THURSDAY, MAY 28, 1896.

THE PHOTOGRAPHY OF HISTOLOGICAL EVIDENCE.

An Atlas of the Fertilisation and Karyokinesis of the Ovum. By E. B. Wilson, with the co-operation of E. Leaming. (New York and London: Macmillan, 1895.)

PROF. WILSON has earned the gratitude of teachers and students of biology by publishing his "Atlas of Fertilisation." He has collected, on ten plates of a convenient size, a series of photographs illustrating the development of *Toxopneustes*, from the mature ovarian ovum until the formation of a sixteen-celled blastosphere. The photographs were made by Dr. Leaming, from sections prepared by Prof. Wilson; and they have been admirably printed from untouched negatives. Each figure is about three and a half inches in diameter, so that all details capable of photographic reproduction can be easily seen.

The first plate contains two photographs of ovarian eggs, in which the nuclear structure is well seen; a third, showing the nuclear division leading to the first polar body; and a fourth, showing the mature egg after extrusion of both polar bodies. The next four plates illustrate the entrance of the spermatozoon, the approximation of the male and female nuclei, and the formation of the "asters." The sixth plate shows the changes in the approximated nuclei during the pause which follows the entrance of the spermatozoon; and the seventh, eighth and ninth contain twelve very beautiful figures of the first division of the fertilised egg. Finally, some of the later divisions are exhibited on the tenth plate.

The photographs are accompanied by a short but clear account of the phenomena they are intended to illustrate; and in many cases difficult details are rendered intelligible by means of diagrams.

There can be no doubt that this Atlas will be of great service to students and to teachers, as an exposition of our present knowledge concerning the main facts of fertilisation; although one is tempted to regret the absence of any figures demonstrating the number of chromosomes, either in the polar bodies or the pronuclei. The excellence of the work suggests, however, another standard by which to judge it—a standard indicated by Prof. Wilson himself in his preface, when he points out that the most careful drawings involve a subjective element from which photographs are free, and states his belief that, in spite of certain necessary shortcomings, "the photographic plates here presented give, on the whole, a clear and accurate impression of the preparations."

If photography could indeed provide an image of histological preparations, as clear and accurate as that received by the eye of a trained observer, then a great step would have been made; for every histologist would be enabled to convey to others the whole evidence for his statements in a way before impossible; and a photograph, when once successfully taken, might serve as material for future research in the hands of men unable to procure the object photographed.

Unfortunately, Dr. Leaming's photographs, admirable as they are, do not approach the perfection necessary if they are to be regarded as representing the whole evidence given by the actual sections. This may easily be seen by any one who tries to determine from them the truth of some statements made in the text.

Prof. Wilson holds the view, now shared by the majority of observers, that both the centrospheres of the fertilised egg arise from a portion of the spermatozoon; and he considers that the male and female chromatin elements lie side by side, without mixing, during the division of the single original centrosphere. As evidence of this, he gives photographs 17, 18 and 19, and woodcuts xi. and xii. In the woodcuts, the distinction between the male nucleus and the female is clear and unmistakable; while, at least in photographs 18 and 19, this is not the case. Again, in the photograph fig. 19 there is no clear indication of structure in the male nucleus; while in the woodcut fig. xii. B, which may well have been drawn from the actual section photographed, a distinct reticulum is indicated in its substance.

Few persons will believe that Prof. Wilson has made positive statements on the evidence of sections showing no more than the photographs referred to: every one will feel that the woodcuts represent the essentials of his preparations better than the photographs. So that we have to judge the question, after all, by reading the author's account of what he says he saw; and when photography has done its best, the evidence of the condition of these nuclei at a particular moment still rests upon his reputation as a histologist, as completely as it would have done had he published the woodcuts only, or no figures at all.

In the case just referred to, the author's statement is so completely in accord with those of other workers, that few will hesitate to accept it; but when he points to photograph No. 19 as evidence that the rays of the amphi-aster "are really fibres, and not, as some recent authors have maintained, merely the optical sections of thin plates or lamellæ in a radially arranged alveolar structure," there is equally little evidence one way or the other to be obtained from the photograph, while there is more room for doubt as to the accuracy of the interpretation. The reference is, of course, to Bütschli's work on the structure of protoplasm; and those readers of NATURE who have compared Prof. Bütschli's photographs with his drawings, will remember that in his case also the photographic reproduction of the evidence was not a material addition to the strength of the argument.

On the whole, it seems certain that the best photograph at present possible does not show so much as can be seen by looking directly at a good histological preparation: so that it is not yet possible for a histologist to multiply copies of his evidence in a form from which the subjective element is altogether excluded. There is still no way of testing a histological statement without direct examination of the object described. Further, it seems that a careful drawing by a trained observer gives a better idea of appearances seen under the microscope than the best available reproduction by photography can at present achieve.

W. F. R. WELDON.

THE KEW INDEX OF PLANT NAMES.

Index Kewensis Plantarum Phanerogamarum. Sumptibus beati Caroli Roberti Darwin ductu et consilio Josephi D. Hooker confecit B. Daydon Jackson. Fasciculus iv. Pp. 641–1297. (Oxonii : e prelo Clarendoniano, 1895.)

THE serial issue from the press of large works of reference like that under notice does not always proceed with the rapidity which, to those whose appetites are whetted by foretaste, appears possible and desirable. It is therefore with all the more satisfaction that we chronicle the issue with commendable promptness of this, the fourth, fasciculus of the Kew Index, by which the work is brought to completion. Botanists and all who have concern in the names of plants are thereby furnished with a book which must always form an essential tool in their library equipment.

The appearance of the earlier fasciculi gave occasion for a notice in NATURE of the aim and scope of the work, and it is not necessary therefore to refer to these again, the less so as the two years that have elapsed since the first fasciculus came into our hands have sufficed to familiarise those who have need to use such a book with its value as a standard work of reference. It may not, however, be mistimed to repeat here the caution given by the Director of Kew in his address at the Ipswich meeting of the British Association, that the work is no more than its name signifies. It is a sound and safe guide ; it is not a critical botanical work. The bulk of the names as cited in the Index may be regarded as definitely fixed for the nomenclature of botanists, at least in Great Britain ; but throughout the volumes any one may find abundant evidence that it was not the intention of those who have laboured to produce this magnificent work to go beyond the identifications established in the literature of botany at the date at which their citations close. Further study and investigation must result in modifications of limits imposed by the state of botany in 1885, and names will change therewith ; but such alterations of names, the acceptation or rejection of which must be a matter of botanical opinion, will not detract from, but will rather enhance the value of the Index as a standard of botanical nomenclature.

In no direction is the beneficent influence of the publication of the Index more immediately to be looked for than in the literature of horticulture, and it is in this aspect that the book will appeal to that large section of the public delighting in gardening, and which naturally objects to purchasing from a nurseryman the same plant over and over again under different names. It would appear that the Index is already exercising an effect, and that nurserymen are disposed to use the botanical name, if not instead of, at least cited alongside of, the trade name for plants in their catalogues—a practical result for which we cannot be too thankful, and in the hastening of which we must recognise the stimulus given by the excellent series of hand-lists of plants cultivated in the Royal Gardens, Kew, now in course of publication.

On the completion of their labours upon this vast work the botanical world will accord to Mr. Daydon Jackson and Sir Joseph Hooker its hearty congratulations, nor will it forget that to Mr. Darwin it owes the projection and endowment of the book. To the Clarendon Press, too, its thanks will be given for the dress in which it has sent out the volumes. Whatever may be the future of botanical nomenclature—and the opening of the twentieth century is threatened with no less an infliction than a new "nomenclator," prepared in conformity with his own special principles by Dr. Otto Kuntze, which is to sweep away the nomenclature of the Kew, Berlin, and New York "cliques" (the productive seats of systematic botany)—botanists in all time must recognise the sound, judicious, conscientious workmanship displayed in the Index Kewensis through which it takes and will retain its value as a work of reference.

THE ANATOMY OF FEAR.

Fear. By Angelo Mosso. Translated from the fifth edition of the Italian, by E. Lough and F. Kiesow 8vo. Pp. 277. (London, New York, and Bombay: Longmans, Green, and Co., 1896.)

THE learned and eloquent Professor of Physiology at Turin has given us in the book which he has entitled "Fear," an analysis of this mental condition and its accompanying physical states, which, marked as it is by scientific accuracy and couched in charming and even in poetical diction, will take high rank as a popular exposition of our knowledge of the expression of one of the most interesting of the emotions of both men and animals. The extent of ground which is covered by the author, and the amount of information which he has contrived to convey within a small compass, excites our astonishment and admiration. Nor, in spite of the complicated scientific problems which are dealt with, is there a word of heavy reading from beginning to end. The book is beyond measure interesting, and one that when taken up it is difficult to lay down unread. Clearly it was impossible in a work with this title to avoid gruesome details, and readers whose nerves are disagreeably affected by descriptions of morbid conditions may put the book down with a shudder when they arrive at a passage in which a pathological case, which is used to illustrate the argument, is painted in glowing language from the life. For the author has in no wise burked such details ; on the contrary, they come before one from time to time in the work with a vividness which transports one bodily to the hospital ward, the asylum, the vivisection table ! But there is at the same time such a strong under-current of sympathy with suffering pervading the whole, that while the reader will come away from the scenes depicted, deeply interested in the lessons which they teach, there is no fear that he will be rendered callous by the familiarity which he has acquired with their horrors.

The idea of the book is to endeavour to rest the expression of this important emotion upon a physiological basis. With this aim in view, the effects of dread upon the heart and circulation, upon the respirations, upon the muscular system both voluntary and visceral, upon the secretions, and upon the central nervous system, are portrayed. Nor does the author confine himself strictly to the emotion which gives the book its title, although this naturally constitutes the main theme. The number of other subjects incidentally treated of, furnishes a pleasing variety, and largely helps to maintain the interest of the reader, whether he be scientific or not. In pursuing his subject, Prof. Mosso is led into a criticism of Greek art, and contrasts as a medium of expression of the emotions the works of Phidias and Praxiteles with those of the schools of Pergamos and Rhodes. He compares the Niobe with the Laocoon; in the former he finds lacking "the expression of intense emotion, of horror, fear, and pain, which would inevitably be present in the terrible moment of so cruel a butchery."

"Though Praxiteles himself were the creator of the Niobean group, I yet hold that a humble physiologist, looking with dispassionate eye at these statues, may affirm that they fall short of the fame of so great a master, because the faces are not so modelled as to produce the desired effect, because nature is not faithfully copied, and because there lacks the sublime ideality of terror aroused by the chastisement of an offended deity, which was the subject of the work."

On the other hand, in spite of certain anatomica errors in the furrows of the brow in the Laocoon,

"an intense and majestic pain is written on the face, . . . one seems to hear the sigh of superhuman agony from his lips, and sees the lines of beauty and of pain wonderfully blended."

In touching upon questions of inheritance, the author shows himself rather a disciple of Spencer than of Darwin. But it is not clear upon what evidence he founds the statement that if two hounds of the same litter are taken, and one trained for sport and the other as a watch-dog, their offspring, after four or five generations of such training, although brought up under the same conditions and far from noise, will be in the one case excited, in the other terrified on first hearing the report of a gun. Nor I conceive will the assertion be generally accepted that the disappearance of the eyes in subterranean animals "is certainly not the result of natural selection, for eyes are not injurious even to beings living in the dark." On the other hand all will agree with the author in deprecating the installation of fear in the child, of which the ignorant mother or nurse is so often guilty.

"The children of ancient Greece and Rome used to be frightened with the lamias who would suck their blood, with the masks of the atellans, the Cyclops, or with a black Mercury who would come to carry them away. And this most pernicious error in education has not yet disappeared, for children are still frightened with the bogey-man, with stories of imaginary monsters, the ogre, the hobgoblin, the wizard and the witches."

"Children should be brought up as though they were rational. . . . The same methods should be followed in education as in the teaching of science . . . we should never issue any command without showing the reasons why it should be done in this way rather than in another." . . . "They must not be fatigued with study . . . even for healthy children premature education is a very grievous error."

"Parents who have already some weak spot—a little fault in the character, a slight blemish in the organism—should redouble their care in order to cure their children from their own defects. . . . The paramount object of education should be to increase the strength of man, and to foster in him everything which conduces to life. . . . We sometimes imagine that the most important branch of culture is that which we attain through education and study . . . but in ourselves, our blood, there is a no less important factor. . . . Fear is a disease to be cured; the brave man may fail sometimes, but the coward fails always."

The translation is excellent throughout.

E. A. SCHÄFER.

OUR BOOK SHELF.

Die Physiologie des Geruchs. (*The Physiology of Smell.*) By Dr. H. Zwaardemaker. Pp. 324. (Leipzig: Engelmann, 1895.)

VON HARTMAN, in defending himself against a friend who upbraids him for having wasted upon philosophy talents which might have been devoted to the accumulation of facts of positive science, points out in memorable words that facts of science are amassed only in order that they may be synthesised.

The critic is bound to remember this in appraising a book like that of Dr. Zwaardemaker's, for Dr. Zwaardemaker has added to the burden of physiological facts, and he has not established any generalisations to assist us in the carrying of that load.

If we overlook this fact, and we ought not to overlook it lightly, the work is a most praiseworthy one, a work that is characterised by the thoroughness which the Teuton strives after, and which, as a matter of fact, is found in the best of Low German science. There are very careful chapters in this book, only to mention a few, on the physical characteristics of odorous substances, on the mechanics of smell, on "olfactory" and "breath-fields," on the relations between taste and smell, on a new method of testing the acuity of smell, on the masking of smells by other smells, on the classification of smells, and on Prof. Haycraft's work on the relations between odour and chemical composition. Many of these subjects are treated with considerable originality. The "breath-field" is mapped out by breathing on a bright metallic surface. It is shown that two patches of dimness are produced, corresponding respectively to the right and the left nostril. It is further shown that each of these fields is subdivided into two smaller fields by a linear interspace, which in all probability corresponds to the inferior turbinated bone. The two patches of dimness on each side, therefore, in all probability correspond to the two streams of air which pass respectively above and below the lower turbinated bone. The patch of dimness which corresponds to the current of air which passes over the lower turbinated bone is conterminous with the olfactory field as determined by an independent method.

The apparatus for testing the acuity of smell consists of a porous clay cylinder, which is fitted up somewhat after the manner of a syringe. The piston-rod consists of a tube which serves to convey the air into the nostril. The air which is thus fed into the nostril consists in part of inodorous air which has been drawn in from without through the open end of the clay cylinder, and in part of air which has been in contact with the walls of the porous cylinder which has been impregnated with an odorous substance. The proportion of odorous to inodorous air can be varied at pleasure by regulating the position of the piston in the cylinder.

The chapter on the association between smell and taste emphasises the fact that there is an inlet to the olfactory chamber through the posterior nares, as well as through the nostrils. We therefore smell both when we inspire and when we expire. It is because he is ignorant of this fact that the layman is incredulous when he is informed that many of the sensat ons which he refers to taste are in reality referable to smell, and it is on account of the same ignorance, that the child thinks he is treated irrationally when his nose is held while his castor-oil is being administered to him.

A few facts of this sort will be all that an ordinary reader will carry away from a perusal of this book. The book will be really valuable only to the physiologist who, like Dr. Zwaardemaker, is willing to devote himself to the study of the physiology of smell.

Computation Rules and Logarithms. By Prof. Silas W. Holman. Pp. xlv + 73. (New York and London: Macmillan and Co., 1896.)

THE first portion of this book treats of the way to use logarithms so as to apply no more figures than necessary; the author pointing out that probably one half of the time expended in computations is wasted through the use of excessive number of places of figures, and through the failure to employ logarithms. With this in view, rules are given showing what place tables to employ, and also how many figures to retain to obtain an accuracy of any desired percentage.

That such rules are of high importance may be seen from the fact that the use of five place tables when four would suffice nearly doubles the labour; using six place instead of four nearly trebles it, thus wasting a hundred and two hundred per cent. respectively of the necessary amount of work, and probably a greater proportion of time.

Besides these rules and the usual explanation to the collection of mathematical tables, there is a short treatment on "Notation by Powers of Ten," which, as the author sees, is a method that if taught with elementary arithmetic, it would enormously facilitate the teaching of logarithms; but his "Symmetrical Grouping of Figures" about the unit's place is a departure likely to be received with some degree of conservatism. There is a useful paragraph on the "Habit in Reading off Numbers or Logarithms," which consists in emphasising and grouping the figures in a certain habitual way. The latter part of the book is taken up by a collection of mathematical tables, *e.g.* logarithms, antilogarithms and cologarithms to four places, logarithms to five places, logarithms of the trigonometrical functions, slide wire ratios to four places, &c. The decimal point, usually omitted, has been retained in the tables for facilitating in reading off.

Remarkable Eclipses. By W. T. Lynn. Pp. 52. (London: Edward Stanford, 1896.)

THIS "sketch of the most interesting circumstances connected with the observation of solar and lunar eclipses, both in ancient and modern time," appears at a very appropriate time, since in a little more than two months the general public will be mildly interested in a total eclipse of the sun, for the observation of which in Norway, Japan, and elsewhere, many astronomers are making preparations. Mr. Lynn has contrived to compress a marvellous amount of very readable information in his slender little volume, and as a condensed statement of the history of eclipse observations his essay is admirable. The book is uniform with "Remarkable Comets," and it deserves the same successful career as its forerunner.

The Old Light and the New. By Wm. Ackroyd, F.I.C. Pp. 102. Illustrated. (London: Chapman and Hall, Ltd., 1896.)

WE very much question the wisdom of placing this book upon the market. The information on researches with Röntgen rays is very sketchy, while a large portion of the book, dealing with theories of the natural colours of bodies, is nothing more than padding, and is altogether out of place in a volume of this character.

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.*]

A Curious Idiosyncrasy.

A STRONGLY marked idiosyncrasy has lately come to my notice, which should be recorded. A lady of my acquaintance was walking with a relative, Colonel M., when the wife of a tenant addressed her, and described how the hand of her own child had been pinched in a door. Overhearing her story, Colonel M. became quite unwell, so much so as to lead to particular inquiry, which resulted in showing that allusions to any accidents of that kind affected him at once in a very perceptible way. Finally, at the request of the lady, he wrote an account of his peculiarity, which she forwarded to me. Thereupon I corresponded with Colonel M., who slightly revised what he had written, and sanctioned its publication. It is as follows:—

"From my earliest remembrance, and still up to now, any sight of an injured nail in any person, even if a total stranger, or any injury, however slight, to one of my own nails, causes me to break into a deadly cold perspiration, with feeling of sick faintness. But still further; if I chance to hear any one else narrating in casual conversation any injury of this particular sort to themselves or others, it brings on me exactly the same feeling I have described above. So much is this the case, that many years ago, when I was in the prime of life, at a large dinner party, when one of the guests near me persistently chanced to go on talking minutely of some such little accidental injury that had befallen him, I turned very faint, tried all I knew to shake it off, but could not, and presently slid right under the table quite unconscious for the moment. This is the more singular because on no other point am I in the least squeamish. In old days I have seen soldiers flogged before breakfast without its affecting me, though some of the rank and file would be very much upset, and in cases of death, illness, or wounds, I have never experienced, as an onlooker, the sensations I have alluded to above."

I may mention that the mother of Colonel M. had pinched her own finger-nail badly shortly before his birth, and, as is not uncommon in coincidences of that kind, she believed her accident to have been the cause of her son's peculiarity. He writes to me:—

"As a boy I was conscious of this repugnance of mine, but was ashamed of it, and never used to mention it to any one. When I became a young man I one day mentioned it *privately* to my mother, who it appeared had already noticed it in me as a child. She then told me the incident about her own finger, and she and I being both utterly unscientific persons, assumed then and there that my squeamish feelings about injuries to finger-tips must be connected with her little accident."

