announces courses on Mammalian Morphology and Palæontology. The usual courses are being given in the departments of Physics, Chemistry, Mineralogy and Botany and Physiology.

In the Faculty of Medicine, Dr. Ritchie, Lecturer on Pathology, will give a course of practical instruction on Bacteriology. Lectures will also be given on Medicine, Surgery, and Materia Medica. Prof. Arthur Thomson is lecturing on the Uro-genital system.

April 13 being the twenty-fifth anniversary of the Zoological Station at Naples, Dr. Anton Dohrn sent a telegraphic message to the Chancellor, acknowledging the assistance rendered by the University to the Station.

Prof. Burdon Sanderson has been re-elected Chairman of the Board of Faculty of Medicine.

The large and valuable collection of butterflies offered to the Hope Department of the University by Mr. F. Ducane Godman, F.R.S., and Mr. Osbert Salvin, F.R.S., was accepted by Convocation on Tuesday, and the thanks of the University were voted to the donors. The collection has already been briefly described in NATURE (vol. lv. p. 524, April 1).

CAMBRIDGE.—A memorial, signed by 2100 resident undergraduates and bachelors of arts, has been presented to the Vice-Chancellor, protesting against the proposal to grant titles of degrees to women, on the ground that this would injure the position and efficiency of the University as a University for men. A counter memorial, signed by only 298 of the junior members of the University, has also been received. It states that in the opinion of the signatories the proposal would *not* injure the University. Meanwhile the notice of *non-placet* by the resident graduates has been circulated, and bears the names of about 280 members of the Senate, out of about 450 in actual residence. The list includes eighteen professors and 110 past or present tutors and lecturers. If, therefore, the decision lay with the resident body of teachers and officers, the result would be a decided negative; and there is no doubt that among the students the feeling against the contemplated change is overwhelmingly strong. The latter fact gives some colour to the assertion that the admission of women would probably be followed by a serious falling off in the number of men desirous of entering the University.

The proposal of the Special Board for Physics and Chemistry, that candidates for either part of the Natural Sciences Tripos should be required to submit to the Examiners their laboratory note-books, duly attested by the signatures of their teachers, has been adversely criticised in the Senate. It was feared that it might interfere with the good relations at present existing between teachers and students, and encourage the special preparation of note-books for the Examiners' inspection. The Report was referred back to the Board for reconsideration.

The dates of the next ensuing College Examinations for Scholarships and Exhibitions in Natural Science are announced as follows:—November 2: St. John's and Trinity, Pembroke, Caius, King's, Jesus, Christ's, and Emmanuel. November 30: Peterhouse and Sidney Sussex. December 7: Clare and Trinity Hall. April 1898: Downing. Information as to the value and conditions of tenure of the several emoluments may be obtained from the respective College Tutors.

WE understand that the late Prof. Edward D. Cope left an estate valued at over one hundred thousand dollars. Most of the amount is bequeathed to the University of Pennsylvania, and to establish a chair of Vertebrate Palæontology in the Philadelphia Academy of Natural History.

AMONG the grants just authorised by the legislature of the State of New York are: 2,500,000 dols. for the new public library in New York City; 500,000 dols. for an extension of the Museum of Natural History; 150,000 dols. for the new Zoological Park in New York City; and 10,000 dols. for the proposed public library in Brooklyn.

In a brief note (p. 21) on the application of the Hartley Institution for a share of the increased grant which it is proposed to give to the University Colleges of Great Britain, the term "professorial" staff was misprinted "professional" staff. Dr. R. W. Stewart, the Principal of the Institution, calls our attention to the fact that the Committee appointed to consider the distribution of the Government grant gave, in 1889, what almost amounted to a pledge that if certain defects in the Institution were remedied, a future application for a share of the grant might receive favourable consideration. The work and management of the Institution have since then been entirely reorganised, and it is on these grounds that the application has been renewed.

