was made in the calvarium over the left sensorimotor cortex. A 30-gauge needle attached to a microinjection syringe held rigidly in a stereotaxic micromanipulator was inserted into the cortex 1.2 mm below the exposed dura. Aqueous solutions were injected in 5 $\mu$l volumes over 5 minutes. Cats were restrained and anesthetized in a similar fashion and injected with 10 $\mu$l of aqueous iron solution; two animals were injected in the postcruciate gyrus and two in the sigmoid gyrus.

7. During generalized electrographic seizures, rats interrupted cage exploration. Piloerection and rhythmic twitching of the vibrissae and neck musculature accompanied each spike discharge. Cats with left postcruciate lesions displayed intermittent focal motor seizures originating in the limb musculature with occasional secondary major motor generalization.
8. Animals were lightly anesthetized with ether, paralyzed with *d*-tubocurarine (3.0 mg/kg, subcutaneously), and artificially ventilated by way of a tracheostomy. All wound margins were infiltrated with 2 percent lidocaine. Bilateral craniectomies were performed and a recording array of six Nichrome wires was placed on the isocortex along the site of iron injection parallel to the sagittal suture. Two electrodes were placed on the contralateral homotopic cortex. The electrocorticogram was recorded with bipolar and referential montages with a Grass model 6 electroencephalograph.
9. Animals were anesthetized with pentobarbital and killed by transcardiac perfusion with neutral buffered formalin. Selected brains were embedded in paraffin, and coronal sections (10 $\mu$m) were taken from an area extending 2 mm anterior and 2 mm posterior to the site of injection. Alternate sections were stained with phosphotungstic acid–hematoxylin, Masson's trichrome, hermatoxylin-eosin, and cresyl violet. Other brains were mounted in a freezing microtome and sectioned at 25 $\mu$m. Alternate sections were stained with cresyl violet, hematoxylin-eosin, Perl's Prussian blue stain, and Turnbull's reaction.
10. Iron occurs in group VIII of the periodic table of the elements.
11. P. M. Harrison, *Clin. Toxicol.* **4**, 529 (1971).
12. F. Panimon, M. K. Horwitt, R. W. Gerard, *J. Cell. Comp. Physiol.* **17**, 1 (1941).
13. A. Schaefer, A. Seregi, M. Komlos, *Biochem. Pharmacol.* **23**, 2257 (1974).
14. E. P. Richardson, Jr., and P. R. Dodge, *Epilepsia* (third series) **3**, 49 (1954); B. Jennett, *J. Neurol. Neurosurg. Psychiatry* **38**, 378 (1975); W. F. Caveness, *J. Neurosurg.* **20**, 570 (1963); H. A. Kaplan, *Epilepsia* **2**, 111 (1961); W. R. Russell and C. W. M. Whitty, *J. Neurol. Neurosurg. Psychiatry* **15**, 93 (1952).
15. Supported by the Medical Research Serivce of the Veterans Administration. We thank F. A. King and M. Greer for review and comments on the manuscript.

20 December 1977; revised 6 March 1978

## Intellectual Status of Working-Class Children Adopted Early into Upper-Middle-Class Families

Abstract. *Failure rates observed (13 ± 6 percent for school failures, 17 ± 5 percent for scores below 95 on a collective IQ test) were far below those expected from the social class of birth (55 percent, 51 percent) or observed in a control group (56 ± 8 percent, 49 ± 9 percent) but close to those expected from the social class of adoption (15 percent, 15 percent).*

There have been a certain number of speculations recently that there may be a genetic origin for the "educational lag of disadvantaged children" (*1*), that possibly "the class structure of modern society is essentially a function of the innately differing intellectual and other qualities of the people making up these classes" (*2*), or that we may be faced with "a future in which social classes not only continue but become ever more solidly built on inborn differences" (*3*). Part of the confusion surrounding these speculations stems from a failure to distinguish clearly between questions about individual variations and questions about group differences and also from the rarity of directly relevant observations (*4*). Our study contributes in a direct manner to the question of group differences in educational failures within primary school.

For questions concerning group differences, empirical answers can only come from the study of subjects who have been reared since birth by adoptive parents belonging to a different group from that of the biological parents (*5*). We present here the principal results of a study of this type, in which we have examined the intellectual failures of working-class children adopted early into upper-middle-class families. School curricula and IQ scores were obtained for an unbiased sample of 32 such subjects, all of them Caucasians. Comparisons were made with a control group of children of the same biological mothers, as well as with groups of children of the general population studied by others (*6, 7*).

The 32 adopted (A) subjects were obtained from the files of six public agencies from various parts of France. We examined the files of all the children who had been abandoned at birth between 1962 and 1969. We focused our attention on cases where the absence of professional qualification was known for both biological parents. For one-fifth of these cases, the children turned out to have been placed before the age of 6 months into a family of high socio-professional status (*8*). We succeeded in locating the children and in obtaining school curricula and IQ scores for all 32 subjects.

For 28 of these 32 A subjects, the biological mother could eventually be traced. Among these 28 mothers, 20 turned out to have children of school age who had not been abandoned (*9*). The 20 sibships contained 39 biological (B) subjects.

