Page[1] (1876).—The regulating arrangement is the following: A piece of glass tube about seven-sixteenths of an inch diameter and 1½ inch long is fitted at one end with a short round cork; through the centre of this cork a hole is bored, so that the stem of the thermometer just fits in it; the other end of this glass tube is closed by a short tightly-fitting india-rubber cork, which is pierced by a fine brad-awl through its centre. Into the hole thus formed is forced a piece of fine glass tubing three inches long and small enough to fit loosely inside the stem of the thermometer. The gas enters by this fine tube.

Fletcher[2] (1876) stated that he had for some time used a similar regulator, but that the thermometer had an iron bulb capable of containing two or three pounds of mercury. He also reversed the direction of the gas.

Mercurial Thermometers (*b*).—Scheibler[3] (1865) devised the following arrangement. In the bath or chamber which is being heated is placed an electric thermometer; this communicates with an electro-magnet which is inclosed in a small metallic chamber through which the gas for the burner has to pass. When by a rise in temperature the circuit is closed, the hinged armature of the magnet is brought into contact with the opening of the gas inlet-tube, and is not liberated until a fall in the temperature breaks the circuit.

O. Zabel[4] (1867) placed in communication with an electric thermometer a contrivance which consisted of two electro-magnets acting on a hinged metallic screen. The completion of the circuit by a rise in temperature placed the screen over the flame, and thus checked the heat.

J. Maistre[5] (1866) recommended an electric thermometer connected with an electro-magnet, the armature of which could remove the gas-burner from under the bath, or which could be connected by means of a lever with the gas-supply tap.

Springmühl[6] (1871) arranged an electro-magnet with a hinged armature, so that on the completion of the circuit a weight attached to a lever closed the gas-tap, which was not opened until the release of the armature liberated a spring which acted in the opposite direction.

Vapour-tension Thermometers.—Appold's[7] consists of a glass tube having a bulb at each end. The tube is filled, as also about half of each bulb, with mercury; the lower bulb containing ether to the depth of half an inch, which floats on the mercury. The tube is secured to a plate of boxwood, supported on knife-edges, on which it turns freely. At the end of the plate, underneath the higher bulb, is a lever, which controls the supply-valve of a gas-stove or the damper of a furnace. With a rise in the temperature the increased tension of the ether-vapour drives more mercury into the upper bulb; this end then falls. With a diminished temperature the reverse action takes place.

Andreae's[8] (1878) is like Kemp's and various others, on the principle of an U-tube with one limb closed. It is, however, rendered more sensitive by the introduction of a certain quantity of a volatile liquid into the air space. It must be borne in mind that the liquid must be selected according to the temperature required, as it is obvious that the regulator cannot be used in any case where it has to be heated beyond the boiling-point of the liquid.

Benoit[9] (1879) constructed an apparatus in which he regulated the temperature by adjusting the pressure on the volatile liquid contained in the bulb. The following is the arrangement:—A small reservoir, which can be shaped to suit the oven or bath in which it is placed, holds the volatile liquid. This is connected by means of a tube from the bottom, to which is attached an india-rubber tube, to a regulator of the same pattern as that used by Reichert. The regulator is fixed on a board which can be raised or lowered, and is provided with two side tubes for adding or drawing off mercury at will.

By-pass.—Since it is obvious that in cases where the quantity of gas required to pass through the regulator is large, any perceptible increase in the pressure or the supply from the main must be accompanied by a rise in the temperature of the bath, it is advisable therefore to adjust the by-pass tap so that as small a quantity as possible shall have to pass through the regulator. Here, however, experience must decide how wide a margin must be left to the control of the regulator, for in some districts the difference between the day and evening pressures is so great that adjustment becomes a matter of great difficulty. In some laboratories, especially when near a suburban gas-works, the day pressure is so low and the evening pressure is so high that unless a pressure regulator be interposed between the main and the temperature regulator, the by-pass cannot be used.

