Mr. Day in the *Phil. Transactions* for 1876, showed that if we assumed *all* the instances therein mentioned of sensibility of selenium to light were due to an electromotive force set up, and not to change of resistance at all, then on the whole all the results would have been arrived at if this electromotive force set up in different cells, for the same intensity of light, increased more rapidly than the resistance of the cell, and was the greater, the greater the electromotive force of the auxiliary battery employed. They disagreed therefore from Mr. Bidwell in his idea that the name "cell" was at all inappropriate.

Professors Ayrton and Perry referred the Members to their original letter in NATURE for the account of their plan for seeing by electricity. Shortly, it consisted in projecting at the sending-station an image on a screen consisting of a number of selenium cells, the current flowing in each of which from an auxiliary battery was controlled by the intensity of the light falling on it. At the receiving-end of the line a light was thrown on a screen intercepted more or less by little shutters, the opening or closing of each of which was controlled by the current allowed to pass through the corresponding selenium cell at the sending end. Hence on the receiving screen a picture in mosaics was cast corresponding with the image projected on the screen at the sending-end, and varying with every change in the image cast on the sending-screen.

The experiment they desired to show the Society was the successful reproduction on the receiving-screen of every change of illumination of one square of the sending-screen. The shutter was an elliptical blackened aluminium disk suspended in a blackened tube of a kind of galvanometer, and making an angle of 45° with the tube when all the light tending to pass through the tube was cut off. When this disk was deflected through 45° all the light passed through the tube and an image of a square hole was formed by a small lens attached to the tube. For every intermediate position of the shutter an image of the square hole was formed on the screen, but varying in intensity of illumination. Attached to the shutter was a small magnet making an angle of 67½° with it, and the two were suspended by a silk fibre about one-twentieth of an inch in length. These particular angles were selected so that first all variation in intensity of the illumination could be produced with a small motion of the shutter, and secondly, so that the magnet should always be in its most sensitive position in the coil through which passed the electric current which traversed and was controlled by the corresponding selenium square at the receiving-end of the line. [The apparatus was then shown in action.]

They explained how their method of putting, say, thirty or forty selenium cells on a revolving arm would enable them, while dispensing with a large number of cells, to transmit electrically a complete picture of even moving objects, and would in addition obviate the difficulty arising from abnormal variations of selenium.

Instead of the apparatus exhibited to the meeting to show the perfect feasibility of the scheme, Professors Ayrton and Perry mentioned that they were also experimenting with a large thin mirror with many thick ribs at the back crossing one another. Electro-magnets firmly fixed behind the thin parts of the mirror produced by their expansion and contraction very small convexities and concavities on the mirror's face. From their experiments, published in the *Proc.* Roy. Soc., on the so-called Japanese magic mirrors, it was known that excessively small convexities and concavities of this kind might be made to show themselves in a very decided way on a screen by a divergent beam of reflected light. They proposed to have a circular mirror in rotation, but with only a certain sectional space at the back fitted with electro-magnets as described, and they anticipated that this in conjunction with the rotating section of selenium cells at the other end of the line would produce on a screen a picture over the whole area of the mirror corresponding with the distant image projected on the area traced out by the revolving sector of selenium cells.

EARTH CURRENTS—ELECTRIC TIDES

AT a meeting of the Society of Telegraph Engineers and of Electricians on Thursday evening, February 10, Prof. G. C. Foster in the chair, a communication was read by Mr. Alex. J. S. Adams upon "Earth Currents—Electric Tides," in which the author related that, from investigations he had carried on in connection with earth currents since the year 1866, he considered the globe we inhabit as an electrified sphere whose normal electrical condition was liable to disturbance both from within and from without. Starting upon this theory as a basis, and finding from the result of his observations no evidence that the sun exerted sufficient influence to materially disturb the earth's electricity, he undertook a series of systematic observations upon the daily earth-current variations in strength, to elucidate the question, and obtained consecutive observations every quarter of an hour during the interval from April 1 to 21, 1879, with a result that the curves of those observations coincided throughout with the curve of moon phases for the same period, and clearly indicated that the chief disturbing power was the moon, and that the earth current variations were strictly *lunar-diurnal*.

