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MAN AND HIS ENVIRONMENT

Biomedical
knowledge
and social
action

RENÉ DUBOS



PAN AMERICAN HEALTH ORGANIZATION
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Biomedical Knowledge and Social Action

René Dubos

*First in the series of PAHO/WHO Scientific Lectures,
presented on 29 September 1965, on the occasion
of the inauguration of the new headquarters building
of the Pan American Health Organization,
in Washington, D.C.*

*With an introduction by Dr. Abraham Horwitz,
Director of the Pan American Sanitary Bureau*



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INTRODUCTION

Presentation at the Opening of the PAHO/WHO Scientific Lectures,
29 September 1965, in Washington, D.C.

Dr. Abraham Horwitz
Director, Pan American Sanitary Bureau

It is a great honor for us to inaugurate the PAHO/WHO Scientific Lectures. These lectures will deal with health in the broadest acceptance of the term, especially its role in present-day society. We believe that the Lectures can enrich the specialists in the various fields concerned with the origin of diseases, their prevention and treatment, and the adaptation of human beings to their environment. We hope that when published they will be of interest to students of the subjects dealt with, and will help to spread knowledge of health care as a social function.

For that we desire, as in no other aspect of our work, outstanding quality, excellence, and originality in ideas and in projections. And that depends exclusively on the persons who, because of their experience, are willing to study the topics we suggest because we consider them important for health experts and for the work of our Organization.

This series, which will be continued, could not have been begun under better auspices; tonight the speaker is Dr. René Dubos and the topic is "Man and his Environment—Biomedical Knowledge and Social Action." Our distinguished speaker has delved deeply into

the complex relations that govern the dynamics of the health and sickness of human beings and has formulated original lines of research for examining man as a biological and social unit—not a simple aggregate of cells, tissues, and organs but a thinking and acting entity in a society that in turn reveals itself to be an indivisible whole. Referring to modern medicine, Dr. Dubos has stated that one of its greatest responsibilities “is to give mankind some guidance concerning the problems posed by the responses of the body and the mind to technological civilization. Man feels threatened and *is* threatened by the estrangement of life from conditions and natural cycles under which human evolution occurred; by the constant and unavoidable exposure to the stimuli of urban and industrial civilization; by the varied aspects of environmental pollution; by the emotional trauma and often the solitude of life in congested cities; by the monotony, the boredom, indeed, the compulsory leisure ensuing from automated work. These are the very influences which are now at the origin of most medical problems. To a very large extent, the disorders of the body and the mind are but the expression of inadequate responses to environmental influences.”¹ What is serious, Dr. Dubois points out, is that we lack experimental methods to determine the reactions of the whole living organism to the total environment. The time has come to give these investigations the same dignity and support as those dedicated to the components of each living being.

We believe that this task is of particular import for the Americas and for the policy of our Organization. The Governments have decided that activities for the prevention and treatment of disease and the promotion of health should be incorporated into the general process of development. In this view health is a good for each human being, but at the same time a service which contributes to the economy, the development, and the welfare of the community. We have as yet found no scientific proof of this assertion, which nevertheless seems rational and justifies what the Governments in the Hemisphere are doing, as well as the lines along which the Organization is working. It is obviously inspired by the ideas of Dr. Dubos and will be substantially nourished by the experimental line he is following. Because it is clear, to our way of thinking, that of all branches of biology, health care, as a social function, is the one that requires a

¹Dubos, René: “Environmental Biology.” In *Bioscience*, January 1964, p. 11.

greater association between sciences and humanities, a veritable dialogue. We have to deal with the most vital activities of every society. We have to accomplish it, adjusting knowledge and techniques to the dominant conduct, attitudes, and beliefs. We must perform our task as part of a process of interaction of ecological, economic, and cultural factors. We must motivate and persuade and not impose and coerce. It has been rightly said that "the humanism of our time comprises science, technique, and action; and the dialogue of the Humanities, as knowledge and formation of the cultural world, with the Sciences, as knowledge of the natural world, and with the Techniques, as training to use it, is produced most intensely and effectively in action."