THE following are among recent appointments:—Dr. C. H. Draper to be head-master of the Municipal Technical School at Brighton; Miss M. Maclean to be demonstrator of anatomy, and Miss D. Clark demonstrator in the botanical laboratory, in Queen Margaret College, Glasgow; Mr. W. H. Lang to be lecturer on botany in the same college; Dr. Frech to be professor of geology and palæontology at Breslau; Dr. Walter Kruse to be professor of hygiene at Bonn; Dr. W. Ule to be professor of geography at Halle; Dr. Gustav Jäger, privat-docent in theoretical physics at Vienna, to be a professor; Prof. W. F. Edwards to be president of the Washington University, Seattle; Dr. Andr. Lipp to be professor of analytical chemistry in the Polytechnic Institute at Munich. Prof. Sissingle, of the Polytechnic Institute of Delft, has been called to the chair of Physics in the University of Amsterdam.

THE Technical Education Board of the London County Council will proceed shortly to award not less than five Senior County Scholarships, which are of the value of 60*l.* a year, together with payment of tuition fees up to 30*l.* a year, and are tenable for three years at university colleges and advanced technical institutes. These scholarships are confined to residents within the administrative county of London, and are only open to those whose parents are in receipt of not more than 400*l.* a year. Candidates should, as a rule, be under twenty-two years of age, though the Board reserves the right to give preference to candidates who are under nineteen years of age. The scholarships are intended to encourage more especially the teaching of science, and to enable those students who cannot afford a university training to pursue advanced studies for a period of three years in the highest university institutions in the country. Candidates must apply before Monday, May 17, to the Secretary of the Technical Education Board, St. Martin's Place, W.C.

SCIENTIFIC SERIALS.

American Journal of Mathematics, vol. xix. No. 2 (April 1897).—On the most perfect forms of magic squares, with methods for their production, is an interesting paper on these squares by Dr. E. McClintock, which treats the subject in a somewhat novel manner. As it was read before the American Mathematical Society so long ago as April 25, 1896, the references to the Rev. A. H. Frost's work on similar lines make no allusion to the recent memoir by this gentleman (the construction of Nasik squares of any order), which was read before the London Mathematical Society, June 11, 1896, and, in its printed form, occupied pp. 487-518 of vol. xxvii. of the Society's *Proceedings*. Dr. McClintock refers to the earlier papers in the *Quarterly Journal of Mathematics* (vol. vii. and xv.).—Dr. Chree contributes a complementary paper to his article in vol. xvi. Its title is "Isotropic elastic solids of nearly spherical form." The method of the two papers is practically the same, but the author states the differences in detail to be considerable. His principal object is to find what may be regarded as the change in pitch due to a small change in the shape of the surface; the result shows what effect an absence of perfect sphericity has on the frequency of vibrations.—Non-uniform convergence and the integration of series, term by term, by W. F. Osgood, is a paper which was read at the August (1896) meeting of the American Mathematical Society. The geometrical method for the study of uniform convergence, set forth in the present article, was treated at some length in a paper by the same writer, which we have noted in our abstract of the Society's *Bulletin* (vol. iii. pp. 59-86) for November 1896.—Two notelets close the number: viz. a note on the factors of composition of a group, by Ellery W. Davis, and simple proof of a fundamental theorem in the theory of functions, by R. D. Bohannan.—A loose sheet gives a very brief outline of Sylvester's career and work. Prof. Sylvester was the principal founder of the *American Journal of Mathematics* (in 1877), and he was the principal editor until his departure from America in December 1883. He contributed to its pages some fifty papers in all.