[1] *Journ. Chem. Soc.* i. 24 (1876). [2] *Journ. Chem. Soc.* i. 488 (1875).
[3] Carl Repert, "Exp. Phys." iv. 122 (1868); *Fres. Zeit. Anal. Chem.*, vii. 88 (1868).
[4] *Ding. Polyt. Journ.* 186, 202 (1867); *Fres. Zeit. Anal. Chem.* vii. 239.
[5] *Les Mondes*, x. 271 (1866).
[6] *Ding. Polyt. Journ.* ccii. 242 (1871); *Fres. Zeit. Anal. Chem.* xi. 431.
[7] *Proc. Roy. Soc.* xv. 144 (1866). [8] *Ann. Phys. Chem.* iv. 614 (1878).
[9] *Séance de la Soc. Franc. de Phys.*, 6 (1879).

Bunsen's[1] thermostat is the vessel in which he maintains a constant temperature, and which is used by him in his vapour density method. It consists of a sheet-copper cylinder, from which at seven places equally distant from each other project pairs of copper rods 7–8 mm. thick, which are riveted and brazed into it. These rods are heated by gas flames, and the temperature is adjusted by moving the burners to or from the cylinder; but in order to maintain it as constant as possible, the apparatus must be carefully screened and the heights of the flames kept nearly equal by means of a gas-regulator, and the flames must reach a height sufficient to keep both the copper rods in the middle part of the flame, and not to have the upper rod heated only by the extreme point of the flame.

Hipp's[2] (1868) regulator, which is described by Hirsch (and is therefore sometimes referred to as Hirsch's), consists of a bent compound metallic strap, *steel* on the outside and brass on the *inside*. The ends thus approach with a falling temperature. The one end is fixed securely inside the air-bath, and the free end communicates by means of a fine copper wire with a regulating screw which connects it with a bent rod carrying the gas-control valve.

Flow of Liquid.—Dupré and Page[3] (1869). The water-bath contains a coil of metal-tube like an ordinary condenser. The lower end of this coil is connected with a second and smaller worm, which is contained in a small water-bath. The latter is heated by a lamp and kept gently boiling. The lower end of this second worm is bent upwards and terminates in a long funnel. Any water poured into this funnel will pass first through the worm surrounded by boiling water, and be thus heated, and then through the tube in the water-bath containing the specific-gravity bottle. By regulating the flow of water the temperature of this water-bath can be raised quickly, or kept constant at any desired point.

Stricker and Burdon-Sanderson[4] (1870).—In this apparatus, which is especially arranged for heating the stage of a microscope, the temperature is adjusted by regulating the flow of boiling water, through the hollow stage, by means of a compression clamp. As the water in the small boiler is kept at a constant level by means of an overflow, the supply when once adjusted remains uniform.

The exceedingly accurate method of maintaining a constant temperature by controlling the pressure under which a liquid in an outer casing is made to boil, is one that depends so essentially on pressure that its consideration must be reserved for the paper on Pressure-regulators.

J. T. BROWN

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The establishment of the Waynflete Professorship of Physiology was provided for by the late University Commission, it being arranged that the emoluments of the post should be paid out of the funds of Magdalen College, to which college the Professor is to be attached as a Fellow. Magdalen College had already shown interest in the development of physiology, and has for some years past maintained a physiological laboratory, in which Mr. Yule, Fellow of the College, has given courses of instruction in Practical Physiology, open to all members of the University, and his lectures have been attended by all candidates for honours in physiology, such instruction not having been available elsewhere in Oxford. Since the passing of the new statutes, the Linacre Professorship has become confined to Human and Comparative Anatomy, and there has been no University representative of physiology. The want of a Professor of Physiology has lately been very strongly felt, especially as the number of candidates in the subject has much increased. It is understood that Magdalen College, acting on the representations of the University to that effect, has determined to apply such surplus funds as are avail-