We are honored by the presence of Dr. Dubos, not only because of his exceptional vision, his contributions to scientific knowledge, especially in microbiology, the numerous distinctions he has been awarded by universities and other cultural centers, but above all because of the quality of his ideas. Deeply concerned with penetrating the nature of man, with understanding him intimately, in his conduct and his biological and social group living, he is today, in our opinion, the most distinguished exponent of the natural history of ideas which, in health, have to do with the interpretation of life, i.e., with philosophy. Let us listen to one of his many messages, one which appears in his book *Mirage of Health*:² "The kind of health that men desire most is not necessarily a state in which they experience physical vigor and a sense of well-being, not even one giving them a long life. It is, instead, the condition best suited to reach goals that each individual formulates for himself. Usually these goals bear no relation to biological necessity; at times, indeed, they are antithetic to biological usefulness. More often than not the pursuit of health and happiness is guided by urges which are social rather than biological; urges which are so peculiar to men as to be meaningless for other living things because they are of no importance for the survival of the individual or of the species.

The satisfactions which men crave most, and the sufferings which scar their lives most deeply, have determinants which do not all reside in the flesh or in the reasonable faculties and are not completely accounted for by scientific laws.

² Dubos, René: *Mirage of Health; Utopias, Progress, and Biological Change*. Harper and Bros., New York, 1959, pp. 233, 235.

“ . . . The earth is not a resting place. Man has elected to fight, not necessarily for himself but for a process of emotional, intellectual, and ethical growth that goes on forever. To grow in the midst of dangers is the fate of the human race, because it is the law of the spirit.”

We have had Dr. Dubos's cooperation as an outstanding member of our Advisory Committee on Medical Research. Today he has been good enough to inaugurate our Organization's Scientific Lectures. I once again express our gratitude to him.

MAN AND HIS ENVIRONMENT

Biomedical Knowledge and Social Action

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1. *The Universality and Diversity of Mankind*

Any medical problem presents itself under two aspects which are sharply different, but complementary. On the one hand all phenomena of health and disease reflect the biological unity of mankind; on the other hand, all are conditioned by the diversity of the social institutions and ways of life. The duality of man's nature—unity and diversity—creates a medical paradox that is responsible for the complexities of the problems faced by the Pan American Health Organization. The paradox is that, all men, irrespective of origin, have fundamentally the same biological constitution, physiological requirements, and responses to stimuli; yet despite this biological uniformity, their diseases and medical needs differ profoundly according to their habitats, social institutions, and ways of life. Any one concerned with problems of health and disease must therefore keep in mind both the universal aspects of human biology, and the social diversity of medical problems.

The dedication of a new building provides an opportunity to re-examine the goals of the institution that it serves. For this reason, I shall take the liberty of making a few general statements that may help to sharpen the contrast between the universal requirements of

man's life, and the special medical needs of his societies. This contrast will bring into relief some unsolved health problems which are in the province of PAHO.

The prehistorical and historical events of the human adventure in the Americas constitute perhaps the most convincing evidence for the unity of mankind. As far as can be judged, various populations of ancient man began to move into the Americas during the late paleolithic period. After their initial penetration, they rapidly spread over the whole American continent, but they appear to have remained almost completely isolated from the rest of mankind for more than 10,000 years. During that period they progressively developed several great civilizations, profoundly different from those of Asia and Europe, yet very meaningful to those of us whose cultural evolution took place on other continents. Obviously, the most fundamental and universal characteristics of the human mind were already fully developed by the time ancient man first penetrated the Americas.

During the past five centuries, many waves of immigration brought other human races from all parts of the earth into intimate contact with the various tribes of Amerindians. These mass migrations resulted in an immense number of highly varied and successful racial mixtures. The genetic and physiological compatibility of human races that had been separated for so many thousand years thus confirms the cultural evidence that all human beings originally derive from the same evolutionary stock.

Because of their biological similarity, all men are potentially liable to the same kinds of diseases—a fact well documented by anthropological studies and by recent medical surveys of primitive tribes. Furthermore, all men can derive benefits from the same kinds of medical care, as proven by the uniformity of their response to the prophylactic and therapeutic procedures of modern medicine. But despite these medical similarities, experience shows that each geographic area, each type of society, and each economic group, is characterized by its own pattern of diseases and has special medical needs. For example, the control of disease in tropical lowlands obviously presents theoretical and practical problems far different from those encountered on arid plateaus or on high mountains. The contrast is even greater between the disease problems most prevalent in impoverished rural communities and those emerging at present in prosperous industrial agglomerations.

