THURSDAY, JUNE 4, 1891.

THE BRITISH INSTITUTE OF PREVENTIVE MEDICINE.

THE progress of bacteriological science, and the amount of exact information which it has shed upon the problems of disease during the last fifteen years, have led several of the Governments of the Continent and America to establish institutes providing for original research, as well as technical instruction, in preventive medicine.

This country, on the other hand, which pioneered sanitary science from its birth, has, strangely enough, been distinctly behindhand in the study of bacteriology (fraught as it is with interest of such vital importance to the health and prosperity of the nation); and of the provision of institutes of the kind which have been established abroad, such as the Pasteur Institute in Paris, the Hygienische Institut in Berlin, Königsberg, Breslau, Wiesbaden, St. Petersburg, Moscow, Odessa, Tiflis, Warsaw, Cracow, Naples, Turin, Rome, Milan, Palermo, Malta, Barcelona, Constantinople, Bucharest, Budapest, Rio Janeiro, New York, Washington, we have no example in the United Kingdom. In these institutions, the study of the morphology, biology, physiology, and chemistry of micro-organisms, whether pathogenic or not, is being actively pushed forward, and a thorough analysis of their subtle influence as causative factors of disease pursued.

In this manner the poisons of the following maladies, the effects of which are among the direst evils to humanity, viz. pyæmia, anthrax, erysipelas, septicæmia, glanders, tubercle, diphtheria, &c., have been isolated, and discovered to be micro-organisms which are now known certainly to be the active principle of the virus. When we reflect that, for centuries and centuries, the crippling effects of epidemic and devastating diseases have been only too well known, but attributed to the operation of all manner of causes, *e.g.* supernatural agencies, Divine wrath, meteorological and climatic influences, &c., &c., the fact that the real truth concerning the nature of their causes has been ascertained only within the last few years by laboratory research is, in itself, overwhelmingly expressive of the immense value of Bacteriological Institutes and their work.

But their value does not stop here. Knowing, as thanks to bacteriology we now do, the origin of these diseases, it may be asked what has the same science done towards stamping them out and preventing their development, or haply arresting their progress should they unfortunately gain access to, and invade, the tissues of the body. To express ourselves more plainly, the question might be put in this form, "What has bacteriological science done to discover the antidotes of such poisons?" The answer is, that whereas centuries of clinical observation have done very little indeed—by watching the sick and the employment of drugs—towards the direct arrest of the virus of infective maladies, laboratory work, on the other hand, has already provided us, not merely with many invaluable and additional facts to general science on the subject of immunity, vaccination, *i.e.* protection before infection, resistance of tissues to invasion by parasitic organisms, &c.; but has given to medical science, what no pharmacopœia has ever been able to do—namely, chemical antidotes which by their specific action upon the virus of diseases alone successfully save human beings as well as the lower animals from death and incapacitating illness.

Of these new methods, perhaps the most noteworthy is Pasteur's treatment of hydrophobia, but others have been already discovered, and are being examined and tested for practical employment in medicine and surgery.

A large institute of this kind, however, is not reserved solely for the investigation of the problems of disease—on the contrary, it has a far wider sphere of usefulness. Bacteriology, which Pasteur showed was the key to the secrets of fermentation, is, of necessity, all-important to many very extensive trades and commercial undertakings. The botanical and biological researches of the Pasteur Institute are thus to a large extent utilized by the French manufacturers, as well as by those of other countries, to their great profit.

The particular bearing of this branch of science has never been fully comprehended by the public, who are not aware what an enormous debt of obligation they owe to M. Pasteur, and to the extension of scientific research, which received its impetus from his genius, and which has resulted in so much direct gain and benefit to the community. In like manner, to agriculture, the questions of changes in soils—such, for example, as nitrification, now known to be due to the action of micro-organisms—are not less important, and indeed essential. A Bacteriological Institute, therefore, has in agriculture, quite apart from the subject of diseases of animals, a fertile source of work of the utmost value and assistance to practical men. But, in addition, there has of later years arisen a branch of chemical industry directed towards the synthetic production of numerous substances which prove to be powerful drugs. The knowledge of these is, of course, incomplete and dangerous until thorough experimental investigation of the action of these substances has been made. In this country, however, our chemists are precluded, by the harassing legislation under which their co-workers in physiology, pathology, and medicine labour, from pursuing this useful line of research, without great trouble and endless restrictions, although such work is solely directed towards the therapeutic relief of disease and suffering.

The chemistry of disinfection offers in itself an extensive field of research which can alone be cultivated in an institution of this kind reserved for bacteriological investigations.

Lastly, in such an institute two subjects of general interest receive special careful attention. These are (1) the technical instruction of medical men, health officers, chemists, and manufacturers, in bacteriology, both in its morphological and biological aspects; and (2) the examination of tissues and substances suspected to be the seat or vehicle of infectious diseases and submitted for investigation and report. The functions of a Bacteriological Institute, therefore, clearly involve interests of the highest national as well as particular or individual import.

Since the formation of the Pasteur Mansion House

Fund, which has provided for the treatment in Paris of many English sufferers from the bites of rabid dogs, some of the members of the Committee of that Fund, as well as of the Mansion House meeting at which it was inaugurated, knowing the importance to the community of having a similar institute in Great Britain, determined to make an effort to establish the same.

A survey of the conditions under which bacteriology is practised in Great Britain is sufficient to show at once the pressing need of creating a centre of the kind, since, although several medical schools and Universities have provided for the teaching of bacteriology to a degree suitable for diplomas in public health medicine, and although in the laboratories of the College of Physicians and Surgeons in Edinburgh, and of the conjoint London Colleges, besides those of University College, King's College, and the College of State Medicine, there is room and provision for a certain amount of original work, still it is quite notorious that the majority of original investigators are driven to go to Paris and Berlin, not only on account of the splendid collection of material and freedom of experiment there, but also for lack of sufficient accommodation in the laboratories of the United Kingdom. To remedy this state of things, and to provide an establishment which would greatly assist the medical schools and technical education generally, is therefore the object of the promoters of the British Institute of Preventive Medicine. The development of the scheme has now arrived at a very interesting point, which, as usual in this country, resolves itself into a contest between the friends and enemies of science. The object of the Institute being purely charitable and scientific, it was from the outset necessary to give its constitution a firm basis, in order to obtain the confidence of the public from whom naturally the cost of creating the Institute is to come. It has therefore to be incorporated, and such incorporation can practically only be obtained by permission of the Board of Trade, which grants leave for the registration of such institutes as limited companies, the word limited being omitted, thus insuring the appropriation of the funds for none but purposes identical with the original object for which they were intended. The Executive Committee of the British Institute, therefore, made through their solicitors, Messrs. Hunter and Haynes, the formal application for such registration to Sir Michael Hicks Beach, the President of the Board of Trade. To their surprise Sir Michael refused to register the Institute, and this without assigning in his letter any reason for his refusal. It is, however, understood that he has done so in consequence of his having received petitions from a few bodies of anti-vivisectionists, among whom are to be found as usual certain names, mostly ecclesiastical, of gentlemen whose intentions, however admirable, are dictated by absolute ignorance of the questions which they presume to discuss.

We understand (though it is incomprehensible how a Minister should have allowed himself to be placed in such a false position) that Sir Michael Hicks Beach alleges privately that by registering the Institute, a portion of the work of which will naturally include experiments on animals, he will be encroaching on the duties of the Home Office, to which department alone, however, as a matter of fact, is intrusted the administration of the utterly incompetent and harassing so-called Vivisection Act. Nothing can excuse the confusion of mind or ignorance which is thus displayed by an official of the Government, for, as is evident to the merest tyro in law, the question of experimental science has nothing whatever to do with the matter submitted to the Board of Trade. That body has only to make sure that the funds of the Institute cannot in the future be misappropriated to any other object. That is all it is asked to do, and that solely in the interests of the public.

The official seal of the Board of Trade having thus been given to stamp the Institute with the character designed for it by its promoters—namely, that of a charitable and not a commercial undertaking—it would then, of course, be necessary for the Executive Committee to apply to the Home Office for the registration of the Institute as a place where experimental science may be carried on.

With this second registration the Board of Trade has nothing whatever to do, and by taking upon himself the duty of considering this part of its constitution, the President has gone out of his way to raise difficulties in the formation by private individuals of a National Institute, which in other more intelligent and far-seeing countries the Governments have hastened to take the initiative in establishing and liberally supporting.

It is evident that Sir Michael Hicks Beach has been greatly misinformed on this matter, and we look forward with interest to the result of the representations of a very powerful deputation which we learn is to wait upon him on Friday, June 5, at 11 a.m., and which, constituted as it is of distinguished men in all branches of science, as well as of those of the general public who are interested in philanthropic sanitary measures, will point out to him the real facts of the case on which he has to adjudicate, and rescue the question from the erroneous position which it now occupies, owing to his unfortunate readiness to listen to the calumnious assertions of the haters of science and progress.

It is not difficult, we believe, to read between the lines in such a case as this. No beings are more human than Ministers and members of Parliament, or, in fact, all those whose own position or that of their party depends upon popular clamour. Such unfortunates listen like Eve with a fatal fascination to the voice of the deceiver, but, with a taste less worthy than hers, the fruit which attracts them is not that of the tree of universal knowledge, but of the ballot-box. They have hitherto laboured under the mistaken impression that an energetic and noisy group of agitators, leading in their train a few unscientific quasi-public men, were an important political body, and they consequently sacrifice to their misrepresentations the liberties of science and the good of commerce. The day is coming, or is rather come, when the scientific and cultured world will refuse to submit any longer to such a condition of affairs, and when all its branches, physiologists, agriculturists, chemists, engineers, medical and legal men, will unite in a compact body for the protection of their common interests, and we rather welcome the present difficulty, which has served to bring prominently forward the spirit animating them, and which no administrator will do wisely in failing to recognize.

THE GEOLOGY AND PHYSICAL GEOGRAPHY OF NORTH SYRIA.

Grundzüge der Geologie und physikalischen Geographie von Nord-Syrien. Von Dr. Max Blanckenhorn. Mit Zwei Karten, &c. (Berlin: Friedländer, 1891.)

IN this excellent treatise the author presents the reader with a synoptical view of the results of his observations over a region but little known; referring to his previous essays on the geology, palæontology, and petrology of North Syria for fuller details. The region described extends from the northern slopes of the Lebanon to those of the Taurus Mountains, and from the Mediterranean coast to the banks of the Euphrates and the ruins of Palmyra, embracing an area of about 45,000 square miles. It also includes the whole of the Orontes Valley and the Kurdish Mountains. The mountainous tracts immediately to the south have already been ably described, as regards their physical structure, by Carl Diener, in an essay which was favourably reviewed in NATURE at the time of its publication in 1886, and these observations on the geology of the Lebanon and Hermon have been taken up and extended by Dr. Blanckenhorn to the borders of Asia Minor. Still further south, we have the geology of Palestine illustrated and described by Fraas, Lartet, Tristram, and the officers of the Palestine Exploration Fund, extending into Edom and Moab and the Sinaitic peninsula; so that, as far as it is possible for travellers to carry out such a work as that of the geological portraiture of the region, we have now the whole tract from the shores of the Red Sea to the Taurus Mountains very fully described and illustrated. Two maps on a large scale, one showing the topography, the other the geology, accompany the present work. That there should be uncoloured spaces at intervals in the latter was inevitable, and is a proof of the caution exercised by the author in its preparation. The text itself also contains numerous geological sections and illustrations.

In comparing the geological structure of the Lebanon, as described by Diener,[1] with that of the range between the valley of the Orontes and the coast, called Djebel Ansârige (Nusairier-gebirge), the author observes that the representatives of the Upper Jura and Cenomanian lying at the base of the Lebanon formations are absent in the more northerly tracts, the lowest beds of the series being represented by the "Rudisten-kalk," of probably Turonian age. The engraved longitudinal section which the author gives to illustrate this, amongst other physical features, is drawn from the coast at Latakia (Lâdikije) over Dj. Hassan Erai to the Orontes at Mischalûm, and is of much interest as illustrating the general structure of this part of Northern Syria. The valley of the Orontes is shown to be in the line of a great fault, or system of faults, by which the Eocene limestone beds are "thrown down" along the eastern side of the valley against the older Cretaceous strata, which are elevated into the ranges of Dj. el Ansârije and Hassan Erai, capped by the same Eocene limestones which form the bed of the Orontes, but at a difference of relative level of about 1600 feet. On the eastern side of the valley the Eocene strata rise into high ridges, partly by the aid of a N.-S. fault, which is not improbably a continuation of the "great Jordan-Arabah fault," which has produced such remarkable effects in connection with the physical structure of Palestine and Arabia Petræa.[1] The position of this fault seems also to be indicated in the section across the Orontes at Hammâm Sheikh Isa, illustrating the region of Mons Cassius.

The author gives a graphic description of the gorge of the Orontes in the neighbourhood of the hot springs (Hammam) above the great bend which the river takes from its northerly course towards the west in order to reach the Mediterranean. At Djisr esh-Schughr the river enters a cañon which has been worn down to a depth of 160 metres in beds of Eocene limestone and marble rich in Nullipores, and amongst the massive Miocene limestone (Grobkalk); while to the left rises the plateau of Dj. el Koseir, breaking off in successive terraces towards the Orontes Valley, and on the right the crest of Dj. el 'Alâ. On leaving this gorge the river enters an extensive alluvial plain, making a magnificent sweep round to the westward; and in its course through a rocky and broken country bathes the ruined walls of Antioch, the once famous capital of Syria—a city which bears so honourable a place in the early history of Christianity.

The region of Northern Syria physically divides itself into three distinct regions which are adopted for purposes of description by the author. The first includes the coast ranges; the second, the depression lying to the east of these, including the valleys of the Orontes and the Kara sea and river; the third, the "Hinterland," or interior tracts of North Syria lying to the east of the depression, and including the Khurdish Mountains: we can only here specially notice this last. This region is remarkable for the great tracts of Miocene strata, reposing sometimes on those of Eocene, sometimes on those of Cretaceous, ages of the Palmyrene wilderness and of Anti-Lebanon, and which are in turn largely overspread by great sheets of plateau basalt. Of these Miocene strata the plains round Aleppo are chiefly formed. Here they are nearly horizontal, but towards the north they are tilted, and the Eocene and Cretaceous strata again rise to the surface and terminate in the escarpment of Kardalar Dagh, beyond which rises the high plateau of Kâwâr, and still further towards the north-west the lofty ridge of Giaur Dagh, which reaches an elevation of 1330 metres. This latter is formed of Devonian limestone, slate, and grit, which appear to be the fundamental rocks of this part of Syria. The plateau of Kâwâr, which intervenes between the Giaur Dagh and the Kurdish ranges, is formed of gabbro, norite, schillerfels, and serpentine, of an age intervening between the Upper Chalk and the Eocene. The Miocene strata which occupy so extensive a part of Northern Syria were formed, according to the author, under the waters of an arm of the Mediterranean, which extended inwards at the base of Dj. el-Koseir beyond the Kuweik and the vicinity of Aleppo, bounded by irregular ranges of emergent hills of Eocene and Cretaceous strata. The formation consists of basal conglomerates of flint pebbles, passing into calcareous sands, clays, and finally the massive limestone (Grobkalk) already referred to, and has yielded forms of *Operculina*, *Clypeaster*, &c., clearly indicating its marine origin. This epoch was remarkable

[1] "Libanon, Grundlinien der phys. Geographie u. Geologie v. Mittel-syrien," 1886.

[1] "Mem. on the Physical Geology and Geography of Arabia Petræa, Palestine, &c." (Palestine Exploration Fund), 1885, pp. 103-12.

for the display of volcanic energy on a vast scale. Great sheets of augitic lava, together with tuff and agglomerate, were erupted during the Miocene epoch, not only in Northern Syria but in the East Jordanic region to the south, and were again renewed in Post-Pliocene times. It is probable that to volcanic action we must refer the origin of some of the peculiar little lakes of Northern Syria, such as those of Homs and Kara, one occupying the bed of the Orontes, the other that of the Kara, where the ground probably fell in and became filled with water. The Pliocene period is represented by both marine and freshwater strata, deposited in bays and depressions along the margins of uprising lands, formed of all the older formations, including those of the Miocene period. All of these had been disturbed, upraised, and partially eroded before the deposition of the Pliocene strata. In this, as in other physical phenomena of Northern Syria, we are reminded of those of Palestine and Egypt. Throughout all this region the Nummulitic and Cretaceous strata were disturbed and upraised into dry land, and subjected to extensive denudation at the close of the Eocene and again at the close of the Miocene epochs, so that the stratigraphical continuity of these Tertiary formations has been repeatedly broken.

It may be worth while, in conclusion, to glance at the points of analogy, as well as of difference, between the physical conditions of Syria and of the region to the south of the Lebanon. In Northern Syria, and along the ranges of the Taurus and Anti-Taurus, the fundamental rocks on which are superimposed the great calcareous formations of Cretaceous and Tertiary ages consist of Devonian schists, greywacke, and limestone,[1] together with masses of various igneous rock. In Southern Palestine and the Sinaitic peninsula, on the other hand, the fundamental rocks consist of granite, gneiss, various crystalline schists of Archæan age, traversed by innumerable dykes of hornblendic, augitic, and felspathic rock; surmounted at intervals by Lower Carboniferous beds; this is a remarkable contrast. But a still greater, perhaps, is to be found at the next stage. All along the eastern border of the Jordan Valley, south of the Sea of Galilee, extending southwards along the table-land of Moab, Edom, and the Arabah Valley, as well as through the Sinaitic peninsula, and into Upper Egypt, the base of the Cretaceous series is represented by the Nubian sandstone,[2] a formation of great persistency, and interesting from an architectural point of view for its extensive use as a building-stone in the great structures of Ancient Egypt; as, for example, in the colossal figures of Amenophis in the plain of Thebes, as also in the temples and sepulchres of Petra. This formation appears to be altogether wanting north of the Lebanon, where, according to Herr Blanckenhorn, the Cretaceous strata of the Turonian stage are the lowest of the series.[3] The points of contrast, however, here terminate; for over the whole region from Upper Egypt and the Libyan Desert on the south to the Taurus Mountains on the north, a distance of 1000 miles and beyond, the Cretaceous and Eocene limestones were deposited, and formed part of the floor of the ancient ocean, the original limits of which it is hard to determine with any approach to accuracy.

