the useful micro-organism

Can man survive civilization?
Academician Ivan Malek, Director of the Institute of Microbiology in Prague,
a member of the Agency's Scientific Advisory Committee
and for many years an adviser to the
Food and Agriculture Organization,
the World Health Organization and UNESCO,
believes he can,
But he also considers that if man *is* to survive
he must study and use all the resources at his disposal —
including the micro-organisms of the planet earth.

Academician Malek posed the question and sketched the outlines of an answer at a morning lecture at the headquarters of the Agency in January. He spoke with enthusiasm and with hope, but he began on a note of warning.

Man, he said, had created in the threat of nuclear annihilation an ingenious caricature of the promise of nuclear power. But this was only one of the dangers he faced. There were, too, dangers inherent in the world's burgeoning population growth and the need to feed man's children; and there was danger in the addition to the environment of factors which are alien to nature - pollution.

"In many cases our knowledge of the ecology is so meagre that when we try to abolish one danger we prepare a new one", said Academician Malek. "Usually it is not so clear-cut as the first, but it can be still more dangerous, as it creeps step by step..."

Ubiquitous Micro-organisms

It was a known fact, said Academician Malek, that micro-organisms could cause trouble in many ways, contributing for example to corrosion of metal parts lubricated by fluids in which they can live. It had been estimated that in factories in Britain alone corrosion from this cause cost industry about £500 million a year. Microbiologists in industrial plants could attempt to reduce this bill by preventing the growth of the damaging micro-organisms. Then again, in the moisture and heat of tropical countries micro-organisms could destroy commonly-used electrical insulating materials within hours.

Academician Malek talked of these ubiquitous micro-organisms as "enemies", citing case after case of their possible harmful effects — such as their role in the spoilage of food. Much food went to waste because it was spoiled, despite efforts to preserve it which included the use of ionizing radiation. And, in any case, some micro-organisms had developed radiation-resistant strains.

Yet there was a positive and more endearing side to the micro-organism. Microbiology could make a major contribution to the closing of the protein gap, the difference between adequate diet and perpetual hunger for millions throughout the world. Academician Malek pointed out that microbiology had already contributed to the population explosion by helping in the alleviation of diseases which had been killers in the recent past — diseases like tuberculosis, diptheria, malaria, meningitis and so on. The problem now was that the population was rising, and the greatest rate of population growth was in countries in which the shortage of food was most difficult to make up.

The Protein Gap

This "shortage" could be traced basically to a deficiency of protein in the diet. How could the gap be overcome? "Naturally, all means should be developed," said Academician Malek. "In reality mankind is trying to find or activate all resources. But we have always to bear in mind that plant production only" (millions receive protein mainly from plant sources) "cannot cover sufficiently this gap, or at least not in time — plants may have a sufficient amont of proteins, but the proteins they do have are usually lacking or have only a low amount of some important amino acids and so on. To solve the problem in the developing countries by the production of meat is very expensive. So we have to have in mind that probably the main way could be or should be using micro-organisms. They have in their biomass a high quantity of proteins, usually 40 to 60 per cent of body weight, and the proteins in them are nearer to animal proteins than plant proteins.

"What is more important, their growth is extremely rapid. If the biomass of a cow is to be doubled it takes several months. If you have one ton of yeast you can double it in two hours. The slowest organisms, algae, take 12 hours. Compare that with a period of several months."

And micro-organisms could usually be grown in waste materials such as molasses, or waste from the fermentation of alcohol. Various types of cellulose waste could be converted for growing micro-organisms.

"There are inexhaustible possibilities in this. Some micro-organisms are able to use hydrocarbons as a carbon source — more good food for micro-organisms. And this is a source which is not agricultural, it could be used very easily without exhausting resources from agriculture. We could introduce a fermentation process into the processing of petroleum. From only 3.5 per cent of the petrol processed today we should be able to cover the gap in proteins."

Experiment in Czechoslovakia

Would protein produced from such a source be palatable to man? It could be said that such protein would certainly not be a carcinogen. That was known. There were admittedly some problems, but such ptotein could be used to supplement the fodder of animals. In Czechoslovakia it was hoped to start an experimental factory to produce about 5000 tons of dry yeast a year, to assess the chances. The main problem was that although it could now be said that protein from such a source would be cheap — cheap enough to be competitive with the price of soya-bean protein in the United States — it was necessary to go as far with economy as possible. This could be achieved only in very large-scale production, which brought some technical difficulties. These must be overcome.

The contribution of the nuclear sciences could be important. On the one hand, radiation techniques could be used to induce mutants in the micro-organism population which contained more, and more of the right sorts, of proteins, amino acids and so on. On the other, a protein production plant could be built in association with the agro-industrial complex surrounding a nuclear installation for the desalting of water. Such a scheme would make economic sense in that the water produced, probably more expensive than a natural fresh water supply, could be used more efficiently than in irrigation of poor desert land in that it would be unable to evaporate into the air.

"I am convinced," said Academician Malek, "that we have to use every effort to use this contribution of microbiology to fill the protein gap. Naturally, it is a first contribution, and we are hoping that we have in our hands still other possibilities for the future, like the production of green algae, which are very efficient transformers of radiation, solar energy, into biomass using CO_2. Algae have a content of more than 50 per cent proteins, vitamins and so on, and the protein is quite palatable. I am convinced that here is another possibility of solving this problem for the distant future. Then again, there is the possibility of cultivating algae on wastes from cities. This could be a very efficient way of producing algae. Even in the present state of knowledge, in our country in conditions which are very far from the best for the cultivation of algae, we can produce the protein on an area of about 100 000 acres for all consumption. It is not economically competitive yet, but this is a problem for the future: how will be the economic calculation? We are paying very great attention, we microbiologists, to this problem."

Academician Malek asked as many questions as he answered; he pointed the way to research which remains to be done — "Even in studies of the population, population growth and changes and so on," he

suggested. "The study of steady states in microbial populations is extremely interesting and important. You would be very much surprised how many features we face in the human society which are parallelled with those we find in microbial studies of the steady state.

"We see that we can form the conditions where the same population is physiologically very active, or dying out. I am sure that we have to do it in our human society and with the human population, study the factors which will cause the human population to die out, to make it really physiologically active. I hope that, in this sense, we can learn something."

Snail fever (schistosomiasis or bilharziasis) affects about 200 million people in tropical or semi-tropical areas. People become infected when bathing or washing in irrigation canals, as in this photograph taken in Egypt for the World Health Organization and issued on World Health Day. The disease, which may have some relation with cancer of the bladder, has been the subject of Agency research contracts. Photo: D. Henrioud