city Chüchow suffered most, not a house remained standing, many lives were destroyed; frequent shocks occurred for a year after. The province of Szechuan is also liable to continuance of seismic throes, one of these commenced in the fourth month, 1462, and continued eleven months—there were in all 375 shocks.

In the loess formation of Northern China (discovered and described by Baron Richthofen) the land is not unfrequently riven by earthquakes forming long narrow chasms of unknown depth that gradually disappear on account of the vertical cleavage and unstratified nature of loess.

In the first decade of the fourth month, 1828, an earthquake caused a fissure over three miles in length, twenty to thirty feet broad, from which a vapour issued that proved fatal to many: people, animals, houses, and tombs were ingulfed. About two months later, during heavy rain, the chasm gradually filled up.

The chief earthquake region of China lies in a great seismic zone, which extends from near the gulf of Chihli to the shores of the Caspian—including Turkestan and the Aralo-Caspian depression. In Eastern Turkestan they present a periodic character (five per annum with remarkable regularity). Yet there are few portions of the world so far removed from active volcanoes. Recent Russian exploration has discovered that the supposed Tienshan volcano is merely a solfatara, or an ignited coal-field.

Observations of officers appointed by the Emperor Chienlung to examine the newly subjugated territory in reference to these "firefields," are several. They say: "Three days travel to the east of Okishu and to the south of the hill at Palikeh there are several firefields. The ground is of a red colour, and a number of variegated stones are piled upon each other in the neighbourhood; from the middle of which flames upward of a foot in height are emitted: they are alternately extinguished and lighted up, while the smell is so strong as to render a near approach to the place impossible. For a distance of about 100 *li* not a blade of grass, not an inch of wood, nor a drop of water can be seen. From the peculiar smell of the fire thus raised, it is imagined that the soil must be strongly impregnated with sulphur."

The same work represents earthquakes as so common in Eastern Turkestan and the desert, that to the inhabitants "they are not considered strong; four or five occur every year; even when violent, they merely cause the doors and windows to rattle, but on account of the firm and adherent character of the soil, and thick walls and light roofs in common use, the houses are never thrown down."

A recent English traveller[1] makes a similar statement respecting Mid-Asian earthquakes generally. At Tashkend they generally average five in a year, but so slight, as not to be noticed by anybody. In that part of the world earthquakes appear to be most frequent at the close season. In the western portion of the seismic zone, they are of greatest frequency and violence in mountain regions.

Anent the opinion of M. Perrey, that a maximum of earthquakes is coincident with the moon's perigee, I submit the following statistical fragment that escaped the loss referred to: it is partially confirmatory of Prof. Milne's observations, that cold weather furnishes the maximum of frequency.

Lists of 738 continental shocks:—

1st month	65	5th month	46	9th month	56
2nd ,,	82	6th ,,	63	10th ,,	43
3rd ,,	72	7th ,,	70	11th ,,	65
4th ,,	49	8th ,,	70	12th ,,	88

(The first day of the first month occurs about February 6th, or at the new moon which falls nearest to the point when the sun is in the fifteenth degree of Aquarius.) In their seismic records the Chinese seldom designate the day of the month (moon) when earthquakes occur. Yet a considerable number may be found. Seventy-two cases show twice as many in the first and second as in the third and fourth quarters of the moon's phrases: forty-eight in the former period, and twenty-four in the latter; of that number fifteen occurred at the syzygies. The 6th day shows the largest number, twelve. None took place on the 2nd, 5th, 13th and 14th; one occurred on each of the following, 4th, 7th, 17th, 20th, 22nd, 23rd, 24th, 28th, 29th. Hours are rarely given; so far as they go, they show that a large majority are nocturnal.