"But," said he, "there is a yet deeper meaning to the lunar-diurnal current curve than at first sight appears, for an examination shows that the curve for each day represents *four electrical maxima, two of a kind*, and that each maximum is divided from the other by a zero or point of no current." He further explained that whilst two of these maxima always exist upon the opposite sides of the globe, which are in a line *perpendicular* to the moon, two other maxima were also found upon the sides of the globe lying at right angles to the former maxima, and that from a long and careful consideration of these features of the phenomenon he had arrived at the conclusion that whilst the earth's disturbed electricity was, as it were, heaped up by the moon upon the sides of the earth nearest to and farthest from her, much as are the waters of the globe in forming the oceanic tides, the two *lateral* maxima, upon the other hand, must be considered as parts of a belt or band of electrical maximum that encircles the earth in a position at right angles to a line drawn between the earth and moon. Thus it appeared that there were zones of maxima at the sides of the globe nearest to and farthest from the moon, and a *circle* of maximum at right angles between them, but divided from them by zones of no current. This arrangement of the earth's electricity by the moon the author termed the earth's *lunar electric distribution*; the electric maximum facing the moon he designated the *major electric pole*, that farthest from the moon the *minor electric pole*, and the belt of maximum that encircles the earth the *electric circle*. Likewise the zone of no current that divides the electric circle from the major pole he terms the *major zero circle*, and that zero which separates the electric circle from the minor pole, the *minor zero circle*.

The earth's electricity, as thus arranged by the moon, followed that orb in her course through the heavens, and this motion of the earth's disturbed electricity round the earth, yet irrespective of the globe itself, was termed the *lunar diurnal electric circulation*, and the axis upon which it turned the *lunar-diurnal axis*.

A due apprehension however that *the moon's influence is in proportion felt by the earth's electricity at every part of the earth's surface* he considered necessary for the proper appreciation of the reasonings which led to the foregoing deductions.

It was then pointed out that there existed a regular retardation or lagging of the earth-current variations behind the corresponding phases of the moon to the extent of nearly three hours, this curious phenomenon being in no way, so far as he could trace, attributable to solar influence.

The magnetic variations were then considered, and a striking coincidence between the electric and the magnetic lunar-diurnal variation-curves was shown to obtain. The author reasoned that the earth's electric forces as constituted in the *electric distribution* revolved also about an axis parallel to a line passing through the centres of the earth and moon, *i.e.* a line drawn between the major and minor electric poles—a motion of the electric forces that agreed with the *observed direction* of the earth current, and which appeared fully sufficient to account for the effect of lunar-diurnal magnetic variation.

In conclusion he said that a comprehensive consideration of earth-current phenomena opens out a much wider sphere of investigation than that simply embracing variations of strength: it has to recognise *directive influence* which, applied to electricity, means the production of magnetism, and that the electric circulating systems that appear to obtain by reason of these three motions, the *earth's diurnal rotation*, the *lunar current circulation*, and the *terrestrial current circulation*—causes which result in the apparently disconnected variations observable in the movements of the magnetic needle.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The examiners for the Natural Science Tripos during this year are Dr. W. H. Gaskell, Prof. Bonney, Mr. P. T. Main, Prof. Watson (Owens College), Prof. Lewis (recently

appointed Professor of Mineralogy), Messrs. W. Garnett, F. M. Balfour, and S. H. Vines.

The Rev. W. Cunningham, M.A., of Trinity College, has been appointed Deputy for the Knightbridge Professor, Prof. Birks, and has resigned the Assistant-Secretaryship of the Local Examinations and Lectures Syndicate.

Mr. W. Hillhouse, B.A., of Trinity College, Assistant-Curator of the Botanical Museum, has been approved as a teacher of botany, and Mr. J. J. Lister, B.A., of St. John's College, Demonstrator of Comparative Anatomy, as a teacher of that subject for the purposes of medical certificates.

It was resolved last Thursday to admit women students at Cambridge to the Previous Examination and to the various Tripos Examinations, to publish separate class-lists for women, and in cases where order of merit is indicated in the men's class-lists, to indicate the position which any female student would have taken in the corresponding list of men. The examiners may also state that any candidate who does not attain an honour standard is adjudged to have deserved an ordinary degree. It will be necessary to present a further report on minor details of fees and regulations, but it can hardly be doubted that students duly qualified may be admitted formally to the examinations coming on in June next.

The University accounts just published show that examiners cost the University last year 2200*l.*, professors, demonstrators, lecturers, &c., 8400*l.*, in addition to those specially endowed. The ordinary expenses of the museums and lecture-rooms have been 2500*l.*, while the grant from the University is 2000*l.* The botanic garden has cost nearly 1000*l.*, and 660*l.* has been so far spent on a curator's house. The Local Examinations and Lectures Board have received 8400*l.*, and have invested a further sum of 500*l.*, which at a future time may help to provide a building for this extensive work. The University Library has overdrawn its balance nearly 900*l.*, and the Museums and Lecture Rooms Building Fund is in debt 2725*l.* On the whole it appears that the University has been very careful not to sanction new expenditure in this time of transition, and has succeeded in laying by 3000*l.*, now possessing a capital of 27,000*l.* in stocks. 3000*l.* was the University's income last year from common rents and dividends, while 27,000*l.* was paid by members of the University in fees for examinations, degrees, &c.

