Man and Nature Must Be Partners

SIR HAROLD HARTLEY, *President, Institution of Chemical Engineers, Great Britain*

BY THE YEAR 2000, on the basis of a conservative estimate of world population, an additional food production of over 60% will be required to meet nutritional requirements. Today the increase is barely keeping pace with increased numbers. In the year 1952–53 for the first time the production of food per head in the world is estimated to have reached its prewar value, but the increases were mainly in the advanced countries and not where they are so badly needed. In fact the gap between the richer and the poorer countries is widening—that is the alarming feature.

The armchair solution is increased productivity by modern methods, a billion extra acres in the tropics and 300,000 more in the Northern Hemisphere. But think of the shifts of population and the vast effort that would be involved. Gourou in his relative study in "The Tropical World" has exposed the weakness of the tropics, excepting the flooded rice lands where good crops have been raised for centuries.

With all that science can do, the human problem will remain: the need to change traditions and superstitions, to provide incentives and to break the vicious circle in which malnutrition reduces effort and lowers the food production which is the source of malnutrition itself.

Does the only remedy lie in conventional agriculture with its inefficient use of sunlight? Two ways in which mass culture by microorganisms might help to relieve the world's nutritional deficiencies are now being studied. Agricultural waste materials such as molasses and cellulose can be converted into proteins or fats by appropriate organisms growing under controlled conditions. The production of protein by yeast in this way was not economic and the product was unpalatable. Food processing might cure this and the value of protein will rise.

The other development is potentially more important as it would lead to a more efficient use of sunlight. The inefficiency of the plant's photosynthesis is due partly to the low concentration of carbon dioxide in the air. By increasing this in closed vessels in which organisms like algae can grow, the output of protein per unit of surface can be increased many times as compared with agricultural crops. It is true that an immense area would still be required to make a significant contribution and the biochemical engineering difficulties are great. The problem is being studied in many countries and it is too early yet to say whether an economical solution is possible.

I was once discussing the future of tropical agriculture with Karl Bosch, the head of the prewar German I.G., when he told me that Steinmetz, the genius of Schenectady, had said to him "Bosch, I know that you can make indigo cheaper than God, someday you may make rubber cheaper than God, but you will never make cellulose cheaper than God." There is a basic truth in that sentence. We can make simple materials to compete with nature, we can join together simple molecules in the long chains of synthetic fibers with the repetition of the simple pattern at regular intervals. The patterns of the proteins and polysaccharides, on which in the long course of evolution nature has decided we must live, are far more complex. Nature makes them so cleanly with her enzyme catalysts by some template method, but there is no hope that man unaided by nature will reproduce them. There are limits to the man-made synthetics as Steinmetz saw.

So we are driven to rely on Nature and the hope lies in closer partnership with her in the future in many different fields. She is an exacting partner and when you try to change her ways you must watch her reactions very closely with all the help that science can give. The growing emphasis in research into the processes of life is a good omen for the future.

One thing is certain, the material future will depend on the ever closer working of science and industry and on the closer partnership of man with nature.

(Excerpts from an address delivered at The First Fawley Foundation Lecture, Southampton University, May 20, 1954)