though of some practical interest, does not rise above the level of the ordinary works laboratory. A study of the air currents in the chamber, however, revealed the fact that the fan, though seemingly placed where it would circulate the whole body of enclosed air, did as a matter of fact merely puddle in its own neighbourhood, producing powerful vortices on the surface of the brine. This and many similar instances have convinced the Board that the principles which underlie the movement of air in a space partly occupied by solid masses, such as the cargo in a hold, or the carcases in a store, are not clear, and therefore they have arranged that this general fundamental inquiry shall be prosecuted at the National Physical Laboratory.

This example will serve to show how the particular leads to the general; but general solutions are not reached readily, and, therefore, if each particular problem is regarded only as the door to the general, the number of problems which can be undertaken by the small staff at the disposal of the Board is limited.

The papers on the practical engineering aspect of cold storage were so numerous, and the impression which the Congress left upon one was that the progress made on the purely technical side has been so considerable, that it threw into strong relief the inadequacy of our knowledge on the fundamental problems of biology.

A Congress such as the one under review, with its strong international backing, should have been the occasion for a frank review of the situation and for discussions on the fundamental problems with which the industry is faced. The proceedings of these successive congresses could be made to serve as definite landmarks in the history of the science of refrigeration by epitomising the advances made in the intervening years both in pure and applied science, in so far as they relate to the preservation of perishable food-stuffs, and by formulating the general plans of attack on the new problems.

EZER GRIFFITHS.

Mechanism of Cell Growth.

IN the higher plants, new cells are formed and new tissues arise by the activity of certain definitely localised and clearly characterised tissues, the meristems. In the Dicotyledon, these are found at the apex of root and shoot, that is, at either end of the growing axis; in addition, two continuous cylinders of meristem, the cork phellogen and vascular cambium, run lengthwise through the axis and contribute to its subsequent increase in girth. Within these meristems proceeds the construction of new protoplasm, with subsequent mitotic division into new cells as nuclear and cytoplasmic substance accumulates. In such a plant, then, the fundamental metabolic synthesis inseparable from growth, with the subsequent multiplication of the cells of the embryonic tissue, can be visualised as proceeding in strictly localised regions, and the question as to the conditions which promote such growth and division can to some extent be investigated experimentally. Within recent years the meristems have been examined from this point of view. It is clear that if their investigation gives any information as to the condition favouring such a fundamental process as the growth and multiplication of embryonic cells, this information may have very general importance and illuminate a wide range of problems.

From this point of view, an article by Friedl Weber in *Die Naturwissenschaften* for April 18 is of exceptional interest, as it reviews the recent plant physiological approach to these problems from a wide angle and with a wealth of documentation (for citation to original papers referred to below, reference must be made to Weber's paper).

The best known contribution to the conditions governing meristem activity is Haberlandt's theory as to the circumstances which give rise to a new meristem when the plant is wounded and a cork phellogen arises as a result. In this case, cells that have differentiated, and ceased to grow, return again to the embryonic state, and Haberlandt traces this to the effect upon these cells of growth-promoting hormones released from the injured cells. Weber examines the view sympathetically, and has himself used it to explain the forcing of buds from their winter's rest by freezing, narcotics, and various other methods by the assumption that the efficacity of the treatment depends upon the release of such hormones as the result of "physiological wounds" within the bud. Schillings' experiments, however, in which stems of flax and hemp, bent so that they droop earthwards, grow vigorously in the region of the flexure, tell strongly against Haberlandt's view, as this stimulus to growth disappears, although the injury does not, when the shoot is supported in the erect position after bending. But the greatest disadvantage of Haberlandt's view is that it throws no light upon the normal meristematic activity of the uninjured plant.

From this point of view, therefore, Weber finds a wider significance in the views recently developed by Priestley and Woffenden. These investigators similarly start from an examination of wound cork, but the conclusions they reach that its formation depends upon, first, a blocking of the wounded surface, and then an accumulation of sap in the walls and intercellular spaces below this block, enable them by consistent use of the same developmental factors to give a causal explanation of the position of the normal cork phellogen clothing root and stem. Weber then proceeds to a discussion of the more general suggestion as to the conditions for activity of the intercalary meristems of the Dicotyledon recently advanced by Pearsall and Priestley. These authors have pointed out that these two cylinders of meristem appear to be functioning across two reverse gradients of hydrogen ion concentration, the vascular cambium lying between acid xylem within and relatively alkaline phloem without, whilst the cork phellogen has within it the cortex at about P_H6, but outside it cells, the walls of which are bathed in fatty acids with a reaction of P_H3. Weber examines in the light of a wealth of relevant data the suggestion of Pearsall and Priestley that protoplasmic synthesis, and therefore meristem activity, takes place, across this gradient, at the iso-electric point of the cell proteins, the protoplasm at this reaction losing water to cells on either side which, being at other points on the hydrogen ion gradient, swell and vacuolate, withdrawing water from the meristem.

Weber points out that many other physico-chemical properties of the colloidal state of protoplasm are involved in addition to the power of absorbing water, and emphasises that the delicate equilibrium of these properties, which alone permits of protoplasmic synthesis and mitotic division, probably will only be maintained over a limited range of hydrogen-ion concentration. From this point of view, he re-examines Kühns' classical experiments upon nuclear and cell division in Amœba, and directs special attention to the experiments which, by micro-dissection or by other methods, throw light upon protoplasmic viscosity, and show that alterations of viscosity are quite generally characteristic of mitosis and the activities of embryonal cells.

