DERMATOGLYPHIC INVESTIGATIONS IN TWINS AND SIBLINGS

C. C. PLATO (1), J. T. SCHWARTZ (2), W. WERTELECKI (3)

(1) National Institute on Aging, Gerontology Research Center, National Institutes of Health, Baltimore, Maryland, USA

(2) Office of Biometry and Epidemiology, National Eye Institute, National Institutes of Health, Bethesda, Maryland, USA

(3) Department of Medical Genetics, University of South Alabama College of Medicine, Mobile, Alabama, USA

The present report describes the preliminary results of an extensive dermatoglyphic investigation among 491 pairs of MZ and DZ twins, and sibs of both sexes. Paired homolateral comparisons were performed for the determination of the degree of discordance for each dermatoglyphic trait and the results were presented in a series of histograms. Some of the outstanding points brought forth by this study are: (1) different dermatoglyphic traits at different digits or palmar areas have different degrees of discordance; (2) in MZ twins the frequency of discordance for each trait is constant regardless of sex or laterality, whereas in DZ twins and sibs both sex and lateral differences are observed; (3) the higher number of significant differences in concordance between the MZ twins vs. sibs than between MZ vs. DZ twins suggests that, at least in the female, the dermatoglyphics may be affected by changing intrauterine environments.

We are all aware of the truism that no two individuals are alike in their dermatoglyphics. We also know from several studies that most dermatoglyphic traits are inherited with varying degrees of complexity. Intrauterine conditions during the first trimester of pregancy have also been shown to have an effect on the dermatoglyphic phenotypes. Sibs and other close relatives have higher degrees of dermatoglyphic similarity than unrelated individuals; and MZ twins show much higher intrapair similarity than the DZ twins.

Presently we will report on the preliminary results of a detailed investigation to estimate the degree of intrapair dermatoglyphic similarity and dissimilarity, with their respective specific components, among MZ twins, DZ twins, and sib pairs.

MATERIAL AND METHOD

The study involved 491 pairs of twins and sibs: 125 pairs of MZ males, 148 pairs of MZ females, 50 pairs of DZ males 48 pairs of DZ females, 60 pairs of brothers, and 60 pairs of sisters. Zygosity diagnosis was based on blood group and anthropometric observations, but not on dermatoglyphics. All of the twins were participants of the ophthalmological twin survey directed by one of us (J.T.S.); further information of the methodology and ascertainment are referred to in a previous report (Schwartz 1970).

The sibs are part of a familial dermatoglyphic study which is composed of both parents with two or more normal children. Only two sibs from each family were used in this study. The ages of the sibs ranged from 5 to 20 years. Whenever a choice was afforded, we selected the sibs with the least age difference. At no instance was the age difference within pairs more than 5 years. The prints were collected by the Faurot inkless technique and were evaluated for the most part by the methods described by Cummins and Midlo (1943). The modal types of the C line (Plato 1970) and the modal types of the D line (Cummins and Midlo 1926) were also utilized. In this preliminary report only the main digital and palmar patterns will be discussed. Subtype and other detailed comparisons will be dealt with in the final report which is presently under preparation.

Intrapair homolateral comparisons were completed and the results are presented herewith in terms of percentages of discordance for the following dermatoglyphic traits: (1) presence of specific pattern in the I, II, III, IV

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and V digits and the pattern intensity index; (2) Modal types of the C and the D lines, and the main line index; (3) Presence of specific pattern types and subtypes in the hypothenar, thenar/I, II, III and IV interdigital areas; (4) Presence and number of accessory triradii in the hypothenar area, and in the II, III and IV interdigital areas; (5) Width of the atd angle.

