particular branch of post-office telegraph business with its licence or consent.

Mr. Preece in conclusion congratulated the Society on its great success.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The Cambridge mathematical tripos this year contains 102 names. There are 33 classed as wranglers, 33 as senior optimes, 33 as junior optimes, and 3 ægrotant. In 1879 the list contained 91 names: 28 wranglers, 33 senior optimes, 29 junior optimes, and 1 ægrotat. The senior wrangler, Mr. Joseph Larmor, of St. John's, is a native of Belfast, and was born in 1857. He was educated at the Royal Academical Institution and Queen's College, Belfast. In 1874 he graduated at the Queen's University, Belfast, obtaining a double first in mathematical and experimental sciences, with two gold medals and exhibitions. He obtained similar distinction when he became M.A. In 1876 he entered the University of London, where he obtained an exhibition for mathematics, subsequently being awarded the Arnott exhibition and medal in experimental physics. At the first B.A. examination in 1878 he obtained the University scholarship in mathematics. He subsequently proceeded to the degree of B.Sc. In 1876 he obtained an open scholarship at St. John's, and has been on several occasions a prizeman at the college examinations. The next in order are Mr. Joseph John Thomson, of Trinity College; Mr. Walter Burt Allcock, a scholar of Emmanuel; and Mr. Homersham Cox, of Trinity. It is remarkable that the senior wranglers of two successive years have been from Queen's College, Belfast.

Among the wranglers this year, if the list had been complete, Miss Scott of Girton College would have been bracketed eighth wrangler. Moreover, she is younger than many of the wranglers, being still under twenty-two. Possibly she may go in for the Smith's Prize examination, although in the present state of regulations it would be impossible to award it to a lady. Nevertheless this achievement must be one more blow to those who would persistently keep ladies from having Cambridge degrees. Miss Scott intends to proceed to a degree at London University in physics. The fourth place in the first class of the recent moral sciences tripos was secured by Miss Martin of Newnham; and it is said that the only names in the first class in the historical tripos were those of two lady students, also of Newnham. No men were placed in the first class in this tripos.

Prof. Stuart reopens his workshop at Cambridge this term, and there will be practical instruction in the use of tools in iron and wood which will be provided, and also more advanced classes for those who have already acquired a knowledge of the use of tools. Classes will be formed in mechanism, engineering, drawing, applied mechanics, theory of structures and the application of higher mathematics to engineering. The professor means to found a first-class school for civil and mechanical engineering, and evidently intends to leave no stone unturned to accomplish this object, as well as to teach candidates for the University examinations.

Mr. Garnett will lecture on heat in the Cavendish Laboratory on Mondays, Wednesdays, and Fridays, this term.

OXFORD.—In a congregation held on the afternoon of February 3, Mr. Vernon Harcourt's amendment to the form of statute, respecting degrees in Natural Science came on for discussion. It will be remembered that the preamble of the statute alone remains, enacting that it is expedient for the University to grant degrees in Natural Science. When it appeared by counsel's opinion that the new degree in Natural Science would not confer on the graduate the privileges of a member of convocation, all the clauses of the proposed statute were rejected after a close division last term. Mr. Harcourt's proposal was to insert a clause in the statute to the effect that "every person who shall have been admitted to the degree of Natural Science shall also be admitted to the degree of Master of Arts." This proposal was defeated by a large majority, 27 voting for it, and 110 against it.

The examiners for the Burdett-Coutts geological scholarship have given notice that the examination will commence on Monday, February 16, at 10 a.m. The scholarship is tenable for two years, and is open to all members of the University who have passed all the necessary examinations for the B.A. degree, and shall not have exceeded their twenty-seventh term. The examiners are Prof. Prestwich, Dr. Odling, and Mr. Hatchett Jackson.

There will be an election to at least one junior studentship in natural science at Christ Church, on February 21. Candidates must not have exceeded the age of twenty on January 1, 1880. Papers will be set in chemistry, biology, and physics, but no candidate will be allowed to offer himself in more than two of these subjects. The examination begins on February 11.

The composition of the governing body of the French University has been the occasion of protracted and violent debates in the French Senate. It was only by a few votes that M. Ferry obtained its secularisation and expelled all ministers of every denomination.

The Geneva University numbers now 525 students and assistants, 134 more than last year, of whom 106 are in the faculty of science, 208 in that of literature, 35 in philosophy, 15 in theology, 54 in law, and 107 in medicine; 125 are Swiss, strangers to Geneva, and 200 foreigners.