At the close of the Eocene epoch this ocean bed was subjected to powerful movements. Large tracts, including the Libyan Desert and Egypt, Palestine and Syria, were elevated into dry land; while the strata were bent, folded, and faulted along lines ranging generally from north to south. To this period is to be referred the production of the great Jordan-Arabah fault, which has now been traced at intervals from the Gulf of Akabah to the valley of the Orontes, a distance of over 350 miles, while the main features, especially the mountains, had the outlines which they now present marked out. During the Miocene period, along with a partial re-submergence, volcanic action came into play over a region generally bounded by the Jordanic depression on the west, and extending from the Arabian Desert to the base of the Taurus, and the head waters of the Euphrates. In Northern Syria, extensive sheets of basaltic lava are found west of the Orontes Valley, as well as at Antioch, Aleppo, and other parts. At a later period, bordering on the present, fresh eruptions were added. The region we have been considering has its natural boundary towards the north in the Taurus range, where a system of E.-W. flexures take the place of those of the region to the south, where (as we have seen) the prevalent direction of the flexures is meridional.

EDWARD HULL.

[1] As determined by Hamilton, Warington Smyth, Tchihatcheff, and others.
[2] Probably of Neocomian age.
[3] Representing those of the chalk-marl of England.

EUROPEAN BOTANY.

Plantæ Europeæ: enumeratio systematica et synonymica plantarum phanerogamicarum in Europa sponte crescentium vel mere inquilinarum. Autore K. Richter. Tomus I., pp. 378. (Leipzig: Verlag von Wilhelm Engelmann, 1890.)

WHAT is most wanted in systematic botany at the present time is a general flora of Europe, worked out for the different countries on one uniform plan, with the sub-species and varieties placed in their proper subordination under the primary specific types, and the synonyms worked out carefully. The number of plants in Europe is about the same as in the United States. For these Asa Gray planned a general flora in three volumes, of which the middle one, containing the Gamopetalæ, was published shortly before his death, and the first and third left in a forward state of preparation. Many years ago Mr. Bentham planned and carried out, with the assistance of Baron von Mueller, a complete flora of Australia. There are 40 or 50 per cent. more plants in India than in Europe. Sir Joseph Hooker's "Flora of British India," containing descriptions and full synonymy of every species, has reached the end of the Dicotyledons, and in the last part the Orchideæ are finished, so that five-sixths of the work is now done. There is, however, no such book in existence as a general descriptive flora of Europe. For Europe the difficulty lies far more in the bibliography than in the plants themselves. An enormous number of subordinate forms have been described under specific names, and the number of channels of publication in the way of journals and reports of societies becomes greater and greater every year. Nyman's "Sylloge," published in 1854-55, and his later "Conspectus," have been a great boon to all European workers. Though they do not contain any descriptions, they give a tabular view of the whole European flora, tracing out in detail the geographical distribution of the species; and in the "Conspectus" especially, great pains has been taken to separate the subordinate from the primary types. The present work, like Nyman's, does not contain any descriptions. It deals with the geographical range of the species much more briefly, indicating it within the compass of a single line. Its strong point is bibliography, and it gives under species a list of all the names that have been applied to it by different authors, with a citation of the book and page where each name is published, with a note of the date of publication. The plan followed can be best illustrated by an example, and the following is the way in which the cultivated wheats are dealt with:—

TRITICUM, Section *Sitopyros.*

19. *T. monococcum*, L., Sp. Pl., edit. 1, p. 86 (1753).
 Syn.: *Ægilops Crithodium*, Steud., Syn. Gl., i. p. 355 (1855).
 Crithodium ægilopoides, Lk., in Linn., iv. p. 142 (1829).
 T. bæticum, Bss., Diagn. Pl. Or., i. 13, p. 69 (1853).
 T. pubescens, MB., Casp. M., p. 81 (1800).

Europa austro-orientalis (Ceterum cultum). (Caucasus.)

20. *T. sativum*, Lam., Enc., ii. p. 554 (1786).
 (*a*) *Spelta*, L., Sp. Pl., ed. 1, p. 86 (1753.
 Syn.: *T. Zea*, Host, Gram., iii. t. 29 (1805).
 (*b*) *dicoccum*, Schrk., Baier. Fl., p. 389 (1789).
 Syn.: *T. amyleum*, Ser., Mel. Bot., i. p. 124 (1818).
 T. atratum, Host, Gram., iv. t. 8 (1809).
 T. Cienfugos, Lag., El., p. 6 (1816).
 T. Gartnerianum, Lag., *ib.*
 T. Spelta, Host, Gram., iii. t. 30 (1805).
 T. tricoccum, Schuebl., in Flora, 1820, p. 458.
 (*c*) *sativum*, Hack., in Nat. Pflzf., ii. 2, p. 85 (1887).
 α. *vulgare*, Vill., Pl. Dauph., ii. p. 153 (1787).
 Syn.: *T. æstivum*, L., Sp. Pl., ed. 1, p. 85 (1753).
 T. cereale, Bmg., En., ii. p. 266 (1846).
 T. hybernum, L., *l.c.*, p. 86.
 β. *compactum*, Host, Gram., iv. t. 7 (1809).
 Syn.: *T. velutinum*, Schübl., Diss., p. 13 (1818).
 γ. *turgidum*, L., Sp. Pl., ed. 1, p. 86 (1753).
 Syn.: *T. compositum*, Linn., f. Suppl., p. 477 (1781).
 T. Linnæanum, Lag., El., p. 6 (1816).
 δ. *aurum*, Desf., Fl. Atlant., i. p. 114 (1798).
 Syn.: *T. Bauhini*, Lag., El., p. 6 (1816).
 T. brachystachyum, Lag., *ib.*
 T. cochleare, Lag., *ib.*
 T. fastuosum, Lag., *ib.*
 T. hordeiforme, Host, Gram., iv. t. 5 (1809).
 T. platystachyum, Lag., *l.c.*
 T. sativum β, Pers., Syn., i. p. 109 (1805).
 T. tomentosum, Bayle-Bar., Mon., p. 40 (1809).
 T. villosum, Host, Gram., iv. t. 6 (1809).

Cultum in diversis varietatibus.

21. *T. polonicum*, L., Sp. Pl., ed. 1, p. 86 (1753).
 Syn.: *T. Cevallos*, Lag., El., p. 6 (1816).

Cultum.

Of course it is impossible for an author covering such a wide field to work out for himself all the details, and in the critical genera, such as Potamogeton, Festuca, Crocus, Iris, Tulipa, and Narcissus, no two authors are ever likely to agree as to which should be classed as primary, which as subordinate types, and which as mere synonyms. The present portion of the work includes only the Gymnosperms and Monocotyledons. The author admits 250 European genera, 1830 species, and 840 sub species. He keeps up the oldest specific name published under any genus, not, as is usual in England, the name first published under the genus in which the plant is now placed. I find that a considerable number of books and papers published in England have not been taken into account; for instance, Maw's magnificent monograph of the genus Crocus, C. B. Clarke's monograph of the European species of Eleocharis in the *Journal of Botany*, 1887, p. 267, and Arthur Bennett's work on Potamogeton, as summarized in the last edition of Hooker's "Student's Flora." The book has cost great care and pains, and will be found very useful by all who work at European botany.

J. G. BAKER.

OUR BOOK SHELF.

The Missouri Botanical Garden. 8vo, with several Maps and Engravings. (Printed for private circulation by the Managers, 1891.)

THE Missouri Botanical Garden is situated at the city of St. Louis, and was founded by the late Henry Shaw. He was born at Sheffield in the year 1800, and emigrated to Canada with his father at the age of eighteen, and a year later moved southward to St. Louis, which was then a small isolated French trading post. He established himself in business as a dealer in cutlery, made a fortune of 250,000 dollars by the time he was forty years of age, and then retired from business. In 1840 he visited Europe for the first time, and in 1842–45 made a three years' tour in the Old World. In 1851 he visited Chatsworth, and particularly admired its garden and conservatories. This led him to entertain the idea of forming a large garden at home. One of the best American botanists, Dr. Engelmann, lived at St. Louis, and Mr. Shaw sought his help and advice. In 1857 he opened a correspondence with Sir William Hooker. He engaged from the Royal Botanic Garden in Regent's Park Mr. James Gurney to superintend the carrying out of his plans. He died in 1889, and bequeathed to his trustees 760 acres of land, situated partly within and partly outside the limits of the city of St. Louis, to be kept up as a Botanic Garden open to the public, containing a museum and library.

On the recommendation of Dr. Asa Gray, Mr. William Trelease, who was then Professor of Botany in the Wisconsin University at Madison, was appointed in 1885 Director of the Garden, a post which he still holds, and provision was made for the establishment of a school of botany and the endowment of six scholarships for garden pupils, each worth 300 dollars a year, with free lodging and free tuition.

The present volume contains a biographical sketch of the founder of the Gardens; a copy of his will; of the Act that was passed to enable him to convey the land to the trustees, and of the deed of gift for the endowment of the School of Botany; a copy of the inaugural address by Prof. Trelease, when the School of Botany was founded; also of the first annual report of the Director; of the proceedings at the first annual banquet of the trustees, to which a large number of eminent men of science and other guests were invited; and of the first annual flower sermon, which was preached in Christ Church Cathedral on May 18, 1890, by the Bishop of Missouri. The book is illustrated by plans of the garden, a large number of views of the museums and other buildings, including Mr. Shaw's house and a fine statue of Humboldt.

Everything is now in full working order, and we have just received from Prof. Trelease a capital synopsis of the American species of the difficult genus Epilobium, containing full botanical descriptions and figures of all the species. The herbarium now contains about 20,000 mounted sheets of flowering plants and ferns, also a large collection of Fungi and other Cryptogamia.

J. G. B.

Géologie: Principes—Explication de l'Époque Quaternaire sans Hypothèses. Par H. Hermite. Pp. 145. (Neuchatel, 1891.)

ON taking up this little book the geological reader is at once struck by the words "sans Hypothèses" in the title. A volume on Pleistocene geology free from hypotheses would seem to him to usher in a new era in geology, and would be most heartily welcomed by him. The title of the present work, however, is misleading; the book is almost entirely devoted to theoretical explanations of purely hypothetical facts. We have not space to notice in detail the various subjects of which the author treats, but as an example of his method we may point to his "Origine des Pluies Quaternaires" (p. 39). In this section he accepts the hypothetical Quaternary "Pluvial Period"—which, by the way, seems to have been characterized by a singularly poor aquatic fauna and flora—and he then accounts for the supposed excessive rainfall during Tertiary and Quaternary time by the amount of vapour thrown out by volcanoes, adding that the small rainfall of the Secondary periods is accounted for by the absence of volcanic action during those periods! Then we meet with our old acquaintance the former excess of carbonic acid in the air and its influence on the ancient climate of the polar regions—possibly correct, but certainly hypothetical. Further on, speaking of the origin of the continental platform at a depth of 200 metres, the author states that this feature results from the raising of the general level of the sea from the melting of the Quaternary ice; and from this hypothetical raising he arrives at the result that the mass of the Quaternary ice corresponded to the total mass of the sea now lying above the level of the continental platform. Another speculation relates to the breaking through of the Indian Ocean across Siberia to the Polar seas, thus causing a milder climate, and accounting also for the parallel roads of Glen Roy and the terraces in Norway and Greenland. We cannot pretend to follow the reasoning, but it is all somehow connected with the author's theory "qu'à une diminution de la densité des mers correspond un abaissement de leur surface."

C. R.

Webster's International Dictionary of the English Language. Revised and Enlarged under the Supervision of Noah Porter, D.D., LL.D. (London: George Bell and Sons. Springfield, Mass. U.S.A.: G. and C. Merriam and Co.)

WEBSTER'S Dictionary is so well known on both sides of the Atlantic that it is unnecessary to do much more than note the appearance of the present edition. The work was published originally in 1828, after which it was steadily improved in successive issues. It has now been revised so thoroughly, and with the aid of so many competent scholars, that for popular use it can hardly fail to maintain the ground it has already won. Much prominence is given to "the definitions and illustrations of scientific, technological, and zoological terms," and in the preface to the English edition it is stated that no pains have been spared to make this part of the book "as perfect as possible in both text and illustration." The definitions in particular branches of science have been revised by such men as Prof. H. A. Newton and Prof. E. S. Dana—names which are a sufficient guarantee for the way in which the task has been accomplished. In the department of etymology, Prof. E. S. Sheldon, of Harvard University, has carefully dealt with the results presented in the last edition, bringing them into accord with the philological ideas of the present day. The pictorial illustrations are numerous, and well adapted to the purposes for which they are inserted.

Elementary Chemistry; for Beginners. By W. Jerome Harrison, F.G.S. (London: Blackie and Son, 1890.)

THIS volume of 144 pages consists of an expansion of the author's notes of lessons prepared for teaching children from nine to thirteen years of age according to the outlines given in the education code. The information is conveyed in familiar language, and each chapter closes with a series of questions which are well calculated to test the child's progress. It is a pity to issue any book that deals with scientific matters without a contents table and an index, and we fear that the absence of these in the present case will lead to inconvenience. And we would suggest that the quantities selected for the examples might approximate more closely to those most generally employed. The hydrogen from the use of a ton of zinc, the preparation of 1000 lbs. of carbon dioxide, eighteen quarts of oxygen mixed with an equal volume of hydrogen and exploded, ten gallons of hydrogen mixed with half its volume of chlorine and exposed to sunlight, indicate experiments on an extravagant if not an appalling scale. These, however, are matters of detail. The notes of so successful a teacher as Mr. Jerome Harrison cannot fail to be valuable to others who are engaged in a like work as well as to the students themselves.

Examination of Water for Sanitary and Technical Purposes. By Henry Leffmann, M.D., Ph.D., and William Beam, M.A. Second Edition. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1891.)

THE fact that a second edition has been called for only two years after the issue of the first, shows that this excellent hand-book has been very generally appreciated. The authors have revised the work and made many additions to it chiefly of processes that have recently grown in importance. Among the principal of these additions, we observe that the three pages on "Living Organisms in Water" of the first edition are now expanded into a chapter of thirteen pages entitled, "Biological Examinations." A table of culture phenomena of some of the more important microbes is given. But concerning this matter the authors state that "until pathogenic microbes are more clearly indicated and described, the methods will be of little use in dealing with the problem of the determination of the sanitary and technical value of water supplies."

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.*]

The University of London.

I DO not wish to criticize in the least Prof. Lankester's valuable statement in your last issue, with which I entirely agree; but I desire to point out that unless some energetic action is taken very soon we are likely to be farther than ever from the ideal which he has in view—namely, the establishment of a strong professorial University in London. The only scheme at present in the field is that put forward by the Councils of University and King's Colleges in the proposed charter for an Albert University.

This scheme has never met with the cordial support of a large section at least of the teaching staff of University College, and for the very obvious reason that it does not constitute a professorial University, but creates a new examining body on which the two Colleges will be, in the beginning at any rate, largely represented. The Albert University charter would create a second Victoria University in London. Now, both Mr. Dyer and Prof. Lankester are agreed that we do not want a federal University like Victoria in London; but they seem to forget that this pettifogging excuse for a University—a scheme drafted by bureaucratic rather than academic minds—is the only scheme in the field, and that, further, the Lord President of the Council has determined to hear by counsel, on an early day in June, what can be said for and against this scheme. It is further rumoured that the Burlington House Senate intends, after its recent discomfiture, to remain absolutely neutral. The danger, then, that we shall have a repetition in London of the difficulties of Manchester is a very immediate one. Let me point out exactly the anomalies of the Albert scheme. In the first place, it does not create a teaching University, but a new examining body. The University as such will have no control over the appointment of the professoriate either at University or King's Colleges, it will have no funds to dispose of, and there will be nothing to prevent rival second-rate teachers and teaching equipment instead of first-rate central teaching and central laboratories. For example, at the present time, putting aside the Central Institute, we have some half-dozen second-rate physical laboratories in London, but not a really first-class one worthy of a modern University among them. So long as there is competition between the Colleges, so long as they possess a double staff competing at every turn with each other for students' fees, this is unlikely to be remedied. Prof. Lankester speaks of a *union* of King's and University, and talks about their *combined* resources. The fusion of these two Colleges would certainly be the first stage to a true professorial University in London, but there is nothing in the Albert charter to bring this about: it unites the two Colleges not for teaching but for examining purposes. But what is still worse, while these two Colleges will remain autonomous, the Albert charter proposes to admit any further autonomous bodies, the teaching of which can be shown to have reached a certain academic standard. These bodies will not be absorbed, but their independent staffs will be represented on the Faculties and Senate. Here we have in fact the University of London over again,—at first composed almost entirely of the two Colleges, afterwards embracing all sorts and conditions of institutions in London, and ultimately open to every isolated text-book reader in the universe. It cannot be therefore too strongly insisted upon that the Albert charter, if granted, will not call into existence a professorial University, but federate a group, and an ever-widening group, of competing institutions for the purposes of *examination*. If it sheds for a time any additional lustre on the teaching staffs of the two Colleges—which I am much inclined to doubt—it will not achieve, what most of us have at heart, the establishment in London, at any rate in the germ, of a great University in the Scottish or German sense. A University, on the scale we hope for, would *absorb* the plant of University and King's Colleges, of the Royal College of Science, and of the Central Institute without the least difficulty. With the death or transference of existing teachers, whose pecuniary interests would have of course to be carefully safeguarded, special branches of higher teaching and research might be localized at these various centres,[1] and we thus might reach in the future an efficient University organization in London. This may indeed be considered a merely ideal future, but any scheme like the proposed Albert University, which will only impede its ultimate realization, ought to meet with strenuous opposition from those who believe that a great professorial University must sooner or later be established in London.

The difficulty as to the granting of medical degrees will for long be the stumbling-block of any scheme, but the true way to surmount it seems to be that suggested by Prof. Lankester—namely, the complete divorce of the clinical teaching at University and King's Colleges from the science teaching, and the establishment of separate clinical schools at the existing College hospitals on precisely the same footing with regard to the University as the other medical schools. The preliminary science teaching at the various medical schools might then be safely intrusted to University readers, who might continue to be, as they now largely are, peripatetic. These readers would naturally belong to the science faculty of the new University, and if largely paid by students' fees might be trusted to safeguard the "preliminary scientific interests" of the medical schools. It seems to me, therefore, that some vigorous effort ought to be made to obtain the modification of the Albert University scheme in the sense indicated by the following proposals:—

PROPOSALS *in re* TEACHING UNIVERSITY.

No scheme for the constitution of a teaching University in London will be satisfactory which does not:

1. Place the appointment of the teaching staff, as well as the control of laboratories, libraries, and buildings, in the hands of a single executive body, hereinafter spoken of as the new University Senate, or of bodies, such as Faculties or boards of study, to which it may delegate its powers.

2. Confer on the new University Senate the power of granting degrees in all Faculties, including that of Medicine.

3. Give to the teaching staff an immediate representation of one-third, and an ultimate representation of at least one-half, on the new University Senate.

These conditions would probably be best fulfilled by:

4. The immediate fusion of the Councils of University and King's Colleges, and the Council or Governing Body of any other institution doing work of admittedly academic character in London, which may be willing that its laboratories and equipment should be placed under the control of the new University Senate.

