ERYTHROCYTE GALACTOSE-1-PHOSPHATE URIDYLTRANSFERASE AND GALACTOKINASE LEVELS IN TWINS

P. CHOLNOKY (1), F.C. SITZMANN (2), I. TEUBL (3), H. KALOUD† (4)

(1) County Hospital, Department of Paediatrics, Szombathely, Hungary
(2) Children's Department of the Medical School of the University of Erlangen-Nürnberg, GFR
(3) Department of Blood Transfusion and Blood Serology of the Surgical Clinic, Graz, Austria
(4) Children's Department of the University of Graz, Austria

The levels of the two enzymes, GAL-1-PUT and GAL-KIN, have been examined in a sample of 35 MZ and 45 DZ twin pairs of both sexes. The activities of these enzymes do not appear to be influenced by sex. The role of genetic factors appears to be rather limited in the case of GAL-1-PUT, but much higher in the case of GAL-KIN.

Little is known about within-pair twin similarity in the levels of the most important enzymes of galactose metabolism, galactose-1-phosphate uridyltransferase (GAL-1-PUT) and galactokinase (GAL-KIN). In our cooperative study we aimed at some peculiarities of this problem.

Twins born during the years 1962-1965 in the Hungarian county Vas (280,000 inhabitants) adjacent to the Austrian frontier, were examined in 1974-75. There were 156 sets in 14,600 live births. In the 68 pairs of twins and the set of triplets accessible for examination, ABO, MN, Ss, Cs, Cw, D, Ee, Kk and Fy blood groups were determined (Teubl, Graz) for zygosity. Since two members of the triplet set proved to be MZ, the 139 children (68 M, 71 F) could be classified into 46 DZ pairs (9 MM, 9 FF, 28 MF) and 25 MZ pairs (11 MM, 14 FF).
Blood samples were taken for enzyme measurements. Erythrocyte GAL-1-PUT- and GAL-KIN-activities were measured by Sitzmann (Erlangen) by methods previously described (Beutler and Baluda 1966, Beutler and Mitchell 1968, Inouye et al. 1968, Beutler et al. 1971).
The children's age at the time of blood sampling was 8-12 years (mean age 10.1).

For both enzymes the mean values were nearly identical for boys and girls (GAL-1-PUT: males, 15.44 U/gHb; females, 15.52 U/gHb; GAL-KIN: males, 23.10 mU/gHb; females, 22.28 mU/gHb). The GAL-1-PUT values corresponded to those observed in children of the same age by the same laboratory (Kaloud and Sitzmann 1971*a,b*), mean GAL-KIN values lay somewhat lower than in earlier studies (Kaloud et al. 1973, Sitzmann et al. 1973, Kaloud and Sitzmann 1974). Since there was no sex difference, data of both sexes were pooled.
Two heterozygotes were found for GAL-1-PUT, a MZ female pair. Four GAL-KIN heterozygotes were found, a MZ male pair, the two others being each a female member of an unlike sexed pair.
Comparison was made between MZ and DZ pairs for the intrapair differences of both enzymes. Table 1 shows the intrapair correlation coefficients and mean differences for GAL-1-PUT values.

Table 1. *GAL-1-PUT values in twins*

	r	Mean difference	*SD*
MZ	0.659	1.35 U/gHb	1.74
DZLS	0.824	2.38 U/gHb	1.75
DZUS	0.767	1.98 U/gHb	1.68
DZ	0.797	2.14 U/gHb	1.70

No difference in correlation could be established between MZ and DZ, or between like sexed (LS) and unlike sexed (US) DZ twins. The mean intrapair differences between MZ and DZ twins does differ, but this difference is not statistically significant. On the other hand, in about one third of DZ twins the value of the intrapair

difference is greater than the greatest difference observed in MZ twins (Fig. 1).

