NUTRITION

Starvation and the Brain

Studies of children and animals reveal permanent brain damage from improper diets.

Around the turn of the century, scientists decided the human brain is immune to the debilitating effects of starvation and so turned their attention to other problems. That is still true—for adults. Mature animals and humans are capable of enduring long periods of severe undernourishment without a sign their brains have been physically affected.

But whether infant brains can stand the same deprivation was the subject of a three-day international meeting recently at the Massachusetts Institute of Technology. And the message is that they cannot.

There are some 300 million malnourished children under five in the world. Put another way, 60 percent of the world's preschoolers lack sufficient protein food. Thus, whether or not this level of nutrition can permanently cripple mental capacity is of momentous concern.

It is also of enormous difficulty. Most undernourished children live in poor social conditions, with ignorance, superstition, neglect and overcrowding the common experience. These conditions are themselves capable of retarding mental development, so parceling out the blame between diet and environment is a complex, tedious task—which, as the MIT conference clearly revealed, has only begun.

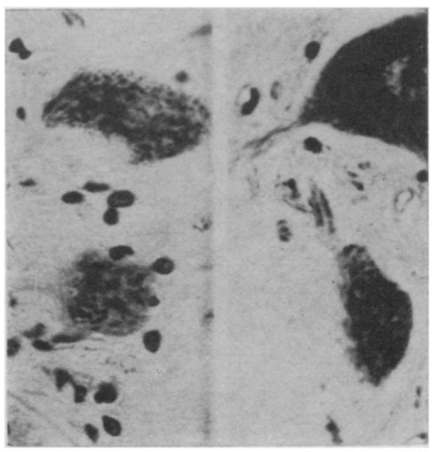
Though the answer to the main question—do diets currently fed children in most developing nations cripple their mentality—will not begin dribbling in for several years, evidence is emerging to link firmly severe food deprivation during infancy with brain damage.

The most convincing data on humans comes from a South African physician who reported the results of an 11-year study on 40 Capetown children.

Twenty of the children had been virtually starved during their first year of life. They were the most grossly undernourished children that could be found among an ethnic group that was both low economically and of racially mixed origin, including Hottentot, Bantu, Malay and European, reports Dr. Mavis B. Stoch of the Red Cross Hospital in Capetown.

Matched with this undernourished group throughout the 11 years were 20 children from a similarly poor background, but who were not malfed.

The differences in mental capacity and head size between the two groups



Stewart and Platt

Pig brain cells—abnormal at right.

of children, now in school, were both significant and striking, says Dr. Stoch.

Head circumferences among the food-deprived children averaged one inch less than the others, indicating smaller brains. In overall intelligence, 60 percent of the undernourished fell below the level of even the lowest adequately-fed child and only one exceeding the mean.

Their pattern of intellectual deficit was also suggestive, says Dr. Stoch. Normally, a poor environment or maternal neglect will stunt verbal ability in the child. And, in fact, all the children, both well-fed and undernourished, were "markedly impoverished" in language ability. But the undernourished had additional handicaps.

They particularly lacked capacity in the nonverbal range, having to do with mathematical ability and pattern perception, compared to the others. They were deficient also in the kind of brain power that provides eye-hand coordination. All of which leads Dr. Stoch and her supervisor, Dr. Patrick M. Smythe, to believe there had been organic damage due to stunted growth and caused by lack of food during the critical infancy period.

Even though 13 undernourished children were subsequently moved to better homes, said Dr. Stoch, they never caught up in mental development.

But then, the level of starvation these 20 children survived was far worse than most, as indicated by the fact one child weighed 12 pounds at the age of three.

There remains the question of malnutrition and the millions of children who eat enough calories—all of them starch.

So far, the best comment on a protein deficient diet comes from experiments on baby pigs, dogs and rats. On diets no worse than those people eat in some parts of the world, these animals develop central nervous system abnormalities. Changes reach to the level of nerve cells, and can produce a pathological increase of glial or supportive cells and a relative decrease in neurons or working cells. R. J. C. Stewart of the National Institute for Medical Research in London, who co-authored a study with England's B. S. Platt, theorizes that the glial cells may swell in a vain effort to draw more nutrients out of the body.

He also says the consistent brain damage scientists have found across species suggests that man's brain is also susceptible to protein deficiency.

There is no way of telling how much damage the human brain can tolerate before its capacity is affected, says Stewart. His dogs, however, were afflicted with muscle spasms, twitches and palsy. They had a wide-gaited walk and after a few steps would fall into convulsions.

The dogs with the worst conditions were those born of malfed mothers and undernourished in puppyhood because of the mother' poor milk. Since protein deficiency appears to reach even into the placenta, Stewart suggests that developing countries should be concerned with the problem of malnourished pregnant women.

Dr. John Dobbing of London's Institute of Child Health makes the same point on the basis of his rat experiments testing the periods of peak brain growth.

He says the point of greatest susceptibility may come before birth. Species differ in the timing of their "brain growth spurts." In humans growth reaches its peak in the last few weeks of pregnancy, while in rats the brain starts its major growth after birth.

Dr. Dobbing found that even a mild protein deficiency during the rat's growth spurt left clear and permanent damage. But at five weeks, after its brain was developed, the rat could starve to death and his brain be unaffected.

Because the human growth spurt comes before birth, Dr. Dobbings concludes, humans are most vulnerable then.