mines, especially where the data are known to be very accurate. Doubling the weights above assigned to Przibram, St. Gothard, Mont Cenis, Schemnitz, Kentish Town, Rosebridge, and Seraing, and quadrupling that assigned to Sperenberg, no material difference is made in the result. The mean still comes out 1° F. in 64 feet, or more exactly ·01566 of a degree per foot.

This is a slower rate than has been generally assumed, but it has been fairly deduced from the evidence contained in the Committee's Reports; and there is no reason to throw doubt on the results in the upper portion of the above list more than on those in its lower portion. Any error that can reasonably be attributed to the data used in the calculations for the St. Gothard Tunnel and for the numerous deep mines of the East Manchester coalfield, will have only a trifling effect on the rates of increase assigned to these localities.

To obtain an approximation to the rate at which heat escapes annually from the earth, we will first reduce the above rate of increase ·01566 to Centigrade degrees per centimetre of depth. For this purpose we must multiply by ·0182, giving ·000285.

To calculate the rate of escape of heat, this must be multiplied by the conductivity.

The most certain determinations yet made of the conductivity of a portion of the earth's substance are those deduced by Sir William Thomson by an indirect method, involving observations of underground thermometers at three stations at Edinburgh, combined with laboratory measurement of the specific heats and densities of the rocks in which the thermometers were planted. The specific heats were determined by Regnault, and the densities by Forbes. Specific heats and densities can be determined with great accuracy in the laboratory, but the direct determination of conductivity in the laboratory is exceedingly difficult, it being almost impossible to avoid sources of error which make the conductivity appear less than it really is.

Prof. Herschel, in conjunction with a Committee of the British Association, has made a very extensive and valuable series of direct measurements of the conductivities of a great variety of rocks, and has given additional certainty to his results by selecting as two of the subjects of his experiments the Calton Hill Trap and Craigleith sandstone, to which Sir William Thomson's determinations apply.

From combining Prof. Herschel's determinations with those of Sir Wm. Thomson, ·0058 is adopted as the mean conductivity of the outer crust of the earth, which, being multiplied by the mean rate of increase, ·000285, gives

$$16330 \times 10^{-10}$$

as the flow of heat in a second across a square centimetre. Multiplying by the number of seconds in a year, which is approximately 31½ millions, we have

$$1633 \times 315 \times 10^{-4} = 41{\cdot}4.$$

This, then, is our estimate of the average number of gramme-degrees of heat that escape annually through each square centimetre of a horizontal section of the earth's substance.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The lists of Boards of Studies for the first time include the separate Boards of Physics and Chemistry, and of Biology and Geology, as constituted by the new Statutes. The Woodwardian Professor appears in both Boards. The Physiology Professor, not being yet appointed, only appears in brackets; the same is the case with the Professor of Pathology in the Board of Medical Studies.

The new Statute B having been finally approved, determines that in 1883 and 1884, a sum of between 5cc0*l.* and 6000*l.* in each year will become available for University purposes from College revenues, subject only to deduction of 40*l.* by each College for each Professorial Fellowship held at the College.

The Professors of Physiology, Pathology, and Mental Philosophy and Logic are to be appointed in such order as the University may think fit, as soon as sufficient funds can be provided conveniently for the purpose from the common University fund, or from other sources. The Professors of Physiology and of Pathology are not to undertake the private practice of medicine or surgery. The stipends are fixed at 800*l.* for these two Professors, and 700*l.* for the Professor of Mental Philosophy.

The appointment of Readers is similarly dependent on the convenient provision of funds. Thus, until the Council of the Senate has published its recommendations, nothing certain can be said as to the objects upon which it will be thought wisest first to expend the new funds accruing. But it must not be forgotten that a considerable amount of the new income will be required to pay the increased stipends of present professors.

Prof. Liveing will lecture on the General Principles of Chemistry this term, and also take practical classes in spectroscopic analysis. Prof. Dewar will lecture on Physical Chemitry, and Tutorial lectures will be given in connection with this course by Mr. A. Scott, Prof. Dewar's assistant. Demonstrations in volumetric chemistry will be given by one of the demonstrators.

Lord Rayleigh will lecture on Electrical Measurements to advanced students; Mr. Glazebrook will give demonstrations on Electricity and Magnetism, and Mr. Shaw on Heat in the Cavendish Laboratory. Mr. Trotter will give an elementary course on Electricity and Magnetism at Trinity College, and also a course on Optics and Light.

Mr. Vines will lecture on the Physiology of Plants, at Christ's College, in connection with practical work, and will also give an elementary course at the New Museums, especially for medical students. The Assistant Curator of the Herbarium, Mr. T. H. Corry, B.A., of Caius College, will give a series of demonstrations on the natural orders of plants.