In reply to further questions, I learn that the injury to the mother, however painful at the time, was not so severe as to leave a permanent mark. Also, that no analogous peculiarity is known to exist among the near relations of Colonel M., of whom he specifies his father, brother, three sisters, nephews and nieces. He has no children.

This anecdote proves, so far as the evidence goes, that a very peculiar idiosyncrasy may spring suddenly into full existence, and need not develop gradually through small ancestral variations in the same direction. It is a more astonishing phenomenon than the equally sudden appearance of musical faculty in a single member of a non-musical family, being very special, and so uncommon and worse than useless that its ascription to reversion, in the common sense of the word, would be absurd. That is to say, it would be silly to suppose a sickly horror of wounded finger-nails or claws to have been so advantageous to ancient man or to his brute progenitors, as to have formerly become a racial characteristic through natural selection, and though it fell into disuse under changed conditions and apparently disappeared, it was not utterly lost, the present case showing a sudden reversion to ancestral traits. Such an argument would be nonsense. But though this particular characteristic is of negative utility, its existence is a fresh evidence of the enormously wide range of possibilities in the further evolution of human faculty.

FRANCIS GALTON.

Becquerel's and Lippmann's Colour Photographs.

THE point raised by Prof. Meldola (p. 28) is partially, if not completely, answered by Otto Wiener in a most valuable paper, "Ueber Farbenphotographie durch Körperfarben, und Mechanische Farbenanpassung in der Natur," published in *Wiedemann's Annalen*, 1895, lv. 225–281. Wiener devised a method of examining colour photographs through a right-angled prism in such a way that pigment colours, which owe their hues to absorption, are distinguished from interference colours by not changing their positions when seen through the prism. The application of this method to colour photographs by Lippmann's process and the older processes of Seebeck, Poitevin and Becquerel, shows that in Lippmann's photographs the colours are due entirely to interference. In Becquerel's process they are due mainly to interference, though pigment colours are formed to an extent which is generally very small, but which increases with the duration of the exposure. The colours on Becquerel plates *do* change with the angle of incidence, though the changes are very small, probably in consequence of the high refractive power of the film. Further, when the film is examined from the back the colours do not occupy the same positions as when they are viewed from the front. It follows that the colours on Becquerel plates are due essentially to the same cause as those on Lippmann's plates, and the theory of standing waves is applicable in both cases.

With the processes of Seebeck and of Poitevin, on the other hand, the colours are exclusively pigment colours, and the theory of standing waves is not applicable.

Weston-super-Mare, May 16. C. H. BOTHAMLEY.

Influence of Terrestrial Disturbances on the Growth of Trees.

IN reply to the note of Mr. H. J. Colbourn on "Influences of Terrestrial Disturbances on the Growth of Trees," in your issue of April 23, allow me to say that his ingenious suggestion of connecting a zone of narrow rings in a section of Douglas spruce with some supposed terrestrial disturbances occurring about the same time, is hardly tenable, even if the coincidence of the two phenomena were established, which seems not to be the case. The occurrence of a zone of narrow rings is common in all our trees, and I have observed it most frequently in all southern pitch pines, which are rarely over three hundred years old, and hence outside of the possibilities of the influence of unknown or uncertain terrestrial disturbances.

The suddenness with which the rings become narrow and then again wide, described by Mr. Colbourn, and observed by us in many other trees, is, to be sure, puzzling; nevertheless, we cannot escape the conclusion that it is due to changes in the conditions surrounding the tree. Yet it is not necessary that the change of conditions and of ring-width should be simultaneous, that is to say, the change of conditions may have occurred without having been immediately responded to by the growth of the tree.

The following explanation may serve as a type. Let a tree grow up under favourable conditions for a hundred years, as the Douglas spruce in question seems to have done, when its ring-growth will be wide, its crown reaching above its neighbours. A hurricane breaks off a large part of its crown, when necessarily and suddenly, at least within a year, the rings become narrow in proportion. Within the next thirty years the crown recuperates, which in a resinous conifer like the Douglas spruce is possible without fear of fungus attacks and decay; but the food-material descending from the foliage will for a long time be only sufficient, on the particular section in question at the base of the tree, to make the narrow annual ring, even after the crown is fully recuperated. Were a section cut higher up in the tree, it would be found that the rings there have begun to widen sooner than at the lower section. Finally, and rather suddenly for any given section, the supply has become normal, and especially if an exceedingly favourable season occurs at the same time the rings show again normal width.

The same sudden change from narrow to wide rings is observed when a tree oppressed by its neighbours is suddenly relieved by windfall or by man's interference from its oppressors; but the response even then is not simultaneous, it takes one or more years before the crown is in condition to utilise the full amount of light at its disposal, and to furnish food to all parts of the tree in increased ratio. B. E. FERNOW.

Washington, D.C., May 11.

Our Bishops and Science.

THE friends of both science and religion will thank you warmly for publishing the Bishop of Ripon's public testimony to Huxley's spirit of sincerity and love of truth. It is the more timely because of your recent strictures upon the Bishop of London. May I therefore, as a country parson, with an equal love for scientific integrity and religious truth, suggest to the readers of those strictures in NATURE (p. 607, April 30) that probably Bishop Temple has been misunderstood. I am sure it is not fair to his spirit to put into his mouth, "Away with all these abominations. Purge the elementary schools of everything scientific, and substitute dogmas and subjects more fitted to the stations of life in which it has pleased God to call the scholars."

Is it not more likely that the real clue is in the sentence quoted about "instructing little children in *elementary* schools in *a great many scientific subjects?*" For many earnest educationalists have, as friends of science, spoken strongly on the evils of the cramming of bits of science subjects and "stages" by crudely crammed "Government certificated" "science" teachers cramming large classes for grants on "passes" to butter their bread.

In any case, the true views of the great bishop will be found in his "Bampton Lectures" for 1884, on the relations between science and religion; and the last *Quarterly Review*, on G. J. Romanes, contains an eminent example of the reverent treatment of both.

I will frankly add that I do not think your quotations from Mr. Mundella's address can be too widely known among the bishops and clergy who have such influence with the laity. Agricultural pursuits suffer more from our ignorance than our want of money; and agricultural science cannot be widely taught until the elementary principles of chemistry and physics are diffused in our villages.

On this subject we have also had the weighty testimony of Mr. Gladstone. The voting of money for light railways and such objects is a quack remedy. The fact is that true educational enthusiasts who will think first of our children, and be generous to them *first*, have hitherto been appallingly scarce in the House of Commons and its parties.

Nor is even the *geographical* significance of our need of science education likely to be perceived by the majority, if, as is stated in the *Anti-Slavery Reporter* (March–April 1896, p. 80), two M.P.s can stand before a map of South America in the map room of the House of Commons, and dispute with one another as to where Egypt was to be found on that map. However, matters are mending, we hope. J. F. HEYES.

Crowell, Oxon, May 15.

Blood-Brotherhood.

THERE are good reasons why this ancient custom can never be a preventive of disease, though sometimes it may be a cause of it. The serum treatment has been found useful, and presumably will be found useful only in such diseases or diseased conditions as are due to poisons (toxins) secreted by various species of pathogenic micro-organisms (*e.g.* those of rabies, anthrax, diphtheria), or by some animals (*e.g.* scorpion, snake), as weapons of offence or defence.

As regards certain zymotic diseases (*e.g.* small-pox, scarlatina, syphilis), it is known that one attack confers more or less complete immunity against subsequent attacks; that is, the micro-organisms of these diseases are, after the recovery of the host, unable to persist and produce their toxins in him; and this for the reason that during his illness certain of his body cells, known as phagocytes, become inured to the toxins, and are thus enabled to attack and destroy the micro-organisms producing them. When the phagocytes fail to become inured, the micro-organisms continue to produce these toxins, and the host perishes, poisoned by them. Now the toxins produced by the micro-organisms of most zymotic diseases are not always of the same degree of virulence, and when they are feeble the phagocytes the more easily become inured to them, and destroy the micro-organisms; and not only do they do so, but this preliminary training enables them, when attacked by more virulent micro-organisms of the same species, *i.e.* of the same disease, to react to the stronger toxins of these also, and again destroy the micro-organisms. Man has taken advantage of this fact to artificially lower or "attenuate" the virulence of various species of pathogenic micro-organisms (*e.g.* those of anthrax and cholera); and inoculation with them or their toxins inures the individual so treated to resist the attacks of micro-organisms of the same species and of the normal degree of virulence. One way of attenuating or rendering less virulent the toxins is to inject them into an animal that does not easily perish of them (*e.g.* horse, as regards diphtheria), when they undergo partial intracellular digestion within his tissues. His blood serum then contains altered toxins (the so-called anti-toxins), experience of which inures the cells of an animal of a more susceptible species (*e.g.* man) to resist the attack of virulent micro-organisms with unaltered toxins. It is noteworthy that when toxins and anti-toxins are mixed the latter may inure the cells to the former before death occurs, for the reason that these do not under normal conditions cause immediate death. For this reason animals are able to withstand much more than a fatal dose of a toxin when it is mixed with the appropriate anti-toxin, and sometimes even to recover from a disease which would otherwise be fatal if during the course of it the anti-toxin is injected. But toxins and anti-toxins are not retained within the system. They are digested by the cells and excreted, and therefore enduring immunity is not conferred by their presence, but by the fact (in some diseases at least) that when the cells are once inured they remain so.

It is clear that the serum treatment can be useful only in diseases against which immunity may be acquired, if only for a short time. In other diseases (*e.g.* tuberculosis, malaria, leprosy) against which immunity cannot be acquired, which do not run a pretty definite course of limited duration, of which one attack does not protect against subsequent attacks, it is useless; for here training does not benefit the cells, or if in some cases it does benefit them, this benefit is of such limited duration as to be practically useless.

After this, from want of space, very dogmatic statement of the rationale of serum-therapeutics, let us inquire what may be hoped from the ceremony of blood-brotherhood in its medical aspects. Clearly nothing. It will not, of course, endow the traveller with his blood-brother's powers of resisting hardship (heat, cold, hunger, &c.); it will not confer immunity or increased powers of resistance against that class (the most death-dealing class) of diseases against which immunity *cannot* be acquired; and lastly, it will not confer immunity or increased powers of resistance against that class of diseases against which immunity *can* be acquired, unless there is present in the blood-brother this or that micro-organism in an attenuated form, or unless antitoxins are present in him to an inconceivable degree of concentration—very remote possibilities, or rather impossibilities, on which the traveller were wise not to count. On the other hand the blood-brother may communicate actual virulent disease, for instance syphilis and malaria.

G. Archdall Reid.

Remarkable Sounds.

In a Japanese work, "Hokuetsu Kidan," by Tachibana no Mochiyo (published *circa* 1800, tom. ii., fol. 5, *seqq.*), I have found some remarkable sounds described. Among the details given therein of the "Seven Marvels of the Province of Echigo," we read: "The fifth marvel, the Dônari [literally *Body Sounds*, or *Temple Sounds*], is a noise certain to be heard in the autumnal days, just before a fine weather turns to stormy, it being sounded as if the thunder falls from the cloud, or the snow slides down a mountain. Where it originates is quite uncertain, as there are in the counties several mountains assigned therefor. The sounds are heard of same intensity in variously distant places." Further, the author recites a folk-tale current in his time among the villagers of Kurotori, in Co. Kambara, which attributes these sounds to the head and body of a hero, Kurotori Hyôe [killed in 1062?]; separately interred under a Shintoist temple in this village, they ever strive to unite once more. "The marvel, it is said, is now seldom met with; still it occurs frequently within two or three miles of the village, proceeding doubtless from the precinct of the temple. And the fact is more wonderful that the inhabitants of Kurotori themselves never hear the sounds unless they go out of the village." Concluding the narrative, the author, from his personal observation, argues the action of the tide-waves upon the earth to be the real cause of these curious sounds.

May 18. Kumagusu Minakata.

BOSNIA-HERZEGOVINA AND DALMATIA.

The progress of prehistoric archæology, the youngest of the inductive sciences, is one of the more important facts in the history of the intellectual development of the latter half of the nineteenth century. Up to 1870, attention was chiefly directed to the antiquity of man and his place in the geological record, and to the classification of his advance in the Neolithic, Bronze, and Iron ages in Europe. Man was proved to have lived in a remote past, not to be measured by years and under climatal and geographical conditions totally different to those now met with in Europe. The next ten years were chiefly spent in elaborating the details as to the range of Palæolithic man, and in working out the sequence of events, separating the Pleistocene period from the dawn of history. The Neolithic, Bronze, and Prehistoric Iron ages of human progress were traced far and wide over nearly the whole of the old and the greater part of the new worlds. In the last decade the centre of archæological interest has shifted slowly in the direction of the frontier of history. On the one hand the researches of Flinders Petrie have revealed the close connection of ancient Egypt with the nations of the Mediterranean long before the rise of the Greeks, and have rendered it possible for us to use the Egyptian chronology as the standard to fix the date of prehistoric events in Southern Europe and in Asia Minor. On the other, in these latter areas, many workers, among whom Schlieman stands foremost, have revealed the manners and customs, the daily life, the modes of warfare, the habitations, fortresses and tombs of the very peoples who were in touch with Egypt. We even know, thanks to Arthur Evans, that there was a system of writing in the Ægean area long before the introduction of the Phœnician alphabet, and we may look forward to his future researches to make it intelligible.

A valuable book[1] on Bosnia-Herzegovina and Dalmatia is the last contribution to the subject. Under the modest title of "Rambles and Studies," it might very well be taken for the usual book of travels in a land of wonderful beauty, till now practically closed to the ordinary traveller. Under the Austro-Hungarian dominion, now some twenty years old, good roads have replaced the old tracks, and law and order reign instead of the brigandage of the past. New lines of railway and of steamers connect the chief centres, manufactures are encouraged, and schools for the education of both Christian and Moslem are in full swing. There are luxurious hotels in place of the old caravanserais, and the records of the past are being carefully preserved in museums, under the charge of competent scientific men, instead of being ruthlessly destroyed, as they were under the old *régime*. There are snow-covered mountains, great rivers and waterfalls, like those at Ottawa, and lakes embosomed in trees. There are ravines, like those of Miller's Dale, only larger, and caverns, and all the characteristic scenery of the limestone forms the surface of the country. The interest, however, chiefly centres in the inhabitants. The present phase of transition from Eastern to Western ideas is of special value at this time, when the cry of oppressed lands is ringing in the ears of the Western nations, because it shows with what extraordinary rapidity a people ground down to the dust for centuries by the Turk, may become happy and prosperous under a good system of local self-government. What the Austro-Hungarians have done in the Bosnia-Herzegovina, may be done by the Powers in Asia Minor and in the islands of the Ægean Sea. From this point of view Dr. Munro's well-written book is worthy of the attention of our rulers. Dr. Munro has dealt with all these things with a light and pleasant

[1] "Rambles and Studies in Bosnia-Herzegovina and Dalmatia." By Robert Munro, M.A., M.D., F.R.S.E. 8vo. (Blackwood, 1895.)

hand. He, accompanied by Mrs. Munro, travelled under great advantages. He went in 1894, at the invitation of the Austro-Hungarian Government, to attend an archæological congress, and he has made the most of his opportunities.

It is not, however, the traveller's side of the book which more immediately concerns us. It is rather with it as a contribution to archæological literature, in which the author brings to bear, on the discoveries made in those lands by others, the scientific method which he had already used so well in carrying out his investigations into Lake-dwellings in Britain and on the continent. We shall review in their chronological order the more important of the discoveries, now laid before English readers, in a quarter of Europe shut off by lofty mountain ranges from the pathways of the nations.

The group of Neolithic remains at Butmir gave rise to much difference of opinion at the congress. According to Mr. Radimsky, they were deposits of refuse round ancient huts on the land, and the irregular amœba-like hollows in the clay were taken to be the bases of huts. In Dr. Munro's opinion these hollows were made by the extraction of the clay for the covering of the wattles of the huts, as well as for the large amount of pottery and terra-cotta found on the site. He points out that they have been filled up by the deposit of silt under water, as well as by human débris, and concludes that the whole accumulation was formed in and round pile-dwellings like those of Switzerland, the piles of which, as well as all the other woodwork, have wholly rotted away. We agree with this view; and would advance a further argument in its favour, that a settlement on a clay soil liable to floods is unknown in the history of Neolithic dwellings. On that spot pile-dwellings would be the only habitations possible. The inhabitants were skilful potters, and their vessels made by hand were in some cases ornamented by spirals. They also manufactured stone implements, polished axes, spears, arrows, and the like. They were also spinners and weavers; they had herds of pigs, domestic oxen, among which we may note the short-horned ox (*Bos longifrons*), and flocks of sheep and goats. In their fields they grew wheat and barley, and carried on a trade by barter with other communities. The rude terra-cotta idols imply that they had some kind of religion. Their burial-places have not yet been discovered. Among the purely Neolithic remains are twenty-seven perforated axe-hammers of a type found in the Bronze age elsewhere, and made of a stone which does not exist in the district. With the exception of three, all the rest of the implements amounting to 5118, are of native stone. It is probable that in this out-of-the-way place the Neolithic civilisation lingered long after the Bronze age had begun in the more accessible surrounding districts. We may accept Dr. Munro's conclusion, that the settlement of Butmir "is one of the side eddies of the early stream of immigrants who found their way into Europe by the Danubian valley from the regions to the south and east of the Black Sea," in the Neolithic age, and who lived on into the Bronze age—an age which in Bosnia is not so well defined and conspicuous as it is in Germany, Scandinavia, and Western Europe generally.

While bronze implements and weapons were gradually finding their way into Bosnia-Herzegovina, a new civilisation appeared at the head of the Adriatic, and extended over the southern watershed of the Danube, Northern Italy, the Tyrol and the adjacent regions, known, from the principal site of the discoveries, as that of Hallstadt. From this centre the characteristic products were scattered far and wide over Europe by means of commerce, marking the close of the Bronze and the beginning of the Iron age. The tumuli on the plateau of Glasinac, more than 20,000 in number, mark this age in Bosnia. Of these about one thousand have been explored, proving that both inhumation and cremation were practised. The articles buried with the dead consist of iron knives swords, spear-heads and axes, some double-edged, others in the shape of socketed celts. Bronze vessels, pendants, bracelets, finger-rings, and brooches, were discovered in great variety. The brooches are of great interest as indices to the age of the tumuli. This is marked by the stage presented in the evolution of the brooch from a straight pin. The first stage is presented by the bending of the pin; the second, by its being twisted round so that the point is brought to rest on a development of the head specially made to receive it; the third, by the development of one or more twists, so as to form an elastic spring or springs—the safety-pin type. From those of one spring, the Greek and Roman fibulæ are descended. At Glasinac about 44 per cent. were those with two springs, or of the Hallstadt type. Those with one are more closely allied to the Greek, while others are purely Roman. A helmet from a tumulus at Arareva is of pure Greek type and similar to one found at Olympia, bearing an inscription that it was dedicated by the Argives to Zeus out of the spoils of Corinth. It is also identical with the helmet on a warrior carved on the Harpy Tomb, Xanthos, Lycia, in the British Museum. Both these belong to about the middle of the sixth century before Christ. These things were found along with an infinite variety of ornaments and implements of bronze, iron and silver, of glass and amber and bone, together with fragments of pottery. It is obvious that these tumuli were used from the remote Hallstadt time down to the days of the Roman dominion. It is not a little remarkable that there is no mention of coins in the three elaborate volumes recording these discoveries, published by the scientific staff of the Public Museum in Sarajevo. Coins had not then found their way into the country, or if they had, were not buried with the dead.