[This would remove any ground from the objection that the two Colleges are claiming powers which they are not willing to share with the Royal College of Science or the Central Institute. It provides for these latter coming into the scheme on the same terms, if that is possible.]

5. The granting of a Charter to a body consisting of these combined Councils together with representatives of the teachers in the combined institutions.

6. The constitution of the new University Senate in the following manner:—

A. Immediate constitution—

(1) The fused Councils of King's and University Colleges or their representatives.

(2) The Councils of other academic bodies in London willing to be absorbed, or their representatives.

(3) Representatives of the teachers to the extent of one-third of the total number.

B. Ultimate constitution—

(1) University professors, either as *ipso facto* members or as representatives of the body of professors.

(2) Representatives of the Faculties (*i.e.* of the readers and professors of each Faculty).

(3) Co-optated members, not to be selected from the teaching staff.

And possibly,

(4) Representatives of bodies willing to endow professorships in the new University, or to hand over to the control of the University existing professorships or lectureships, *e.g.* (*a*) the Corporation of the City and the Mercers' Company as trustees of Sir Thomas Gresham's estate; (*b*) the Inns of Court—provided these bodies are willing to attach the Gresham Lecturers and the Readerships instituted by the Council of Legal Education to the new University.

(5) Representatives of the Medical Schools and Royal Colleges of Physicians and Surgeons other than those selected by the Medical Faculty. This would only be a matter for consideration when the power to grant medical degrees became actual.

7. The transition from the immediate to the ultimate constitution of the new University Senate in the following manner:—

(*a*) By not filling up vacancies among the members contributed to the new Senate by the existing College Councils as such occur.

(*b*) By the increase of professorial members and representatives of the Faculties.

[1] *Elementary* teaching in many branches might for local convenience be still carried on at several centres.

8. The suspension of the power to grant medical degrees until such time as the Senate of the new University shall have satisfied the Lord President of the Council that an agreement has been reached with the Royal Colleges and the chief London Medical Schools as to the terms on which medical degrees shall be granted.

9. Providing, on the repeal of the Acts of Incorporation of University and King's Colleges which would accompany the granting of the new Charter, special regulations for the control of certain portions of the endowments or of certain branches of the College teaching, which it may not seem possible or advisable at present to hand over without special conditions to the management of the new Senate. For example, the Department of Divinity at King's College.

10. Paying due regard to the pecuniary interests of existing teachers (many of whom depend entirely upon students' fees) in the appointment of future University professors or readers.

11. Offering those professors of the existing Colleges, who might be willing to surrender the title of College professor, that of University reader, but not creating the occupants of chairs in any of the existing Colleges *ipso facto* professors in the new University.

In this mere sketch I have said nothing as to how faculties and boards of study might be constituted or as to how the University should grant degrees, for these seem to me "academical" problems, *i.e.* problems to be thrashed out by the University itself when it is once incorporated. Objection will be taken to much of the above by many individuals, but I believe it foreshadows the direction in which the *only scheme at present under discussion* must be modified if it is to lead to the ultimate establishment of a great teaching University in London, and not to a mere organization of teachers for examination purposes.

KARL PEARSON.

IT seems to me that the force of the arguments of Profs. Lankester and Ramsay in last week's NATURE (May 28, pp. 76, 78), so far as they harmonize with each other, would have to be admitted, if the main object of a University were to foster that premature specialism, which, under the scholarship system, has already wrought great mischief to real education in this country, or to increase as far as possible the number of clever but half-educated specialists, with which a close acquaintance with any of the great scientific societies makes one only too familiar. The example of this has been well set by at least one of the great metropolitan day schools. The fatal weakness of the arguments referred to is that they ignore, as no University ought to do, the claims of general education. If the advancement of scientific research is really desired by University and King's Colleges, all they have to do is to institute on their own account a diploma of the nature of the Associateship of the Royal School of Mines or College of Science, and make the training for it so good and thorough that the possessors of such a diploma shall be such a *desideratum* in those "commercial" quarters to which Prof. Ramsay appeals as a sort of final authority, that they shall drive such creatures as B.Sc.'s out of the field. Special brain-power, highly developed, is no doubt a splendid thing in its way, and recognition of it in the field of science is fully provided for in the B.Sc. honours, and in the ultimate D.Sc. degree; but, in considering the terms on which a *degree* should be given, general education and culture cannot be left out of account. In Germany something of the sort is guaranteed by the examinations which have to be passed on leaving the gymnasium (or high school) before students proceed to the University to specialize; in England it has been found necessary to institute the matriculation examination. That need, however, is no longer so imperative as it was; and for my own part I see no real objection to the "leaving certificate" of the Oxford and Cambridge Examining Board being accepted in lieu thereof; for I speak of what I know, when I say that this carries with it a guarantee of as much education and culture as the Matriculation Examination does, and often a great deal more. I would only stipulate that it should include one modern language and one branch of science.

Prof. Ramsay has over-ridden his horse, by the emphatic preference he gives to a German degree. He is a comparatively young man; but some of us (who are not yet quite senile) can remember the time when the facilities for obtaining the German Ph.D. degree were such (they are such to this day in America) that the degree became a by-word and a reproach, and still carries with it suspicions altogether disadvantageous to those who have taken the genuine degree in Germany. This is surely a warning against the multiplication of small Universities in this country. Again, if the time-honoured Universities of Oxford and Cambridge are not proof against the temptation to swell the contents of the University chest by accepting fees for the silken degree of M.A., which in the eyes of the *vulgus* is supposed to represent higher intellectual attainments than the B.A., can we expect greater virtue in a small and brand-new University struggling to "make both ends meet"? Were any further illustration required of the way things would be likely to drift with small and independent degree-granting corporations, we might find it in the readiness with which the authorities of King's College threw over Latin two years ago in the mercantile department of their school (then in a state of depression), at the mere bidding of the Chambers of Commerce, although its retention had been advocated by two leading scientific men. The really inspiring motive of this agitation is, I think, astutely kept in the background.

A. IRVING.

Wellington College, Berks, June 1.

ONE of the taunts most frequently levelled at the London University—or "Burlington Gardens," to use Prof. Lankester's favourite expression—by certain professors of University College and other advocates of a "teaching University in and for London" is, that the present University is a "mere examining board." The University has, it is true, a Brown Professor of Physiology and Pathology, who delivers annually a course of lectures relating to the studies and researches carried on at the Brown Institution. But this professorship is an exception, though the University, by accepting the Brown Trust, showed clearly enough that it did not recognize any obligation to abstain from appointing University Professors and Lecturers. We have been previously told that there was a "tacit understanding" at the foundation of the University that this should not be done. But Prof. Ray Lankester goes far beyond the assertion of a "tacit understanding." He talks of "pledges" given by the founders of the University being "falsified," and "most solemn obligations" violated—terrible crimes, which, however, have been committed already by the appointment of the Brown Professor. But how such "obligations" and "pledges," or even a "tacit understanding," could ever have existed, I fail altogether to see, for it was the expressed intention of the founders of the University that its powers and privileges should be the same as those of the Universities of Oxford and Cambridge. Testimony as to this pledge may be found in the evidence given before the recent Commission. The late Dr. Carpenter's view of this matter was stated by Mr. Dickins in his communication to NATURE. Convocation has, years ago, voted in favour of the establishment of University Professorships and Lectureships, though I do not in the least believe that the graduates would sanction any proposal involving that the University should prepare candidates for its examinations, or compete with the ordinary work of the Professors in University College and other similar institutions. Whether research is or is not carried on successfully at University College is a matter on which I express no opinion. But, however this may be, it should be remembered that the students of this College have become only a small fraction of the candidates for London degrees. It would be, it seems to me, in the public interest that the University should make provision for the encouragement and reward of those among the great majority of its members who show a capacity for research and a power to extend the boundaries of knowledge. That the University has only one solitary Professor is due, I believe, in great measure to the narrowminded and unwise jealousy of University College, and to the fear lest some endowments should chance to be diverted to the University.

Prof. Lankester abandons altogether the scheme set forth in the Draft Charter of the "Albert University of London." This Charter proposed the establishment of a University whose range of activity should extend over colleges or other institutions in an area with a diameter of thirty miles. Prof. Lankester's ideal University, which would still be federal, is to consist only of University and King's Colleges. These institutions have not as yet shown any disposition to amalgamate the one with the other, and such a disposition is not likely to arise. They are, in fact, founded on distinct principles. The motto of the one, if I recollect rightly, is *Cuncti adsint* and of the other *Sancte et sapienter*. Some time ago I heard of a Society of University

College students being compelled to meet elsewhere instead of in the College on account of there being something of a religious character connected with their meetings, while there are facts of a different character in the history of King's College which may be easily remembered. That a federal University consisting of institutions so dissimilar would work harmoniously I very much doubt. Probably the graduates of the existing University would care but little, except on general public grounds, about University and King's Colleges having power to grant degrees, if as a University they would assume a name not likely to be mistaken for that of the University of London. As yet the Victoria University is not a conspicuous success, and the London University examinations are still held at Owens College.

With the views set forth by Mr. Thiselton Dyer I should be disposed in great measure to agree, though there are some points on which I should have liked to make some remarks; but I fear, if I did so, I should trespass too far on your space.

London, May 29. THOMAS TYLER.

THOSE who have taken part in the interesting discussion on the University of London, in your columns, have all viewed the subject from the academic standpoint. Would it not be well to consider it also from another point of view, viz. that of the educational needs of London? Prof. Ramsay contends "that a University is primarily a place for the extension of the bounds of knowledge." It is surely more accurate to say that a University, under the conditions that now exist, has two main functions—the one the extension of the bounds of knowledge by research, and the other the wide diffusion of that knowledge. The purpose of such diffusion should be to afford, as far as possible, to every individual the opportunity of obtaining such a training as would qualify him or her to take part in the development of some branch of knowledge, or at any rate to follow with appreciation and interest the advance made by others.

It needs no argument to show that it would be for the advantage of research, and for the well-being of the community, that real University training should be as widespread as possible. Ability and bent for some special study may frequently not be developed until somewhat late in life, after a business career has been begun. There is scarcely a branch of science that does not owe much to investigators whose researches were carried on during hours spared from some bread-winning occupation. The late Prof. John Morris was in early life a chemist in the Borough; Dr. James Croll was for years the janitor of the Andersonian University, Glasgow; even in the very number of NATURE containing Mr. Dyer's letter, the case of M. Rouault, one of the pioneers in the geology of Brittany, is mentioned, who did his early work while carrying on the business of hairdresser. A University training would have been of inestimable value to such students as these (and there are hundreds of such, with capacity for good work, scattered over London and the country), but no provision is made for them in our existing system.

Surely the important question therefore is, What kind of University would discharge most effectively for London the duty of providing for the needs of every class of students? The University should clearly recognize all organized teaching of University rank, whether given within the walls of a specified College or not. One of the most urgent needs of London is a co-ordinating head for all its multifarious higher educational agencies. The only University that will really adequately meet the needs and stir the enthusiasm of Londoners will be a University in vital relation with and directing and controlling all the higher teaching of the metropolis. This would, no doubt, be a new type of University, but the changed conditions of these times necessitate large modifications in the constitution of our institutions. This is sufficiently illustrated by the fact that the University of London itself was a new type of University, as also was the more recent Victoria University.

The new teaching University for London should have as its accredited professors and lecturers the staffs of University and King's Colleges, the Royal College of Science, the various medical schools, and any other institutions of equal rank, and in addition a large staff of lecturers at work in different parts of the metropolis at convenient centres. It would be possible, by an extension of the principle admitted into the draft scheme for the re-constitution of the University of London, viz. that of requiring from every University teacher a syllabus of his course of teaching, and further, by making such syllabus the basis of the examination, to incorporate all the work done by the accredited teachers of the University into its curriculum for degrees. This would make it possible to open up a University career to evening students. While day students would complete their course of study in three or four years, evening students would take nine or ten, and the curriculum could without serious difficulty be modified to meet the conditions.

May 30. R. D. ROBERTS.

I WOULD ask whether it is quite fair to assume that, because Convocation has rejected the Charter proposed for the University of London, it therefore follows that that body is out of sympathy with the attempts that are being made to establish a "real University," whatever that may mean. Is it not possible that a large proportion of those adverse votes were recorded because there were elements in the scheme which were felt to be impracticable or open to serious objection? At all events, I feel sure that there are many who would refrain from regarding the vote as being an expression on the main issue.

The views so well put forward by Prof. Ray Lankester as to the undesirability of establishing what he terms federal Universities fully enlist our sympathies; but are we not sailing very near the wind in the suggestion that University and King's Colleges and "other institutions" should be incorporated on University lines?

I say, by all means avoid centralization and beware of the "never-ending Committees and schedules of such clumsily-organized Universities." But what of value is then left that University College does not already possess? Would the appropriate definition and allotment of degrees of all shades and grades have contributed one iota to the work and influence of Graham, Sanderson, Sharpey, Foster, Williamson, and Prof. Lankester himself, or have added to the benefit they have conferred upon University College? One does not surely regard the granting of degrees as an important element in the German University: its distinguished professors are not Berlin men or Strassburg men—they are pupils of Liebig, of Wöhler, of Bunsen, and the like; and its students are not regarded as graduates of Heidelberg or Giessen, but in like manner as pupils of so-and-so. And University College is, I take it, much more nearly in function a German University now than ever it is likely to be as a federal University. I verily believe that such is the taste of the so-called properly ordered English mind for schemes, plans, and organizations, that a governing body, even though largely composed of the most uncrystallizable elements, would shortly be found carefully hedging itself round (and the students) with that beautiful machinery which Prof. Lankester so heartily detests. Prof. Ramsay's association of "examination on the brain" with the London University undergraduate I fear does the said undergraduate an injustice, if it is meant to differentiate him from his fellows of the "real Universities."

The men who regard the College Calendar with its traditional questions as their *vade mecum*, and whose only other study is the idiosyncrasies of the examiner, are ubiquitous, and their name is legion. If I could think they were confined to the "Burlington Gardens University," I, for one, would vote against the alteration of one jot or tittle of the present organization, if only lest they might be disturbed from their resting-place there. G. H. BAILEY.

May 30.

Quaternions and the Ausdehnungslehre.

PROF. GIBBS' second long letter was evidently written before he could have read my reply to the first. This is unfortunate, as it tends to confuse those third parties who may be interested in the question now raised. Of course that question is naturally confined to the invention of methods, for it would be preposterous to compare Grassmann with Hamilton as an analyst.

I have again read my article "Quaternions" in the *Encyc. Brit.*, and have consulted once more the authorities there referred to. I have not found anything which I should wish to *alter*. There is much, of course, which I should have liked to extend, had the Editor permitted. An article on Quaternions, rigorously limited to four pages, could obviously be no place for a discussion of Grassmann's scientific work, except in its bearings upon Hamilton's calculus. Moreover, had a similar article on the *Ausdehnungslehre* been asked of me, I should certainly have declined to undertake it. Since 1860, when I ceased to be a Professor of Mathematics, I have paid no special attention to general systems of *Sets*, *Matrices*, or *Algebras*; and without much further knowledge I should not attempt to write in any detail about such subjects. I may, however, call attention to the facts which follow; for they appear to be decisive of the question now raised. Cauchy (*Comptes Rendus*, 10/1/53) claimed *quaternia* as a special case of his "clefs algébriques." Grassmann, in turn, (*Comptes Rendus*, 17/4/54; and *Crelle*, 49) declared Cauchy's methods to be precisely those of the Ausdehnungslehre. But Hamilton (*Lectures*, Pref. p. (64), foot-note) says of the clefs algébriques (and therefore, *on Grassmann's own showing*, of the methods of the Ausdehnungslehre) that they are "*included* in that theory of SETS in algebra . . . . . . announced by me in 1835 . . . . . . of which SETS I have always considered the QUATERNIONS . . . . . . to be merely a *particular* CASE."

But all this has nothing to do with Quaternions, regarded as a calculus "*uniquely* adapted to Euclidian space." Grassmann lived to have his fling at them, but (so far as I know) he ventured on no claim to priority. Hamilton, on the other hand, even after reading the first *Ausdehnungslehre*, did claim priority and was never answered. He quoted, and commented upon, the very passage (of the *Preface* to that work) my allusion to which is censured by Prof. Gibbs. [*Lectures*, Pref. p. (62), foot-note.] I still think, and it would seem that Hamilton also thought, that it was *solely because Grassmann had not realized the conception of the quaternion*, whether as $\beta\alpha$ or as $\beta\alpha^{-1}$, that he felt those difficulties (as to angles in space) which he says he had not had leisure to overcome. I have not seen the original work, but I have consulted what professes to be a *verbatim* reprint, produced under the author's supervision. [*Die Ausdehnungslehre von* 1844, *oder die lineale Ausdehnungslehre, &c. Zweite, im Text unveränderte Auflage. Leipzig*, 1878.] Prof. Gibbs' citations from my article give a very incomplete and one-sided representation of the few remarks I felt it necessary and sufficient to make about Grassmann. I need not quote them here, as anyone interested in the matter can readily consult the article.

In regard to Matrices, I do not think I have ever claimed anything for Hamilton beyond the *separable* ϕ, and the symbolic cubic (or biquadratic, as the case may be) with its linear factors; and these I still assert to be exclusively his. My own work in this direction has been confined to Hamilton's ϕ, with its square-root, its applications to stress and strain, &c.

As to the general history, of which (as I have said above) I claim no exact or extensive knowledge, Cayley and Sylvester will, no doubt, defend themselves if they see fit. It would be at once ridiculous and impertinent on my part were I to take up the cudgels in their behalf. P. G. TAIT.

The Spinning Ring.

I CANNOT suppose that the mathematicians are all in error; but venture modestly to ask what are the assumed conditions under which a girdle round the earth at the equator would be subject to strain. If the surface of our globe at the equator were continuous and level land, about 30,000,000 of persons—more than 1000 to a mile—standing at equal distances and joining hands, would form a girdle without any strain, or the girdle might be formed of separate pieces of wire placed end to end in close contact, which, if afterwards soldered, would form a girdle, without strain.

Then, it is stated, in NATURE, vol. xliii. p. 514, that a wire girdle supported on poles, if "relieved from gravitation," but acted upon by a (greatly augmented) "centrifugal force *equal* to the cable's weight"—that is, by an equal force acting in the opposite direction—would be subjected to a 20 *fold* strain. Why? REGINALD COURTENAY.

4 Serjeants' Inn, Fleet Street, April 30.

BISHOP COURTENAY'S questions may perhaps be clearly answered as follows. The centrifugal force of a free spinning hoop has to be balanced by its peripheral tension; but this, having a large tangential and a small radial component, acts at a disadvantage, and may have to be very big to balance even a moderate centrifugal force. The larger the hoop the more marked is the magnitude of the tangential component as compared with the radial or effective component; so that a hoop 8000 miles in diameter could not rotate even once a day without tearing itself asunder.

