Intelligence: Prenatal and Preconception Environmental Influences

Kennedy's paper, "Racial differences in intelligence: still an open question?" (*1*), which was presented at the annual meeting of the National Academy of Sciences, dealt with many of the variables which might determine differences in I.Q.-test scores between races. To examine the role of environmental variables, Kennedy suggested "a definitive study" in which illegitimate Negro children would be placed in middle-class Negro homes at birth and given all the school advantages of a middle-class environment. The later I.Q. and achievement scores of this group would be compared with those of lower-class Negro and lower-class white children, as well as with national norms.

In order to understand more fully the environmental contributions to intelligence, environmental variables must be controlled or manipulated before the child is born. Some of the effects of a poor prenatal environment may not show themselves clearly until relatively complex intellectual tasks are presented later in the child's life.

There are considerable data showing that lower socioeconomic status is associated with dietary deficiencies during pregnancy, lack of adequate medical care during pregnancy and delivery, prematurity, and greater maternal and infant mortality. In a group of mothers of nonretarded children, Lilienfeld and Pasamanick (*2*) found that twice as many nonwhite mothers experienced one or more complications of pregnancy as white mothers of the same age. However, the higher incidence of maternal complications in the group of nonwhite mothers may be accounted for by the poor nutritional and medical history of this lower socioeconomic group.

Nutrition during pregnancy has been found to influence the condition of the child (*3*). When vitamin supplementation was given to a low socioeconomic group of pregnant and lactating women with poor nutritional environment, the offspring at 4 years of age had an average I.Q. score 8 points greater than the average score of the children of mothers given a placebo over the same period.

The mother's nutritional history, even prior to the conception of the child, may influence the status of the infant. Drillien (*4*) found a greater correlation between the incidence of prematurity and the economic status of the child's maternal grandfather than with the economic status of the child's father, an observation which suggests that the mother's nutritional history and perhaps other aspects of her health environment during childhood and adolescence influenced her subsequent pregnancy. The latter data imply that the nongenetic influences on the status of children may include the environmental history of the mother prior to pregnancy as well as the prenatal and postnatal environments of the child.

Studies, such as the one proposed by Kennedy, will enhance our knowledge of the contributions of environment to intelligence, but attributing to heredity any I.Q. differences on the basis of such studies could hardly be justified, (i) because not all of the known relevant environmental variables would have been controlled, and (ii) because knowledge of the relevant environmental variables cannot be assumed to be complete. Conversely, if a sufficient number of the relevant variables are controlled with the result that differences in I.Q. scores between races become nonsignificant, our statistical methods will never, with any experimental design, prove that differences in the hereditary contributions to intelligence do not exist.

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References and Notes

1. W. A. Kennedy, *Science* **156**, 539 (1967).
2. A. M. Lilienfeld and B. Pasamanick, *Amer. J. Mental Deficiency* **60**, 557 (1956).
3. R. F. Harrell, E. Woodyard, A. I. Gates, *The Effects of Mothers' Diets on the Intelligence of Offspring* (Bureau of Publications, Teachers College, New York, 1955).
4. C. M. Drillien, *J. Obstet. Gynaecol. Brit. Commonwealth* **64**, 161 (1957).

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Erickson's comments suggest both a necessary control procedure and some of the limitations which must be imposed on the interpretation of the results of the proposed definitive study. The original paper made note of an important finding of the Cooperative Developmental Research Project, which indicates that when the mothers are given adequate prenatal care, even as late as the second trimester of pregnancy, the findings of Pasamanick do not hold. That is, if the mothers are given a vitamin and dietary supplement and adequate prenatal care, the Negro children, far from being born at a physical disadvantage, are born instead in what appears to be a superior position, as far as the general measures of intellectual and physical health are concerned. Although Pasamanick's study does indeed call attention to the necessity of controlling the prenatal environment, his findings are not consistent with those of almost any well-baby clinic which reports on Negro children born with hospital prenatal care. His findings evidently result from a combination of factors related to extreme poverty in a large city slum with very poor prenatal care. The proposed study would require the identification of mothers in the first trimester, excellent medical, dietary, and environmental support in the second trimester, and boarding care in a home during the third trimester. This would not take care of the problems which occur in the first trimester, but mothers could be eliminated if they showed any evidence that massive deprivation had occurred during the first trimester. The objection which Erickson raises is a practical one but it has practical solutions.

The second objection is, however, a theoretical one, and must be dealt with on theoretical grounds. This is the statement that since it is quite possible that not all relevant environmental variables are known, the study would not be definitive, particularly if significant differences between the experimental and two control groups were obtained. This could well be the case, given the use of the null hypothesis. But the study would make it possible to put to rest some of the most frequently used explanations, or else to defend them, and at the same time it would allow for a most useful factor-analytic study of differences on a very wide span of variables obtained from a large population during a long-range, longitudinal study such as that proposed.

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