RESULTS AND DISCUSSION

The results of all the above comparisons are summarized and presented graphically in a series of histograms (Figs. 1, 2, and 3) indicating the percentage of homolateral discordance for each type of twin and sib pair. The results were expressed in terms of discordance, in order to avoid the misleadingly high frequencies of concordance resulting from the bilateral absence of certain features, such as the presence of interdigital patterns, accessory triradii and palmar creases. All figures have similar format. They are composed of four sets of histograms. The first two relate to the left vs. left and right vs. right homolateral intrapair comparisons for the male, and the other two to the left vs. left and right vs. right for the female. In each case the black area indicates the percentage of discordance among the MZ twins, the gray area that of the DZ, and the barred the discordance among pairs of sibs. Since the figures are for the most part self explanatory, the discussion will be limited to general observations.

Fingerprints

The paired homolateral frequencies of patterns on each digit together with the overall pattern intensity index (PII) are shown in the histograms of Fig. 1. Some of the outstanding observations from this figure are:

(*a*) In all digits, as expected, the MZ twins have the lowest percentage of intrapair homolateral discordance irrespective of laterality or sex.

(*b*) The male DZ twins for the most part, show higher degree of discordance than the pairs of brothers, while in the female this trend is reversed.

(*c*) Regardless of the pairs compared, (MZ twins, DZ twins, or sibs), the frequency of discordance varies from digit to digit; the second digit shows the highest degree of discordance and the fifth the lowest.

(*d*) Within each digit the discordance frequencies of the MZ twins are more or less uniform while some of those of the DZ twins and sibs vary considerably.

Palm Prints

The results of the palmar dermatoglyphic homolateral comparisons are given in Figs. 2 and 3. The modal types of the C and D lines and the main line index (MLI), Figs. 2A, 2B and 2C respecively, show, as a rule, higher frequencies of discordance in the right-hand comparisons than the left. In Fig. 2D the atd angles were considered discordant if their width difference was more than 5°. The last two sets of histograms, Figs. 2E and 2F, refer to the homolateral presence of accessory triradii in the hypothenar and the IV interdigital area. Data on the II and III interdigital areas were omitted due to the very small numbers involved. Looking at Fig. 2 as a whole it can be seen, as in Fig. 1, that the MZ twins are less discordant than either the DZ twins or sibs and their discordance frequencies within each dermatoglyphic feature show considerably less variation by hand or sex than either the DZ twins or the sibs. The frequencies of discordance for the patterns in the hypothenar, thenar/I, and the II, III and IV interdigital areas, are given in Figs. 3A, 3B, 3C, 3D, and 3E, respectively. The determination of discordance was based not only on the presence or absence of pattern but also on the type of pattern present. Such combinations as vestige/loop and loop/whorl were considered as discordant. The general observations of lower and less variable discordance frequencies among the