Individual persons differ of course in their genetic constitution and consequently in their innate resistance to disease. But in most cases, genetic endowment and racial origin play only a very small role in determining the types and severity of the diseases characteristic of a particular region, or a particular social group. Whether they be of African, Amerindian, European, or Oriental origin, and whatever the complexity of the racial mixtures of which they are constituted, human populations usually acquire the burden of diseases characteristic of the geographic area and social group in which they are born and live. Medically speaking, man is in general more the product of his environment than of his genetic endowment. The health of the people is determined not by their race, but by the conditions of their life. I feel justified in emphasizing these obvious truths, because they are fundamental to the formulation of practical medical policies as well as to the development of research programs in biomedicine.

2. *The Diseases of Scarcity*

Irrespective of race and climate, the incidence of most nutritional, infectious, and even degenerative diseases is closely related to the economic status. In fact, social factors are of such obvious importance in the causation and control of disease, that many sociologists and even medical scientists are inclined to believe that political and social reforms are the most promising approach to health improvement among destitute people. There is no doubt concerning the factual validity of the observations on which this belief is based, but its unconditioned and uncritical acceptance would probably lead to the formulation of national policies unfavorable in the long run both to health improvement and to social development. It seems worthwhile therefore to focus our attention this evening on the comparative merits and limitations of the social and medical approaches to disease control. To discuss this problem, I shall briefly consider a few examples illustrating the complex interplay between economic conditions, the health of the people, and biomedical knowledge.

As we all know, malnutrition is certainly responsible for a very large percentage of the disease problems in the world, and especially in the Americas. There is no doubt furthermore that shortages of food and bad nutritional habits are usually the outcome of economic limitations and of unwise social practices. It would seem to follow

from these premises that the solution to the problem of nutritional diseases is more likely to come from political and social reforms, than from the application of scientific knowledge. But in reality, both approaches are equally essential. Experience has shown that political and social measures cannot be effective unless they are based on very sophisticated scientific information concerning nutritional needs and the chemical constitution of foodstuffs.

Nutritional surveys have revealed for example that deficiencies in proteins and in certain vitamins constitute a more frequent cause of severe malnutrition than is the shortage of calories. Modern analytical methods have shown furthermore that the various proteins differ greatly in nutritional value because they do not all have the same amino acid composition. Thus it has become clear that malnutrition cannot be corrected merely by producing more food, for example more beans or more corn. Just more protein will not either necessarily solve the problem. What is needed is a regimen having the proper chemical composition. In practice, mixtures of foodstuffs providing a correct balance of all essential nutrients, especially of all essential amino acids, constitute the nutritional formulae most favorable to health and best suited to the economies of developing countries.

Precise chemical knowledge of food composition is thus necessary for the formulation of nutritional requirements and of agricultural programs. But this knowledge is not sufficient to produce the kind of food readily accepted by the people, and therefore beneficial to them. There exists in each region and each culture a number of food habits that cannot be changed without an immense amount of effort. At the end of the First World War, for example, corn (maize) was shipped by the American Relief Committee to the famished people of Europe; however, Europeans were not able to use the grain because it was foreign to their nutritional traditions, so much so that they did not even know how to cook it and incorporate it in their diet. Thus, knowledge of the chemical composition of foods and of their theoretical nutritional value must be supplemented not only by a know-how of production methods, but also by a sophisticated awareness of what is socially acceptable in a given region.

As we shall see later, other complications arise from the fact that, paradoxically enough, overnutrition also can constitute a form of malnutrition. Furthermore, human beings often develop physiological adjustments to nutritional scarcity or to excessive abundance, and

thereby acquire food habits and behavior patterns that are unfavorable to health and to social growth.

I realize that everyone in this room is quite familiar with the problems of malnutrition that I have discussed so superficially in the preceding paragraphs. My purpose in mentioning them was not to convey factual knowledge, but merely to illustrate that social action must be guided by biomedical wisdom. Without this guidance, social reforms are likely to be misdirected and fail altogether, or at best to benefit only a very small percentage of the population.

The control of diarrheal diseases constitutes another problem in which social action is likely to fail unless guided by scientific understanding of etiology. There is, of course, good reason to believe that infectious processes play an important role in most kinds of intestinal disorders. For this reason, it has been commonly assumed that medical programs for their control should be based on the widespread distribution of drugs and vaccines against pathogens such as shigellas, salmonellas, amoeba or enteroviruses. In fact, large and expensive public health campaigns are being carried out on this assumption. The truth is, however, that the etiology of diarrheal diseases is not at all understood. Prophylactic and therapeutic measures based on such inadequate knowledge are at best of little usefulness; in fact, they probably do more harm than good in many cases. There are indications indeed that general dietary improvement, better practices of infant feeding and handling, and simply an abundant supply of water, would be a far more effective, and less costly approach to the control of many intestinal disorders, than are prophylaxis and treatment with drugs and vaccines.

