white to ruby and sapphire, at prices ranging from four to ten shillings a carat, according to colour, quality, and size.

Whatever may be their economic importance, a very much debated question, there can be no doubt as to the scientific interest of this group of artificial gems. In the first place, it is a matter of some interest that a mass of fused material formed in this way should not only be crystalline, but possess all the characteristics of a single crystal. Crystallographers are agreed that each boule is a single crystalline individual, with the axis roughly perpendicular to the plane of formation—that is to say, running from the point of attachment of the pedestal to the top of the mass.

Then there is the matter of coloration. One would like very much to know what is the state of combination of the chromium in a ruby, and whether the colour is produced by chromium aluminate in solution or metallic chromium in molecular suspension.

A point of more practical interest is the fact that although the artificial corundum is a true crystal, it possesses the shape and formation of a congealed liquid or glass. The practical interest of this lies in the fact that it affords the only means of distinction between this artificial corundum and the naturally formed gem-stone. Being of exactly the same composition and crystalline structure as the natural mineral, it cannot be identified by any of the physical tests I briefly referred to above. For all practical purposes, the artificial ruby *is a ruby*, and one can only deny that it is a "genuine ruby" if this

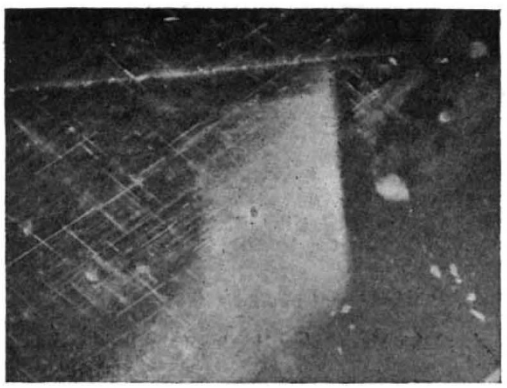

FIG. 3.—Section of Natural Ruby, ×100.

word is held to connote essentially a product found in the earth and not made by man.

And yet, owing to the curious anomaly of its structure, the artificial product can almost invariably be distinguished from the natural with the greatest ease. In the naturally formed stone any foreign matter which may be present is coerced into following the lines of growth of the crystal, and more particularly bubbles of gas which may be present in the liquid are distorted from their natural shape so as to accord with this symmetrical growth. It is the great exception to find a natural ruby entirely free from such inclusions, which generally form irregular cavities with a decided tendency to geometrical shape.

In the great majority of cases examination of the cut stone with a lens is sufficient to decide the artificial process of formation, but in doubtful cases a more minute examination may be made by placing the stone in a little cell filled with highly refracting liquid, in order to secure regular illumination, and examining it under the microscope by transmitted light, when the minutest trace of structure can be detected. In the case of an absolutely flawless stone it would be impossible to decide whether it were natural or artificial, but such stones are so rare that this case is almost theoretical.

Reconstructed emeralds have been made by the Verneuil process, but these are, of course, amorphous, and do not possess the double refraction and other properties consequent upon the crystalline structure of the natural stone. The problem of producing this stone artificially has not as yet been solved.

The opal ranks with the diamond in resisting attempts at artificial production, and is even superior to it in that it cannot be really successfully imitated.

The peculiar lustre of the pearl, like the colour of the opal, is due rather to its structure than its composition. It is formed in the oyster by the deposition of successive layers of calcium carbonate round some central object, and consists of an innumerable number of thin overlapping laminæ of the crystalline variety of this substance known as aragonite. These layers being semi-transparent, the light falling on the surface is partially reflected from the surface and partially transmitted into the stone, where it suffers reflection from the surface of lower layers.

Perhaps the well-known Japanese pearl may be correctly described as artificial pearl, although the oyster has a great deal to do with it.

