atoms of oxygen, silicon, aluminium, magnesium, iron and the rest are known with considerable accuracy. But the remarkable properties of clay are dependent on the behaviour of the larger flake-like assemblages of colloidal dimensions, which lie between the direct observation of the X-ray methods and those of the microscope.

In dielectrics the slow changes of time bring about rearrangements, hastened by the electrical tensions to which the material is subjected. The electrical forces look for the weakest point for a break-through, just as a stress discovers the weakest point of a chain or any member of a structure. Changes are therefore important. One would wish that a structure was like the "Deacon's shay", which was so designed that every part was as strong as every other so that when the shay came to its end, it became a heap of dust upon the road. Unfortunately, that is not the case with any material in use: and whatever its structure an equal balancing is apt to be destroyed by changes in its grain-like condition.

Perhaps the structure of the huge protein molecules may suggest a way of closing the gap in our knowledge and our means of inquiry. It is a very striking fact that their magnitudes tend definitely to group themselves about certain values, which, moreover, are simply related to one another. They are not mere groups of atoms thrown together without design. Their definite formation implies obedience to rules which must be in force at the beginning of the assembling, and are in force until an unavoidable result is reached. This would mean, as indeed a vast number of observations already imply, that the junction of carbon atoms is governed by strict geometrical laws of distance and orientation. It has indeed been pointed out by Dr. Wrinch and others that the long chains consisting of two carbons and one nitrogen in regular succession can be formed, under the guidance of the rules mentioned, into space-enclosing sheets presenting an external appearance of linked hexagons, and the number of sizes to which these assemblages can attain is limited. Possibly we have here an example of a form of procedure from the groupings of a few atoms to the larger assemblages of thousands, the process depending on a certain obedience to laws of building which have been shown to hold in the simpler case. We are encouraged to hope that this may be so, by the unexpected strictness and definiteness of the building rules in the cases which fall within the scope of the X-ray methods.

The constitution of the solid body is being examined now as it has never been possible to examine it before. We are not surprised that it is found to possess a grain-like structure, or that this structure is of first-rate importance. It is not only of interest from the purely scientific point of view, but also it turns out to be of fundamental importance to all the constructive work of industry and to all the examinations of living constructions within the domain of biology. In the effort to know its details and to understand their significance a host of interesting scientific inquiries make their appearance, so that industry and science more than ever play into each other's hands. It is certainly to be expected that from these tempting labours there will result much improvement of natural knowledge.

Progress in the Transport and Storage of Foodstuffs

THE work of the Food Investigation Board is carried out in the interests of the general body of consumers in Great Britain and is directed to reducing waste and improving the variety and quality of foodstuffs generally available by the application of scientific knowledge to the problems of storage and transport. The annual report of the Board*, besides describing the Board's activities, includes, in the report of the Director of Food Investigation, a concise statement of the progress of the investigations carried out during the year under review, many of which have not yet reached the stage at which full publication of the results is feasible. The keynote of the Board's activities in 1936 was its co-operation with other bodies interested in similar problems of food preservation in different parts of the world. The British Commonwealth Scientific Conference met during September 1936, and the members visited the various experimental stations maintained by the Board, namely, the Low Temperature Research Station at Cambridge, the Torry Research Station at Aberdeen, and the Ditton Laboratory at East Malling in Kent. The seventh International Congress of Refrigeration was held at The Hague in June 1936 and was attended by several members of the Department of Scientific and Industrial Research. A number of visits abroad were paid by members of the Food Investigation staff: thus

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Dr. A. J. M. Smith proceeded to South Africa to consult with the authorities there on a number of questions relating to the export of foodstuffs ; Dr. R. G. Tomkins went to Palestine to discuss questions relating to the transport and storage of citrus fruits ; Dr. E. C. Smith was present at the opening of the new laboratories of the Kältetechnische Institut at Karlsruhe, and finally Dr. F. Kidd, superintendent of the Low Temperature Research Station, proceeded to South Africa to act as chairman of a commission set up by the Government there to inquire into matters connected with the export of deciduous fruits.

A 'refresher' course was held at Cambridge, in co-operation with the National Institute for Research in Dairying, the Fruit Preservation Research Station, Chipping Campden, and the Torry Research Station, and was attended by members of the Services, of research associations and of the scientific and technical staffs of various firms. Members of the Engineering Committee attended meetings of a consultative group, consisting of representatives of the manufacture of refrigerating plant, and of the consultative group which represents the shipping industry, thus having brought to their direct notice the actual problems encountered in commercial practice.

The Board has arranged for the preparation of a report dealing with the application of thermodynamical methods to the equilibrium state in biological systems, including industrial applications of the biological sciences, and also of a report summarizing our present knowledge of the chemistry of the apple.

The Board makes a special reference to its relationship with home agriculture, pointing out that the distinction between production, on one hand, and transport and storage, on the other, is justified on the grounds of expediency alone. It is obvious that where the agricultural product is to be stored or to receive other special treatment, production and research in production must have that end in view. Producers require a specification towards which to work ; the preparation of that specification is the task of the Board. Although research has not gone far enough to make such specifications possible yet to any great extent, still it is already possible in some measure to specify, in scientific terms, what is required of the producer in an apple for storage, in a fish for smoking, and in a pig for the manufacture of bacon. Such specifications will increase in scope and accuracy as research progresses.

It is possible to refer here only to a few of the results obtained in the many scientific researches carried out by the members of the Food Investigation staff. Some of those with a probable immediate practical application will be selected. From the results of investigations at the Ditton Laboratory during the past few years, it appears that the pear responds even more favourably than the apple to gas-storage ; Conference and William's Bon Chrétien varieties can be stored successfully for several months at 34° F. in atmospheres containing 2·5–10 per cent oxygen and 5–10 per cent carbon dioxide. It appears that the successful achievement of long periods of storage depends to a great extent upon bringing the fruit to gas-storage at a low temperature with the minimum of delay after gathering. After removal from the store the fruit ripens more slowly and therefore allows more time for marketing than fruit that has not been stored in this way. It is hoped that this new knowledge will lead to a considerable increase in home production.

The condition known as 'storeburn' is due to excessive evaporation of water and can be prevented if the foodstuff is suitably wrapped. Aluminium foil covered with waxed paper has been shown to be a suitable wrapping for both frozen lambs' kidneys and Sussex poultry, when stored at − 10° C. The birds were trussed and allowed to cool and set (with the heads down) for 16–20 hours at room temperature before storage ; after five months the fowls were thawed and drawn. The guts, including the liver, were found to be firm and perfectly wholesome ; the birds were cooked and eaten and found to be indistinguishable from freshly killed chickens.

Last year it was reported that muscular tissue from the carcasses of pigs that had been overheated before slaughter had an abnormally high electrical resistance ; it has since been found that hams made from these carcasses showed an unusually high incidence of taint. Farm-killed pigs give low values for electrical resistance and a low incidence of taint. The electrical resistance of factory-killed pigs can be reduced to a certain extent by resting the animals before slaughter. The high electrical resistance is associated with a rise in the ultimate *p*H of the tissue after death—presumably due to loss of glycogen during the exercise taken just before death—and a decrease in the rate of penetration of salt during curing, two factors which predispose to bacterial spoilage.

Other interesting results have been obtained on the retention of fertility in eggs during storage, on the storage of potatoes and broccoli and on the corrosion of the tinplate container used for canned foodstuffs, but for the details of these the original report must be consulted. The extracts already given must suffice to indicate the activities of the Food Investigation staff during the past year.

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