the restoration of isostatic equilibrium is attended by minor oscillations, the conditions requisite for repose having been overpassed by the early reëlevation of outer portions of each of these great glaciated areas. The close of the Ice Age was not long ago, geologically speaking, for equilibrium of the disturbed areas has not yet been restored.—An automatic mercury vacuum pump, by M. I. Pupin. This pump is a combination of a suction pump capable of raising mercury to practically any height, and an ordinary Sprengel pump, the two being connected by a siphon barometer. Mercury is pumped into the Sprengel reservoir by the suction pump. The reservoir of the latter is provided with two vertical tubes dipping into two mercury vessels. The end of one of these is higher than that of the other, so that when the mercury has fallen to the level of the end, no more mercury enters the tube, and the column already in it is bodily drawn up into the siphon barometer.—Graphical thermodynamics, by René de Saussure. The author recommends the adoption of new coordinates instead of P and V. Instead of these, he advocates the variables ϕ and s, defined by the equations $\phi = \pi/i^2$ and $s = \pi a^2$, where i is the period and a the amplitude of the vibratory motion constituting heat. Then the value of each variable depending upon the phenomenon can be obtained graphically.—Solutions of salts in organic liquids, by C. E. Linebarger. The law enunciated by Schroeder and Le Chatelier, that the solubilities at equal intervals from the temperature of fusion for different solid bodies and in different solvents are the same, although approximately true for the cases investigated by them, is not applicable to the case of inorganic salts in normal organic solvents.

Wiedemann's Annalen der Physik und Chemie, No. 13, 1894.—A new spectrum photometer, by Arthur König. Between the telescope and the collimator, which is provided with two parallel slits, are introduced, besides the refracting flint-glass prism, a twin prism and a Rochon polarising prism. One of the slits is provided with a total-reflection prism, in order to admit the standard light from the side. The field of view shows two semicircles, one for each of the sources of light, and their relative intensities can be adjusted and measured by a Nicoll prism near the eye. The observer notes the angle through which the Nicoll prism must be rotated in order to give equal intensities to the two halves of the field.—Spectra of various sources of light, by Else Köttgen. By means of König's spectrum photometer, various petroleum and gas lamps were spectroscopically studied.—On the process of light emission, by G. Jaumann. The author shows that the emissive vibrations of a luminous body exhibit a damping which may be measured.—Capillary electrometers and drop electrodes, by G. Meyer. The surface tension of mercury and some, but not all, amalgams is reduced by the addition of a solution of a salt of mercury, or of a salt of the metal contained in the amalgam. The reduction of surface tension which takes place during anodic polarisation is due to the formation of such mercuric or metallic salts.—Thermo-electricity of chemically pure metals, by K. Noll. This paper gives an account of a careful redetermination of the thermo-electric forces of pure Cd, Sn, Ag, Au, Cu, Zn, Al, Pt, Mg, Fe, Ni, Hg, and German silver.—Influence of magnetisation and temperature upon the electric conductivity of bismuth, by J. B. Henderson. The author shows that, before bismuth spirals can be employed to measure magnetic fields by their change of resistance, it will be necessary to find a ready means of testing their temperature, as the resistance is profoundly affected by changes in the latter.—High temperature thermometers of Jena glass No. 59III, by Alfons Mahlke. These thermometers have to be filled partly with liquid carbonic acid, after which they may be employed for temperatures up to 550°, the carbonic acid keeping the mercury from boiling. The author describes how he found the expansion of the glass and the mercury for such high temperatures, and calibrated one of the thermometers with reference to the air thermometer.