In 1890 a cemetery was discovered at Jezerine, belonging to the same period as the tumuli of Glasinac, and containing the same types, but with fewer weapons. It is remarkable for the beautiful rings and beads made of blue, yellow, white and green glass. A gravestone with a figure of a warrior found here is assigned by Dr. Hoernes to the late Hallstadt period. The helmet with the lofty crest reaching far down the back is identical with that carved on the Harpy Tomb at Xanthos, and those on the heads of warriors, on painted early Greek vases. It may very well be of late Hallstadt age, as well as early Greek.

Besides burial-places such as the above, there are numerous forts belonging to this people, similar in construction to the hill-forts of Scotland, and built of rubble masonry without mortar.

Nor are we without evidence as to the physique of the people themselves. Of thirty-two human skulls from Glasinac, examined by Dr. Glück, 76 per cent. are either long or mesocephalic, while 24 per cent. are short; a fact of considerable interest when contrasted with the present roundness of head of the Bosnians. Out of 1500 natives examined by Dr. Weissbach, 7 per cent. only were long and 93 per cent. short.

The prehistoric inhabitants of Bosnia, like those of Hallstadt, were mainly long-headed, while the presence of the short-headed minority shows the existence of two races in both regions. The reversal of this in Bosnia in later times is due to the immigration of short-headed people, mostly Slavs, from the time of the tumuli down to the present day. It may be inferred that in Herzegovina and Bosnia, as in Western Europe, the aboriginal and Neolithic peoples were long-headed, and that they were invaded by a new race of round-headed conquerors. Whether this took place in the Bronze age must be left for future inquiry, and whether it took place from the line of the valley of the Danube, or, as Dr. Munro suggests, by the head of the Adriatic, must also be left an open question in the present condition of the inquiry. The close connection with Hallstadt renders the latter view the more probable, although there is clear proof of the Greek influence from the south. This, however, it must be admitted, may belong to a later period.

In closing this review, we may congratulate Dr. Munro on his success in writing a book which is short, picturesque, and scientific; and we feel sure that he will gain his end, of attracting attention to the archæological treasures awaiting the explorer in this hitherto little-explored corner of Europe. W. Boyd Dawkins.

EXPERIMENTS IN MECHANICAL FLIGHT.

I HAVE been for some years engaged in investigations connected with aerodromic problems, and particularly with the theoretical conditions of mechanical flight. A portion of these have been published by me under the titles "Experiments in Aerodynamics" and "The Internal Work of the Wind," but I have not hitherto at any time described any actual trials in artificial flight.

With regard to the latter, I have desired to experiment until I reached a solution of the mechanical difficulties of the problem, which consist, it must be understood, not only in sustaining a heavy body in the air by mechanical means (although this difficulty is alone great), but also in the automatic direction of it in a horizontal and rectilinear course. These difficulties have so delayed the work, that in view of the demands upon my time, which render it uncertain how far I can personally conduct these experiments to the complete conclusion I seek, I have been led to authorise some account of the degree of success which has actually been attained, more particularly at the kind request of my friend Mr. Alexander Graham Bell, who has shown me a letter which he will communicate to you. In acceding to his wish, and while I do not at present desire to enter into details, let me add that the aerodrome, or "flying-machine" in question, is built chiefly of steel, and that it is not supported by any gas, or by any means but by its steam-engine. This is of between one and two horse-power, and it weighs, including fire-grate, boilers, and every moving part, less than seven pounds. This engine is employed in turning aerial propellers which move the aerodrome forward, so that it is sustained by the reaction of the air under its supporting surfaces.

I should, in further explanation of what Mr. Bell has said, add that owing to the small scale of construction, no means have been provided for condensing the steam after it has passed through the engine, and that owing to the consequent waste of water, the aerodrome has no means of sustaining itself in the air for more than a very short time—a difficulty which does not present itself in a larger construction where the water can be condensed and used over again. The flights described, therefore, were necessarily brief. S. P. Langley.

Through the courtesy of Mr. S. P. Langley, Secretary of the Smithsonian Institution, I have had on various occasions the privilege of witnessing his experiments with aerodromes, and especially the remarkable success attained by him in experiments made on the Potomac River on Wednesday, May 6, which led me to urge him to make public some of these results.

I had the pleasure of witnessing the successful flight of some of these aerodromes more than a year ago, but Prof. Langley's reluctance to make the results public at that time prevented me from asking him, as I have done since, to let me give an account of what I saw.

On the date named, two ascensions were made by the aerodrome, or so-called "flying machine," which I will not describe here further than to say that it appeared to me to be built almost entirely of metal, and driven by a steam-engine which I have understood was carrying fuel and a water supply for a very brief period, and which was of extraordinary lightness.

The absolute weight of the aerodrome, including that of the engine and all appurtenances, was, as I was told, about 25 pounds, and the distance, from tip to tip, of the supporting surfaces was, as I observed, about 12 or 14 feet.

The method of propulsion was by aerial screw propellers, and there was no gas or other aid for lifting it in the air except its own internal energy.

On the occasion referred to, the aerodrome, at a given signal, started from a platform about 20 feet above the water, and rose at first directly in the face of the wind, moving at all times with remarkable steadiness, and subsequently swinging around in large curves of, perhaps, a hundred yards in diameter, and continually ascending until its steam was exhausted, when, at a lapse of about a minute and a half, and at a height which I judged to be between 80 and 100 feet in the air, the wheels ceased turning, and the machine, deprived of the aid of its propellers, to my surprise did not fall, but settled down so softly and gently that it touched the water without the least shock, and was in fact immediately ready for another trial.

In the second trial, which followed directly, it repeated in nearly every respect the actions of the first, except that the direction of its course was different. It ascended again in the face of the wind, afterwards moving steadily and continually in large curves accompanied with a rising motion and a lateral advance. Its motion was, in fact, so steady that I think a glass of water on its surface would have remained unspilled. When the steam gave out again, it repeated for a second time the experience of the first trial when the steam had ceased, and settled gently and easily down. What height it reached at this trial I cannot say, as I was not so favourably placed as in the first; but I had occasion to notice that this time its course took it over a wooded promontory, and I was relieved of some apprehension in seeing that it was already so high as to pass the tree-tops by twenty or thirty feet. It reached the water one minute and thirty-one seconds from the time it started, at a measured distance of over 900 feet from the point at which it rose.

This, however, was by no means the length of its flight. I estimated from the diameter of the curve described, from the number of turns of the propellers as given by the automatic counter, after due allowance for slip, and from other measures, that the actual length of flight on each occasion was slightly over 3000 feet. It is at least safe to say that each exceeded half an English mile.

From the time and distance it will be noticed that the velocity was between twenty and twenty-five miles an hour, in a course which was constantly taking it "up hill." I may add that on a previous occasion I have seen a far higher velocity attained by the same aerodrome when its course was horizontal.

I have no desire to enter into detail further than I have done, but I cannot but add that it seems to me that no one who was present on this interesting occasion could have failed to recognise that the practicability of mechanical flight had been demonstrated.

Alexander Graham Bell.

THE APPROACHING CELEBRATION OF THE KELVIN JUBILEE IN GLASGOW.

IT may interest our readers to state the programme of the approaching celebration of the jubilee of Lord Kelvin as Professor of Natural Philosophy in the University of Glasgow.

On the evening of Monday, June 15, at 8.30 p.m., the University will give a conversazione, when there will be an exhibit of Lord Kelvin's inventions. On Tuesday, June 16, addresses will be presented to Lord Kelvin by delegates from home and foreign University bodies, from several of the learned Societies of which he is a member, from student delegates from other Universities, and from the students and graduates of the University of Glasgow. It is expected that the honorary degree of LL.D. will be conferred on the same day on several of the distinguished foreign visitors. On Tuesday evening, June 16, the City will give a banquet to Lord Kelvin, to which the visitors who have come to do him honour have been invited.

On Wednesday, June 17, the Senate of the University will invite the visitors of the University staff to sail down the Clyde. The students of the University also invite the students' delegates from other Universities to a similar trip.

Representative scientific men—about fifty in number—from America and the British colonies, and from all the European countries, and about 150 from the United Kingdom, have signified their intention to be present.

The exceptional nature of the occasion, and the feeling which Lord Kelvin's name awakens everywhere, will give these proceedings a peculiar interest.

NOTES.

THE University of Wales is to be represented at the forthcoming celebration of the Kelvin jubilee by Principal J. Viriamu Jones, F.R.S., of Cardiff (the Vice-Chancellor for the year), and Prof. A. Gray, of Bangor.

THE Mayor of Bristol, at the suggestion of a deputation representing the chief local scientific societies and educational institutions, has decided to invite the British Association to visit Bristol in 1898. A visit to Bristol after the Toronto meeting would be made in a singularly opportune year, for it was in 1497 that Cabot discovered the American mainland, where the Association will be in 1897, whence he started on his second voyage in 1498. The meeting would thus serve to commemorate the tercentenary of a memorable voyage of one of Bristol's greatest citizens. That the Association should take Bristol after Canada would, therefore, be very appropriate.

THE Epidemiological Society of London has resolved, having regard to the historical connection of the Society with vaccination and other preventive measures, to found a medal in memory of Jenner. It is proposed that the medal shall be founded with a view to the promotion of epidemiological research, and that it shall be bestowed from time to time by this Society on persons who shall have contributed to the knowledge of preventive medicine. Donations (not exceeding one guinea) may be sent to the Honorary Treasurer, 6 Hereford Mansions, Bayswater, W.

THE death is announced of Dr. August Hosius, Professor of Mineralogy and Palæontology in Münster University.

THE King of Belgium has honoured Prof. Leo Errera, Professor of Botany in the Université Libre de Bruxelles, and Director of the Institut botanique, by creating him a Chevalier of the Order of Léopold.

REUTER'S correspondent at Adelaide states that a well-equipped expedition started on May 22 to explore the interior of the Australian continent. It will be absent eighteen months. Mr. Calvert is defraying the cost of the expedition.

AN extra Friday evening meeting of the members of the Royal Institution will be held on June 19, when Mr. Thomas C. Martin, of New York, American Delegate to the Kelvin jubilee, will deliver a lecture on "The Utilisation of Niagara."

WE learn from the *American Naturalist* that a biological station will be opened on June 22 at Biscayne Bay, Florida, and will remain open for six weeks. The place is well situated for the study of the tropical and subtropical flora and fauna, while its situation upon the continent makes it more readily accessible than the West India Islands. The station will be under the direction of Prof. Charles L. Edwards, of the University of Cincinnati.

MR. T. D. A. COCKERELL proposes to establish a biological station at Las Cruces, New Mexico, U.S.A. The climate of the country is exceptionally favourable for persons in the earlier stages of phthisis, while the abundance of new and interesting forms of life, especially among the insects, is remarkable. Many interesting general problems, such as those of the life-zones, can also be studied in New Mexico to great advantage. A beginning will be made this summer if students can be found. Mr. Cockerell will be glad to hear from any who are interested in the matter, and especially from those who might be inclined to work with him for longer or shorter periods during the present summer.

A GENERAL meeting of the members of the Federated Institution of Mining Engineers will be held in London on Thursday, June 4, and on Friday, June 5. The following papers will be read, or taken as read:—Presidential address, by Mr. Geo. A. Mitchell; "The Causes of Death in Colliery Explosions," by Dr. J. S. Haldane; "Road Engines," by Mr. John McLaren; "The Gobert Freezing Process of Shaft-sinking," by Mr. A. Gobert; "Precautions necessary in the Use of Electricity in Coal-mines," by Mr. H. W. Ravenshaw. The papers down for discussion are: "Photography in the Technology of Explosives," by Mr. Alfred Siersch; "Coal-washing Plant at the Wirral Colliery, Neston, Cheshire," by Mr. J. Platt; "Lead and Lap of Winding and other Engines," by Mr. Hargrave Walters.

THE gold medal of the Linnean Society of London, which is annually presented alternately to a zoologist and to a botanist, has this year been awarded to Prof. George James Allman, F.R.S., for distinguished researches in zoology. A graduate in medicine in the University of Dublin in 1844, and subsequently Regius Professor of Botany there, he was elected a Fellow of the Royal Society in 1854, and from 1855 to 1870 held the chair of Regius Professor of Natural History in the University of Edinburgh, where the honorary degree of LL.D. was conferred upon him. In 1873 he was awarded the "Royal Medal" of the Royal Society. In 1874 he was elected President of the Linnean Society in succession to Mr. Bentham, and in 1879 was President of the British Association on the occasion of its meeting at Sheffield. His chief scientific work has relation to the lower forms of animal life, concerning which his most notable publications are his monographs of the Fresh-water Polyzoa and Hydroida—issued by the Ray Society—and his exhaustive report on the Hydroida collected by the *Challenger* exploring expedition. The medal will be presented at the anniversary meeting of the Linnean Society, to be held on Thursday, June 4, at 8 p.m.

MESSRS. C. GRIFFIN AND CO. have just published the thirteenth annual issue of their "Year-Book of Scientific and Learned Societies of Great Britain and Ireland." The work comprises lists of papers read during 1895 before these societies, which are arranged into fourteen classes according to the branches of science fostered by them. As a handy and accurate index to our scientific societies, and a record of progress, the work is most useful.

WE learn from *La Nature* of May 23 that a meeting was held on April 24, at the Geological and Geographical Society of Stockholm, in favour of the Polar expedition of M. Andrée. That gentleman opened the meeting by an explanation of the preparations already made, and of the prospects of the expedition. The generator of the hydrogen gas is nearly completed, and the steamer *La Vierge* is in dock at Gothenburg. A folding canvas boat, to carry three persons and 600 kilograms of provisions, has also been constructed. The expedition is to sail from Gothenburg on June 7, and should arrive at Spitzbergen about the 18th of that month. After that, M. Andrée cannot state what may happen—whether it will be a long balloon voyage, or a sledge and boat journey. M. Ekholm enumerated the various instruments which will be taken; they include several self-recording meteorological instruments, photographic apparatus, and electrometer. M. Strindberg gave details respecting the construction of the balloon. After the meeting a banquet took place, at which Baron Nordenskiold wished success to the expedition, to which M. Andrée warmly responded.

IN spite of the numerous excursions that have been previously made to Spitzbergen, it is remarkable that so very little has been done in the interior. The botany of its coast-lands is as well known as that of many British counties; its mosses, hepatics, and marine algæ have been carefully monographed. Many groups of the fauna have been equally well described. The geology of the coast sections has been mapped, and rich collections of fossils made from the remarkably rich sequence of rocks ranging from the Devonian to the Pleistocene, and including representatives of the Carboniferous, Permian, Trias, Jurassic, Cretaceous and Miocene. Nevertheless hardly anything is known of the interior of West Spitzbergen, the largest island of the archipelago. Nordenskiöld and Palander crossed the north-east island in June 1873, but up to the present only two short excursions have been made on to the ice-sheet of the main island. The first of these was a short traverse by the late Gustav Nordenskiöld from Horn Sound to Bel Sound, and the other a visit by Ribot to Mount Milne-Edwards, to the south-east of Ice Fiord. The interior is known to be covered by an ice-sheet, and a careful study of this would no doubt throw much light on the problems of the former glaciation of Europe. An effort to fill this remarkable gap in our knowledge is now being made by Sir W. Martin Conway, who has organised an expedition to Spitzbergen, which will start on June 2. The main object of the expedition is the study of the interior, but it is hoped also to supplement our knowledge of the fauna of the coast-lands, and to make extensive collections for this country. The party will consist of five other members, Mr. Ed. Conway, Mr. R. D. Darbishire, Mr. E. J. Garwood, Dr. J. W. Gregory, and Mr. A. Trevor-Battye. The party expects to return early in September. The collections made will be the property of the British Museum, the Trustees of that institution having lent Dr. Gregory's services to the expedition.

WRITING to the *Electrician* on the subject of Röntgen rays, Mr. James Mark Barr enunciates the proposition that reversing the current in a "focusing" tube improves it for its normal working after "fatiguing" has set in. He adds that the reverse current used should be comparatively weak.

A FINE specimen of a rare Marine Chalonian, the Leathery Turtle (*Dermochelys coriacea*) has lately been presented to the South African Museum by Mr. P. C. Keytel, of Cape Town. The animal was stranded on Blaauwberg beach in Table Bay, and was secured by some fishermen; its length is over 5 feet, and its breadth more than 2 feet.

IN the *Indian Engineer* some interesting statistics are given relating to the development of the coal fields in Labuan. The island contains four seams of coal varying in thickness from $1\frac{1}{2}$ to 10 feet, and running from north-east to south-west. The coal is good steam coal containing an abundance of resin, and the outcrops are three-quarters of a mile from the sea. In prospecting for coal near the head of the Ogangara River, oil was struck, which continued to flow for a few days, when the spring became exhausted. The yearly output of coal three years ago was 18,000 tons.

THE current number of the *Journal of the College of Science*, at Tōkyō, fully maintains the standard of its predecessors; but we note with deep regret the announcement of the death of Mr. Hirota, whose last paper (on the "Dendritic Appendage of the Urogenital Papilla of a Siluroid") it contains. The half-dozen monographs which have fallen from Mr. Hirota's pen are of exceptional merit, and show their author to have been a worker of much promise and sound judgment. His first paper on the "Sero-Amniotic Connection and the Fœtal Membranes in the Chick" came as a revelation; and let it be recorded to his lasting memory, that he therein disposed of an error in fundamentals, of which Western embryologists, studying the hen's egg *ad nauseum*, had never dreamt. We tender our Eastern confrères our profoundest sympathy, for their loss is our own.

A PROTEST is raised in the *Agricultural Gazette of New South Wales* (vol. vii. part 2) against the indiscriminate destruction of beneficent lady-birds. The small yellow and black-banded pumpkin beetle, *Aulocophora hilaris*, Boisd., feeds upon many plants frequented by the 28-spotted lady-bird, *Epilachna 28-punctata*, and it is common to find these two destructive species side by side upon the same plant. This appears to have led to the misapplication of the term "lady-bird" to *Aulocophora hilaris*, with the unfortunate result that the whole of the group Coccinellidæ, to which the appellation properly belongs, has been, in the most general terms, denounced and described as a scourge. Considering that, out of the large number of species of lady-birds to be found in New South Wales, only two—*Epilachna 28-punctata* and *Epilachna guttato-pustulata*—are really injurious, it would be a great misfortune if all the useful species of Coccinellidæ were to be ostracised on their account.

THE last number of the American journal, *Modern Medicine and Bacteriological Review*, draws attention to a report recently drawn up by Prof. Conn, of the Western University, on the bacteriology of milk, published by the United States Department of Agriculture. Examinations of milk made at various places yielded numbers varying from 330,000 to 9,000,000 microbes per ounce. The milk-supply of Boston was found to be particularly rich in microbes, as many as 135 million germs being found per ounce. The *Boston Medical and Surgical Journal* lately reported a case in which a young man contracted tubercular disease by drinking milk from a herd of cows, fifty-nine of which were afterwards found to be tuberculous, whilst two persons employed in making butter from the same herd, and who drank large quantities of milk, also became infected. Although much has been accomplished in our country of late years to improve the sanitary conditions surrounding our public milk-supplies, yet a great deal still remains to be done, and there cannot be a doubt that the next important step will be the distribution by our dairies of "pasteurised" milk and butter. The example has already been set by one important London dairy company, and it is to be hoped that others will follow what is, after all, but a tardy imitation of what has been done for some time past by our more enlightened neighbours on the continent.

IN commemoration of the Jenner centenary, a special number of the *British Medical Journal* has been issued, containing a number of interesting papers on Edward Jenner's life, work, and writings.