In this case again, it would be out of place to describe here programs of research and action. My purpose is rather to emphasize that diarrheal diseases and other infectious processes, including tuberculosis, present biomedical problems peculiar to each geographic area and to each social group. Their control often requires that the living conditions be changed, and this in turn demands a kind of social action based on comprehensive epidemiologic and etiologic understanding.

Both malnutrition and diarrheal diseases create medical problems that are especially dramatic in the young age groups. In fact, these disorders account for a very large percentage of infant mortality in

destitute populations. But the importance of malnutrition and infection greatly transcends the damage revealed by mortality statistics. Children who have suffered from nutritional deficiencies or from prolonged infectious processes during the early stages of their development, commonly fail to grow into healthy, vigorous adults. Not only do the pathological experiences of early life tend to depress physical and mental activity during youth and the teen-age period; very frequently the unfavorable effects persist through adulthood and appear indeed irreversible.

The irreversibility of the pathological effects resulting from early experiences is not limited to malnutrition and infection. Irreversible damage commonly results from most forms of early deprivation, whether they be physiological, emotional, or social in nature. Some of the effects exerted by early influences are so lasting that they condition most activities during the entire life span, and thereby affect the social and economic performance of adults and therefore of the whole society. Control of disease, during the very early phases of life, and also the guidance of all aspects of physical and mental development, may thus constitute the most far-reaching aspect of medical action.

Allow me to express here my deeply felt conviction that the extent of health improvement that ensues from building ultramodern hospitals with up-to-date equipment, is probably trivial in comparison with the results that can be achieved at much lower cost by providing all infants and children with well-balanced food, sanitary conditions, and a stimulating environment. Needless to say, acceptance of this thesis would imply profound changes in medicosocial policies and would affect also the selection of problems in scientific research. The aged deserve, of course, all our help and sympathy; the adults obviously constitute the resources of the present, but more importantly perhaps, the young represent the future. Much biomedical knowledge as well as social wisdom is needed to formulate policy decisions concerning the comparative degrees of emphasis to be placed on the medical care of the different age groups.

3. *The Diseases of Civilization*

The examples that I have mentioned so far concern diseases extremely prevalent and destructive in underprivileged populations.

But in fact, the diseases that are emerging in the prosperous industrialized countries could have served just as well to illustrate that social planning should always be guided by biomedical knowledge. Had time permitted, I would have discussed at length the disturbing fact that, contrary to general belief, life expectancy past the age of 45 has not increased significantly anywhere in the world, not even in the social groups that can afford the most elaborate medical care. Vascular diseases, certain types of cancers, chronic ailments of the respiratory tract, are among the many conditions that are becoming increasingly frequent among adults in affluent societies. As long as this trend continues, there cannot be any hope for greater longevity.

Epidemiologic studies leave no doubt that the increase in incidence of chronic and degenerative diseases is due in part at least, and probably in very large part, to environmental and behavioral changes, in industrialized societies. Many different factors have been incriminated as playing a role in the diseases of adult life in prosperous countries. These factors include aspects of the modern world as different as environmental pollution, overnutrition of adults, latent endogenous infectious processes, and the psychic disturbances associated with competitive behavior, emotional solitude, traffic congestion, or automated work. In reality, there is as yet no convincing knowledge concerning the mechanisms that relate the environment and the ways of life, to the increased incidence of chronic and degenerative diseases in affluent societies. But granted the deficiencies in etiologic understanding, I must mention nevertheless some general aspects of the relation of social health to the total environment which make the problem relevant to all countries of the world, irrespective of their state of economic development.

It can be taken for granted that industrialization and urbanization will soon become almost universal human phenomena. In view of the speed at which social and technologic changes occur, many of the environmental stresses that plague the affluent countries today are likely to spread to the rest of the world in the near future. In this regard, it is hardly an exaggeration to state that the future begins today even in the least developed countries. Wherever a new industry is established, there will soon be pollution of the water and the air, occupational dangers for the workers and their families, changes in nutritional habits and in other social practices,

emotional upsets arising from unfamiliar working conditions and from disruption of ancestral customs. Unless carefully watched and controlled, these disturbances will add their deleterious effects to those of malnutrition, tuberculosis, malaria, schistosomiasis, etc., and will create new kinds of physiological misery in the areas of the world undergoing industrialization.

