

Health, Disease, and the Population Crisis

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If the problem currently facing mankind was that man develop a global system which would cater to the nutritional, educational and material needs of the world's 4 billion or so present inhabitants, I would be fairly confident that he could achieve a solution within a generation. He could solve the world's hunger problem within 5 to 10 years. Man is ingenious and has developed a technology which can accommodate his ingenuity but I have serious reservations that he can cope with the current population explosion for many more years.

Technically he has the ability to implement actions which could solve both the population and nutritional problems within a few years (the correction of serious ecological disturbances, pollution, social and educational disparities would take some time longer) but he has no means of combatting political, religious and cultural impediments to the solution of what has now become a problem of survival for our civilization at least, and for the species homo sapiens at most.

Man is the only animal which has, to my knowledge, managed to separate the act of coitus from subsequent reproduction. Herein must lie the only painless answer to man's dilemma - if he can apply his knowledge in time. The alternatives will be painful not only to those who will inevitably perish but to those who manage to survive the ravages of those of the Horsemen of the Apocalypse who eventually set out to provide the solution for us.

The prime movers of the human species have been the hunger and sex drives. Biologically these drives preceded man himself by millions of years and have been essential to the very survival of every species which has ever inhabited this planet. Hunger is an essential force to the survival of the individual and the species; copulation on the other hand is necessary only to the point that it ensures the continuation of the species beyond the existing generation. Unlimited copulation, if followed by reproduction, is a luxury affordable only when food supplies are sufficient to meet the needs of both parents and offspring. For man in the 20th century that time has passed.

The ability to copulate is worldwide, although a variety of purely local factors may affect the efficiency of the act if measured by the consequent reproductive rate. The ability to satisfy hunger is not universally attainable and only for about half of the earth's people are a full belly and satisfied appetite not considered luxuries.

Until very recently a system of checks and balances has kept local populations within the limits of survival. Growth of populations was slow but proceeded at a pace which enabled technology to improve food yields at a rate sufficient to meet demand under normal circumstances. A state of ecological balance existed at the global level. Since the industrial revolution the balance has since been tipping away from the point of equilibrium at an increasing rate.

If we represent man's time on earth linearly with a scale of 1" to one century our line would extend at least 250 yards. Twenty inches back from today's mark the world population was probably about 200 million. Approximately 1 1/2" back the population reached one billion, it doubled to two billion in the next inch and doubled again in the last 1/2". At the present rate of growth it will double within 1/3" from today's mark. You have had several lectures on population and food production and I will say little more about them. We are all aware of the seriousness of the problem.

Europe, North America, and Australasia have now fairly low rates of natural population increase and would cause little concern on their own. What is now fashionably called the Third World (a term I don't like because it suggests that it is divorced from us whereas its future is inexorably intertwined with our own) is where the weights are being added to our balance of population vs. food production. Frankly, the situation looks bleak - these underdeveloped countries have had many of the benefits of modern public health services without having had the capital resources

(an educated population, money, etc.) to develop their national economies sufficiently rapidly to offset their population pressures. Their rate of growth of Gross National Product has generally been insufficient to maintain the status quo in terms of education, social services, employment, and agricultural development over the past 10 to 15 years.

George Harrar¹ has pointed out that the underdeveloped countries accounted for 70% of the world population in 1960 but by the year 2000 they will account for 80% of the total. A 10% increase over 40 years may not seem much but numerically it represents an additional three billion people in the underdeveloped as opposed to 400 million in the developed nations.