Such pearls are formed by introducing a mother-of-pearl shape between the shell and mantle of the oyster, and then leaving the oyster alone for a time to allow it to convert this into a pearl by the deposition of several layers of nacre. The mass is then removed from the shell and converted into the semblance of a true pearl by supplying a back of mother-of-pearl. Such pearls, however, never have the fine orient of those produced under normal conditions, and they can readily be detected by examining the back, when the lustreless mother-of-pearl and the line of junction can be detected.

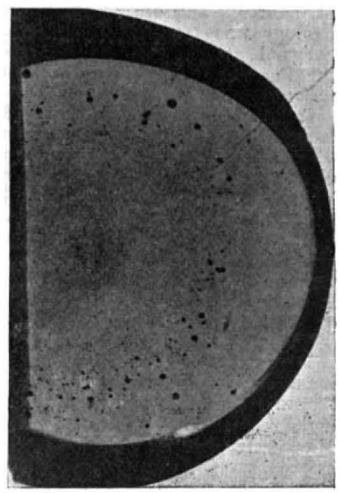

FIG. 4.—Section of Artificial Ruby, ×10.

Nobody has any right to supply anyone with paste under the name of artificial (or synthetic, or scientific, if these names are preferred) gem. I think that the distinction between the two should be clearly recognised, and that it should not be permitted to use the term artificial indiscriminately. At present this is being widely practised; every day one sees offered for sale "rubies, emeralds, sapphires, and pearls artificially produced, and having all the properties of the natural stone." Now, as I have indicated, such a thing as an artificial emerald answering this description is unknown, and, as a matter of fact, the stones supplied under this title are, as a rule, nothing more or less than paste imitations, the public being deliberately led to believe otherwise. There is in this case, as I have indicated, a real practical difference between the two articles, not merely a question of opinion.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—In the faculty of medicine an important change in the organisation of clinical teaching is being made. Hitherto this branch of teaching has been quite outside the control of the University. A clinical board appointed by the staffs of the Queen's and General Hospitals has directed the teaching and collected and administered the fees of students. In future the clinical board is to consist of nine members, of whom five will be appointed by the University and four by the two hospitals. The board will arrange all details of clinical teaching, and will nominate to the council of the University persons in the hospitals to act as clinical teachers, who will become members of the University staff. The fees for this teaching will be paid to and administered by the University. In consequence of the new arrangement, medical studies will be recognised by the Board of Education as a "technical" subject, in

aid of which a grant of money may be made—a privilege which could not be allowed so long as a part of the medical curriculum lay outside the control of the University.

CAMBRIDGE.—Mr. A. E. Shipley, F.R.S., Master of Christ's College, and Mr. P. V. Bevan, of Trinity College, have been approved by the general board of studies for the degree of Doctor in Science.

The Rede lecture will be delivered on Thursday, June 8, at 10.30 a.m., in the lecture room of the Botany School by the Hon. C. A. Parsons, C.B., F.R.S.

It is proposed that Dr. Haddon, F.R.S., and Dr. W. H. R. Rivers be appointed to represent the University at the Universal Races Congress to be held in London in July.

LONDON.—Mr. Andrew Carnegie has given a donation of 5,000*l.* towards the building and equipment of the Institute of Medical Sciences of University College.

Sir Felix Semon has offered to the University for the foundation of a lectureship in laryngology the sum of 1,040*l.*, being the amount presented to him by British laryngologists on his retirement from practice. The benefaction has been accepted by the Senate.

The degree of D.Sc. (engineering) has been conferred upon Mr. F. C. Lea, an external student, for a thesis on "Influence Diagrams as concerned with Stresses in Structures" and other papers, and the degree of D.Sc. in geology has been conferred on Mr. R. L. Sherlock, an external student, for a thesis entitled "Relationship of the Permian to the Trias in Nottinghamshire" and other papers.

It has been decided to invite the committee of the fifth International Philosophical Congress to hold the meetings of the congress in the University buildings in the spring of 1915. The following appointments have been made:—The principal (Dr. H. A. Miers, F.R.S.), representative of the University at the celebration of the centenary of the Royal Frederick University of Christiania in September, 1911; Prof. J. D. Cormack, governor of the Imperial College of Science and Technology (in place of Sir Arthur Rücker, F.R.S., resigned); Dr. Thomas Buzzard, governor of Westminster Hospital Medical School.

