correct. When the stronger light falls upon one side of the leaf-stalk, those cells on the side which is more illuminated are stimulated to activity to a greater extent than those on the less illuminated side, and the stimulus is transmitted to the motor region. Inasmuch as this stimulus is due to physico-chemical changes set up in the cells nearest to the light, the plant may be said to perceive a difference in the effects produced by the light on the two sides—that is, it is able to compare the two intensities. As soon, however, as the leaf reaches its right position, the apex of the stalk is illuminated more or less equally on all sides, and as the physico-chemical changes in the cells may now be considered to be more or less equal, no further stimulus will be transmitted, or, if so, will be transmitted equally all round the stalk, and no curvature in either direction will take place. The leaf now being placed in a definite position with reference to the direction of the light rays, it would seem quite justifiable to conclude that the plant is capable of perceiving the direction of the rays of light.

But the leaf is also capable of distinguishing between light of different wave-lengths. Notwithstanding the fact that rays of light both at the red end and at the blue end of the spectrum are absorbed, the plant responds phototropically mainly to the rays at the blue end of the spectrum, very slightly, possibly, in some cases to the red rays. This has been demonstrated by keeping plants behind different coloured light filters, and also in different parts of the spectrum. That this power is localised in the percipient region at the apex of the leaf-stalk can be very easily proved by exposing this percipient region to rays of the blue or red colour. The filters prepared and spectroscopically examined by Messrs. Wratten and Wainwright can be used for this purpose. Experiments were made with blue, green, and red filters. A strong curvature took place under the influence of the blue rays, but no curvature under the influence of the green or red rays, even when the exposure was continued for more than a week.

Here we have to do, therefore, with the quality as well as with the intensity and direction of the light rays, and the fact that the plant is more sensitive heliotropically to the shorter and more frequent vibrations at the blue end of the spectrum than to the longer and less frequent vibrations at the red end, indicates that it cannot merely be the direction of the light rays that is perceived. Moreover, we must remember that the plant does not respond directly to the action of light, but to the physico-chemical changes that take place in the photo-sensitive cells of the percipient region. We ourselves perceive the light because the brain is able to translate into sense impressions the physico-chemical changes which take place in the elements of the retina. The plant perceives the light because it is able to translate into a motor response the physico-chemical changes taking place in the photo-sensitive cells of the perceptive region.

We may imagine that in the plant the action is as follows: The light is absorbed by, and excites, certain photo-active substances in the cells of the sensitive region. A stimulus is thus set up which is conveyed through the cytoplasmic fibrils of the protoplasts to the motor region. A further impulse is then set up which acts upon the cells in the motor region, by which it is probable that changes in the permeability of the protoplasts are effected; the turgor conditions of the cells are thereby differentially altered, and the result is a motor response. We have here, in fact, a very simple type of reflex act taking place through the agency not of highly specialised nerve-cells, but of ordinary protoplasm and of the delicate protoplasmic fibrils which extend from one cell to another.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Prof. R. B. Clifton, who lately retired from the professorship of experimental philosophy at the end of his fiftieth year of service, has been elected to an honorary fellowship at Wadham College. He has been connected with that college ever since his appointment in 1865, and was an ordinary fellow for the thirty-two years previous to his retirement.

THE Secretary of State for India has appointed Mr. K. Zachariah to be professor of political economy and political philosophy at Presidency College, Calcutta; and Mr. W. A. Jenkins to be professor of physics at the Dacca College.

WE learn from the issue of *Science* for December 3 that objections have been filed to the will of the late Mr. Amos F. Eno, who bequeathed a large sum to public purposes and made Columbia University his residuary legatee. It is said that under the will Columbia University would receive 600,000*l.* or more. Our contemporary also states that a bequest of 10,000*l.* has been made to Cornell University by Mrs. Sarah M. Sage to promote the advancement of medical science by the prosecution of research at Ithaca.