Bulletin de la Société des Naturalistes de Moscou, 1894, No. 1.—Contributions to the Moss flora of Russia, by Dr. Ernst Zickendrath, being an enumeration of 202 species collected by the author in European Russia proper (in German).—The formation of the primary blastoderms and the origin of the chord and the mesoderm in the Vertebrates, by B. Lwoff (in German, with six plates). A work which already has been partially published in *Biologisches Centralblatt* for 1892; it is based on the study of the embryology of the *Amphioxus*, the *Pteromyzon*, the *Axolotl*, the *Pristiurus* and *Torpedo*, several fishes and the *Lacerta*, and the author comes to the conclusion that the whole of the process is quite different from what is usually described as gastrulation. The paper is to be continued.—A general expression of the Thermodynamic Potential, by N. Oumoff.—Meteorological observations at the Petrovsk Agricultural Academy for the year 1893.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 17.—"The Latent Heat of Evaporation of Water." By E. H. Griffiths, M.A., Sidney Sussex College, Cambridge.

A calorimeter was suspended within a chamber the walls of which were kept at a constant temperature in the manner described in a previous paper.[1] The calorimeter was filled with a singularly limpid oil, which was stirred by paddles revolving about 320 times per minute, and immersed in the oil was a silver flask, which contained the water to be evaporated. The ends of a platinum-silver coil, within the calorimeter, were maintained at a known constant potential difference, and the rate of evaporation so controlled as to exactly balance the heat supplied by the electric current. The advantages of this method are that the results are not appreciably affected by (1) errors in thermometry; (2) changes in the specific heat of water; (3) errors in the determination of the water equivalent; (4) loss or gain by convection, &c. Differential platinum-thermometers were used, in order to ascertain the equality of the calorimeter temperature and that of the surrounding walls, thus differences of 0·0004° C. could be accurately measured, and smaller differences detected.[2]

A series of experiments in which the saturated vapour was removed from the flask by a stream of dry gas, gave the following results.

Temp. (Nitrogen Scale).	L (in terms of a thermal unit at 15°).
24°·96	581·9
39°·99	572·4
49°·82	566·5

The method of experiment was then altered; rapid evaporation was caused by removal of pressure, and the mass of water evaporated determined in a different manner.

A considerable number of experiments gave the following results.

Temp. (N. Scale).	Extreme values of L.	Mean L.
30°.00 ...	578·58 – 578·90 ...	578·70
40°·15 ...	572·12 – 573·01 ...	572·60

The conditions as to rate of evaporation, &c., were varied greatly during the experiments.

The results are expressed by the following formula:

$$L = 596{\cdot}73 - 0{\cdot}6010\,\theta$$

This formula would give

$$L = 596{\cdot}73 \text{ when } \theta = 0^\circ$$

and

$$L = 536{\cdot}63 \text{ ,, } \theta = 100^\circ.$$

And these values are almost identical with those obtained by Dieterici at 0° (596·73) and Regnault at 100° (536·60). A study of the results leads the author to the conclusion that the "thermal unit at 15°" must be almost identical with the "mean thermal unit between 0° and 100°." It has been shown by Rowland, by Bartoli and Stracciati, and by the author, that at low temperatures the specific heat of water decreases as the temperature rises, and it is probable that it arrives at a minimum between 30° and 40°, afterwards increasing with rise of temperature. There is, therefore, nothing impossible in the above supposition.

An investigation into the density of aqueous vapour (assuming the author's values of L and J) indicates that at low pressures the density of the saturated vapour is that of a perfect gas, and that at higher pressures (above 140 m.m.) it attains a density about 1·02 times as great as the "theoretical density."

January 24.—"Mathematical Contributions to the Theory of Evolution. II. Skew Variation in Homogeneous Material." By Prof. Karl Pearson, University College, London. (See p. 319).

[1] "The Mechanical Equivalent," *Phil. Trans.* 1893 A, pp. 361–504.

[2] See *Phil. Mag.* January 1895.