Prof. Stuart will lecture on Mechanism and Applied Mechanics, and the workshops and drawing office will be opened to pupils on October 13. At Gonville and Caius College one or more Entrance Scholarships of values varying from 40*l.* to 80*l.* according to merit of candidates, will be awarded in Natural Science by an examination beginning on January 8 next. They are only open to candidates under nineteen years of age on the first day of examination, and are tenable only for one year, after which a foundation scholarship may be awarded. The subjects are Physics, Chemistry, Biology, and Animal Physiology; two subjects at least are required, Chemistry being essential. Particulars of subjects may be learnt on application to the Senior Tutor, Rev. A. W. Steel. Scholarships may also be awarded for Mathematics and Natural Science combined.

The examination for Entrance Scholarships at Emmanuel College will commence on January 12. They are tenable in the first instance for two years. The subjects in Natural Science are Chemistry, Physics (including Dynamics and Hydrostatics), Elementary Biology, and Geology and Mineratogy. Candidates may also obtain scholarships for Mathematics and Natural Science combined. Mr. W. Chawner, the tutor, will supply all information.

Mr. A. Sedgwick, of Trinity College, Cambridge, will conduct the classes in Morphology which Prof. Balfour had announced for the present term.

SCIENTIFIC SERIALS

The Journal of Anatomy and Physiology (Normal and Pathological), vol. xvi. pt. iv., July, 1882, contains:—Observations in comparative myology, by Dr. Hans Gadow. The first section of this interesting paper is devoted to the important subject of a scientific nomenclature for muscles.—On fat embolism, by Drs. R. Saundby and G. Barling (with a plate).—On Micrococcus poisoning, by Dr. Alex. Ogston.—On the action of saline cathartics, by Dr. M. Hay (D and E series of experiments).—On a variety of pulmonary lobation and its relation to the thoracic parietes, as illustrated by comparative anatomy and abnomalities in the human subject, by Dr. W. Allen.—Prof. Gegenbaur, critical remarks on polydactyly as atavism; translated by Drs. Garson and Gadow.

The American Naturalist for August, 1882, contains—On the compass plant, by B. Alvord.—On the development of the tree toad, by M. H. Hinckley.—On some entomostraca of Lake Michigan and adjacent waters, by S. A. Forbes.—Organic physics, by Charles Morris.—The Editor's table.—Recent lite-

The same for September, 1882, contains—The methods of microscopical research adopted in the Zoological Station in Naples, by C. O. Whitman.—Notes on the habits of the "Savannah cricket frog," by C. C. Abbott.—On the evolution of forms from the Clinton to the Niagara group, by E. N. S. Ringueberg.—On hypnotism in animals, by Dr. W. Prentiss.

The Transactions and Proceedings of the New Zealand Institute for 1882, being vol. xiv., edited by Dr. J. Hector, F.R.S., and published at Wellington, May, 1882, have just reached us. They form a royal octavo volume of over 600 pages and 39 plates.

Among the more important memoirs may be mentioned the following:—On historical incidents and traditions of the Maoris, Part II.—Contributions to a better knowledge of the Maori race, Part IV., and on the fine perception of colour of the ancient Maori, by W. Colenso.—On the causes leading to the extinction of the Maoris, by Dr. A. K. Newman.—Several memoirs on the mollusca of New Zealand, by Prof. Hutton.—On New Zealand crustacea, by C. Chilton.—On the skeleton of *Notornis mantelli*, Py Prof. Parker.—On New Zealand shells and cephalopoda, by T. W. Kirk.—On the Coccidæ of New Zealand, by W. M. Maskell.—On New Zealand crustacea, by G. M. Thomson.—On new Orthoptera and Coleoptera, by W. Colenso.—On the freshwater algæ of New Zealand, by W. Spencer (a very imperfect paper).—On additions to the flora, by T. F. Cheeseman.—On new species of plants from New Zealand forests, by W. Colenso.—On the Alpine flora of New Zealand, by John Buchanan.—On the New Zealand olives, and on recent additions to the flora, by T. Kirk.—On a deposit of moa bones (probably the oldest yet found) near Motanau, North Canterbury, by A. McKay.—Notes on the mineralogy of New Zealand, by S. Herbert Cox.

Berichte über die Verhandlungen der Naturforschenden Gesellschaft zu Freiburg, I.B. Band viii. Heft 1, 1882.—On some actions of coercitive force, by E. Warburg.—Imitation of the phenomena of optically-anomalous crystals by stretched colloids, by F. Klocke.—On the action of unilateral pressure on optically-anomalous crystals of alum, idocrase, and apophyllite, by the same.—Axial images in convergent light in alum, nitrate of lead, pressed gelatine, and quickly-cooled glass, by the same.—On the motion of glaciers, by K. R. Koch and Fr. Klocke (second paper).—On the classification of surfaces according to the displaceability of their geodetic triangles, by H. v. Mangoldt.—On the connection between viscosity and density in fluid, especially gaseous fluid substances, by E. Warburg and L. v. Babs.—On a method of testing micrometer-screws, by K. R. Koch.

