may be informed exactly how to carry out the invention after the monopoly has expired. If the industry carry out the invention as described, there is ample evidence of use, but in the large proportion of cases the public do not wish to avail themselves of the privilege. Cases are known of specifications being quoted forty years after being filed, during which period there had been no use in accordance with the specification. If the industry has not exercised the privilege of use, and the subsequent inventor has eliminated the defects that prevented the previous patent from coming into use, surely he has good ground for claiming that he has produced a new manner of manufacture.

No less than 16,172 patents were sealed in 1907. Of these 677 were paid up for the sixteenth year in 1922, *i.e.* 4·2 per cent. Of these 677 patents, excluding ordnance, less than 100 related to mechanical engineering. When we realise that only one mechanical patent in 10,000 is worth exploiting, and the industry has to bear the cost in brain power, fees, etc., it seems probable that it would be cheaper for the industry to associate to test designs such as is now being done for research, standardisation, and the other associated activities.

The chief difference between research and invention is that, when conducted by an association of the industry, the results belong to the industry, but the rights of a patented invention belong temporarily to the patentee. The mind of an inventor is liable to exhibit a preference for those designs which may become subject-matter for a patent. The mind of the research worker should be quite free from such restraint, the only object being the best possible result suitable for general adoption and, in some cases, standardisation. It is remarkable that when fixing standards it is seldom, if ever, the British Engineering Standards Committee has wished to adopt an appliance that has been the subject of a patent. The activities of research associations, learned societies, technical colleges, and the British Engineering Standards Association will undoubtedly increase and perform a great many of the duties that in the past were performed by patentees.

Sir John gave an account of the various bodies which are promoting research, and said that it would take too long to give a complete list of the researches in progress—researches that no single firm could carry out wisely or successfully. Such researches can be undertaken only by associations, which those interested ought to assist in every way possible for the benefit of the industry as a whole. Every one who uses knowledge successfully ought to do something to obtain further new knowledge. Sir John desired to impress upon his audience the increasing confidence and hope that, in the future, research will help us to surmount our difficulties. It is of importance that all research workers should realise that by "team" work they must justify and increase this confidence. The nation is watching the result, and critics are not wanting—some are useful and some take a narrow view. We have now opportunities that we never had before, and with British determination we can confidently expect great developments in the future, far exceeding those that have been accomplished in the past.

The New Chemistry.[1]

By Dr. E. F. ARMSTRONG, F.R.S.

IT can be argued that we have just entered on a new stage in chemical investigation. Labours in the main of an analytic type have enabled the exact structure of all but a very few substances to be established: the results have been confirmed by synthetic operations, and most compounds have been built up step by step from their elements. Whilst physicists of the modern school, by a series of most brilliant researches, have learnt much about the nature of the atom, the chemist is now concerned with the behaviour of the molecule. This has entailed the recognition that he has not only to deal with crystals and relatively simple molecules in solution but also to consider actions taking place at the surface of colloid aggregates. As it is probable that the bulk of the reactions in the plant and animal cell are of this nature, their importance will be at once conceded. Further, it must be realised that there is evidence that molecules in solution have a definite space orientation at such colloid surfaces, and indeed according to the work of Hardy at surfaces in general.

According to the accepted space lattice theory of matter, there is a definite attraction causing adhesion between each layer of molecules, and consequently at a surface, say of a piece of glass, there are unsatisfied forces or valencies. At first when a drop of a lubricant is placed on such a surface nothing happens, but when two surfaces of glass are moved over one another the molecules of the lubricant become arranged according to a definite pattern. The chemist to-day, in seeking to explain chemical action, has to realise that this takes place in many instances between aggregates of molecules and at the surface of such aggregates, and not between single simple molecules in solution such as his equations postulate and the ionic theory in its original form demands.

The first fact which has emerged from the detailed study of chemical action at a surface is that the action is not one of the so-called first order in which the same fraction of the reacting substance undergoes changes in successive equal intervals of time—a change expressed graphically by a logarithmic curve. When proper and sufficient care is taken to keep the surface active, the rate of change is uniform, provided that the changing substance is present at the surface in sufficient quantity. These facts are in accord with the hypothesis that action is preceded by the formation of an additive unstable complex which breaks down in all possible ways, that is, into a variety of components, practically as fast as it is formed. The problem of the source of the energy necessary to effect this is not without interest, but it is common to all chemical reactions and its discussion may safely be left to the exponents of the quantum and other theories.

Such actions as we are considering are known as catalytic, the change being effected by virtue of the activity of the catalyst surface, the only other agent involved in practically all cases both in the living cell and the test tube being water. It is now recognised that the water molecule can undergo rupture in two ways, either being distributed upon a single molecule, which is thereby resolved into two others:

$$A.O.B + H.OH = A.OH + B.OH,$$

or divided between two molecules in such manner that whilst the one is oxidised the other is reduced:

$$A + 2H.OH + B = AO + H_2O + BH_2.$$

Entirely different classes of catalysts bring about the two actions, but all are classed as enzymes when

[1] Synopsis of an address delivered to the South Wales Section of the Society of Chemical Industry on November 8.

concerned with changes which take place in the cell. Such enzymes as are well known are highly specific and selective, a different enzyme being required for each class of compound.