We learn from a paper just published in the *Journal* of the Russian Ministry of Public Instruction that the number of scholars in all Russian colleges (gymnasia) reached 53,072 in 1878. But the figures as to the number of scholars who have terminated their studies in colleges are very unsatisfactory. Out of 57,917 scholars who entered the colleges during six years (1872 to 1877), only 6,511, *i.e.*, 2·5 per cent. terminated their studies, 51,406 having left the colleges without having received attestations of maturity. In "Real" schools, where the whole education is based on the study of natural science instead of that of language, the percentage is far more satisfactory.

SCIENTIFIC SERIALS

Zeitschrift für wissenschaftliche Zoologie, 33 Bd. 3 Heft, December, 1879, contains:—Conrad Keller, studies on the organisation and development of *Chalinula fertilis*, pl. 18 to 20.—Dr. G. Haller, contributions towards a knowledge of the *Læmodipodes filiformes*; commencing with a very careful and detailed account of the anatomical details to be met with in that group, it proceeds to an account of the life-history of the species, with a paragraph on their mimicry, under the heading "Darwinia": among the epizootic animals described is a very curious new species of Podophrya, with a long tapering and transversely striated stalk, and possessing a nucleus, with nucleolus, and to this follows the systematic portion, in which several new species of Proto, Caprella, and Podalirius are described and figured, pl. 21 to 23.—Olga Metschnikoff, on the morphology of the pelvic and shoulder girdles in cartilaginous fishes, pl. 25 and 26.—A. Gruber, on new infusoria, describes a number of new genera of fresh water infusoria.—Prof. Selenka, on a siliceous sponge with an octoradiate structure, and on the development of sponge-offsets, pl. 27 and 28.

Nyt Magazin for Naturvidenskaberne, 25de Binds, 2det Hefte, 1879.—D. C. Danielssen and J. Koren, the echinoderms of the Norwegian North Sea Expedition. Several very remarkable new genera and species belonging to the Holothuriadæ are described and excellently figured in this part.—Leonard Stejneger, contributions towards the Western ornithological fauna.

Journal de Physique, January.—On the thermal laws of the electric spark in gases, by Prof. Villari.—Projection of images formed between two plane mirrors, by Prof. Bibart.—On the compressibility of air and carbonic acid at 100°, according to M. Regnault's experiments, by M. Bouty.—Chloride of lime battery, by M. Niaudet.—Photometric researches on coloured flames, by M. Gouy.—New producer of electricity based on capillarity, by M. Debrun.

Reale Istituto Lombardo di Scienze e Lettere, Rendiconti, vol. xii., fasc. xx.—On the structure of the peripheric and central medullated nerve fibres, by Prof. Golgi.—On the temperature and humidity of the air, and the formation of dew in the neighbourhood of great lakes, by Prof. Cantoni.—On the conditions of most suitable form and exposure of evaporimeters, by the same.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 15.—"Results of an Inquiry into the Periodicity of Rainfall." By G. M. Whipple.

The author has collected the following series of rainfall observations, all of which contain more than fifty years' records.

Station.	Periods.	No. of years.	Authority.
Paris	1639—96, 1699—1754, 1773—97, 1804—75..	161	Annuaire de l'Observatoire de Montsouris, 1879.
Padua...	1725 to 1878	154	MSS. from P. Denza.
England (Symons' table)	1726 to 1865	140	B.A. Report, 1866.
Milan	1764 to 1878	115	MSS. from P. Denza.
London	1813 to 1878	66	Dines and Symons.
Madras	1813 to 1877	65	NATURE, vol. xviii. p. 565.
Philadelphia ...	1810 to 1867	58	Smithsonian Tables, p. 97.
Edinburgh	1822 to 1878	57	NATURE, vol. xviii. p. 97.
New Bedford ...	1814 to 1867	54	Smithsonian Tables, p. 90.
Rome	1825 to 1878	54	MSS. from P. Denza.

To these he added an eleventh, forming a series by combining together the annual rainfall for 1822 to 1875 at London, Paris, and Edinburgh, which increased the total number of years of observations to 978.

These he has discussed after a method described at length in the paper, and determined for every series the curves which represent the variation in the means of the amount of annual rainfall for each of the years comprising the series on the assumption of the presence of a cycle, which he varies in duration from five to thirteen years.