Royal Microscopical Society, January 16.—Annual meeting.—A. D. Michael, President, in the chair.—After the report of the Council for the past year and the treasurer's statement of accounts had been read and adopted, the President announced that the following were elected as officers and Council for the ensuing year :—President, A. D. Michael; vice presidents, Prof. L. S. Beale, F.R.S., Dr. R. G. Hebb, E. M. Nelson, T. H. Powell; treasurer, W. T. Suffolk; secretaries, Prof. F. Jeffrey Bell, Dr. W. H. Dallinger, F.R.S.; ordinary members of Council, T. D. Aldous, C, Beck, A. W. Bennett, Dr. R. Braithwaite, Rev. E. Carr. Frank Crisp, E. Dadswell, G. C. Karop, C. F. Rousselet, Dr. H. C. Sorby, F.R.S., J. J. Vezey, and T. Charters White. The President then delivered the address, the subject being, "The History of the Royal Microscopical Society." The President said that if any of his hearers would leave that West-end abode of science, and journey eastward to Tower Hill, and thence by Sparrow Corner along Royal Mint Street, he would find himself in Cable Street, St. George's-in-the East, not a very quiet or a very clean locality; turning down Shorter Street he would emerge opposite a space of green, where once stood the Danish Church, with its Royal closet reserved for the use of the King of Denmark when visiting this country; the space is surrounded by houses which have seen better days, and amongst them, between a pickle-factory and a brewery, stands a rather dilapidated erection which is 50 Wellclose Square; where, in 1839, lived Edwin J. Quekett, Professor of Botany at the London Hospital; and there, on September 3 of that year, seventeen gentlemen assembled "to take into consideration the propriety of forming a society for the promotion of microscopical investigation and for the introduction and improvement of the microscope as a scientific instrument." Among the seventeen were N. B. Ward, the inventor of the Wardian-case, which is not only an ornament to town houses, but was the means of introducing the tea-plant into Assam and the chinchonas into India, and who became treasurer of the society; Bowerbank Lister, who has been called the creator of the modern microscope; Dr. Farre, Dr. George Jackson, the Rev. J. B. Reade, and the enterprising and scientific nurseryman George Loddiges. Most of these subsequently became presidents of the Society. A public meeting was held on December 20, 1839, at the rooms of the Horticultural Society, then at 21 Regent-street, when the "Microscopical Society of London" was formally started. Prof. Richard Owen (not Sir Richard at that time) took the chair and became the first president, and shortly after the famous John Quekett became secretary, an office which he held almost to his death. At this moment Schleiden in Germany was commenting upon the paucity of British microscopical research, and attributing it to the want of efficient instruments, not knowing that a society was then forming which was to raise British microscopes to probably the first position in the world. The President then traced the history of the Society through the presidencies of Dr. Lindley the botanist, Prof. Thomas Bell the zoologist, Dr. Bowerbank, Dr. George Busk, Dr. Carpenter, Dr. Lankester, Prof. W. Kitchen Parker (all deceased), and of others equally famous who are still living; and showed how, under its influence and by its assistance, the vast improvements in the microscope, and the enormous extension of its use had gradually arisen; he also described its connection with the origin of the *Quarterly Journal of Microscopical Science*, the *Monthly Microscopical Journal*, and other publications, besides its own present widely circulated journal with its exhaustive summary of microscopical and biological work. He related how on John Quekett's death certain members of the Society subscribed to purchase for the Society's collection a curious microscope which Quekett possessed, and which had been made by the celebrated Benjamin Martin about 1770, probably for George III., and how they extended their subscription so as to provide a medal to be called "the Quekett medal" to be given from time to time to eminent microscopists; and how, difficulties having arisen, it happened that the only Quekett medal ever awarded was given to Sir John Lubbock. Finally, the President considered the future of the microscope and the prospects of further improvements. He said that many people were of opinion that the instrument is now perfect, and that consequently the most important *raison d'être* of the Society was over; he by no means agreed in that view, he believed that there was as much scope for progress in the future as there had been in the past; it was not by any means the first time that this idea had been put forward. In 1829 Dr. Goring, then a great authority on the subject, wrote in one of his published works: "Microscopes are now placed completely on a level with telescopes, and like them must remain stationary in their construction." In 1830, less than a year after, appeared Lister's epoch-making paper, "On the improvement of achromatic compound microscopes," and we have been improving ever since.—Mr. H. V. Tebbs proposed a vote of thanks to the President for his address; this, having been seconded by Prof. Bell, was carried.

EDINBURGH.

