workshops. His ingenious devices are worth an article in themselves. We were greatly impressed by his method of doing Kundt's experiment, using a brass tube with two thick circular plates of brass soldered at nodes a quarter of the length of the tube from each end; these plates fit between two blocks of wood on a rigid stand. The cork at one end of the brass tube is stuck on by resin, so as not to constrain the vibration of the tube, and the resonance tube of glass contains no visible lycopodium until the note is obtained, when the nodes are evident as very fine lines, the position of which can be read to 0·02 cm. by a travelling microscope. Mr. Meier said that a few degrees difference in temperature, such as results from turning out a gas fire in the room, produces a measurable displacement of the nodes.

The retiring chairman of the Association, Mr. W. H. Barrett, of Harrow School, handled the annual business meeting with skill. A resolution was passed assuring the president that the Association would support him in any steps he may take to initiate a reform of our educational system on the lines laid down in the course of his presidential address.

The next meeting of the Association is to be held at the University of Bristol, on Jan. 3–5, 1933, and the new president will be Prof. A. M. Tyndall. E. N.

Form and Height of Clouds.

THE Central Meteorological Observatory at Tokyo has recently published an illustrated account of a thorough photometric study of clouds made at the Meteorological Observatory at Mera. Mera lies at the southern extremity of the Bôsô peninsula, in the south-east of Japan proper, at no great distance from Tokyo. The observations cover the period of two years ending on Mar. 31, 1929, and were made by three members of the staff of the Mera Observatory.

Although the work does not appear to have been undertaken with the solution of any particular problem in view, and might be adversely criticised on the ground that we have already too many such bulky statistical compilations relating to the weather of temperate latitudes, such criticism should be qualified in view of the fact that the information about the heights of various forms of cloud in this work is rarely based on measurements of single points in the cloud, but on so many points that an idea is given of the vertical extent of the cloud as well as of its height above the ground. For example, a photograph numbered 217 in the section devoted to stratocumulus clouds, portrays a group of these clouds and alongside a key diagram with numbered points. In a table underneath, the measured heights of these points are shown. One of the larger fragments of cloud contains five such points, and the table shows that the lowest height was 1489 metres and the highest 1587 metres, whence we deduce a minimum of 89 metres for the vertical extent of this particular cloud. The table further informs us that the mean height of the whole group was 1534 metres and the range 117 metres.

The heights were obtained by two photo-theodolites of German manufacture set up at the ends of a base line 1161 metres in length—a length that should ensure a fair degree of accuracy even in the measurement of cirrus clouds, which normally occur at heights equal to about seven times the length of the base line.

There is another aspect of the work which calls for favourable criticism, and that is that the quality of the photographs and the complete range of form illustrated justifies the authors in describing section viii. as a "Cloud Atlas". It is an atlas in which the full information about the heights of the clouds just described is supplemented by figures giving the mean amount of cloud on each occasion, its speed and direction of movement, and the speed and direction of the wind near the ground. When telephotographic representations of cloud are given and no terrestrial object appears in the field of view, the reader is likely to have a difficulty in imagining the true appearance of the clouds, unless some device is adopted for giving the scale of the photograph. In this event, a circular line might with advantage have been added in one corner of each photograph, the diameter of the circle being equivalent to about half a degree, that is, to about the diameter of the sun or moon, so that the clouds could be compared with either of these luminaries.

It should be noted that in addition to the section described as a cloud atlas, there are numerous tables relating to the heights of the different clouds, and the seasonal variations of these are shown by graphs, as well as being given in tabular form.

E. V. N.

Photocells: the Valves which operate by Light.*

ONCE the potentialities of devices in which the action of light produces or changes the magnitude of an electric current are properly appreciated, they are likely to become very widely employed. At least four types of these are now available: the selenium cell and its congeners, the alkali metal cell —operating on the external photoelectric effect, and often called a photoelectric cell to the exclusion of the others—the electrolytic cell, and the dry plate rectifier cell. Of these, the electrolytic cell, in which the electromotive force is changed when the electrodes are exposed to light, is as yet little understood, although it is likely to be of value for some purposes. More attention is being paid to the rectifier cell, which is the development of a crystal rectifier which has been found recently to be sensitive to light and is going to be very important. Selenium cells employ a half conductor of a similar type to the crystal, but work simply by its change in resistance when illuminated, Ohm's law being obeyed, which is not true of rectifiers.

Choice of cell for any particular purpose depends upon exactly what is required of it, but the answer that an engineer wants in most of the less complicated industrial applications can be illustrated by performing an experiment, in which the current through an incandescent lamp is altered until it produces a current of a few microamperes in the circuits of various cells exposed to its light. Selenium cells are found in this way to be the most sensitive, then electrolytic cells, gas-filled alkali cells, and rectifier cells, and the vacuum alkali cells come last. On the other hand, vacuum alkali cells give a response proportional to the intensity of the light, provided its colour is not altered, and have the great advantage of having an effectively instantaneous response, whereas the response of the selenium cells bears a less simple relation to the intensity of the light and may not reach a

* Substance of a lecture-demonstration given by Mr. C. C. Paterson on Jan. 5 at the Physical and Optical Societies' Annual Exhibition of Scientific Instruments and Apparatus at the Imperial College of Science, South Kensington.

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steady state for several seconds. Again, the selenium cell is most sensitive to red light and the potassium vacuum cell to green light, although to a green which is well to the short wave-length side of the region of maximum visual acuity. With a vacuum cell in which the sensitive cathode is a very thin film of cæsium on a base of cæsium oxide the maximum is in the infra-red. No one of these cells agrees with the eye about colour in giving a maximum in the yellow which appears brightest to the eye.

