None of the shell high explosives possess all the desirable qualities. Those now in use have little more than half the shattering power of blasting gelatine. All are products derived from the distillation of coal.

In spite of its great merits, picric acid has now been largely replaced as a shell-filling by trinitrotoluene and amatol.

Given that the picric acid is pure and proper precautions have been taken, it is quite safe and the most powerful shell-filling in use. It is also unaffected by high atmospheric temperatures, unlike T.N.T., and is specially suitable for tropical climates.

Trinitrotoluene ($C_6H_2(NO_2)_3CH_3$).—Usually called T.N.T., this substance, at present the most important of the shell high explosives, is known in the Service as trotyl. When heated to about 300° C., T.N.T. ignites and burns with a hot, but very smoky, flame. When a large mass is involved, the heat given out will invariably raise the temperature to the detonating-point. It is fully detonated by fulminate, except when in the form of cast slabs untamped, when the addition of a little lead azide to the fulminate is necessary. Fulminate detonators are used in bombs, torpedoes, and grenades. T.N.T. can also be detonated by less sensitive substances, such as picric powder and tetryl, and these are used in shells. The velocity of detonation in its densest form is about 7000 metres per second. The power is less than that of picric acid, about in the proportion of 91 : 100. Owing to the inferior velocity of detonation, the shattering effect (brisance) is proportionately still less, about 87 : 100.

When an amatol shell detonates there is only a little grey smoke, and no definite indication as to whether detonation has been complete or not. For observation purposes a packet of smoke producer is put in. The power is a little greater than that of pure T.N.T., but the velocity of detonation much less—4000 to 4500 metres per second, so that the local shattering effect is much less. For some purposes this is even an advantage.

Amatol is the most used of all the shell high explosives at present.

Tetranitromethylaniline ($C_6H_2(NO_2)_3NCH_3NO_2$).—This substance is known in the trade as tetryl, and in the Service as C.E. (composition exploding). It is readily detonated by a very small charge of fulminate, such as that used in shell detonator caps, is very powerful, and has a velocity of detonation of more than 7000 metres per second. It is an excellent initiator of detonation in other less sensitive explosives. In powder, pellets, and cylinders it is used in the gaines or detonators for T.N.T. and amatol shells, with which it is very effective.

Detonation of High-explosive Shells.—The problem of the detonation of a high-explosive shell is difficult. The shell is subjected to an enormous shock in the act of firing, the detonating charge must be in intimate contact with the filling, and if fulminate were used there would be a great risk of this being detonated by the shock. The problem seems to have been solved by the introduction of the gaine method.

The Gaine.—The gaine is a metal tube screwed to the fuse, which enters a cavity in the filling and makes good contact with it. This is very necessary. It contains a chain of substances, about four, of decreasing order of sensitiveness, starting from the fuse, and increasing order of violence of explosion. Use is made of the fact that a substance in powder is more easily detonated than when in compressed pellets, and pellets than a cast, dense solid. The actual substances vary with the shell and nature of the filling, but always start with gunpowder, which is very certain in action. Thus we may suppose the chain to consist of (1) gunpowder, (2) tetryl powder, (3) tetryl pellets, and (4) T.N.T. pellets.

The action is started by a fulminate cap in the fuse, which fires the gunpowder. This partially explodes and partially detonates No. 2, which detonates No. 3, which in turn detonates No. 4, and this detonates the main filling. With fuse and gaine in good condition there are very few failures now.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ABERDEEN.—Lord Cowdray has been elected Rector of the University in succession to Mr. Churchill, who has occupied the position for the last four years.

THE Mercers' Company has given 125*l.* towards the maintenance fund of the Cancer Investigation Department of the Middlesex Hospital.

THE sum of 1000*l.* has been given to the City of London School by Prof. Carlton Lambert for the foundation of a science scholarship.

A RESEARCH fellowship of the annual value of 150*l.* has been founded at Guy's Hospital in memory of the late Lieut. R. W. Poulton Palmer and his sister, the late Mrs. E. H. A. Walker, the object of which will be the investigation of obscure diseases in man.