Royal Society, December 17, 1894.—The Hon. Lord M'Laren, Vice-President, in the chair.—Mr. Patrick Murray read an obituary notice of the late Mr. Donald Beith.—In a paper on germination in ponds and rivers, Mr. H. B. Guppy described observations on the germination of semi-aquatic and aquatic plants, and discussed the effects of temperature and light.—A paper on the Hall effect and some related actions in bismuth, by Mr. J. C. Beattie, was read. Mr. Beattie finds, with high fields, a reversal of the Hall effect in certain specimens of bismuth.—Mr. George Romanes communicated a paper on attraction treated by graphic processes, with deductions.

January 7.—The Rev. Prof. Flint, Vice-President, in the chair.—Dr. W. Peddie read a paper on a case of yellow-blue blindness, and its bearings on the theories of dichromasy. The historical aspect of the Young-Helmholtz theory is as follows: (1) Young gave his theory of colour-blindness by lapse of one sensation, stating that this seemed to him to be simpler than any other assumption. But, as with his theory of colour-vision, he meant this theory to be given up if it were subsequently found to be inconsistent with experiment. (2) Helmholtz added his ideas regarding the nature of the mechanism, adopting *implicitly* Young's reservations, and stating *explicitly* that his ideas, if false, did not affect the basis of Young's theory. (3) In accordance with the above facts, when E. Rose brought forward the evidence of his observations, Helmholtz at once indicated the probable direction in which the statement of the theory had to be modified. (4) Subsequently, Helmholtz's pupils, König and Dieterici, working presumably under his direction, made a crucial test to find if it were absolutely essential to abandon the idea of lapse of a fundamental sensation, and found that it was necessary to do so. (5) König investigated, at different parts of the spectrum, the mean error of wave-length which could be made in adjusting light from different near parts of the spectrum to equality. (6) Helmholtz gave an expression, in terms of the unknown fundamentals, for the rate at which the total "sensation" varies with wave-length. He wrote down three linear equations, with unknown coefficients, expressing the three fundamental sensations in terms of those chosen (arbitrarily so far) by König and Dieterici. The latter were known in terms of the wave-length by means of the observations of these two investigators. Therefore, if Helmholtz could determine the unknown coefficients, he could express the other fundamentals in terms of the wave-length. Now an obvious assumption to make is this: the mean error of wave-length which can be made in adjusting two very narrow strips, one from each of two similar spectra, to apparent equality corresponds to a constant difference of total "sensation." Helmholtz made this assumption in order to determine the unknown coefficients by means of König's observations on the mean error. And he further justified this by showing that there was a close correspondence between the mean errors found by König and the mean errors calculated from his own theory on the assumption of a constant difference of sensation. Thus the new fundamentals, given by Helmholtz as "provisional," may be regarded as having been determined upon a purely experimental basis, with no assumption other than the radical assumption of three fundamental sensations. The whole thing is a beautiful example of the cautious, steady, scientific development of a theory. There has not been, by Helmholtz, any violent upholding of a weakened theory, followed by a sudden facing round after defeat. In violet, or yellow-blue, blindness, the two colours of the spectrum are red and bluish-green, and the spectrum is shortened at the blue end with a sharp limit near the line G. Blindness of this type is rare. The case described in this paper presents the peculiarity that there is no shortening of the spectrum at either end. The range extends beyond the line *a* at the red end, and beyond the line H at the violet end. The

neutral point is near the line D, on the more refrangible side. The maximum intensity of the red colour is reached at a point near C on the less refrangible side, and the maximum intensity of the green colour is reached at a point rather nearer to F than the mid-distance from *b* to F. There is no second neutral point in the blue. It does not seem that the phenomena can be readily, if at all, accounted for on Hering's theory. On the other hand, it is easily accounted for on the Young-Helmholtz theory by fusion of the fundamental sensations.—Dr. Noël Paton read a paper, by Dr. John Douglas, on metabolism in thyroid feeding.—Dr. Richard Berry read a paper on the anatomy of vermiform process and cæcum.—Prof. Tait communicated a paper on the ultimate state of a system of colliding particles, and the rate of approach to it.