[1] Lansdell's "Russian Central Asia," 1885.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The following list of lectures and classes in Natural Science has been arranged for the summer term:—

Physics.—In the Clarendon Laboratory Prof. Clifton lectures on Instruments and Methods employed in the Study of Optics. Practical instruction in Physics is given by the Professor and by Messrs. J. Walker and A. L. Selby. At Christ Church, Mr. Baynes lectures on Electro-Kinematics and Dynamics, and has a class for practical instruction in Electric and Magnetic Measurements. At Balliol Mr. Dixon lectures on Elementary Electricity and Magnetism. At Trinity the new Millard Laboratory will be opened for instruction in Mechanical and Electrical Engineering under Mr. Frederick Smith.

Chemistry.—In the Chemical Department of the University Museum Dr. Odling lectures on Some Special Points in Organic Chemistry. Mr. Fisher and Dr. Watts continue their courses on Inorganic and Organic Chemistry respectively. Mr. W. R. Dunstan lectures on Organic and Pharmaceutical Chemistry. Practical instruction is given in the laboratories by Messrs. Fisher, Watts, Baker, and Marsh. At Christ Church Mr. Vernon Harcourt has a class for Quantitative Analysis, and Mr. Dixon for Gas Analysis.

Animal Morphology.—In the Morphological Department Prof. Westwood lectures on the Haustellated Orders of Winged Arthropodous Animals. Prof. Moseley lectures on the Mammalia, Mr. Baldwin Spencer on Embryology, and Mr. J. B. Thompson on the Osteology, Distribution, and Odontography of Birds and Mammals. Practical instruction is given by Prof. Moseley and by Messrs. Robertson and Spencer. In Human Anatomy Mr. A. Thomson lectures on the Vascular and Respiratory Systems, and gives demonstrations on Topographical Anatomy. Daily instruction is also given in Practical Anatomy.

Physiology.—In the Physiological Department Prof. Burdon Sanderson lectures on the Chemical Processes of the Animal Body, and on Elementary Physiology. Mr. Dixey lectures on Histological Methods. Practical instruction is given daily.

Botany.—At the Botanic Garden Prof. Balfour lectures and gives practical instruction in Vegetable Morphology and Physiology. Prof. Gilbert gives four lectures on Rural Economy.

Anthropology.—Dr. Tylor lectures on the Origins of Civilisation.

Geology.—Prof. Prestwich lectures on the Secondary and Tertiary Series as illustrated by the geology of the neighbourhood of Oxford. Each lecture is followed by a geological excursion.

CAMBRIDGE.—The Special Board for Biology and Geology have recommended the following grants from the Worts Fund:

(1) 50*l.* to Mr. W. Bateson, of St. John's College to assist him in investigations into the fauna of lakes in the neighbourhood of the Sea of Aral in 1886, and an additional 50*l.* if he continues his investigations into the summer of 1887. Mr. Bateson's investigations into the development of Balanoglossus in the Southern United States have, it is well known, been of great value.

(2) 60*l.* to Mr. A. C. Seward, of St. John's College, to assist him in studying and collecting fossil plants in Belgium and France.

(3) 35*l.* to Mr. Hans Gadow, of King's College, to assist him in exploring the ossiferous caves of Portugal, which he has already partly explored during two former visits. Prof. Boyd Dawkins strongly recommends the continuance of these explorations.

(4) 25*l.* to Mr. C. Potter, of Peterhouse, to assist him in elucidating the life-history of the alga parasitic on the water-tortoise in Portugal.

In the list of lectures issued by the Board of Physics and Chemistry for the present term we note that Dr. Ruhemann, assistant to the Jacksonian Professor, will lecture on Gas Analysis, and also on the Aromatic Bodies. The other chemical courses repeat the usual advanced and elementary courses.

In Advanced Mathematics Mr. Forsyth lectures on Thermodynamics, Mr. Glaisher on Theory of Errors, Mr. Webb on Dynamics of a System. The latter course will be continued during the Long Vacation, when also Prof. Darwin will lecture on the Theory of Attractions, Potential, and Figure of the Earth.