[1] *Liebig's Ann.* cxli. 273 (1867); *Phil. Mag* xxxiv. 1 (1867).
[2] Carl Repert. "Exp. Phys." iv. 201 (1868); *Dingl. polyt. Journ.* cxci. 366 (1869).
[3] *Phil. Trans.* clix. 608 (1869). [4] *Q. J. Micro. Sci.*, 366 (1870).

able at once to the foundation of the professorship, and it is expected that an election to the post will therefore take place shortly. All praise is due to the college for having thus promptly acted in the best interests of science in the University, and given this professorship precedence amongst several other schemes which might have been carried out by it first instead. The Profesor is required by the Statutes to give instruction in Human and Comparative Physiology, with histology.

CAMBRIDGE.—The annual report of the Museums and Lecture Rooms Syndicate at Cambridge has contained in past years no more valuable record of work than that lately issued. Taking first the department of experimental physics, we learn that sixty-two students were attending the practical classes in the Lent term, doing work which few of the candidates for the mathematical or natural sciences triposes ever did at Cambridge before the establishment of the Cavendish Laboratory. The pupils in mechanism in Prof. Stuart's workshop have numbered thirty-six during the past winter. In chemistry the increase in the students has considerably exceeded the accommodation available in the University laboratory, notwithstanding the existence of several college laboratories. Professors Liveing and Dewar plead strongly for further provision as regards both buildings and appliances, such as may bear comparison with those of Zurich and Bonn; they believe that to delay building until other departments can be adequately dealt with will be most detrimental to the present flourishing prospects of chemistry. A new register of the specimens in the mineralogical museum is completed; but the want of additional apparatus is seriously felt. Prof. Hughes records the use of the Arts School as a lecture-room, and the arrangement for additional class and work-rooms in the Woodwardian museum. The accessibility of the collections, and the determinations being kept up to date, attract many geologists who wish to pursue special investigations. Among the additions to the collections are 700 species of Pliocene shells from Tuscany, casts of vertebrates from Lausanne Miocene, 270 species of Miocene shells from the Vienna basin; Upper greensand corals from Devonshire, many Cretaceous specimens from the neighbourhood of Cambridge, 450 specimens from Neocomian of Saint Croix, Switzerland, and casts of *Hesperornis regalis*, Marsh, from Kansas; several hundred specimens from Portland Sands, Swindon, Wilts, collected by Mr. H. Keeping, the curator of the museum; numerous specimens of rocks and building-stones.

Turning, now, to the biological departments, the Woodward and Hepburn collections of shells have been carefully examined and catalogued by the curator, Mr. A. H. Cooke. The report gives notes upon the principal families of mollusca, as represented in the museum, with indications of gaps in the series; it should be widely circulated in the interest of the museum itself, as many old University students must have it in their power to supply deficiencies at a slight cost of trouble to themselves. Mr. Salvin reports that his catalogue of the Strickland collection of birds is complete, making an octavo volume of 653 pages. The species in the collection number 3125. Mrs. Strickland has presented a further portion of the valuable library of her late husband to the museum. In Amphibia and Reptilia the collection is still relatively poor. A beautiful skeleton of Menopoma has been prepared by W. Robinson, one of the assistants in the museum, and a considerable number of skeletons and skins of representative genera in these groups has been added. Among the mammalian acquisitions should be mentioned the skeleton of a male giraffe purchased from the Zoological Society; a skeleton of a mare, presented by Mr. R. Pryor, of Trinity College; skeletons of a ringed seal, a bladder-nosed seal, and a Polar bear, all carefully killed and preserved, so that the bones were neither injured nor missing, as is too often the case. A complete skeleton of an Indian elephant has been given by Sir John Phear, and a less perfect skeleton of an individual of the same species, sent from Calcutta through the kind exertions of Sir Joseph Fayrer. English additions of interest continue to be made, such as a male badger, an adult male otter from Norwich, and a female wild cat from Sutherlandshire.