The health problems posed by social and technologic changes have determinants that are peculiar to each geographic area, indeed to each community. Smogs differ in composition according to the climate, the topography of the district, the kind of fuel used, and the type of technological operations. Similarly, each industrial process engenders its own kind of occupational dangers and of water pollution. Clearly then, the public health problems caused by rapid industrial growth cannot be solved by applying slavishly methods developed under other conditions. Their control will require programs of research and of social action suited to the peculiarities of each local situation.

Even more important is the obvious fact that the so-called "diseases of civilization" will not automatically be eliminated by improving the economic status, since they are in fact created by industrial growth. Just as scientific guidance is required for the control of the diseases of scarcity that prevail at present in the "underdeveloped" regions of the world, so a new kind of science must be developed to deal with the medical problems affecting the industrial areas which could properly be called "mal developed." Unless the social structure can be managed on the basis of a suitable biomedical knowledge, all countries in the process of becoming industrialized will soon become mal developed. They will duplicate the horrible conditions that prevail now in the polluted, congested, and inhuman industrial centers. It would be tragic indeed if technologic and economic growth meant the replacement of the diseases of scarcity in the underdeveloped areas by the diseases of affluence in the mal developed countries.

4. *Adaptation and Its Dangers*

While both scarcity and affluence are at the origin of much disease throughout the world, it is also true on the other hand that men can survive and multiply under the most wretched and un-

natural conditions. After all, many human beings survived the horrors of concentration camps during the War! And the most polluted, mal developed, and traumatic cities are also the most populous! Life in the Americas illustrates in fact and in a spectacular fashion, the wide range of man's adaptive potentialities, since these potentialities have enabled him to colonize even the least hospitable parts of the continent. For many thousands of years, men have maintained themselves against great odds and have created civilizations in tropical lowlands, on semi-desert plateaus, or on the high Andes. They have become adjusted to isolation in remote areas, to crowding in shanty towns, to nutritional scarcity, to intense air and water pollution, even to high doses of radioactive background. It would seem to follow from these facts that mankind can become adapted to almost any type of hostile environment. One could assume, in other words, that mankind will be able to take in stride the stresses of the second Industrial Revolution and of overpopulation, just as it has survived famines, wars, and epidemics in the past.

Adaptability is by definition an asset for survival. But paradoxically, it constitutes in certain cases a heavy handicap against cultural and economic growth. The biological phenomena of adaptation present, therefore, problems that are of immediate relevance not only to health but also to social development.

It can be anticipated that the emergence of new technologies and the need to discover and exploit new natural resources will increasingly compel human beings to change their professional occupations and to move rapidly from one place to another. The very process of change creates problems for public health because adults who have to live and to function under physical and social conditions profoundly different from those in which they have developed, frequently experience physiological and emotional stresses. The most common cause of disease in the modern world is probably the failure to meet successfully the exacting adaptive demands created by changes of life, because these changes are now so frequent and so rapid. For this reason, understanding of the mechanisms through which adaptation takes place, and the development of medical and social techniques to facilitate its achievement, has become one of the large responsibilities of physicians and of medical scientists.

It has become apparent on the other hand that adaptive processes

can generate dangers of their own—dangers which often remain so completely unnoticed at first that their medical and social consequences are neglected. The dangers originating from some forms of adaptation are indeed so varied, and so great, that the field deserves an exhaustive study by biomedical and social sciences. For lack of time, I shall limit myself to two examples, namely, the distant consequences of air pollution and of malnutrition.

Air pollution provides tragic evidence of the fact that many of the physiological, mental, and social processes which make it possible to live in a hostile environment commonly express themselves at a later date in overt disease and in economic loss. During the past two centuries, for instance, the inhabitants of the industrial areas of Northern Europe have been exposed to large concentrations of many types of air pollutants produced by incomplete combustion of coal, and released in the fumes from chemical plants. Such exposure is rendered even more objectionable by the inclemency of the Atlantic climate. However, long experience with pollution and with bad weather results in the development of physiological reactions and living habits that obviously have adaptive value, since Northern Europeans seem to accept almost cheerfully conditions which appear unbearable to a non-experienced person.