Desperate and often uncoordinated efforts have been made to improve food production through foreign aid programs operated by the Western Nations. Little effort has been made to effect population control at the same time; indeed public health projects still receive foreign moneys to further reduce infant and general mortality by controlling communicable and other diseases. Much of the money spent directly or indirectly on agriculture has been utterly wasted because of poor planning, lack of knowledge of local conditions and public attitudes. Because of the development of high yield grains through genetic engineering the world was granted a respite in the late 1960's. A few optimists thought that the so-called Green Revolution was the solution to the problem of world overpopulation; as you know the shortfall in foodstuffs is only one facet of the population crisis and while it may appear to be the one of immediate importance, attempts to correct the situation rapidly by increasing food production, even if attainable, will lead to levels of pollution that will probably be the last straw to a tottering world. Tropical farmers were able to improve the yields of many crops during the past decade but to sustain these yields increasing quantities of fertiliser are required each year - the soil is being destroyed and food crops increasingly grown on an artificial chemical medium. As Paul Erlich has pointed out, specialised high yield crops grown on a wide scale will lead to a loss of genetic variability, thus being susceptible to overwhelming disaster². Even if a miraculous sudden control of birth rates could be achieved worldwide, to the point of replacement reproduction only, several Green Revolutions would be required to keep up with a growing population for five or six decades. In fact, because around 40% of the world population is under the age of 15 years and thus has yet to reach reproductive years, the immediate attainment to replacement

1. Harrar, G. *Strategy Toward the Conquest of Hunger*. New York, The Rockefeller Foundation, 1967.
2. Ehrlich, P.R. "Ecology and The War on Hunger". *War on Hunger*, IV, No. 12, 1, 1970.

level reproduction (2.13 children per family) would not result in zero population growth for 70 years. Replacement reproduction is that level at which every woman is replaced by a female offspring surviving to adult age. All the women who will reproduce up to the year 1990 are already born.

We know that under ideal conditions population control programmes can and do work. They work best, however, in industrialized, developed countries with good general education levels and relative affluence. They do not work well in agrarian, underdeveloped societies. Surprisingly, abortion on demand has a more significant impact in some nations than does contraception, e.g. Japan and Eastern Europe. I shall not list the various contraceptive techniques or incentives to family planning but some of the contrary issues should be mentioned for they represent arguments which one will hear frequently - religious opposition is well known even in Canada, accusations of racism and neo-colonialism because most nations and social groups (e.g. American negroes) who have high birth rates are non-white, the equation of high population density with industrial growth, military strength and national wealth by many politicians and leaders in underdeveloped nations and finally personal distaste for or cultural opposition to the contraceptive methods available.

Let me quote Ehrlich again - "population growth is going to stop. The only question is, will it stop because we have solved the problem by controlling births or because nature has solved the problem through a massive increase in the death rate?"

There have been many factors interacting to produce the devastating increase in population which the world has experienced this century. The development of the science of Public Health and Preventive Medicine must surely bear a major part of the credit, or blame (depending on your point of view). Ironically, having created the present problem there is some evidence that the golden age of public health science has passed. Critical analysis of mortality and morbidity statistics from many developed countries suggests that the secondary effects of high population density and excessive material well-being are beginning to take their toll. Mortality rates are rising and life expectancies falling very slightly in some major urban areas, coronary heart disease increases its devastations yearly and the cancer picture is no brighter than it was twenty-five years ago despite frequent assertions that a cure is about to be announced.

Even the necessity for improved agricultural production to feed the millions "saved" by public health measures presents hazards to the continued health of the community. One of the most obvious is the backlash effect of antibiotics in animal feeds - humans are sensitised to

antibiotics which are often necessary in their medical care and bacteria develop resistance to the drugs which will eventually be used to treat the illnesses they cause.

But let us look at the "Third World" to see some of the real health problems being created by man's interference with the balance of nature and, initially, a small scale example of how projects designed to improve the health of people, and alleviate suffering, have led to the present predicament.

The speed with which the infant mortality rate (I.M.R.) can be reduced can be exemplified by the experience of St. Lucia between 1962 and 1965. A project to improve infant and child nutrition resulted over the three years in an 80% reduction in protein calorie deficiency disease deaths. This direct effect was calculated to reduce the I.M.R. by 34 points - i.e. from 103 to 69 whereas the total effect was a reduction of I.M.R. by 64 points, to a rate of 39 per 1000 live births³. Improved nutritional status in infancy has reduced the deaths in this age group from all infectious disease but particularly from gastro-enteritis. This synergistic interaction of nutritional deficiency and infection is now well documented. It was not an expected result of the nutrition project but synergistic reactions must be anticipated whenever ecological disturbance is effected by man over a short time period.