An actual girdle round the earth is not dependent on peripheral tension for balancing its centrifugal force, since it is subject to an overpowering centripetal force due to the earth's gravitation.

The statement made by Mr. Herschel on p. 514, vol. xliii., involved not a 20-fold stress but a 20-fold speed, which means a 400-fold stress. OLIVER J. LODGE.

The Use of Startling Colours and Noises.

LAST January a friend showed me a smew (*Mergus albellus*) shot on the Dee, near Chester, the crop of which he had found to be full of young flat-fish. He called attention to the dazzling whiteness of the bird's breast, and suggested that it must frighten the fish, and so be a disadvantage to it. A little consideration showed that the effect would be precisely the reverse. As long as the flat-fish remains at rest, its colouring assimilates so closely to the sand on which it lies, and with which it partly covers itself, that it would not be easily seen by the smew. But if, startled by the white object flashing down on it from above, it moves, it is seen at once, and of course captured. Anybody who has ever collected small insects, such as beetles, will admit the truth of this at once.

The same effect is probably produced by the hooting or screaming of owls when hunting at night. A mouse, which would be invisible even to the sharp eyes of an owl when motionless, would be seen at once if startled into motion by the sudden "shout" of the bird, whose noiseless flight had brought it unperceived into close proximity.

Perhaps these suggestions may serve to explain other apparent difficulties in the way of natural selection.

The brown owl hoots throughout the winter here, so that it cannot be a sexual call. ALFRED O. WALKER.

Nantyglyn, Colwyn Bay, May 25.

The Formation of Language.

I PERCEIVE that my note on the evolution of speech in the case of one of my children has excited some interest and called out communications both to myself and to you; but I must trespass again on your kindness to explain that what I considered noteworthy in that case was not the invention of words, which is not of rare occurrence, but the, to me, far more important phenomenon of the evolution of the habit of speech through the three stages, so distinctly marked in this case—of simulation, the faculty we share with the monkey, and which does not imply the possession of the idea; of invention of symbols, which indicates the birth of the power of conception, and perhaps the formation of what Max Müller calls "concepts," and the perception by the young mind of a community of interest and intelligence; and, finally, the faculty of learning from others ideas already formed, or what must be considered the germ of science: and it was the clear demarcation of the three states which interested me more than the mere invention of words. And this interest is the greater as the case appears to illustrate a law that the development of the individual follows the lines of the universal, so that the child but repeats, in a very much abbreviated sequence, what humanity had gone through as a whole. My purpose in bringing the case before your readers was rather to invite the repetitions of my observations with a view to the establishing of the law, than to publish an isolated phenomenon. W. J. STILLMAN.

Rome, May 8.

Cordylophora lacustris.

IT will be interesting to zoologists to know that Prof. Weldon recently found very large quantities of *Cordylophora lacustris* on submerged roots and stems in the Rivers Ant, about Ludham Bridge, and Thurne, at Heigham Bridges, Norfolk. From my own knowledge, I can say that it is very generally met with throughout the whole system of rivers and broads in connection with the Bure. At the places spoken of, a fresh-water tide of from 6 to 18 inches is felt. I think I am safe in saying that a salt tide has but once been known so high up these rivers.

JOHN BIDGOOD.

7 Richmond Terrace, Gateshead-on-Tyne.

ON SOME POINTS IN THE EARLY HISTORY OF ASTRONOMY.[1]

IV.

FROM what has been stated it is not too much to assume that the Egyptians observed the sun on the horizon. This being so, the chances are that at first they would observe the stars on the horizon too, both stars rising and stars setting; and that is rendered more probable by the very careful way in which early astronomers defined the various conditions under which a star can rise or set, always, be it well remembered, in relation to the sun. They spoke of a star as rising or setting achronically, heliacally, or cosmically.

The cosmic rising meant that the star rose, and the cosmic setting meant that the star set, at the same moment as the sun—that is, that along the eastern horizon we should see the star rising at the moment of sunrise, or along the western horizon a star setting at the moment of the sun setting. The achronical rising is different from the cosmic in this respect—that we have the star rising when the sun is setting and setting when the sun is rising. Finally we have the heliacal rising and setting; that is taken to be that the star appeared in the morning a little in advance of the sunrise, or set at twilight a little later than the sun. The following table from Biot[1] should make matters quite clear:—

Star at eastern horizon. ... Rising. ...	Morning. ...	True or cosmic.	Sun rising.
	Morning. ...	Apparent or heliacal.	Sun not yet risen, but depressed below horizon sufficiently to enable the star to be seen.
	Evening. ...	True or achronic.	Sun setting.
	Evening. ...	Apparent or heliacal.	Sun just set, and depressed below horizon sufficiently to enable the star to be seen.
Star at western horizon. ... Setting. ...	Evening. ...	True or cosmic.	Sun setting.
	Evening. ...	Apparent or heliacal.	Sun set, and depressed below horizon sufficiently to enable the star to be seen.
	Morning. ...	True or achronic.	Sun rising.
	Morning. ...	Apparent or heliacal.	Sun not yet risen, but depressed below horizon sufficiently to enable the star to be seen.

It is Ideler's opinion that, in Ptolemy's time, in the case of stars of the first magnitude, for heliacal risings and settings, if the star and sun were on the same horizon a depression of 11° was taken; if on opposite horizons a depression of 7°. For stars of the second magnitude, these values were 14° and 8½.° But if temples were employed as I have suggested, even cosmic and achronic risings and settings could be observed in the case of the brightest stars.

Before we begin to consider the question of stars at all, we must be able to describe them, to speak of them in a way that shall define exactly what star is meant. We can in these days define a star according to its constellation or its equatorial or ecliptic co-ordinates, but all these means of reference were unknown to the earliest observers; still we may assume that the Egyptians could define some of the stars in some fashion, and it is evident that we here approach a matter of the very highest importance for our subject.

So far, as we have been dealing with the sun and the observations of the sun at rising and setting, we have taken for granted that the amplitude of the sun at the solstices does not change; the amplitude of 26° at Thebes, for the solstices, is practically invariable for a thousand years; but one of the results of astronomical work is that the *stars* are known to behave quite differently. In consequence of what is called precession the stars change their place with regard to the pole of the heavens, and further, in consequence of this movement, the position of the sun among the stars at the solstices and equinoxes changes also.

In the last lecture we considered what were called the ecliptic and the equatorial co-ordinates. The ecliptic was the plane in which the earth moves round the sun, and 90° from that plane we had the pole of the heavens; celestial latitude we found reckoned from the plane of the ecliptic north and south up to the pole of the heavens, and celestial longitude we reckoned along the plane of the ecliptic from the first point of Aries. We had also declination reckoned from the equator of the earth prolonged to the stars, and right ascension reckoned along the equator from the first point of Aries. The pole of the heavens then we must regard as fixed, but the pole of the earth is not fixed, but slowly moves round it. *In consequence of that movement there is a change of declination in a star's place.*

Going back to the tables, we find that the amplitude of a body rising or setting at Thebes or anywhere else depends upon its declination, so that if from any cause the declination of a star changes, its amplitude must change at any particular place.

That is the first point where we meet with difficulty, because if the amplitude changes it is the same as saying that the place of star rising or star setting changes; that is, a star which rose in the east in a certain amplitude this year will change its amplitude at some future time.

The real cause of the precession of the stars lies in the fact that the earth is not a sphere, its equatorial diameter being longer than its polar diameter, so that there is a mass of matter round the equator in excess of what we should get if the earth were spherical. Suppose that matter to be represented by a ring. The ring is differently presented to the sun, one part being nearer than the other, the nearer part being attracted more forcibly. If we take the point where there is the greatest attraction, and draw a line to the least, we can show that the case stands in this way: that the sun's pull may be analyzed into two forces, one of them between the sun and the point in a direction parallel to the line joining the centre of the sun and the centre of the

[1] Continued from p. 60.

[1] Biot, "Traité élémentaire d'Astronomie physique," 3rd edition, vol. iv. p. 625.

ring, and another force at right angles to it. The question is, what will that force at right angles do?

Here we have a model showing the rotation of the earth on its axis, and the concurrent revolution of the sun round the earth once a year. To represent the downward pull it is perfectly fair if I add a weight. Then the earth's axis, instead of retaining its direction to the same point as it did before, is now describing a circle round the pole of the heavens. It is now a recognized principle that there is, so to speak, a wobble of the earth's axis round the pole of the heavens in consequence of the attraction of the sun on the nearer point of this equatorial ring being greater than on the part of the equatorial ring removed from it. That precession movement is not quite so simple as it is shown by this model, because what the sun does in this way is done to a very much larger extent by the moon, the moon being so very much nearer to us.

In consequence, then, of this luni-solar precession we have a variation of the points of intersection of the planes of the earth's equator and of the ecliptic; in consequence of that we have a difference in the constellations in which the sun is at the time of the solstices and at the equinoxes; and, still more important, we have another difference, viz. that the declinations, and therefore the amplitudes, and therefore the places of setting and rising of the stars, change from century to century.

Having thus become acquainted with the physical cause of that movement of the earth's axis which gives rise to what is called the precession of the equinoxes, we have next to inquire into some of the results of the movement. The change of direction of the axis in space has a cycle of something between 25,000 and 26,000 years. As it is a question of the change of the position of the celestial equator, or rather of the pole of the celestial equator, amongst the stars in relation to the pole of the heavens, of course the declinations of stars will be changed to a very considerable extent; indeed, we easily see that the declination of a star can vary by twice the amount of the obliquity, or 47°, so that a star at one time may have zero declination—that is, it may lie on the equator—and at another it may have a declination of 47° N. or S. Or, again, a star may be the pole star at one particular time, and at another it will be distant from the pole no less than 47°. Although we get this enormous change in one equatorial co-ordinate, there would from this cause alone be practically no change with regard to the corresponding ecliptic co-ordinate—that is to say, the position of the star with reference to the earth's movement round the sun. This movement takes place quite independently of the direction of the axis, so that while we get this tremendous swirl in declination, the latitudes of the stars or their distance from the ecliptic north or south will scarcely change at all.

Among the most important results of these movements dependent upon precession we have the various changes in the pole star from period to period, due to the various positions occupied by the pole of the earth's equator. We thus see how in this period of 25,000 years or thereabouts the pole stars will change, for a pole star is merely the star near the pole of the equator for the time being. At present, as we all know, the pole star is in the constellation Ursa Minor. During the last 25,000 years the pole stars have been those lying nearest to a circle struck from the pole of the heavens with a radius of 23½°, which is equal to the obliquity of the ecliptic; so that about 10,000 or 12,000 years ago the pole star was no longer the little star in Ursa Minor that we all know, but the big star Vega in the constellation Lyra. Of course 25,000 years ago the pole star was practically the same as it is at present.

Associated with this change of the pole star there is another matter of the highest importance to be considered, because as the axis is being drawn round in this way, the point of intersection of the two fundamental planes, the plane of the earth's rotation and the plane of the earth's revolution, will be liable to change, and the period will be the same, about 25,000 years. Where these two planes cut each other we have the equinoxes, because the intersection of the planes defines for us the vernal and the autumnal equinoxes; when the sun is highest and lowest between these points we have the solstices. In a period of 25,000 years the star which is nearest to the equinox will return to it, and that which is nearest the solstice will return to it. During the period there will be a constant change of stars marking the equinoxes and the solstices.

The chief points in the sun's yearly path then will change among the stars in consequence of this precession. It is perfectly clear that if we have a means of calculating back the old positions of stars, and if we have any very old observations, we can help matters very much, because the old observations—if they were accurately made—would tell us that such and such a star rose with the sun at the solstice or at the equinox at some special point of ancient time. If it be possible to calculate the time at which that star occupied that position with regard to the sun, we have an astronomical means of determining the time, within a few years, at which that particular observation was made.

Very fortunately we have such a means of calculation, and it has been employed very extensively at different periods, chiefly by M. Biot in France, and quite recently by German astronomers, in calculating the positions of the stars from the present time to a period of 2000 years B.C. We can thus determine with a very high degree of accuracy, the latitude, longitude, right ascension, declination, and the relation of the stars to an equinox, a solstice, or a pole, as far back as 2000 years B.C. Since we have the planes of the equator and ecliptic cutting each other at different points in consequence of the cause which I have pointed out—the attraction of the sun and moon—we have a fixed equator and a variable equator depending upon that. In consequence of the attraction of the planets upon the earth, the plane of the ecliptic itself is not fixed, so that we have not only a variable equator but also a variable ecliptic. What has been done in these calculations is to determine the relations and the results of these variations.

A simpler, though not so accurate a method, consists in the use of the precessional globe, one of which I have here. In this we have two fixed points at the part of the globe representing the poles of the heavens, on which the globe may be rotated; when this is done the stars move absolutely without any reference to the earth or to the plane of the equator, but purely with reference to the ecliptic. We have, then, this globe quite independent of the earth's axis. How can we make it dependent upon the earth's axis? We have two brass circles at a distance of 23½° from each pole of the heavens (north and south), these represent the circle described by the pole of the earth in the period of 26 000 years. In these circles are 24 holes in which I can fix two additional clamping screws, and rotate the globe with respect to them by throwing out of gear the two points which produced the ecliptic revolution. If I use that part of the brass circle which is occupied by our present pole star, we get the apparent rotation of the heavens with the earth's axis pointing to the present pole star.

If we wish to investigate the position of things, say 8000 years ago, we bring the globe back again to its bearings, and then adjust the screws into the holes in the brass circles which are proper for that period. When we have the globe arranged to 6000 years B.C. (*i.e.* 8000 years ago), in order to determine the equator at that time all we have to do is to paint a line on the globe in some water-colour, by holding a camel's hair pencil at the east or west point. That line represents the equator 8000 years ago. Having that line, of course the intersection of the equator with the ecliptic will give us the equinoxes, so that we may affix a wafer to represent the vernal equinox. Or if we take that part of the ecliptic which is nearest to the north pole and therefore the declination of which is greatest, viz. 23½° N., we have there the position of the sun at the summer solstice, and 23½° S. will give us the position of the sun at the winter solstice. So by means of such a globe as this it is quite possible to determine the position of the equator among the stars, and note those four important points in the solar year, the two equinoxes and the two solstices. I have taken a period of 8000 years, but I might just as easily have taken a greater or a smaller number. By means of this arrangement, therefore, we can determine within a very small degree of error without any laborious calculations, the distance of any body north or south of the equator, *i.e.* its declination.

The positions thus found, say, for intervals of 1000 years, may be plotted on a curve, so that we can, with a considerable amount of accuracy, obtain the star's place for any year. Thus the globe may be made to tell us that in the year 1000 A.D. the declination of Fomalhaut was 35° S., in 1000 B.C. it was 42°, in 2000 it was about 44°, in 4000 it was a little over 42° again, but in 6000 B.C. it had got up to about 33°, and in 8000 B.C. to about 22°.

The curve of Capella falls from 41° N. at 0 A.D., to 10° at 6000 B.C., so we have in these 6000 years in the case of this star run through a large part of that variation to which I drew your attention.

Here is the curve of Sirius. This star, in 0 A.D., had a declination of 24° S.; but 5000 years B.C. it had a declination of something like 31½°. In Sirius we have the curve plotted from the computations of Mr. Hind, who has kindly placed them at my disposal. From other computations supplied by him, I have ascertained that the globe is a very good guide indeed within something like 1° of declination, always assuming that the star has no great proper motion. Considering the difficulty of the determination of amplitudes in the case of buildings, it is clear that the globe may be utilized with advantage, at all events in the first instance.

Now that we are familiar with the effect of the precession of the equinoxes in changing the amplitudes of the rising and setting places of stars, we can return to the consideration of the temples. So far, we have considered those built in relation to the sun, in the case of which body there is, of course, no precessional movement, so that a temple once oriented to the sun would remain so for a long time. After some thousands of years, however, the change in the obliquity of the ecliptic would produce a small change in the amplitude of a solstice.

Suppose we take, as before, that region of the earth's surface in the Nile valley with a latitude of about 26° N. The temples there built to observe the sun will have an east and west aspect true if they have anything to do with the sun at the equinoxes, and will have an amplitude of about 26° N. or S. if they have anything to do with the sun at the solstices.

The archæologists who have endeavoured to investigate the orientations of these buildings have found that they practically face in all directions; the statement is that their arrangement is principally characterized by the want of it; they have been put down higgledy-piggledy; there has been a symmetrophobia, mitigated by a general desire that the temple should face the Nile. This view may be the true one, if stars were not observed as well as the sun; for at Thebes, if any temple have an amplitude more than 26° N. or S. of E. or W., it cannot by any possibility have been used, as we have seen the temples at Karnak might have been used, for observations of the sun; for since the maximum declination of the sun is almost 24½° (it is at present only 23½°), represented by an amplitude of 27°, no temple oriented in a direction more northerly or more southerly could get the light of the sun along its axis.

Let us see, then, if the builders of them had any idea in their minds connected with astronomy. If they had, we may conclude that there was some purpose of utility to be served, as the solar temples were used undoubtedly, among other things, for determining the exact length of the solar year. When we come to examine these non-solar temples, the first question is, Do they resemble in construction the solar ones? Are the horizontal telescope conditions retained? The evidence on this point is overwhelming. Take the temple of Denderah. It points very far away from the sun; the sun's light could never have enfiladed it. In many others pointing well to the north or south, the axis extends from the exterior pylon to the Sanctuary or Naos which is found always at the closed end of the temple. We have the same number of pylons, gradually getting narrower and narrower as we get to the Naos, and in some there is a gradual rise from the first exterior pylon to the part which represents the section of the Naos, so that a beam of horizontal light coming through the central door might enter it over the heads of the people flocking into the temple, and pass uninterruptedly into the Sanctuary.

In these, as at Karnak, you see we have this collimating axis. We have the other end of the temple blocked; we have these various diaphragms or pylons, so that, practically, there is absolutely no question of principle of construction involved in this temple that was not involved in the great solar temple at Karnak itself.

We made out that in the case of the temples devoted to sun-worship, and to the determination of the length of the year, there was very good reason why all these attempts should be made to cut off the light, by all these diaphragms and stone ceilings, because, among other things, one wanted to find the precise point occupied by the sunbeam on the two or three days near the winter and summer solstices in order to determine the exact moment of the solstice.

But if a temple is not intended to observe the sun, why these diaphragms? Why keep the astronomer, or the priest, so much in the dark? There is a very good reason indeed; because the truer the orientation of the temple to the star, and the greater the darkness he was kept in, the sooner would he catch the rising star. In the first place, the diaphragms would indicate the true line that he had to watch; he would not have to *search* for the star which he expected; and obviously the more he was kept in the dark the sooner could he see the star.