THE Clarendon Press announces for early publication a "Flora of Berkshire," by Mr. G. C. Druce. It is intended to be not only a catalogue, but also a history, of the plants of the county.

DR. PH. MOLLE has reprinted from the *Memoirs* of the Royal Academy of Belgium his "Recherches de microchimie comparée sur la localisation des alcaloïdes dans les Solanacées." These alkaloids are found chiefly in the superficial organs of the plant, especially in the bark, where they serve to protect it against the attacks of herbivorous animals. They are entirely absent from both the embryo and the endosperm of the ripe seeds, and can in no sense be regarded as reserve food-materials; if they occur at all in the seed, it is only in its integument.

MR. C. F. CLARKE, of Plumstead, writes to point out a clerical slip in the notice of Dr. Orchard's "Astronomy in Milton's Paradise Lost," by which Satan's shield is said to be compared to Galileo's glass (not a very large object, that of the Lick or Yerkes telescope might have been more appropriate had such then existed), instead of the moon as viewed through it. Besides the three constellations mentioned in our notice, Milton also alludes to Orion, supposed by him, as by the ancient poets, to be associated with windy and stormy weather.

WE welcome No. 12 of the *Alembic Club Reprints*, published by Messrs. W. F. Clay, Edinburgh. The volume contains Faraday's papers on "The Liquefaction of Gases" (1823-1845), and an appendix consisting of papers by Thomas Northmore on the compression of gases, which were referred to by Faraday, in his historical statement, in the following terms. "The most remarkable and direct experiments I have yet met with in the course of my search after such as were connected with the condensation of gases into liquids, are a series made by Mr. Northmore in the years 1805-6." Students of physics, and every one interested in the subject of the liquefaction of gas, should possess a copy of this latest addition to the *Alembic Club Reprints*.

THE Deutsche Seewarte has recently issued the last of its series of atlases dealing with maritime meteorology and other useful information relating to the great oceans. The present work, which refers to the Pacific Ocean, contains thirty-one folio coloured charts, with explanatory text, and, like its predecessors, forms an appendix to the Sailing Directions which are published in a separate form. The atlases for the Atlantic and Indian Oceans have been in the hands of German sailors for some years, and, being in a clear and popular form, are almost equally useful to other countries. In addition to the usual charts of ocean currents, specific gravity, temperature of air and sea-surface, relative frequency of winds, distribution of rainfall, &c., there are others containing useful *data*, among which we may mention the mean sailing routes, and the distribution and principal haunts of various kinds of whales. The charts are based on a large amount of information supplied by German captains, and include materials collected by other nations. A just appreciation of this part of the work of the Deutsche Seewarte is shown by the fact that it has been found necessary to prepare a second edition of the Sailing Directions for the Atlantic Ocean, which will be published as soon as practicable.

THE *Journal* of the Asiatic Society of Bengal can scarcely be said to have a place in our chemical libraries; the current number, however, contains a paper by Dr. P. C. Rây, of the Presidency College, Calcutta, on mercurous nitrite, that is worthy of note. During a preparation of mercurous nitrate by the action of dilute nitric acid in the cold on mercury, yellow crystals were deposited which, upon examination, proved to be mercurous nitrite. The analysis proved somewhat difficult, as the substance dissociates in solution into metallic mercury and mercuric nitrite. The fact that this nitrite is stable in strongly acid solutions, is an additional proo of the views advanced by Dr. Divers as to the "nitronic" constitution of the nitrites of copper, silver, mercury, and bismuth. The stability of silver nitrite towards nitric acid has already been noticed by Acworth and Armstrong, and by Russell, and the behaviour of mercurous nitrite is closely analogous. Dr. Rây proposes, in a subsequent communication, to give the results of an attempt to prepare fatty nitro-derivatives from this compound.

THE Commissioners of the St. George's Public Library record, in their second report, that good progress has been made with the arrangement of the cases and specimens comprised in the natural history collection presented to the library. The donor generously undertook the laborious task of installing, classifying, and labelling the whole of the objects, as well as the preparation of the numerous explanatory reading-cases, which will contribute so much to the proper understanding of the contents of the room. The collection may now be considered as ready for the use of students, and it affords an illustration of what can be done to connect the public libraries with natural history museums generally. Certain annual subscriptions were promised for three consecutive years towards the cost of maintaining the collection, but unfortunately in the second year (1895) the full amount has not been realised. It is stated that at least £150 is required to cover the working expenses during the four years for which the Commissioners have undertaken to house the collection, until it shall be seen whether good use is made of it by natural history students; the cost of *installation* having been defrayed partly out of the library rate and partly by the donor.

THE School of Practical Science at Toronto may be proud of an Engineering Society which can issue a volume of *Proceedings* (No. 9) such as we have just received. The papers in the volume are of more than engineering interest. Mr. McLennan has a paper on "Röntgen Radiation," detailing results obtained by him; and special attention should be called to an excellent essay on "The Pendulum," by Mr. A. M. Scott, which gained for the author the 1851 Exhibition Science Scholarship allocated by the University of Toronto. There is also an original contribution on the action of heat upon cements, and another on brickwork masonry. Even astronomy finds a place in the volume. Mr. W. L. Innes contributes a brief history of celestial science, and Mr. A. T. Laing describes an ingenious planetarium devised by him. As an instance of the value of a little astronomical knowledge, we may refer to a short paper on "Aspect and Prospect," by Mr. C. H. C. Wright, in which a diagram is given to show the azimuth of the sun at any time of the year for any place in the latitude of Toronto. The diagram, which is due to Prof. Kerr, should be of much assistance to architects in deciding upon the best aspects for windows of various rooms. Other subjects treated are lightning arresters, planimeters, standards in machine shop practice, the Chicago Canal, and a simple form of telemeter.

THE Report of the American Museum of Natural History, just issued, shows notable increase in the various collections, and large and expensive additions to the building. The expeditions to Peru, Honduras, Sumatra and Mexico, have resulted in the acquisition of a large number of interesting objects and photographs. In the department of Public Instruction, regular courses of lectures have been delivered to the teachers of the public schools, and free lectures to the people on public holidays as well as every week. The department of Mammalogy and Ornithology received in 1895 the William Dutcher Collection of New York Birds, numbering over two thousand specimens, contributed by the Linnean Society of New York. A very large number of Arctic mammals and birds have been received as the result of the expedition to Greenland. The department of Vertebrate Palæontology has been enriched by the Cope Collection of Fossil Mammals of North America, comprising nearly ten thousand specimens, representing 483 species. The acquisition of this valuable collection establishes the Museum as a centre of study and research in palæontology. Increasing interest in the Museum has been evinced by all classes of the citizens of New York. Every course of lectures has been attended by crowded audiences, and pupils of public and private schools, as well as students of science, have derived advantage from the library as well as from the collections.

Several new editions of scientific works have reached us during the past few days. The first volume of a new edition of Prof. Fleming's systematic treatise on "The Alternate Current Transformer," dealing with the induction of electric currents, has been published by the *Electrician* Printing and Publishing Co. The great progress made during the seven years which have elapsed since the appearance of the original work, has necessitated a thorough revision of the matter, and the volume as it stands now will be appreciated by all who are concerned with alternating-current practice or investigations. Another volume having practical electricity for its subject is "Electric Lighting and Power Distribution" (Whittaker and Co.), by W. Perren Maycock. The first volume of the third edition of this work has been issued in an enlarged form, after careful revision. The second edition of the first volume of Dr. Schlich's "Manual of Forestry" has been published by Messrs. Bradbury, Agnew, and Co. The original was reviewed in Nature in December 1889 (vol. xli. p. 121), and quite recently (April 2, p. 510) was referred to in these columns. The second edition contains a new part on the State in relation to forestry, and a general review of the timber requirements of the British Empire. Messrs. Longmans, Green, and Co. have issued a second edition of "The Essentials of Chemical Physiology," by Dr. W. D. Halliburton. The chief alterations made are those rendered necessary by the advance of knowledge since 1893, when the first edition was published. The fifth edition of "Southall's Organic Materia Medica," by J. Barclay, has been published by Messrs. J. and A. Churchill. To quote the sub-title, the volume is "a handbook treating of some of the more important of the animal and vegetable drugs made use of in medicine, including the whole of those contained in the British Pharmacopœia." New editions of two volumes by the late Dr. J. E. Taylor, have been received from Messrs. W. H. Allen and Co. The books are "Nature's Byepaths," a series of recreative papers in natural history, and "The Aquarium," a popular manual on the history, construction, and principles of management of public aquaria. Dr. G. Herbert Fowler has edited the sixth edition of the late Prof. Milne Marshall's valuable work on the anatomy, histology, and dembryology of "The Frog" (David Nutt). A few additions and alterations have been made, but the work remains substantially the same practical and educational handbook that it ever was. Finally, the recent changes in the Physiography Syllabus of the Department of Science and Art have resulted in the production of a new edition (the sixth) of "Earth Knowledge" (Part II.) by W. Jerome Harrison and H. R. Wakefield. The book follows the Department's Advanced Syllabus, and appears to fulfil the purpose for which it has been designed.

The additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Sir William Call; a Blue-bearded Jay (*Cyanocorax cyanopogan*) from Para, presented by Mr. H. C. T. Beadnell; four Puff Adders (*Vipera arietans*), two Ringhals Snakes (*Sepedon hæmachates*), an Egyptian Cobra (*Naia haje*), three Cape Vipers (*Causus rhombeatus*), a Cape Bucephalus (*Bucephalus capensis*), two Infernal Snakes (*Boodon infernalis*), a Nilotic Monitor (*Varanus niloticus*) from South Africa, presented by Mr. J. E. Matcham; a Grey Ichneumon (*Herpestes griseus*) from India, deposited; two Indian Tree Ducks (*Dendrocygna javanica*) from India, purchased; a Japanese Deer (*Cervus sika*), born in the Garde 's.

OUR ASTRONOMICAL COLUMN.

Temperature Errors in Meridian Observations.—M. Hamy has applied his method of interference fringes to a study of the errors caused in meridian observations by the radiations of the sources of light usually employed in observatories, as well as those due to the presence of the observer himself (*Bull. Ast.*, vol. xiii. p. 178). The researches have completely demonstrated that the unequal distribution of light sources may produce errors in the measures amounting to several seconds of arc, while the heat from the observer may affect the results to the extent of several tenths of a second. It is evident therefore that the subject is one of great importance, and the interferential method is specially adapted for its investigation. M. Hamy has arrived at his conclusions from experiments made with the Gambey meridian circle of the Paris Observatory. In the case of an ordinary gas flame at a distance of 0·83 metre from the telescope, the mean angular displacement of the optic axis with respect to the meridian amounted to 2″·1, the flame being lit for ten minutes. Other observations indicate that the deviation is sensibly in inverse proportion to the square of the distance of the flame from the optic axis. The effects of different sources of light were also compared at one metre distance, and the practical outcome is that gas flames provided with chimneys are to be studiously avoided, the variation in collimation amounting in this case to 4″·4. The errors due to the heat of the human body are greatest in the case of declination measures, owing to the greater heating of the under side of the telescope tube. It is evident that these errors will depend to some extent upon the materials of which the instrument is constructed, and M. Hamy is of opinion that the best possible material is a metal of high conductivity, such as copper, in which case inequalities of temperature would be almost impossible.

Search Ephemeris for Comet 1889 V.—The following is a continuation of Dr. Bauschinger's search ephemeris for the return of Brooks's periodic comet (1889 V) (*Ast. Nach.*, No. 3350).

	R.A. h. m. s.	Decl. ° ′	Brightness.
May 28	22 2 38	−19 44	0·44
June 1	7 17	19 29	0·48
5	11 43	19 14	0·52
9	15 54	19 1	0·56
13	19 49	18 49	0·61
17	23 26	18 39	0·66
21	26 44	18 30	0·71
25	22 29 44	−18 22	0·77

The unit of theoretical brightness is that on 1889 July 8, the date of the first accurate observation. The comet was last seen in January 1891, at the Lick Observatory, when the calculated brightness was only 0·08. During June the computed path lies in the southern part of Aquarius, so that observations can only be made in the early morning.

Constants for Nautical Almanacs.—At a convention of Directors of Nautical Almanacs, held at Paris after the recent congress of the International Photographic Chart, Dr. Gill's value of the solar parallax (8″·80), resulting from heliometer observations of minor planets, was adopted, and consequently the constant of aberration becomes 20″·47. Dr. Gill's value for the mass of the moon, leading to 6″·21 for the nutation, was also adopted, and Newcomb's value was accepted for the precession.

The Planet Mercury.—A postcard from Dr. Kreutz, Kiel, contains the information that Mr. Leo Brenner, of the Manora Observatory, saw the dark part of the planet Mercury sharp and distinct on May 18, at 23h. Manora time.

STELLAR PHOTOGRAPHY WITH SMALL TELESCOPES WITHOUT DRIVING-CLOCKS.

Stellar photography has now become such an important branch of astronomy, that anything which will encourage possessors of small telescopes to turn their energies in this direction will tend towards the advancement of the celestial sciences. It is proposed to show here that useful work may be done by amateur astronomers with their ordinary small refractors, and with none of the mechanical contrivances which are essential for such large telescopes as are used in the international photographic survey of the heavens, which are driven by elaborate and costly machinery in order that the camera shall follow the apparent motion of the stars.

The accompanying photographs were taken with a 3¼-inch refracting telescope of 29 inches focus, totally unprovided with any driving mechanism, not even a tangent screw and slow-motion rod, the guiding having been performed entirely by hand. The correct rate of angular motion was secured by constant visual observation of the image of a star, much out of focus, as seen in a 2¼-inch guiding telescope, carrying an eyepiece magnifying fifty times. This was mounted side by side with the telescopic camera, and moved with it.

Fig. 1 shows the instruments mounted on a firm equatorial stand which is supported on a home-made brick pillar. The 2¼-inch guiding telescope, by Cooke of York, is seen on the left, provided with its total reflection prism and eyepiece, and just above it is a small "finder." On the extreme left is a counterpoise which balances the 3¼-inch photographic telescope, which is on the opposite side of the declination axis, and is mounted in a home-made wooden tube of square section, with dew-cap and diaphragms of the same material. At the lower end the dark slide is seen, and behind is a smaller camera which carries an ordinary portrait lens of 2¼-inch aperture, which is used for obtaining a duplicate photograph, on a smaller scale, simultaneously with the larger one. The whole is so evenly balanced by the two

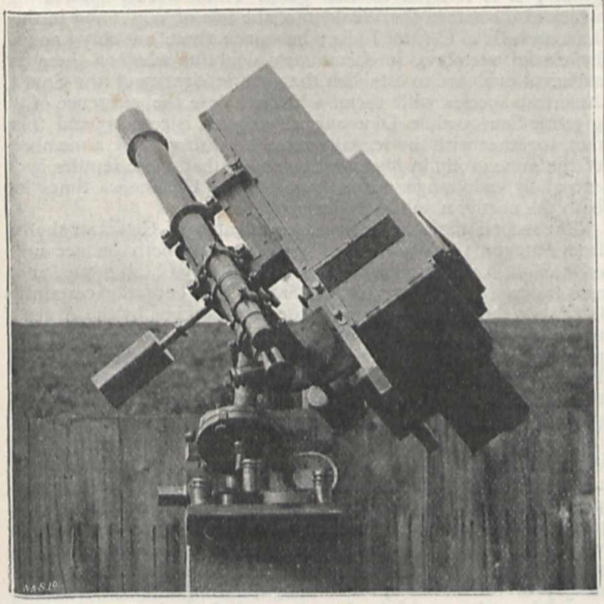

FIG. 1.—3¼-inch Equatorial Photographic Telescope (as used for hand driving).

counterpoise weights—one of which is seen low down on the right—that when unclamped it remains at rest in any position. Adjusting screws are provided in order to move the telescopic camera slightly in right ascension or declination whilst the guiding telescope remains stationary. This enables one to use the nearest bright star for guiding purposes when the centre of the photographic field contains no conspicuous stars. Absolute parallelism of the two telescopes is of no importance, but their rate of angular motion must be identical. Interesting results can be obtained with such a telescopic camera without any guiding whatever. The camera remaining fixed, the images of the stars travel along on the plate and leave "trails," which appear on the negative as straight or curved parallel dark lines.

By placing a small ink dot at one end of each of these lines, the relative positions of the stars can be indicated. It was found that the faintest stars visible to the naked eye, leave trails on negatives taken with such a 3¼-inch camera, and accurate charts of stars down to the sixth magnitude can be very easily secured in this manner.

These trails can also be usefully employed in certain cases to secure records of the changes of brightness of "variable" stars, as faint stars give very fine lines, and brighter stars leave thicker and denser ones on the negatives. Variations in brightness are thus recorded in the varying thickness and density of the lines, which are compared with the trails of other standard stars near. From what has been said about trails, and seeing that the image of a star moves more than its own diameter on a stationary plate in a few seconds, it is evident that all the naked-eye stars can be photographed with such an instrument with an exposure of a few seconds. As an illustration of this, a photograph taken with an exposure of only fifteen seconds, when the crescent moon was

FIG. 2.—Orion's belt. (Exposure 30 min.)

close to the Pleiades, showed not only the crescent, but also the "old moon in the new moon's arms," due to earth-shine, and twelve of the stars in the Pleiades. Accurate hand driving for such a short period is a matter of comparative ease.

Fig. 2 shows a photograph of Orion's belt taken with an exposure of thirty minutes. The negative on close examination shows stars down to the tenth magnitude. In the region represented,

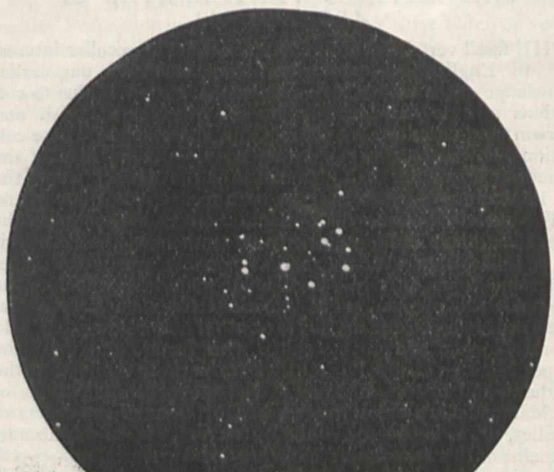

FIG. 3.—The Pleiades. (Exposure 60 min.)

only about eight stars can usually be seen with the naked eye. The photograph shows that amateurs can obtain, by half an hour's exposure, a chart of any region of the sky, much more accurate and revealing a far larger number of stars than are shown in the star atlases usually in their hands. These photographs, obtained by such simple means, can always be used as records, and might easily serve for the detection of "new" and "variable" stars when repeated at intervals and compared. The scale of these photographs is 3·4 times as large as that of Klein's Star Atlas, and the area of any region is 11·5 times larger. This is somewhat smaller than Argelander's charts.

The multiple star δ Orionis, a single star to the naked eye, is well shown as three stars, one of which is much elongated, showing the duplicity of that component; a curious S-shaped group of stars is clearly seen between δ and ε. These are quite invisible to the naked eye.

Fig. 3 represents the Pleiades as photographed with sixty minutes' exposure. In the region shown, ordinary keen eyes see only seven stars. On the negative seventy-eight stars can be counted in a space of 3° square in the centre of this region. These include stars of the eleventh magnitude.

As regards the actual driving of the telescopes, very little practice is needed; a gentle pressure of the finger at the lower end of the base-board carrying the objective and plate, is sufficient to move the telescope at the proper rate, and the co-operation of hand and eye during guiding seems soon to become almost automatic in character. When the instruments are stationary, the image of the star used for guiding, apparently travels many times faster than does the image of the star on the plate, owing to the magnification by the eyepiece; and for this reason any tendency to error in driving can be readily seen, especially with the enlarged star disc divided into four quadrants by crossed hairs in the eyepiece—long before such an error would be appreciable on the plate itself.

