCIENCE AND MILITARY EDUCATION.

THE *Journal* of the Royal United Service Institution for January contains a full account of the important discussion on November 9, 1903, initiated by Lieut.-Colonel F. N. Maude, *late* R.E., on the subject of military education, and on January 18 there was published a revised scheme of subjects for the entrance examinations to the Royal Military Academy and the Royal Military College respectively. The discussion at the United Service Institution, which was of a decidedly discursive character, dealt to a large extent with a real or supposed deterioration of the public school boy of to-day, or at least of those public school boys who desire to obtain commissions in His Majesty's Army.

This part of the discussion was based very largely on statements made by army tutors, which, though there may be some truth in them, must be rather carefully scrutinised. First, because army tutors are human,

and have been suffering severely for some years past from the fact that the public schools now pass their boys directly into Woolwich and Sandhurst in greatly augmented numbers, and therefore send far less of them to the tutors than formerly. And, secondly, because, owing to the above mentioned circumstance, very few boys now go to the army tutors from the public schools, in normal circumstances, unless they are a good deal below the average of public school candidates; whilst formerly, when these candidates were much less carefully looked after in many schools than they are now, a great many boys of more than average ability passed from the schools into the hands of the tutors. The change in the quality of the boys who come into the classes of the latter, therefore, probably is not due to a deterioration of the work done in the schools—even if there be such a deterioration—but to an entirely different cause, viz. that which we have indicated above.

The truth of the matter, judging from what was said in the discussion and other evidence, appears to be something of this sort, that the Sandhurst and Woolwich candidates of to-day, so far as concerns those "who are at all likely to obtain a commission," are seldom "wanting in the moral qualities of an officer," are "willing to learn" and "easily interested in their work for a time," but a great many of them are "mentally incapable of concentration" for anything but short periods of time. The cause of this defect is to be sought and remedied partly in the schools, partly also in modern English home life; but we fear it will never be eradicated so long as the military profession continues to be not self-supporting. And for this reason:—The supply of able and ambitious young men who desire a soldier's career and who are in a position to follow a profession which will not, in most cases, support them is somewhat small, whilst the number of such young men required for officers is large. The result is that though the competition for commissions in the engineers is a real one, that for the other branches of the army is much less severe than is generally supposed. Hence the spur to work is much less than the interests of the army demand.

Other very important topics which came up in the discussion were the methods of teaching mathematics and the great need for more science in the education of officers. On both these points Colonel Maude is thoroughly sound. He advocates a far wider use of graphic methods in mathematics, and realises that the subject could and should be made more interesting, though apparently he is unaware of the recent great changes that have been effected in this department, for he remarks that he is told the method is in use in France, and that he learns from the *Engineer* that Prof. Perry recommends it in England.

On the second subject he says, "Primarily, we need" in our officers "the power to observe facts accurately, *i.e.* scientific teaching"; and again, in the discussion on his paper he pointed out, what we ourselves directed attention to a few days later, that under the proposals formulated for the examinations for entrance to the army in the future it would continue to be possible for candidates to get into the army "with no knowledge of science" and, it may be added, with no scientific training to enable them to sift facts and distinguish the true from the false.

A few days after Colonel Maude's paper was read a protest on the subject of the new regulations was made in NATURE, and there were many others, some made through the Press and others directed to the Advisory Committee. These various appeals appear to have induced the committee to reconsider the matter. But, alas! we find from the announcement made on January 18 that the committee has quite failed to understand the objections to its scheme, and that in its main feature, though not in all its details, the revised scheme is indistinguishable from that which preceded it.

In the first scheme, that which was published in November, 1903, the provisions were as follows:—

(1) That there should be a qualifying examination, which might take the form of a leaving certificate, for all candidates, and that this must include English, history, and geography, mathematics (elementary), French or German, and either (*a*) science, or (*b*) Latin or Greek.

(2) That there should be in addition a competitive examination, and that for Woolwich this should include three compulsory subjects, viz. English, either French or German, and mathematics i., together with any two of mathematics ii., science, history, French, German, Latin, Greek; whilst for Sandhurst there were to be two compulsory subjects, English and French or German, together with any two of mathematics i., mathematics ii., science, history, French, German, Greek, Latin.

On the publication of this scheme it was quickly pointed out in our columns and elsewhere that it would go near to killing science in many, and perhaps in most, public schools, since, for reasons which need not be repeated, Latin would hold an advantage too great to be withstood in such a competition. On January 18 some alterations in the scheme were announced. These are as follows:—

(1) The subjects covered by the qualifying certificate will be divided, as shown below, into two classes.

Class i.—(1) English, (2) English history and geography, (3) mathematics (elementary). N.B.—All candidates must take up and qualify in each of the above three subjects.

Class ii.—(1) Science, (2) French or German, (3) Latin or Greek. N.B.—All candidates must take up and qualify in any two of the above three subjects (1), (2) and (3).

(2) No candidate will be allowed to take out a leaving certificate or its equivalent, or pass the qualifying literary examination, before he has attained the age of seventeen years.

(3) The languages which may be taken up as voluntary subjects at the competitive examination for admission to the Royal Military Academy or Royal Military College will be—German or French, and Latin or Greek.

No doubt at first sight this seems a considerable change in the right direction, since it appears to put science on an equal footing with French or German and with Latin or Greek. But if we look more closely into the proposal we see that one of these three subjects, viz. French or German, and one only, is compulsory for both Woolwich and Sandhurst in the competitive part, and must, therefore, be taken up at the qualifying stage also by practically every candidate. Thus the scheme in its new form is only the original scheme rewritten. The real alternative is still, as before, between science and Latin or Greek,[1] and between these two only.

It is nothing less than astounding that the body of officers and gentlemen who have now had this matter before them for several months should so little understand the certain effect of their own regulations that they could put forward this change, which is no change, after all that has been said and written on the subject.

Taken as a whole, the new proposals do, it is true, make a slight alteration. In part ii. candidates will be unable to take up two modern or two classical languages, which may tend in some slight degree to widen the school training of a few of the candidates.

[1] Really, in effect, between science and Latin.

But on the main point they wholly fail to meet the objections that have been brought forward.

In our opinion it is a great misfortune in view of the present state of affairs that the War Office has only so lately become aware of the existence of the University of London, and that consequently Sir Henry Roscoe, who has given much attention to the subject of army examinations for many years past, has only joined in the consultations of the Advisory Committee since the committee concluded the consideration of this subject. For this circumstance has prevented the committee from having the benefit of his opinion upon the doubly vital question—vital equally for the army and for English public school education in the immediate future—What is the proper position for experimental science in the education of an officer?

MINERAL OUTPUT OF INDIA.

THE progress of India as a mineral-producing country is made plain by the following diagrams, which have been compiled from a statistical abstract recently issued by the Indian Government.[1]

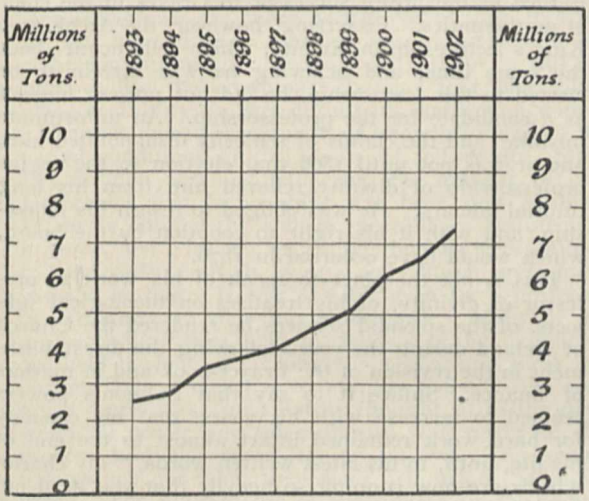

FIG. 1.—Output of Coal.

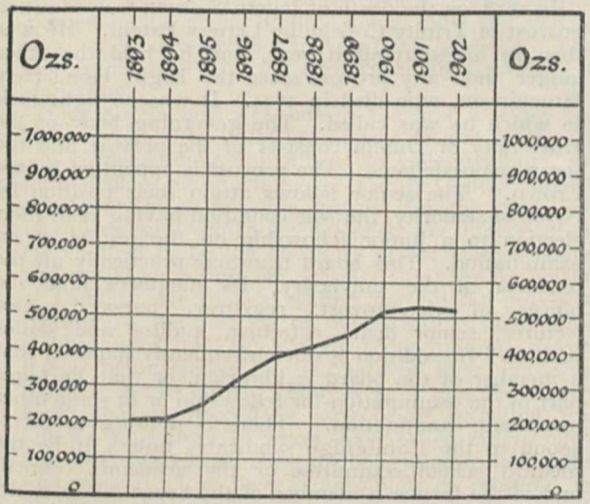

FIG. 2.—Output of Gold.

1 "Statistics of the Mineral Production in India in the Ten Years 1893 to 1902." (Calcutta, 1903.)

The output of coal has risen from 2½ million tons in 1893 to nearly 7½ millions in 1902; 84 per cent. of the coal is raised in Bengal. The yield of gold, which

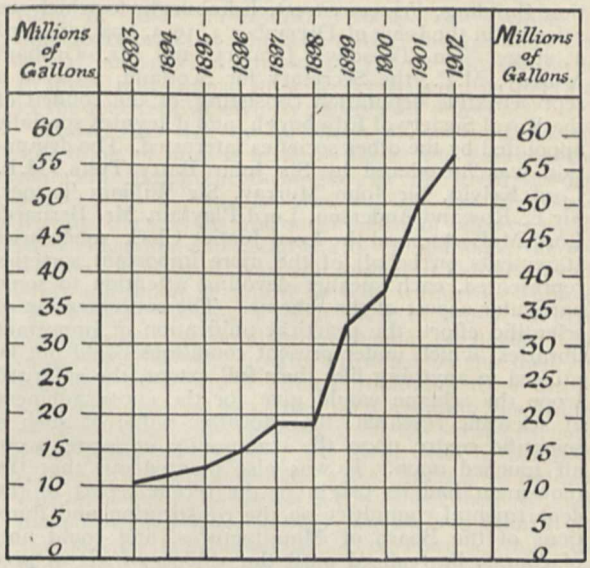

FIG. 3.—Output of Petroleum.

comes mainly from Mysore, is 2½ times what it was ten years ago. The quantity of petroleum produced has increased more than five-fold, and the rise in the

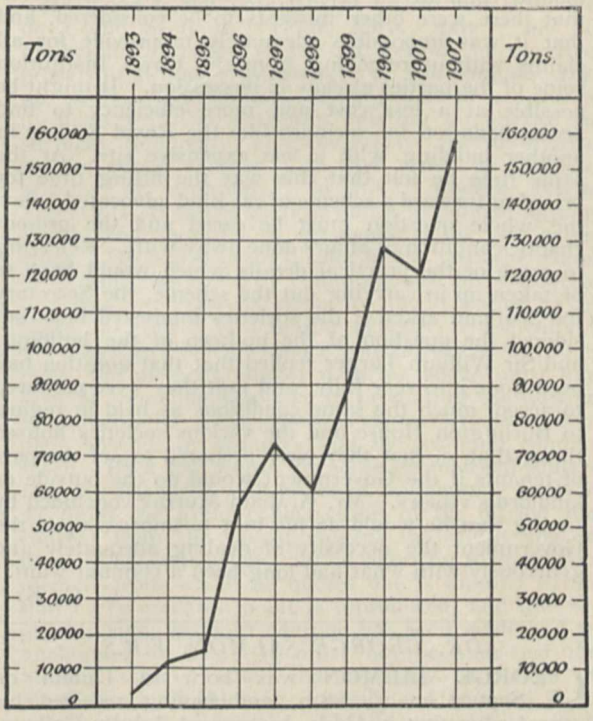

FIG. 4.—Output of Manganese Ore.

output of manganese ore is still more striking. The petroleum is supplied principally by Burma, whilst the manganese ore comes partly from the Central Provinces and partly from Madras.