The next point that I have to make is that in the case of some of these temples which are not directed to the sun we get exactly the same amplitudes in different localities. To show this clearly it will be convenient to bring together the chief temples near Karnak and those having the same amplitudes elsewhere.

We can do this by laying down along a circle the different amplitudes to which these various temples point. To begin with, I will draw your attention to those temples which we have already discussed with an amplitude of 27° or 26°, at Abydos, Thebes, and Karnak. Next we have non-solar amplitudes at Karnak and Thebes, associated with temples having the same amplitude at Denderah, Abydos, and other places. We have the majority of the non-solar temples removed just as far as they can be in amplitude from the solar ones, for the reason that they are as nearly as possible *at right angles* to them. We have temples with the same amplitudes high north and high south, in different places—temples, therefore, which could not have been built with reference to the sun; just as we have at different places temples with the same amplitudes which *could* have been used for solar purposes.

In connection with the possible astronomical uses of these temples, I find that when one of these temples has been built, the horizon has always been very carefully left open; there has always been a possibility of vision along the collimating axis prolonged. Lines of sphinxes have been broken to ensure this; at Medinet Abou, on the opposite side of the river to Karnak, we have outside this great temple a model of a Syrian fort. If we prolong the line of the temple from the middle of the Naos through the systems of pylons, we find that in the model of the fort an opening was left, so that the vision from the Sanctuary of the temple was left absolutely free to command the horizon.

It may be said that that cannot be true of Karnak, because we see on the general plan that one of the temples, with an azimuth of 71° N., had its collimating axis blocked by numerous buildings. That is true; but when one comes to examine into the date of these buildings, it is found that they are all very late; whereas there is evidence that the temple was one of the first, if not the very first, of the temples built at Thebes.

Mariette spent a long time in examining the temple of Karnak. His idea is that the part of the temple near the Sanctuary represents the first part of the building; and at that time the great temple of Karnak—enormous though it is now—was so small and entirely out of the way of the line of the axis of the temple of Maut that its existence might have been entirely neglected. There was first a square court like the court of the Tabernacle, and very shortly after that a very laboured system of pylons was introduced to restrict the light. The next stage shows the Sanctuary thrown back away from the court; then, after that, more complication is introduced by the addition of pylons, until finally, after two or three extensions, the length of the temple was quadrupled. So that the proof is positive that at first the horizon of the temple of Maut was left perfectly clear. Why it was subsequently blocked I shall suggest afterwards.

The next point to be noticed is that there is in very many cases a rectangular arrangement, so that if the sun were observed in one temple and a star in the other, there would be a difference of 90° between the position of the sun and the position of the star at that moment. This would, of course, apply also to two stars. Sometimes this rectangular arrangement is in the same temple, as at Karnak, sometimes in an adjacent one, as at Denderah.

If we look at Denderah we find that we have there a large temple inclosed in a square *temenos* wall, the sides of which are parallel to the sides of the temple; and also a little temple at right angles to the principal one.

It is hardly fair to say that a rectangular arrangement, repeated in different localities, is accidental; it is one which is used to some extent in our modern observatories.

The perpetual recurrence of these rectangular temples shows, I think, that in all the pairs of temples which are thus represented, there was some definite view in the minds of those who built them.

Another point is that, when we get some temples pointing a certain number of degrees south of east, we get other temples pointing the same number of degrees south of west, so that some temples may have been used to observe risings and others settings of stars in the same declination. It is then natural of course to conclude that these temples were arranged to observe the rising and setting of the same stars.

J. NORMAN LOCKYER.

(*To be continued.*)

BOTANICAL ENTERPRISE IN THE WEST INDIES.

WE have several times had occasion to mention the mission of Mr. D. Morris, the Assistant Director of the Royal Gardens, Kew, to the West Indies, in connection with the extension and organization of botanical stations in the British colonies of that region; and the *Kew Bulletin* for May and June, as we have already noted, contains his report thereon. It is a lengthy and interesting document, from which we propose to extract some particulars that may be welcome to our readers, and serve to put on record the reviving enterprise in the development of the natural resources of that part of the Empire. The primary object of Mr. Morris's visit was to settle the practical details of a scheme for establishing and administering a number of smaller botanical gardens in connection with the larger gardens of Trinidad and Jamaica. The main purpose of these gardens is to raise plants of economic value, suitable for cultivation in the various islands, "and to do all that is possible to encourage a diversified system of cultural industries, and thus relieve the planters from the results inevitable from the fluctuations of prices in the one or two staples to which they have hitherto confined their attention"; but they will also be made, as far as possible, pleasant places of public resort. Mr. Morris met with a hearty reception everywhere, and great interest was manifested in the work by the negro freeholders, in some of the islands, as well as the English colonists. The men in charge of these experimental stations, as they may be called, rather than botanical gardens, are mostly trained men from Kew; and Kew is the centre from which plants and seeds of economic plants likely to succeed in the West Indies are distributed. Mr. Morris left Kew in November last, and returned home at the end of February. Advantage was taken of his outward journey to send by the same ship, under his immediate supervision, a number of Wardian cases filled with Gambier plants. Gambier, it may be added, is the name of a substance used in tanning, obtained from *Uncaria Gambier*, Roxb.; and the plants had been raised at Kew from seeds received from the Straits Settlements, several attempts to introduce plants from the East having failed. How the plants were successfully carried to the West Indies we learn from the following passage in the report:—

"Owing to the cold weather, the cases containing the plants on board the *Atrato* were placed below in the main saloon. There was very little direct light in the daytime, but the question of warmth was for the moment of more importance than that of light. It was also hoped that they could be placed on deck in a day or two at the most. The weather during the whole of the first week, however, continued very cold, and it was impossible to expose the plants on deck. Under these circumstances it was fortunate that the electric light, with which every part of the ship was supplied, was available to try an experiment of some interest. Although the plants received very little light during the day, they had a good supply of the electric light during the night, and the plants in the cases more fully exposed to the electric light were afterwards found to be in a much better condition than the others. It is well known that plants will thrive under the influence of artificial light, but in this instance there was so little direct light available during the day, that the plants had to depend almost entirely on the light they received at night. The Gambier plants are particularly sensitive as regards a diminution of light. During the prevalence of fogs at Kew they have been known to drop their leaves within a day or two, and to remain bare during the rest of the winter. This may have been, in some measure, also due to the injurious influence of the fog itself.

"The use of electric light for the safe transit of such valuable plants as are obliged to be despatched from this country during the winter months is evidently capable of being greatly extended. It may also be utilized in the case of tropical plants arriving in this country from abroad, during the prevalence of cold weather. Such plants could be placed below directly the weather is becoming too cold for them on deck, and then the more electric light they have the better."

Out of the whole consignment to the various islands only ten plants succumbed; but this was due to an oversight in carrying the case on to Trinidad and La Guayra, and having to bring it back again to St. Vincent, thereby causing a delay in landing of ten days.

Mr. Morris visited successively Antigua, Dominica, Montserrat, St. Kitts, Anguilla, Tortola, Santa Lucia, St. Vincent, Grenada, Barbados, and Jamaica, being present at the opening of the Exhibition at the last-named island. Everywhere the Governors and other officials seem to have done their utmost, both personally and indirectly, to assist Mr. Morris in fulfilling the object of his mission. Established gardens were inspected, sites for new gardens selected, means discussed, and addresses delivered, from which it is confidently hoped that substantial advantages to the cultural industries may accrue.

Mr. Morris's Report, which may be obtained for the sum of fourpence, is a valuable and interesting account of the present condition and future prospects of planting in the various islands, and should be in the hands of all concerned. We conclude this notice with an extract from a description of the lime plantations in Montserrat, "where the immense golden heaps of ripe fruit were alone worth a journey to the West Indies."

"The West Indian lime (*Citrus medica*, var. *acida*) appears to be a thin-skinned local variety, little known outside the West India Islands. It yields juice of a singularly pure acid flavour, and it deserves to be much better known in this country in the fresh state for making 'lemon' beverages, as well as for general use in cookery. The enterprise of the Montserrat Company extends to other things besides limes. Nevertheless, from limes alone it is possible to produce a variety of articles more or less valuable. The limes themselves are exported as gathered, or they are preserved in salt water, and shipped in a pickled state for consumption in certain parts of the United States. Lime-juice, obtained by compression, is exported either raw or in a concentrated state. This latter is obtained by evaporating the raw juice in boilers until it is reduced to about one-twelfth of the original bulk, when it is ready for export as a dark, viscid substance like molasses. This is used for the preparation of commercial citric acid. From the rind of the fruit, by a process known as 'ecuelling,' which consists of gently rubbing the fruit on rounded projections arranged inside a brass basin, a very fine essence of limes is obtained. Again, by distilling the raw lime-juice a spirit is obtained known as oil of limes."

NOTES.

THE deputation which is to submit to Sir Michael Hicks Beach to-morrow a statement of the facts relating to the proposed British Institute of Preventive Medicine, will be large, influential, and thoroughly representative of the various departments of science. It is expected that the following gentlemen will speak: Sir Joseph Lister, the Duke of Westminster, Sir Henry Roscoe, Prof. Dewar, Mr. Haldane, M.P., Q.C., and Prof. Ray Lankester. A letter from Prof. Huxley will be read.

THE list of those selected for Birthday Honours includes Dr. Archibald Geikie, on whom the honour of knighthood has been conferred, and Mr. Robert Giffen, who has been made C.B.

IN the course of an investigation, part of which has already been communicated to the Royal Society, Prof. Roberts-Austen has discovered the most brilliantly coloured alloy as yet known. It has a rich purple colour, and bright ruby tints are obtained when light is reflected from one surface of the alloy to another. It contains about 78 per cent. of gold, the rest of the alloy being aluminium. The constants of the aluminium-gold series of alloys are now being examined, and will shortly be published.

ON Tuesday last, at Oxford, Convocation sanctioned the expenditure of very considerable sums of money in order to provide increased accommodation for the medical and science schools. The Lecturer in Human Anatomy, Mr. Arthur Thomson, estimated that the immediate wants of his department necessitated the expenditure of £7000. With this sum might be provided a laboratory, which would include dissecting-rooms, a museum, working rooms, and a lecture theatre. Hitherto the accommodation provided for the lecturer has been of a temporary character, and has now proved itself utterly inadequate for the requirements of his class. The number of students now studying in Oxford with the intention of passing the M.B. examination is 67. As illustrating the growth of the class, and the interest taken in this school, it may be mentioned that in 1885 the lecturer's class consisted of only three members. The Deputy Professor of Physiology (Dr. Ray Lankester) required the more modest sum of £2000 in order to supply the deficiencies in the department of Morphology. With this sum two laboratories could be provided, one 40 × 20 feet, and the other 30 × 20 feet. Meanwhile the departments of Ethnology and Geology find themselves cramped for space at the University Museum, and Convocation has granted the sum of £1300 to provide rooms for the use of the Curator and the servants of the Museum, and increased accommodation for teaching. The Hope Professor of Zoology (Prof. Westwood) needed only the expenditure of £350 upon additions and improvements in his department at the University Museum. The expenditure of these various sums, amounting in the aggregate to nearly £11,000, will place the School of Medicine and the related sciences in a satisfactory position, and the University of Oxford is to be congratulated on its appreciation of the importance of these departments, and the liberality with which it maintains them.

THE Gold Medal of the Linnean Society has this year been awarded to Dr. Edouard Bornet, of Paris, for distinguished researches in botany. His earliest publications related to the structure and life-history of Fungi and Lichens, but his name is best known for the important researches in which, with his friend M. Thuret, he has been for some years engaged, on the life-histories of Algæ, and for his valuable contributions on this subject in the "Études Phycologiques," and the "Notes Algologiques," with their beautiful illustrations.

AT a meeting of the Ashmolean Society, Oxford, on June 1, there was an interesting discussion on a paper, by Mr. Romanes, on Weismann's theories of heredity, in which Prof. Lankester and Mr. Poulton took prominent parts.

M. DOULIOT, Demonstrator in Botany at the Museum of Natural History, Paris, has undertaken a scientific expedition to Madagascar.

MR. NORMAN LOCKYER, F.R.S., has undertaken to give a lecture at Bedford College (for Ladies), Baker Street, on Wednesday next, at o'clock, "On Natural Philosophy for Artists."

WE regret to have to record the death of Sir John Hawkshaw, F.R.S. He died on Tuesday last at his town residence, Belgrave Mansions, in his 81st year. The greatest of his many engineering feats was the construction of the Severn Tunnel. He was President of the Institution of Civil Engineers in 1862–63, and of the British Association at its Bristol meeting in 1875. He received the honour of knighthood in 1873.

SEVEN years have elapsed since the first International Ornithological Congress took place in Vienna, under the presidency of the late Crown Prince Rudolph. England was on that occasion, as a correspondent wrote at the time, "conspicuous by her absence," and at the second Congress, which has just been held at Budapest, Great Britain was but feebly represented. It is difficult to understand this unwillingness of Englishmen to visit an International Congress. Our countrymen are always sure of a hospitable reception, the interchange of ideas with foreign colleagues is pleasant and profitable, the personal friendships which result are of permanent value, and in the case of Museum officials the relations established with the Museums of the Continent invariably result in mutual benefit. The great question which all zoologists can discuss is that of nomenclature. This year a preliminary skirmish took place at Frankfort, where the annual meeting of the German Ornithological Society was held on May 11 and 12, under the presidency of Prof. Wilhelm Blasius, of Brunswick. The Senckenburg Museum at Frankfort had been closed for four years, and had been opened to the public only four days before the arrival of the visitors. Prof. Noll, the well-known editor of the *Zoologischer Garten*, welcomed the German Ornithological Society in a few well-chosen words, and then followed the discussion on zoological nomenclature, which occupied the best part of two days of hard work. The proposals of the Committee appointed to examine into and report on the rules of zoological nomenclature were fully discussed, and were adopted, though, by the courtesy of the members, Mr. Bowdler Sharpe, and Mr. Büttikofer, of the Leyden Museum, were allowed to state their objections to some of the propositions. The members and guests of the Society were conducted round the Museum by Prof. Noll and Dr. Hartert, and great satisfaction was expressed at the excellent condition in which Prof. Rüppell's types were found to be. The ornithological collection has been carefully catalogued by Dr. Hartert, and his recently-published catalogue of the collection is an admirable piece of work. At the conclusion of the meeting, an adjournment took place to the Zoological Gardens, where the visitors were hospitably entertained by the Director, who personally conducted them round the Gardens. From Frankfort a detachment of members and guests proceeded to Vienna and thence to Budapest, to attend the meeting of the Ornithological Congress.

MESSRS. MACMILLAN have nearly ready for publication "A History of Human Marriage," by Dr. Edward Westermarck, Lecturer on Sociology at the University of Finland, Helsingfors. In an introductory note the work is commended to the attention of students by Dr. A. R. Wallace, who expresses a high opinion of the learning and insight displayed by the author. Dr. Westermarck differs widely in many respects from the opinions hitherto held by most anthropologists as to the development of the various forms of marriage.

IN the House of Commons on Friday last, there was an interesting debate on the Ordnance Survey. Mr. Roby, who introduced the subject, had much to say as to the unsatisfactory rate at which the Survey is proceeding, and Sir George Campbell effectively contrasted the work done in England with that done in other countries. In India, he said, the surveys were incomparably ahead of those in the United Kingdom; he was often surprised at the perfection of the surveys even of those portions of that vast country only reached by sportsmen or explorers. "In his own country he found nothing of the kind. There, in one of the most cultivated and civilized places in the world, they had nothing but the old survey. It was a disgrace to the country that we should not have decent maps." Mr. Chaplin, under whose department the Ordnance Survey has been placed, said what he could in defence of existing arrangements, but was not disposed to deny that there was much solid ground for complaint. He promised that his influence should be used to secure reform in various directions.

THE University College Biological Society has arranged for an excursion to Sheerness on Saturday, June 6. The excursion will leave Victoria at 10 a.m., and the time at Sheerness will be spent either in dredging or shore work. The party will be accompanied by Prof. Weldon.

THE Eastern papers report that an expedition has, by order of the Straits Government, commenced work on the frontier between Burmah and the Malay Peninsula. Its operations will be chiefly confined to Pahang. It is placed under the charge of Mr. Ridley, Director of Gardens and Forests in the Straits Settlements, accompanied by Mr. William Davison, Curator of the Raffles Library, Singapore, and Lieutenant Kelsall, R.A. The funds available for the expedition are 2000 dollars voted from the Straits Treasury. The object is to ascend the highest mountain in Pahang, incidentally noting all that can be learned about the physical features and the flora and fauna of the country. The expedition was to go by steamer to Pekan; thence up stream to Kuala Lipis; thence northerly up the Tembelinis and Sat rivers. Having ascended the latter river so far as it may be navigable for small canoes, the expedition will strike through forest and jungle, estimated to extend for sixty miles, till they emerge at Gunong Tahan, which is said to be about 8000 feet high. Ascending this mountain, and crossing what is called Cameron's plateau, they will then ascend Gunong Siam, a mountain the height of which has been estimated to be as much as 14,000 feet. Having completed this ascent, they will return by the same route, the estimated period of absence from Singapore being between two and three months. The party were to take with them three Tamil hunters and collectors attached to Mr. Davison's Museum staff, and three Malays of the Gardens and Forests Department.

AT the meeting of the French Meteorological Society on May 5, a discussion by M. Millot of fifty years' observations at Nancy was presented. The temperature and rainfall values were divided into two periods, viz. 1841-79 and 1880-90. These averages showed that the mean temperature had considerably decreased since the winter of 1879-80, and that the amount of rainfall had increased; the climate showed a tendency to become more continental. M. Teisserenc de Bort communicated the results of his inquiries respecting a destructive tornado which visited the town of Dreux on August 18 last. At 10h. 5m. p.m., Paris time, a sharp clap of thunder occurred, followed by heavy rain and hail for about a minute, and five minutes later the tornado broke over the town with a noise resembling that of an express train, making a furrow in the ground, and in less than a minute tiles were flying about, trees uprooted, and several houses destroyed. After a short course the effects of the tornado ceased, and it appeared to rise to the upper strata of air, but descended again with equal violence near Epone about 60 kilometres distant, the rate of translation being about 29 miles an hour. The action of the electricity seemed to be of an unusual nature; although much damage was done by it, no metallic object was fused, but only traces of fusion could be found in bad conducting bodies. Among other incidents an iron bedstead was dismounted, without trace of fusion. The paper was illustrated by several photographs, showing the damage done in various parts of the path.