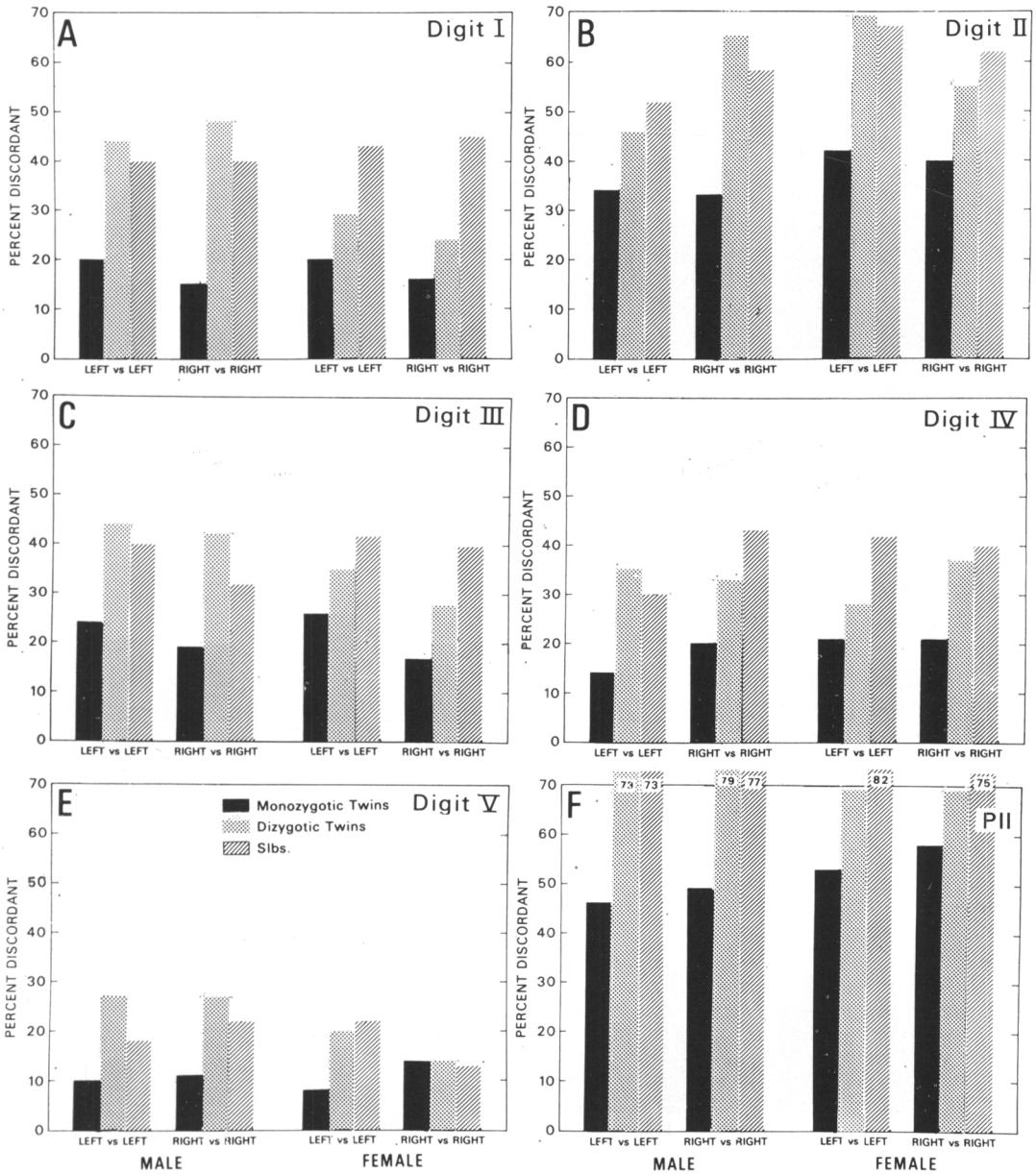

Fig. 1. Frequencies of intrapair homolateral discordance among the MZ twins, DZ twins, and sibs, for patterns in each of the five digits and the pattern intensity index (PII).