MANCHESTER.—To enable those taking up farming, estate management, or the teaching of agriculture to obtain a thorough scientific and practical training in agriculture, an arrangement has been made between the University of Manchester and the College of Agriculture and Horticulture, carried on by the Cheshire County Council at Holmes Chapel, by which a scheme for complete courses of instruction in agriculture has been established. A course of study leading to the degree of B.Sc. in agriculture or to the diploma of the Agricultural College may be pursued. The students take lectures and laboratory work in chemistry, physics, and biology, as well as special courses in agriculture, estate management, agricultural chemistry, agricultural botany, agricultural zoology (including entomology). The courses in agriculture and estate management and part of the course in agricultural chemistry and in botany are taken at the Agricultural College. A special prospectus has been prepared giving full particulars of the courses.

Prof. T. W. Richards, of Harvard University, who is to deliver the Faraday Lecture of the Chemical Society, is to receive the honorary degree of D.Sc. on July 8.

OXFORD.—Dr. H. L. Bowman, Waynflete professor of mineralogy, has been appointed secretary to the delegates of the University Museum, in place of Mr. H. Balfour, curator of the Pitt-Rivers Museum, who resigns the office next month.

Dr. W. T. Brooks, Christ Church, has been appointed Litchfield lecturer in medicine as from October next.

Mr. William Bateson, F.R.S., has been appointed Herbert Spencer lecturer for 1911.

THE Edward Kempton Adams research fellowship has been awarded by Columbia University to Prof. R. W. Wood, of Johns Hopkins University.

PROF. R. PATRICK WRIGHT, principal of the West of Scotland Agricultural College, has been appointed agricultural adviser to the Scotch Education Department.

WE learn from *Science* that Dr. E. B. Wilson has been designated Da Costa professor of zoology in Columbia University in succession to Prof. H. F. Osborn, who becomes research professor of zoology.

DR. H. WENHAM, of the Union Medical College, Peking, announces that for the first time in history the Chinese Government has granted a medical degree. Sixteen out of twenty-one candidates have passed the required examinations.

THE University Society of Nottingham and the East Midlands was formed on Saturday last at a meeting held at the Nottingham University College, the object of which is the furtherance of university education in the East Midland counties.

THE West Riding Education Committee has appointed Miss Helen M. Wodehouse to the principalship of the Bingley Training College, which is to be opened in September next. Miss Wodehouse is at present lecturer on philosophy in the University of Birmingham.

IT has been decided that Dr. Roberts, the secretary of the forthcoming Congress of the Universities of the Empire, shall visit Montreal in order to be present at the preliminary Conference of Canadian Universities, which is to be held in the first week of June, to ascertain the views of the Canadian universities as to the most suitable questions for discussion at the congress and to give any information respecting the steps that are being taken in the United Kingdom.

IN the April issue of *The Technical Journal*, which has now been received, a new series of articles on "Famous Technical Schools" is initiated with an illustrated description of the Glasgow and West of Scotland Technical College, by Drs. G. S. Cruikshanks and F. J. Wilson. It is proposed that the series shall not be confined to schools in the United Kingdom, but shall deal, so far as possible, also with the leading Continental and American schools.

THE fifth annual conference of the Association of Teachers in Technical Institutions will be held at Southport on June 5 and 6. Mr. Barker North, of the Bradford Technical College, will deliver the presidential address, and among the questions arranged for discussion are "The Organisation of Higher Technical Instruction," "The Representation of Teachers on Educational Bodies," "The National Organisation of Technical Education," and "The Salaries and Pensions of Technical Teachers." Further particulars of the conference may be obtained from the hon. secretary of the association, Mr. P. Abbott, The Polytechnic, Regent Street, W.

