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## Malnutrition, Learning, and Behavior

Children reared in poverty tend to do poorly on tests of intelligence. In part this is due to psychological and cultural factors. To an important extent it is a result of malnutrition early in childhood. This matter is discussed in a recent article in *Science*\* and in a report of an International Conference on Malnutrition, Learning, and Behavior.† Both publications survey the effects of deprivation at an early age. It seems likely that millions of young children in developing countries are experiencing some degree of retardation in learning because of inadequate nutrition, and that this phenomenon may also occur in the United States.

Because of complex social and psychological factors associated with malnutrition, it is not easy to assess the effects of dietary deficiencies in man. However, observations in underdeveloped countries, coupled with studies on animals, provide substantial evidence. In rats and pigs the brain reaches 80 percent of adult size by normal weaning time. At that stage, body weight is 20 percent of that at maturity. During the period of rapid growth the brain is vulnerable to nutritional damage. A relatively short period of undernutrition results in smaller brain size at maturity even if the animals are maintained on a good diet after weaning. Changes in brain size are accompanied by persistent anatomical and biochemical changes.

In humans, the brain of the infant attains 80 percent of adult weight by age 3, when the body weight is about 20 percent of that at maturity. Thus the animal experiments suggest that good nutrition during the first 3 years of life is particularly important.

In some countries undernutrition involves a deficit in calories, proteins, and vitamins. Usually lack of protein is the most serious problem, but vitamin deficiencies are also important. Throughout much of the world, grains are the principal sources of protein. These do not contain a full complement of all the essential amino acids—lysine is usually in short supply. Many individuals, even in the United States, who have adequate caloric intake primarily from low-cost foods may be malnourished. This possibility has become a matter of increasing concern to the federal government.

Desirable objectives for a U.S. food program have been described by Dr. Aaron M. Altschul of the Department of Agriculture‡: (i) no one must go hungry; (ii) hunger or malnutrition must not be a deterrent to economic development; and (iii) the American diet must provide for optimum health throughout life.

These are laudable goals, but they will not be easily attained. Enough food can be provided, but that is not the whole answer. The consumer must choose to eat nourishing foods. In part the problem can be met by enriching commercial food products. For example, cereal foods such as wheat flour or products made from it are markedly improved by the addition of lysine (0.2 percent) and of needed vitamins and minerals.

Good nutrition is desirable at all ages, but it is evident that the first 3 years are crucial. To respond to this need, the federal government has begun to distribute, in some places, a special supplementary food package to new and expectant mothers, through health centers and clinics. This program should be expanded. However, unless mothers understand how to care for their young, bountiful supplies of food will not suffice. There is real need for general education in the basic principles of nutrition and for continuing effort to assure that no one, and especially no infant, fails to develop properly because of malnutrition.

—PHILIP H. ABELSON

\* H. F. Eichenwald and P. C. Fry, *Science* 163, 644 (1969). † N. S. Scrimshaw and E. Gordon, Eds., *Malnutrition, Learning, and Behavior* (MIT Press, Cambridge, 1968). ‡ A. M. Altschul, testimony before the Senate Select Committee on Nutrition and Human Needs, 18 December 1968.