ACCOMMODATION OF SCOTTISH SCIENTIFIC SOCIETIES.

THE movement for the accommodation of the Scottish scientific societies in the Royal Institution Building, Princes Street, Edinburgh, to which we referred in the issue of December 3, 1903, has advanced a stage. On Tuesday, January 19, Mr. Graham Murray, M.P., the Secretary for Scotland, received a representative deputation consisting of the council of the Royal Society of Edinburgh, and delegates specially appointed by the other societies interested. The deputation was introduced by Sir John Batty Tuke, M.P. Lord Kelvin, Sir John Murray, Sir William Turner, Sir E. Rowand Anderson, Lord Playfair, Mr. Bernard, Lord McLaren, and the Lord Justice Clerk made brief statements on behalf of the more important societies represented, each speaker devoting attention to some particular aspect of the scheme. The concentration of scientific effort, the practical unification of important libraries, which under present conditions could not be utilised to anything like their full extent, the enlarged scope the scheme would give for the encouragement of scientific research, the educative value of such a scientific centre upon the community at large, were all touched upon. It was also pointed out that the movement had its origin in the recent report of the departmental committee on the constitution and functions of the Board of Manufactures, and could not, of course, be realised until the schools of art at present accommodated in the Royal Institution were otherwise provided for. The Secretary for Scotland in his reply expressed his sympathy with the object aimed at, although it was impossible for him to commit himself at present to the furtherance of any scheme which might naturally follow the acceptance of the departmental committee's report. It must be remembered that there were other interests to be considered, and that it was impossible adequately to provide for all claims without removing from the Royal Institution some of the parties already in possession. It might be possible at a less cost and more efficiency to find accommodation for societies like the Royal Society in another building with a less expensive site. At the same time he felt that this was the fitting time for bringing forward a scheme of the kind advocated, when the whole question must be faced and the present chaotic condition of affairs done away with. Referring to some of the practical details which would have to be taken up in carrying out the scheme, the Secretary for Scotland asked if the societies interested had considered the question of the up-keep of the building, and Sir William Turner replied that that question had been gone into very fully, and that they were prepared to accept much the same conditions as held in regard to Burlington House and the various societies housed there, that is, that they were prepared to act the part of tenants if the Government would do the outside or landlord's repairs. Mr. Graham Murray concluded by saying that he would do his best to impress upon the Government the necessity of dealing adequately and generously with what had long been a clamant want.

C. G. K.

DR. GEORGE SALMON, F.R.S.

GEORGE SALMON was born in Dublin on September 25, 1819, and having received his school education in Cork, he entered Trinity College, Dublin, and graduated in the year 1838 after a distinguished university career. He was elected to a scholarship in classics in 1837, and obtained first senior moderatorship at the honour degree examination in mathematics in 1838. In 1840 he was awarded the Madden's premium, having, in the opinion of the examiners at the fellowship examination, "best deserved to succeed if another fellowship had been vacant." In the year following he was elected to a fellowship. In due course he became tutor, his duties being to lecture to classes of ordinary students twice a day during term, to assist in examining and to advise and direct his pupils. With a large chamber of pupils, such as Salmon's, this work, though not severe, is liable by its frequent interruption to render it extremely difficult for a tutor to carry out any systematic original work; but Salmon knew the value of time, and with his wonderful power of abstraction he produced most of his forty-one mathematical papers and his four great mathematical treatises during his twenty-five years' service as tutor. In 1858 he was appointed Donegal lecturer, and taught engineering students the calculus in addition to his tutorial work. In 1859 he proceeded to the degrees of B.D. and D.D., and he published in 1861 his first series of sermons preached in the Chapel of Trinity College.

It was natural that a man of Salmon's originality and versatility should have desired freedom from the irksome duties of a tutorship, and in 1862 he was regarded as the fitting successor to Graves in the chair of mathematics. Preferring, however, the Archbishop King's lectureship in divinity, which fell vacant about the same time, and believing he was certain to be elected to this lectureship, he did not present himself as a candidate for the professorship. An unfortunate mistake and the claims of seniority disappointed him, and it was not until 1866 that election to the regius professorship of divinity relieved him from his long tutorial labours. He was obliged to resign his fellowship, and with it his right to cooption by the board, which would have occurred in 1876.

This is not the place to speak of his work as professor of divinity, of his treatises on theological subjects, of the splendid services he rendered the Church of Ireland during the years following the disestablishment in the revision of the Prayer-book and in matters of finance. Suffice it to say that Salmon's powers seemed to increase with his years, that his capacity for hard work remained intact almost to the end of his life, until, in his latest written words, "my chariot wheels are now running so heavily that you need not be surprised to hear at any time that they have ceased to move at all."[1]

In 1888, on the death of Jellett, Salmon was admitted provost of Trinity College by Letters Patent. He was then in his sixty-ninth year, and he held the office longer than any provost since the Right Hon. Hely Hutchinson, who died in 1794. It was no light task to which he was called. The governing body of the University of Dublin consists of the provost and the seven senior fellows. The provost is appointed by the Crown. The senior fellows attain their position by virtue of seniority, the sole condition having been their election to a junior fellowship on the results of an examination. This board transacts practically all the business of the university. Its members hold the offices of vice-provost, registrar, bursar, senior lecturer, senior dean, catechist, auditor and senior proctor. In addition it not unfrequently happens that a member of the board is librarian, or that he takes part in the examination for fellowship or in some other important examination. There is nothing to correspond to the Cambridge syndicates unless it be the medical school committee or the academic council, and of the former a member of the board is the chairman, while at least three senior fellows and the provost have belonged to the latter since its inception in 1874, the provost being the *ex officio* chairman.

[1] From letter to the Bishop of Chester dated January 12.

Indeed, Dr. Salmon had no small share in the origination of the academic council—"to cooperate (with the Board) and have a share in the regulation of the Studies, Lectures, and Examinations . . . and in the appointment and election of Professors," but during his masterful tenure of the provostship the power of the council was not of importance. Enough has been said to show the difficulty of Dr. Salmon's office as the head of a responsible board overloaded with duties of the most multifarious kind—a board composed of eight men whose united ages at one time approached if they did not exceed the magnificent total of five hundred and eighty years.

However, Salmon was not an old man at seventy, nor, indeed, at eighty, nor did he appear so at eighty-four to anyone who had the good fortune to enjoy at his most hospitable table the delightful flow of his quaint and simple humour. No doubt he did in his later years grow weary of prolonged controversy, and he was willing to put things off with "It will do very well for my time," or he would use his inimitable powers of ridicule or employ the most fantastic and ingenious arguments to crush any proposal that had not his approval. It might have been otherwise had his duties been less laborious, had he not felt constrained to rule the board with a rod of iron, had he, in fact, more time to consider matters which did not claim his immediate attention, yet perhaps he did not fully realise the enormous changes that had taken place in Trinity College during his connection with it—changes due to the growth of knowledge and to the varied conditions of the tenure of fellowship. Since Dr. Salmon obtained fellowship the number of professorships and lectureships has been just doubled. When he entered the college the celibacy statute was in force, and with few exceptions fellows were obliged to take orders. Rich livings and church preferment were to be had. It was possible even for a professor of astronomy to step into a bishopric. Many of the professorships then held by fellows or by ex-fellows are held by fellows no longer. A new and most important body of men has come into existence—the non-fellow professors—men hardly thought of in the days when all power and all authority was vested in the provost and the seven senior fellows. The senior fellows are not what they were just before Salmon's time. The allurements of matrimony or the seductions of great ecclesiastical positions used to produce a rapid flux, and a senior fellow was generally coopted in the prime of life—not as now the survivor of a set of men whose constitutions have been most thoroughly tested by the rigours of an appalling examination.

Though Salmon was one of the first to experience these changes, they did not appear to him to warrant any corresponding adjustment in college affairs, and some deplore his inaction, yet Trinity College must be ever grateful to her late provost for the noble conservatism with which he defended her independence. He claimed to be the *Ordinary* of the college chapel, and would not admit the jurisdiction of the Archbishop of Dublin. He took a leading part in the provisions relating to the position of the divinity school, which is absolutely free from clerical domination, its professors being elected by the board on their merits and on their merits alone. Moreover, it must be remembered that the board is now being recruited from fellows only three of whom have taken orders out of the thirty-five elected since the obligation to take orders was repealed; that there is absolutely no religious test for fellowship candidates, so that it is theoretically possible that a board exclusively composed of Mohammedans may at some time be called upon to elect the professors in divinity. He was willing to afford Roman Catholics every facility for religious exercises within the walls of Trinity College, but he would suffer no clerical interference, whether from the Church of Ireland or the Church of Rome. Indeed, those who know anything of Trinity College can detect little of the "Protestant atmosphere" which its opponents say is so oppressive there, though there may be an "anti-clerical atmosphere," if we take the phrase to mean that clerical interference will not be tolerated in the teaching of divinity, science or letters.

Those who had the privilege of knowing Salmon will think of him as a man—not as the great mathematician, the great theologian or the great head of affairs. As a man he was superb—the kindest of friends, the keenest and most subtle of opponents, the most charming and delightful of companions, the best of men. His figure was well known in Dublin—nearly every afternoon he might be seen wandering through the streets; he was a great lover of music, a great chess-player, an omnivorous reader of novels. For many years he was greatly attracted by the theory of numbers[1]—he said it almost amounted to a disease with him, and he was often seen avoiding the tedium of some meeting by scribbling on his scraps of paper in his search for primes and for periods of recurring decimals. Yet he took the widest interest in ordinary matters. Many Dubliners will recollect their astonishment at seeing the venerable provost less than a year ago leaving Kingstown on an exceedingly rough day in a small boat to visit the Channel Fleet, which lay at some considerable distance outside the harbour. Many a time he has surprised his friends by writing to them from some remote Swiss valley inaccessible to many a far younger man.

Salmon's first paper was published in 1844, "On the Properties of Surfaces of the Second Degree which Correspond to the Theorems of Pascal and Brianchon on Conic Sections" (*Phil. Mag.*, xxiv.); his last mathematical paper was "On Periods in the Reciprocals of Primes" (*Messenger of Mathematics*, 1873, pp. 49–51). The majority of his papers have reference to numerical characteristics relating to curves and surfaces, and many of these results are summarised in the great chapter "on the order of restricted systems of equations" in his "Modern Higher Algebra." It would be most unfair to Salmon to judge of his contributions to mathematics by his papers alone. He had a great dislike to the physical trouble of writing; he modestly communicated his discoveries to friends or reserved them for incorporation in his books, so that it is a matter of extreme difficulty to say how much is his. Apart from his discovery of new facts, the methods employed in his books must have been of tremendous service in promoting the advance of mathematics. His style was characterised by a complete absence of pedantry and by profound common sense. By a few words, by some geometrical illustration, he dispensed with pages of troublesome analysis. At times the great condensation of his diction may conceal from the casual student the width and the depth of his conclusions, but on referring to an original memoir from which he quotes one is amazed to find that every essential point is reproduced, and that frequently some brilliant addition has been made and left unclaimed by him. It must not be supposed that Salmon shared the characteristic attributed to MacCullagh of shirking analysis and trusting to his great geometrical insight. On the contrary, he seemed to revel in analysis so tedious and so intricate that it would be distasteful to most mathematicians. He says,[2] "By means of the differential equation I calcu-

[1] Having nearly completed a book on this subject, he burned it for some unknown reason.