With the lens used, which was made by Hilger, and is uncorrected for photography, a field of good definition 5° square could readily be obtained.

An ordinary portrait lens of 2¼-inch aperture, mounted side by side with the 3¼-inch refractor, gave very good results. One photograph of the Hyades, taken by its means, showed Neptune very distinctly.

The wooden dew-cap was found remarkably effective in keeping the object-glass clear, even when that of the guiding telescope, provided with a metal dew-cap, became bedewed.

When amateurs come to recognise that, with their small instruments, such a fruitful field for investigation is open to them, astronomy will probably be enriched by many discoveries which would otherwise be missed or delayed.

JOSEPH LUNT.

THE EXTINCT VERTEBRATES OF ARGENTINA.[1]

THE fossil vertebrata of South America are of peculiar interest to English palæontologists, since much of our earlier knowledge of the extinct mammals of that region is due to collections sent to this country by Sir Woodbine Parish and Darwin, and described by Owen, Clift, and others. These collections, however, valuable as they were, gave no idea of the extraordinary variety and abundance of the extinct fauna, the full importance of which has only been recognised of late years.

The terrestrial Mammalia of South America are, perhaps, the most remarkable and most strictly autochthonous in the world. If we except some marsupials as possibly Australian types and some comparatively recent immigrants, the whole of the mammals are peculiar. The American Edentata form a distinct order (for there is no reason for associating the Old World Manidæ and Orycteropidæ with them), and until the Upper Miocene (Loup Fork), they are entirely confined to the southern half of the continent. The other great divisions of the Mammalia are either represented by peculiar sub-orders or families, or, as in the case of the Insectivora, are entirely absent. Remains of this remarkable fauna are found in deposits of several horizons, which, in the wealth of species and individuals they contain, can only be compared to the Tertiary lake-basins of North America. In some cases the series seems to be sufficiently complete for the history of certain of the groups to be, at least partly, worked out, and it is to be hoped that the study of the development of these isolated types, taken in conjunction with the already clearly determined phylogenetic history of many North American groups, may lead to important generalisations as to the laws in accordance with which mammalian evolution has advanced. Unfortunately, up to the present, much less attention has been paid to points of morphological interest than to the making of new genera and species, many of which are founded on quite insufficient evidence, the result being that the nomenclature has been brought into an almost unparalleled state of confusion. It was with the intention of clearing up some of this confusion that, at the invitation of Dr. Moreno, Mr. Lydekker, in 1893–94, paid two visits to the La Plata Museum. The brief time at his disposal rendered it impossible for him to carry out his object with complete success, but he has nevertheless produced a work of the highest value, both from the purely original matter it contains, and also because it renders easily accessible descriptions and good figures of many little-known forms. Moreover, he has earned the gratitude of all students of mammalian palæontology by relegating to the synonymy a large number of imperfectly defined genera and species.

The first of the two volumes contains three memoirs, two of which consist of descriptions of new material, while the third is occupied by a revision of the Ungulata. The second, with the exception of a few supplementary pages on the Ungulates, and descriptions of two new species of Carnivora, is entirely devoted to the Edentata.

In the first memoir are described some Dinosaurian remains from Patagonia, the first recorded from South America. The most completely known form is a member of the Sauropodous group; it is referred to the genus Titanosaurus, species of which also occur in the Wealden of the Isle of Wight and in the Lameta beds of Central India; but since these are only known by caudal vertebræ, it seems very doubtful whether there is sufficient evidence to establish the generic identity of the South American species with them. Nevertheless the existence of a gigantic Sauropodous Dinosaur in Patagonia is certain; and this fact, together with the recently recorded discovery of a member of the same group in Madagascar, shows that these reptiles had extremely wide range during Jurassic and Cretaceous times in both the northern and southern hemispheres.

The second memoir deals with a number of Cetacean skulls from Patagonia. These are of great interest, both on account of the light some of them throw on the history of the group, and also because they show that the Santa Cruz beds are certainly later than the Eocene (to which they are assigned by the Argentine writers), and are probably Miocene. Physodon, a genus previously known only from teeth occurring in the Miocene and Pliocene of Belgium and England, and probably ancestral to the sperm whales (Physeter), is represented by *Physodon patagonicus*, which possessed a series of teeth in the upper jaw; these have entirely disappeared in the recent form. Another interesting species is *Prosqualodon australe*, a Squalodont remarkable for the small number of its molars and for its comparatively well-developed nasals, characters in which it approaches the Eocene Zeuglodonts more nearly than any toothed whale previously known. A primitive type of the Platanistidæ is also described. This memoir is an important addition to the history of the Cetacea, for although, as might have been expected from the age of the deposits, no light is thrown upon the difficult question of the origin of the group, the author is to be congratulated on having helped to fill some of the gaps in our knowledge of it.

The South American Ungulates appear to suffer from an extraordinary superfluity of names. Mr. Lydekker regards no less than ten generic terms as synonymous with Nesodon, and states that the number of specific names that have been applied to *Nesodon imbricatus* is countless. In the classification of the order the most important innovation is the establishment of a new sub-order, the Astrapotheria, for the reception of the Homalodontotheriidæ and the Astrapotheriidæ. It is suggested that the European genus Cadurcotherium may belong here; this seems very improbable, but if true is one of the most remarkable facts of distribution known. In the description of Astrapotherium there seems to be some doubt as to the nature of the immense upper tusks, since in one place they are said to be canines, while in the dental formula given they are put down as incisors. The sub-order Litopterna, adopted for the reception of the Proterotheriidæ and Macraucheniidæ, is regarded by the author as being intermediate between the Astrapotheria and the Perissodactyla, though not ancestral to the latter. Indeed there can be no doubt that the peculiar foot-structure of the Litopterna was acquired quite independently of the Perissodactyla, and that such points of resemblance as exist between them are merely due to parallelism of their lines of evolution, a cause of similarity often neglected.

[1] "Contributions to a Knowledge of the Fossil Vertebrates of Argentina." Parts I. and II. By R. Lydekker, F.R.S. (*Anales del Museo de la Plata*, "Palæontologia Argentina, II. and III.) Folio, La Plata. 1893-4.

Nearly half the second volume is devoted to the Glyptodontidæ. The author rejects the various subdivisions of this family suggested by Ameghino and adopted by Zittel, and refers all the species to six genera, some seventeen other generic terms being regarded as synonymous.

In this group the earlier forms are of comparatively small size, and it is only in the later (Pleistocene) deposits that such giants as *Glyptodon clavipes* and *Dædicurus clavicaudatus* are found. The same progressive increase in bulk is noticeable in other groups, *e.g.* in the Mylodonts and in the Litopterna among the Ungulates. It is not improbable that the great size of the Pleistocene species had much to do with their rapid extermination when some change in the environment took place.

The remainder of the memoir deals with the Dasypodidæ and Megatheriidæ; the latter family being given a somewhat wider scope than usual. The most interesting of the genera described is Eucholœcops, which is probably ancestral to the Mylodonts and in some respects approaches Myrmecophaga.

These memoirs are illustrated by more than a hundred magnificent photographic plates, undoubtedly among the finest of their kind yet published; and while lithographic drawings by a competent artist are to be preferred for the representation of detail, such figures as those of the skeletons of Toxodon and of many of the Glyptodonts will not easily be surpassed.

The text is printed in English and Spanish in parallel columns; the English portion is unfortunately disfigured by very numerous misprints, doubtless owing to the fact that the author was compelled to entrust the correction of the proof-sheets to some person unfamiliar with the language.

THE EVOLUTION OF MODERN SCIENTIFIC LABORATORIES.[1]

THE scientific discoveries of the present century have had such a profound influence upon inventions, upon industries, and upon the comfort, health, and welfare of the people in general, that there is widespread, even if not always adequate, appreciation of the value of scientific study and investigation. But it may be doubted whether there is any proper understanding, in the minds even of the educated public, of the material circumstances which surround scientific discovery and which make it possible. The average man, if interested at all, is interested that the discovery is made, not how it is made.

In America, where men of science rely mainly upon enlightened private beneficence, and not upon governmental aid, to furnish the pecuniary resources which are essential for scientific progress, it is important that there should be some general information not only regarding the results of scientific work, but also regarding the external material conditions necessary for the fruitful prosecution of such work.

At the present day the systematic study and advancement of any physical or natural science, including the medical sciences, requires trained workers who can give their time to the work, suitably constructed work-rooms, an equipment with all of the instruments and appliances needed for the special work, a supply of the material to be studied, and ready access to the more important books and journals containing the special literature of the science.

All of these conditions are supplied by a well-equipped and properly organised modern laboratory. Such laboratories are, with the partial exception of the anatomical laboratory, entirely the creation of the present century, and for the most part of the last fifty years. They have completely revolutionised during the past half-century the material conditions under which scientific work is prosecuted. They are partly the result, and in larger part the cause, of that rapid progress of the physical and natural sciences which characterises the era in which we are living.

The evolution of the modern laboratory still awaits its historian. It is not difficult to find incidental references to historical facts bearing upon this subject. The development of the chemical laboratory has been traced with some fulness. But it is curious that there is no satisfactory monographic treatment of the general subject of the historical development of scientific laboratories. The subject seems to me an attractive one. It would surely be interesting to trace the development of the teaching and the investigating laboratory back to its beginnings, to learn about the material circumstances under which the physicists, the chemists, the morphologists, and physiologists of former generations worked. What share in the development of laboratories had the learned academies of the Renaissance and of the subsequent centuries? What share had public and private museums and collections of instruments of precision? What share had the work of the exact experimentalists, beginning with Galileo, of physicians, of the alchemists, and of the apothecaries? What individuals, universities, corporations, and governments were the pioneers in the establishment of laboratories for the various physical and natural sciences? The detailed consideration of these and many other questions pertinent to the subject would make an interesting and valuable historical contribution.

There is evidence that in Alexandria, under the early Ptolemies in the third century before Christ, there existed State-supported institutes, in which students of man and of nature could come into direct personal contact with the objects of study, and by the aid of such appliances as were then available could carry on scientific investigations. The practical study of anatomy, physiology, pathology, and other natural sciences was here cultivated. We are very imperfectly informed as to the results and the material circumstances of this remarkable period in the history of science. We know that after about a century of healthy activity the Alexandrian school gradually sank into a place for metaphysical discussions.

Fifteen hundred years elapsed before we next find any record of the practical study of a natural science. In 1231, the great Hohenstaufen, Frederick the Second, who has been called the most remarkable historic figure of the Middle Ages, commanded the teachers at Salernum diligently to cultivate the practical study of anatomy. After the passage of this edict occasional dissections of the human body were made, but it cannot be said that there was any diligent cultivation of anatomy on the part either of teachers or of students during the following two centuries.

In the latter half of the fifteenth century there developed that active interest in the practical study of human anatomy which culminated in the immortal work of Vesalius, published in 1543. After this the study of anatomy by dissections gradually assumed in the medical curriculum that commanding position which it has maintained up to the present day.

For over six hundred years there has been at least some practical instruction in anatomy, and for over three hundred years there have existed anatomical laboratories for purposes of teaching and of investigation, although only those constructed during the present century meet our ideas of what an anatomical laboratory should be. It is a matter of no little interest, both for the history of medicine and for that of science in general, that the first scientific laboratory was the anatomical laboratory. Private laboratories for investigation must have existed from the earliest times. Doubtless Aristotle had his laboratory. But the kind of laboratory which we have on this occasion in mind is one open to students or investigators, or both. There was no branch of physical or natural science, with the exception of anatomy, which students could study in the laboratory until after the first quarter of the present century. Only in anatomy could students come into direct contact with the object of study and work with their own hands and investigate what lay below the surface.

The famous Moravian writer on education, Amos Comenius, over two hundred and fifty years ago, gave vigorous expression to the conception of living, objective teaching of the sciences. He said, "Men must be instructed in wisdom so far as possible, not from books, but from the heavens, the earth, the oaks and the beeches—that is, they must learn and investigate the things themselves, and not merely the observations and testimonies of other persons concerning the things." "Who is there," he cries, "who teaches physics by observation and experiment instead of by reading an Aristotelian or other text-book?" But how little ripe were the conditions then existing for the successful carrying out of ideas so far in advance of his times is illustrated by the very writings of the author of "Orbis Pictus" and "Lux in Tenebris."

It would lead too far afield to trace in detail on this occasion the development of physical and of chemical laboratories, but on account of the intimate connection between the development of physics and chemistry and that of medicine, especially of more

[1] An address delivered at the opening of the William Pepper Laboratory of Clinical Medicine, Philadelphia, December 4, 1895, by Prof. William H. Welch.

exact experimental work in the medical sciences, a few words on this subject will not be out of place.

Methodical experimentation in the sciences of nature was definitely established by Galileo, and was zealously practised by his contemporaries and successors in the seventeenth century. It was greatly promoted by the foundation during this century of learned societies, such as the Accademia dei Lincei and the Accademia del Cimento in Italy, the Collegium Curiosum in Germany, the Académie des Sciences in Paris, and the Royal Society in England. Much of the classical apparatus still employed in physical experiments was invented at this period. Experimental physics from the first acquired a kind of fashionable vogue, and this aristocratic position it has ever since maintained among the experimental sciences. These sciences must concede to physics that commanding position which it has won by the genius of the great natural philosophers, by the precision of its methods and the mathematical accuracy of its conclusions, and by the fundamental nature and profound interest and importance of its problems. The debt of the medical sciences to the great experimental physicists, from Kepler and Galileo and Newton down to Helmholtz, is a very large one, larger than is probably appreciated by medical men who have not interested themselves in the history of experimental and precise methods in medicine.

There existed in the last century cabinets of physical apparatus to be used in demonstrative lectures, but they were very inadequate, and suitable rooms for experimental work scarcely existed. It was not until about the middle of the present century that we find the beginnings of the modern physical laboratory. Lord Kelvin, then William Thomson, established a physical laboratory in the University of Glasgow about 1845 in an old wine-cellar of a house. He tells us that "this, with the bins swept away, and a water supply and sink added, served as a physical laboratory for several years." It was as late as 1863 that Magnus opened in Berlin his laboratory for experimental physical research. Since 1870 there has been a rapid development of those splendid physical institutes which are the pride of many universities.

Humbler but more picturesque was the origin of the chemical laboratory. This was the laboratory of the alchemist searching for the philosopher's stone. In the painter's canvas we can still see the vaulted, cobwebbed room with its dim and mysterious light, the stuffed serpent, the shelves with their many-coloured bottles, the furnace in the corner with the fire glowing through the loose bricks, the fantastic alembics, the old alchemist in his quaint arm-chair reading a huge, worm-eaten folio, and the assistant grinding at the mortar. Fantastic and futile as it all may seem, yet here was the birth of modern chemistry. The alchemists were the first to undertake the methodical experimental investigation of the chemical nature of substances. No more powerful stimulus than the idea of the philosopher's stone could have been devised to impel men to ardent investigation. But search for gold was not all that inspired the later alchemists Paracelsus, the alchemist, that strange but true prophet of modern medicine as he was of modern chemistry, said, "Away with these false disciples who hold that this divine science, which they dishonour and prostitute, has no other end but that of making gold and silver. True alchemy has but one aim and object, to extract the quintessence of things, and to prepare arcana, tinctures, and elixirs which may restore to man the health and soundness he has lost." And again he says of the alchemists, "They are not given to idleness nor go in a proud habit or plush or velvet garments, often showing their rings upon their fingers, or wearing swords with silver hilts by their sides, or fine and gay gloves upon their hands, but diligently follow their labours, sweating whole days and nights by their furnaces. They do not spend their time abroad for recreation, but take delight in their laboratory. They wear leather garments with a pouch and an apron wherewith to wipe their hands. They put their fingers among coals and into clay, not into gold rings."

During the seventeeth and eighteenth centuries the doctrines and work of the alchemists had profound influence upon medicine. Alchemy was not completely overthrown until Lavoisier gave the death-blow to the phlogistic theory of Stahl. But for a considerable time before Lavoisier introduced the new spirit into chemistry, its methods and its problems were gradually approaching those of modern times. It was, however, over thirty years after the tragic death of Lavoisier before the first chemical laboratory in the modern sense was established. One cannot read without combined feelings of wonder and pity of the incommodious, forlorn, and cramped rooms in which such men as Scheele and Berzelius and Gay-Lussac worked out their memorable discoveries. Liebig has graphically described the difficulties encountered by the student of that day who wished to acquire practical training in chemistry. With some of the apothecaries could be obtained a modicum of practical familiarity with ordinary chemical manipulations, but Sweden and France were the centres for those with higher aspirations.

It was the memory of his own experiences which led Liebig, immediately after he was appointed professor of chemistry in Giessen in 1824, to set about the establishment of a chemical laboratory. Liebig's laboratory, opened to students and investigators in 1825, is generally stated to be the first modern public scientific laboratory. Although, as we shall see presently, this is not quite correct, it is certain that Liebig's laboratory was the one which had the greatest influence upon the subsequent establishment and organisation not only of chemical laboratories, but of public scientific laboratories in general. Its foundation marks an epoch in the history of science and of scientific education. This laboratory proved to be of great import to medical science, for it was here, and by Liebig, that the foundations of modern physiological chemistry were laid.

The significance of this memorable laboratory of Liebig is not that it was a beautiful or commodious or well-equipped laboratory, for it possessed none of these attributes—indeed, it is said to have looked like an old stable—but that here was a place provided with the needed facilities and under competent direction, freely opened to properly prepared students and investigators for experimental work in science.

The chemical laboratories of to-day are, in general, the best organised and the best supported of scientific laboratories.

The need of establishing physiological laboratories was recognised several years before the foundation of Liebig's laboratory. The important results to be derived from the application of the experimental method to the study of vital phenomena had been demonstrated first and most signally by Harvey, and after him by many experimenters. The fecundity of exact experimentation by physical and chemical methods applied to the phenomena of life had been shown by the classical researches of Lavoisier on respiration and animal heat. Magendie had entered upon that remarkable scientific career which entitles him to be regarded as the founder of modern experimental physiology, pathology, and pharmacology.

In 1812, Gruithuisen, who, after the custom of the times, filled an encyclopædic chair, being professor in Munich of physics, chemistry, zootomy, anthropology, and later of astronomy, published an article advocating the establishment of physiological institutes. In 1823, Purkinje, one of the most distinguished physiologists of this century, accepted the professorship of physiology in Breslau, this being the first independent chair of physiology in any German university. In 1824, Purkinje succeeded in establishing a physiological laboratory, which therefore antedates by one year Liebig's chemical laboratory in Giessen, although it cannot be said to have exercised so great an influence upon the organisation of scientific laboratories in general as did the latter. In 1840, Purkinje obtained a separate building for his laboratory.

With two or three exceptions, all of the separate physiological laboratories worthy of the name have been established since the middle of the present century. Bernard, that prince of experimenters, worked in a damp, small cellar, one of those wretched Parisian substitutes for a laboratory which he has called "the tombs of scientific investigators." There can be no greater proof of the genius of Bernard than the fact that he was able to make his marvellous discoveries under such obstacles and with such meagre appliances. France was long in supplying her scientific men with adequate laboratory facilities, but no more unbiassed recognition of the value and significance of the German laboratory system can be found than in the reports of Lorain, in 1868, and of Wurtz, in 1870, based upon personal study of the construction and organisation of German laboratories.

Of modern physiological laboratories, the one which has exerted the greatest and most fruitful influence is unquestionably that of the late Prof. Ludwig in Leipzig. This unequal position it has won by the general plan of its organisation, its admirable equipment, the number and importance of the discoveries there made, its development of exact methods of experimentation, the personal character and genius of its director, and the number of experimenters there trained from all parts of the civilised world.