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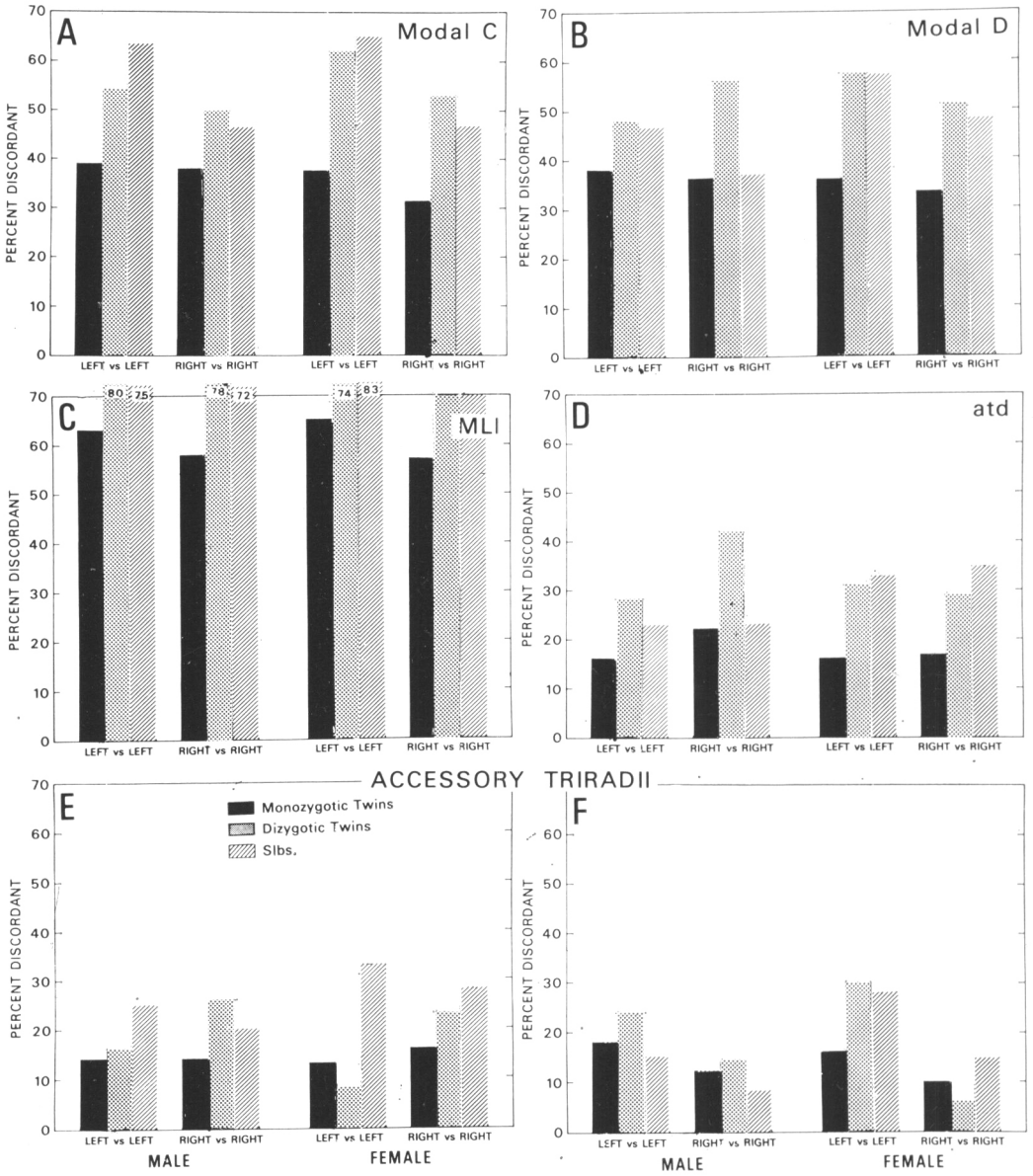

Fig. 2. Percent of intrapair homolateral discordance for: A, the modal types of the C line; B, the modal types of the D line; C, the main line index (MLI); D, the width of the atd angle; E, axial accessory triradii; and F, IV interdigital area accessory triradii.