PARIS.

Academy of Sciences, January 21.—M. Marey in the chair.—On the variable star β (Algol) in Perseus, by M. F. Tisserand. The author represents the variation in apparent magnitude as being due to (1) the existence of one obscure satellite with an eliptical orbit, and (2) a slight oblateness of the principal star, and shows that on these assumptions the variation periods can be satisfactorily represented (see "Our Astromical Column").—On boron steel, by MM. H. Moissan and G. Charpy. As the result of a series of comparative tests, it is found that boron (0·58 per cent. in alloy used) imparts the property of a great increase in tensile strength by tempering without a corresponding increase of hardness. A sample of carbon steel giving similar increase of tensile strength on tempering, became so hard as to require working on the emery-bob, whereas the boron-steel could still be worked with a file.—Morphology of the lymphatic system. On the origin of the lymphatics in the skin of the frog, by M. L. Ranvier.—On the perforation of armour-plates, by M. E. Vallier.—On the production of the glycolytic ferment, by M. R. Lépine. The author is of opinion that the glycolytic ferment is produced from diastase. He relies on the increase of glycolytic power of pancreas when treated with dilute sulphuric acid, in conjunction with the loss of saccharifying power and gain of glycolytic power suffered by maltine when similarly treated with dilute acid.—*Résumé* of solar observations, made at the Royal Observatory of the Roman College, during the three last quarters of 1894. A letter from M. P. Tacchini sent to the President.—On the convergence of determinants of infinite order and of continued fractions, by M. H. von Koch.—Influence of the rhythm of successions of interruptions on the sensitiveness to light, by M. Charles Henry. The investigation had for object the determination of the sensitiveness of the eye to interrupted light-rays of different types. The conclusion is drawn that it is possible to augment the luminous range of a signal by means of a succession of interrupted rays following a sufficiently complex non-rhythmic law.—Influence of temperature on the transformation of amorphous zinc sulphide, by M. A. Villiers.—Failure of the Kjeldahl method for estimation of nitrogen when applied to chloroplatinates, by M. Delépine. In the cases of trimethylamine and ammonium platinochlorides, the author finds by the permanganate modification of the Kjeldahl process a considerable deficiency in ammonia obtained. This deficiency is attributed to a reaction of free chlorine with the ammonia, as follows:

$$(NH_4)_2PtCl_6 + 3Cl_2 = PtCl_4 + 8HCl + N_2.$$

—On arabinochloral and xylochloral, by M. Hanriot.—A new synthesis of anthracene, by M. Delacre. Anthracene is produced from benzyl trichloracetate and benzene, by heating these substances in presence of aluminium chloride, and distilling the resultant ether, when it decomposes giving carbon dioxide and anthracene.—A contribution to the study of the ethereal salts of the tartaric acids, by MM. Ph. A. Guye and J. Fayollat. A study of the rotatory power of nine of these esters in the light of the theory of the product of asymmetry.—On a parasite of *Lampyris splendidula*, by M. A. Gruvel. The author names the newly-described parasite *Stylogamasus lampyridis*.—On some bacteria from the *Dinantien* (Culm), by M. B. Renault.—On the development of sieve-tubes in the Angiosperms, by M. Chauveaud. The author concludes that (1) the rule of indirect development of sieve-tubes is far from general. Both direct and indirect methods of development may occur in the same bundle. (2) The presence of companion-cells is not absolutely characteristic of the sieve-tubes of Angiosperms.—On the Chili-Argentine earthquake of October 27, 1894, by M. A. F. Nogués.—Note on *Uredo viticida*, by M. L. Daille.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—A First Step in Euclid: J. G. Bradshaw (Macmillan).—Memoir of Sir Andrew Crombie Ramsay: Sir A. Geikie (Macmillan).—A Handbook to the British Mammalia: R. Lydekker (Allen).—The Great Problem of Substance and its Attributes (K. Paul).—A Travers le Caucase: E. Levier (Neuchatel, Attinger).—Forschungsberichte aus der Biologischen Station zu Plön: Dr. O. Zacharias, Theil 3 (Berlin, Friedländer).—How to Live in Tropical Africa: Dr. J. Murray (Philip).—Field and Garden Crops of the N.W.P. and Oudh: J. F Duthie, Part 3 (Roorke).