THE London County Council has arranged a series of addresses to London teachers on various aspects of the problem of national reconstruction after the war. The first two addresses will be:—November 22, "The British Commonwealth," by C. Grant Robertson; and December 11, "Hours of Labour," by Lord Leverhulme. Sir Cyril Cobb, chairman of the Education Committee of the Council, will preside at these lectures. Other lectures in connection with reconstruction will be given on the following subjects:—Economic Recovery, Housing, Agriculture and Rural Life, Women's Employment, Adult Education, Food Supply, International Relations, India, and National Health. The lectures are arranged for London teachers, but other persons can be admitted if accommodation is available. Applications for tickets should be made to the Education Officer, L.C.C., Education Offices, Victoria Embankment, W.C.2, marked H. 45. A stamped addressed envelope should be enclosed.

ONE of the main matters to which Sir J. J. Thomson's committee on the position of natural science in the educational system of Great Britain gave attention was the provision of courses intended to stimulate interest in natural facts and phenomena and their human aspects. The appearances and movements of the heavenly bodies are particularly suitable for observations and instruction of this kind, yet few pupils leave school with any knowledge of them, and most people go through life without an intelligent understanding of the simplest facts of astronomy. Sir Frank Dyson, the Astronomer Royal, in an address to the British Astronomical Association on October 30, urged that the claims of astronomy should be borne in mind in any schemes for the broadening of science teaching in schools. A certain amount of valuable work in this direction is done already in connection with the practical geography lessons; and the British Association Report on Science Teaching in Secondary Schools contains, in one of the syllabuses, much useful guidance to such observations. Sir Frank Dyson rightly lays stress upon the educational value of work

with terrestrial and celestial globes, the latter in a simplified form and showing the position of the sun in the ecliptic on, say, the first day of each month. He suggests also that an orrery should be used to make clear the transference from the geocentric to the heliocentric point of view, and that a 4-in. telescope should be provided wherever possible to observe sun-spots, the lunar surface, Jupiter's satellites, and the phases of Venus. Such observations, together with simple lessons on the applications of spectroscopy to elucidate the composition of the sun, stars, nebulæ, etc., illustrated by some of the excellent astronomical photographs now available, should do much to remove the reproach that nothing is done in schools to encourage pupils to lift their eyes to the heavens and learn something of the universe around them.

THE endowment fund now being raised for the establishment of a University College in Swansea has been augmented by donations of 25,000*l.* from Mr. F. Cory Yeo and 10,000*l.* from Mr. W. T. Farr, retiring directors of the Graigola Merthyr Co., Ltd., 5000*l.* of the former donation to be devoted to scholarships "in the first place for Graigola boys, and, if any after, for open competition." The University College scheme originated in a movement to secure for the Swansea Technical College recognition in the faculties of science and technology as a constituent college of the University of Wales. The governors and staff were of opinion that for a full development of the higher work of the college University recognition and association were essential. To this end the governors approached the recent Royal Commission on University Education in Wales, asking for a direct recommendation that the college should find a place in at least the above-mentioned faculties in the reorganised University. A proof that the application was backed by the community was the establishment in the course of a few weeks before the end of 1916 of an endowment fund exceeding 65,000*l.*, in addition to which the Swansea Town Council undertook to provide all necessary land and buildings. The Royal Commission reported very favourably, but laid down that the new University College must make provision for work in the faculty of arts. To assist in fulfilling this condition, the Swansea Council has agreed, subject to the consent of the Board of Education, to bring in its Training College for Teachers as part of the scheme. This will enable full provision to be made in the faculty of arts, science, and technology, but necessitated an appeal for a much larger endowment fund, a minimum of 150,000*l.* being the present aim. Messrs. Cory Yeo's and W. T. Farr's donations are the first-fruits of this appeal, and brings the gifts or promises well above 100,000*l.* The college has also received notice of a bequest of the residue of the estate of the late Mr. T. P. Sims, assayer, of Swansea, the bequest being subject to a life-interest. The value of the residue is estimated at more than 10,000*l.*, and the income is to be devoted to scholarships in chemistry, metallurgy, and modern languages.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 7.—Sir J. J. Thomson, president, in the chair.—Prof. G. E. **Hale**: The nature of sun-spots.—E. O. **Hercus** and T. H. **Laby**: The thermal conductivity of air.—T. K. **Chinmayanandam**: Haidinger's rings in mica.