DR. J. HANN has communicated another important treatise to the Vienna Academy, entitled "Studies on the Conditions of Air-pressure and Temperature on the Summit of the Sonnblick, with remarks upon their importance for the theory of cyclones and anticyclones." The work is based upon four years' observations, and is divided into eight sections, viz.:—(1) An investigation of the general meteorological conditions under which the maxima and minima of air-pressure occur on the Sonnblick. The anomalies of pressure are more marked above than below, and are increased by the accompanying temperature anomaly, which is relatively high in barometric maxima, and relatively low in barometric minima. (2) The range of temperature during the passage of a barometric wave. This is, at least during the winter season, the opposite to that at the lower level. (3) Temperature with varying amount of cloud in winter. The highest temperature coincides with the least cloud, upon the summit, and conversely on the plain. The clear winter days on the Sonnblick have relatively high temperature with great dryness, and these conditions are characteristic of the barometric maxima. (4) Monthly maxima and minima of temperature. The former mostly occur during barometric maxima, and the latter when the high pressure lies in the west or north, and while a barometric minimum exists over Italy or the Adriatic. (5) Temperature and air-pressure on the Sonnblick during barometric minima over Central Europe, especially over the Eastern Alps. The mean temperature at the height of 6650 feet during the passage of barometric minima was below the normal, amounting on an average to 2°·5 F. during the winter season. The use of deviations of pressure and temperature in answering many questions of atmospheric physics is here discussed. (6) Vertical distribution of temperature, and mean temperature in a column of air of 3 kilometres in height. The calculations have been made separately for each winter. (7) Preliminary indications respecting the relations of the wind-directions to barometric maxima and minima. A considerable divergence (45°–90°) is shown from the directions as observed below, and the results confirm the conclusions drawn from cloud observations by J. A. Broun and others. (8) Refutation of some objections against the conclusiveness of temperature observations on mountain summits, and general remarks on cyclones and anticyclones. The author points out that recent mountain temperature observations and other facts are opposed to the explanation of barometric maxima and minima in extra-tropical regions by purely thermic considerations.

THE relations of weather and disease have been recently investigated by Herr Magelssen, of Leipzig, who, having formerly called attention to the nature of certain "waves" which recur in the variations of temperature (distinguishing waves of about 12 days, 50 days, and 18 to 20 years duration), now traces a connection of these with diseases and mortality. The year-waves especially show this connection; the mortality (in our latitudes) varying with the winter temperature. The least mortality (relatively) is at the middle part of the temperature periods. The injurious influence of heat is dominant in the more southern latitudes (such as Vienna), while cold begins to act beneficially. In northern places, mild winters prove injurious where several very mild winters come in succession (*e.g.* Stockholm in 1871–74). The most favourable conditions seem to be an alternation of moderately cold and moderately mild winters. Too much importance, the author thinks, has been attached to relative humidity. He further offers proof that infectious disease is even more dependent on weather than disease of the respiratory organs, or arising from chill.

THE value of systematic observation of snow is now being recognized in meteorology; and in Russia observations were commenced in January last year at 428 stations in the European portion of the Empire, 21 in the Asiatic, and 55 in the Caucasus. At first it was simply reported daily whether there was a continuous snow-covering about the station or not. But last winter the inquiry has been extended to the depth and general behaviour of the snow. Thus it is expected that in a few years, some valuable climatological material will have been accumulated at St. Petersburg. The report of Herr Berg on the snow in the early months of 1890, in European Russia (*Repert. für Meteor.*), contains a map showing the southern and western limit of the continuous snow-covering for the first and fifteenth of each of the months January to April. In the west the snow extended steadily till the beginning of March, the limit being then close to the Baltic. In the south-east, there was steady advance till February, and as far as the coast of the Caspian. In the south, the advance was fluctuating, there being a maximum in the middle of January, and the middle of February, both reaching to the Black Sea coast. The retirement of the snow-limit began in the south and south-east in the middle of February; in the west about half a month later. The general direction was north-east. On April 15 the limit passed through Onega on the White Sea, Wetluga, and Katherinenburg. By the first of May, all European Russia was free from snow. Herr Berg describes the weather accompanying the disappearance of the snow, and traces its causation.

A DIRECT observation of hail in the process of formation is recorded in the *Naturw. Rundschau*. In the afternoon of a squally day Prof. Tosetti, looking eastwards through the window of a house (in Northern Italy) which, with two others, enclosed a court, saw the rain which streamed down from the roof to the right, caught by a very cold wind from the north, and driven back and up in thick drops. Suddenly a south wind blew, and the drops, tossed about in all directions, were transformed into ice balls. When the south wind ceased, this transformation also ceased, but whenever the south wind recurred, the phenomenon was reproduced, and this was observed three or four times in ten minutes.

Engineering of the 29th ult. states that an extraordinary accident had occurred at the London-Paris Telephone Office in the Palais de la Bourse. One of the *employés*, a gentleman named Weller, wished to communicate with the London office on a matter of service. He had already rung up the English officials, and, the bell having sounded in reply, took up the receivers and put them to his ears, when he suddenly sustained a shock of electricity of such severity that it threw him staggering backwards against the door of the telephone cabinet, which, not having been properly fastened, flew open, with the result that he was thrown heavily to the ground. It appears from inquiries that similar accidents, although less serious, have occurred at this telephone office on several previous occasions. The officials attribute them to lightning striking the wire, either at San Gatte, where the submarine cable ends, or at the terminus of the land wire on the Palais de la Bourse. Such accidents, it is declared, might be easily prevented by the simple expedient of erecting lightning conductors at the point where the cable comes ashore, and at the terminus in Paris.

IN the nineteenth annual report of the directors of the Zoological Society of Philadelphia, attention is called to the unprecedented destruction of many of the more valuable and important animals of the native American fauna, and to the need for the immediate adoption of every means which can be employed to save them from complete extinction. The directors think that a good deal may be done in furtherance of this object, both in zoological gardens and private preserves. Of all the bisons now surviving outside the National Park, probably nine-tenths are comprised in a few herds owned by private individuals and zoological societies.

A FINE tortoise, weighing 87 pounds, obtained by the U.S. Fish Commission steamer *Albatross*, during her recent visit to the Galapagos Islands, has recently been deposited in the Zoological Park at Washington, D.C. The specimen was collected by Mr. C. H. Townsend on Duncan Island, and is of much interest, not only on account of the locality it represents, but as showing that Dr. Baur was a little hasty in deciding that *Testudo ephippium* is only a synonym of *T. abingdoni*. The Duncan Island tortoise agrees exactly with Dr. Günther's figure of *T. ephippium*, and is entirely distinct from the Abingdon Island species, which is also well-figured in Dr. Günther's paper. This figure shows a little emargination in the second marginal scute, which might seem accidental, but as it is exactly repeated in the specimen belonging to the U.S. National Museum, and as the emargination exists in the bony carapace, it is probably a constant specific character. Dr. Günther gives Indefatigable Island as the locality of *T. ephippium*, and if this be correct the species occurs on at least two islands of the group. Besides the Duncan Island Tortoise, examples of *T. vicina* and *T. nigrita* are now living in the Zoological Park, while the U.S. National Museum possesses skeletons of *T. abingdoni* (imperfect), *T. vicina*, and *T. nigrita*. The locality of this last-named species is still uncertain, but there is some reason to suppose that it may be from Chatham Island. *T. nigrita* has the most arched carapace of any species, *T. ephippium* and *T. abingdoni* the longest and anteriorly most compressed and elevated carapaces. Between these lie in the order named *T. microphyes* and *T. vicina*. There is a direct correlation between the anterior height of the carapace and the length of the neck, the rule being the higher the carapace the longer the neck, *T. nigrita* and *T. abingdoni* having respectively the shortest and longest necks. Mr. Townsend writes that tortoises are now extremely rare on Duncan Island.

THE June number of the *Zoologist* contains an interesting paper on the habits of the moose, by Mr. J. G. Lockhart. One of the points noted by the author is, that moose generally lie with the tail to windward, trusting to their senses of hearing and smelling, which are remarkably acute, to warn them of approaching danger from that quarter; they can use their eyes to warn them from danger to leeward, where hearing, and especially smelling, would be of little use. While they are sleeping or chewing the cud, their ears are in perpetual motion, one backward, the other forward, alternately. They also have the remarkable insight to make a short turn and sleep below the wind of their fresh track, so that anyone falling thereon and following it up is sure to be heard or smelt before he can get within shooting distance.

MR. L. UPCOTT GILL has published as a pamphlet a paper read by the Rev. H. A. Soames before the Bromley Naturalists' Society on the scientific measurement of children. Mr. Soames says he finds such measurements as he describes, taken every term, a good guide as to whether his pupils may be pressed with work or not. "If the increase is regular and the weight fair, according to the height, I do not fear to press them; but if, on the other hand, the weight is low, or if the height increases and not the weight, or if the increase in height is too rapid, I think it a very fair excuse for laziness, and take great care that too much work is not expected from them."

THE first volume of Sir William Thomson's "Popular Lectures and Addresses" (Macmillan), has reached a second edition. The third volume has also just been published, and the author hopes that the second volume may appear in the course of a year or two.

THE new number of the Journal of the Anthropological Institute (vol. xx., No. 4) opens with a paper in which Lady Welby calls attention to what she calls an apparent paradox in mental evolution. The number also includes a paper, by Mr. F. W. Rudler, on the source of the jade used for ancient implements in Europe and America; and the Presidential address delivered by Dr. Beddoe.

THE Botanical Society of Edinburgh has issued the eighteenth volume of its Transactions and Proceedings. Dr. Aitchison's "Notes on the Products of Western Afghanistan and of North-Eastern Persia," forming the first part of the volume, may be obtained separately.

TWO new parts (62 and 63) of the elaborate dictionary of Chemistry included in the "Encyclopaedie der Wissenschaften" (Breslau: Eduard Trewendt) have appeared. The eighth part of the hand-book of Physics, in the same Encyclopædia, has also been published.

THE ninth edition of "Telegraphy," by W. H. Preece and J. Sivewright (Longmans), has been published. The edition is described as "almost a new book." No fewer than 24 figures have been altered and 44 excluded, and there are now 265 as compared with 194 in the last edition. The authors have aimed at "providing such a general introduction to the art and science of telegraphy as will enable the student to proceed to the study of more advanced works, and give to the operator an intelligible explanation of the apparatus with which he has to deal."

MESSRS. LONGMANS, GREEN, AND CO. are issuing the tenth edition of Quain's "Elements of Anatomy." It will appear in three volumes, and is being edited by Prof. E. A. Schäfer and Prof. G. D. Thane. The second part of the first volume—by Prof. Schäfer—has just been published. The subject is general anatomy or histology.

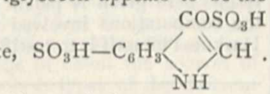
PART 32 of Cassell's "New Popular Educator" has been published. Besides illustrations in the text, it contains a coloured map of Switzerland.

THE Geological Survey Department of Canada has issued the first of a series of descriptive and illustrated quarto memoirs on the Vertebrata of the Tertiary and Cretaceous rocks of the Canadian North-West Territory, prepared for the Survey by Prof. E. D. Cope, of Philadelphia. The Report is devoted exclusively to a consideration of the species from the Lower Miocene deposits of the Cypress Hills, in the district of Alberta, and consists of twenty-seven pages of letterpress, illustrated by fourteen full-page lithographic plates. The second part, which will contain illustrated descriptions of the Vertebrates of the Laramie formation of the North-West Territory, by the same author, is now in course of preparation.

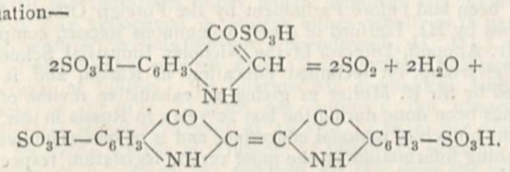
MR. PERCY F. KENDALL has prepared a little volume entitled "Hints for the Guidance of Observers of Glacial Geology." It is intended to serve as an answer to the requests for guidance which have been made by members of the North-West of England Boulder Committee. The work is printed only on alternate pages, so that students using it will have space for occasional brief notes.

"AN approved Treatise of Hawks and Hawking by Edmund Bert," 1619, has just been reprinted, with an introduction by Mr. J. E. Harting. It is the rarest of English books on falconry, and no copy has come into the market for nearly twenty years. The reprint is as nearly a facsimile as it is possible to make it without the aid of photography, and a hundred copies only have been printed. It is issued by Mr. Quaritch.

INDIGOCARMINE, the commercially important disulphonic acid of indigo, has been synthesized in an extremely simple manner by Dr. Heymann in the laboratory of Messrs. Bayer and Co. of Elberfeld, and a description of the mode of operation is given in the new number of the *Berichte*. The reaction merely consists in acting with excess of fuming sulphuric acid upon phenyl glycocoll, $C_6H_5—NH—CH_2—COOH$, the aniline derivative of glycollic acid. When a quantity of fuming sulphuric acid is poured upon a tenth of its weight of phenyl glycocoll in a test tube, the phenyl glycocoll rapidly dissolves, the acid becoming coloured yellow and slightly elevated in temperature, while sulphur dioxide commences to be evolved. If the solution is then poured over ice the greenish-blue colour of indigocarmine is at once obtained. The best conditions for working the process on the large scale are as follows. One part of phenyl glycocoll is mixed with ten to twenty times its weight of fine sand so as to avoid local superheating during the process of addition to the fuming acid. The mixture is then introduced into about twenty times its weight of fuming sulphuric acid at a temperature of about 20°–25°. The fuming acid should contain at least 80 per cent. of sulphuric anhydride, and the temperature should be so controlled that it never exceeds 30° during the process of adding the mixture. The yellow solution thus obtained yields instantly the blue coloration due to indigocarmine on removing the large excess of sulphuric anhydride by the addition of ordinary oil of vitrol, sulphur dioxide being evolved. Upon further diluting with ice and addition of common salt (indigocarmine being more difficultly soluble in salt solutions than in pure water) the colouring-matter is precipitated, and may be readily isolated. The product thus obtained is found to consist of pure indigocarmine. The tints obtained with this product are vastly superior in beauty and clearness to those obtained with even the better kinds of commercial indigocarmine, on account of the higher degree of purity attained by this mode of preparation. The chemical changes occurring during the process appear to be as follows. The first product of the action of fuming sulphuric acid upon phenylglycocoll appears to be the sulphonic acid of indoxyl sulphate,



This substance, however, is unstable, and decomposes upon the removal of the excess of SO_3 into indigo disulphonic acid, sulphur dioxide, and water, probably according to the following equation—



Of course the most important point of commercial interest about a new reaction is the yield, and in this respect Dr. Heymann is very fortunate, for already 60 per cent. of the theoretical has been attained. The process has consequently been patented by Messrs. Bayer and Co., and appears likely to become a very successful one.

THE additions to the Zoological Society's Gardens during the past week include a Water Buck (*Cobus ellipsiprymnus* ♀), a Leopard (*Felis pardus*), two Vulturine Guinea Fowls (*Numida vulturina*), two Mitred Guinea Fowls (*Numida mitrata*) from East Africa, presented by Mr. G. S. Mackenzie, F.Z.S.; a Peregrine Falcon (*Falco peregrinus*) from Scotland, presented by Mr. Thomas C. Smith; a Mountain Ka-Ka (*Nestor notabilis*) from New Zealand, presented by Mr. Herbert Furber; a Grey Squirrel (*Sciurus griseus*), a Squirrel (*Sciurus* sp. inc.) from North America, a Ducorp's Cockatoo (*Cacatua ducorpsi*) from the Solomon Islands, presented by Mr. Nicholas O'Reilly; two Ravens (*Corvus corax*) from Ireland, presented by Captain Ogilby; a Cheetah (*Cynœlurus jubatus*) from Persia, three Blandford's Rats (*Mus blandfordi*), two —— Terrapins (*Clemmys* sp. inc.) from India, deposited; two Coypus (*Myopotamus coypus*) from South America, two Andaman Starlings (*Sturnia andamanensis*) from the Andaman Islands, two Red-billed Hornbills (*Toccus erythrorhynchus*), two African White Spoonbills (*Platalea alba*) from Africa, two Virginian Eagle Owls (*Bubo virginianus*) from North America, purchased; a Red Deer (*Cervus elaphus* ♂), a Japanese Deer (*Cervus sika* ♀), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE MERIDIAN PHOTOMETER.—In vol. xxiii. of the *Annals of the Harvard College Observatory*, Prof. E. C. Pickering and O. C. Wendell give and discuss the observations made at Cambridge, U.S., with the meridian photometer during the years 1882–88. The observations relate principally to stars north of the declination −40°. Vol. xiv. of the *Annals* contained the results of observations of the brightness of stars made with a small meridian photometer. The present volume deals with the photometric measurements of somewhat fainter stars, made by means of a similar but larger instrument.

REPORT OF HARVARD COLLEGE OBSERVATORY.—Prof. Pickering has just issued his Report for last year. He again urges the necessity of a fire-proof building for storing the 27,000 photographic plates of spectra, 9000 of which were taken in 1890. Legacies for the endowment of science in America are so common that it is not surprising to learn that the Observatory has received a gift of 25,000 dollars through the late Mr. J. I. Bowditch. During the past year 1309 photographs of stellar spectra have been taken with the Bache telescope at the station near Closica, in Peru. Nearly all of them relate to the region south of −20°. Mrs. Draper has added another instrument of the same kind to the Henry Draper Memorial. This is mounted in the Observatory grounds at Cambridge, and since September 1889, 2157 photographs have been taken with it, covering the sky north of −20°. By placing a prism of small angle over the objective, the spectra of stars as faint as the tenth magnitude have been obtained. Six stars with Type IV. spectra have been discovered. Spectra of fifteen planetary nebulæ have been photographed. The hydrogen line F has been shown to be bright in eight stars. Bright line stars of the Wolf-Rayet type now number twenty-eight, three having been added to the list during the past year. The names are given of thirty variable stars of long period, in which the hydrogen lines are bright at maximum. This peculiarity has furnished a means of discovering seven new variable stars. The 11-inch telescope has been used for a detailed study of the spectra of the brightest stars, with the result that β Aurigæ and ζ Ursæ Majoris have been discovered to be close binaries. One photograph of σ Herculis seems to show that this star also is double, but this has not been confirmed. With the 12-inch telescope a number of "canals" on Mars have been recognized, but only one of them was distinctly seen to be double. An important accession to the white spot surrounding the southern pole was found by photographs to have occurred between the nights of April 9 and 10. The Report concludes with a list of the numerous publications issued by the Observatory during the year.

THE SOLAR PARALLAX AND ITS RELATED CONSTANTS.

