National Institute of Agricultural Botany.

THE King and Queen paid an informal visit to the headquarters of the National Institute of Agricultural Botany at Cambridge on Friday, October 14. They were accompanied by Princess Mary, and the suite included the Minister of Agriculture, Sir Arthur Griffith-Boscawen. Their Majesties were received at the institute by Sir Lawrence Weaver, chairman of the institute, and Lady Weaver and Mrs. Brinton, chairman and founder of the Housing Association for Officers' Families, by which the fourteen houses adjoining the institute have been built for the accommodation of officers' widows and disabled officers. After the presentation of a number of visitors and members of the council of the institute, the Royal party were conducted round the buildings by Sir Lawrence and Lady Weaver and the director of the institute, Mr. Wilfred H. Parker. They were shown an exhibit of wheats and barleys by Prof. Biffen and Mr. E. S. Beaven, the different processes of seed-testing by Mr. C. B. Saunders, chief officer of the Official Seed Testing Station, and a collection of potatoes arranged by Dr. Salaman and Mr. H. Bryan, the superintendent of the Potato Testing Station, Ormskirk. The Royal party were then conducted to the council room, where they made the first entries in the visitors' book, and, after the King had planted a mulberry tree in front of the institute to commemorate his visit, inspected the domestic quarters. Mrs. Brinton then took their Majesties to visit the houses occupied by officers' widows, in front of which a second mulberry tree was planted by the Queen.

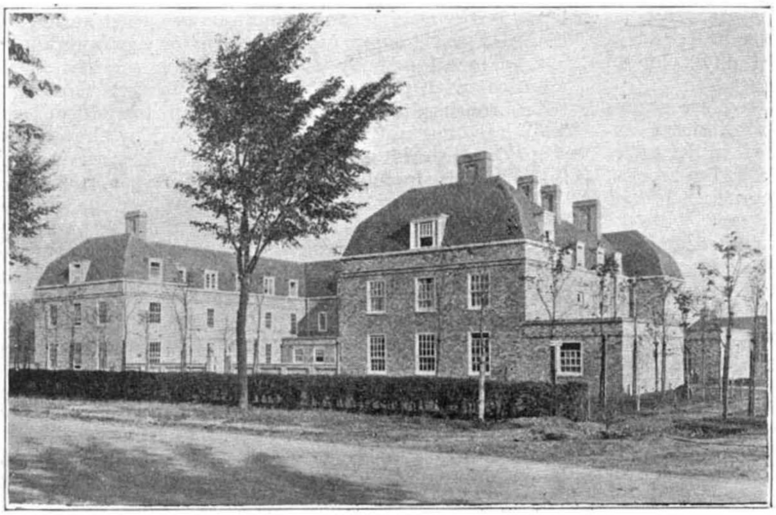

FIG. 1.—National Institute of Agricultural Botany, Cambridge.

The necessity for such an organisation as the institute became very apparent during the latter years of the war, when the imperative need for an increase of food production led the Government to introduce a measure of seed control. This resulted in the establishment, in the autumn of 1917, of the English Official Seed Testing Station, and it was from the study of Continental methods of seed control that the National Institute of Agricultural Botany came to be founded in the early part of 1919 by Sir Lawrence Weaver, now the Second Secretary of the Ministry of Agriculture and Fisheries, who has been responsible for the administration of the new control of seeds. The institute has been modelled generally on the lines of the famous Svalof organisation in South Sweden.

The institute was constituted as a charitable trust. Large contributions to the trust fund were received from Sir Robert McAlpine and Sons, Viscount Elveden, members of the agricultural seed trade of the United Kingdom, the milling industry, and other agricultural trades, while a generous gift of a 334-acre farm at St. Ives, Huntingdon, was made by Mr. Fred Hiam, of Cambridge. The national importance of the scheme was recognised by the Development Commissioners, who have provided a grant on the *1l.* for *1l.* basis.

The director of the institute, Mr. W. H. Parker, was appointed in April, 1920. Prof. R. H. Biffen, the director of the Plant Breeding Institute at Cambridge University, is one of the vice-presidents of the institute, and works in the closest co-operation with it.

The institute's headquarters buildings have only recently been completed, and were formally opened by Sir Lawrence Weaver on Friday, October 7. They are situated in Huntingdon Road, Cambridge, about $1\frac{1}{2}$ miles from the town, and were designed by Mr. P. Morley Horder. The thirty acres surrounding the buildings will be utilised as a trial ground. In addition to this, the institute owns the Hiam Farm, St. Ives, Huntingdonshire, referred to above, and a farmhouse and 39 acres of good market land at Ormskirk, Lancashire, which are used as the Potato Testing Station.

The work of the institute is divided into three main branches:—

(*a*) *The Crop Improvement Branch.*—The improvement of farm crops will be achieved by the testing of promising new and re-selected varieties of all kinds of plants of the farm which may be handed to the institute by the Plant Breeding Institute of Cambridge University, other similar organisations, and individual plant-breeders, the multiplication of those stocks which have shown the best results as to yield and quality, and the subsequent marketing through existing trade channels of those varieties which, after further close observation, are approved by the institute. The growing-on of the new varieties to a commercial scale will be undertaken at the Hiam Farm, St. Ives, and also by contract with farmers in different parts of the country.

(*b*) *The Official Seed Testing Station for England and Wales.*—The administration of the English Official Seed Testing Station has been delegated to the institute by the Ministry of Agriculture. The greater part of the headquarters buildings at Cambridge is now occupied by the Seed Testing Station, which had hitherto—since its formation—been inadequately housed in temporary premises in London. The station is now the largest and best-planned in the world.