To-day every properly equipped medical school has its physiological laboratory. This department is likely to continue to hold its place as the best representative of exact experimental work in any medical science. A good knowledge of physiology is the best corrective of pseudo-scientific, irrational theories and practice in medicine.

Physiological chemistry has been an important department of research for over half a century, but it is only within recent years that there have been established independent laboratories for physiological chemistry. A large part of the work in this branch of science has been done hitherto in laboratories of general chemistry, of physiology, of pathology, and of clinical medicine. A physiological laboratory cannot well be without a chemical department, and the same is true of several other medical laboratories; but it seems to me that physiological chemistry has won its position as an independent science, and will be most fruitfully cultivated by those who with the requisite chemical and biological training devote their entire time to it. The usefulness of independent laboratories for physiological chemistry has been shown by the work done in Hoppe-Seyler's laboratory in Strassburg since its foundation in 1872. This was the first independent laboratory of physiological chemistry.

The first pathological laboratory was established by Virchow, in Berlin, in 1856. About this time he wrote: "As in the seventeenth century anatomical theatres, in the eighteenth clinics, in the first half of the nineteenth physiological institutes, so now the time has come to call into existence pathological institutes, and to make them as accessible as possible to all." It cannot be doubted that the time was fully ripe for this new addition to medical laboratories. Virchow secured his laboratory as a concession from the Prussian Government upon his return from Würzburg to Berlin. Virchow's laboratory has been the model as regards general plan of organisation for nearly all pathological laboratories subsequently constructed in Germany and in other countries. It embraced opportunities for work in pathological anatomy, experimental pathology, and physiological and pathological chemistry. This broad conception of pathology and of the scope of the pathological laboratory as including the study, not only of diseased structure, but also of disordered function, and as employing the methods, not only of observation, but also of experiment, should never be lost sight of.

The first to formulate distinctly the conception of pharmacology as an experimental science distinct from therapeutics and closely allied by its methods of work and by many of its problems to physiology, was Rudolph Buchheim. This he did soon after going to Dorpat in 1846 as extraordinary professor of materia medica, and it was apparently not long after he there became ordinarius in 1849 that he established a pharmacological laboratory in his own house and by his private means. Later, this laboratory became a department of the University, and developed most fruitful activity. Buchheim's laboratory was the first pharmacological laboratory in the present acceptation of this term. The conception of pharmacology advocated by Buchheim has been adopted in all German universities, and in not a few other universities; but it cannot be said to have been as yet generally accepted in the medical schools of this country and of Great Britain, although it seems destined to prevail.

The medical science which was the latest to find domicile in its own independent laboratory is hygiene. To Pettenkofer belongs the credit of first establishing such a laboratory. Since 1847 he had been engaged with hygienic investigations, and in 1872 he secured from the Bavarian Government the concession of a hygienic institute. This admirably equipped laboratory was opened for students and investigators in 1878. By this time Koch had already begun those epochal researches which, added to the discoveries of Pasteur, have introduced a new era in medicine. The introduction by Koch of new methods of investigating infectious diseases and many hygienic problems became the greatest possible stimulus for the foundation of laboratories of hygiene and bacteriology, and to some extent also of laboratories of pathology. The results already achieved by these new methods and discoveries in the direction of prevention and cure of disease, and the expectation of no less important results in the future, constitute to-day our strongest grounds of appeal to governments and hospitals and medical schools and the general public for the establishment and support of laboratories where the nature, the causes, the prevention, and the cure of disease shall be investigated. You have established in Philadelphia, and in connection with the Johns Hopkins University, the first hygienic laboratory in America, housed in its own building and assured, I believe, of a future of great usefulness.

It is apparent, from the brief and imperfect outline which I have presented of the evolution of modern scientific laboratories, that the birthplace of these laboratories, regarded as places freely open for instruction and research in the natural sciences, was Germany. Such laboratories are the glory to-day of German universities, which possess over two hundred of them. By their aid Germany has secured since the middle of the present century the palm for scientific education and discovery.

Great scientific investigators are not limited to any country or any time. There are those of surpassing ability who will make their own opportunity and will triumph over the most discouraging environment. This country and every civilised country can point to such men, but they are most exceptional. The great majority of those even with the capacity for scientific work need encouragement and opportunity. We now have sufficient knowledge of the workings of scientific laboratories to be able to assert that in general where the laboratory facilities are the most ample and the most freely available, there are developed the largest number of trained workers, and there the discoveries are the most numerous and the most important. At the present day no country, no university, and no medical school can hold even a respectable place in the march of education and progress unless it is provided with suitable laboratories for scientific work.

A properly equipped and properly conducted scientific laboratory is a far more expensive institution than is usually conceived. It must be suitably domiciled either in a separate building or in rooms commodious and well-lighted. The outside architectural features are of secondary importance. The instruments and appliances necessary for exact observation and experiment, even in those sciences which apparently require the least, are numerous and costly. A working library, containing the books and sets of journals most frequently consulted, is most desirable, if not absolutely indispensable. The director of the laboratory should be a man of ability and experience, who is a master in his department of science. He must have at least one assistant, who is preferably a young man aiming to follow a scientific career. A person of no small value in the successful working of the laboratory is the intelligent janitor or "diener," who can be trained to do the work of a subsidiary assistant and can be entrusted with the care and manipulation of instruments. There must be funds for the purchase of fresh supplies and new instruments when needed. The running expenses of a first-class laboratory are not small.

But, costly as may seem the establishment and support of a good laboratory, the amount of money expended for laboratories would seem to us ridiculously insignificant if we could estimate the benefits to mankind derived from the work which has been done in them. Wurtz has truly said of the money required for laboratories, "It is a capital placed at a high rate of interest, and the comparatively slight sacrifice imposed upon one generation will bring to following generations increase of well-being and knowledge."

The educational value of the laboratory cannot well be overestimated. For the general student this is to be found primarily in the development of the scientific habit of thought. He learns that to really know about things it is necessary to come into direct contact with them and study them. He finds that only this knowledge is real and living, and not that which comes from mere observation of external appearances, or from reading or being told about things, or, still less, merely thinking about them.

The problem of securing for the student of medicine the full benefits of laboratory instruction in the various medical sciences is a difficult one, and cannot, I believe, be solved without considerable readjustment of existing schemes of medical teaching; but this subject is one which I cannot attempt to consider here.

The whole face of medicine has been changed during the last half-century by the work of the various laboratories devoted to the medical sciences. Anatomy, physiology and pathology now rank among the most important of the sciences of nature. They have been enriched with discoveries of the highest significance and value not only for medicine, but also for general biology. Although we have not penetrated, and perhaps may never penetrate, the mystery of life, we are coming closer and closer to an understanding of the intimate structure and the fundamental properties of living matter. We already know that living matter is not that homogeneous, formless substance which, not many years ago, it was believed to be, but that it possesses a complex organisation.

Practical medicine has been profoundly influenced by the unparalleled development of the medical sciences during the last fifty years, and especially during more recent years. Scientific methods have passed from the laboratory to the hospital. Cases of disease are now studied with the aid of physical and chemical and microscopical and bacteriological methods. The diagnosis of disease has thereby been greatly advanced in precision, and if Boerhaave's motto, *qui bene diagnoscit, bene medebitur*, be true, there should be a corresponding advance in the results of the treatment of disease. Whether or not this dictum of the old master be true—and I have serious doubts as to its entire truth—it cannot be doubted that great progress has been made in medical, and especially in surgical treatment as a result of scientific discoveries, although the treatment of disease still rests, and will doubtless long continue to rest, largely upon empirical foundations.

We are assembled here to-day to assist at the opening of a laboratory which gives the fittest and strongest possible expression to the influence of scientific work upon practical medicine. The generous founder has marked with characteristic insight the direction in which the current is setting.

The conception of a thoroughly equipped laboratory as an integral part of a hospital and intended for the study and investigation of disease is of recent origin. The germs of this idea, however, may be traced back to such men as Hughes Bennett and Beale in Great Britain, and to Frerichs and Traube in Germany, who in their hospital work made fruitful application of microscopical, chemical, and experimental methods. A little over ten years ago, von Ziemssen, in Munich, established a well-conceived clinical laboratory, containing a chemical, a physical, and a bacteriological department, a working library, and rooms for practical courses and the examination of patients. A similar laboratory was secured by Curschmann in Leipzig in 1892.

The growing recognition of the need of such laboratories is the result of the great progress in scientific medicine during recent years. The thorough clinical examination of many cases of disease now requires familiarity with numerous technical procedures, physical, chemical, microscopical, and bacteriological. The laboratory outfit required simply for routine clinical examinations is considerable. A microscope and a few test tubes and chemical reagents for simple tests of the urine no longer suffice. As illustrations of this, I call attention to the clinical value of examinations of the blood, of the contents of the stomach, of fluids withdrawn from the serous cavities, of the sputum and various secretions, of fragments of tissue removed for diagnosis. Such examinations require much time, trained observers, and considerable apparatus. To secure for the patients the benefits in the way of diagnosis, prognosis, and treatment to be derived from these methods of examination, a hospital should be supplied with the requisite facilities.

A hospital, and especially one connected with a medical school, should serve not only for the treatment of patients, but also for the promotion of knowledge. Where this second function is prominent, there also is the first most efficiently and intelligently carried out. Herein we see the far-reaching beneficence of a laboratory, such as this one, thoroughly equipped to investigate the many problems which relate to clinical medicine.

The usefulness of an investigating laboratory in close connection with a hospital has already been abundantly demonstrated. Chemical studies, more particularly those relating to metabolism in various acute and chronic affections, microscopical and chemical investigations of the blood and bacteriological examinations of material derived directly from the patient, may be mentioned as directions in which researches conducted in hospital laboratories have yielded important results and will garner still richer harvests in the future.

There need be no conflict between the work of clinical laboratories and that of the various other medical laboratories. Each has its own special field, but it is not necessary or desirable to draw around these fields sharp boundary lines beyond which there shall be no poaching. It will be a relief to pathological and other laboratories to have certain examinations and subjects relating directly to practical medicine consigned to the clinical laboratory, where they can receive fuller and more satisfactory consideration. The subject-matter for study in the clinical laboratory is primarily the patient and material derived from the patient. Anatomical, physiological, pathological, pharmacological, and hygienic laboratories must concern themselves with many problems which have apparently no immediate and direct bearing upon practical medicine. In the long run their contributions are likely to prove most beneficial to medicine if broad biological points of view, rather than immediate practical utility, are their guiding stars. The clinical laboratory will concern itself more particularly with questions which bear directly upon the diagnosis and the treatment of disease.

To the small number of existing well-equipped clinical laboratories the William Pepper Laboratory of Clinical Medicine is a most notable addition. It is the first laboratory of the kind provided with its own building and amply equipped for research in this country, and it is not surpassed in these respects by any in foreign countries. It is intended especially for investigation and the training of advanced students. It is a most worthy memorial of the father of its founder.

William Pepper the elder was a very distinguished physician and trusted consultant of Philadelphia, for many years an attending physician at the Pennsylvania Hospital, where he was a clinical teacher of great influence, and for four years the professor of the theory and practice of medicine in this University. He belonged to that remarkable group of American physicians, trained under Louis, who brought to this country the best methods and traditions of the French school of medicine at the time of its highest glory. His diagnostic powers are said to have been remarkable. With his broad sympathies, his lofty ideals, and his active and enlightened efforts for the promotion of clinical medicine, how he would have welcomed such opportunities as will be afforded by this laboratory to contribute to a better knowledge of the nature, the diagnosis, and the treatment of disease!

Our country has until within a very few years been deprived of the encouragement and opportunities for original investigations in the medical sciences afforded by large and thoroughly equipped laboratories. We can still count upon the fingers of one hand our medical laboratories which are comparable in their construction, organisation and appliances to the great European laboratories. Notwithstanding these obstacles, there have been American physicians of whose contributions to medical science we may feel proud.

But a new era has dawned. Of that we are witnesses here to-day. The value of medical laboratories is now widely recognised among us. To those of us who appreciate the underlying currents in medicine, who follow with eager interest the results of the almost feverish activities in foreign laboratories, who recognise the profound interest and importance of the many medical problems which await only patient investigation and suitable facilities for their solution, and who would like to see our country take the prominent position it should in these investigations, our laboratories may seem slow in coming, but they will in time be provided by enlightened benevolence. The individual or institution or hospital which contributes to the establishment of a good laboratory devoted to any of the medical sciences merits in unusual degree the gratitude of all medical men; yes, of every true friend of humanity. Such gratitude we feel for the generous and public-spirited founder of this laboratory, who has contributed largely to the advancement of medicine in this country, and of whose splendid services to this university I need not speak in this presence.

I congratulate this city and this university and this hospital upon the important addition made by this laboratory to higher medical education and the opportunities for scientific work in this country. May the enlightened aims of the founder, and the hopes of all interested in the promotion of medicine in this country, be fulfilled by the scientific activities which will now begin in the William Pepper Laboratory of Clinical Medicine.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—At the Encænia this year (June 24) it will be proposed to confer the honorary degree of D.C.L. upon Sir Archibald Geikie, among others.

The Rolleston memorial prize has been awarded to Mr. Horace M. Vernon, for his dissertations on (1) the effect of environment on the development of Echinoderm larvæ, (2) the relation of the respiratory exchange of cold-blooded animals to temperature, (3) the respiratory exchange of the lower marine invertebrates.

CAMBRIDGE.—The Reade Lecture will be given on Wednesday, June 10, in the Anatomy Theatre, by Prof. J. J. Thomson. The subject for this year is "Röntgen Rays."

Prof. Lewis announces a course of lectures and demonstrations in Crystallography, to be given daily during the Long Vacation, beginning on July 8.

A new syndicate, to take the place of that rejected by the Senate last term, has been nominated to consider the question of degrees for women. It consists of the Vice-Chancellor, Dr. C. Taylor, Mr. W. Chawner, Dr. V. Stanton, Dr. F. W. Maitland, Dr. L. E. Shore, Dr. M. James, Prof. Robinson, Mr. J. W. Cartmell, Mr. R. D. Roberts, Mr. W. N. Shaw, F.R.S., Mr. A. W. W. Dale, Mr. A. N. Whitehead, and Mr. A. Berry. This list includes only three members of the Council, and is said to be younger and less partisan than the rejected syndicate.

Meanwhile Dr. Hobson, F.R.S. of Christ's College, has issued a fly-sheet proposing that, as the balance of opinion in the Senate is against the admission of women to full membership, it might suffice to confer on them the "title" of B.A. by diploma. The title, he thinks, should be open to women who have studied at recognised colleges other than Newnham and Girton, provided they pass one of the Tripos examinations. It remains to be seen what reception will be given by Newnham and Girton to this proposal for an encroachment on their monopoly.

The Statute authorising the University to make provision for Advanced Students has received the approval of the Queen in Council. A guide to the courses of advanced study and research at present arranged for, has been prepared by Dr. Donald MacAlister, Tutor of St. John's College, and will be issued in June by the University Press.

A STRENUOUS and persistent effort to endow Barnard College (for women) has just been successfully made. The college some months ago purchased a site adjoining the new site of Columbia University, paying 160,000 dols., of which sum 100,000 dols. remained on mortgage. An unknown benefactor offered to pay the amount of this mortgage, provided others would contribute an equal amount by May 10. It is now known that this benefactor is Mrs. Van Wyck Brinkerhoff. Another unknown donor, who turns out to be Mr. John D. Rockefeller, offered 25,000 dols.; others contributed smaller amounts, but on the morning of Saturday, May 9, there was still a deficit of 23,000 dols. By strenuous efforts, however, this was secured during the day. Among the contributors were Mr. Seth Low, Mrs. F. E. Hockley, and an anonymous friend, who each paid 10,000 dols., and Mr. Jacob H. Schiff, who paid 8000 dols.

WE notice that at the last meeting of the Oxfordshire County Council, held at Oxford on the 12th inst., a proposition was made to devote the sum of £2000 out of a total of £4080, arising from the Customs and Excise Duties, to the relief of the rates; but it was defeated by a large majority. At a meeting of the East Sussex County Council, held on the same day, a resolution was carried that the whole of the funds available for the purposes of technical education be in future devoted to this object, instead of £5000 as heretofore. A similar motion was proposed at the meeting of the County Council for the North Riding of Yorkshire, held on the 6th inst. at Northallerton, and gave rise to a considerable amount of discussion, during which one councillor, a prominent member of Parliament, described the Technical Instruction Committee as the "horse-leech of the Council." Eventually an amendment, "that the County Council devote £6000 of the Local Taxation (Customs and Excise) grant for 1896-7 to technical education," was carried unanimously. By referring we find that during the financial year 1893-4 the total amount available was £6928.

THE last number of the *London Technical Education Gazette* gives some very interesting information concerning the number of scholarships and exhibitions which have been awarded by the Technical Education Board of the London County Council. The total number of the Board's scholars and exhibitioners is 1752, of whom 1154 are junior, 118 are intermediate, and 10 senior county scholars. The reports, which the Board receives at regular intervals, show that in the majority of cases the conduct and progress of the scholars are satisfactory. Some scholars have done remarkably well, especially in the case of the intermediate and senior students. In the case of a few of the junior scholars it has been found necessary to give a caution and to renew their scholarships for a short time on probation. This has in most cases been quite enough, though one or two scholarships have had to be taken away entirely. The scholarship winners are left free to choose any school that appears on the Board's published list. The result is, that at present 913 junior county scholars are in attendance at secondary schools, and 241 at upper standard public elementary schools. The secondary schools most commonly chosen are Roan School, Owen's School, Alleyn's School, and Aske's School, Hatcham, at all of which there are over fifty scholars and exhibitioners. The intermediate county scholars are now attending all the principal secondary schools of London, and some are in attendance at institutions of university rank, after having been for a year at a secondary school. The senior county scholars have joined some of the principal universities of the country, two being at Cambridge, at Clare and Sidney Sussex Colleges, and two at Newcastle in connection with the University of Durham.

THE report of the Technical Instruction Committee, which was presented to the May meeting of the West Riding Council, supplies abundant evidence of the good work which has been done during the session which is being completed. As would be expected, a very important place is occupied by the Committee's consideration of the Education Bill, an excellent summary of which forms the opening part of the report. The conclusions to which the Committee have come are that it would be undesirable for the duties connected with the administration of elementary education to be placed upon County Councils and for any expenditure in reference to such instruction to be thrown upon the County rates. The proposals with reference to secondary education are very favourably regarded, but it is pointed out that already the expenditure exceeds the income provided under the Local Taxation (Customs and Excise) Act, 1890, and must necessarily increase; and hence, if the County Council is to utilise the extended powers and carry out the duties to be conferred by the Bill, it is essential that adequate moneys be provided by Parliament. They further recommend that the Education Department should not be endowed with additional powers of control over the County Council in respect of the expenditure of funds provided under the above-mentioned Act, or out of the County rate for purposes of secondary education. We would call especial attention to certain supplementary regulations which have been adopted by the Committee as to the award and tenure of technical exhibitions. In future the Committee will, in considering recommendations for exhibitions, have regard to the preparatory work already done by the student, and as a rule no technical exhibition will be awarded unless evidence can be given by the candidate that he possesses a satisfactory knowledge of the principles of those sciences on which such technological subject is based; for instance, an exhibition in electric lighting and power distribution would in no instance be awarded to a student possessing an inadequate knowledge of applied mechanics and electricity and magnetism. No exhibition will usually be granted for a study of a *technological* subject to an applicant under eighteen years of age. These are but examples of a number of really wise provisions.

SCIENTIFIC SERIALS.