For each of the 20 sibships, one B subject to be tested was defined before the school curricula were known as the closest one in age to the corresponding A subject. Extensive search and the subsequent examination of school records made it unlikely that any B subject of school age had been missed and we were eventually able to obtain the school curriculum of every single B subject. This permitted both an unbiased estimate of the rate of school failures among B subjects and an a posteriori check on the absence of bias in the B subjects tested for IQ.

For the 20 B subjects tested and for 95 percent of the A subjects (*10*), we obtained two independent IQ scores, usually by administering a French collective test ECNI (*6*) as well as the full WISC (*11*). For school curricula (*12, 13*), a distinction was made between relatively mild failures (the repetition of grades within primary school) and serious failures (placement in a class with a simplified curriculum). For IQ tests, a reasonably comparable metric was obtained by defining mild failure as scoring below 95 and serious failure as scoring below 85. The comparison between A and B groups is presented in Table 1.

The contrast in intellectual status between the two groups is considerable, especially for serious failure—that is, for those failures that are likely to have the greatest impact on the future social and professional life of the subjects.

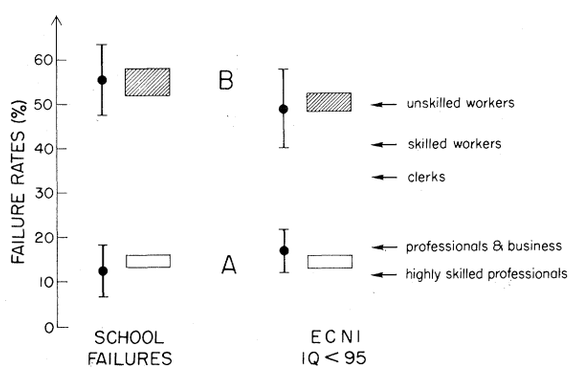


Fig. 1. Comparison of failure rates of A and B groups (circles with standard error bars) with rates expected for A children on the basis of adoptive parents (open rectangles) or biological parents (shaded rectangles) and with rates observed in the general population for five groups of schoolchildren (arrows).


0036-8075/78/0630-1503$00.50/0 

In order to further evaluate the significance of this contrast, we used observations made by others on large representative samples of French schoolchildren. The results observed for the A children were compared to those expected on the basis either of their biological parents or of their adoptive parents.

For school failures, comparisons were made with a large and representative cohort of 14,000 children leaving primary school, whose failure rates were known, between grades 1 and 6 (*7*). For the WISC, no national norms are available concerning the various social groups, but for the collective test ECNI we have one of the best standardizations ever made, based on a representative sample of 120,000 schoolchildren aged 6 to 14 (*6*). This test may also be less culture-biased than the WISC: the children of highly skilled professional parents (the top 5 percent) only have a mean score of 111.5 compared with 94.8 for children of unskilled industrial workers.

The results of the comparison have been plotted in Fig. 1. For school failures, the percentages observed for the A and B groups (13 ± 6 and 56 ± 8 percent) are compared to the failure rates expected for the A children on the basis either of their adoptive parents (15 percent) or of their biological parents (55 percent). For the collective test ECNI, the percentages of scores below 95 (17 ± 5 and 49 ± 9 percent) are compared to the rates expected from the social class of the adoptive parents (15 percent) or of the biological parents (51 percent) and to the rates observed for five social groups.

We emphasize the absence of ascertainment bias and the fact that the two groups are biologically equivalent (*14*), so that the contrast observed between them is essentially of environmental origin. The details of our results and the possible sources of bias are being examined (*15*).

The contrast in intellectual status between the A and B children is close to that prevailing in the population at large between children of upper-middle-class parents and children of unskilled workers. Moreover, the failure rates observed for the A children are almost embarrassingly close to those expected solely on the basis of the social class of their adoptive parents. We think that the most economical interpretation of these observations is that there are no important genetic differences between social groups for factors relevant to school failures. An alternative interpretation would be that a certain genetic disadvantage of the A children was exactly compensated for by a special environmental advantage related to their adoptive status. In this case, however, one begins to wonder whether there exists any experimental design by which the hypothesis of a genetic origin for the "educational lag of disadvantaged children" (*1*) could be submitted to scientific test.

Table 1. Comparison of A and B groups. For IQ tests 1 and 2—usually WISC and ECNI (*11*)—percentages of failure were obtained by assuming a normal distribution of scores.

| | Percentages | |
|---|---|---|
| | A | B |
| *Serious failures* | | |
| Special class | 2* | 25† |
| Scoring below 85 | | |
| Test 1 | 1 | 20 |
| Test 2 | 4 | 21 |
| *All failures* | | |
| Special class or repeat | 13‡ | 56§ |
| Scoring below 95 | | |
| Test 1 | 8 | 52 |
| Test 2 | 17 | 49 |

| Test | *N* | IQ | $\sigma$ |
|---|---|---|---|
| 1A | 32 | 110.6 | 11.3 |
| 1B | 20 | 94.5 | 11.3 |
| 2A | 31 | 106.9 | 12.2 |
| 2B | 20 | 95.4 | 12.9 |

*(½)/32 (*10*). †11/39 = 28 percent (*13*). ‡4/32. §24/39 = 62 percent (*13*).