Schriften der Naturforschenden Gesellschaft in Danzig, vol. v. Heft 3, 1882.—Pagan remains found in the Weichsel-Nogal delta, by Dr. Marshall.—Communications on amber, by O. Helm.—A case of duplication of the allantois and the external genitals, by O. Meyer.—Proceedings of the West Prussian Botanical-Zoological Society; fourth meeting at Elbing in June, 1881.—On the hygienic significance of drinking water and rational principles for its examination and estimation, by M. Barth.—On Cenomanian petrefactions from the diluvium of the environs of Danzig, by J. Kiesow.—Telegraphic determination of longitude between Danzig and Königsberg, by E. Kayser.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, October 2.—M. Blanchard in the chair.—Reference was made by M. Dumas to the death of Friedrich Wöhler (who was a Foreign Associate).—M. de Candolle presented a work on the origin of cultivated plants. It treats of 247 species; and of all, except three (viz. two species of *Cucurbita* and the kidney bean), it is possible to say whether they are from the old or the new world. Of 49 species cultivated for more than 4000 years, six or seven are extinct or in course of extinction.—Transit of Venus over the sun, by M. Dumas. The last of the eight missions, that to Florida, under Col. Perrier, left Havre on September 30. M. Dumas gives the complete list. The navy figures prominently. There are three members of the Academy, MM. d'Abbadie and Tisserand, and Col. Perrier; also a nephew of Arago. The eight destinations are: Port-au-Prince, Mexico, Martinique, Florida, Santa-Cruz, Chili, Chubut, and Rio-Negro. Each station will have two equatorials carefully tested. The members have all practised at the Observatory with artificial transits. Most of the missions will use photography. The railway and steamboat companies have given great facilities in transport.—On the shock of imperfectly electric bodies, by M. Resal.—Typographic reproduction of photographs; process of M. Ch. Petit, by M. Marey. Two samples of the process (which is named *similigravure*, but is not described), are given.—Optical communications between Mauritius and Reunion, by Mr. Adams.—The coercitive force of steel rendered permanent by compression, by M. Clémandot. He attributes the effect to the more absolute homogeneity produced by pressure and cooling under pressure. The steel submitted to compression is *soft*, and may be filed, bored, &c.—Researches on the action of the intermolecular ether in the propagation of light, by M. De Klercker. He believes he has, by a purely physical method, established a new theory of the action.—On the treatment of phylloxerised vines with coal tar, *àpropos* of a recent communication of M. Max Cornu, by M. Balbiani.—On the employment of heavy oils of coal in treatment against the winter egg of phylloxera, by M. De Laffitte.—A telegram from Munich (October 2) announced that the experimental transmission of force by an ordinary telegraph wire, between Miesbach and Munich (57 km.), by M. Deprez' method, had fully succeeded. Another telegram (September 26) was received from the Emperor of Brazil about the comet. The presence of sodium and carbon was noted.—Observations of the comets Barnard and Common (1882), at the Lyons Observatory, by M. André.—On a class of uniform functions of two independent variables, by M. Piccard.—Hydrodiapasons, by M. Decharme. One of these is formed of a brass tube of elongated U shape, with a nozzle screwed into the curved part and conducting town water. The upper part of each branch is bent round, so that the free ends are closely opposed. To these ends disks or other pieces may be attached with screws. On passage of the water, a regular vibratory motion occurs, with sound; by attraction if the branch-nozzles have thick edges, by repulsion, if they have thin. The experiment is better if the branches are put in water. The feeling when one touches the instrument is like that of shocks from a weak induction coil.—On the nature of vibratory motions which accompany the propagation of flame in combustible gaseous mixtures, by MM. Mallard and Le Chatelier. They have studied, with the help of photography, the period of accelerated and very irregular velocity (accompanied by sound), which follows a (first) period of slower, silent, and regular propagation, in a tube closed at one end, and having its combustible gaseous contents (bioxide of nitrogen and sulphide of carbon) lit at the other. A vibratory movement is indicated; the amplitude increasing as the last third of the tube's length is neared (where is one of the ventral segments of vibration). A mean pressure of at least 5 atm. is produced for a few ten-thousandths of a second. The mean velocity of propagation is accelerated as the amplitude and rapidity of the vibrations increase.—Action of anhydrous chloride of aluminium on the acetone, by M. Louise.—On the secretory epithelium of the kidney of batrachians, by M. Bouillot.—Cause of the rot of grapes in America, by M. Prillieux. The rot is due to penetration of *Peronospora*, not to *Phoma uvicola*, which is merely developed on the grapes already killed.—M. Daubrée sketched the work of a Committee which has reported to the Minister of Public Works on the means of preventing explosions of fire-damp.—M. Daubrée presented a catalogue of the collection of meteorites of the Museum of Natural History on July 1, 1882, and noted recent acquisitions, &c.

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