Armed with the knowledge of the fundamentals of chemical action in the cell, the time is ripe for the chemist to ascertain the inner meaning of phenomena which the biologist can investigate only by the recording of external visual characteristics. As a case in point, the coloration of flowers and its inheritance may be cited. There is much in favour of the view that flower colours, whether anthocyans or belonging to other groups, are the product of the interaction of two factors, an oxidase and a colourless precursor of the pigment. The absence of either factor means failure to develop colour by the plant, that is, white flowers, and there may also be a third factor present which prevents action taking place between oxidase and leucobase.

If proper combination of effort between the biologist and chemist can be ensured, numerous baffling problems, many of which are of far-reaching economic importance, can be attacked. As illustrating one such, in which that all-essential factor quality is concerned, the puzzling fact well known to agriculturists may be mentioned, that one pasture can fatten stock whereas another is of very little value for this purpose.

University and Educational Intelligence.

CAMBRIDGE.—Dr. Horace Lamb, Trinity College, has been appointed to give the first Rouse Ball lecture on some subject related to mathematical science.

Mr. M. H. A. Newman has been elected a fellow of St. John's College.

It is proposed that the sum of 3030*l.* bequeathed to the University by Mrs. Amy Price Read, shall be devoted to the establishment of a research scholarship similar to the Allen scholarship. In the years when the Allen scholarship is confined to literary subjects of study the Amy Price Read scholarship is to be confined to scientific subjects and vice versa. The scholarship would be open to women students who have been admitted to the titles of degrees on the same terms as to graduates of the University.

LONDON.—The degree of *Ph.D. in Science* has been conferred on Fanny Lowater (Imperial College—Royal College of Science) for a thesis entitled "A Study of the Band Spectrum of Titanium Oxide."

THE use of wireless for university extension work has progressed rapidly in America. Of fifty-seven universities and colleges possessing broadcasting stations at least two—the University of Michigan and Michigan Agricultural College—have organised regular radio extension courses, and the National Radio Chamber of Commerce is developing a plan for establishing other similar courses.

THE Council of Armstrong College, Newcastle-on-Tyne, has appointed Prof. A. S. Ferguson, Ontario, to the chair of philosophy rendered vacant by the departure of Prof. R. F. A. Hoernlé to the University of the Witwatersrand, Johannesburg. Prof. Ferguson is a student of St. Andrews and Oxford, and has contributed articles on Plato to various periodicals.

THE directors of the Leplay House educational visits abroad are taking a group of their members, and others who care to join, to Spain for the Christmas vacation, leaving London December 22, and returning January 6, or with extension January 13. Modern social, economic, and political problems will be touched upon both from the point of view of the peasant life and the city life of to-day. A course of lectures will be included in the programme. Full particulars can be obtained from Miss Margaret Tatton, Leplay House, 65 Belgrave Road, Westminster, S.W.1.

A DEPARTMENT of Geology, Mining, and Metallurgy has been established by the Benares Hindu University under the direction of Prof. N. P. Gandhi. This development was made possible by a gift of Rs. 200,000 by the Maharaja of Jodhpur, who has also endowed a Jodhpur-Hardinge chair of technology. At present the staff of the department comprises two professors—of mining and metallurgy and of geology—an assistant professor of assaying and two demonstrators.

Two travelling fellowships open to women graduates of Great Britain, each of the value of 1000 dollars, are being offered through the British Federation of University Women, 92 Victoria Street, S.W.1. One is offered by the American University Women, to enable the holder to carry on a year's research in any foreign country she may choose. The other, the Rose Sidgwick Memorial fellowship, also endowed by the Americans, offers the same amount to enable a British woman graduate to carry on a year's research or advanced work at an American university, the choice of the university being left to the holder.

IN an article on the Rhodes Scholarships in the *Empire Review* for October, Mr. Ian D. Colvin celebrates the "coming of age" of the great scheme founded in 1902. He remarks that it is yet too young for us to judge of its fruits, as scholars have not yet had time to reach maturity and make their name in the world: he accordingly confines himself to an appreciation of the character of the founder and his aims in founding the scholarships, and a description of the administration of the trust. President Frank Aydelotte, of Swarthmore College, the American Secretary to the Rhodes trustees, is less cautious, having attempted in "Oxford of To-day" an estimate of the influence exerted by the American Rhodes scholars. In the first place he points out that they have, almost to a man, returned to America, and there is a consensus of opinion that they go back better Americans for their Oxford experience. Only one of them has become a British subject. More than a third of them are engaged in educational work, and of these many are already college professors, deans, and presidents. "Perhaps there is no career in the United States at the present time which represents more accurately what Rhodes thought of as public life, no career which offers a better opportunity to influence public opinion than that of professor or administrative officer in one of our American colleges or universities." One of them is United States Commissioner of Education, and as head of the Washington Bureau undoubtedly exercises very great influence. No account such as President Aydelotte has given for the Americans seems to have been published regarding the careers after leaving Oxford of the other Rhodes scholars. It is known, however, that an occupational census of those who were elected to scholarships up to 1916 gave the following percentages: educational work 32, law 25, business and industry 11, administration and other government service 8, medicine 7, ministers of religion 4, farming 3, social and philanthropic work 1½, journalism and publishing 1½, engineering and mining 1½, other occupations 5.