American Journal of Science, May.—Carbon and oxygen in the sun, by J. Trowbridge. The peculiar bands of the arc spectrum of carbon can be detected in the sun's spectrum. They are, however, almost obliterated by the overlying absorption lines of other metals, especially by the lines due to iron. In order to form an idea of the amount of iron in the atmosphere of the sun which would be necessary to obliterate the banded spectra of carbon, the author compared the spectrum of carbon with that of carbon dust and a definite proportion of iron distributed uniformly through it. The carbon dust and iron reduced by hydrogen was formed into pencils suitable for forming the voltaic arc, and containing 28 per cent. of iron to 72 per cent. of carbon. Photographs were taken of the portion of the solar spectrum which contains traces of the peculiar carbon band lying at wave-length 3883·7. The pure carbon-banded spectrum was photographed on the same plate immediately below the solar spectrum, and the spectrum of the mixed iron and carbon immediately below this. It was found that the iron present almost completely obliterated the carbon, and this fact tells in favour of the supposition that the traces of bands observed are true carbon bands. The author also investigated the spark spectrum of oxygen produced by a dynamo and transformer, and compared the bright lines found with the solar iron lines found in the same positions. The result showed that the oxygen lines, if present in the sun, are not sufficient to cover even the faintest iron absorption lines. Still, the author inclines to the view that the sun's light is due to carbon vapour in an atmosphere of oxygen.—On the determination of the division errors of a straight scale, by H. Jacoby. The author compares every division, and set of divisions, microscopically with every division on a duplicate scale. This is Gill's method. But he improves it by counting the "weight" of each observation according to its true value, instead of assigning the same weight to all readings without distinction.—Röntgen rays not present in sunlight, by M. Carey Lea. The author proved this by trying to obtain radiographs from the sun's light through one hundred leaves of a book, or through aluminium foil. No trace of Röntgen rays was found in sunlight, nor was any found in the light from a Welsbach incandescent gas burner.—On numerical relations existing between the atomic weights of the elements, by M. Carey Lea. It has already been shown that elements whose ions are always colourless can be arranged in vertical lines so that the horizontal lines contain each a natural group. Also that the elements whose ions are always coloured, form series with the atomic weights immediately following one another. If the atomic weights in the first vertical column are subtracted from those in the second, the second from the third, and so on, certain standard differences are found to recur. One of these is about 16, the other about 46, and the third about 88. The elements with ions always coloured are outside of this rule. Their behaviour is altogether anomalous. The colourless elements, beginning with hydrogen, fall into four series of nine each, interrupted by four coloured groups, and followed by an alternate series, Hg, Tl, Pb, Bi, Th and U.

Bulletin of the American Mathematical Society, April.—A two-fold generalisation of Fermat's theorem, a paper presented to the Society at its February meeting, is stated by the author, Prof. E. H. Moore, to be one-fold generalisations of two known theorems, of which one may be looked at as a theorem in the ordinary Gauss-congruence theory, while its generalisation is a theorem in the Galois-field theory. It is naturally highly symbolical. Prof. J. Pierpont gives an interesting and valuable note on the Ruffini-Abelian theorem. Gauss, in 1799, rigorously established the fundamental theorem that every equation of degree n possesses n roots real or imaginary. When n is less than five, it had been long known that these roots could be expressed as explicit algebraic functions of the coefficients. Between the years 1799 and 1813 an Italian mathematician, Ruffini, made several attempts to establish the justice of the doubts that the roots of equations of degree greater than four possessed this property. His reasoning, however, has not been judged to be conclusive, and the question remained open until the publication of Abel's argument in 1826. Prof. Pierpont, in addition to the preceding statement, gives several other historical notes, and states that his object is to give a demonstration of the theorem which shall be as direct and *self-contained* as possible. In addition he gives demonstrations, one of which is a modification of Ruffini's form, and the other Kronecker's modification of Abel's form.—On certain subgroups of the general projective group, is a paper, read before the January meeting, by the author, Prof. Henry Taber. It is on the lines of recent previous papers by the author in the *Bulletin*, the *Proceedings* of the London Mathematical Society, and the *Mathematische Annalen*. The "Notes" give the courses for the summer semester at Berlin and Göttingen. A synopsis is also published of the first volume of a work of great originality, viz. the Geometrie der Berührungstransformationen, Dargestellt von Sophus Lie und G. Scheffers. A long list of new publications closes the number.

SOCIETIES AND ACADEMIES.

London.

Royal Society, April 30.—"On some Palæolithic Implements found in Somaliland by Mr. H. W. Seton-Karr." By Sir John Evans, K.C.B., F.R.S.

In the course of more than one visit to Somaliland, Mr. Seton-Karr noticed, and brought home for examination, a number of worked flints, mostly of no great size, which he laid before the Anthropological Section of the British Association, at the meeting last year at Ipswich.[1] Although many of these specimens were broad flat flakes trimmed along the edges so as to be of the "le Moustier type" of M. Gabriel de Mortillet, and although the general *facies* of the collection was suggestive of the implements being of Palæolithic age, they did not afford sufficient evidence to enable a satisfactory judgment to be formed whether they undoubtedly belonged to the Palæolithic period.

On returning to Somaliland, during the past winter, Mr. Seton-Karr was fortunate enough to meet with a large number of specimens in form absolutely identical with some from the valley of the Somme and other places.

Of this identity in form there can be no doubt, and though at present no fossil mammalian or other remains have been found with the implements, there need be no hesitation in claiming them as Palæolithic. Their great interest consists in the identity of their forms with those of the implements found in the Pleistocene deposits of North Western Europe and elsewhere.

The discovery aids in bridging over the interval between Palæolithic man in Britain and in India, and adds another link to the chain of evidence by which the original cradle of the human family may eventually be identified, and tends to prove the unity of race between the inhabitants of Asia, Africa, and Europe, in Palæolithic times.

May 7.—"The Electromotive Properties of the Electrical Organ of *Malapterurus electricus*." By Francis Gotch, F.R.S., and G. J. Burch.

The conclusions drawn by the authors from the experiments on the isolated organ and on the entire uninjured fish may be summarised as follows:—

(1) The isolated organ responds to electrical excitation of its nerves by monophasic electromotive changes, indicated by electrical currents which traverse the tissue from the head to the tail end; this response commences from 0·0035″ at 30° C. to 0·009″ at 5° C. after excitation, the period of delay for any given temperature being tolerably constant.

(2) The response occasionally consists of a single such monophasic electromotive change (shock) developed with great suddenness, and subsiding completely in from 0·002″ to 0·005″, according to the temperature; in the vast majority of cases the response is multiple, and consists of a series of such changes (shocks) recurring at perfectly regular intervals, from two to thirty times (peripheral organ rhythm); the interval between the successive changes varies from 0·004″ at 30° C. to 0·01 at 5° C., but is perfectly uniform at any given temperature throughout the series.

(3) Such a single or multiple response (in the great majority of cases the latter) can also be evoked by the direct passage of an induced current through the organ and its contained nerves, in either direction heterodromous (*i.e.*, opposite in direction to the current of the response) or homodromous.

(4) The time relations of the response are almost identical whether this is evoked by nerve-trunk (indirect stimulation), or by the passage of the heterodromous induced current.

(5) There is no evidence that the electrical plate substance can be excited by the induced current apart from its nerves, *i.e.* it does not possess independent excitability.

(6) The organ and its contained nerves respond far more easily to the heterodromous than to the homodromous induced current, and the period of delay in the case of the latter response is appreciably lengthened.

(7) The peripheral organ rhythm (multiple response) varies from about 100 per second at 5° C. to about 280 per second at 35° C.

(8) One causative factor in the production of the peripheral rhythm is the susceptibility of the excitable tissue to respond to the current set up by its own activity (self-excitation).

The authors further conclude that, since each lateral half of the organ is innervated by the axis cylinder branches of one efferent nerve cell, and has no independent excitability, the specific characters of the reflex response of the organ express far more closely than those of muscle the changes in central nerve activity, and are presumably those of the activity of a single efferent nerve cell.

The single efferent nerve cell, the activity of which is thus for the first time ascertained, shows—

(*a*) A minimum period of delay of 0·008″ to 0·01″.

(*b*) A maximum rate of discharge of 12 per second.

[1] Report 1895 p. 824.

(c) An average rate of discharge of 3 to 4 per second.

(d) A susceptibility to fatigue showing itself in the discharge failing after it had recurred from two to five times at the above rates.

Physical Society, May 22.—Prof. Ayrton, Vice-President, in the chair.—Mr. R. Appleyard read a paper on dielectrics. The author has particularly investigated the effect of temperature on dielectric resistance. He has employed for this purpose condensers insulated with mica and paraffined paper. In order to eliminate some of the effects of surface leakage, Price's guard-ring arrangement was made use of in all the experiments. The author finds that the capacity of a paraffin condenser varies irregularly with the temperature, but that to within the accuracy attainable with his instruments (1 per cent.), the capacity of a mica condenser is constant between 33° F. and 110° F. If the resistance of paraffin at a temperature t is represented by $R_t = R\alpha^t$, the mean value for log α deduced from all the author's measurements is $\bar{1}\cdot96344$. Experiments made with a parallel plate condenser with paraffin as the dielectric, show that when the temperature reaches within about 20° of the melting point the resistance rapidly falls; when melting commences there is a rapid drop, but while melting is in progress the resistance remains constant. Prof. Ayrton said he could bear witness to the extreme value of Mr. Price's device, as it completely did away with the necessity for the extreme care previously necessary to prevent errors due to surface leakage. He regretted that he had not had an opportunity of comparing the author's numbers with some obtained some years ago by Prof. Perry and himself (Prof. Ayrton).—A paper by Prof. Viriamu Jones, on the magnetic field due to an elliptical current at a point in the plane of the ellipse and within it, was taken as read. Prof. Silvanus Thompson said that this paper was of interest not only on account of the application which others might make of the author's method, but also in that the correction when applied to Prof. Jones's results brought the international ohm more nearly into accord with the true ohm. Mr. J. J. Walker said he considered that the paper was more suited to the Mathematical Society. The integration which the author reduced to elliptic integrals might be more easily performed by another method. Prof. Ayrton said that Prof. Jones's value for the true ohm was now 106·302 cm. of mercury.—Mr. Campbell read a paper on new instruments for the direct measurement of the frequency of alternating or pulsating electric currents. The author employs two arrangements, in one of which a steel wire, the tension on which is variable, and the other a steel spring of variable length, clamped at one end, are acted upon by an electro-magnet, through which the periodic current is passed. The tension or length, as the case may be, is varied till maximum resonance is obtained, a small contact piece being employed to detect when this occurs. The instrument exhibited was capable of measuring the frequency of periodic currents of from 40 to 150 double vibrations per second. Mr. Watson said he thought that in the case of the steel spring there would be a considerable temperature correction, and he suggested a method by which this might be compensated. Mr. Blakesley asked if the author had found that the spring became magnetised and thus gave the octave. Mr. Carter asked whether elastic fatigue influenced the results, and said that a synchronous motor and a speed indicator could be used to measure the frequency. Prof. Silvanus Thompson suggested that it might be preferable to employ a polarised apparatus, since to avoid the impression of forced vibrations on the spring it was better, as was done in the case of tuning-forks, to make it massive. It had been found in other cases, such as in Hughes' telegraph and the telephone, that better results were obtained with polarised apparatus. He (Prof. Thompson) had used a telephone, placed anywhere near a magnet traversed by the periodic current, together with a tuning-fork, which gave beats with the note produced by the telephone, to measure frequencies. The variations in frequency ordinarily met with in practice were much greater than was generally suspected. Mr. Blakesley said he considered that the advantage of the author's instrument over a telephone and tuning fork was that it was continuously variable over a large range. Mr. Enright asked if the author had been troubled by the spring or wire breaking into overtones. In some experiments in which rather long wires were used, he had been troubled in this way. Prof. Ayrton said that he did not think that it was possible to get the wire or spring to respond to the octave unless the alternating current contained a component of the frequency of the octave; in fact, he had himself used such a stretched string as a wave analyser. He had used a telephone to prove that the note given by a hissing alternate current arc corresponded in frequency to that of the current. In the instrument used by Prof. Perry and himself, a polarised arrangement was always employed, since the alternating current was passed either through a wire in a constant magnetic field, or through an electro-magnet which acted on a wire through which a constant current was passed. The author, in his reply, said that the instrument responded, though feebly, to the octave, and this response might be made use of to check the accuracy of the scale.—The Society then adjourned till June 12.

Entomological Society, May 6.—Prof. Meldola, F.R.S., President, in the chair.—Mr. Champion exhibited specimens of *Amara famelica*, Zimm., from Woking, Surrey, a recent addition to the British list. He also exhibited, on behalf of Mr. Dolby-Tyler, a series of *Eburia quadrinotata*, Latr., from Guayaquil, Ecuador, showing variation in the number of the raised ivory-white lines on the elytra.—Mr. Horace Donisthorpe exhibited a specimen of *Pterostichus gracilis* with three tarsi on one leg, taken near Weymouth last April.—Mr. G. T. Porritt exhibited a series of *Arctia menthrastri* which he had just bred from Morayshire ova; the ground-colour of the specimens varied from the usual white, through shades of yellow, to dark smoky-brown.—Mr. Merrifield exhibited specimens of *Gonepteryx rhamni* bred from larvæ found in North Italy and Germany, the pupæ of which had been subjected to various temperatures. He stated that high temperature appeared to cause an increase of yellow scales in the female, and low temperatures generally reduced the size of the orange discal spot on the forewings of both sexes.—Mr. Merrifield said that the effects on the imago produced by temperature were being made the subject of systematic research by Prof. Weismann, Dr. Standfuss, Mr. E. Fischer, and others.—Mr. Kirkaldy exhibited and made remarks on ova of *Notonecta glauca* var. *furcata*.—Mr. Tutt exhibited living larvæ of *Apamea ophiogramma*, together with the grass on which it was feeding.—Mr. Goss read a communication from Mr. E. Meyrick on the subject of Prof. Radcliffe-Grote's criticisms, contained in his paper published in the *Proceedings* of the Society, 1896, pp. x.-xv., on the use of certain generic terms by Mr. Meyrick in writing on the Geometridæ.—Mr. McLachlan opened a discussion as to the best means of preventing the extinction of certain British butterflies. He referred to the extinction of *Chrysophanus dispar*, *Lycæna acis*, and *Aporia cratægi*, and to the probable extinction, in the near future, of *Papilio machaon*, *Melitæa cinxia*, and *Lycæna arion*. He stated that one of the objects he had in view in bringing this matter forward was to see whether some plan could not be devised to protect those specially localised species which were apparently in danger of being exterminated by over-collecting.—Prof. Meldola said he fully sympathised with the remarks of Mr. McLachlan, and thought that a resolution passed by the Society, possibly in conjunction with kindred Societies, might produce some effect. Mr. Goss stated that *Papilion machaon*, although apparently doomed to extinction in its chief locality in Cambridgeshire (Wicken Fen), would probably linger on in the country in smaller fens, such as Chippenham, where the larvæ had been found feeding on *Angelica sylvestris*. It would certainly survive in the Norfolk Broads, both from the irreclaimable nature of the fens there and the extensive range of the species in the district. He stated that *Melitæa cinxia*, although gradually disappearing from most of its old localities in the south of the Isle of Wight, was still found in the island further west, where he had seen it in numbers in May 1895. He added that *Lycæna arion* was far from extinct in Gloucestershire, and was distributed over a much wider area in the extreme south-west of England than was generally supposed.—Mr. Elwes stated that *L. arion* formerly occurred in several places on his own property in Gloucestershire, but had disappeared of late years, although not collected. Its disappearance was probably due to changes of climate.—Colonel Irby said that *L. arion* had disappeared many years ago not only from Barnwell Wold, Northamptonshire, but from another part of the county, on the estate of Lord Lilford, not accessible to the public, and that its disappearance there was no doubt caused by the destruction of the food plant and other herbage by burning the pasture, and by the grazing of sheep. Mr. Crowley, Mr. Tutt, Mr. Waterhouse, and Mr. Blandford continued the discussion.—Mr. Guy A. K. Marshall communicated a paper entitled "Notes on Seasonal Dimorphism in South African Rhopalocera."—Mr. P. Cameron communicated a paper entitled "Descriptions of new species of Hymenoptera from the Oriental Region."

Geological Society, May 13.—Dr. Henry Hicks, F.R.S., President, in the chair.—An account of a head or gateway driven into the Eastern Boundary-fault of the South Staffordshire coal field, by William Farnworth. The author described certain peculiarities observed during the driving of a head towards the fault separating the Coal-Measures and Permian rocks, from a pit situated four miles east of Walsall, at the southern extremity of the Cannock Chase coal field.—On the geographical evolution of Jamaica, by Dr. J. W. Spencer. The object of the paper was to set forth the physical and geological characteristics of Jamaica which bear upon the problem of its late high elevation and former connection with the continent, and to trace across the neighbouring seas and islands to the mainland the evidences of the former linking of Jamaica to North and South America. The first part of the paper treated of the growth of the island. The second part of the paper treated of the continental connections of Jamaica. The author gave details of the submerged plateaus and drowned valleys which are analogous to those still existing above sea-level. They indicate that the former altitude of the West Indian plateau, and some portions of the adjoining continent, reached two and a half miles. But the floors of the Mexican Gulf and Honduras and the Caribbean Sea formed low plains draining into the Pacific Ocean, for at that time the eastern region was high, while the Mexican area was generally low.—Dundry Hill: its upper portion, or the beds marked as Inferior Oolite (G 5) in the maps of the Geological Survey, by S. S. Buckman and E. Wilson. The authors gave an account of previous geological work relating to Dundry Hill, especially that which refers to the correlation of its strata. Then they described the different exposures on the hill, together with the results of various excavations carried out by quarrymen under their superintendence for the purpose of the present communication. Besides demonstrating the sequence of the strata of Dundry Hill, the authors were able to show a number of results of special interest.

Zoological Society, May 19.—Sir W. H. Flower, K.C.B., F.R.S., President, in the chair.—Mr. Sclater exhibited a daguerreotype portrait of what was believed to be the first gorilla that was ever brought alive to Europe. It was living in Wombwell's menagerie in 1855. This portrait had been lent to Mr. C. Bartlett by Mr. Fairgrieve, formerly associated with Mr. Wombwell, who had sent with it an account of the animal and its habits.—A communication was read from Mr. G. E. H. Barrett-Hamilton, on a variation in the pattern of the teeth of a specimen of the common field-vole (*Microtus agrestis*).—A second communication from Mr. Barrett-Hamilton contained remarks on the existence in Europe of two geographical races or sub-species of the common field-vole. Mr. Barrett-Hamilton considered the field-voles of England, Belgium, and the North of France, and possibly of a large part of the continent, as distinct from the Scandinavian animals, which would remain the typical *Microtus agrestis*, while the British and western continental form should be called *Microtus agrestis neglectus*, Jenyns. This view agreed with that of De Selys-Longchamps in 1847.—Mr. F. E. Beddard, F.R.S., read the third of his contributions to the anatomy of Picarian birds. The present paper related to the variations in pterylosis and in anatomy of the *Alcedinidæ*, of which he had examined specimens. Although this family was so uniform in external structure, it presented considerable differences when the pterylosis and anatomy were examined.—Mr. de Winton described a new rodent of the genus *Lophuromys* from British East Africa, which he named *L. ansorgei*.