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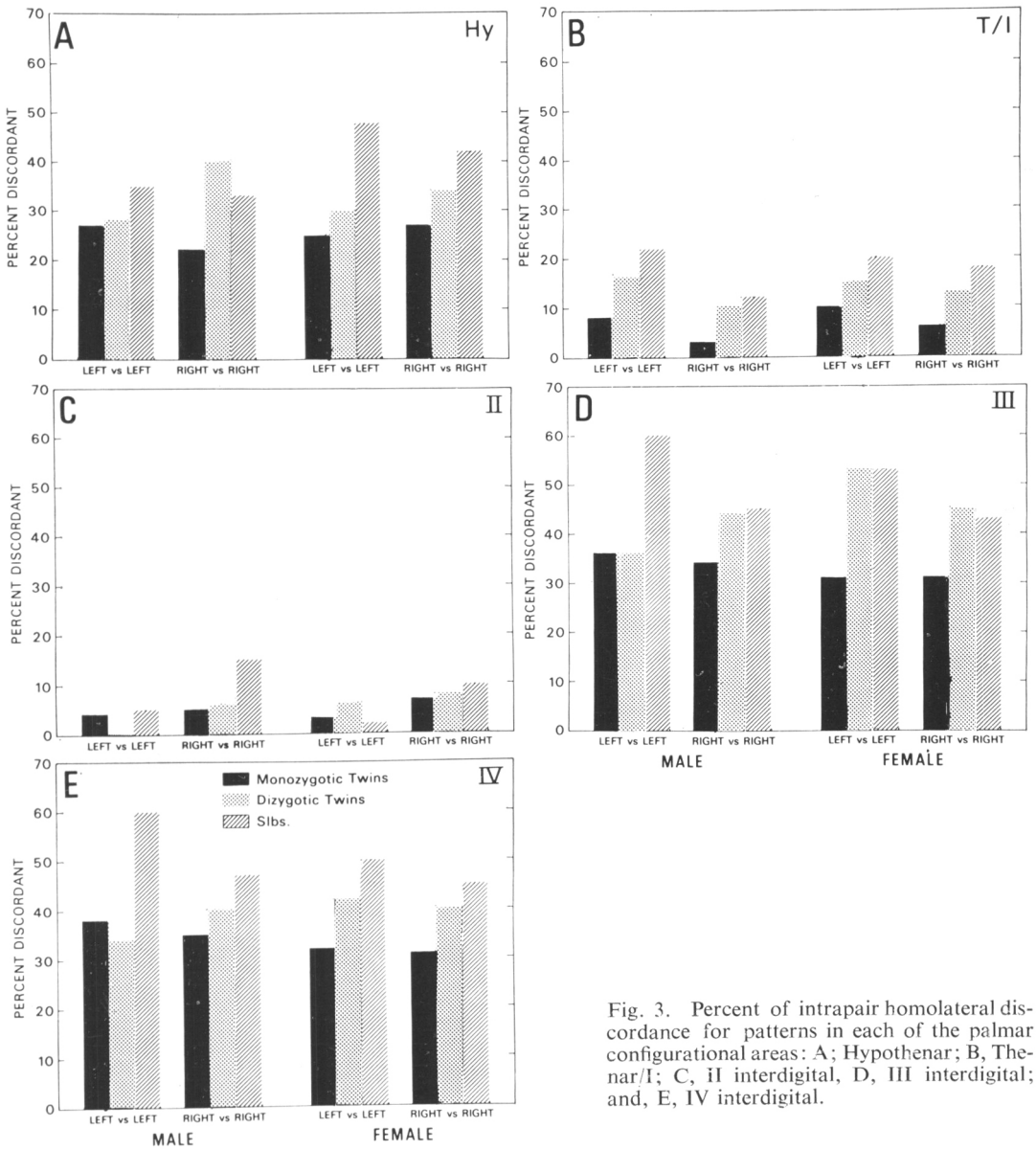

Fig. 3. Percent of intrapair homolateral discordance for patterns in each of the palmar configurational areas: A; Hypothenar; B, Thenar/I; C, II interdigital, D, III interdigital; and, E, IV interdigital.

MZ twins noted in Figs. 1 and 2 are also evident in Fig. 3. The low discordance rates of Figs. 3B and 3C are due to the high frequency of bilateral absence of patterns in the thenar/I and the II interdigital area. The histograms for the hypothenar, the III and IV interdigital areas (Figs. 3A, 3D, and 3E) show very similar trends although the overall discordance frequencies of the former are somewhat lower than those of the other two.