The computed curves are then compared with the actual curves representing the observations, and the number of coincidences and non-coincidences in the epoch of maximum and minimum determined.

The results show that in no one case is there any indication of a period of any integral number of years from five to thirteen inclusive running through them.

It also became evident that for the same epoch the curves of variation differ widely for localities comparatively close together. For example, taking the eleven-year cycle for Padua and Milan, stations only about 130 miles apart, both well situated for observing rain, and no mountain range intervening, the variation curves are as follows:—

Year...	1800 $+11n$	1801 $+11n$	1802 $+11n$	1803 $+11n$	1804 $+11n$	1805 $+11n$	1806 $+11n$	1807 $+11n$	1808 $+11n$	1809 $+11n$	1810 $+11n$
Padua.	−1·3	−0·3	−1·7	+1·1	+4·2	+4·2	−4·9	+3·4	−2·8	−2·8	+1·7
Milan.	−5·0	+1·5	+0·2	−1·9	−2·5	0·0	+3·0	+4·7	−5·6	+2·6	+3·3

These show that the years of greatest rainfall at Padua are represented by the formula [1804 or $5 + 11n$], and of least by [$1806 + 11n$], whilst for Milan the maximum occurs at [$1807 + 11n$], and the minimum at [$1808 + 11n$].

Numerous other instances of incongruity are found in every one of the cycles, leading forcibly to the conclusion that either no short term of exactly five, six, seven, eight, nine, ten, eleven, twelve, or thirteen years exists in the annual amount of rainfall at any of the stations whose observations have been discussed in the paper, or that the effect of abnormal falls is so great that it cannot be eliminated by upwards of a hundred years' observations.

In any case the author thinks it may now be stated with certainty that all predictions as to rainy or dry years, based upon existing materials, must in future be considered as utterly valueless.

Zoological Society, January 20.—Prof. Flower, F.R.S., president, in the chair.—Mr. H. N. Moseley exhibited and made remarks on some microscopic preparations of corals made by a new method invented by Dr. G. V. Koch.—Prof. Flower, F.R.S., read a letter addressed to him by Col. Heysham, of the Madras Commissariat Staff, giving particulars of two cases of female elephants, in India, having produced young in captivity.—Dr. A. Günther, F.R.S., exhibited and made remarks on a drawing of a West Indian fish (*Holacanthus tricolor*) obtained on the coast of the Island of Lewis, and believed to have been found for the first time in the British Seas.—Mr. P. L. Sclater read some remarks on the species of the genus *Tyrannus*, in relation to a paper on this subject recently published by Mr. Ridgway, in America.—A communication was read from Mr. Roland Trimen, containing an account of a new species of Roller (*Coracias*), from the Zambesi, which he proposed to name *C. spatulata*, from its long spatulated tail.—A communication was read from Mr. Alexander Agassiz, of Cambridge, Mass., containing notes on some points in the history of the synonomy of Echini, in reference to some papers recently published by Mr. Bell in the Society's *Proceedings*.—A paper was read by Mr. F. Moore on the genera and species of the lepidopterous sub-family *Ophiderinæ*, inhabiting the Indian region.