Bulletin of the American Mathematical Society, vol. iii. No. 7 (April 1897).—On Cayley's theory of the absolute, is a paper by Prof. C. A. Scott, which was read at the January (1897)

meeting of the Society. Miss Scott attempts to show, "as a matter of purely pedagogic interest," how simply and naturally Cayley's theory follows from a small number of very elementary geometrical conceptions, without any appeal to analytical geometry.—Lines common to four linear complexes, is a short note, by Dr. V. Snyder, which was read at the February meeting.—The cubic resolvent of a binary quartic derived by invariant definition and process, by Prof. H. S. White, was read at the Chicago Conference (January 1, 1897).—Dr. Isabel Maddison reviews two recent works on geometry, viz. Phillip's and Fisher's "Elements of Geometry," and H. D. Thompson's "Elementary Solid Geometry and Mensuration," which she thinks rise above the general level. Dr. Maddison also points out that the map-colouring problem was discussed (before Cayley and De Morgan wrote upon it) by Möbius, in his lectures in 1840. The problem was propounded to Möbius by Prof. Weiske, and is to be found in the *Berichte der Sächsischen Gesellschaft der Wissenschaften zu Leipzig*, Math.-physiche Classe, Bd. 37, 1885. The Note referred to is by Prof. Baltzer, and its title is "Eine Erinnerung an Möbius und seinen freund Weiske."—The Notes contain the mathematical courses at the Universities of Berlin and Harvard.

THE last number of the *Journal of the Russian Chemical and Physical Society* contains, in an appendix, the third instalment of the "Record" (*Vremennik*) of the Russian Chief Board of Measures and Weights. Most of it is given to an elaborate paper, by Prof. Mendeléeff, on the "Methods of Accurate or Metrological Weighings." The formulæ relative to the oscillations of the scales' index, and to the "condition" of the scales, are discussed in great detail, and new formulæ are given; while the discussion of some of the results has brought the Russian professor to the discovery of a new property of the parabola relative to the surface of a segment of it (*Comptes rendus*, 1895, p. 1467).—The same issue contains papers on the quantity of carbon dioxide contained in the air of the Weighing Hall of the Board of Measures and Weights, by A. Dobrokhotoff; the results of the verification at the Standards Department of the Board of Trade, in 1894 and 1895, of the Avoirdupois Pound belonging to the Russian Government, and the comparison of the Russian half-sashen with the Imperial standard yard, by H. J. Chaney, Mendeléeff, and Blumbach (in English and Russian); on the geographical position of the Board of Measures (chiefly its exact altitude above the sea-level); and a note, by Prof. Mendeléeff, on the agreement of the author's well-known formula for the density of water at different temperatures with the last measurements of the same, by M. Thiesen.

Bollettino della Società Sismologica Italiana, vol. ii., 1896, N.N. 7, 8.—Influence of the different nature and sensitiveness of instruments on the measure of the velocity of seismic waves, by G. Agamennone.—On the geodynamic system of the world, by G. Grablovitz.—Summary of the principal eruptive phenomena in Sicily and the adjacent islands during the six months July–December 1896, by S. Arcidiacono.—Velocity of propagation of the earthquake of Ahmed (Asia Minor) of April 16, 1896 (in French), by G. Agamennone.—Vesuvian notes for the year 1896, by G. Mercalli.—Notices of earthquakes recorded in Italy, August 31–September 8, 1896; the most important being a series of records of the Iceland earthquake of September 6.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 8.—"Further Note on the Sensory Nerves of Muscles." By C. S. Sherrington, M.A., M.D., F.R.S., Holt Professor of Physiology in University College, Liverpool. Received February 26.

I was somewhat surprised when, after the sensory nature of the structures originally termed muscle-spindles (Kühne) had been proved (Sherrington), I was unable to find in the eye-muscles any examples of these structures. I had expected to find in those muscles, on account of the great delicacy of their control and coordination, and in view of the well-known richness of their innervation, a field peculiarly favourable for the examination and study of "spindles."