MICHEL SCHIFF, MICHEL DUYME
ANNICK DUMARET, JOHN STEWART
STANISLAW TOMKIEWICZ
JOSUE FEINGOLD
*Institut National de la Santé et la Recherche Médicale (INSERM), U 69, 1 rue du 11 Novembre, 92120 Montrouge, France*

**References and Notes**

1. A. R. Jensen, *Harv. Educ. Rev.* **39**, 1 (1969).
2. H. J. Eysenck, *The Inequality of Man* (Temple Smith, London, 1973), p. 19.
3. R. J. Herrenstein, *IQ in the Meritocracy* (Little, Brown, Boston,1973), p. 214.
4. M. Skodak and H. M. Skeels, *J. Genet. Psychol.* **75**, 85 (1949); H. M. Skeels, *Child Dev. Monogr.* **31** (3) (1966); S. Scarr and R. A. Weinberg, *Am. Psychol.* **31**, 726 (1976).
5. L. F. Richardson, *Eugen. Rev.* **4**, 391 (1913).
6. Institut National d'Etudes Démographiques, *Travaux et Documents*, **54** (1969). The norms for the collective ECNI (Echelle Collective de Niveau Intellectuel) test are given in table $II_1$ of volume 64 (1973) of the same series. For the general population, the mean is 99.2, with a standard deviation of 15.
7. Ministère de l'Education, Service Central des Statistiques et Sondages, *Etudes et Documents* **28** (1974); the norms for school failures were obtained from the raw data of tables $I_{21-24}$ and $III_{21-25}$.
8. Biological parents of the A children: all putative fathers were unskilled workers, and there were no skilled workers among the mothers. Class of adopted children: 20 belonged to the top 5 percent, 10 to the following 10 percent, and 2 to the next 10 percent, in terms of socio-professional status.
9. The 12 cases of B mothers without a B child were distributed as follows: Four mothers could not be followed up because their identity was not in the files, four had numerous other children but had abandoned them all, three had no other child, and one had left France.
10. The A group contained 35 children, including three twin pairs; each member of a twin pair was counted as half of one subject.
11. Usually, score No. 1 came from the Wechsler Intelligence Scale for Children (WISC) and score No. 2 from ECNI. For the collective test, one subject was absent and two were given the Cattell scale No. 2 because they were too old for the ECNI scale. The other exceptions (10 percent of scores) concern children who had been placed in special classes and for whom one or two IQ scores were available in school files.
12. A subjects: 6 in grade 3, 10 in grade 4, 3 in grade 5, and 13 in grade 6 or above.
13. B subjects: 6 in grade 2, 3 in grade 4, 3 in grade 5, and 27 in grade 6 or above. The probability of school failure increases with age; hence a small age correction was made to take account of the fact that, on the average, the B children were slightly older than the A children.
14. Briefly, the possible effect of selective placement of "bright" infants into "good" families is minimal because of the early age at which this placement occurred (mean age, 4 months; maximum age, 6 months). Another small systematic bias could have arisen from the fact that the fathers of the A and B children were different in most cases; however, this could only decrease the effect observed, because the fathers of the A subjects were purposely chosen to be of the lowest possible socio-professional group, whereas some of the fathers of the B children were in a somewhat higher group.
15. M. Schiff, M. Duyme, A. Dumaret, J. Stewart, S. Tomkiewicz, J. Feingold, in preparation.
16. Supported by the Grant Foundation, INSERM, Centre National de la Recherche Scientifique, and the Fondation pour la Recherche Médicale Française. In the initial stage, crucial support was given by R. Cohen, A. Gerbal, J. M. Goux, R. Havighurst, A. Jacquard, C. Meljak, S. Richardson, C. Ropartz, M. Vigier, and R. Zazzo.

22 November 1977; revised 15 March 1978

## Role of Adipocyte Geometry in Eating Behavior

According to the lipostatic theory of body weight regulation (*1*), a humoral satiety signal, directly proportional in intensity to organismic adipose mass or some covariant, provides information to the nervous system which alters appetitive behavior. Meal size or frequency, or both, are thereby adjusted to maintain body mass relatively constant over the long term. The nature of this signal and the aspect of adipose mass to which it is sensitive are unknown, but insulin and some correlate of adipocyte size are, respectively, attractive candidates. Since the sensitivity of adipocytes to insulin-sensitive metabolic processes appears to vary inversely as their size, a closed-loop system relating prandial insulin levels to current adipose mass can be envisioned (*2*). A recent study of experimentally joined rats has provided strong evidence for an adipose mass–related humoral satiety factor (*3*).

The data of Faust *et al.* (*4, 5*), which demonstrate both a strong tendency toward constancy in organismic adipose mass and an apparent influence of adipocyte size on eating behavior, support this


0036-8075/78/0630-1504$00.50/0 