The average number of students working at physiology practically is now over 100. Mr. Balfour's classes in practical morphology have very nearly attained the same numbers. More demonstrators are seriously needed. Mr. Vines has been assigned a small room for practical botany, but the advanced students can only do their work by the course being repeated two or three times, since only ten students can work at once. Elementary students are at present unprovided with any space for practical study.

Prof. Paget, in reporting on the department of medicine, strongly urges the speedy appointment of a Professor of Pathology, and the provision of a Pathological Laboratory. The Museum of Human Anatomy has been enriched by sixteen models of the brain and other models, prepared by the late Mr. Joseph Towne, modeller to Guy's Hospital, presented through Mr. T. Bryant.

One further note should be made, calling attention to the magnificent presents made to the Philosophical Library, on its transfer to the new room, and being made available for all students in the museums, by Mr. J. W. Clark, Prof. Humphry, Mr. F. M. Balfour, Prof. Babington, Prof. Newton, and others. Mr. Clark's gift is of priceless value to the science school, including as it does several hundreds of volumes of the most valued and superb editions of zoological and anatomical works.

The Hopkins Prize for the best original memoir, invention, or discovery in connection with mathematics physical or mathematics experimental science that may have been published during the three years immediately preceding, has been awarded to Lord Rayleigh, M.A., F.R.S., of Trinity College, Professor of Experimental Physics in the University, for his various important papers connected with the theory of vibrations, and particularly for his paper on "The Theory of Resonance."

Prof. Humphry announces practical classes in histology by the Demonstrator, Mr. Hill, and in osteology by Mr. Wheny, during July and August.

The Cavendish Laboratory will be open to students obtaining permission from the Professor during July and August, and the Professor or one of the Demonstrators will attend daily.

It has been decided to confer the Honorary Degree of LL.D. on Prof. J. P. Cooke, the eminent Professor of Chemistry in Harvard College, U.S.

The opening of the Botanic Garden during three hours on Sundays to members of the Senate and friends accompanying them has been confirmed by 88 to 76 votes.

MR. H. S. HELE SHAW has been appointed Professor of Engineering at University College, Bristol, vice Dr. J. T. Main, elected Assistant Professor of Mechanics at the Normal College of Science and Royal School of Mines, South Kensington. Mr. Sidney Young, D.Sc. London, succeeds Mr. W. L. Goodwin as Chemical Lecturer and Demonstrator, the latter having obtained the professorship of Sackville College, New Brunswick, Canada.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 11.—"On the Organisation of the Fossil Plants of the Coal-measures," part xii. By Prof. W. C. Williamson, F.R.S.

At the recent meeting of the British Association at York, Messrs. Cash and Hick read a memoir, since published in part iv. of vol. vii. of the *Proceedings* of the Yorkshire Geological and Polytechnic Society, in which they described a stem from the Halifax Carboniferous deposits characterised by a form of bark hitherto unobserved in those rocks. To this plant they gave the name of *Myriophylloides Williamsonis*. It was characterised by having a large cellular medulla, surrounded by a thin vascular zone composed of short radiating lamellæ. This, in turn, was invested by a cylinder of cortical parenchyma from which radiated a number of thin cellular laminæ, like the spokes of a wheel, separating large lacunæ. Each lamina generally consisted of a single series of cells. At their peripheral end, these laminæ merged in a thick, large-celled, cortical parenchyma. The generic name, Myriophylloides, was given to the plant because of the resemblance between sections of its cortical tissues and those of the recent Myriophyllum. Two reasons induced the author to object to this name (NATURE, December 8, 1881, p. 124), and to propose the substitution of that of Helophyton. Such substitution, however, was rendered unnecessary by the discovery, by Mr. Spencer, of Halifax, of some additional specimens which indicate that the supposed new plant was merely the corticated state of the Astromyelon, described by the author in his Memoir, part xi. (*Phil. Trans.*, 1878). These specimens showed that the plant was more complex than had been supposed, different ramifications of it having each their individual peculiarities.