Many disease eradication programmes are suffering setbacks at a stage when it was anticipated that the objectives would have been reached. Malaria control seemed so easy initially - all that was required was money and that was available through U.N. agencies and foreign aid programmes. In recent years the malaria parasite has developed resistance to the drugs used to kill it within the human host, mosquitoes have become resistant to many insecticides and many irrigation schemes have created environmental conditions highly suited to mosquito breeding and have brought the disease to areas which were formerly free from it. Large tracts of newly constructed agricultural land have been deserted because malaria and/or bilharziasis (an aquatic snail borne disease) have made them uninhabitable. In many parts of the world malaria is slowly regaining the territory it lost to man only twenty years ago. The current fear of insecticides compounds the problem - they are necessary to keep the disease at bay but they are considered harmful in the developed nations. Some are banned and production controlled in many countries - if they are eventually considered ecologically too dangerous or considered too great a health risk production may be banned by the manufacturing nations. No

3. Lees, R.E.M. "Protein Calorie Deficiency in St. Lucia and the Effect of Prevention on the Mortality of Infants and Young Children". University of Glasgow, 1967.

underdeveloped countries produce DDT! They do, however, need it to survive - to maintain their health and hold their precious gains in agricultural production.

Cholera, the ancient scourge, has since 1961 spread from Celebes in the Pacific, north, south, and westwards despite man's belief that cholera was contained within a small pocket around the Ganges River near Calcutta and was no longer a threat to world health. In 1971 the disease reached West Africa and the Mediterranean. Although it is regarded as an easily curable disease in the presence of even modest medical facilities, it entered Italy (certainly not an underdeveloped nation) in 1973 and left twelve people dead in Naples (25 in all southern Italy) before it was brought under control.

During 1974 cholera swept into Portugal and to date over 1000 cases have been reported. In both these countries we are faced with the importation of a new disease which has established itself in the community and is now being transmitted within the local population.

On 4 November, 1972, a jumbo jet en route to Sydney, Australia from London stopped in Bahrein. Meals were taken aboard the aircraft to feed 347 passengers and 19 crew. Forty-three cases of cholera, including one fatality, subsequently occurred. The international spread of disease by air travel is a constant threat to the inhabitants of any nation and demands increasing vigilance by national health authorities.⁴ In 1974 we had an imported case of cholera in Kingston.

Man's egotism in talking of eradication of specific diseases has been dealt a hard blow in the past three years. Indeed in some areas he has not been able to prevent disease arising in consequence of ecological changes brought about by engineering projects designed to alleviate local shortages of food and power. The great dams of Africa attest to this - the Volta complex in Ghana and Nigeria has resulted in more onchocerciasis (river blindness) than before, the Kariba extended the area of bilharziasis in Rhodesia while the Aswan High Dam has been a disaster from every standpoint - even yet Lake Nasser is only half full and has an evaporative loss that will probably prevent its ever filling, and the Nile delta fisheries have been destroyed by chemical pollution and altered salinity.⁵ What a disaster in a land already short of protein! Behind the Aswan Dam bilharziasis and filariasis (elephantiasis) have increased in prevalence. Many parasitic diseases such as those listed here are chronically debilitating rather than rapidly fatal and, affecting as they do, larger proportions of the population, reduce productivity but not reproductivity. They thus exaggerate the very problem the dams were designed to alleviate. The tragedy of all of these and similar projects is that the consequent ecological disturbances were predictable and to a certain extent certainly avoidable. There was a complete absence of interdisciplinary communication.

4. *Epidemiological Bulletin*, 16, 133. Ottawa, 1972.

5. Heyneman, D. "Mis-aid to the Third World". *Canadian Journal of Public Health*, 62, 303, 1971.

Shortage of food and space for the increasing millions in Africa and South America mean that man must continually extend the frontiers of his territory, penetrating hitherto unknown jungles and attempting to bring these remote, savage areas under his control. The dangers of the jungles are not restricted to encounters with large and ferocious animals and the hazards encountered may well threaten the species, man, as well as the unfortunate individual who uncovers them. The tropical rain forests were the hiding place of yellow fever, a disease of high fatality rate which periodically broke out in epidemic form and ravaged towns and villages. There is some evidence that these forests hold greater surprises for man than yellow fever.