PAMPHLETS.—Sur la Nature et l'Origine de l'Aurore Boréale: A. Paulsen (Copenhague).—Der Logische Algorithmus: J. Hontheim (Berlin, Dames).—International Beginnings of the Congo Free State: Dr. J. A Reeves (Baltimore).

SERIALS.—Journal of the Sanitary Institute, January (Stanford).—National Geographic Magazine, December 29 (Washington).—Transactions of the American Institute of Electrical Engineers, November and December (New York).—Imperial University, College of Agriculture, Bulletin Vol. ii No. 3 (Tōkyō).—Records of the Botanical Survey of India, Vol. i. Nos. 3 and 4 (Calcutta).—Psychological Review, January (Macmillan).—Monist, January (Chicago).—Himmel und Erde, January (Berlin).—English Illustrated Magazine, February (Strand).—Sunday Magazine, February (Isbister).—Good Words, February (Isbister).—Astrophysical Journal, January (Wesley).—Longman's Magazine, February (Longmans).—Chambers's Journal, February (Chambers).—Observations Internationales Polaires, 1882–3. Expédition Danoise, Observations faites a Godthaab, tome i. livr. 2 (Copenhague).—Humanitarian, February (Hutchinson).—Natural Science, February (Rait).—American Naturalist, January (Wesley).—Journal of the College of Science, Imperial University, Japan, vol. vii. Parts 2 and 3 (Tōkyō).—Transactions of the Linnean Society of London, Vol. iv. Part 2, On the Flora of Mount Kinabalu in North Borneo: Dr. O. Stapf (Linnean Society).—Ergebnisse der Beobachtungsstationen an den Deutschen Küsten über die Physikalischen Eigenschaften der Ostsee und Nordsee und die Fischerei, Heft 1–6 (Kiel, Lipsius).

CONTENTS.

	PAGE
Geo-Morphology. By Dr. J. W. Gregory	313
Organic Chemistry	317
Our Book Shelf:—	
Wyatt: "British Birds: being Coloured Illustrations of all the Species of Passerine Birds resident in the British Isles, with some Notes in reference to their Plumage"	318
Naber: "Standard Methods in Physics and Electricity Criticised, and a Test for Electric Meters Proposed."—W. W.	318
Slingo and Brooker: "Electrical Engineering, for Electric Light Artisans and Students"	318
Orford: "Lens-Work for Amateurs"	318
Rolleston and Kanthack: "Manual of Practical Morbid Anatomy"	318
Letters to the Editor:—	
A New Step in Statistical Science.—Francis Galton, F.R.S.	319
The Kinetic Theory of Gases.—G. H. Bryan	319
Boltzmann's Minimum Function.—S. H. Burbury, F.R.S.	320
Electroscopes in Lecture.—Prof. Oliver J. Lodge, F.R.S.	320
The Perseid Meteors.—W. F. Denning	320
The Artificial Spectrum Top.—Dr. F. W. Edridge-Green; Charles E. Benham	321
Snake Cannibalism.—H. Tsnagal	321
More About Moths.—L. C. Jones	321
The Physical Society's Abstracts of Physical Papers from Foreign Sources	321
The Natural History of the Solway. By G. Stewardson Brady	322
Professor Arthur Cayley, F.R.S.	323
Notes	323
Our Astronomical Column:—	
The Natal Observatory	327
The New Dudley Observatory	327
The Milky Way	327
The System of Algol	328
The Explosive Nature of the Sodium and Potassium Derivatives of Nitromethane. By A. E. Tutton	328
Recent Work at Harvard College Observatory	329
Electric Discharge through Gases. (*Illustrated.*) By Prof. J. J. Thomson, F.R.S.	330
University and Educational Intelligence	333
Scientific Serials	333
Societies and Academies	334
Books, Pamphlets, and Serials Received	336