[2] "Treatise on Modern Higher Algebra," art. 260.

lated the invariant E. Its value was given at length in the second edition, where it occupied thirteen pages, but I have not thought it worth while to reprint so long a formula." Yet to the volume which contained this elaborate investigation and many others involving equal skill and almost equal labour he prefixed the words:—"To A. Cayley, Esq., and J. J. Sylvester, Esq., I beg to inscribe this attempt to render some of their discoveries better known, in acknowledgment of the obligations I am under, not only to their published writings but also to their instructive correspondence."

Questions of priority must be left to some more learned pen, and to a writer who has less reason to revere Salmon and to respect his reticence. The value of his work is shown by the number of the editions and of the translations of his treatises, and by the honours he received from every quarter. To a friend who might question him about his honours he would say, "You will find all about them in that drawer." He received them with humility, though he well knew he was worthy of them.

DR. W. FRANCIS.

DR. WILLIAM FRANCIS, whose death we recorded last week, was born in London in February, 1817. After his school-time, spent partly at University College School, but chiefly in France and Germany, at St. Omer, Cravelt, and Gera, he studied for a short time at University College, London (then known as the University of London), whence he proceeded to the University of Berlin and subsequently to Giessen, where Liebig was then at the height of his scientific activity. Here he took the degree of Doctor of Philosophy in 1842. His long residence abroad, supplemented by frequent subsequent journeys, many of them on foot, gave him an accurate knowledge of French and German, and enabled him to become personally acquainted with a very large number of the leading men of science on the Continent.

In 1842 he established the *Chemical Gazette*, which he continued to edit until December, 1859, when it was merged in the *Chemical News*. By this publication and by the translations and abstracts he contributed for many years to the *Philosophical Magazine*, he did valuable service in making known the work of foreign chemists to their English colleagues. Among other work of the same kind were translations of important foreign papers, including Ohm's "Die galvanische Kette mathematisch bearbeitet" and Helmholtz's celebrated paper, "Die Erhaltung der Kraft," for Taylor's "Scientific Memoirs." From 1851 until his death he was one of the editors of the *Philosophical Magazine* and of the *Annals and Magazine of Natural History* from 1859. His wide acquaintance with various branches of science, as well as with leading scientific men at home and abroad, made him well fitted for these functions, and the sound judgment with which he discharged them is generally recognised.

Dr. Francis was one of the original members, probably the last survivor of them, of the Chemical Society, having been elected an Associate in 1841 and a Fellow shortly afterwards. He was elected a Fellow of the Linnean Society in 1844. He was also a Fellow of the Royal Astronomical Society and an original member of the Physical Society. For the greater part of his life Dr. Francis was actively engaged in business as a partner, since 1852, in the well-known firm of Taylor and Francis, successors of Richard and John E. Taylor, printers and publishers.

He died at his residence, the Manor House, Richmond, on January 18.

NOTES.

A PROVISIONAL committee has been formed with the object of commemorating the scientific work of the late Prof. A. Cornu by means of a medal struck for that purpose. The committee includes more than fifty members of the Institute of France; and the secretary is M. E. A. Martel, 8 Rue Me'nars, Paris.

THE King, accompanied by the Queen, opened Parliament in state on Tuesday. In the King's speech reference was made to the insufficiency of the supply of the raw material upon which the cotton industry of this country depends, and the hope was expressed that the efforts which are being made to increase the area under cultivation in various parts of the Empire will be attended with success. Among the measures to be introduced is a Bill to amend the laws relating to education in Scotland.

A LAFFAN message from Rome states that the Academy of Sciences at Turin has divided the Ballauri prize of 1200*l*. between Signor Marconi and Prof. Grassi, of Rome, and has awarded the Brasso prize of 350*l*. to the Duke of the Abruzzi.

DR. D. H. SCOTT, F.R.S., has been elected president of the Royal Microscopical Society for the ensuing year.

THE *Daily Chronicle* announces the death of Mr. W. G. McMillan, secretary to the Institution of Electrical Engineers.

THE petition of the Linnean Society of London praying for the grant of a supplemental charter has been referred to a committee of the Lords of the Privy Council, and is down for consideration by their lordships on March 1.

A PETITION in support of the Bill for the adoption of the metric weights and measures, which will be introduced in the House of Lords by Lord Belhaven and seconded by Lord Kelvin, is being extensively signed throughout the kingdom.

PROF. HENRI CORDIER, of the School of Modern Oriental Languages at Paris, has been appointed president for 1904 of the Geographical Society of Paris.

THE thirty-first annual dinner of the old students of the Royal School of Mines will be held on Friday, February 26, at the Hotel Cecil. The chair will be taken by Mr. A. G. Salamon. Tickets may be obtained from Mr. David A. Louis, 77 Shirland Gardens, London, W.

AT the annual meeting of the Psychical Research Society held on January 29, it was announced that the fund intended to endow a research scholarship had reached 6195*l*., but a minimum of 8000*l*. is needed. Sir Oliver Lodge, the retiring president, introduced the new president, Prof. W. F. Barrett, who delivered his presidential address.

IT is proposed to hold a horticultural and gardening exhibition in the month of June next under the auspices of the Royal Botanic Society in the new exhibition grounds of the society, situated in the centre of the Botanic Gardens in Regent's Park. The proposed scheme embraces horticulture, forestry, botany, educational methods, nature-study, and a special section for colonial produce. In addition to the exhibition, lectures and conferences are in course of arrangement.

GRANTS in aid of research have recently been made from the Rumford fund of the American Academy of Arts and Sciences as follows:—to Prof. E. W. Morley, for his research on the nature and effects of ether drift, 100*l*.; to Prof. Carl Barus, for his research on the study by an

optical method of radio-actively produced condensation, 40*l.*; to Mr. J. A. Dunne, for his research on fluctuations in solar activity as evinced by changes in the difference between maximum and minimum temperature, 40*l.*

AT the ordinary quarterly meeting of the Royal College of Physicians held on January 30, Sir William Church announced that Dr. Horace Dobell, of Parkstone Heights, Dorset, had presented a sum of 500*l.* to the college for the promotion of original research into the ultimate origin, evolution, and life-history of bacilli and other pathogenetic micro-organisms. The conditions are that the president and censors of the college shall select a lecturer once in every two years, who shall give a record of original researches on the above subject, made by others and himself, and that he shall receive a fee of 50*l.* for so doing. These lectures are to be continued biennially, as long as a sufficient amount of the 500*l.* and its accumulated interest remains. The first lecture will be delivered during this year.

THE death is announced of Mr. William Vicary, of Exeter, who had an intimate acquaintance with the local geology and possessed a fine collection of fossils, chiefly from the Upper Greensand of Haldon and Blackdown. He first directed attention to the occurrence of fossils in the quartzites of the Triassic pebble-bed of Budleigh Salterton. The death is also announced of Mr. Alfred Gillett, of Street, near Glastonbury, in his ninetieth year. He gathered together a fine collection of fossils, which he presented in 1887 to the Crispin Institute at Street. One of the gems, however, an almost entire skeleton of *Ichthyosaurus tenuirostris*, obtained from the Lower Lias of Street, and personally developed by Mr. Gillett, was presented to the British Museum (Natural History).

NEWS of the sudden death of Miss Anna Winlock, a member of the staff of the Harvard College Observatory, has reached us from Boston. Miss Winlock's first official computing work at the observatory was done in 1875. Later she passed to more advanced work, as she was conversant with most branches of mathematics as applied to astronomy, had studied various methods of star reduction, and understood the use of the theory of probabilities. She did a large part of the computation for Prof. Rogers's zone work, of which a description is given in vol. xv. of the *Annals* of the observatory. In 1886 Miss Winlock was joint author with Prof. Rogers of a paper on "The Limitations in the Use of Taylor's Theorem." In connection with the photographic work of the observatory a convenient catalogue of close polar stars was needed, and this work was carried out by Miss Winlock for both the north and south poles. The result of this work was the most complete catalogue of close polar stars ever made, and the best means of comparison of different observations. The next important piece of work done by Miss Winlock was the catalogue published in the *Annals* of the observatory of the positions of five hundred stars near the North Pole, which had been observed photographically. After the discovery of the minor planet Eros, some work of the same nature was done by Miss Winlock, in determining its precise position from photographic plates. Her death deprives astronomy of one whose faithful and exact work has a permanent value.

MESSRS. BURROUGHS, WELLCOME AND CO. have issued a reprint of the historical souvenir on "Antient Cymric Medicine" prepared by Mr. Wellcome on the occasion of the meeting of the British Medical Association at Swansea, 1903. The pamphlet, which is profusely illustrated, contains much interesting information.

LAST autumn a commission of the American Marine Hospital Service reported that it had discovered a protozoan parasite, the so-called *Myxococcidium stegomyiae*, in the yellow fever mosquito, *Stegomyia fasciata*, that had bitten yellow fever patients. Dr. James Carrol now states (*Journ.* Amer. Med. Assoc., November 28, 1903) that this supposed protozoon is merely a yeast fungus accidentally infecting the mosquitoes, and has nothing to do with the transmission of yellow fever.

POPULAR confirmation of the value of scientific methods and advice is always welcome. In a letter to the secretary of the Liverpool School of Tropical Medicine, the Booth Steamship Company gives an extract from the log of its steamship *Javary*. Her captain reports that the mosquito nets supplied by the company have been a great boon to the men, and that whereas cases of malaria were formerly frequent, sometimes resulting fatally, since the introduction of the nets and their general adoption the crews have enjoyed a wonderful immunity from sickness.

THE January number of the *Journal of Anatomy and Physiology* (part ii., vol. xviii.) contains a number of papers of anthropological, anatomical, physiological, and embryological interest, and is illustrated with several plates. Mr. Wright describes a number of skulls obtained from the round barrows of east Yorkshire, Mr. Lewis discusses the functions of the spleen and other hæmolymph glands, and Prof. Elliot Smith publishes a note on an exceptional human brain presenting pithecoid abnormality. Prof. Arthur Robinson's first Hunterian lecture on the early stages in the development of mammalian ova is printed *in extenso*, and Dr. Beard gives another instalment of his article on the germ cells.

MESSRS. A. E. STALEY AND CO., of 35 Aldermanbury, E.C., have sent us a prism binocular which magnifies eight times, and costs five guineas complete in a solid leather case. It is strongly made, weighs barely 12 ounces, and has a fairly large field of view. It differs from many other glasses of this construction in that there is no means of altering simultaneously the focus of the two sets of lenses. It is intended that each eye-piece should, in the first place, be focused carefully on an object situated at a distance of about 300 yards, the divisions on each of the eye-pieces being carefully noted. For all objects distant 100 yards or further from the user the glasses are in focus without any other manipulation, and are therefore always ready and in adjustment. If the glass be employed for nearer objects this principle is not satisfactory, for then each eye-piece would have to be focused separately, which would entail time. The general use of such binoculars is thus somewhat restricted, but for those who would employ them for such purposes as stalking, yachting, shooting, &c., and who thus do not require shorter ranges than 100 yards or so, they should be of service. The elimination of the arrangement for focusing both eye-pieces together renders it possible to make the glasses lighter, stronger, and more secure from derangement. An examination of their interior shows the simplicity of construction, and the definition leaves little to be desired.

THE *Atti dei Lincei*, xii. (2), 12, contains a biographical notice of the late Prof. Luigi Cremona, by Prof. G. Veronese, together with a list of his principal writings, eighty in number.

IN a supplement to the *Communications* from the Leyden Physical Laboratory, Dr. J. E. Verschaffelt discusses, with a diagram, the form of the Van der Waals Psi surface in

the neighbourhood of the critical point for binary mixtures with only a small proportion of one component.