IT would be difficult to conceive a more masterly and comprehensive exposition of astronomical and physical constants than one just issued by Prof. W. Harkness, of the United States Naval Observatory. As is rightly pointed out, "The solar parallax is not an independent constant. On the contrary, it is entangled with the lunar parallax, the constants of precession and nutation, the parallactic inequality of the moon, the lunar inequality of the earth, the masses of the earth and moon, the ratio of the solar and lunar tides, the constant of aberration, the velocity of light, and the light equation." It should therefore be determined simultaneously with all these quantities by means of a least-square adjustment, and Prof. Harkness develops such a method. The equations connecting the constants are given, whilst the numerical values which are discussed are based upon an enormous mass of astronomical, geodetic, gravitational, and tidal observations which have required more than two hundred years for their accumulation. The sources of probable error are also examined, and it is suggested how some of the constants may be improved in the future. The completeness of the lists of constants, and the careful manner in which they are discussed and corrected by the comprehensive least-square adjustment which is developed, justifies our giving *seriatim* the results obtained:—

Equatorial semi-diameter of the earth—

$$3963{\cdot}124 \pm 0{\cdot}078 \text{ miles.}$$

Polar semi-diameter of the earth—

$$3949{\cdot}922 \pm 0{\cdot}062 \text{ miles.}$$

One earth quadrant—

$$10001816 \pm 125{\cdot}1 \text{ metres.}$$

Oblateness or flattening of the earth—

$$1/300{\cdot}205 \pm 2{\cdot}964.$$

Eccentricity of the earth—

$$0{\cdot}006651018.$$

Mean density of the earth—

$$5·576 \pm 0·016.$$

Surface density of the earth—

$$2·56 \pm 0·16.$$

Length of the seconds pendulum (ϕ = latitude)—

$$39·012540 + 0·208268 \sin^2\phi \text{ inches.}$$

Acceleration due to gravity—

$$32·086528 + 0·171293 \sin^2\phi \text{ feet.}$$

Length of the sidereal year—

365d 6h. 9m. 9·314s.

Length of the tropical year at time t—

$$365d.\ 5h.\ 48m.\ 46·069s. - 0·53575s. \left(\frac{t - 1850}{100}\right).$$

Length of the sidereal month—

$$27d.\ 7h.\ 43m.\ 11·524s. - 0·022671s. \left(\frac{t - 1800}{100}\right).$$

Length of the synodical month—

$$29d.\ 12h.\ 44m.\ 2·841s. - 0·026522s. \left(\frac{t - 1800}{100}\right).$$

Length of the sidereal day—

86164·09965 mean solar seconds.

Ratio of the mean motions of the sun and moon—

0·074801329112.

Mass of Mercury (Sun = 1), $\frac{1}{8374672 \pm 1765762}$

„ Venus „ $\frac{1}{408968 \pm 1874}$

„ Earth „ $\frac{1}{327214 \pm 624}$

„ Mars „ $\frac{1}{3093500 \pm 3295}$

„ Jupiter „ $\frac{1}{1047·55 \pm 0·20}$

„ Saturn „ $\frac{1}{3501·6 \pm 0·78}$

„ Uranus „ $\frac{1}{22600 \pm 36}$

„ Neptune „ $\frac{1}{18780 \pm 300}$

„ Moon (Earth = 1) $\frac{1}{81·068 \pm 0·238}$

Constant of solar parallax—

$$8''·80905 \pm 0''·00567.$$

Mean distance of earth from sun—

$$92796950 \pm 59715 \text{ miles.}$$

Eccentricity of the earth's orbit—

0·016771049.

Lunar inequality of the earth—

$$6''·52294 \pm 0''·01854.$$

Lunar parallax—

$$3422''·54216 \pm 0''·12533.$$

Mean distance from earth to moon—

$$238854·75 \pm 9·916 \text{ miles.}$$

Eccentricity of moon's orbit—

0·054899720.

Inclination of moon's orbit—

$$5° 8' 43''·3546.$$

Mean motion of the moon's node in 365¼ days—

$$- 19° 21' 19''·6191 + 0''·14136 \left(\frac{t - 1800}{100}\right).$$

Parallactic inequality of the moon—

$$124''·95126 \pm 0''·08197.$$

Constant of luni-solar precession—

$$50''·35710 \pm 0''·00349.$$

Constant of nutation—

$$9''·22054 \pm 0''·00859.$$

Constant of aberration—

$$20''·45451 \pm 0''·01258.$$

The time taken by light to traverse the mean radius of the earth's orbit (the light equation)—

$$498·00595s. \pm 0·30834s.$$

The velocity of light *in vacuo* per second of mean solar time—

$$186337·00 \pm 49·722 \text{ miles.}$$

In order to improve the system of constants discussed, Prof. Harkness thinks that the parallax of the moon should be determined by the diurnal method at one or more stations as near as possible to the equator, and that the Observatories in the northern and southern hemispheres should co-operate with each other for two or three years in systematically making meridian observations of the moon to improve our knowledge of its parallax. Numerous pendulum observations are required, and new determinations of the constants of aberration and nutation by as many different methods as possible. The most probable coefficient of the lunar inequality of the earth's motion should be obtained from Greenwich and Washington meridian observations of the sun, whilst the opposition of Mars in 1892, and favourably situated asteroids, should be utilized for new determinations of the solar parallax.

The laborious character of an investigation which leads to the results here given is patent to all. To say, therefore, that all the computations involved were made and checked by Prof. Harkness himself is to testify to industry very rarely excelled.

TECHNICAL EDUCATION IN RUSSIA.

AN interesting report on technical education in Russia has been laid before Parliament by the Foreign Office. It is a digest by Mr. Harford of a very voluminous Report, compiled by Mr. Anopoff, Director of the Nicholas Industrial School at St. Petersburg, on technical education in Russia, and is described by Sir R. Morier as giving an exhaustive review of all that has been done during the last 20 years in Russia in this important branch of national education, and is of special interest as furnishing information on the most recent legislation respecting schools about to be founded.

M. Anopoff confines himself to giving full details of intermediate and elementary technical and industrial teaching institutions, without attempting a description of the higher schools. The establishment of these former classes of schools dates, he says, from only some 25 years back, but in that short space of time they have spread to the confines of the Russian Empire. In 1883, a special section for technical and professional education was created in the Ministry of Education. According to the new regulations of the *Realschulen*, intermediate and elementary technical and industrial schools are to be opened at the public expense. M. Anopoff remarks, however, that these new schools cannot be expected to be at first as successful as the existing schools with their long practical experience. He adds, too, that the greater number of the technical schools in Russia were founded at the initiative, and often even at the expense, of local societies and private persons. The various technical and industrial institutions in Russia are divided into five groups :—(1) Technical schools with the course of intermediate schools resembling the *Realschulen*, but differing from them by their professional character being more strongly marked. The task of these schools, which, as regards the knowledge required, is about equivalent to the standard of the *Realschulen*, with a course of from six to eight years, consists in imparting a general acquaintance with the technical and partly commercial subjects which are indispensable for the assistants of engineers, and for independent managers of small technical undertakings. (2) To the second group may be referred institutions in which subjects of general education are taught within the scope of the courses of municipal schools and district and village schools with two classes. From those who enter them a knowledge is required approximate to the scope of primary schools, the full course of study lasting from four to six years. In these schools, besides the subjects taught in the municipal schools under the regulations of 1872, the following additional subjects are taken up : physics, mechanics, technology of metals and woods, bookkeeping, &c., while to drawing, both freehand and geometrical, much attention is given. The object of these institutions is the preparation of skilled artisans for factories, of lesser mechanical specialists, machinists, and draughtsmen. In this category should be included the railway schools, but as they are under the control of the Ministry of Communications, and serve certain special objects exclusively connected with railways, no account of them is given. (3) Industrial schools with a course of general education not exceeding the scope of the course of primary schools, or sometimes reaching the standard of the second class in village schools with two classes. In most of them pupils are received who have completed the course in the public school, and who repeat what they have gone through in it. These schools are founded with the object of preparing skilled artisans for village and domestic industries, and also factory hands. They contain workshops for joiners, blacksmiths, carpenters, fitters, tailors, shoemakers, saddlers, bookbinders, &c.; but few of these institutions can boast of a systematic course of instruction in trades. (4) To this group belong various special and general educational schools for adults, as the school for foremen builders, the school for printers, the evening and Sunday special classes of the Imperial Technical Society at St. Petersburg, the Riga Industrial School, &c. The teaching in these institutions takes place in the evenings of week-days, and on Sundays, *i.e.* when the adult workmen for whom they are intended are free from their work. (5) This group consists of elementary schools of general education, *i.e.* primary, district, or municipal schools with supplementary industrial sections. It is worthy of notice that persons who have gone through the whole course, or at least reached a certain standard, at any of the schools of these five groups, enjoy certain privileges with regard to exemption from military service.

The report then goes on to describe in detail the courses of some of the leading industrial schools as types of the different groups, as well as of the industrial classes attached to the elementary schools. In conclusion, the report summarizes the more important provisions of the ukase of March 7/19, 1888, respecting the conditions under which technical and industrial schools may be opened in Russia, either wholly or in part, at the expense of the State (given in Appendices I., II., III.). The cost of maintenance of these schools is respectively estimated in the ukase as follows: the intermediate mechanical technical schools at 27,311r. (£2730) per annum; the elementary mechanical technical schools at 19,436r. (£1945) per annum; and the trade schools at 11,960r. (£1200) per annum. The Ministry of Education has assigned for this year the sum of £50,000 for the creation of these technical schools, and it is reported that the Ministry has been urged to devote a considerable portion of this sum to founding schools in the districts where village industries prevail, the richer manufacturing districts being better able to dispense with State aid. The provisions of the ukase are:—(1) The industrial schools for the male inhabitants of the Empire exist for the purpose of diffusing among the population technical education of the intermediate and elementary standards, as well as instruction in handicrafts. (2) The intermediate technical schools impart the instruction and skill indispensable to artificers who are destined in time to act as the trusted assistants of engineers and of other managers of industrial enterprises. (3) The elementary technical schools, besides initiation into the mysteries and methods of some one definite handicraft, likewise impart the knowledge and skill indispensable to men whose duty it will in time become to act as master-workers and immediate overseers of the operations of artisans in industrial establishments. (4) The trade schools exist for the purpose of giving practical tuition in the methods of any one trade, and at the same time of communicating such knowledge and skill as are absolutely necessary to the intelligent execution of the work of such trade. (5) Industrial schools of each of the above-mentioned categories can exist either apart or in conjunction with other similar schools of various degrees and specialities. (7) The industrial schools are supported at the expense of the Crown, or of the *zemstvos*, societies, guilds, or private individuals, or by funds contributed simultaneously from all these sources. (8) The course in the intermediate technical schools is not to exceed four years; that of the elementary and trade schools three years. (9) Those who enter trade schools are required to produce a certificate of their having gone through the course of an elementary school; those who enter the elementary technical schools, a certificate of having gone through the course in a municipal school, or village school, with two classes; while those who enter intermediate technical schools must have gone through five classes of a *Realschule*. (10) Those who are unable to satisfy the conditions mentioned in the preceding paragraph, but who have worked not less than two years in industrial institutions, and have proved that they can successfully follow the course at the school they wish to enter, may be also admitted. (11) Industrial schools must have: (*a*) a library, (*b*) a room with appliances for geometrical and freehand drawing, (*c*) where possible a room with appliances for modelling, (*d*) the necessary school books for the special object for which the school is intended, and in addition the requisite appliances for the practical work of the apprentices. (14) Pupils who have successfully completed their education in an intermediate technical school, after a four years' course, receive the appellation of artificer in their specific calling. Those who have only gone through a two or three years' course, only receive this appellation after three or two years respectively, spent uninterruptedly in industrial work. Those who are so styled obtain certain privileges as regards their civil status and in respect to military service, and they enjoy in addition the right of entering the higher technical schools. Those who have completed the course at the other two categories of schools enjoy the privileges as regards civil status and military service which correspond to the general education they have received.

FOSSIL FISH OF THE SCANDINAVIAN CHALK.

MR. DAVIS has availed himself of the opportunities presented to him by the chief officers of the Museums of Lund, Stockholm, and Copenhagen, and has published a monographic account of the fish remains from the Cretaceous formations of Scandinavia.

Over seventy years ago Sven Nillson first discovered fish remains in the Swedish chalk. Since then numerous large collections have been made by the officers of the Geological Survey of Sweden and others, and the greater number of these specimens were unreservedly placed at the disposal of Mr. Davis for description in his memoir; he has also had the opportunity of consulting some smaller collections in Sweden, and most of the forms have been figured from the original specimens by Mr. Crowther.

These fish remains show a closer relationship to the Cretaceous fish remains of the north of Europe, as represented by the English and French chalk fish, than to the more highly specialized chalk fauna of Asia Minor, but they do not afford representatives of several of the Physostomous Teleosteans, such as Ichthyodectes, Protosphyræna, and Pachyrhizodus, which have been found in the English chalk, and have also occurred in the Upper Cretaceous rocks of North America.

The great majority of the fish remains are Selachian, and comprise twenty-four species. Of these, *Carcharodon rondeletii*, *Otodus obliquus*, and *Odontaspis acutissimus* are regarded as indicating a Tertiary fauna, but in the Scandinavian chalk they have been found asoociated with many undoubted Cretaceous forms in the Faxe limestone or chalk. The character and extent of this fauna indicates conditions very similar to those accompanying the deposition of the English and French chalk and of that of Central Europe generally, whilst it affords comparatively few data for comparison with that of Lebanon. The occurrence of numerous teeth of several species of Scapanorhynchus in the Swedish area is worthy of note, but the fish are not found preserved bodily as they are in the chalk of Lebanon.

This memoir is published as Part vi. of vol. iv. of the Transactions of the Royal Dublin Society, and is illustrated with an atlas of nine plates.

SOCIETIES AND ACADEMIES.

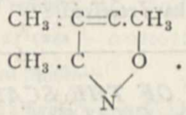
LONDON.

Royal Society, May 28.—"On the Bases (Organic) in the Juice of Flesh. Part I." By George Stillingfleet Johnson, M.R.C.S., F.C.S., F.I.C. Communicated by Prof. G. Johnson, F.R.S.

The author has endeavoured to ascertain by careful experiments how far the substances hitherto prepared from flesh are true "*educts*," and really present in the flesh itself, or merely products, due to (1) the action of chemical or physical agencies applied in the course of extraction, or (2) to bacterial action modifying the composition of the flesh before it comes into the hands of the operator.

The final conclusion drawn is that sarcous kreatine is not present in fresh muscle, but results from bacterial action whereas sarcous kreatinin is probably a true "educt."

Chemical Society, May 7.—Dr. J. H. Gladstone, F.R.S., Vice-President, in the chair.—The following papers were read:—The action of alkalis on the nitro-compounds of the paraffin series, by W. R. Dunstan and T. S. Dymond. The paper contains the results of further investigation of the interaction of alkalis and nitroethane, of which a preliminary account has already been given (Chem. Soc. Proc., 1888, p. 117). Nitroethane and alkali carbonates in the cold interact to yield carbon dioxide, and the alkali derivative of nitroethane, which is obtained when alkali hydroxide is employed. Ammonia combines with nitroethane in the cold to form a crystalline compound, analogous to the potassium and sodium derivatives. The action of alkalis proceeds further on warming, and there are formed alkali nitrite, acetonitrile, and a compound, boiling at 171°, and solidifying to a crystalline mass when cooled to 3°·5. The authors find that this compound is trimethylisoxazole



It is very stable, and is almost unaffected by heating in closed tubes with strong acids and alkalis. Permanganate oxidizes it to acetic acid, and nitric acid to acetic and oxalic acids. By reducing-agents it is slowly decomposed with formation of ammonia, acetic acid, and secondary butyl alcohol. By the action of sodium on a well-cooled moist ethereal solution, a *dihydride* $C_6H_{11}NO$ (m.p. 110°) is formed, which, when heated with water, is decomposed into ammonium acetate and ethyl methyl ketone. The *mercurichloride* has the formula C_6H_9NO, Hg,Cl_2, and the *aurichloride* the formula $C_6H_9NO, AuCl_3$. Nitropropane, when acted on by alkalis, yields triethylisoxazole, propionitrile, and alkali nitrite, but the reaction occurs with greater difficulty than in the case of nitroethane. Nitromethane is readily acted on by alkalis, and hydrogen cyanide, alkali nitrite, and much resin are formed. The parent isoxazole could not be isolated. Secondary nitropropane is attacked with difficulty by alkalis, and no isoxazole is formed.—Some new addition compounds of thiocarbamide which afford evidence of its constitution, by J. E. Reynolds, F.R.S. Thiocarbamide combines with ammonium bromide, iodide, and chloride at the temperature of boiling alcohol, and forms compounds of the type $(H_4N_2CS)_4H_4NR'$. Under the conditions specified no compounds were obtained containing less than four molecular proportions of the amide to one of the ammonium haloid salt. Methyl-, ethyl-, allyl-, phenyl-, diphenyl-, and acetylphenyl-thiocarbamides do not yield compounds with ammonium bromide at the temperature of boiling alcohol. Thiocarbamide and tetrethylammonium bromide and iodide yield compounds of the type $(H_4N_2CS)_2Et_4NR'$. Under the experimental conditions, no well-defined substance was obtained containing more than two molecular proportions of the amide to one of the tetrethylammonium salt. Thiocarbamide and diethylammonium bromide form the compound $(H_4N_2CS)_3Et_2H_2NBr$. Thiocarbamide, when treated with triethylammonium bromide yields a mixture of the two compounds $(H_4N_2CS)_3Et_3HNBr$ and $(H_4N_2CS)_2Et_3HNBr$. With methylammonium bromide the amide forms the compound $(H_4N_2CS)_4MeH_3NBr$. It does not, however, combine with ethylammonium bromide, and when heated with the salt in the molecular proportions 4 : 1 at 135° in a sealed tube, together with alcohol, it yielded ethyl oxide and tetrathiocarbamidammonium bromide. The author points out that these facts supply evidence against the symmetrical constitution of thiocarbamide $CS(NH_2)_2$, and altogether in favour of the unsymmetrical constitution $HN : C(SH)NH_2$.—The action of acetic anhydride on substituted thiocarbamides; and an improved method for preparing aromatic mustard oils, by E. A. Werner, Trinity College, Dublin. The action of acetic anhydride on diphenyl-, ortho-, meta- and para-ditolyl-, meta-dixylyl-, dibenzyl- and diethyl-thiocarbamides has been studied. In the case of the aromatic derivatives, no acetylated derivatives of the thiocarbamides were produced. The solution of the thiocarbamide in acetic anhydride is accompanied by simultaneous decomposition into "anilid" and mustard oil in accordance with the equation $CS(NHR)_2 + (CH_3CO)_2O = CH_3CONHR + R.NCS + CH_3COOH$. When the solution is heated for five minutes at the boiling-point of acetic anhydride, an almost theoretical yield of mustard oil is obtained. Prolonged heating produces a secondary reaction expressed by the equation $R . NCS + CH_3COOH = CH_3CONHR + COS$. In the case of fatty thiocarbamides a well-defined acetylated thiocarbamide is first produced, and prolonged heating gives rise to the formation of mustard oil, but the yield of the latter is never high, and as final product a substituted amide is produced.—The decomposition of silver chloride by light, by A. Richardson. When pure silver chloride is exposed to light under water oxygen is evolved, part of which is present as ozone; when small quantities of water are present, chlorine and hydrogen chloride are found in solution; with large quantities of water, hydrogen chloride, but no chlorine, is found. The influence of hydrogen chloride in retarding the decomposition of silver chloride is considered, and is explained from experimental results given, which show that even minute quantities of hydrogen chloride exercise a marked influence on the stability of chlorine water when exposed to light, the rate of decomposition of the silver chloride being dependent on the readiness with which the chlorine in solution and water interact to form hydrogen chloride. The author describes experiments which show that the darkened product obtained by exposure of silver chloride to light contains no oxygen, and he concludes that it is of the nature of a sub-chloride rather than an oxychloride.—The addition of the elements of alcohol to the ethereal salts of unsaturated acids, by T. Purdie and W. Marshall. The authors record the results of experiments on the addition of the elements of alcohol to ethereal salts of fumaric and maleic acids by the agency of small quantities of sodium alkylate; they also describe a series of experiments with other ethereal salts, the object of which was to ascertain if the ethereal salts of unsaturated acids in general are capable of undergoing the same additive change. By the action of a small quantity of sodium methylate in the cold, on a mixture of methylic alcohol and methylic fumarate, an almost theoretical yield of methylic methoxysuccinate is obtained. Methyl fumarate, on heating with alcoholic sodium methylate, yielded a compound of the formula $C_{11}H_{12}O_7$, formed by the abstraction of 3 mols. of methyl alcohol from 2 mols. of methylic methoxysuccinate. Under similar conditions methylic amylate gave methylic methylpropionate. Methylic and ethylic crotonate gave methylic methoxybutyrate and ethylic ethoxybutyrate. The authors think that the alkyloxy-group attaches itself to the β-carbon atom. Ethylic methacrylate also formed additive compound; but pure products were not obtained from the reaction. Ethylic angelate, ethylic allylacetate, methylic and ethylic cinnamate and ethylic *o*-(β) ethylcumarate do not undergo additive change.—Notes on the azo-derivatives of β-naphthylamine, by R. Meldola, F.R.S., and F. Hughes. The authors have completed the series of azo-derivatives obtainable from the nitranilines and β naphthylamine by preparing orthonitrobenzene azo-β-naphthylamine. The latter by the action of nitrite in a warm acetic acid solution gives orthonitrobenzeneazo-β-naphthol. In cold acetic acid solution the naphthyl acetate is formed. Acetyl derivatives of the ortho-, meta-, and para-nitroazo-derivatives of β-naphthylamine have also been prepared. The pseudazimides from the para- and metanitro-compounds have been prepared. These compounds have the formula $C_{10}H_6\langle {N \atop N} \rangle N . C_6H_4 . NO_2$ (*p* or *m*). The action of aldehydes on these β-naphthylamine azo-derivatives gives rise to the formation of triazines, which are being investigated.—A method for the estimation of nitrates, by G. McGowan, Ph.D. This estimation is based on the interaction $HNO_3 + 3HCl = NOCl + Cl_2 + 2H_2O$. The gaseous products are led into a solution of potassium iodide.—New benzylic derivatives of thiocarbamide, by A. E. Dixon, M.D. A re-examination of "monobenzyl-thiocarbamide" has shown that the substance hitherto bearing this name is benzylamine thiocyanate; the latter can be converted into the isomeric thiocarbamide by heating for a short time at 150°–160°. The author describes a great number of benzylic derivatives of thiocarbamide.