I had noted that the intrafusal muscle-fibres, of the "red" variety as they are, undergo, when the nerve-trunk of a muscle has been severed, a much slower course of alteration than do extra-fusal muscle fibres, *i.e.* I found no pronounced degeneration for even two years following section. I therefore cut through *n. oculomotorius* at its origin, and examined the resultant degenerations in the eye-muscles which it innervates and in their individual nerve-trunks.

In the nerve-trunks, extra-muscular and intra-muscular, the Wallerian degeneration clearly demonstrated that, with the exception of a few minute fibres, of variable number, derived perhaps from the ciliary ganglion, *all* myelinate nerve-fibres in all these eye-muscles degenerate. Therefore these eye-muscles derive the vast majority of their myelinate nerve-fibres from *n. oculomotorius*. The sensory innervation of these muscles is not, therefore, derivable from the fifth cranial pair. In accord with this, I found (α) that severance of both trigemini caused no obvious impairment of the movement of the eye-balls, (β) that the combined severance of both *nn. trigemini*, and of both optic nerves, even after section of the encephalic bulb, did not severely depress the tonus of the eye-muscles. Now we know that section of the sensory spinal roots belonging to muscles does very severely depress the tonus of them.

At the same time, I was struck with the long distance to which many of the nerve-fibres in these muscles travel forward towards the ocular tendons of the muscles. I was the more impressed with this fact because direct examination proved that the regions of the distribution of motor end-plates in these muscles is almost confined to the middle portion of the fleshy mass of the muscle. Further investigation of the course and destination of the nerve-fibres at the tendon end of the muscle revealed them (both in cat and monkey) undergoing terminal subdivision, and in numerous instances passing beyond into the bundles of the tendon itself. The terminations of some of these nerve-fibres lie within the tendons; many recurve again towards the muscular fibres, and end just at junction of muscle-fibre with tendon-bundle. The nerve-fibres in so terminating frequently become thick—as I have described in the case of muscle-spindles—with shortened internodes.

My observations have included also the fourth cranial pair, and with like result. Investigation of the sixth cranial pair is also in progress.

It also appears from the above that the absence of the distinct Kühne-Ruffini "spindles" from a muscle does not exclude the possession by it of sensorial end-organs, and of afferent nerve-fibres. This point is not without importance, because examination of various muscles has led me to the conclusion that the "spindle-organs" are absent from the following muscles:—From all the orbital eye-muscles; from the intrinsic muscles of the larynx, though Pacinian corpuscles occur, as in various other muscles; from the intrinsic muscles of the tongue, and from the diaphragm. It is notable that all these muscles belong to that set which are innervated by nerve-fibres of rather smaller calibre (Gaskell) than those supplying the skeletal muscles generally; that is to say, are innervated by the non-ganglionated splanchnic efferent nerves of Gaskell.

"On Boomerangs." By G. T. Walker, M.A., B.Sc., Fellow of Trinity College, Cambridge. Communicated by Prof. J. J. Thomson, F.R.S. Received March 15.

A typical returning boomerang resembles in general outline a symmetrical arc of a hyperbola, and is about 80 cm. in length measured along the curve. At the centre, where the dimensions of the cross section are greatest, the width is about 7 cm., and the thickness 1 cm.

Of the two faces, one is distinctly more rounded than the other; in addition the arms are twisted through about 4°, in the same manner as the blades of a right-handed screw propeller.

Such an implement, if thrown with its plane vertical, will describe a circular path of 40 or 50 metres in diameter, rising to a height of from 7 to 12 metres, and falling to the ground with its plane of rotation horizontal at a point somewhere near the thrower's feet.

The flight may be regarded as a case of steady motion, of which the circumstances gradually vary. In the more complicated, as well as the simpler, paths, observation makes it clear that everything depends on the changes in direction and inclination of the plane of the boomerang, and that the character of these changes is always the same; if they can be explained theoretically, the peculiarities of the motion may be accounted for.

Since the effects of the different forces at work are conflicting, it is necessary to adopt quantitative methods, even if the degree of accuracy attainable is not high; accordingly ratios