A NOTE on the b constant of Van der Waals's law is contributed by Mr. J. D. van der Waals, jun., to the *Physikalische Zeitschrift* for January 1. By different methods Van der Waals and Boltzmann have arrived at the formulæ $b = b_\infty - 17{b_\infty}^2/32V$ and $b = b_\infty - 3{b_\infty}^2/8V$, and the writer now claims to have proved that the latter is the correct value.

A PORTRAIT of the late Father Stephen Joseph Perry, F.R.S., director of Stonyhurst Observatory, is reproduced in *Terrestrial Magnetism and Atmospheric Electricity* for September, 1903 (recently received), accompanied by a short biographical sketch. Prof. H. F. Reid contributes to the same number a short account of the second International Seismological Conference which met in response to a call from the German Government at Strassburg from July 24 to 28 of last year to discuss the formation of an International Seismological Association.

INTERNATIONAL balloon ascents, both manned and unmanned, were made on November 5 and December 3, 1903, by many European countries (the British Islands excepted), and kite observations were also made at the Blue Hill Observatory, United States. The highest altitudes attained were :—Trappes (near Paris) 16,000 and 14,800 metres, and Itteville (near Paris) 11,200 and 10,800 metres. At Zürich the balloons reached 13,000 and 17,000 metres. Kite observations were also made at Torbino, at the private observatory of M. Demtschinsky. From its northern position, latitude 58° 38′, not far from Pavlovsk, these observations are of special interest. The meteorological results will be published later on.

WE have received the report of the chief of the U.S. Weather Bureau for 1903; it contains a most interesting summary of the great work carried on by that department, furnishes ample proofs of the usefulness of its operations, and gives great hopes of ultimate improvement of our present knowledge of meteorological conditions. The operations of the U.S. Weather Bureau are naturally of much greater proportions than can be possible in our own country. It issues each morning (Sundays and holidays excepted) about 25,000 maps exhibiting graphically, with text and tables, the weather conditions at 8h. a.m.; about 50 per cent. of these maps are produced at the larger outlying stations of the bureau. The expenditure on various branches of the service amounts to one and a quarter million dollars, and the independent comments of the Press give evidence that the high average of success of the warnings of storms and of cold waves affecting agriculture and crops "brings an adequate return to the commerce and industries of the country." Prof. Willis Moore states that the Weather Bureau has for some years been carrying on an investigation into the fundamental problems as to the true causes of weather conditions, and that the construction of high-level charts based chiefly on cloud observations points unmistakably, in Prof. Bigelow's opinion, to a theory which will supersede those heretofore published in meteorological literature. With reference to the problem of seasonal forecasts, Prof. Moore states that meteorology is really a very closely allied but difficult branch of solar physics, and ought to be studied with the aid of a fully equipped observatory devoted especially to such researches. In this sense suitable reference is made *inter alia* to the Solar Physics Observatory at South Kensington, which is putting forth valuable results under the directorship of Sir Norman Lockyer.

THE third number of *Spolia Zeylanica* contains an exceedingly interesting account, by Mr. Everard im Thurn, the Lieutenant-Governor of the island, of last year's pearl-fishery in Ceylon. This fishery took place after an interval of eleven years, and the gathering of both Europeans and natives was consequently very large. The results are not yet made known. Mr. im Thurn himself donned a diver's dress and descended to the oyster-beds—a depth of about nine fathoms. To a novice such an experience entails many unpleasant sensations, but the author deemed himself well rewarded by the sight which met his eyes on the sea-bed, when all pains were forgotten in the interest of his surroundings. It is pointed out that a good many pearls lying near the mouths of the oysters are abstracted by the divers during the return from the fishing grounds to shore. The fishing was continued for a period of about two months, at the end of which the native divers were utterly exhausted. Before the next fishery, the Government hopes to find some more scientific method of reaping this harvest of the sea than the one which has been in vogue for untold centuries.

AN interesting addition has recently been made to the Natural History Museum, South Kensington, by the receipt of specimens of some of the blind cave-fishes of Cuba, which were described by Prof. Poey in his "Memorias sobre la Historia Natural de la Isla de Cuba" so long ago as 1856, but which, up to this time, have remained unrepresented in European museums. The special interest of these fishes (*Lucifuga subterraneus* and *Stygicola dentatus*) lies in the fact that their alliance is with salt-water forms (such as Brotula) which exist in the neighbouring sea, and not with fresh-water fishes, as is the case with Amblyopsis and its allies of the Great Cave of Kentucky. There can be little doubt that the Cuban caves in which the blind fishes are found were formerly in communication with the sea, and that the ancestors of these fishes entered the caves from the adjacent ocean. It is, however, a matter of speculation how long a period of life in darkness it has taken to reduce the eyes of these fishes to their present rudimentary state and to effect the other changes which now distinguish them from their nearest marine relatives.

A SHORT biography of the late Major J. W. Powell, of Washington, has recently been compiled by Mr. G. K. Gilbert from a series of articles by various writers in the *Open Court*. From his early youth he lived a strenuous life, both physical and mental, his varied reading being rectified by much field work. He lost his right arm in the Civil War, in which he served as an engineer. Then he was offered the chair of geology in the Illinois Wesleyan University, and there organised field expeditions as part of the official curriculum in the geological and natural history studies. He resigned his professorship to undertake the exploration of the canyons of the Colorado River, and was the first to descend that dangerous river. Major Powell was appointed director of the U.S. Bureau of Ethnology in 1879, and also director of the U.S. Geological Survey in 1881; the latter office he resigned in 1894, but he kept the former until his death in September, 1902. Not only was Major Powell a hard worker, but he was a stimulating chief and was very fertile in ideas, which he freely gave to others. The loving reverence that was paid to the "Major" by his colleagues comes out strongly in the report (*Science*, November 14, 1902, p. 783) of the meeting that was held before his funeral.

WE have received from the author, Mr. H. H. Bloomer, a paper from the *Journal of Malacology* (vol. x. part iv.) on the anatomy of the molluscs *Pharella orientalis* and *Tagelus rufus*.

THE fourth part of vol. lxxv. of the *Zeitschrift für wissenschaftliche Zoologie* is taken up by two papers on parasitic organisms. In the first, Dr. R. Ritter von Stummer-Traunfels commences a general account of the anatomy and histology of the Myzostomaria, those remarkable annelids parasitic on crinoids and starfishes, with a description of *Myzostoma asteriae*. In the second Mr. F. Schmidt describes *Branchiobdella parasita*, an oligochæte worm infesting the gills of the crayfish.

THE first appendix to the Kew *Bulletin* for the present year has been received. It contains a list of seeds of hardy herbaceous plants and of hardy trees and shrubs which ripened at Kew during the preceding year. The unfavourable conditions which prevailed have considerably reduced the number of species in the list.

THE *Journal of Botany* (January) opens with the first part of an account of R. Brown's list of Madeira plants, which is contributed by Mr. J. Britten. The Rev. W. M. Rogers presents a general list of plants gathered in the three botanical counties which form the subprovince of the north-east Highlands, and gives separately the collections made near Tomatin and Dalwhinnie, two stations situated above the thousand feet level.

SIGNOR F. ARDISSONE has made a study of the flora of Monte Baro, a peak near Lake Como, and publishes a list of the plants collected there in the *Memoirs* of the Lombardy Institute of Science and Arts. Despite the somewhat low altitude and the circumscribed area of the mountain, the number of species is considerable, and the flora contains several types which are sparsely distributed in Lombardy, this being especially noticeable in the case of the orchids.

AN account of the native timber trees is contributed by Mr. A. O. Green to the *Proceedings* of the Royal Society of Tasmania. The author not only describes their specific qualities and uses, but is able to give the results of tests which he has made in order to determine the strength of the more important of these. Owing to the scarcity of soft wood trees in Australasia, it is interesting to note that two valuable pines, the huon pine, *Dacrydium Franklinii*, and the celery-top pine, *Phyllocladus rhomboidalis*, are both said to be common, the former being, however, only locally abundant.

A SMALL brochure upon the application of electricity to the cultivation of plants has been received. The writer, M. Guarini, has summarised the principal experiments which have been recorded under two heads, distinguishing between those in which electricity has been adopted as the source of continuous artificial light and those in which the plant is stimulated by electric currents. The latter method is the more important, and, according to the experiments of M. Lemstroem and others, the results are distinctly beneficial, mainly in the increased amount of growth.

THE *Mitteilungen aus den deutschen Schutzgebieten* contains a new map of the central part of Kamerun, between Sanaga and the eighth parallel of north latitude, by Herr M. Moisel. The scale is 1 : 1,000,000, and the map includes much new and unpublished material.

THE first number of the new volume of the *Abhandlungen* of the Vienna Geographical Society is devoted to the introductory part of a valuable monograph on the Federated Malay States, by Mr. W. R. Rowland. The section issued deals with the physical geography of the region and its flora and fauna. Publication has unfortunately been delayed for two years, but the paper has been brought up to date by competent hands in Vienna. The second part, which will apparently deal with the development of the States under British protection, is to be accompanied by a map.

THE *National Geographic Magazine* for January contains, besides a number of short articles of interest, a report of an address delivered before the National Geographic Society by Mr. F. H. Newell, chief engineer of the Reclamation Service, United States Geological Survey. The Reclamation Service is responsible for the carrying out of a law passed by Congress in 1902, which provides that the proceeds of the disposal of certain public lands shall be set aside for the construction of irrigation works in the arid regions of the west. Mr. Newell gives some account of the progress of work up to the present time. The paper is illustrated by a number of useful physical maps.

A THIRD edition, which has been greatly enlarged and almost entirely rewritten, of Dr. A. Rabagliati's "Air, Food and Exercises. An Essay on the Predisposing Cause of Disease," has been published by Messrs. Baillière, Tindall and Cox.

MESSRS. CHARLES GRIFFIN AND CO., LTD., have published a third English edition of "The Cyanide Process of Gold Extraction," by Prof. James Park, the first edition of which was reviewed in NATURE for June 14, 1900. The text-book has been revised and enlarged, much new material—dealing for the most part with lead-smelting of gold-slimes, the sulpho-telluride ores, and filter-press practice—having been added.

WOMEN workers in all branches of activity will find something useful to them in the "Englishwomen's Year Book and Directory, 1904." Miss Emily Janes, who edits the volume, is to be congratulated upon the completeness of the new issue of this annual publication. The volume contains sections dealing separately with science and education. The former includes brief notices of the research work in science upon which women are at present engaged; a list of the principal scholarships and exhibitions for science attainable by women; and lists of the societies of which women may become members, and of women who are engaged as examiners or lecturers in science. The section of the "Year Book" dealing with education contains an excellent account of the present facilities for the higher education of women in our home universities.

A NEW magazine for technical students, entitled *Technics*, has been started by Messrs. Newnes, Ltd. The new periodical is designed to become the organ of the great body of students of technological science throughout the country. If the magazine, as its founders intend it to do, succeeds in increasing the number of people interested in technical and scientific work, and in becoming a medium for the interchange of ideas between those engaged in technical instruction, it will have fully justified its existence. The contents page of the first number is an exceedingly varied one, ranging as it does from the art of dyeing to the training of chauffeurs. Among the articles may be mentioned a description of the Technical High School at Charlottenburg, by Prof. Dalby; on radium, by Mr. E. Edser; on rapid-cutting steel, by Prof. J. T. Nicolson; and contributions on different aspects of the technical education problem by Sir William Abney, Sir William White and others.

A SECOND edition of vol. ii. of Dr. F. Dannemann's "Grundriss einer Geschichte der Naturwissenschaften" has been published by Mr. W. Engelmann, Leipzig (London: Williams and Norgate). The volume deals with the de-

velopment of scientific knowledge from the time of Thales to the present epoch; and though it is impossible to compress the history of science into 450 pages, the author's survey of progress is excellently conceived and carried out. Original texts and illustrations are given prominence, so that the student who reads the work cannot fail to derive inspiration from it. For students interested in special branches of exact science Ostwald's "Klassiker der exakten Wissenschaften" are available, and for those who require a general view of scientific progress, constructed in the same spirit, Dr. Dannemann's volume is excellently adapted.