Royal Meteorological Society, May 20.—Mr. E. Mawley, President, in the chair.—Mr. R. H. Curtis read a paper on the exposure of anemometers, in which he gave the results of a comparison of the records from the three anemometers at Holyhead, viz. the Robinson, the bridled, and the pressure-tube anemometers. It was clearly shown that the force of the wind is greatly affected by surrounding objects. The author is of opinion that for anemometrical records to be trustworthy and of value, not only must the instrument be exposed in an open place, free from local obstructions, but it is also absolutely essential that the stand which carries it shall offer practically no resistance to the wind, and that the instrument should not be placed on the roof of a house. The paper was illustrated by a number of lantern slides.—An interesting collection of photographs of clouds, sent to the Society by Mr. H. C. Russell, F.R.S., of the Sydney Observatory, was also exhibited.

CAMBRIDGE.

Philosophical Society, April 27.—Prof. J. J. Thomson, President, in the chair.—On photographing the whole length of a spectrum at once, by Prof. Liveing. Prof. Liveing exhibited photographs of a variety of spectra in which the whole length of the spectrum between the wave-lengths 550 and 214 was depicted on a celluloid film at one operation. A concave grating of 10½ feet radius was used, with the slit in the centre of curvature, and the slide which held the sensitive film formed part of a cylinder with a radius of 5¼ feet, so that, when the axis of this cylinder was midway between the slit and grating, every part of the spectrum was perfectly focused on the film.—On dioxymaleic acid and its derivatives, by Mr. Fenton. This paper contains a brief summary of the author's recent work upon oxidation products of tartaric acid.—(*a*) On the atomic weight of oxygen; (*b*) on the combining volumes of carbon monoxide and oxygen, by Mr. A. Scott. Mr. Scott gave a short account of the present state of our knowledge as to the atomic weight of oxygen, and said that it might be regarded as conclusively proved that if H = 1, O = 15·87 to 15·88. Morley determined the densities of hydrogen and of oxygen, the ratios by volume in which the gases combine (by a somewhat indirect method), and finally combined known weights of hydrogen and weighed the water produced. Thomsen made similar determinations, but with far less pretension to the highest accuracy attainable. The results were:

	Morley.	Thomsen.
Weight of a litre of oxygen at 0° C. and 760 mm. at sea-level, lat. 45°. ...	1·42900 ...	1·42906
Ditto for hydrogen ...	·089873 ...	·089947
Ratio of densities ...	15·9002 ...	15·8878
Ratio of combining volumes ...	1 : 2·00269 ...	1 : 2·00237
Atomic weight of oxygen ...	15·879 ...	15·869

The ratios by volume in which the gases combine agree well with that published by the author directly three years ago, viz. 1 : 2·00245 at about 15° C., and 1 : 2·00285 at 0° C. Mr. Scott also described some preliminary experiments made to determine the ratio by volume in which carbon monoxide and oxygen unite to form carbon dioxide and to determine at the same time the volume of the latter gas in terms of the others. Experiments so far showed that the ratio was very nearly 2 : 1 for the combining gases, but that satisfactory determinations of the volume of carbon dioxide produced had not been obtained as yet.—On the active principles of Indian hemp, by Messrs. Wood and Easterfield. The authors have examined a sample of charas, the exuded resin of Indian hemp, with a view to isolating the physiologically active constituent. They find that charas contains a compound $C_{18}H_{24}O_2$, B.P. 265°–270° C. at 15 mm. pressure (31 per cent.), to which they attribute the physiological action of the hemp plant. This active compound, which the authors name *Cannabinol*, is a red semi-solid substance at ordinary temperature, but is quite liquid at 60° C.; it yields a monacetyl and monobenzoyl derivative, and can be nitrated. The same compound has been isolated by the authors from the usual medicinal preparations of *Cannabis indica*.—Note on the pharmacological action of hemp resin, by Mr. Marshall. The pharmacologically active compound of charas is the compound, cannabinol. In doses of 0·1 g. to 0·15 g. it produces decided intoxication characterised by fits of uncontrollable laughter, slurring speech, and ataxic gait, a complete loss of time relation, and a sense of extreme happiness: sensation is diminished somewhat, and the pulse-rate rises: as a rule, there are no hallucinations. The acute symptoms last about three hours Smaller doses (0·05 g.) produce similar effects, but to less marked degree. Animals appear to be less susceptible to its influence than man, and herbivorous animals than carnivorous.

PARIS.

Academy of Sciences, May 18.—M. A. Cornu in the chair.—Second note on the theory of gases, by M. J. Bertrand. A critical analysis of Maxwell's second demonstration of the formula giving the distribution of the velocities between the molecules of a gas.—On the *rôle* of the ring of iron in dynamo-electric machines, by M. A. Potier. Remarks on a note by M. Marcel Deprez. The experiment quoted by M. Deprez is only in apparent contradiction to the ordinary rule, the principles involved having been already utilised in the construction of dynamos.—Emission of new radiations by metallic uranium, by M. Henri Becquerel. Metallic uranium gives off invisible rays possessing properties similar to the salts of that metal previously studied.—Preparation and properties of uranium, by M. H. Moissan.—The significance of an axis of symmetry in plants, by M. A. Chatin.—On the transformation of fat into carbohydrate in unfed animals, by M. A. Chauveau. During hibernation it has been noticed that the animal may increase in weight. This can be accounted for by the partial oxidation of the stearin to glucose, carbon dioxide, and water. If this is really the case the respiratory constant should be about 0·27.—On the integration of the differential equation of the radius vector of a certain group of small planets, by M. O. Backlund.—On a family of left-handed curves, by M. Jules Andrade.—The area of parabolas of higher order, by M. P. H. Schoute.—On some properties of the X-rays penetrating ponderable media, by M. C. Maltézos. A mathematical proof that if the X-rays be regarded as hyper-ultra-violet rays, the different absorptive power of various substances may be explained by supposing that the index of refraction is not exactly unity, but a number very near this value, and depending on the density.—On the application of the formula of Clapyron to the melting point of benzene, by M. R. Demerliac. An experimental study of the lowering of the melting point of benzene by pressure. The manometer used had been calibrated against a mercury column directly, and the alterations in temperature were measured to ·001° by the changes in resistance of an iron wire forming an arm of a Wheatstone's bridge. The alteration in melting point for an additional pressure of one atmosphere calculated from Clapyron's formula is 0°·02936; the experimental figure is ·0294, the difference being less than the errors of observation.—Remarks on the reply of MM. Benoist and Hurmuzescu, by M. Aug. Righi.—Observations on the X-rays, by M. T. Argyropoulos.—On a new ozone generator, by M. G. Seguy.—On a new apparatus for electrolysis, by M. D. Tommasi. In the apparatus described the advantages claimed are the suppression of polarisation, that the deposited metal is removed from the oxidising action of the bath, and that the electrical resistance of the bath is considerably reduced.—Researches on nickel cyanide, by M. Raoul Varet. A thermochemical study of nickel cyanide and its double salts. The thermal data show that the compounds undissociable by dialysis, may be looked upon as salts of a complex acid, hydronickelocyanic acid, differing only from ferrocyanides in stability.—On a crystallised tetrachromite of barium, by M. E. Dufau.—On the chloraloses, by M. Hanriot. Galactose forms a compound with chloral similar to the chloraloses previously prepared. The acetyl and benzoyl derivatives and the acid obtained on oxidising with potassium permanganate are described. The corresponding reactions with levulose were also examined.—On some aromatic symmetrical derivatives of urea, by MM. P. Cazeneuve and Moreau. Carbonate of guiacol serves as the starting point for these compounds, aniline giving diphenyl-urea, paratoluidine, di-paratolyl-urea, and ortho-toluidine, diorthotolyl-urea.—On the ratios which exist between the chemical constitution of organic compounds and their oxidisability under the influence of laccase, by M. G. Bertrand. The degree of oxidation of the aromatic polyphenols studied appears to depend upon the facility with which they can be transformed into quinones.—Characterisation and separation of the chief vegetable acids, by M. L. Lindet. For the separation of citric and malic acids advantage is taken of the different solubility in methyl alcohol of their acid quinine and cinchonine salts.—On the internal appendages of the female genital organs of the Orthoptera, by M. A. Fenard.—On the general relation connecting the degrees of sensation and luminous intensity, and on the laws of simultaneous contrast of lights and tints, by M. C. Henry.—On the browning of the cuttings of the vine, by MM. P. Viala and L. Ravaz—Researches on the carpellary venation in the bicarpellary Gamopetalæ of Bentham and Hooker, by M. Paul Grélot.—On the siphons of springs and underground rivers, by M. E. A. Martel.—The *Cadurcotherium*, by M. Marcellin Boule.—Measurements of the variation in length of glaciers in the French region, by Prince Roland Bonaparte.—Method for defining the position of the surface of emission of the X-rays, by M. Stcherbakof.

BERLIN.

Meteorological Society, April 14.—Prof. Börnstein, President, in the chair.—Dr. Schwalbe spoke on the investigation and most important theories of atmospheric electricity, and added an account of experiments he had made on the dissipation of electricity by vapour. A metal plate insulated, charged to ten volts, and connected with a Thomson's quadrant electrometer, discharged itself in exactly the same time when dry as when wetted with water or other easily vaporised fluid. Sprinkling with finely pulverised quartz greatly hastened the discharge; coarsely powdered glass to a less extent. The time of discharge was the same for a rough as for a polished plate. He considered that these experiments had settled the fact that vapour does not discharge an electrified body, but that fine powders do.

Physical Society, April 17.—Prof. Warburg, President, in the chair.—Prof. König spoke on the number of visual units existing in the human retina. The acuteness of vision was measured by the distance at which a grating made of regular rectilinear wires begins to appear wavy. Starting at the *fovea* it diminishes towards the periphery, and in such a way that the curves of equal visual acuteness form concentric ellipses. The area of each retinal field by which two wires are seen as two, increases towards the periphery. If such a field be called a visual unit, then their total number for the whole retina is 50,000. If it be assumed that each unit can perceive three kinds of colour, of which the resulting impulse is conveyed to the brain by a separate nerve fibre, then there must be 150,000 fibres in the optic nerve. As a matter of fact, histologists give them as 400,000 to 500,000 in number. He further discussed the experiments he had made in conjunction with Dr. Zumpf, which had shown that objects of different colour must be perceived at different depths in the retina. The difference of these depths for red and blue rays was found to be so great, that one lay in the pigment layer, which must hence be regarded as a sensory organ. As a matter of fact, quite recently an English anatomist has described the existence of spherules in this layer united to a nerve-plexus from the rods and cones. He finally gave an historical retrospect of Purkinje's phenomenon, in which two coloured (red and blue) fields of equal luminosity as seen by daylight appear unequally luminous at twilight, the red disappearing much sooner than the blue. After this phenomenon had been studied by a whole series of observers, and its importance insisted upon, Prof. Hering had quite recently found that it is really an exceptional phenomenon. It can only be observed in dark surroundings; in daylight and bright surroundings the differently coloured fields remain equally luminous, while the intensity of their illumination is reduced down to a point at which colour perception ceases. Prof. König had satisfied himself of the truth of the above observation, so that Purkinje's phenomenon has now lost all its supposed significance.

May 1.—Prof. von Bezold in the chair.—Dr. du Bois spoke on the magnetising and hysteresis of various kinds of steel and iron, basing his remarks on experiments made in conjunction with Mr. E. T. Jones. The discrimination of different samples of iron by means of their hardness has now lost all its importance; the real criterion is rather hysteresis, coercitive power, residual and maximal magnetisation, which had been determined, together with other magnetic properties, for a large series of samples. Chemical composition is of less importance than the mode of treatment during manufacture from ore to metal. The magnetic constants of the material are of importance to physicists and technologists. The speaker then gave the results of his measurements for three kinds of iron with maximal, and three with minimal hysteresis. As a general rule hardening increases hysteresis and coercitive intensity, whereas residual magnetism is lessened. Krupp's cast-iron is distinguished by its low hysteresis and small coercitive intensity.

PHILADELPHIA.

Academy of Natural Sciences, April 14.—In connection with the presentation of a collection of recent and fossil Strombidæ, Mr. H. A. Pilsbury discussed the ancestry of *Strombus costata* and *Melongena subcoronata*, their relations fossil species being illustrated by large suites of intermediate forms.—Mr. James Willcox commented on the influence of environment on the species as illustrated by the specimens presented. It was apparent that those from the southern coasts of Florida swept by the Gulf Stream were all of a dwarfed type.—Dr. Benjamin Sharp related the plentiful occurence of a Ctenophore, *Mneopsis Leidyi* in a fresh-water pond near Nantucket. The embryos had been swept in by an accession of salt water, and had accustomed themselves to their new environment. The species did not, however, persist in the pond, in consequence probably of the severity of the winter. Specimens of the species referred to were beautifully preserved in a 2 per cent. solution of formaline.—Mr. Pilsbury announced the finding by Mr.

Charles Johnson, for the first time in the Eocence of Texas, of a representative of the genus Scalpellum. It is a new species for which the name Chamberlaini was proposed, in recognition of the services of the Rev. L. T. Chamberlain to palæontological science.

NEW SOUTH WALES.

Linnean Society, March 25.—The President, Mr. Henry Deane, in the chair.—The President delivered the annual address, in the course of which the subject of forestry, especially in relation to the needs and resources of Australia, was brought forward, and the experiments of other countries were summarised, as a safe guide to be followed. The question of the origin of the Australian flora was also dealt with at some length, critical objections being offered to Ettingshausen's views on the characters of the Australian Tertiary flora, based upon no more satisfactory evidence than is afforded by leaf-remains. The address concluded with a summary of the salient points of interest in the recently issued first instalment of the "Report of the Horn Expedition to Central Australia" (Zoology, part ii., edited by Prof. Baldwin Spencer), a work which, in its completed form, promises to be the most comprehensive and elaborate account of the natural history of any portion of the continent ever issued in a self-contained form.—The following papers were read:—A contribution to the structure and relations of the organ of Jacobson in the horse, by Dr. R. Broom.—Descriptions of further highly ornate boomerangs from New South Wales and Queensland, by R. E. Etheridge, jun.—Note on the occurrence of callosities in *Cypræa* other than *C. bicallosa* and *C. rhinocerus*: and on the presence of a sulcus in *Trivia australis*, by Agnes F. Kenyon.—On a new genus and species of Australian fishes, by J. D. Ogilby. The genus *Apogonops* is proposed for a small fish of puzzling affinities from Maroubra Bay. At a first glance it would seem to be naturally referable to the family *Apogonidæ*. But this view is precluded by the absence of vomerine teeth and the number of its dorsal spines, unless it is to be considered as an aberrant Apogonid with sciænoid affinities.—Catalogue of the described Coleoptera of Australia. Supplement. Part ii. *Dytiscidæ* and *Staphylinidæ*, by George Masters.

GÖTTINGEN.

Royal Academy of Sciences.—The *Nachrichten* (mathematico-physical series) part 1 for 1896 contains the following memoirs contributed to the Society.

January 11.—Pendulum observations at Freden and Alfeld, by A. von Koenen.—The movement of the spinning-top, by F. Klein.

January 25.—Discovery of *Ceratites nodosus aut.* in the Vicentine Trias, and its stratigraphical significance. A new demonstration of Kronecker's fundamental theorem on Abelian *Zahlenkörper*. A letter of Gauss to Gerling (on Bolyai's geometry), by Paul Stäckel. Continuous groups of quadratic transformations of the plane, by G. Bohlmann.—On the representation of finite groups by means of Cayley's colour-diagrams.

February 8.—Researches conducted in the Göttingen University laboratory (III.), by O. Wallach. (1) A new heptylamine. (2) Ketones from propenyl-compounds. (3) On reuniol. (4) On pinol hydrate. (5) On isothujone and thujamenthone. (6) Refractive and dispersive powers of a series of isomeric camphors.

March 7.—The theory of the formation of petroleum, by Fr. Heusler.—On a theorem in the analysis of position, by A. Schoenflies.

AMSTERDAM.

Royal Academy of Sciences, April 18.—Prof. Van de Sande Bakhuyzen in the chair.—On four-dimensional prismoids, by Prof. Schoute.—On the equilibrium of radiation in the case of doubly-refracting bodies, by Prof. Lorentz.—Prof. Kamerlingh Onnes presented a paper to be published in the report of the meeting, and entitled "a contrivance for lighting up scales for mirror-reading," and also, on behalf of Dr. L. H. Siertsema, a communication on measurements of the magnetic rotation of gases. This communication is a continuation of those published in the *Transactions*, 1893–94, p. 31, and 1894–95, p. 230. After supplementing the descriptions of the apparatus, the method of observation, and the manner of calculation—a plate being added for illustration—the author communicated the results with respect to air, oxygen, nitrogen, carbonic acid, and nitrogen monoxide. The results for the first two gases have been deduced from the same observations as the previous ones, but have been re-calculated, a better determination of certain constants having been obtained. Moreover, the rotations have been expressed in minutes, by means of a provisional reduction factor. The results for CO_2 and N_2O must only be considered as provisional, as the pressure was not measured with sufficient accuracy.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—The Alternate Current Transformer: Dr. J. A. Fleming, Vol. 1, new edition (*Electrician* Company).—Physics for Students of Medicine: Dr. A. Daniell (Macmillan).—The Flora of Dumfriesshire: G. F. Scott-Elliot (Dumfries, Maxwell).—Through Jungle and Desert: W. A. Chanler (Macmillan).—The Frog: Prof. A. Milnes Marshall, 6th edition, edited by Dr. G. H. Fowler (Nutt).—The Great Rift Valley: Dr. J. W. Gregory (Murray).—A Manual of North American Birds: R. Ridgway, 2nd edition (Lippincott).—Fur and Feather Series. The Hare: Macpherson, &c. (Longmans).—Press-Working of Metals: O. Smith (Chapman).—Mars: P. Lowell (Longmans).—How Plants Live and Work: E. Hughes-Gibb (Griffin).—Official Year-Book of the Scientific and Learned Societies of Great Britain and Ireland, 13th annual issue (Griffin).—Reminiscences of a Yorkshire Naturalist: Prof. W. C. Williamson (Redway).—Miscellaneous Papers: Prof. H. Hertz, translated by D. E. Jones and G. A. Schott (Macmillan).—A System of Medicine: edited by Prof. T. C. Allbutt, Vol. 1 (Macmillan).—Catalogue of the Madreporarian Corals in the British Museum (Natural History), Vol. 2: H. M. Bernard (London).—Catalogue of the Snakes in the British Museum (Natural History), Vol. 3: G. A. Boulenger (London).—Lehrbuch der Ökologischen Pflanzengeographie: Dr. E. Warming, Deutsche vom Verfasser Genehmigte Durchgeschene und Vermehrte ausgabe: Dr. E. Knoblauch (Berlin, G. Borntraeger).—The Indian Calendar: R. Sewell and S. B. Dikshit (Sonnenschein).—Results of Rain, River, and Evaporation Observations made in New South Wales, 1894 (Sydney).

PAMPHLETS.—Die Grenzen Geistiger Gesundheit und Krankheit: Dr. P. Flechsig (Leipzig, Veit).—Thoughts on Evolution: P. G. F. (Sonnenschein).

SERIALS.—Quarterly Journal of Microscopical Science, May (Churchill).—Bulletins de la Société D'Anthropologie de Paris, 1895, No. 6 (Paris, Masson).—Mémoires de la Société D'Anthropologie de Paris, tome 1, 3e série, 4e Fasc. (Paris, Masson)—Journal of the Institution of Electrical Engineers, May (Spon).—Quarterly Journal of the Geological Society, May (Longmans).—Natural Science, June (Rait).—Longman's Magazine, June (Longmans).—Himmel und Erde, May (Berlin).—Illustrations of the Zoology of H.M. Indian Marine Surveying Steamer *Investigator*, 5 parts (Calcutta).—Good Words, June (Isbister).—Sunday Magazine, June (Isbister).

CONTENTS.