

# Twin Studies in Human Genetics

## SIGNIFICANCE OF SECULAR BODILY CHANGES OF THE JAPANESE FROM THE VIEWPOINT OF A TWIN STUDY

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The shapes of the skull of the common people in Tokyo-Yokohama area have undergone secular changes from the protohistoric age to the present day.

The common people in Japan are considered to be the descendants of protohistoric farmers who inhabited and cultivated the same locality from generation to generation. Nevertheless, the mentioned changes can be regarded as gradual ones if skeletal materials of the intermediate ages (5th to 19th century A.D.) are examined.

Some features, such as cranial form, facial form, nasal form, and elevation of the nasal root, have changed significantly, whereas other traits, such as the sum of cranial length and breadth, cranial module, horizontal circumference, and mediosagittal arc of the cranium, have undergone little change.

The results of a twin study are supposed to elucidate the probable reason for these age changes.

Anthropological measurements were made on an unselected sample of 286 MZ and 83 same-sexed DZ twin pairs aged 12 to 14 years, all living in Tokyo Metropolitan area. A total of 18 measurements of the head and face were made. Von Verschuer's percentage deviation method was applied for the data analysis.

The mean intrapair difference is maximum in the sum of the head length and breadth, horizontal circumference, module of the head; medium in bizygomatic breadth; minimum in frontal breadth, etc.; maximum in facial height, length-breadth index of the head, nasal height and breadth, elevation of the nasal root.

The results suggest that features showing

minimum intrapair difference are stable to the environment, whereas features showing maximum intrapair difference are unstable to the environment.

Therefore, of the various changes in the cranial features which have taken place since protohistoric times, the most conspicuous ones correspond to such features that are supposed to be most unstable to the environment. On the contrary, the chronologically little changed ones correspond to the stable features.

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## TWINS: GENETIC EFFECTS ON PHYSICAL GROWTH FROM BIRTH TO FOUR YEARS

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Height and weight growth curves have been developed for twins, based on a sample of 584 twins that were repeatedly measured from birth to four years of age. Sex differences in growth rate were evident at several ages: males grew more rapidly in the first 6 months, whereas females grew more rapidly in the third year. Compared to singletons, the size deficit for twins was greatest at birth, but there was a marked recovery in the first six months, followed by only minor changes thereafter. Weight was somewhat more affected by growth suppression than height; the twins remained 0.45 standard deviations below the singletons for weight, whereas they nearly equalled the singletons for height at age 4. The results suggest that prenatal adipose-cell replication may be restricted by the nutritional demands of a twin pregnancy.

When the sample was separated into MZ twin pairs and DZ same-sex pairs, the MZ twins were found to be less alike for birth

weight than DZ twins (MZ within-pair correlation = 0.61; DZ = 0.70). By one year of age, however, the MZ twins had become increasingly similar ( $r_{mz} = 0.87$ ), while the DZ twins moved further apart in weight ( $r_{dz} = 0.55$ ). The same pattern was evident for length in even more pronounced form; at birth, the MZ correlation was 0.58 and the DZ correlation was 0.77. By two years of age, however, the MZ correlation reached 0.89, while the DZ correlation regressed to 0.58. The results are discussed in terms of (a) prenatal influences that differentially affect birth size within MZ pairs and DZ pairs, and (b) the rapid convergence of each twin on his genetic growth curve during the first year of life.

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## DETECTION OF GENETIC VARIANCE IN BLOOD PRESSURE: THE NATIONAL HEART AND LUNG INSTITUTE TWIN STUDY

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The National Heart and Lung Institute Twin Study has examined 514 white adult male twin sets aged 42-56 at five centers in the United States. Blood pressure measurements for cotwins were obtained on the same day at the same center but by different physicians according to a standardized protocol. The distributions of diastolic and systolic blood pressures in the twins were comparable to those observed in other populations. Significant differences between centers were observed but no differences by zygosity were demonstrable after adjustment was made for center differences.

The data were analyzed by a method of Christian et al. which eliminates possible biases in estimated genetic variances that

could result from different total variances in MZ and DZ twins. Results of the test for the presence of genetic variance indicate that both systolic and diastolic blood pressure are to a considerable extent genetically controlled with an estimated heritability of 0.8 for systolic and 0.6 for diastolic pressure. Although these findings are at variance with some previous reports, it is thought that much of the discrepancy results from application of different analytic techniques, not in the data themselves. The application of these findings to our understanding of hypertension epidemiology and community hypertensive control programs are discussed.

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## GENETICS OF PLASMA CHOLESTEROL AND TRIGLYCERIDES

### A Study of Adult Male Twins

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White male twins born from 1917 to 1927 (514 sets, 250 MZ and 264 DZ) were studied in 5 U.S. Centers as a part of the National Heart and Lung Institute Twin Study. Fasting plasma triglycerides and cholesterol, as well as cholesterol in very-low-density and high-density lipoproteins (HDL), were measured. Analysis of variance of the five lipids revealed no significant differences between the means of MZ and DZ twins and only HDL cholesterol was significantly variable among the 5 centers.

A new method was used to choose an estimate of genetic variance. This method includes an estimate of genetic variance for