THE record of a notable achievement was contained in the final report of the building committee of the Glasgow and West of Scotland Technical College presented to a recent meeting of the governors. The committee reported the completion of the buildings, the foundation stone of which was laid in May, 1903. The buildings contain about seven acres of floor space, and the cubic contents amount to 7,292,382 cubic feet. Their cost, including professional fees and electric lighting and ventilating installations, was 272,329*l.*, or less than 9*d.* per cubic foot, although they are of the most substantial fireproof construction. The portions of the site not previously in the possession of the college were purchased for the sum of 46,153*l.*, and the equipment of the laboratories cost 34,746*l.*, making a total expenditure of 353,228*l.* The whole expenditure involved in this large undertaking has been met without the incurrence of any debt. The college received grants from the Scotch Education Department of 88,660*l.*, and voluntary subscriptions and donations amounting to 278,603*l.*; a balance of 14,000*l.* is therefore available to meet additions to the laboratory equipment now in course of construction or about to be ordered. These additions include an experimental steam turbine of the multi-stage impulse type and

of 200–250 horse-power; also a larger turbine of the reaction type. A high-speed paraffin engine of 40 horse-power and a four-cylinder petrol motor have been presented recently to the laboratory. The development of the college has kept pace with the increased accommodation. Last year a school of navigation was established, and its success has justified the governors in contemplating the purchase of a sea-going training vessel. A lectureship in sugar manufacture has also been instituted. Mr. Alfred Campion, who was appointed lecturer in metallurgy two years ago, has been raised to the rank of professor.