In Geology Prof. Hughes lectures on Stratigraphy and Cam-

bridge Geology, Mr. Marr on Advanced Palæontology, especially the Graptolites, Mr. Harker on Microscopic Petrology.

In Botany Dr. Vines is lecturing on the Cryptogams; Mr. F. Darwin on Physiology, and Mr. Potter on Advanced Systematic Botany.

In Zoology, Mr. Sedgwick continues the courses of Elementary Biology, and the Anatomy and Embryology of the Vertebrata; Mr. Gadow gives a summary Course on the Palæontology of the Vertebrata.

In Physiology, beside Prof. Foster's Elementary Course, we have advanced lectures by Dr. Gaskell, Dr. Hill, and Mr. Langley.

Prof. Macalister lectures on the Variations in the Skeletal, Muscular, and Nervous Systems of the Races of Mankind.

The Special Board for Physics and Chemistry report to the Vice-Chancellor on the new Mechanical Science Tripos:—

In consequence, the report states, of the Grace passed March 11, 1886, confirming their report, dated December 14, 1885, the Board have drawn up regulations for the New Tripos in Engineering, Physics, and Chemistry, for which they would propose the name "Mechanical Science Tripos." They do not think it desirable that the University should examine in subjects for which the University does not or may not easily provide adequate teaching, and have therefore made the examination in Engineering mainly an Examination in Mechanical Engineering. They have included, however, in it such elementary portions of Civil Engineering as can be taught in Cambridge and such as may often be advantageously studied by those who are intending to become Mechanical Engineers. With respect to the Engineering papers in Part II. of the Examination one paper would test the ability of the candidates to indicate how a given design should be carried into execution; another would include questions on steam and the steam-engine besides other prime movers, and also on boilers and furnaces; a third would include questions on bridges, roofs, arches, abutments, elementary hydraulics, strength of materials, and elementary building construction. In the Examination in Physics in Part II. the papers would contain questions on the application of dynamics to physical phenomena; gravitation; attractions; hydrostatics and hydrodynamics; properties of matter, including elasticity, capillarity, diffusion, and viscosity; heat; kinetic theory of gases; radiation; light, including the application of the undulatory theory to the problems of geometrical optics; mineralogical physics; acoustics; meteorology; cosmical physics; electricity and magnetism; reduction of observations. The Practical Examination would extend over two days, the Examination on the first day being of such a nature as would test the knowledge of the candidates in the general methods of laboratory work; on the second day a list of experiments would be given, one or more of which each candidate would be expected to complete.