(*c*) *The Potato Testing Station.*—The institute carries out at its Ormskirk station the highly important potato immunity trials, which establish the immunity or otherwise of different varieties of potatoes from the great scourge of wart disease. This work is delegated to it by the Ministry of Agriculture, but the institute also holds trials to establish the time of maturity, yield, and quality of potatoes.

Synonymity in potato varieties has long been a

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source of loss and confusion to potato producers and merchants. The synonym committee of the institute, consisting of experts both scientific and practical, makes an annual report which declares which of the varieties entered for the immunity trials under new and distinct names prove to be identical with varieties already in the market.

During their visit the King and Queen were able to see the normal work of the Official Seed Testing Station at progress in most of the laboratories. The exhibits of cereals and potatoes arranged in two of the laboratories enabled the visitors to realise the scope of the other branches of the institute's work. Their Majesties were keenly interested in everything that was shown to them, inquiring minutely into the processes of seed-testing, and paying special attention to the methods of potato-breeding and the measures taken to check the spread of wart disease. At the close of their visit they expressed to Sir Lawrence Weaver their complete satisfaction with all that they had seen and their admiration of Mr. Horder's planning of the buildings and the arrangements made to secure the efficiency and comfort of the staff.

Chemical Reactivity and the Quantum Theory.

By Dr. Eric K. Rideal.

THE recent discussion held by the Faraday Society on modern developments in the theories of catalytic chemistry gave rise to an important debate concerning what has been termed the radiation theory of chemical action. It is now almost generally accepted, both by the protagonists and by some of the opponents of this theory, that molecules of the same species in a reacting system may differ from one another in what is termed chemical "activity." Thus in a mixture of hydrogen and oxygen a certain fraction, both of the hydrogen and of the oxygen molecules, are "active." Collision between active molecules of the two species results in chemical combination; collision between inactive molecules produces no chemical change.

It is further argued by the supporters of the theory that true monomolecular chemical reactions exist, *e.g.* the conversion of allotropes, the dissociation of a diatomic gas, or the decomposition of substances like phosphine or ammonia; consequently, as pointed out by Perrin, "active" molecules must exist *per se*, and reaction is not the result of a particular kind of directive collision, or, indeed, of a collision taking place at some particular phase of the molecular vibration; the decomposition of phosphine thus finds an analogy in the disruption of radium.

Granting that this assumption is correct, attention has to be directed to the source of energy of activation. The opponents of the theory, who go as far as to admit the validity of the first postulate, affirm that this energy resides within the molecule itself, and may possibly be identified with the "null punkt" energy at absolute zero.

The supporters of the radiation theory adopt the hypothesis that the energy of activation is acquired from the circumambient radiation, and that in consequence all reactions are in the broadest sense of the term photochemical. The energy supplied to one molecule so as to make it "active" to undergo the given reaction, whether it be explosion or combination with another active molecule, is assumed to be supplied by radiation of a particular frequency, and in amount equal to $h\nu$, where h is Planck's constant.

For all the ordinary chemical reactions the amount of energy of activation to be supplied, as calculated by application of the fundamental equation of Arrhenius to the temperature coefficient of the reaction, is sufficiently small as to permit of the utilisation of quanta in the infra-red portion of the spectrum; for some reactions, however, visible or ultra-violet light will be necessary, whilst for accelerating the rate of change of radio-active decomposition ultra-X-rays would be required.

The equation of Wien on radiation intensity, and of Arrhenius on the temperature coefficient of chemical reactions bear a formal resemblance to one another, and it is not doubted that the same fundamental properties of matter and of radiation account for the similarity. It is further admitted that the quantum theory of Planck, applied by Bohr to the internal structure of the atom, is likewise valid in many physical and chemical operations, such as calculation of the latent heats of change of state, the heats of formation of chemical compounds, including heats of ionisation and the photoelectric effect. More recently the quantum theory has been applied with success to a general study of reaction kinetics, and it is now evident that there is no essential difference between a typical monomolecular chemical reaction, such as the decomposition of phosphine, and a physical reaction like evaporation. It cannot be doubted that both physical and chemical forces are identical in their nature and also in their mode of action.

The opponents of the theory admit these premises, but see no reason to assign to radiation the important *rôle* given to it by its adherents, and prefer to attribute the two phenomena to some common, but as yet unknown, property, giving rise to these apparent similarities.

The supporters of the theory point out that in fact many photochemical reactions do exist, and, thus admitting the possibility of the direct action of radiation on matter in causing both physical and chemical change, there is no reason why this property should not be universal.

In the development of the theory in its quantitative aspects, however, certain difficulties have arisen necessitating a modification of the simple theory originally proposed; thus the rate of decomposition of phosphine has been accurately determined over a wide range of temperature, the frequency of the radiation necessary to bring about its decomposition calculated from the reaction temperature coefficient, and the amount of energy flowing into the reaction chamber per c.c. per second at the observed temperature calculated from Planck's law. It has been found that there is not enough energy supplied by radiation to account for all the explosions actually observed.

To account for this serious discrepancy several hypotheses may be advanced. Thus we may assume that during the explosion of one phosphine molecule, which has already been activated by the absorption of one quantum of radiant energy, energy is radiated and absorbed by another molecule or by other molecules. Since it is not permissible to assume absorption in fractions of a quantum, it is necessary to adopt an hypothesis of activation of the phosphine molecule by a number of smaller quanta (infra-red)

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