In the Special Examinations for the ordinary B.A. degree last year thirty-six candidates entered in Chemistry, nine of whom failed; two in Geology, nine in Botany; only one failed, viz. in Botany. The examiners report that in Chemistry the requirement of practical work has exerted a useful influence. This requirement however entails much additional work on the examiners in Natural Science, and the appointment of a third examiner is recommended.

Next Monday at three o'clock, Dr. W. H. Gaskell will make a communication to the Philosophical Society on the action of the vagus nerve upon the frog's heart; and Mr. F. M. Balfour will discuss the ancestral form of the chordata.

THE Calendar of St. David's College, Lampeter, for 1881, is of interest in connection with the forthcoming report of the Commission on Higher Education in Wales. It contains a full account of the foundation and history of the University, the means at its disposal, and the nature of the education it offers to students. The examination for the B.A. degree of this college includes either physics or chemistry.

SCIENTIFIC SERIALS

Archives des Sciences Physiques et Naturelles, No. 1, January 15.—Contributions to knowledge of the family of the Pintinnodea, by H. Fol.—On the use of the microphone in the service of the astronomical hour, by M. W. Meyer.—Exercises of analytical geometry, by L. de la Rive.—On the use of some azoic colours in physiological chemistry, by A. Danilewsky.—*Comptes rendus* of the Geneva Chemical Society, by S. Walter.—On the botanical geography of Southern Tessin, by S. Calloni.—Annals of Berne Observatory, by A. Forster.

Rivista Scientifico Industriale, No. 24, December 31, 1880.—Description of three new species of the aphides of Sardinia, by L. Marchiati.

Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, vol. xiii. fasc. xx.—On the rotatory movement of the heart, by E. Oehl.—On a new nuclearia; description and considerations as to its position in the geological system and its importance in animal ontogeny, by L. Maggi.—Registering instruments in meteorology, by C. Chistoni.—Synthesis of two new acids isomeric with vanillic acid, by G. Körner and G. Bertoni.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 27.—"On the Iron Lines widened in Solar Spots." By J. Norman Lockyer, F.R.S.

The observations put forward with reserve in my last communication to the Society have now been confirmed.

In the fine spots visible on December 24, January 1 and 6, many lines in the spectrum of iron were seen contorted, while others were steady.

The facts are given in the following table:—

	The iron lines indicating motion.	Iron lines, visible in the same field of view, steady.
Dec. 24, 1880 ...	5403·2	
	5404·8	5410·0
	5409·0	5414·5
	5408·8	
	5396·0	
	5370·5	
	5369·0	5366·5
	4919·8	
	4918·0	4923·0
	5142·2	5269·8
	5138·5	5268·5
In another part of the same spot—		
	5269·8	5323·5
	5268·5	5327·0 (double).
Jan. 1, 1881 ...	5323·5	5269·8
	5327·0 (double)	5268·5
Jan. 6,[1] 1881 ...	4919·8	
	4918·0	4923·5
	All lines between λ 5323·5 and 5410·0 except ...	5382·1

It is to be noted that these observations furnish us with an instance of inversion similar to those frequently obtained in our observations of the most widened lines in spots.

The inferences to be drawn from these observations, and those on which we are now continuously engaged, must be matter for future communication. But I cannot resist calling attention to the crucial nature of the evidence, at least as regards iron, in favour of the view first put forward by Sir B. Brodie, whom we have so recently lost, that the constituents of our terrestrial elements exist in independent forms in the sun.[2]

I have thought it right to send in a record of this work at once, with a view to induce other observers to follow the continually varying phases of the spots during the approaching maximum.

The observations have been made by Mr. H. A. Lawrance, and confirmed by myself in the majority of cases.

Chemical Society, February 17.—Prof. Roscoe, president, in the chair.—The following papers were read:—On the estimation of organic carbon and nitrogen in water analysis simultaneously with the estimation of nitric acid, by M. W. Williams The author has modified the well-known process of Frankland and Armstrong. Instead of reducing the nitrates with sulphurous acid, he uses the copper-zinc couple of Gladstone and Tribe, which converts nitrates into ammonia. The ammonia produced is distilled off and the distillate nesslerised; the water left in the retort, after distilling off the ammonia, is evaporated to dryness and the residue burnt in the ordinary way. The errors which accompany the use of sulphurous acid are thus avoided, and the time required for the analysis is much shortened.—Capt. Abney and Col. Festing then gave an account of their recent researches on the influence of the molecular grouping in organic bodies on their absorption in the ultra-red region of the spectrum. The authors have photographed the absorption-spectra of numerous inorganic and organic liquids in the region beyond the red. In many cases the presence of an organic radical seems to

[1] In this spot the D lines indicated motion, and *did not retain their parallelism.*

[2] Lecture delivered before the Chemical Society, June 6, 1867.