We have received vol. xxii. of the *Geographical Journal*, which contains the monthly parts from July to December, 1903. As usual, the volume is remarkable for the large number of its excellent illustrations and for the plentiful supply and high character of the coloured maps. Among many other valuable contributions the following may be mentioned:—the account of the first year's work of the National Antarctic Expedition, by Sir Clements Markham, K.C.B., F.R.S.; the bathymetrical survey of the fresh-water lochs of Scotland, under the direction of Sir John Murray, K.C.B., F.R.S., and Mr. L. Pullar; a scheme of geography, by Prof. W. M. Davis; terrestrial magnetism in its relation to geography, by Captain E. W. Creak, F.R.S.; four years' Arctic exploration, 1898–1902, by Commander R. E. Peary; and the Alaska boundary, by Colonel Sir T. H. Holdich, K.C.M.G., K.C.I.E.

The additions to the Zoological Society's Gardens during the past week include a Vervet Monkey (*Cercopithecus lalandii*) from South Africa, presented by Mr. J. Fisher; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mr. H. R. Broad; a Japanese Deer (*Cervus sika*) from Japan, presented by Mr. Leopold de Rothschild; a Common Squirrel (*Sciurus vulgaris*), British, presented by Captain Locock; an Allied Hornbill (*Penelopides affinis*) from the Philippine Islands, presented by Mrs. Johnstone; a Rough-legged Buzzard (*Archibuteo lagopus*), European, presented by Mr. E. A. Maling; two Blue and Yellow Macaws (*Ara ararauna*) from South America, presented by Mr. Charles Storey; two Kestrels (*Tinnunculus alaudarius*), British, presented by Mr. A. H. Bishop; a Hainan Gibbon (*Hylobates hainanus*) from the Island of Hainan, a Variegated Spider Monkey (*Ateles variegatus*) from the Upper Amazons, a Crowned Hawk Eagle (*Spizaetus coronatus*) from Africa, a Blue-rumped Parrakeet (*Psephotus haematonotus*) from Australia, deposited; a Campbell's Monkey (*Cercopithecus campbelli*) from West Africa, purchased.

OUR ASTRONOMICAL COLUMN.

Peculiar Forms of Comets' Tails.—At a meeting of the National Academy (U.S.A.) held at Chicago on November 18, 1903, Prof. E. E. Barnard read a paper dealing with the anomalous appearances sometimes observed on photographs of the tails of comets. Accepting the generally adopted theory that the tails are caused by the repelling action of the sun's light on the cometary particles, he demonstrated that the broken appearance often observed in the tails may be due to the external influence of some resisting medium, possibly groups of meteorites which are in all probability scattered throughout space. Thus the sudden contortions of the tail of Brooks's comet on and after October 22, 1893, might be explained by the supposition that it encountered a swarm of meteorites which caused the extraordinary detachment of the cloud-like masses seen on the photographs obtained between October 22 and November 3. A similar phenomenon might have been produced had the detached portion of the tail of Borrelly's comet (1903), after its separation from the nucleus, encountered any similar resisting medium. Prof. Barnard directs attention to the fact that in the latter case the detached portion gave no evidence of accelerated motion of repulsion such as would be expected if the repulsion were solely due to the action of the sun's light.

Several beautiful photographic reproductions of the various comets discussed by Prof. Barnard accompany his paper in the January number of *Popular Astronomy*.

Actinic Quality of Sky-light.—Mr. Gavin J. Burns has recently published the results of some experiments made by him in order to determine the relative actinic qualities—not intensities—of the light received from the star-lit sky near the zenith on a clear night, of moonlight, of sunlight, and of the light received from the zenith during the daytime.

With ordinary, bright light-sources the usual method of procedure in determining the ratio of actinic to non-actinic rays (*i.e.* the actinic quality) in the total radiation is to analyse the latter, in detail, spectroscopically, but in the experiments performed by Mr. Burns the total radiations were far too faint for the application of this method. He therefore divided the spectrum generally into two parts, actinic and non-actinic, and in order to obtain comparative results used layers of two liquids as screens, the first a solution of bichromate of potash, which totally absorbed the blue, violet, and ultra-violet rays, the second a solution of methyl-violet, which absorbed the orange, yellow and green. In each experiment a layer of known absorptive effect was placed between the photographic plate (Edwards's isochromatic) and the light source. The plate was then exposed to the light for a known period and developed, and then the various results were reduced to standard conditions and compared. From the results thus obtained Mr. Burns concludes that the actinic quality of the light which reaches us from the zenith sky by night, when the sun is at least 18° below the horizon, is greater than that of moonlight from the moon on the meridian, or sunlight when the sun has an altitude not greater than 36°. It is also greater than the average value for the light of the blue, cloudless sky by day. On the other hand, the observations give no information as to the real relative actinic qualities of sunlight and sky-light, for observations of both sources at equal altitudes must be made to determine this ratio (British Astronomical Association *Journal*, vol. xiv., No. 2).

The United States Naval Observatory.—The report of the United States Naval Observatory for the year ending June 30, 1903, contains a general review, by the director, Captain C. M. Chester, U.S. Navy, of the personnel, the work and the results obtained during that period.

Among a number of recommendations as to the future work, the director suggests that subsidiary observatories should be founded on several of the islands governed by the United States in the Pacific. Tutuila, Samoa, situated in lat. 15° S., is especially mentioned in this respect as being generally recognised as an ideal site for an astronomical observatory, and it is suggested that 500 of the 1597 stars adopted at the International Conference of Naval Observatory Directors in 1896 should be observed there by an assistant from Washington, who, with the assistance of the naval officers and men already stationed there, could also make observations of the magnetic elements obtaining on the island.

The director also recommends that one of the ships attached to the European Squadron of the U.S.A. Navy should be deputed to assist a small party of astronomers from Washington in observing the total eclipse of the sun in Spain in 1905. In support of this recommendation he quotes from the report of Sir Norman Lockyer, on the Indian eclipse of 1898, as to the valuable assistance rendered by the officers and men of H.M.S. *Melpomene*, at the suggestion and under the direction of that observer, in making observations of various eclipse phenomena.

Each of the sectional reports has been written by the officer in charge of the particular section reported on, but the results obtained are far too numerous to be given in detail here.

The time service, which operates 18 official time balls and

daily corrects some 40,000 private and public clocks, was efficiently maintained throughout the year with an average error of only 0·15 second.

RADIANT POINT OF THE 1903 LEONID SHOWER.—During a watch extending from 13h. to 17h. on November 14, 1903, two observers at the Ladd Observatory, Providence, Rhode Island, counted 44 meteors, of which 20 were Leonids. Eighteen of the latter were plotted on a chart, and gave a radiant point situated at R.A.=10h. 1m. (150°·25), dec.=+21° 48′. Under similar conditions in 1901 (November 14, 12h. 35m.–17h. 30m.) 91 Leonids were charted. This difference, not being due to unfavourable meteorological conditions, indicates a diminution in the intensity of the shower for the epoch observed (*Popular Astronomy*, January).

COMPARISON-STAR PHOTOGRAPHS FOR MINOR PLANETS, &c.—In No. 1, vol. ii., of the *Publications* of the Astrophysical Observatory, Konigstuhl-Heidelberg, Prof. Max Wolf publishes a catalogue of the photographs taken by Mr. Dugan during the period 1891–1896.

The catalogue contains plates of the regions which were photographed for the purpose of obtaining comparison stars for minor planets, comets and variable stars, and for each plate it gives the date, the objective used, the region photographed, the designation of the guiding star, and the length of the exposure given.

NAUTICAL EDUCATION IN JAPAN.

A COPY of the prospectus of the Nautical College at Tokio has been received from the director of the college, together with some particulars as to the position of the mercantile marine in Japan. So much attention is being directed to that country at the present time that the following facts are of interest in showing the provision made for the scientific training of officers and men. Before entering into the details of nautical education in Japan, a glance at a statement of the increase of tonnage and number of seamen up to the end of 1902 is instructive.

In the year 1897 the total tonnage of the vessels in Japan did not exceed 400,000 tons, including both steamers and sailing ships; but with the expansion of national industry the number and tonnage of the vessels rapidly increased, and by the end of 1902 the tonnage amounted to 934,961 tons, out of which 605,122 tons relate to steamers and 329,839 tons to sailing ships.

At present, of the skilled officers—mates and engineers—of certified ability handling these ships, 1901 are Japanese and 331 are foreigners. As such is the case, the necessity of training good seamen is urgently felt, and the Japanese Government is paying much attention to nautical education.

In Japan the only organised establishment for training higher seamen is the Nautical College at Tokio. It is attached to the Department of Communications, and the institution was first founded in 1875 by the Mitsubishi Company, but it was transferred to the Japanese Mail Ship Company. In 1885 the school was transferred to and re-organised by the Government, and has grown since up to the condition of the present Nautical College.

The college educates youths destined to become officers of the mercantile marine, that is, it instructs them in theory and practice of matters pertaining to the higher seaman's profession. The course of study is divided into two departments, namely, the department of navigation and that of engineering.

The cadets of both departments are enlisted in the navy during their college life and even after their graduation, and as they are to be appointed as naval officers they have to observe the general laws of the navy.

The classes and curriculum of the navigation department are as follows:—

6th Class.	Seamanship (theoretical). Seamanship (practical) Physics. Mathematics. Modern Japanese and Chinese languages.	Law. Chemistry. Commercial geography. Foreign language. Military drill.
5th Class.	Navigation. Law. Commercial geography. Chemistry. Foreign language. Military drill.	Seamanship (theoretical). Seamanship (practical). Physics. Mathematics. Modern Japanese and Chinese languages.
4th Class.	Navigation. Law. Nautical surveying. Seamanship (theoretical). Seamanship (practical). Marine meteorology. Shipbuilding.	General principles of steam engine. Physics. Foreign language. Mathematics. Nautical hygiene. Military drill.
3rd Class.	Navigation. Nautical surveying. Practical instructions in seamanship. Physics. Mathematics. Economics. Marine meteorology.	Seamanship (theoretical). Shipbuilding. General principles of steam engine. Law. Practical surgery. Military drill.
2nd Class.	Navigation. Marine meteorology. / Shipbuilding. Economics. / Foreign language. General principles of steam engine.	Law. Seamanship (theoretical). Seamanship (practical). Military drill.
1st Class.	Gunnery.	Apprenticeship in far-sea-going vessels.

In this department, navigation, theoretical and practical seamanship, nautical surveying, marine meteorology, law and shipbuilding are regarded as principal studies and the others as auxiliaries.

On entering, the cadets are placed in the sixth class, and are promoted to a higher class every half year; they are instructed in the college class rooms until they advance to the first class, when they are taken to the gunnery school at Yokosuka to be instructed in gunnery for about six months. Then they are to serve their terms of apprenticeship on board several vessels for two and a half years, thus taking five and a half years to complete their education.

In the department of engineering, the classes and curriculum are as follows:—

5th Class.	Steam engine. Drawing. Mechanics. Chemistry. Foreign language. Military drill.	Steam boiler. Shop practice. Physics. Mathematics. Modern Japanese and Chinese languages.
4th Class.	Steam engine. Drawing. Mechanics. Chemistry. Foreign language. Military drill.	Steam boiler. Shop practice. Physics. Mathematics. Modern Japanese and Chinese languages.
3rd Class.	Electricity. Shop practice. Mathematics. Military drill. Steam engine.	Drawing. Mechanics. Foreign language. Steam boiler.
1st Class.	Apprenticeship in engineering practice and in the management of steam engine.	