Physical Society, January 24.—Prof. W. G. Adams in the chair.—New member, Mr. W. Ellis.—Mr. Grant read a paper and exhibited experiments on induction and telephonic circuits. He was led to these experiments by a former observation that when an induction coil primary was placed in a circuit consisting of a telephone, microphone, and battery, the microphonic sounds heard in the telephone were increased on closing the secondary circuit of the coil. Employing a double round coil, that is having primary and secondary side by side, he found that the latter could act as a condenser, and "relay" or translate messages into a second circuit, the microphone and battery being in the circuit of one wire (*i.e.*, the primary), the other wire (or secondary) containing a telephone. He also inserted a double normal coil in the latter or secondary circuit, and caused the induced or translated current to flow through both of the wires of this double coil one after another in the same direction. The effect was weak; but on reversing the current in one-half of the double coil by means of a commutator, so as to make it double on itself as it were, the weakening effect of induction was neutralised, and the sounds heard were as loud as if no coil had been inserted in the secondary circuit at all, as was proved by short circuiting the double coil altogether.—Dr. O. J. Lodge read a paper on intermittent currents and the theory of the induction balance. The telephone, as a scientific instrument, seems destined to play an important part as a detector of minute currents of rapidly changing intensity, and the general theory of intermittent currents is being brought into prominence by its use. The equations to which most attention has been hitherto directed have been those relating to the steady flow of a current after the initial inductive or inertia-like effects have subsided. The galvanometer is essentially an instrument for measuring steady currents or for giving the algebraically integrated expression for the total quantity of electricity which has passed in the case of transient currents. But the telephone plate has a very small period of swing compared to a needle, and, moreover, the plate is not limited to one mode of vibration like the needle. The induction balance was used experimentally by Dove and Felici, but was not appreciated as an instrument of research till Prof. Hughes applied it to the telephone and an intermittent current. The general theory of the establishment of a current in circuits of known resistance was given by Thomson, and is to be found in Maxwell's "Electricity." Dr. Lodge used this theory in order to work out the theory of the induction balance and one or two other cases of intermittent currents as completely as possible without taking into account the electrostatic capacity of wires and leakage. The current in either primary of the balance is the same, and the current in either secondary is the same at every instant of time. In fact, the separating of the two halves of the circuits is immaterial to the theory. The current induced in the secondary circuit is a tertiary current induced from the piece of conducting matter inserted between the primary and secondary, an expression being got for the strength of current in the telephone at any instant after a change in the resistance of the primary has occurred. The author deduces among other things the law according to which a small coin, by its position and size, disturbs the balance. Dr. Lodge remarked that Prof. Hughes, either by inventive intuition or great pains, had hit upon the best form of the apparatus for his purpose. The paper, which is very complete, is to be published in the *Philosophical Magazine* for February.—Herr Faber then exhibited his new speaking machine which is designed to imitate mechanically the utterances of the human voice by means of artificial organs of articulation, made on the human model, and actuated by an operator who depresses certain keys as in playing a musical instrument. These organs are a bellows made of wood and india-rubber, which answers to the lungs; a small windmill brought in front of the latter to give the "r," or trilling sounds, a larynx of hippopotamus hide and india-rubber having a vibrating end, to give the "drone" or

basic tone of the voice, a mouth with two lips, a tongue, and a nose or proboscis made of india-rubber tubing, placed below the mouth, but curving up towards it. Fourteen distinct vocal sounds can be uttered by the instrument, but in combining these, any word in any language can be played by the keys. Thus Herr Faber caused his machine to say such words as "Mariana," "Eliza," "Philadelphia," "Constantinople," and various sentences in French, English, and German, more or less distinctly. Laughing and whispering were also produced, and the voice of the instrument which was ordinarily loud and clear, and resembling that of a girl, was lowered in pitch and loudness to a more masculine tone.—Mr. C. Boys exhibited "a liquid voltaic arc" formed of a liquid bead of oxide of iron between two platinum electrodes connected to the poles of twelve Grove cells. The arc emitted a brilliant light, which was intensified by tincturing the glowing drop with glass so as to form a compound silicate of iron.

MANCHESTER

Literary and Philosophical Society, December 16, 1879.—J. P. Joule, LL.D., D.C.L., F.R.S., &c., president, in the chair.—On a new form of marine rain gauge, by W. J. Black. Communicated by J. B. Dancer, F.R.A.S.—On screw propulsion, Part III., by Robert Rawson, Assoc. I.N.A., Hon. Member of the Manchester Literary and Philosophical Society, Member of the Mathematical Society.—On the anal respiration of the copepoda, by Marcus H. Hartog, M.A., B.Sc., F.L.S.

EDINBURGH

Royal Society, January 19.—Prof. H. C. Fleeming Jenkin, vice-president, in the chair.—Part of the material employed by Principal Forbes in tamping the bore for his earth-thermometers was exhibited in its metamorphosed state. An explanatory note from Prof. Piazzi Smyth, Astronomer-Royal for Scotland, was read, and the various specimens of rock and hardened "clay-puddle" were committed to the care of Mr. Murray, of the *Challenger* Expedition, who offered to prepare microscopic sections for the Society.—Mr. J. D. H. Dickson, M.A., Fellow and Tutor, Peterhouse, Cambridge, communicated a new method of investigating relations between functions of the roots of an equation and its coefficients.—Prof. G. Forbes exhibited some of the more striking electrical experiments with Mr. Crookes's high vacua. The deflection by approach of a magnet of the molecular stream from the negative electrode formed the point of greatest interest; and in the course of the subsequent remarks Prof. Chrystal mentioned that he had investigated mathematically to a first approximation the curve which the otherwise straight stream of charged molecules would take if projected at right angles to magnetic lines of force. To the degree of approximation considered this curve was a circular arc, whose plane was perpendicular to the lines of magnetic force. Prof. Tait communicated an additional note on Minding's theorem, which had been partly suggested by Prof. Chrystal's investigation.