WE have received from Washington a copy of a timely volume prepared by Mr. S. P. Capen, specialist in higher education of the United States Bureau of Education, entitled "Opportunities for Foreign Students at Colleges and Universities in the United States." Students of education will find in it an excellent account of the present facilities for higher education in the States. Every kind of information that an intending student can require is provided. Prominence is given to descriptions of the organisation of a typical American university, living conditions, college life, and college entrance requirements. With reference to the expenses of foreign students, Mr. Capen points out that these vary widely at different institutions. Practically all the privately endowed institutions charge annual tuition fees. The fee is rarely less than 8*l.* a year for collegiate instruction, and in some cases is as high as 30*l.* or 40*l.* a year. Professional instruction, particularly in medicine and engineering, is still more expensive. The Massachusetts Institute of Technology charges 50*l.* a year, and to its students in naval construction and naval architecture 100*l.* a year. Most State-aided institutions charge only a small tuition fee to collegiate students not resident in the State, State residents being generally given free instruction. Living expenses, aside from tuition and other fees, vary with the location of the institution. As a rule, the fundamental charges—room, board, and laundry—are rather lower at country institutions than at those in the cities. The possible wide variations in price are indicated by the figure 18*s.* quoted as the weekly minimum by the University of Minnesota, and 2*l.* 8*s.* the weekly maximum mentioned by Cornell University. The incidental expenses of city living, including amusements, should, of course, also be reckoned.

ON December 9 Mr. Patrick Alexander, well known by his pioneer work in aeronautics, made over to the headmaster of the Imperial Service College, Windsor (Mr. E. G. A. Beckwith), the munificent sum of 10,000*l.* "for the furtherance of the education of boys of the Imperial Service College, *i.e.* for the training of character and the development of knowledge." Mr. Alexander had given to the college an aero-laboratory and equipment about five years ago, but owing to long absences abroad, and a serious illness, he has been unable to identify himself with the college of late as heretofore. Having, however, taken up his residence in Windsor for the last six months, he has been able to continue his research work in the labora-

tory that he so generously gave. It is interesting to note how quickly things aeronautical have progressed since Mr. Alexander's first gift. In the course of an address which he gave on that occasion he said "careful demonstrations with kites and gliders" had been made in connection with the laboratory which he had given, while to-day both kites and gliders have almost been forgotten! But though great changes have occurred, the tribute which he then paid to the Aeronautical Society of Great Britain is, if possible, truer to-day, while his closing words are peculiarly interesting now:—"There never was a time when England held a more dominant sway of mankind, and whether we have to fight on the seas, on land, or in the air, British brains and British boys are as good as they ever were, and the boys going through their training at this college will prove that Old England means to have and keep the supremacy of the air." Mr. Alexander has nominated as his co-trustees Mr. A. A. Somerville (head of the Army Side, Eton College) and Mr. E. G. A. Beckwith.