Linnean Society, May 24.—Anniversary Meeting.—Prof. Stewart, President, in the chair.—The Treasurer presented his Annual Report duly audited, and the Secretary having announced the elections and deaths during the past twelve months, the usual ballot took place for new members of Council, when the following were elected: Messrs. C. B. Clarke, G. B. Howes, Arthur Lister, St. G. Mivart, and F. W. Oliver. The President and officers were re-elected. The usual formal business having been transacted, the President proceeded to deliver his annual address, taking for his subject "The Secondary Sexual Characters of Animals and Plants," of which he gave several interesting examples, illustrating his remarks with graphic sketches in coloured chalks. On the motion of Mr. H. Druce, seconded by Mr. C. Tyler, a vote of thanks was accorded to the President for his able address, with a request that he would allow it to be printed.—The Linnean Society's Gold Medal for the year 1891 was then formally awarded to Dr. Edouard Bornet, of Paris, for his researches in botany, and on his behalf was presented to M. Raymond Lecomte, Secretary to the French Embassy. The proceedings then terminated.

Institution of Civil Engineers, May 26.—Annual General Meeting.—Sir John Coode, K.C.M.G., President, in the chair.—In the Report of the Council for the session 1890-91, it was remarked that the salient feature of the session, now terminated, had been the realization of a proposal made more than forty years ago—namely, the formal reception by the President and Council on stated evenings after the ordinary meetings of the members and visitors then present. A series of receptions was held after the ordinary meetings in the months of January, February, March, April, and May, of this year. An endeavour has also been made to identify, in some degree, each gathering with a particular branch of engineering, both in respect to those invited to be present and to the models and other objects of interest exhibited. These receptions were believed to have been most successful, and experience would doubtless suggest directions in which they might be rendered still more useful and attractive in the future. The effective increase in the roll of the Institution during the past year was 247. The number of members of all classes, students excepted, on March 31 last, was 5150, as against 4903 on the same day last year, representing an increase at the rate of 5 per cent.—The adoption of the Report was moved, seconded, and carried, and it was ordered to be printed in the Minutes of Proceedings. Cordial votes of thanks were then passed to the President, to the Vice-Presidents and other Members of the Council, to the Auditors, to the Secretaries and Staff, and to the Scrutineers.—The ballot for Council resulted in the election of Mr. George Berkley as President; of Mr. H. Hayter, Mr. A. Giles, M.P., Sir Robert Rawlinson, K.C.B., and Sir Benjamin Baker, K.C.M.G., as Vice-Presidents; and of Mr. W. Anderson, D.C.L., Mr. J. Wolfe Barry, Mr. E. A. Cowper, Sir Jas. N. Douglass, F.R.S., Sir Douglas Fox, Mr. J. Clarke Hawkshaw, M.A., Mr. Charles Hawksley, Sir Bradford Leslie, K.C.I.E., Mr. George Fosbery Lyster, Mr. J. Mansergh, Sir Guilford Molesworth, K.C.I.E., Mr. W. H. Preece, F.R.S., Sir E. J. Reed, K.C.B., F.R.S., M.P., Mr. W. Shelford, and Mr. F. W. Webb as other Members of the Council.—The session was adjourned until the second Tuesday in November, at 8 p.m. [At the first meeting of the newly-elected Council, the following officers were re-appointed: Mr. H. L. Antrobus, as Treasurer; Dr. Wm. Pole, F.R.S., Honorary Secretary; and Mr. James Forrest, the Secretary.]

EDINBURGH.

Royal Society, May 4.—Sir Douglas Maclagan, President, in the chair.—A preliminary note by Mr. John Aitken, on a method of observing and counting the number of water particles in a fog, was communicated. The phenomena which are denoted by the names fog, mist, and rain, differ merely in degree, and not in kind. In a haze dry dust particles are present in the air to a greater or less extent. The haze turns into a fog when water vapour is condensed upon the particles, and the fog will develop into mist upon the condensation of a sufficient amount of moisture. So that we may regard an ordinary fog and a mist as a dry fog and a wet fog respectively. The water drops in a fog will gradually settle upon the exposed surfaces of bodies. Hence it might seem that, in order to determine the extent to which moisture is present in a fog, it would be sufficient to allow the drops to fall upon a piece of mirror, which they would soon wet. But Mr. Aitken has found that when exposed surfaces are quite dry, a great quantity of water drops are often present in the air. The drops are exceedingly small and evaporate with great rapidity from the surfaces (heated by radiation) upon which they fall. The instrument which Mr. Aitken has adopted for the purpose of determining whether or not water drops are present is essentially identical with his pocket-dust counter. It consists of a glass micrometer divided into squares of a known size, a spot mirror for illuminating the stage, and a strong lens or a microscope for observing the drops on the stage. It is found convenient to observe an area of the stage equal to about 1/16th or 1/20th square centimetre when working with a magnifying lens. In one fog which was observed, objects at a greater distance than 100 yards were quite invisible, and the surfaces of exposed objects were quite dry. The number of drops which fell per minute varied greatly, sometimes reaching 3000 per square centimetre, sometimes only 300 per square centimetre. Two days later the same apparent external conditions regarding fog again obtained, and the number was found to be 1300 per square centimetre per minute—which remained fairly constant until the fog began to clear off when it slowly diminished. In both cases the observation was made at 10 a.m. If the stage be slightly heated, the drops never reach the surface but evaporate in the layer of heated air over it. Mr. Aitken has also modified this apparatus in order to admit of the counting of the number of drops which fall from a column of air of known height. A low power microscope is used, and so a column of air 5 centimetres long can be obtained over the stage. Underneath, and concentric with the microscope, a tube 5 centimetres long and 4 centimetres in diameter is mounted. The top and bottom of this tube can be simultaneously closed by covers which turn on an axis parallel to the axis of the tube. A micrometer, illuminated by a spot mirror, is fixed in the centre of the bottom, and, in the centre of the upper cover, a small opening which corresponds to the lens of the microscope is made. The former instrument may be used to observe the larger particles of dust in the atmosphere.—Dr. J. M. Macfarlane read a paper, illustrated by lantern demonstrations, on a comparison of the minute structure of plant hybrids with that of their parents. He finds that the minute structure of the hybrid, like the larger features, is always intermediate in character between the corresponding structures of the parents.

PARIS.

Academy of Sciences, May 25.—M. Duchartre in the chair.—Researches on the camphene series, by MM. Berthelot and Matignon.—Researches on the vapour-tension of saturated water-vapour at the critical point, and on the determination of this critical point, by MM. Cailletet and Colardeau. In a recent note (*Comptes rendus*, vol. cxii. p. 563, 1891) the authors communicated to the Academy a new method for determining critical temperatures and pressures. They now give the results obtained in the case of water. Six series of experiments with different weights of water indicate that the critical temperature is 365° C., the critical pressure which corresponds to this being 200·5 atmospheres.—On the analysis of the sunlight diffused by the sky, by M. A. Crova. If B be the intensity of the blue light diffused by the sky, and S the intensity of incident sunlight, it may be shown that $\frac{B}{S} = 100\left(\frac{565}{\lambda}\right)^n$, where 565 represents the wave-length of the maximum light intensity of the spectrum, and n is an empirical coefficient. M. Crova calculates values with $n = 4$ and $n = 4{\cdot}5$, and finds that, although Lord Rayleigh's observations (*Phil. Mag.*, 1871, p. 107) are best in accord in the former case, his own observations at Montpellier give results which are better represented when the latter value of n is used.—On the relative age of the Quaternary stratum of Mont Dol (Ille-et-Vilaine), by M. Sirodot. The author's observations lead him to believe that the *débris* on Mont Dol belongs to an epoch anterior to the movement which in Quaternary times elevated the coasts of certain regions of the Baltic Sea.—On the exact determination of the glycolitic power of the blood, by M. R. Lépine and Barral.—Observation of the passage of Mercury across the sun's disk on May 9, 1891, made with the Plœssl equatorial at the National Observatory of Athens, by M. D. Eginitis. The internal contact of egress occurred at 18h. 17m. 20s., and external contact at 18h. 22m. 0s. (Athens mean time). The irradiation phenomenon known as the "black drop" was not observed.—The atmospheric conditions of Greenwich with regard to the universal hour question, by M. Tondini. The cloudy state of the Greenwich sky, and the many rainy days recorded at the Observatory, are adduced as arguments against the adoption of Greenwich as the prime meridian. The meridian of Jerusalem-Nyanza is said to possess numerous atmospheric and other advantages.—On the algebraic integration of differential equations of the first order, by M. Painlevé.—On the determination of the integrals of equations from derived partials of the first order, by M. J. Collet.—On Abelian equations, by M. A. Pellet.—Researches in thermo-electricity, by MM. Chassagny and Abraham.—Determination of the solar constant, by M. R. Savélief. From an actinometric curve obtained on December 26, 1890, the author obtains for the solar constant, reduced to the mean distance of the sun from the earth, the value 3·47 calories. Langley's value, from his Mount Witney observations, was 3·0 calories.—On the fluctuations in the heights of lake waters, by M. P. du Boys. In lakes, and particularly in the Lake of Geneva, the surface of water regularly rises in one part and lowers in another, performing an oscillatory movement. The region where the level is practically constant is called the node, and the movements referred to go by the name of *seiches*. The author investigates this wave-motion mathematically.—On a new portable sounding-apparatus of steel wire, by M. Émile Belloc.—Study of the barometric gradient, by M. G. Guilbert. Some remarkable relations between the force of the wind and the barometric gradient are given.—Relation between atomic weight and the density of liquids, by M. Al. Moulin.—On the sub-chloride of silver, by M. Guntz. Under the action of heat, the sub-chloride decomposes into silver and silver chloride. This decomposition is easily seen by the change of colours of the sub-chloride. Dilute nitric acid has absolutely no action upon the compound. With hot concentrated nitric acid, chloride of silver mixed with the sub-chloride is obtained. Potassium cyanide rapidly dissolves the compound, and decomposes it. Utilizing this reaction, the author has found that a given weight of chlorine disengages practically the same amount of heat (29 calories), when combining with Ag as when combining with Ag_2.—Action of potassium salts upon the solubility of potassium chlorate, by M. Ch. Blarez.—Electrolysis of the fused salts of boron and silicon, by M. Adolphe Minet. Some interesting experiments indicate that, by the electrolysis of white and red bauxites, it is possible to produce a series of alloys of iron, silicon, and aluminium, and, at the end of the operation, to obtain aluminium chemically pure.—On two new crystalline compounds of platinic chloride with hydrochloric acid, by M. Léon Pigeon. The compounds described have the composition $PtCl_4 . 2HCl . 4H_2O$ and $PtCl_4 . HCl . 2H_2O$.—On salicylate of bismuth, by M. H. Causse.—On the heat of solution and the solubility of some bodies in methyl-, ethyl-, and propyl-alcohols, by M. Timofeiew.—On the Stelleridæ found in the Bay of Biscay, at the Azores, and Newfoundland during the scientific expeditions of the yacht *Hirondelle*, by M. Edmond Perrier.—On the equivalence of the bundles in vascular plants, by M. P. A. Dangeard.—On the trappean formation of Toungouska Pierreuse, Siberia, by M. K. de Kroustchoff.—Researches on the elimination of oxide of carbon from the system, by M. L. de Saint-Martin.

MELBOURNE.

Royal Society of Victoria, March 12.—The following officers were elected for the year 1891:—President: Prof. Kernot. Treasurer: C. R. Blackett. Secretaries: H. K. Rusden and Prof. W. Baldwin Spencer.—The following papers were read:—A new species of Dictyonema, by T. S. Hall.—A preliminary account of *Synute pulchella*, by Arthur Dendy. This is a new genus and species of calcareous sponge, which is allied to Ute, but in which the individuals are fused together into a common mass.—The geology of the southern portion of the Moorabool valley, by T. S. Hall and G. B. Pritchard.

April 9.—On the occurrence of the genus Belonostomus in the Rolling Downs formation (Cretaceous) of Central Queensland, by R. Etheridge, Jun., and Arthur Smith Woodward, of the British Museum. This is described as a new species, under the name of *Belonostomus sweeti*.—Note on a new genus of Chætopod worm parasitic on a sponge of the genus Rhaphidophlus from Port Phillip, by Prof. W. Baldwin Spencer. The worm is remarkable in having the dorsal surface covered with a series of rows of setæ, each row enclosed in a membranous web, the bunches of setæ on the feet are also enclosed in webs.

GÖTTINGEN.

Royal Academy of Science.—In the Journal of the Scientific Academy of Göttingen, the following papers of scientific interest appear (July to December, 1890):—

July.—Fr. Pockels: On the interference phenomena of convergent homogeneous polarized light through twin-plate uniaxal crystals.—Voigt: Determination of the elastic constants of Brazilian tourmaline.

August.—Julius Weingarten: On particular integrals of Laplace's equation, and a class of fluid motions connected with the theory of minimum surfaces.—Venske: A modification of Hermite's first proof that *e* is transcendental.—Riecke: Special cases of equilibrium of a system having several phases.—Meyer: Discriminants and resultants of singularity equations (second notice).—Burkhardt: An equation in the theory of the theta-functions.—Klein: On the zero-points of the hypergeometric series.

October.—Nernst: On the distribution of a substance between two solvents.

December.—Riecke: The thermal potential of weak solutions. On electricification by friction.—Meyer: On discriminants and resultants of singularity equations (third notice).—Voigt: On the vibrations of strings.—Riecke: Molecular theory of diffusion and electrolytic conduction.—Hurwitz: On the zero points of the hypergeometric series.—Voigt: Determination of the constants of elasticity of several non-crystalline minerals.—Auerbach: On hardness and its absolute measurement.

STOCKHOLM.

Royal Academy of Sciences, May 13.—The elements of the hydrography of the Kattegatt and Skagerack, by Prof. O. Pettersson.—Studies on the Solenogastres; i. monograph of *Chætoderma nitidulum*, by Dr. A. Wirén.—Researches on the fossil wood of Sweden, by Dr. Conwentz, in Danzig.—Prof. S. Lovén gave a report on the work executed during the last summer at the zoological station of Kristineberg in Bohuslän, Sweden, and reviewed a paper by Dr. C. Aurivillius on the symbiosis between Pagurus and Hydractinia as well as another by Dr. Wirén on *Chætoderma nitidulum*.—Researches and observations on the method of Koch in treating tubercular diseases by Prof. Bruzelins.—A copper-plate engraving of a map of the world made in the beginning of the fifteenth century, formerly belonging to the museum of Cardinal Borgia in Velletri, described by Baron A. E. Nordenskiöld.—Studies on the brain of teleosteous fishes, by Herr G. Andersson Malme.—A final contribution to the flora of the Chlorophyllophysæ of Siberia, by Herr O. F. Borge.—On phen-ethyl-propyl and phenyliso-propyl-triazol combinations by Dr. T. A. Bladin.—On the specific heat of water between 0° and + 40°, by Herr A. M. Johansson.—A few formulæ to calculate the mortality among annuitants of public offices and private societies by Dr. G. Enström.—A comparison between the methods of Ångström and Neuman for determining the conductibility of heat in bodies; ii. experimental researches, by Dr. Hagström.—Hydrographical researches in the Gullman fiord during the summer of 1890, by Miss A. Palmqvist.

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