The different sensitivity of different alkali cells to light of different colours is applied in modern lamp photometry to determine accurately whether the light from two incandescent lamps is of the same colour, and therefore whether the two filaments are at the same temperature, on the principle that if two cells of different colour sensitivity are adjusted to give the same current when exposed to light of some definite colour, they will give the same current when similarly exposed to light of the same colour even if its intensity is different, but will not give the same current if the colour is different.

Amongst the laboratory uses of photoelectric cells may be mentioned the demonstration by one of the modern forms, that photoelectric emission is independent of temperature whereas thermionic emission is not. This has already been accomplished in several ways, but can be shown rather prettily with a cæsium cell, which has a readily measured thermionic current below 200° C. One of these cells is mounted in a small oven and the thermionic current from it (if any) found by the ordinary direct method, whilst light which produces a photoelectric current too small to deflect the thermionic galvanometer is allowed to fall on the cell simultaneously and is rendered intermittent by passing it through a rotating disc. The photoelectric current through the cell is then also intermittent and may be amplified independently of the thermionic current and fed to a loud speaker, the sound from which is a measure of its magnitude. When the cell is cold there is a photoelectric current but no thermionic emission, but, when the oven is heated, a thermionic current develops rapidly, whilst the sound from the loud speaker, and hence the photoelectric current, is not appreciably changed.

Physiological Basis of Sensation.

IF we are to regard a sensation as a change in consciousness in response to a stimulus applied to a sense-organ, then the sensation evoked by a given stimulus will depend on the complexity of the consciousness of the particular individual. This will vary enormously from person to person, depending on heredity, education, experience, and so on and will differ enormously in man and in animal. This variation, however, is no justification for the abandonment of investigation, but is rather a guide to the choice of the most elementary species and the most fundamental processes for experiment.

Prof. E. D. Adrian, for the purposes of the discussion which he opened on Sept. 24 in Section I (Physiology) of the British Association, presented the view that the structural organs involved—namely, the sense-organs, sensory nerve-fibres, and the collection of nerve cells with their interlacing fibres in the brain—work in a fairly simple way. At any rate, the messages or nerve impulses which pass from the sense-organs are fairly simple ; each consists of a very brief wave of activity—in the larger fibres each point remains in the active state for only a few thousandths of a second and the wave travels at a speed of 30 metres a second or more. The passage of an impulse involves a very small expenditure of energy, but fortunately some of it can be easily detected, for it appears as an electric current flowing between the active and inactive parts.

By amplifying these electric changes, Adrian has been able to record the passage of impulses in each nerve-fibre, and has found that a succession of impulses passes up to the brain whenever a sense-organ comes into action. An active sensory ending usually discharges a rhythmical series of impulses with a frequency in the neighbourhood of 20-100 a second, and the sense-organ, like the nerve-fibre, behaves with machine-like regularity, giving always the same discharge of impulses for the same stimulus provided that other conditions are unaltered.

Adrian has recorded similar electrical changes in the optic nerve, which developmentally is a part of the brain, and there is no reason to suppose that changes do not occur in the brain itself similar to those in the sense-organs and their nerve-fibres.

Prof. Frank Allen, of the University of Manitoba, brought forward evidence of a quantitative character in support of the elementary and fundamental physiological basis of sensation. The same law is found to connect the magnitude of the response elicited by a definite adequate stimulus of a sensory organ irrespective of what the sensory organ may be.

Sir John Parsons also contributed to the discussion, pointing out, among other things, the valuable data derived from clinical examination of patients afflicted with such partial deficiencies as colour-blindness.

University and Educational Intelligence.

CAMBRIDGE.—Candidates for the recently established Goldsmiths' professorship of metallurgy are requested to communicate with the vice-chancellor on or before Jan. 16. The salary attached to the chair is £1200 per annum.

The Raymond Horton-Smith prize for the present session has been awarded to Dr. W. D. Newcomb for his thesis on the relationship between peptic ulceration and gastric ulceration and gastric carcinoma.

LONDON.—Mr. O. L. V. de Wesselow has been appointed as from Dec. 1, 1931, to the University chair of medicine tenable at St. Thomas's Hospital Medical School. Since 1920 he has been chemical pathologist to St. Thomas's Hospital.

ST. ANDREWS.—The last examination for the diploma of L.L.A. has been held, and the scheme has now been wound up. Begun in 1877, when there was no opportunity for women to enter the universities and when the L.L.A. examination afforded them an opportunity of obtaining a diploma attesting their attainments in literature, science, and philosophy, the scheme grew gradually up to the year 1909, when there were as many as 1090 candidates in one year. By that time the effect of the admission to the universities of women had diminished to some extent the usefulness of the examination and the numbers gradually decreased. During its existence the L.L.A. has attracted 36,017 candidates and 5119 diplomas have been conferred.

THE sixth World Conference of the New Education Fellowship will be held at Nice on July 29–Aug, 12, under the presidency of Prof. P. Langevin, professor of experimental physics in the École Normale Supérieure, Paris. The theme for the Conference is "Education and Changing Society". Main lectures on the general theme have been arranged, also sectional lectures on special subjects and on progress within national systems of education, and study courses. Further information can be obtained from the Conference Secretary, New Education Fellowship, 11 Tavistock Square, London, W.C.1.

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