In the engineering department, steam engine, steam boiler, electricity, drawing and shop practice are regarded as principal studies and the others as auxiliaries.

On entering the department each and every cadet is first placed in the fifth class, and he can rise to a higher class at the end of every six months. He is instructed in the class rooms, as is the case with the cadet of the navigation department. When he advances to the first class he is placed in some factory or yard to receive practical training for two years, and is then taken on board several vessels to serve his term of apprenticeship in engineering for a year, thus taking five years to finish his course.

It is a great incentive for the students that the college sends abroad those graduates who are of promising ability and of good character for the completion of their education.

Any boy above fifteen and below twenty-one years of age is admitted to the college after passing the entrance examinations. The graduates of the Government public or private middle schools, which are acknowledged by the Minister of Education to be on equal footing with the public middle schools, are admitted to the college without entrance examination on their scholarship, provided they receive satisfactory reports as to ability and character from the respective schools where they have graduated.

The cadets are of two kinds, those who are supported by loans from the Government or from some mercantile corporations, and those paying their own expenses. Such students of good character and ability as are deemed by the college authorities to be worthy examples to follow are treated as honorary students, and they are freed from their expenses.

The teaching and administrative staffs of the college comprise sixty-six members, and the total number of cadets undergoing instruction at the college, in workshops, and on board ships is 515.

To practise the cadets in making knots, seigings, splices, hitches, bends, bending and unbending, making and taking in sails, sending up and down yards and spars, a training ship named the *Meiji Maru* is moored in the basin belonging to the college, where the cadets are drilled after their morning class lessons are over. They are also drilled in boating, sailing and steering. The *Meiji Maru* was built at Glasgow, being of 1037·20 tons gross and 457·46 net tons; length 242 feet, breadth 29·25 feet, depth 21·50 feet. The college owns another sailing vessel named the *Kotonoo Maru*, used as a training ship. This was built in London, being 825·32 tons gross and 775·62 net tons; length 161·85 feet, breadth 17·65 feet. The ship is employed in coasting the neighbouring seas.

A large sailing vessel named the *Taisei Maru*, of more than 2000 tons, is now in course of building at the Kawasaki Dock in Kōbe, and when finished it will be used as a training ship in navigating not only to the different ports in Japan, but also to those of Europe, America, Australia, &c.

Besides the Government Nautical College, the Nippon Kaiin Ekisaikwai (Japan Sailors' Home) is to some extent contributing toward the training of higher seamen. The association has branch offices at Tokio, Kōbe, and Nagasaki, where a number of ordinary seamen of some experience are instructed in order to prepare themselves for the examinations to obtain the higher seamen's licenses.

Other public institutions for training higher seamen are the nautical schools at Hakodate, Hokkaido; Oshima, Yamaguchiken; Ochigori, Ehimeken; Mitoyogōri, Kagawaken; Toba, Miyeken; Sagagori, Saga; Toyoda, Hiroshimaken. In these institutions navigation and engineering courses are offered. The institutions are open to boys who have finished their four years' course at high elementary schools, and to those who are regarded upon examination as of equal ability. The course is about six and a half years, the lessons being as follows:—

Navigation Department.	Moral code.	Reading.
	Composition.	Mathematics.
	Physics.	Chemistry.
	Geography.	Foreign language.
	Drawing.	Gymnastics.
	Elements of surgery.	
	General principles of seamanship, navigation, marine meteorology and shipbuilding.	
	Principles of mercantile marine business.	
Engineering Department.	Mechanics.	Applied Mechanics.
	General principles of electricity.	
	General principles of shipbuilding.	
	Principles of mercantile marine business.	

The graduates of the institution mentioned are required to take the examination for higher seamen, and when they successfully pass it they are made deck-officers or engineers, but the graduates of the Nautical College are granted seamen's certificates without examination.

THE SANDING-UP OF TIDAL HARBOURS.

AT the meeting of the Institution of Civil Engineers on January 26 Mr. A. E. Carey read a paper on "The Sanding-up of Tidal Harbours."

The object of the paper was to indicate the effects of sanding-up in harbours situated (1) where no river debouches, and (2) at the mouths of rivers or estuaries. Of the three channels to the Port of Ostend one is now abandoned, and the other two are kept clear by the annual dredging of 950,000 cubic metres. Similarly the Port of Boulogne requires the annual dredging of 535,000 cubic metres. Mr. Carey considers that dredging is the only satisfactory expedient for conserving working depths at the mouths of sand-threatened harbours. Littlehampton is an instance of a permanent harbour at a river-mouth, but the entrance is almost dry at low water. The obliteration of Ceará Harbour, Brazil, a work which occupied ten years and cost more than 400,000*l*., provides an instance of the extinction of a harbour by sand. From a study of the various stages in the construction of the harbour of Madras, it appears that the changes in the contour of the coast which resulted from the first two years' working included a progressive shoaling of the entire area of the harbour up to the original 7½-fathom line. In the opinion of the mixed commission appointed by the Indian Government in 1883, unless the opening of the harbour as designed were closed, and a new opening to the north-east substituted, the harbour would prove valueless as a shelter for shipping.

Referring to the harbours of Denmark, Mr. Carey said that on the west coast the only harbour is that of Esbjerg, and, with this exception, fishing-boats have no shelter except the mouth of the Limfjord. At Hirtshals a Government harbour was projected at a cost of 550,000*l*., and the works were started in 1879. The work is now sanded-up and abandoned, except that the pier has since been prolonged. The utilisation of the Ringkjöbingfjord was advocated, and plans were submitted of an isolated harbour connected by viaducts with the shore at Sandnæshage, a favourable spot owing to the depth of water there, and the protection of an outlying reef. The Danish Government has now determined on the construction of a small harbour at Skagen, and of two isolated moles, respectively at Hanstholm and Vorupör. In view of the precarious nature of tidal harbour work, a departure from established practice is called for. Harbours of refuge have a limited range of utility, unless in land-locked positions. In a number of instances it would be practicable by means of piled structures to create shipping facilities which would meet reasonable requirements, and come within the resources of local authorities, also avoiding the permanent expense of dredging. Such structures would, however, have to be carefully designed, especially in relation to their height, cranage, and the moorings for vessels frequenting them.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The following appointments of examiners for 1904 and 1905 have been approved:—In the final honour school of chemistry, Mr. Herbert B. Baker; in the preliminary examination in physics, Mr. Robert E. Baynes; in chemistry, Mr. George B. Croushaw; in botany, Mr. A. C. Seward, F.R.S.

It has been resolved in convocation to confer the degree of D.C.L., *honoris causa*, upon Mr. Henry Wilde, F.R.S., and of M.A., *honoris causa*, upon Mr. J. J. Manley, curator of the Daubeny Laboratory, Magdalen College.

A sum of 1200*l*. has been offered to the university by Mr. Philip Francis Walker for the purpose of founding a studentship for original research in pathology. The studentship will not be confined to members of the University of Oxford. Elections to it are to be made by a board consisting of the Vice-Chancellor, the regius professor of medicine, the Waynflete professor of physiology, the president of the Royal College of Physicians, and Mr. Philip F. Walker. It is not to be awarded by the result of a competitive examination. The studentship is to be tenable for three years, and of the annual value of 200*l*.

In order to avoid the overlapping of practical work in

chemistry done in the various college laboratories and in the museum, a scheme is being tried this term in which each laboratory specialises in a particular subject, and men migrate to the courses they wish to attend instead of remaining in the laboratory to which they are normally attached. Preliminary work is taken at the museum by Mr. Fisher, Mr. Walden, and Mr. Lambert; quantitative analysis by Dr. Watts at the museum and Mr. Manley at Magdalen; organic chemistry by Mr. Marsh and Mr. Sidgwick at the museum; physical chemistry by Mr. Nagel and Mr. Hartley at Balliol; inorganic chemistry by Mr. Baker at Christchurch.

On February 9 resolutions will be submitted to congregation for the purpose of making Greek an optional subject in Responsions for candidates intending to read for the honour school of mathematics or natural science. It is proposed that candidates should offer as a substitute for Greek (*a*) a mathematical subject or a scientific subject, both of which are to be determined by the board of natural science; and (*b*) a modern language, viz. either French or German.

CAMBRIDGE.—His Majesty the King has graciously announced his intention of visiting the university on Tuesday, March 1, on the occasion of the opening of the new buildings for the law school and Squire Law Library, the medical school, the Sedgwick Memorial Museum, and the botanical laboratory.

Dr. H. K. Anderson has been appointed university lecturer in physiology in the place of Prof. Langley.

The regulations for an examination and diploma in tropical medicine and hygiene were approved by the senate on January 28.

AT Bedford College for Women on Thursday, March 17, Dr. J. Lawrence will give a lecture on "Pioneers in Philology."

THE Finance Committee of the Liverpool Corporation has decided to recommend the council to make the municipal grant of 10,000*l.* to the university only on certain conditions, which include inspection and report on the educational methods of the university, an annual report by the university to the council, and the devotion of at least 1000*l.* of the grant to Liverpool scholarships, including the assistance of undergraduates and post-graduates.

THE first conference in connection with the School Nature Study Union was held on January 30 at the Passmore Edwards Settlement, Tavistock Place, London, under the presidency of Dr. Heath, director of special inquiries and reports at the Board of Education. Papers were read by Mr. C. B. Gutteridge, of Alleyn's School, Dulwich, on nature-study in secondary schools and how its claims may be advanced, and by Miss Johnson, on nature-study in a village elementary school.

A LARGE part of the National Library at Turin was destroyed by fire on January 26. The library was housed in the buildings of the University of Turin, and was under the control of the university authorities. It contained 350,000 printed books, of which 100,000 have been lost, amounting in value to half a million francs. The globe constructed by the monk Basso in 1570 has been destroyed. The very choice collections of fifteenth century manuscripts from the Abbey of Bobbio were rescued, and altogether about 1000 manuscripts out of 4000 have been saved in a more or less damaged condition. The university has been closed, as some of the halls give signs of collapsing.

WE learn from *Science* that Syracuse University has received 30,000*l.* from the estate of the late James J. Belden; 10,000*l.* goes to the Medical College and 20,000*l.* to the College of Liberal Arts. Syracuse University also receives the residue of the estate of the late John Lyman. The value of the estate is not stated, but special bequests to charitable institutions were made by Mr. Lyman amounting to more than 30,000*l.* The Catholic University of America has received 10,000*l.* from the Knights of Columbus, and Princeton University has received a bequest of 5000*l.* from the late Louis C. Vanuxem, of Philadelphia. The Clark University has received from Mr. Carnegie 20,000*l.* for a library.

IN connection with the generous gift recently made to the University of London by Mr. Martin White for the encouragement of the study of sociology, a course of eight lectures on "Cities and their Culture-Resources" will be delivered this term by Prof. Patrick Geddes, commencing to-day, February 4. Dr. E. A. Westermarck, lecturer on sociology at the University of Helsingfors, will commence a course of seven lectures on "Early Custom and Morals" on Tuesday, February 9. Both courses will be delivered at the London School of Economics and Political Science. At Prof. Geddes's lecture to-day Sir Arthur Rücker will preside, and will make a general statement with regard to the scope of the Martin White benefaction for the study of sociology.

THERE is a steady and growing demand in the State of Illinois for high school teachers who have had a liberal college training together with a thorough preparation in the special branches which they are to teach. The demand upon the University of Illinois for high school teachers of science has for several years so far outrun the actual supply that places might commonly be found for two or three times the number of competent graduates available. The university has published a circular of information concerning the courses and facilities offered by it to science teachers, so that students and instructors may be generally advised of the facts, and a larger number of capable students may be led to prepare themselves for high school science work. The circular points out that the preparation of a teacher for high school science teaching must consist in part of study of the sciences he intends to teach, in part of the more general study necessary to his liberal education, and in part of the pedagogical studies and experience essential to his immediate success as a teacher.

