knowledge may be our most valuable contribution to the future.

To illustrate the results of disharmony, R. L. Richards (Western Infirmary, Glasgow) discussed present knowledge of the distribution and causes of coronary heart disease, which has to some degree offset benefits from suppression of the principal infectious diseases in developed countries. Several factors associated with affluent society can be shown to contribute, but none can yet be singled out as the chief cause. Heart functions were geared to conditions which have now changed in many ways, for example, by new dietary habits, polluted air, decreased exercise and behavioural stresses.

Data show that the risks of chemical food poisoning are trivial compared with those of bacterial food poisoning; it is more towards clean food that our efforts should therefore be directed.

Genetic risks from certain contaminants of the environment present a relatively new problem which was described by Professor H. J. Evans (University of Aberdeen). Although radioactive fallout has received much publicity, the real danger now may be from chemical mutagens; mercury compounds, for example, causing environmental pollution, as in Sweden, have mutagenic properties at concentrations far below their lethal doses. Most induced mutations must be harmful, and so the hazard from such substances is not only to individual health but to the race.

Sir Dugald Baird (Medical Sociology Research Unit, Aberdeen) considered the effects of affluence on child-bearing, where decreased perinatal mortality has been accompanied by a decline in the birth rate. These can largely be attributed to the greater health and improved care of young mothers and the higher standard of education, together with developments in the field of family planning. New problems have also arisen, however, notably the rise in illegitimacy and the problems of termination of pregnancy. There still exists, too, a section of the community which has not yet benefited fully from improved conditions. What is most important is to continue to improve the quality of life for those who are born.

Dealing with the other end of the age scale, Professor Ferguson Anderson (University of Glasgow) pointed out that while the overall expectation of life is longer, it is not much greater for the very old than it used to be, nor is activity prolonged. The study of gerontology calls for much more effort. In the course of his review he compared old people of Western countries with those of the Far East, who appear thin, mobile and not incontinent, less beset by emotional problems. Retirement poses problems, and it is time for Government, employers and employees to collaborate in working out labour force needs, to allow planned redeployment and re-training of older workers. The old are being preserved, perhaps, but not properly incorporated in our society. Magnus Pyke (Glenochil Research Station) also referred to the structure of affluent society and enquired if the close-knit corporate organization of pygmies in the Congo might not reflect a healthier condition than that of some developed countries. Man can be viewed as an individual or as a component of the multicellular colony of political animals which constitutes a nation. Solution of the biological problem of affluence calls for an understanding of the natural history of the political animal to which other disciplines besides biology must contribute.

PLANT ULTRASTRUCTURE

Looking into Chloroplasts

from a Correspondent

ELECTRON microscopy has revealed that the membranes within the chloroplast have two distinct types of structure: the grana, densely pigmented stacks of circular compartments rather like cylindrical piles of coins; and the fretwork, a loose arrangement of membranes which connect the compartments of the grana in a complex but characteristic manner.

Various explanations of the relationship between the fret membranes and the granum have been proposed during the past ten years. Dominick Paolillo, working with R. H. Falk (*Amer. J. Bot.*, **53**, 173; 1966), first demonstrated multiple helical frets around the granum of *Zea mays*, and later, in collaboration with J. A. Reighard (*Canad. J. Bot.*, **45**, 773; 1967), was able to show a similar fret arrangement in the chloroplasts of the bean plant. It would clearly be interesting to know whether multiple helical frets are common in chloroplasts, and now Paolillo has evidence which suggests that they are a typical feature of the chloroplasts of flowering plants in general (D. J. Paolillo, N. C. MacKay and J. R. Graffius, *Amer. J. Bot.*, **56**(3), 344; 1969).

Multiple helical fretwork means that the flat fret membranes are spiralled round the cylindrical granum rather like the steps of a spiral staircase around its core. Furthermore, there are many fret membranes coiled around a single granum. In 1964 W. Wehrmeyer suggested that a fret may increase the height of a granum stack by overtopping the end of the granum to form additional compartments (*Planta*, **62**, 1772; 1964). This simple picture of enlargement of the granum cannot apply to grana with multiple frets wound around them. Paolillo has found multiple helical frets in the chloroplasts of *Phaseolus vulgaris*, *Zea mays*, *Nicotiana rustica*, *Pisum sativum*, *Cannabis sativa*, *Elodea canadensis* and *Spinacea oleracea*. These plants are frequently chosen for ultrastructure investigations, and were used so that findings could be compared with previous results. Between ten and fifteen helices are wound around each granum according to species, and the ratio of granum compartments to fret membrane profiles averages 2.35 : 1, the exception being *Elodea canadensis* which had a ratio of 2 : 1.

Clearly there must be an intimate relationship between the structure of an organelle and the molecular events that take place within it. It is well known that molecules of chlorophyll are localized on the surface of the grana membranes, whereas the enzymes of the carbon dioxide dark fixation cycle are found in the stroma of the chloroplast. Paolillo sees the significance of multiple helical frets as providing a continuity of membranes and membrane-bounded spaces within the chloroplast, which may well be important for the exchange of metabolites between the grana and the stroma. He further emphasizes that current theories of granum ontogeny cannot account for the occurrence of multiple helical frets, and proposes that membrane continuity is a result of membrane rearrangement and fusion as the system of grana and fretwork matures. The apparently stable membrane structure of the mature chloroplast may be the result of a dynamic equilibrium in membrane formation or a reduction in the rate of rearrangement of the fretwork membranes.