PARIS

Academy of Sciences, January 26.—M. Edm. Becquerel in the chair.—The following papers were read:—Influence of temperature and of elasticity on the cables of suspension bridges, by M. Resal.—On the levulo ate of lime, by M. Peligot. He finds its composition very different from that attributed to it. The products of action of alkalis on levulose are those of the same substances on glucose got by saccharification of starch; and they are the more complex because of the intervention of air in the successive transformations they effect.—On the acids which arise when raw fatty acids are redistilled in a current of superheated steam, by MM. Cahours and Demarcay. Acids of the fatty series, from acetic acid to caprylic acid were obtained, and probably much higher terms were present; acids belonging to the succinic series seem also to be produced.—On variations of the force of the heart, by M. Marey. He connected the isolated heart of a tortoise in a tube system representing the circulation, and to measure its *possible* force (ordinary experiments giving only the heart's *actual* effort), he compressed the arterial tube beyond the manometer (which was near the heart), which then rose to twice or thrice the height corresponding to functional action. The maximum effort is at commencement of systole, and it decreases towards the end. The heart has more force the fuller it is. When an obstacle increases the resistance the movements become slower and the ventricle has more time to fill, and thus acquires more force in systole.—Remarks on chlorophyll, by M. Pringsheim. A *résumé* of researches lately described to the Berlin Academy. Chlorophyll is not directly related to decomposition of carbonic acid, but plays rather a regulative *rôle* in the respiratory act of plants.—A letter from M. de Lesseps announced his arrival on the American coast (December 30), and his receptions *en route*, at Martinique, &c.—On a new voltaic condenser, by M. D'Arsonval. Studying Planté's battery, he conceived the idea of substituting liberation of a *solid* metal, zinc, for that of a *gaseous* metal, hydrogen; electrolysing a salt of zinc (the sulphate). To present more lead-surface for oxidation, he uses dust-shot, surrounding a carbon plate. A zinc plate is also inserted, and when a voltaic current passes from the carbon to the zinc the latter plate has zinc deposited on it, and the oxygen forms peroxide of lead with the lead, the sulphuric acid remaining free. With a small couple containing only 1 kg. dust-shot he worked a Deprez motor four hours. A layer of mercury does still better than the zinc plate. The maximum electromotive force was 2·1 volts.—Use of sulphide of carbon for destruction of phylloxera, by M. Boiteau.—On the resistance of phylloxera to low temperatures, by M. Girard.—On functions of two variables with three or four pairs of periods, by M. Appell.—On doubly periodic functions of the second species, by M. Mittag-Leffler.—On the determination of numerical equations having a given number of imaginary roots, by M. Laguerre.—On photography of the infra-red portion of the solar spectrum, by Capt. Abney.—On the density of chlorine at high temperatures, by M. Crafts. Improving MM. Meyer's apparatus, he finds, with them, that at the highest temperature of the Pernot furnace, iodine diminishes in density, and increases in volume in the proportion of about 1 : 1·5 compared with air. The proportion for bromine is about 1 : 1·2; but for chlorine he has not found more increase of volume than a few hundredths, in place of the 50 per cent. of MM. Meyer.—On some facts relative to urinary secretion, by MM. Richet and Moutard-Martin. Diuretic medicaments should be sought chiefly among substances found normally in the urine (as urea, chlorides, phosphates, &c.; they become diuretic, whenever in excess of the normal quantity), or substances which pass easily into the urine (as sugar). Distilled water injected into the veins diminishes or arrests urinary secretion.—On lesions of the kidney and the bladder in rapid poisoning by Cantharidine, by M. Cornil.—Researches on the mode of formation of otocephalian monsters, by M. Dareste.—On the structure, development, and pathological signification of tubercle, by MM. Kiener and Poulet.—On the crateriform disposition of solar faculæ and granulations, by Dom Lamey. A reply to M. Janssen.—On the temperature of the subterranean waters of Paris during December, 1879. The temperature of the drainage was always considerably above zero; this affected the freezing of the Seine considerably, near where the sewage entered the river, and the author suggests directing the waters along the quays a few days in extreme cold. Some farmers in the Gennevilliers plain had the sewage applied in December to freeing their fields of snow.

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