ON Friday last, Prof. Howard Marsh gave an inaugural address as professor of surgery in the University of Cambridge. In the course of his remarks he said that the changes which had taken place in surgery in recent years were as great as those which had revolutionised so many other departments of human energy. The new starting point consisted in the discovery by Pasteur that many diseases in the vegetable and animal kingdoms were due to the action of minute organisms or bacteria. The next step was the application of Pasteur's discovery to surgery by Lister, who commenced the investigations into the use of substances by which these harmful bacteria might be excluded or destroyed. The thirty years that had since elapsed had been years of revelation and advance in every direction. While the fundamental principle was the same, methods of procedure had undergone rapid development. It had been gradually disclosed to us that there was no organ anywhere in the body which was not amenable to operation, no part which was so constituted or endowed that it could not, under the aseptic method, be treated by surgical interference.

THE annual general meeting of the Association of Technical Institutions was held on January 29. Sir John Gorst was elected president for the ensuing year; and in the course of his presidential address he remarked that the great object of most schools seems to be to make the children still and quiet and orderly instead of having them thirsting for knowledge and eager in its pursuit. The questioning which is natural to children is abolished in favour of a system of answering questions put to them, and in these questions anything like originality or eagerness is at once repressed in the interests of discipline. After a certain time the individuality of a restless, eager, curious child is entirely crushed out, and a stolid, quiet, orderly, stupid class is obtained. The object of all teaching ought to be the development of the general powers of the body and mind of the scholar and not its specific and definite preparation for some particular profession. That comes when it is time to specialise. The spirit of technical instruction—the teaching of the student to do something and to acquire knowledge for the purpose of being able to do something—ought to pervade the whole of our education from childhood to manhood. At the annual dinner of the institution, the chairman, Sir J. Wolfe Barry, referred with satisfaction to the fact that the Royal Society had recently addressed a communication to the universities directing

their attention to the urgent necessity for some reconsideration of the requirements of the universities from secondary schools. The Royal Society recognised, as of course it must recognise, the great importance of the humanities, but it felt that there was something wanting in the career which was insisted upon, especially at the older universities. This induced headmasters of secondary schools to select their most promising pupils entirely with a view to scholarships in classical literature, and to insist upon all the boys in a school spending a great deal of their time in studies for which, no doubt, many of them were fitted, but not all. The Royal Society had done a real service to the country by directing attention to this subject.

THE annual meeting of the court of governors of the University of Birmingham was held on January 28, when the Chancellor, Mr. Chamberlain, presided. During the course of a speech on the motion for the adoption of the annual report, Mr. Chamberlain referred to the question of Government aid for university education. He said, "I should be very sorry to see, in any application which may now or hereafter be made—either to public bodies or to the Government—any idea that that was to dispense individuals from their personal duty in the matter. I think undoubtedly that the Government might make a more liberal response to what individuals have in so many cases done, and nowhere more conspicuously than in Birmingham. When we are dealing with such modern universities as Manchester, Liverpool, and Birmingham, I think it is creditable to the inhabitants of the districts in which they are placed that they should have met so readily the calls upon them, and I think they are almost entitled to demand from the Government a corresponding contribution. But I should myself deprecate any attempt to throw the whole charge upon the Government, and thereby to lose all that we gain by the local patriotism which is evoked, the local self-denial, and the earnest interest which follows upon it. We shall ask the Government, in view of the very great development of this institution, for a larger grant, and we shall be supported by other institutions in the same position." We have on many occasions pointed out in these columns that generous treatment on the part of the State for university education, so far from diminishing private endowments and munificence, causes a marked increase of enthusiasm and generosity among the wealthy merchants and manufacturers. It is a mistaken policy, in a matter of such importance as the provision of facilities for higher education, to urge that Government assistance should only follow private efforts in the same direction, and if our statesmen adopt the working policy outlined by the Chancellor of the University of Birmingham, this country will have to wait a long time for a complete and satisfactory university system. Let the Government set the example and publicly recognise in a substantial manner its sense of the value of higher education, and private enterprise and endeavour will soon be aroused in a corresponding degree.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 21.—"On the Structure of the Palæozoic Seed, *Lagenostoma Lomaxi*, with a Statement of the Evidence upon which it is Referred to Lyginodendron." By Prof. F. W. **Oliver** and Dr. D. H. **Scott**, F.R.S. Received December 15, 1903.

The present communication deals with the structure of *Lagenostoma Lomaxi*, a fossil seed from the lower Coal-measures, and with the evidence upon which the authors refer it to the well-known Carboniferous plant, Lyginodendron.

It is found that this species of Lagenostoma, especially in its young form, was enclosed in a husk or cupule, borne on a short pedicel.

The seed, which is of cycladean character, is fully described, and its relation to other fossil and recent seeds discussed.

The cupule enclosing the seed was borne terminally on a pedicel; it formed a continuous, ribbed cup below, and divided above into a number of lobes or segments. Externally, both pedicel and cupule were studded with numerous prominent multicellular glands of capitate form. The anatomy indicates that the whole organ was of a foliar nature.

A comparison with the vegetative organs of *Lyginodendron Oldhamium*, with which the seeds are intimately associated, demonstrates a complete agreement in the structure of the glands and in the anatomy of the vascular system. Where vegetative and reproductive organs, presenting identical structural features, not known to occur in other plants, are thus found in close and constant association, the inference that the one belonged to the other appears irresistible.

As regards the position of the seed on the plant, two possibilities are discussed; the cupule, with its pedicel, may either represent an entire sporophyll or a modified pinnule of a compound leaf. Either view is tenable, but various comparative considerations lend a somewhat greater probability to the second alternative.

In the concluding section of the paper, the systematic position of Lyginodendron is discussed. On the whole of the evidence, the position of the genus as a member of a group of plants transitional between filicales and gymnosperms appears to be definitely established. While many filicinean characters are retained, the plant, in the organisation of its seed, had fully attained the level of a Palæozoic gymnosperm. There are many indications that other genera, now grouped under cycadofilices, had likewise become seed-bearing plants. It is proposed to found a distinct class, under the name Pteridospermæ, to embrace those Palæozoic plants with the habit, and much of the internal organisation of ferns, which were reproduced by means of seeds. At present the families Lyginodendreæ and Medulloseæ may be placed, with little risk of error, in the new class Pteridospermæ.

January 28.—"The Morphology of the Retrocalcarine Region of the Cortex Cerebri." By G. Elliot **Smith**, M.A., M.D., Fellow of St. John's College, Cambridge, Professor of Anatomy, Egyptian Government School of Medicine, Cairo. Communicated by Prof. A. Macalister, F.R.S.

Chemical Society, January 20.—Dr. W. A. Tilden, F.R.S., president, in the chair.—It was announced that the Rev. T. J. Prout had presented to the society a photograph of a portrait by Hayes of Dr. William Prout, F.R.S., the originator of Prout's hypothesis.—The following papers were read:—The chemical reactions of nickel carbonyl, parts i. and ii.: J. **Dewar** and H. O. **Jones**. It is shown that nickel carbonyl is completely decomposed by the halogens, cyanogen and sulphur, carbon monoxide, and the corresponding nickel compounds being produced. With aromatic hydrocarbons of the benzene series, in presence of aluminium chloride, the carbonyl compound condenses to form aldehydes and anthracene derivatives; with naphthalene a complex hydrocarbon is produced.—Optically active asymmetric nitrogen compounds, *d*- and *l*-phenylbenzylmethylethylammonium salts: H. O. **Jones**.—A microscopic method of determining molecular weights: G. **Barger**. The author has improved his method of determining molecular weights by observing the relative changes in size of a series of alternate drops of two solutions enclosed in capillary tubes, so that the experimental error has been reduced to within 5–10 per cent.—Studies in the acridine series, part i.: J. J. **Fox** and J. T. **Hewitt**.—*ortho*-Nitrobenzoylacetic acid: E. R. **Needham** and W. H. **Perkin**, jun.—The *cis*- and *trans*-modifications of *aaγ*-trimethylglutaconic acid: W. H. **Perkin**, jun., and A. E. **Smith**.—The influence of substitution on the rate of oxidation of the side chain, part i., oxidation of the mono- and dichlorotoluenes: J. B. **Cohen** and J. **Miller**.—The interdependence of physical and chemical criteria in the analysis of butter fat: T. E. **Thorpe**. Investigation of the butter produced in the United Kingdom has shown that the chemical nature of this fat is dependent on climatic influences, the nature of the fodder, the breed of the cow, the period of lactation, and the idiosyncrasy of the individual cow. Tables of the chemical constants of the butters examined illustrating this are given.—A simple thermostat for use in connection with the refractometric examination of oils and fats: T. E. **Thorpe**.—The condensation of furfuraldehyde with sodium succinate: A. W.

Titherley and J. F. **Spencer.**—The action of heat on α-hydroxycarboxylic acids: H. R. **Le Sueur.** A description of the aldehyde produced by heating α-hydroxystearic acid.—The fusion of *iso*-pilocarpine with caustic potash: H. A. D. **Jowett.** It is shown that the acid produced in this reaction is *n*-butyric acid, and not the *iso* acid as was formerly supposed.—Organic derivatives of silicon: F. S. **Kipping.** A description of the products obtained by the interaction of magnesium alkyl haloids with silicon and alkyl silicon chlorides.—Derivatives of highly substituted anilines: F. D. **Chattaway** and J. M. **Wadmore.**

Physical Society, January 22.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—Notes on non-homocentric pencils, and the shadows produced by them. (1) An elementary treatment of the standard astigmatic pencil: W. **Bennett.** It is shown that several of the properties of the standard astigmatic pencil, and the variations in the form of its cross section, can be simply deduced from a consideration of the projections of its rays upon two planes, each of which is at right angles to one of the two focal lines. The projections of the rays are in each case concurrent. The shadow of a straight wire at right angles to the axis is also dealt with, and it is shown that the rays intercepted by the wire are one set of generators of a hyperbolic paraboloid. The section of this surface by any other plane is a hyperbola or a parabola. The rays are seen to be all parallel to a plane through the axis. If the object wire is not at right angles to the axis the shadow surface is a hyperboloid of one sheet. The section by any plane is, in general, a hyperbola, which is rectangular when the plane is at right angles to the axis and reduces to two straight lines when the plane passes through either of the focal lines. The asymptotes of the rectangular hyperbolas lie in two planes which pass respectively through the two focal lines. The author showed string models of the various pencils and shadow surfaces and of pencils produced by lenses or mirrors. The paper concludes with a simple method for obtaining, by the method of sagittæ, the positions of the approximate lines produced in a small pencil refracted obliquely through a lens.—Some new cases of interference and diffraction: Prof. R. W. **Wood.** In this paper Prof. Wood discusses certain types of the interference of light which have been known for many years, as well as some cases which he thinks are quite new. The colours of mixed plates and the phenomena of interference in transparent films deposited on metallic reflectors are the cases chiefly considered. The facts which have been brought out may be summed up as follows. The colours of mixed plates are due to diffraction, and should not be classed with interferences in their films. The explanation originally given by Young, and the treatment given by Verdet and others, are unsatisfactory, and do not indicate what becomes of the energy. In the cases of films deposited on perfectly reflecting surfaces, which, according to the elementary theory, should exhibit no interference colours, we may, under certain conditions, have colours far more brilliant and quite as saturated as any shown by the soap bubble. In other cases, where at first sight no interference appears to have taken place, we may, by employing polarised monochromatic light, obtain fringes of a very curious nature, which are the result of the interference between the elliptical vibration coming from the metal surface and the plane-polarised vibration reflected from the surface of the transparent film.—On the photographic action of radium rays: S. **Skinner.** It is well known that a photographic plate by exposure to radium rays is affected in such a way that the plate develops similarly to its development after exposure to light. The experiments described in the paper are an attempt to answer the question: Are the actions the same? So far as can be seen, the final results of the actions and developments are the same, and the experiments appear to indicate that only slight differences occur in the early stages.

