

intra- and inter-specific toxicities encountered in the laboratory obtain under natural conditions.

Human Adaptability to Environmental Stress

Stresses may be defined as those conditions which impose measurable consequences upon individuals and populations. They may involve both stimulus deficiencies and excesses. They are specific to individuals, and are recognizable by behavioral, physiologic, morphologic, and, ultimately, genetic characteristics. An inventory of stresses significant to historical and current phenotypic adaptations and selection in man includes an array of physical, nutritional, disease, and behavioral factors.

Stresses in Growth and Development. The inadequacy of our knowledge of developmental and environmental factors creates an urgent need for research in the following areas:

Early (prenatal to young child) human development in relation to environmental stress

Physical as related to behavioral development

Adaptive aspects of child development

Formation and chronological development of physiological adjustment to heat, cold, hypoxia, and physical exertion

These studies would be particularly valuable if they compared genetically distinct populations and if longitudinal as well as cross-sectional investigations were included.

Stresses Related to Climate. Among the research areas of importance here, four seem to merit special attention:

Cold tolerance—comparative studies of whole-body cooling, metabolic adjustments to standard cold stresses, and local vascular adjustments to cold

Heat tolerance—comparative studies of body temperature and regulatory responses of limited numbers of subjects under standard work-heat stress (or regulatory responses of larger groups of subjects performing standard work under field conditions in hot climates)

High altitude—examinations of blood, body fluids, metabolism, respiratory function, and circulatory responses of subjects under basal conditions and in standard work tests

Exertion—metabolic, respiratory, and circulatory adjustments of subjects to a standard aerobic work test, and to strenuous exertion designed to determine both aerobic and anaerobic capacity

Nutritional Stresses. Because the effect of nutrition on stress resistance is very poorly understood, specific investigations of the relations between nutrition and disease resistance, and between nutrition and thermal regulating processes, should be undertaken and should emphasize genetically distinct properties. Studies of this kind would be most valuable if directed mostly to young children.

Similarly, adjustments to undernutrition should be examined. By morphological, behavioral, and biochemical changes, human populations and individuals have been able to survive in nutritional circumstances that would be considered inadequate by most criteria—such groups or individuals might almost be said to have adapted to undernutrition. But the consequences of this adaptation are not well known and a critical worldwide determination is essential as a basis for predicting the outcome of particular nutritional regimens. Such a study should consider the norms for sex, age, and related factors, and should be correlated with evaluations of human physiological response in differing situations and locations.

Disease Stresses. Disease acts as an agent of natural selection. Among the maladies that might profitably be studied in this context are tuberculosis, malaria, syphilis, Hanson's disease, Chagas' disease, trypanosomiasis, trichinosis, and schistosomiasis. Emphasis should be placed on intensity of infection and differential epidemiology in selected populations. Related data on genetics, nutrition, and other factors could be advantageously accumulated.

A second concern is with overall morbidity patterns within selected populations. One objective would be to gain information regarding differential susceptibility—e.g., data on exposure to disease as indicated by titers of antibodies and data on reactivity to disease as indicated by development of clinical illness.

Allergic diseases represent a third area to be emphasized. Of particular concern is the extent to which these diseases stem from industrialization, from manipulation of the ecosystem, and even from preventive and therapeutic medical practices. In a sense, allergic diseases are failures of adaptation and thus highly relevant to the question of human adaptability.