THE principal of the Northampton Polytechnic Institute presented his annual report at the distribution of prizes to the students on December 18. The report refers more particularly to the work of the session 1914–15. When the enrolments of students were made up at the end of the session, it was found that the total number of students during the session had been 1748, as against 2101 in the preceding session. As usual, the work has received the support of the trades affected. For the eleventh year in succession the principal has been able to place, without payment of any premiums, the whole of the second and third year engineering students in commercial workshops for the summer. In fact, this was easier than usual because by Easter the loss of skilled workers was making itself felt in all engineering trades. A roll of distinction which has been compiled shows that twenty-two members of the staff, 226 students, and 119 members of the polytechnic, making 367 in all, have joined the colours. Of these more than fifty have obtained commissions in one or other of the Services. The roll of honour shows the names of those who have given their lives for the service of their country or who have been wounded in that service. There are seven in the first category and six in the second. As regards the war work being done at the polytechnic, the report points out that courses for drafts from the artillery divisions of the new armies were organised and have been continued down to the present time. The courses consisted of classes in field telephony, in range finding, and in plane table work and map reading. Altogether 897 individual students have passed through these courses, and thanks have been received from Whitehall and from the divisional headquarters, as well as from individual brigades. The manufacture of munitions, also, has been undertaken.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Meteorological Society, December 15.—Major H. G. Lyons, president, in the chair.—F. J. **Brodie**: The incidence of bright sunshine over the United Kingdom during the thirty years 1881–1910. The author described the steady increase in the use of sunshine recorders from the somewhat crude type invented by Mr. J. F. Campbell in the early part of last century to the improved pattern of Sir George Stokes of 1879, which has remained in use with very slight modification to the present day. The paper is based on figures taken from appendix iv. of the *Weekly Weather Report* for 1913, published by the Meteorological Office, and the maps which have been constructed differ somewhat in detail from those appearing in the official volume. The author dealt with the prevalence of sunshine, both by the seasons in their usual grouping, and annually. He also referred to the average number of sunny days at Greenwich and Falmouth, and to the loss of sunshine recorded in London and other large manufacturing centres. He showed that the abatement of the smoke evil tended to an increased record of sunshine, and placed the large towns more on a footing of equality with the urban districts.—Dr. W. **Galloway**: Remarkable cloud phenomena. The author described the curious and rapid changes which took place in a small portion of a thundercloud, witnessed on July 31 last year near Ormesby Broad, Norfolk. The phenomena pointed to the occurrence of electrical discharges, but neither rain, thunder, or lightning occurred.

Royal Anthropological Institute, December 14.—Prof. A. Keith, president, in the chair.—J. Reid **Moir**: The evolution of the earliest Chelles palæoliths of the pointed type from the rostro-carinate implements. A series of ten flint implements from (*a*) the detritus-bed below the Red Crag; (*b*) the stone-bed below the Norwich Crag; (*c*) the Middle Glacial gravel of Suffolk; and (*d*) river-gravels in the Thames valley and at Warren Hill in Suffolk are described, and it is shown that the most primitive type of rostro-carinate has been evolved by gradual stages into the earliest Chelles palæolith of the pointed type. These stages are as follows:—(1) The substitution of a ventral plane formed partly by blows for the ventral plane composed entirely of cortex; (2) the gradual elimination, by flaking, of cortex from the ventral plane, and also the production of a dorsal plane by blows, and devoid of cortex; (3) the gradual reduction in width of the ventral plane until a cutting edge is produced, and the prolongation of the "keel" to the posterior region, accompanied by the disappearance of the dorsal plane.

Mathematical Society, December 9.—Sir Joseph Larmor, president, in the chair.—H. **Jeffreys**: The vibrations of a special type of dissipative system.—F. J. W. **Whipple**: Diffraction by a Wedge.—T. L. **Wren**: Some applications of the two-three birational space transformation.—T. C. **Lewis**: The circles which touch the escribed circles of a triangle.—E. B. **Stouffer**: Semivariants of linear homogeneous differential equations.

Institution of Mining and Metallurgy, December 16.—Sir T. K. Rose, president, in the chair.—E. A. **Wraight**: Influence of heat in cyaniding gold ores. The effect of heat on the dissolution of gold in cyanide solutions is a matter which hitherto has received but scant attention from metallurgists, and the author gives the results of a number of experiments which he conducted with a view to determining whether the application of heat would be beneficial or otherwise. His final deductions are:—(1) That the effect of heating cyanide solutions is of very doubtful benefit; the extraction may be increased for a short period, but this is more than compensated by the increased cyanide consumption and the subsequent decrease in the rate of dissolution of gold; (2) that oxidising agents (hydrogen peroxide excepted) are apparently of no value, and may even exercise a deleterious effect on the extraction; and (3) that the addition of oxygen in a more active form, either as hydrogen peroxide or by means of heated air, increases the solvent activity of cyanide solutions in a very pronounced manner.—A. W. **Allen**: Clay: its relation to ore dressing and cyaniding operations. The presence of clay in so many geological formations, and its invariable association with other metalliferous ores, makes the study of its properties of considerable importance with reference to reduction