From the same point of view, Weber points out that high temperatures, narcotics, and other factors influencing mitosis are factors capable of influencing protoplasmic viscosity, as shown by Heilbrunn in his experiments upon sea-urchin eggs. Similarly, Koernicke has shown that under X-rays, and Hartmann that at high temperatures, all the cells of the meristem of the root apex vacuolate. Weber also points out that the rounded nucleus characteristic of the embryonic cell suggests a different and more plastic physical state of nuclear protoplasm, so that the shape is more controlled by surface tension than in the case of the variously shaped nucleus of the differentiated cell that has ceased to divide.

Weber marshals much evidence to show that the hydrogen-ion concentration of the medium can affect the physico-chemical state of the protoplasm, and directs attention to Spek's interesting suggestion that at mitosis, a base, the bye-product of nuclein synthesis, escapes into the cytoplasm with consequent swelling of the plasma colloids and as a result a stimulus to increased nuclein synthesis, so that the process is autocatalytic. Spek explains the cessation of cell division as brought about by a change in permeability permitting increased entry of salts, which neutralise the action of the base released from the nucleus. Certainly in the mitosis of sea-urchin eggs the influence of the hydrogen-ion concentration of the medium has been established as in the experiments of Vles and his co-workers. Lyon has shown that the carbon dioxide production during mitosis varies at the different stages recognised by the cytologist, whilst Jacobs has tried to correlate these striking fluctuations in carbon dioxide output with the equally striking viscosity changes. As Weber points out, such fluctuation of carbon dioxide output will influence the difference between the reaction of the egg plasma and the outside medium.

The rhythm of cell division may find some explanation in the respiratory production of carbon dioxide. Thus Lapicque has shown that the reaction of the medium in which Spirogyra is growing is affected by carbon dioxide production in the dark and its disappearance during photosynthesis in light, and Weber suggests that here may lie the explanation of the fact that cell division in this plant occurs only at night.

Starling is cited for the view that the problem of cancer is the problem of the control of cell growth. Recent studies of cancer with physico-chemical methods enable Weber to refer to investigations indicating that the cancer cell owes its peculiar growth qualities to the medium, the tumour plasma, in which it lies, and that one important factor of this medium is hydrogen-ion concentration.

Weber thus brings a very wide range of phenomena of great general interest under review, and points out in conclusion that the suggestion of Pearsall and Priestley, that the hydrogen-ion concentration is a material factor in meristematic growth, admits of experimental investigation, Heilbrunn, Meier, Endler, and Robbins, amongst others, having suggested methods for determining the iso-electric point of the protoplasm.

Cambridge and the Royal Commission.

PROVISIONAL SCHEME.

THE University Commissioners have communicated to the University of Cambridge a provisional scheme for the inauguration and organisation of teaching in the University on the general lines of the recommendations of the Royal Commission. They propose to draft necessary statutes and ordinances themselves to carry out their scheme, but publish their proposals in outline in order to give members of the University an opportunity of expressing their opinion about the proposals.

It is proposed to constitute as from October 1, 1926, eleven faculties in the arts group and seven in the science group. In the science group there are to be agriculture, biology, engineering studies (including aeronautics), geographical and ethnological studies, mathematics (including astronomy and geodesy), medicine, physics, and chemistry. The faculty of biological studies is to be divided into two sections, each with separate departments: A. (1) botany, (2) genetics, (3) geology, and (4) zoology. B. (1) biochemistry, (2) experimental psychology, (3) human anatomy, (4) parasitology, (5) pathology, (6) physiology. The faculty of physics and chemistry is to include the following departments: (1) astrophysics, (2) chemistry, (3) mineralogy, (4) physics.

The separate faculties will be composed of official university and college teachers in the appropriate subjects (including fellows of Girton and Newnham Colleges) and others appointed by the Board of the Faculty. The Board of a Faculty will consist of the professors in the subjects concerned, a certain number of nominees of the faculty, of the Board and of the Council of the Senate, together with representatives of cognate studies. The average number of members of a Board, according to the detailed scheme suggested by the Commissioners, is sixteen.

The new General Board of Studies is to consist of four members elected by the group of arts faculties, four members elected by the group of science faculties, four members of the Council of the Senate, and two persons nominated by the Council, with the vice-chancellor as chairman. The number of university lectureships (and demonstratorships) would be determined by the University for each faculty on the recommendation of the Board of the Faculty and of the General Board. The appointments would be made by a standing committee for each faculty of the vice-chancellor, the head of the department, three members of the Board of the Faculty appointed by the Board, and two persons appointed by the General Board. The normal tenure would be for three years in the first instance, and, on renewal, so long as the lecturer was doing his work satisfactorily, until the retiring age of sixty-five.

According to the scheme, all fees for lectures announced by the General Board would be paid to the University into faculty or departmental funds, the lecturers to be paid a basic wage by the faculty for an obligatory minimum of teaching work, with a scale of increments on the basic salary, with continued tenure of a post, and with additional payments for extra work done. It is contemplated that the University will be able to inform the faculties, before they finally create their new lectureships, how much money, if any, the University can put at the disposal of each faculty board in addition to the fees credited to it.

A great amount of work must lie before the Commissioners and various bodies of the University in getting the scheme into working order; a great amount of work must have been done on it already. It represents the completion of a process which has