This adaptive response is not peculiar to Northern Europeans. It occurs among the inhabitants of all heavily industrialized areas who function effectively despite the almost constant presence of irritating substances in the air they breathe. In other words, it would seem at first sight that human beings can readily make a completely adequate adjustment to massive air pollution.

Unfortunately, adaptation to the stresses of the present often has to be paid in the form of physiological misery at some future date. Even among persons who seem to be unaware of the smogs surrounding them, the respiratory tract registers the insult of the various air pollutants. Eventually, the cumulative effects of irritation result in chronic bronchitis and other forms of irreversible pulmonary disease. Generally, however, this does not happen until several years later. In fact, chronic pulmonary disease now constitutes the greatest single medical problem in Northern Europe, as well as the most costly. It is increasing in prevalence at an alarming rate also in North America and it will undoubtedly spread to all areas under-

going industrialization. There is good evidence, furthermore, that air pollution contributes to the incidence of various cancers—not only pulmonary carcinoma. It even increases the number of fatalities among persons suffering from vascular disorders.

The delayed effects of air pollutants constitute a tragic model for the kind of medical problems likely to arise in the future from the various forms of environmental pollution. The course of events can unfortunately be predicted with some confidence.

Wherever it is convenient, chemical pollution of air, water, and food soon will be sufficiently controlled to prevent the disabling toxic effects that are immediate and obvious. Human beings will then tolerate without complaints concentrations of environmental pollutants that do not constitute an obvious nuisance and do not interfere seriously with social and economic life. But it is probable that continued exposure to low levels of toxic agents will eventually result in a great variety of delayed pathological manifestations, creating much physiological misery and greatly increasing the medical load. The point of importance here is that the worst pathological effects of environmental pollutants will not be detected at the time of exposure. Indeed they may not become evident until several decades later. Man readily becomes adjusted to low concentrations of pollutants that do not have an immediate nuisance value, but this apparent adaptation to the conditions of the present will cause in the future much human suffering and create large social burdens.

Adjustment to malnutrition also can have distant consequences of far-reaching importance. Recent physiological and behavioral studies have revealed that people who have been born and raised in an environment where food intake is quantitatively or qualitatively inadequate seem to achieve a certain form of physiological adaptation to low food intake. Unconsciously, they tend to restrict their physical and mental activity so as to reduce their nutritional needs; in other words they become adjusted to undernutrition by living less intensely. Physical and mental apathy and other forms of indolence have long been assumed to have a racial or climatic origin. But in reality these behavioral traits often constitute a form of physiological adjustment to malnutrition, especially when nutritional scarcity has occurred during very early life.

Adaptation to an inadequate food intake has obvious merits for

survival under conditions of scarcity; indolence may even have some romantic appeal for the harried and tense observer from a competitive society. But the dismal aspect of metabolic and mental adjustment to malnutrition is that it creates a vicious circle. It is responsible for much of the difficulty experienced in several parts of the world by those who attempt to stimulate national economies. Populations that have been deprived during early life remain healthy as long as little effort is required of them, but they commonly exhibit little resistance to stress. For this reason, probably, they find it difficult to make the efforts required to improve their economic status.

Hardly anything is known concerning the physiological mechanisms of adaptation to nutritional scarcity. In fact, ignorance in this field is so great that nutritionists would hardly know how to correct the effects of early food deprivation, even if the food supplies in deprived populations became sufficient to provide adults with an optimum diet. The production of more food, and of better food, is a technological and social problem. But the improvement of the nutritional status demands in addition sophisticated biomedical knowledge.

5. Biomedical Sciences and the Human Condition

I have emphasized in this discussion the adaptive responses of man to his environment, not only because of the immense practical problems that they pose, but also because they illustrate so well the complex interplay between human health, social action, and biomedical knowledge. Admittedly, all aspects of man's life including his health are linked to his history and his social structures. Ortega y Gasset went as far as claiming that "Man has no nature, what he has is history." But it is also true that man's social history is conditioned by his biological responses to his total environment. In order to evaluate the significance and to recognize the implications of this fact, it may be helpful to turn back for a moment to the generalities stated at the beginning of this essay, and in particular to the medical paradox arising from the biological unity of man's nature and the diversity of his diseases.

Anthropological evidence leaves no doubt that the diseases of modern man were also present in prehistoric man; furthermore, these diseases also exist today in all underdeveloped societies, including the most primitive. On the other hand, the relative prevalence