

twinning type and sex: verbal and nonverbal cognitive abilities, birth weight, and minimal brain injury.

A total of 45 (20 MZ and 25 DZ) twins pairs of both sexes were matched with 90 singletons of the same age, sex, and school class. All subjects were Israeli kibbutz born youngsters, and as such were all of the same social background. The following data were acquired for all subjects: period of gestation, type of delivery, birth weight, and physical development after birth. Additional data in the case of the twins: birth order and type of twinning.

All subjects took the Raven Progressive Matrices, the Kohs Blocks (nonverbal intelligence tests), and the verbal scales of the WISC. The Bender-Gestalt test and neurological examinations (including fine motor coordination, gross motor coordination, motor impersistence, associated movements, equilibrium, different sensory functions) were also given in order to detect indications of possible brain injury.

*Hypotheses.* MZ twins will have more problems of brain injury than DZ twins, as will males more than females. As the result of organic damage, there would be a decrease in verbal and nonverbal abilities, while in the absence of indications of organic damage, the nonverbal abilities will be normal. However, in the twin group there would be a decrease in verbal abilities even in the absence of such indications, on account of a dependent relationship between the twins.

*Results.* Most of the hypotheses were verified. Within the twin group, patterns of significant correlations were established: birth weight, twinning types, and sex, with neurological problems and achievements in different tests.

Differences in intrauterine environment between singletons and twins and between types of twins are seen as a possible explanation for differences in birth weight, occurrence of brain injury, and therefore as an explanation of differences in some cognitive abilities.

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## WEIGHT INCREASE OF TWINS AND SINGLETONS IN THE FIRST YEAR OF AGE

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Weight increase in the first year of age has been studied on a sample of 25 male and 25 female MZ and 25 male and 25 female DZ twin pairs, as well as on a control sample of 60 male and 60 female single newborns from a similar socioeconomic environment and in the same period (1972-1973). Weight increase in twins, both MZ and DZ, has been shown to be 10% lower than in singletons. Up to the sixth month of life the average weights of twins and singletons are significantly different. In the following months, however, the average weight of twins tends to reach that of singletons. This applies to both MZ and DZ twins and to the two sexes.

Heritability has also been estimated and the  $h^2$  value obtained, approximately 60%, shows a relatively high genetic conditioning of weight increase in the first year of age.

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## CONGENITAL MALFORMATIONS IN TWINS

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Among 1195 twins born in the Collaborative Perinatal Project, for whom information was available, 219 (18.33%) were found to have malformations, 179 (14.98%) single and 40 (3.35%) multiple. The frequency of malformations among twins was significantly higher than that among singletons from the same population, but the difference was entirely contributed by MZ twins. This holds true for both major and minor malformations. The frequency among Negro twins was higher than among white, and among male twins higher than among female. Twins had more malformations of the central nervous, musculoskeletal, ear,

respiratory, cardiovascular, and alimentary systems, and fewer malformations of the genitourinary and integumentary systems than singletons.

Concordance rates were significantly higher among MZ twins than among DZ for any malformation, and for the categories of single and minor malformations.

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## ANTE- AND POSTNATAL FACTORS AFFECTING LEUKEMIA IN TWINS

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In our 1971 publication of the "Epidemiologic Study of Leukemia in Twins", several significant trends which may have affected the occurrence of this disease were brought to light. The perinatal-congenital period was the time during which concordance was notably highest. Concordance was observed to diminish in later life.

Prior to July 1971, 71 cases of leukemia in twins were reported in the literature. Since then, approximately 17 more cases have been reported. These reported cases cannot be used to determine incidence and prevalence rates since the actual number of twins afflicted with leukemia worldwide is unknown, as is the number of sets of twins presently living.

Reports published since 1971 strengthen the impression that four basic factors affect concordance of leukemia among twins: (1) exposure to ionizing radiation; (2) chromosomal changes; (3) conjoined intrauterine circulation, and (4) direct metastasis.

The cumulative reports of Alice Stewart strongly suggest that routine antenatal radiation is potentially carcinogenic. Although a minimal harmful dose has not yet been established, in light of the available statistics it seems incumbent upon the obstetrician to use the utmost discretion in deciding which radiographic studies must be performed, continuously bear in mind the more benign alternative of ultrasound. The conjoined intrauterine circulation model in twins dramatically modifies the idea of a placental barrier. By means of tracer substances, leukemic cells have been shown to cross the so-called placental barrier, consequently increasing the plausibility of direct metastasis of leukemic cells from mother to child. Also, a series of vessel-to-vessel anastomoses, existing antenatally, is quite feasible in MZ pairs and is an enticing explanation for the high incidence of concordance among such twins early in life.

We suggest long-term longitudinal follow-up studies be performed in the nonleukemic twin of a discordant pair in order to determine the earliest onset of preclinical disease. The results of such studies could conceivably shed light on the question of environmental or hereditary factors influencing the course of leukemia in twins.

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## 2. Twin Psychology

### THE TWIN CONDITION AND THE COUPLE EFFECTS ON PERSONALITY DEVELOPMENT

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Twin psychology has been studied to a very limited extent. Only few remarkable peculiarities of the twins' development are known for sure, such as delayed intellectual development, language retardation with fre-

quent cryptophasia, difficulties and fragility of self consciousness, reduced sociability. Bachelorhood is much more frequent in adult twins than in the general population. These peculiarities obviously hold true only in the average twin population and characterize MZ much more than DZ twins. They may result from a number of different factors: biological (higher risks in fetal development, prematurity, and therefore hampered further development), peculiar parental attitude, and the twin situation itself. The latter would appear to be the most