Entomological Society, January 20.—The 70th annual meeting, Prof. E. B. Poulton, F.R.S., president, in the chair.—It was announced that the following had been elected officers for the session 1904-5:—President, Prof. Edward B. Poulton, F.R.S.; treasurer, Mr. Robert McLachlan, F.R.S.; secretaries, Mr. Herbert Goss and Mr. H. Rowland-Brown.—The **President** delivered an address on the subject of "What is a Species?" What is there to fill the vacancy left by the disappearance of the Linnean conception, founded on "special creation"? In many respects it would be advantageous to abandon the word, or to use it solely with its original logical meaning of "kind," or, as zoologists would say, "form." This view was, however, regarded as a "counsel of perfection," impossible of attainment; and the attempt was made to show that the conception of a naturally and freely interbreeding (or syngamic) community lies behind the usual definitions, and that the barrier between species is not sterility, but simply cessation of interbreeding or asyngamy.

PARIS.

Academy of Sciences, January 25.—M. Mascart in the chair.—On certain doubly periodic solutions of some partial differential equations: Émile **Picard.**—On the light emitted spontaneously by certain salts of uranium: Henri **Becquerel.** Some salts of uranium emit light continuously and with an intensity which is greater than would be expected from their radio-activity. The effects are best shown by the double sulphate of uranyl and potassium, and there is a relation between the luminosity and the phosphorescence, since different preparations of this double salt unequally phosphorescent to light are also unequally luminous in the dark. The effects observed are so small that it is necessary for the observer to be in the dark for some time before attempting an experiment. Crystals of the double sulphate exposed to the intense radiation of an electric arc or of a radium salt, and then examined some seconds later in the dark, were no more luminous than specimens of the same salt which had been kept continuously in the dark. The light was too feeble to permit of the examination of the spectrum.—Some new observations on *Piroplasma Donovani*: A. **Laveran** and M. **Mesnil.** This parasite, first found by Dr. Donovan in cases of a fever common near Madras, would also appear to be the cause of a disease known as *Kala-Azar*, or the black fever of the valley of Brahmapootra.—M. Calmette was nominated a correspondant for the section of medicine and surgery in the place of M. Laveran, elected a member in the same section.—The examination of the gases given off or occluded by radium bromide: MM. **Dewar** and **Curie.** A specimen of pure radium bromide was placed in a vacuum in connection with a manometer; gas was found to be evolved at the rate of about 1 c.c. per month, which on spectroscopic examination proved to be hydrogen, most probably produced by the action of the radium compound upon a small quantity of water present. The same specimen, placed in a quartz tube, was heated to redness, any gases given off being removed by the mercury pump. These gases were drawn through tubes cooled down to the temperature of liquid air. The gas which passed through the tube cooled in liquid air was radio-active and strongly luminous, spectroscopic examination of the light emitted showing the three principal bands of nitrogen. The quartz tube containing the radium bromide was then sealed off with the oxyhydrogen blowpipe. Twenty days later M. Deslandres found that the tube gave the complete spectrum of helium, and no other rays could be detected.—On an electrical law of the electrical transportation of dissolved salts: A. **Ponsot.** From the experimental results of M. Chassy, laws are deduced which are in opposition to the hypotheses on which M. Kohlrausch has relied in deducing the molecular conductivity of solutions from the migration numbers.—On certain phenomena arising from physiological sources capable of being transmitted along wires formed of different substances: Augustin **Charpentier.** The physiological radiations, probably identical with the *n*-rays, can be transmitted through a metallic wire as well as through the air. This allows of a much more precise study of these rays from a physiological point of view, one great advantage of the method being that the observer may be placed so far from the sensitive screen as to reduce to a minimum muscular or mental effects foreign to the experiment.—The emission of the Blondlot rays during the action of soluble ferments: M. **Lambert.** The *n*-rays are produced during the action of ferments, the effect being particularly marked for the digestive ferments of albumenoid materials.—On the fluochlorides, the fluobromides and the fluoiodides of the metals

of the alkaline earths: Ed. **Defacqz.** Details are given of the preparation and properties of the barium fluohalogen compounds of the type $BaF_2 : BaCl_2$.—Some colour reactions of molybdic acid: M. Emm. **Pozzi-Escot.** The author has rediscovered the colour reaction between tannin and molybdates which forms the basis of Alexander's method for the determination of lead volumetrically as molybdate.—The electrolysis of chloric acid and chlorates: André **Brochet.** A discussion of the causes of the anomalous results obtained by the electrolysis of chlorates with a copper anode.—On the presence of formaldehyde in atmospheric air: H. **Henriet.** The author has shown in previous papers that there exists in the atmosphere a gaseous substance, which is not formic acid, possessed of energetic reducing properties, capable of reducing Fehling's solution and decolorising iodide of starch solution. By an examination of rain water, proof is now afforded that this reducing substance is formaldehyde, and it appears to be present in proportions between one and five parts per 100,000 of air by weight.—On trichlorisopropyl alcohol: Louis **Henry.** This substance is readily obtained by Grignard's reaction from chloral and methyl magnesium iodide.—On the condensation of acetylenic esters with alcohols: Charles **Moureu.**—On the α-substituted β-methyladipic acids: Marcel **Desfontaines.**—On some derivatives of tetramethyldiaminophenyloxanthranol: MM. **Guyot** and **Stœhling.**—On the formation and saccharification of retrograded starch: L. **Maquenne.**—On the distribution of potash in arable earth: J. **Dumont.**—On a new organism (*Pelmatosphaera polycirri*), the parasite of an annelid (*Polycirrus haematodes*): Maurice **Caullery** and Félix **Mesnil.**—On the necessity of instituting an order of Siphomycetes and an order of Microsiphoneæ parallel to the order of Hyphomycetes: Paul **Vuillemin.**—On the vegetation of some submarine soft water springs of the Lower Seine: Maurice **Gomont.**—On the development of the perithecium of Ascobolus: A. **Dangeard.**—On the geological association of iron and phosphorus and the dephosphorisation of iron minerals by natural metallurgy: L. **De Launay.**—On the magnitude of the nummulitic formation of St. Louis, Senegal: Stanislas **Meunier.**—On the ferment of the disease of wine known as *vin pousse*: J. **Laborde.**—The relation between the interstitial gland and the development of sexual characters: P. **Bouin** and P. **Ancel.**—On the correlation of characters susceptible of natural selection: G. **Coutagne.**—The analytical study of the phenomenon of oscillating life: Joseph **Deschamps.**

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 4.

ROYAL SOCIETY, at 4.30.—The Reduction Division in Ferns: R. Gregory.—Cultural Experiments with "Biologic Forms" of the Erysiphaceæ: E. S. Salmon.—On the Origin of Parasitism in Fungi: George Massee.—On Mechanical and Electrical Response in Plants: Prof. J. C. Bose.—On the Effects of Joining the Cervical Sympathetic Nerve with the Chorda Tympani: Prof. J. N. Langley, F.R.S., and Dr. H. K. Anderson.—Conjugation of resting Nuclei in an Epithelioma of the Mouse: Dr. E. F. Bashford and J. A. Murray.

ROYAL INSTITUTION, at 5.—Recent Research in Agriculture: A. D. Hall.

CHEMICAL SOCIETY, at 8.—The Tautomeric Character of the Acidic Thiocyanates—Preliminary Note: R. E. Doran.—The Resolution of αβ-Dihydroxybutyric Acid into its Optically Active Constituents: R. S. Morrell and E. K. Hanson.

LINNEAN SOCIETY, at 8.—Account of Researches in the Physiology of Yeast: Prof. Sydney H. Vines, F.R.S.—Further Researches on the Specialisation of Parasitism in the Erysiphaceæ: E. S. Salmon.

RÖNTGEN SOCIETY, at 8.30.—Discussion on the Production of Photographic Reversal through the Action of Various Radiations.

FRIDAY, FEBRUARY 5.

GEOLOGISTS' ASSOCIATION, at 7.30.—Annual General Meeting. Address by the President, Mr. H. W. Monckton: on some Examples of the Different Types of Geological Formations, with Special Reference to Recent Excursions of the Association (Estuarine, Lagoon, and Marine Deposits).

SATURDAY, FEBRUARY 6.

ROYAL INSTITUTION, at 3.—Study of Style in Greek Sculpture: Dr. C. Waldstein.

MONDAY, FEBRUARY 8.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Turkestan and a Corner of Tibet: Oscar T. Crosby.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—The Work of the Alloys Research Committee: W. H. Merrett. (Graduates' Lecture.)

SOCIETY OF ARTS, at 8.—Oils and Fats—their Uses and Applications. (Cantor Lectures, III.).

VICTORIA INSTITUTE, at 4.30.—Notes on the Volcanic Phenomena of New Zealand: Miss Hilda Boord.

TUESDAY, FEBRUARY 9.

ROYAL INSTITUTION, at 5.—The Development of Animals: Prof. L. C. Miall, F.R.S.

SOCIETY OF ARTS, at 4.30.—The Biology of Federation: Sir John Cockburn, K.C.M.G.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Tonnage Laws, and the Assessment of Harbour Dues and Charges: H. H. West.

WEDNESDAY, FEBRUARY 10.

SOCIETY OF ARTS, at 8.—Thermit: its Application to Electrical Engineering: C. Vernon Boys, F.R.S.

THURSDAY, FEBRUARY 11.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* A New Method of Detecting Electrical Oscillations: Dr. J. A. Ewing, F.R.S., and L. H. Walter.—Constant Standard Silver Trial Plates: Edward Matthey.—On Certain Properties of the Alloys of Silver and Cadmium: Dr. T. Kirke Rose.—Sun-spot Variation in Latitude, 1861-1902: Dr. W. J. S. Lockyer.—On the High-Temperature Standards of the National Physical Laboratory. An Account of a Comparison of Platinum Thermometers and Thermo-junctions with the Gas thermometer: Dr. J. A. Harker.

ROYAL INSTITUTION, at 5.—Recent Research in Agriculture: A. D. Hall.

SOCIETY OF ARTS, at 4.30.—Our Commercial Relations with Afghanistan: Ccl. Sir Thomas H. Holdich, K.C.M.G., K.C.I.E.

MATHEMATICAL SOCIETY, at 5.30.—On the Roots of the Equation $\Gamma\frac{1}{(x+1)} = c$: G. H. Hardy.—On a Certain Double Integral: Prof. A. C. Dixon.—On an Appropriate Form of Conductor for a Moving Point-Singularity: Prof. A. W. Conway.—On Group-Velocity: Prof. H. Lamb.—On Point-Wise Discontinuous Functions of a Real Variable: Dr. E. W. Hobson.—Some Extensions of Abel's Theorem on Power Series on the Circle of Convergence: G. H. Hardy.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Transatlantic Engineering Schools and Engineering: Prof. R. M. Walmsley.

FRIDAY, FEBRUARY 12.

ROYAL INSTITUTION, at 9.—Westminster Abbey in the Early Part of the 17th Century: the Very Rev. J. A. Robinson.

PHYSICAL SOCIETY, at 8.—Annual General Meeting. Address by the president, Dr. R. T. Glazebrook, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Anniversary Meeting.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Electricity and Destructor Station at Plumstead: T. S. Nash.

MALACOLOGICAL SOCIETY, at 8.—Annual Meeting: President's Address.

SATURDAY, FEBRUARY 13.

ROYAL INSTITUTION, at 3.—Culture and Sculpture: Dr. C. Waldstein.

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