Reports

Intellectual Level Measured by Army Classification Battery and Serum Uric Acid Concentration

Abstract. In a group of 817 individuals inducted into the U.S. Army, serum uric acid concentration was measured. The values were compared with scores secured on intelligence tests used at the Army reception center. A significant but low level of positive correlation between the two sets of values was found.

Students of arthritis have from time to time recorded the impression that the number of prominent and successful people suffering from gout is remarkably high, considering the relative rarity of the disease. In a recent review of a segment of the history of gout (*1*), one of us (D.S.) collected an impressive list of names of persons prominent in science, letters, diplomacy, and war who purportedly had gout. On more than one occasion it has been suggested that a causal relationship between gout and some measure of human achievement may exist.

It is possible that successful people have a tendency to ingest a diet richer in protein and purine than is usual. Such a diet might result in hyperuricemia and, in the predisposed individual, could ultimately lead to gout. On the other hand, an alternative causal relationship might be that some phase of the metabolic defect in gout, possibly the hyperuricemia, produces enhanced activity of the cerebral cortex. The latter mechanism is perhaps inherent in a suggestion by Orowan (*2*), who proposes that the remarkable development of the human cerebrum stems from the mutation, occurring early in anthropoid phylogeny, which resulted in the loss of hepatic uricase. The consequent elevation in blood uric acid concentration is pictured as stimulating the cerebral cortex, a claim for which no documentation is supplied.

In an answering note (*3*), Haldane points out, among other things, that the postulate of Orowan would imply a correlation between intelligence and the level of blood uric acid concentration. Such a correlation, he states, has not been noted.

The purpose of the present communication is to report the quest for such a correlation. A total of 817 Reserve Forces Act (1955) trainees from the reception station at Fort Dix, N.J., were studied (*4*). The score achieved by each inductee in the Army Classification Battery (ACB) was recorded. This collection of tests (*5*) is designed to measure intelligence and certain special aptitudes and correlates well with other measures of intelligence. A sample of blood serum from the routinely collected blood specimen was also secured from each subject. At the time of collection of the blood, the inductees, all young adult males, had been on the station and on a fairly uniform diet for about 48 hours.

The sera were analyzed for uric acid by a uricase method (*6*) involving measurement of optical density at the maximum of absorption for uric acid, 292 mμ. The mean value for uric acid in this population group was 5.06 mg per 100 milliliters, with a range from 1.05 to 8.74 mg and a standard error of 0.033. The mean value for the ACB test scores was 118.1, with a range from 50 to 156 and a standard error of 0.70.

The coefficient of product-moment correlation, determined by the formula

$$r = \frac{N\Sigma XY - \Sigma X\Sigma Y}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}}$$

was found to be + 0.0759. The hypothesis that the observed value of r arose from an uncorrelated normal population was tested (*7*, p. 343) by setting

$$t = r\sqrt{(N-2)/(1-r^2)}$$

and referring to the t-distribution for N-2 degrees of freedom (*8*). The value of t was 2.17. Thus, the probability of obtaining an r-value equal to or exceeding in absolute value that observed is approximately 0.03 and the probability of obtaining a *positive* r equal to or exceeding that observed is approximately 0.015.

The Spearman coefficient of rank correlation provides a test for correlation which does not involve the assumption of normal distribution. It was determined by the formula

$$\rho = 1 - \frac{6\Sigma D^2}{N(N^2-1)}$$

ties being cared for by the bracket rank rule (*9*). The value of ρ was found to be + 0.0742. For sufficiently large N (*7*), the significance of ρ may be tested in Student's distribution by putting

$$t = \rho\sqrt{(N-2)/(1-\rho^2)}$$

The value of t was 2.20, and the probability of obtaining such a positive ρ, or greater, by random sampling from an uncorrelated population is approximately 0.015, in close agreement with the result when r is used.

From these findings it may be concluded that a low level of positive correlation, significant to 1.5 percent, does indeed exist between the score attained in the ACB test and the level of uric acid in blood serum in the population studied. Clearly, the present data provide no basis for discrimination among the several possible causalities for such a correlation.

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References and Notes

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2. E. Orowan, *Nature* 175, 683 (1955).
3. J. B. S. Haldane, *ibid.* 176, 169 (1955).
4. We wish to acknowledge the cooperation of Maj. R. W. Sherwood, Maj. C. E. Motson, Maj. C. A. Horan, M/Sgt. E Patterson, Sfc. W. Tierney, and Sgt. J. P. Cruz, and of their staffs, all of the Fort Dix Health Center. We are also indebted to Lt. Col. W. R. Wilkin of Walter Reed Hospital for information about the psychological testing program of the U.S. Army and to J. E. Lieberman and Dr. J. E. Seegmiller of the National Institutes of Health for assistance in special phases of this problem. This study was made with the technical assistance of Louise R. Miller, Dolores L. Lowery, and Dorothy Lathrop.
5. E. K. Montague, H. L. Williams, A. Lubin, C. F. Gieseking, *U.S. Armed Forces Med. J.* 8, 883 (1957).
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7. M. G. Kendall, *The Advanced Theory of Statistics* (Hafner, New York, ed. 5, 1952), vol. 1.
8. R. A. Fisher and F. Yates, *Statistical Tables* (Harper, New York, ed. 3, 1949).
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Limit the report proper to the equivalent of 1200 words. This space includes that occupied by illustrative material as well as by the references and notes.

Limit illustrative material to *one* 2-column figure (that is, a figure whose width equals two columns of text) or to *one* 2-column table or to *two* 1-column illustrations, which may consist of two figures or two tables or one of each.

For further details see "Suggestions to Contributors" [*Science* 125, 16 (1957)].