The actual numbers of concordant and discordant observations for each set of relationships, i.e., MZ vs. DZ twins, MZ vs. sibs, and DZ vs. sibs, were tested by 2×2 contingency chi square tables. The detailed levels of significance are given in Table 1 with the number of significant differences

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Table 1. *Results of the statistical comparisons of the actual homolateral concordant and discordant observations of each type of twins vs. each of the other twin type or sib*

Comparisons	Male						Female					
	Left vs left			Right vs right			Left vs left			Right vs right		
	MZ vs DZ	MZ vs sib	DZ vs sib	MZ vs DZ	MZ vs sib	DZ vs sib	MZ vs DZ	MZ vs sib	DZ vs sib	MZ vs DZ	MZ vs sib	DZ vs sib
Fingerprints												
I	* * *	* *	— —	* * *	* * *	— —	— —	* * *	— —	— —	* * *	* *
II		*	— —	* * *	* * *	— —	* * *	* * *	— —	— —	* * *	— —
III	* * *	* *	— —	* * *	— —	— —	— —	*	— —	— —	* * *	— —
IV	* * *	* * *	— —	— —	* * *	— —	— —	* * *	— —	*	* * *	— —
V	* * *	— —	— —	* * *	*	— —	*	* * *	— —	— —	— —	— —
Pattern Intensity index	* * *	* * *	— —	* * *	* * *	— —	— —	* * *	— —	— —	*	— —
Modal types of C line	— —	* * *	— —	— —	— —	— —	* * *	* * *	— —	* *	— —	— —
Modal types of D Line	— —	— —	— —	* * *	— —	* * *	* * *	* * *	*	*	*	— —
Main Line Index	*	— —	— —	*	— —	— —	— —	* * *	— —	— —	— —	— —
Palmar patterns												
Hy.	— —	— —	— —	* * *	— —	— —	— —	* * *	— —	— —	*	— —
T/I	— —	* * *	— —	— —	*	— —	— —	— —	— —	— —	* * *	— —
II	— —	— —	— —	— —	*	— —	— —	— —	— —	— —	— —	— —
III	— —	* * *	* *	— —	— —	— —	* * *	* * *	— —	— —	— —	— —
IV	— —	— —	— —	— —	* * *	— —	— —	* *	— —	— —	— —	— —
Access. triradii												
Axial	— —	— —	— —	— —	— —	— —	— —	* * *	* * *	— —	*	— —
II	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
III	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
IV	— —	— —	— —	— —	— —	— —	*	*	— —	— —	— —	— —
atd angle	* *	— —	— —	* * *	— —	— —	*	* * *	— —	— —	— —	— —
Simian crease	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Sydney crease	— —	* * *	* * *	— —	* * *	* *	— —	* * *	— —	— —	* *	— —

* $p < 0.05$, * * $p < 0.02$, * * * $p < 0.01$, — — Nonsignificant

obtained out of 21 dermatoglyphic comparisons summarized in Table 2. The lower row of Table 2 indicates that, for the most part, the DZ twins and the sibs have similar degree of concordance in both the male and female. This is to be expected. In the male, the DZ twins and the sibs had the same number of significant differences from the MZ in both the left and the right hand comparisons. This is also to be expected since the DZ twins and sibs have similar genetic relationship. The surprising findings, however, is seen in the female comparisons, where a much higher number of significant differences are obserweed between the MZ vs. sibs than between the MZ vs. DZ. The difference is

Table 2. *Summary of significant dermatoglyphic differences for the various sets of twin and sib comparisons*

	Male		Female	
	Left vs left	Right vs right	Left vs left	Right vs right
MZ vs DZ	7/21	9/21	7/21	3/21
MZ vs sibs	9/21	8/21	16/21	10/21
DZ vs sibs	2/21	2/21	1/21	1/21

more than twofold in the left hands and more than threefold in the right. Since both the DZ twins and sibs are regarded as having similar genetic relationships and were both gestated in the same maternal uterus, it is reasonable to look at differences associated with time of gestation as a source of disparity among them. That is, at least in the female, certain dermatoglyphic features may be influenced by the intrauterine conditions which are dissimilar at successive pregnancies. Whether these differences in intrauterine environment at a particular time are results of alterations in the reproductive apparatus due to age or parity is still open to further investigation.

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Dr. C. C. Plato, Gerontology Research Center, NIA, NIH, Baltimore City Hospitals, Baltimore, Maryland 21224, USA.