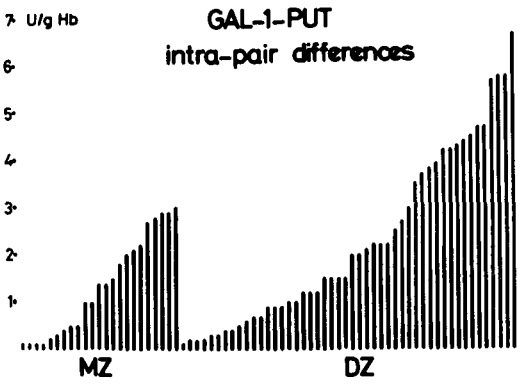

Fig. 1

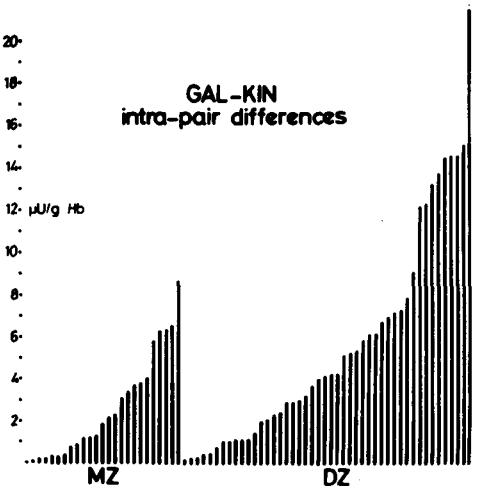

Fig. 2

Table 2 and Fig. 2 show the same relationships for GAL-KIN. Their values for MZ and DZ twins differ significantly (z test: $P < 0.001$), while the mean intrapair differences do not ($t_{MZ/DZ} = 1.87$, $P > 0.05$). Combined activities of both enzymes, calculated by addition of the weighed individual values, using a weighing factor 1.46 (the ratio of mean GAL-KIN and GAL-1-PUT activity in this study) for correction of GAL-1-PUT values, allowed a better discrimination between MZ and DZ pairs: the mean intrapair difference expressed in arbitrary units is much lower in MZ than in DZ, the difference being statistically highly significant ($t = 3.14$, $P < 0.001$) as shown in Table 3. Fig. 3 illustrates the same data graphically. It can be seen that in nearly one half of DZ twins, zygosity could have been told only on the basis of the combined weighed intrapair difference observed in the activity of the two enzymes.

Table 2. *GAL-KIN values in twins*

	r	Mean difference	*SD*
MZ	0.919	2.59 mU/gHb	2.50
DZLS	0.552	6.31 mU/gHb	5.91
DZUS	0.637	5.21 mU/gHb	4.67
DZ	0.592	5.64 mU/gHb	5.15

Table 3. *Combined GAL-1-PUT and GAL-KIN values in twins*

	Mean difference	*SD*
MZ	4.57 arb. units	3.24
DZLS	9.70 arb. units	7.32
DZUS	8.10 arb. units	5.79
DZ	8.75 arb. units	6.41

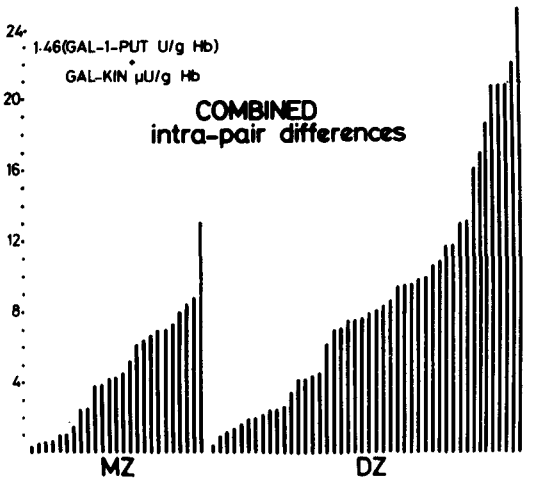

Fig. 3

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As expected, the activities of GAL-1-PUT and GAL-KIN are not influenced by sex. No discordance for heterozygosity was observed in MZ twins. In the case of GAL-1-PUT nongenetic factors influencing the actual activity may be rather strong, since intrapair correlation is not higher, in fact it is somewhat lower, in MZ than in DZ. With GAL-KIN, small additive modifying factors, probably of inherited origin, may explain the much higher intrapair correlation in MZ. The discriminating power for zygosity can be corroborated by combining the intrapair differences for both enzymes; it is probable that in some individual twins of the same sex and without any difference in their blood groups, dizygosity can be established on the basis of rather different enzyme values. Higher resemblance of MZ twins with respect to serum enzyme values or to blood levels of chemical substances is a well documented fact (Gedda and Poggi 1960, Arfors et al. 1963, Simpson and Kalow 1963, Beckmann and Wetterberg 1967, Kulonen 1967, Gedda et al. 1968, Thompson et al. 1969, Gedda and Tatarelli 1970, Hosenfeld and Drössler 1970, Kamaryt et al. 1970). Among the erythrocyte enzymes, G6PD has been investigated (Bewer et al. 1967, Beiguelman et al. 1970). Our findings, especially those concerning GAL-KIN activity in erythrocytes, corroborate the idea that MZ twins are, here too, more similar than DZ.

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Dr. P. Cholnoky, Pf. 143, 9701 Szombathely, Hungary.