SCIENTIFIC SERIALS

Bulletins de la Société d'Anthropologie de Paris, tome 8eme, 4me fascic., 1885.—On the facial and cranial muscles of a young gorilla, by M. Chudzinski. The subject of this post-mortem examination, a young male, was 98 centimetres in height. The muscles of the head and face were the same in number as in the human species, but in form and dimensions they exhibited certain differences, being combined into a single fleshy mass, which covered most of the face.—M. Pozzi laid before the Society various anatomical characteristics with reference to the comparative constitution of the muscles of the Negro and the white races.—M. Folley drew attention to the greater anastomosis of the subcutaneous abdominal veins of the Negro, and the importance of this peculiarity in giving to the organism a greater power of resisting the action of rapid variations of atmospheric or aqueous pressures.—On the common origin of Malays and Vedahs, by M. Beauregard.—On the universal language of F. Sudre, by M. Gajewski. The basis of the system proposed fifty years ago by M. Sudre is the musical nomenclature of the vocal notes, *do*, *re*, &c., and from these he elaborated a language which claims to be equally capable of expression by means of musical instruments and the voice. The defects and impracticabilities of Sudre's proposed musical language were considered at length by MM. Kerckhoffs, Dally, and Dehoux.—Suggestions for the modification of Broca's method of determining the direct absolute cranial capacity, by M. Topinard. The points chiefly insisted on are the different results yielded by fresh, and often-used, lead, the latter being valueless after 100 cubage determinations.—On the cause and nature of the vitrification observed in tumuli, and other ancient structures, by M. Manouvrier.—Report of the recent Anthropological Exposition at Buda-Pesth, by Dr. R. Blanchard.—On the dimensions and location of the dolmens of St. Nectaire, by Dr. Verrier.—History and anthropology, by Dr. Fauvelle. The writer draws attention to the tissue of errors which works intended for the instruction of the young continue to promulgate, as exemplified in the current historical explanations of the origin and usages of earlier races.—On the Gallic habitation of Mané Gohenne, Carnac, by M. Gaillard. The finds, which consisted principally of flints and pottery, included a string of twenty-three green serpentine beads cut into various forms.—On certain unique objects shaped like fishes, found in the Mammoth Cave in Varsovia, by M. Zawisza, and supposed to have been employed as fetishes by sorcerers.—On the significance of certain strongly marked impressions on the inner surface of a skull, by M. Manouvrier. Such impressions have been regarded as an evidence of imperfection in the cerebral convolutions, and of consequent mental deficiency.—On man of the age of Palæolithic pottery in the Lozère district, by MM. Martel and L. de Launay. The local finds attest the co-existence there of man and the cave-bear, and the fabrication of pottery at the time.—On the flint implements of Croix Fringant, near Cognac, by M. Germain.—On the calcareous islets of Taled Sah, in the inner sea of the Samsans, in the Malayan peninsula, and the natives who dwell in natural caverns and are engaged in collecting edible swallow-nests, by M. Macey.—On the displacement of the brain in accordance with the different attitudes assumed by the body, by M. Bonnard.—On the form of the hand and figure of Asiatics, by Dr. Mugnier.—Anthropometric and other observations of three Australians now being exhibited in Paris, by M. Topinard.—On the development of the cranium in the gorilla, by M. Deniker. It is found that, while the frontal region is developed, like other parts of the cranium, as rapidly in the gorilla as in man from the middle of fœtal life to the eruption of the milk molars, different relations supervene after the latter period, the cranial development of the gorilla becoming much more strongly marked in the posterior and inferior than in the anterior regions. At the same time the upper maxillary rapidly acquires its characteristic prognathic form. An almost equal degree of prognathism is observable in the adult Negro, or Australian, and in the infant gorilla, but with its growth the latter acquires a facial angle which is smaller than that of any human cranium.—Ethnographic observations on the cerebral function, by M. Fauvelle.—On a case of an hermaphrodite, by M. A. de Mortillet.—Notes on the post-mortem appearances of an imbecile, by MM. Doutrebente and Manouvrier.—Report, by M. Letourneau, on the Godard Prize Essay of M. de la Calle (1885) on the earliest attempt at speech in infants. M. de la Calle attempts to draw a parallel between the first enunciation of the vowel-sounds *a*, *e*, *o* by infants, and the monosyllabic character of certain languages belonging to various peoples of the far east of Asia, which have scarcely yet entered upon the more advanced stage of lingual agglutination.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 15.—"Dynamo-Electric Machines." By John Hopkinson, D.Sc., F.R.S., and Edward Hopkinson, D.Sc.

Omitting the inductive effects of the current in the armature itself, all the properties of a dynamo-machine are most conveniently deduced from a statement of the relation between the magnetic field and the magnetising force required to produce that field. This relation given, it is easy to deduce what the result will be in all employments of the machine, also the result of varying the winding of the machine in armature or magnets. The magnetic field may be expressed algebraically as a function of the magnetising force, or more conveniently by a curve (*Proceedings* of the Institution of Mechanical Engineers, April 1879, p. 246). Amongst the empirical formulæ which have been proposed to express the electromotive force of dynamo-machines in terms of the currents around the magnets, we may mention that known as Fröhlich's, where $E = \frac{ac}{1 + bc}$, E being the electromotive force of the machine at a given speed, c the exciting current, and a and b constants. For some machines this hyperbola is said to express observed results fairly accurately. In our