In August 1967, laboratory workers engaged in medical research in two centres in Germany, and one in Yugoslavia, became ill after handling tissue from green vervet monkeys (*Cercopithecus aethiops*). All of the monkeys belonged to a batch recently exported to European laboratories from East Africa. Five secondary cases occurred among medical staff attending the 23 initial cases. Seven of the 23 primary cases died - a high case fatality rate of 30%. The Germans asked the British Microbiological Research Establishment at Porton Down to assist in the investigation of this outbreak. Understandably, regular laboratories were reluctant to handle such infectious material but Porton is highly suitable for handling such dangerous organisms. Blood from infected guinea pigs was tested in both the U.K. and U.S. against all known antigens - with negative results. Equally frightening was the complete failure of any antibiotic to alleviate the illness in the infected guinea pigs. Investigation of the infectious particles excluded the possibility of the infecting agent being either virus or bacterium. Scientists at Porton concluded that "this may be an unknown organism".⁶ Interestingly enough, although it was shown in Marburg that the infection was being transmitted among the monkeys in the lab, there was no excess of mortality among them. What undoubtedly stopped this outbreak was the fact that transmission required direct contact with the infected host's blood; breaking all contact with contaminated equipment stopped the outbreak immediately.

Less than 18 months later a mission nurse in northern Nigeria was flown, sick, from her station at Lassa to her base hospital in Jos. She had an illness of unrecognised clinical appearance although it had characteristics common to viral disease. Two nurses who cared for her contracted the same illness. The index case and one of the secondary

6. Smith, C.E.G., *et al.* "Fatal Human Disease from Vervet Monkeys". *Lancet*, 1119, 1967.

cases died; the third recovered after a prolonged illness. Serum flown to the U.S. yielded a new arenavirus at the Centre of Disease Control, Atlanta. The initial illness occurred in January 1969.

Exactly a year later a second outbreak of Lassa fever was observed in Jos. Twenty-eight cases were detected on this occasion; the index case is known to have been infected some distance from Jos but went to the hospital there for treatment. Direct person to person spread occurred and the index case is known to have infected 16 others in the hospital. Five of them were hospital staff including the doctor who had described the disease to the world and had treated the patients a year previously.

The fatality rate of Lassa fever is 50%, no effective treatment is known, and its mode of transmission and reservoir host are as yet undiscovered. The doctor referred to above died of her illness.⁷

During laboratory investigation at the Yale Virus Lab in New York, despite maximum precautions, 2 virologists contracted the disease. One died. I understand that only at C.D.C., Atlanta, in sealed labs is study of Lassa virus now permitted in the U.S.

Man, packed densely into his urban environment, is now more susceptible to virulent, new infectious disease than ever before. While the chances of a disease like Lassa fever breaking out of an unknown reservoir and sweeping the world are not high, they are real enough to be a threat to the human species. One only has to ponder the speed of travel and the global incidence of influenza pandemics to appreciate the danger. Indeed the virus of influenza is frequently mutating and the appearance of a more virulent type than that of 1918 which killed an estimated 22 million people throughout the world is a distinct possibility. Disease, either new or revived, sweeping through the world with a virulence unknown since the time of the Black Death, may yet prove to be the Horseman who answers Paul Ehrlich's question.

The picture does indeed look bleak, but before you retire in despondency to await inevitable famine, disease or consequential global war, let us investigate possible alternatives. They do exist and we do have a little time left to redress the balance of people versus environmental destruction.

Despite many impediments, not the least being a stringent ethical code and an oath sworn by all medical graduates, Medical Science has become much more pragmatic over the past 20 years. Abortions on demand and contraceptive advice for unmarried teenagers are but two of the topics which

7. Carey, D.E., *et al.* "Lassa Fever - 1970 Epidemic". *Trans. Roy. Soc. Trop. Med. Hyg.*, 66, 402, 1972.

could scarcely be mentioned then but are everyday practice now although there are large segments of society which still object violently to such actions.