Aristotelian Society, November 4.—Dr. G. E. Moore, president, in the chair.—Dr. G. E. **Moore**: Some judgments of perception. The question of the real nature of material things is approached by asking what we are judging when we make such judgments as, "This is a coin. Two things seem to be certain, viz. (1) that we are always making some assertion about an immediately given object—an object which has sometimes been described as "the sensation which mediates our perception of the coin in question," and which will be called the sense-datum which is the subject of our judgment—and (2) that what we are asserting about the sense-datum is not, in general, that it is itself a coin. What is doubtful is whether we may not be judging that the sense-datum is itself a part of the surface of a coin, in a sense in which this can only be so if it is identical with "this part of the surface of this coin." This is only possible if, when we seem to perceive that a sense-datum is of a certain size, shape, etc., we really only perceive that it seems to be so, in a sense in which it may seem to be so without being either judged or perceived to be so. Failing this, either (1) there must be some relation such that we are judging "The thing to which this sense-datum has this relation is part of the surface of a coin," and it seems doubtful whether there is any such relation, or (2) we must take some view of the type of Mill's.

CAMBRIDGE.

Philosophical Society, October 28.—Prof. Marr, president, in the chair.—Prof. L. J. **Rogers** and S. **Ramanujan**: Proof of certain identities in combinatory analysis.—S. **Ramanujan**: Some properties of p (*n*), the number of partitions of *n*.—Miss D. M. **Wrinch**: The exponentiation of well-ordered series.—A. E. **Jolliffe**: Certain trigonometrical series which have a necessary and sufficient condition for uniform convergence.—H. W. **Turnbull**: Some geometrical interpretations of the concomitants of two quadrics.—H. B. C. **Darling**: Mr. Ramanujan's congruence properties of p (*n*).—B. **Sahni**: The correct generic position of *Dacrydium bidwillii*, Hook. f. This species, and by inference probably also *D. kirkii* and *D. biforme*, hitherto regarded as forming an interesting transition to the genus Podocarpus, are really species of the latter genus. At least in *D. bidwillii* the epimatium is not entirely free from the integument, nor the integument from the nucellus. The integument, moreover, contains two vascular strands exactly in the same position as in *Podocarpus ferrugineus*, but not quite reaching the level of the equator. In view of the dry epimatium and other features, it is proposed provisionally to place all these New Zealand species of Dacrydium in a new and distinct section of the genus Podocarpus, allied to section Stachycarpus.

PARIS.

Academy of Sciences, October 21.—M. Léon Guignard in the chair.—E. **Picard** and A. **Lacroix**: The Inter-Allied Conference of Scientific Academies in London.—H. **Sebert**: Notice on M. Marcel Deprez.—C. **Richet**, P. **Brodin**, and Fr. **Saint-Girons**: Temporary and definite survival after serious bleeding. In previous papers it has been proved that in the case of dogs, after grave loss of blood, injection into the veins of suitable fluids would prolong life, but after three or four hours the improvement in the condition of the animal disappears and death ensues. The survival is only temporary. Summarising the results communicated in this and previous papers, the authors conclude that the only efficacious treatment after heavy loss of blood appears to be transfusion.—P. **Appell**: Addition to the note on an ordinary differential equation connected with certain systems of linear and homogeneous partial differential equations.—H. **Douvillé**: The geology of the neighbourhood of Argeles and the Pic de Gez.—P. **Termier** and W.