A MEETING of the Association of Teachers in Technical Institutions was held on May 20 at the Cardiff Technical School to consider the formation of a South Wales branch of the association. There was a representative attendance of technical teachers from Cardiff, Swansea, Newport, and the county of Glamorgan. An address was delivered by Mr. P. Abbott, the honorary secretary of the association, on "The Aims and Work of the Association." Mr. Abbott said technical education was the last branch of education to be organised, and consequently technical teachers were the last to band themselves together for the purposes of joint action. The organisation of technical education has not yet gone far, and it is probably safe to say that in this respect we are ten years behind Scotland and twenty years behind Germany. It must be recognised that conditions are changing, and that the extent of the prosperity of a country in the future will be determined more and more by the number of skilled and highly trained industrial experts that it possesses. If this work of organising technical education is to be efficient there must be cooperation. On one hand are those whose business it is to organise, administer, and finance technical education; on the other there are the teachers with an acquaintance with the calibre and the economic conditions of the students. The two classes are complementary, and for true progress the teachers must make their contributions to the solution of the problems involved. Facilities must be provided for the interchange of views and the formulation of opinions. Hence the association has the highest of all claims for the support of technical teachers. Mr. Abbott dealt at some length with the work done by the association, and especially in connection with examinations and curricula. In many respects, he said, the technical teacher is to-day in a relatively worse position than any other section of the teaching profession. Returns showed that the full-time technical teacher is usually paid worse than the secondary-school teacher. In conclusion, Mr. Abbott emphasised the national character of the association. A resolution was passed unanimously in favour of the formation of a South Wales branch.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society May 18.—Sir Archibald Geikie, K.C.B., president, in the chair.—Prof. W. M. **Bayliss**: The properties of colloidal systems. II.—On adsorption as preliminary to chemical reaction. The existence of an "adsorption compound" containing acid and base uncombined chemically, and which can be isolated, is described, together with the manner of its conversion into the true chemical compound or salt. It is shown that a similar kind of compound is formed between an enzyme and its substrate, preliminary to the particular chemical change brought about by the enzyme in question. Adsorption between enzyme and substrate as affected by the presence of neutral salts is investigated, and found to follow the laws of "electrical" adsorption. The relation between the concentration of an enzyme and its activity is shown to be expressed by an exponential formula, the value of the exponent varying considerably according to circumstances. In certain conditions it may be unity, and in others the square root, but is usually between the two. Accordingly, the view that the rate of an enzyme action at any given moment is a function of the amount of the adsorption compound of enzyme and substrate in existence at that time is to be regarded as fairly well established.—S. M. **Jacob**: Inbreeding in a stable simple Mendelian population, with special reference to cousin marriage. The paper investigates, on the basis of Mendel's conception of the segregation of unit-characters, the proportions of different types among the offspring resulting from alliances of various degrees of inbreeding. A detailed examination is made of the consequences of first-cousin marriages, the form of inbreeding most frequently met with in actual human populations, while unions of other degrees of affinity, both those closer and those more remote, are also considered. The important point is brought out that for an evil which is a Mendelian recessive and is of common occurrence, a first-cousin marriage will not be much more likely to produce defective offspring than any other kind of marriage, but that a very rare recessive evil is relatively far more readily developed by such a consanguineous marriage. Now it is probable that there are very many of these rare defects latent in man. As the chance of a *particular* one of these appearing is increased by cousin marriage, the appearance of any random one of the large number is rendered much more probable by such a union. The same is true, on the Mendelian hypothesis, for any desirable qualities when such can be shown to be recessive. It is also established that the relative frequency of the appearance of the allogenic constituent in the offspring of related pairs diminishes by about one half for each grade of cousinship, so that the efficacy of cousin marriages in developing the recessive character diminishes with the grade of the marriage. In general, inbreeding accentuates both the pure dominant and the pure recessive strain to the same extent and at the expense of the hybrid element.—Miss M. **Wheldale**: The direct guaiacum reaction given by plant extracts. Previous work on oxidising enzymes has led to the interpretation of the direct blueing action in terms of the activity of a system consisting of an organic peroxide in conjunction with a peroxidase. The author finds that the power to give the direct action possessed by water-extracts of tissues is accompanied by another phenomenon, *i.e.* the formation of brown of reddish-brown pigments in the tissues on exposure to chloroform vapour. Both phenomena are characteristic of certain natural orders, but are absent from others or are characteristic of certain genera only in an order. When the direct action is not given, the plant extract will blue guaiacum on addition of hydrogen peroxide (indirect action), and the tissues do not show change of colour in chloroform vapour in the same period of time. The phenomenon of direct blueing of guaiacum is considered by the author to be the outcome of the presence of the dihydric phenol-pyrocatechin in the plants examined. Pyrocatechin is oxidised on the death of the tissues, and then acts as a peroxide, enabling the peroxidase, which is almost universally present, to transfer oxygen to the guaiacum. These conclusions are based on the following evidence:—(1) that pyrocatechin can be detected in plants (such as have been examined) which give the direct action and show change of colour in chloroform, whereas it cannot be detected in plants lacking these characteristics; (2) that solutions of both chemically prepared pyrocatechin and the actual plant product, after oxidation in air, will give a direct action with guaiacum and peroxidase only. The same result is not obtained with phenols having the hydroxyl groups in other positions. Hence the *direct* guaiacum reaction has, in all probability, no real significance as such in plant metabolism, but is merely the outcome of the presence of a certain metabolic product.—Dr. A. **Theiler**: Transmission of amakebe by means of *Rhipicephalus appendiculatus*, the brown tick. This is an account of experiments carried out at Pretoria, confirming the result arrived at by the Sleeping Sickness Commission during 1909, that the disease of calves in Uganda, known as amakebe, is in reality East Coast fever. It was arranged with the Government veterinary surgeon in Uganda, Mr. Hutchins, to send to Dr. Theiler nymphæ of *Rhipicephalus appendiculatus*, the brown tick, collected from calves in Uganda suffering from amakebe. On several occasions Mr. Hutchins forwarded ticks, which arrived at Pretoria alive and in good condition. The nymphs in transit moulted into the adult stage. Two experiments were performed to ascertain whether brown ticks, collected as nymphæ in Uganda from a calf suffering from amakebe, will transmit the disease when placed on susceptible calves in the