Medically based actions which can offer hope to our ailing planet and threatened species are:

1) Birth Control, implemented immediately on a massive scale, is the only possible, painless solution which is compatible with the maintenance and eventual improvement of human well-being. Technically it is feasible but would face stiff cultural, religious and political opposition in many places. Unfortunately, the areas of greatest population growth are the selfsame areas in which physicians, nurses and health facilities are few. Nonetheless such a course of action could be financed by the developed nations and local manpower trained quickly for such an emergency operation. Time does not permit us to wait for birth rates to fall naturally in the wake of education and improved standards of living in the countries where the rates of population increase are high.

2) Development of new drugs and chemicals. These substances are produced by the developed nations. Under pressure from civil rights groups, environmentalists, panic merchants and purists within the medical profession, governments are banning the production of some drugs and chemicals which, while perhaps of minor importance in developed nations, are essential to the survival of people in the tropics. The restrictions placed on the development of new drugs are now so severe that it is becoming less and less likely that any new "wonder drug" can be produced. We have to be realistic and accept that every drug has its dangers; we must be prepared to have an occasional accident in which some people will be injured or die. The automobile kills many times the numbers who die as a result of drug sensitivity or side effect but few people advocate banning that machine on the strength of it.

There are several new drugs which have been found to be active in the treatment of virus diseases - a group of organisms previously untouchable - and the pharmaceutical industry should and must be given an opportunity to develop them. They could be as valuable to Medicine as the development of antibiotics in the 1940's.

3) Strong, effective Public Health Services should be created or maintained at the international, national, and local levels. The World Health Organization operates an efficient disease monitoring service, co-ordinated through Geneva, which provides national health

administrations with a daily account of major infectious disease outbreaks throughout the world. Responsibility for the prevention of importing disease across national frontiers and for the control of disease outbreaks within the nation rests with each individual country. There has been a tendency in recent years to allow Public Health Services in general, and communicable disease control sections in particular, to suffer economically at the expense of curative, personal medical services.

4. Immunisation cannot be considered an effective barrier to diseases as yet undiscovered or to new strains of known disease which might develop. Minor changes in the bio-type of known organisms can be combatted provided the change in antigenic structure is not too great - thus cholera vaccine made from classical *Vibrio cholera* does afford considerable protection against the El Tor biotype. Generally speaking, however, the time required to isolate new viruses, manufacture large quantities of vaccine and test them for potency and safety, is too long to allow the vaccine to be used to combat virulent, rapidly spreading pandemics of disease. We encounter this situation every time a new strain of influenza virus appears.
5. Balanced aid from developed nations to the underdeveloped is essential. The donor nations must stop handing out funds for projects which have not been properly designed and planned; some assessment of the long term impact of such projects must be undertaken before they are begun. We have committed sufficient blunders and created enough "horrible examples" to draw on past experience to make such assessment. We should no longer be afraid to offer aid with strings attached - for example, help with agricultural production schemes only on condition that a serious family planning programme is started simultaneously (the donor nations should include the cost of the latter in its aid budget).
6. New techniques of communicable disease control can be developed given the money and resources. Control of eradication of major endemic diseases in Africa could open up vast tracts of productive land. It has been estimated that the elimination of the tsetse fly (a vector of disease for both man and animals) and *Sinulium* (the carrier of river blindness), or the diseases they carry, would make some 4.5 million square miles of fertile land available to agricultural production in Africa. Similar land gains are possible in South America.

Before we condemn Medicine for creating our population problem by its past actions, let me remind you that Society controls that science as it does any other. Science cannot implement actions which are against the will of Society, at least in countries with democratically elected governments. Medicine may have helped to produce the current situation but it has also provided the solution through the several birth control methods it has perfected. It is now up to Society to use the tools it has been given.

As Agricultural Science has provided the "green revolution" to avert famine today, so Medicine can perfect new drugs and maintain effective public health services to provide temporary respite from widespread disease - the long term answer rests with governments and the people and societies they represent.

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