From the Department of Mental Health, State of Illinois

Finger, Hand and Foot Prints in Phenylketonuria as Compared with Other Normal and Abnormal Populations*

By

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With 1 Figure in the Text

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Finger, hand and foot prints of 70 patients with phenylketonuria (PKU) have been compared with 70 non-phenylketonuric patients with birth trauma and postencephalitis. Both groups were taken from the same institution, they had the same social background, the same age distribution and belonged to the same ethnic groups (Anglo-Saxons). The prints of the PKU patients were also compared with various normal and abnormal German populations.

The most striking observation in the PKU patients was the significant prevalence of pattern free fields in their palms and the reduced or lacking C-line as compared with the controls.

The relations of dermatoglyphics and creases to various genetic conditions

The relations of dermatoglyphics and creases of fingers, hands and soles to various pathological conditions has been the object of extensive study by many authors. The simian crease, present in about 60% of patients with Down's syndrome, has been described in 1909 by Langdon-Down. Moreover, peculiarities in the distribution of dermatoglyphic patterns on fingers, palms and soles have been found to exist in Down's syndrome and in other chromosomal aberrations. (Baitsch, Brehme, Cummins, Geipel, Holt, Petzau, Penrose, Smith, Uchida, Walker, and others.) In Down's syndrome, the most important characteristics, beside the simian crease, are the prevalence of loops on the fingers, the almost regular appearance of distal triradii (t’’) in the palm, often connected with a more transverse course of the palm main lines, more frequent loop formations in the third interdigital region, and more open fields in the hallucal area as compared to normal populations.

More or less specific deviations of dermatoglyphic patterns have also been demonstrated in other chromosomal aberrations, particularly in trisomy 13, 17 and 18, and in the Klinefelter and Turner types.

In addition, variations in dermatoglyphics have been described in mental retardation of unknown origin, Wilson's disease, congenital heart disease and other conditions.

It should be stressed, however, that the deviations in all these disorders are only statistical variations, which means that there is scarcely one symptom which is not also found in normal people, at least in a small percentage. It is

* Dedicated to Prof. Dr. Dr. h. c. H. Nachtsheim's 75th birthday on June 13, 1965.
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mostly the accumulation of otherwise rare variations in a group of patients which might be considered as typical for the pathological condition in question.

In the following we would like to refer to our examinations of fingerprints, palms and soles in phenylketonuria (PKU).

**PKU Group**

A group of 70 patients from Dixon and Lincoln State Schools (Illinois) was used, in whom the diagnosis had been ascertained by serum phenylalanine evaluation. None of these patients had received dietary treatment. They were of all ages, from infants to adults, their I. Q. ranging between 3 and 58.

**Dixon State School Control Group**

Since the PKU patients were institutionalized, a negative selection with regard to their background had to be assumed. For this reason, another group of 70 patients, from one of the institutions which provided the PKU patients, was selected for comparison. These control patients were suffering from birth trauma and post-encephalitis, i.e. environmental factors causing mental retardation. It cannot be excluded, however, that, in addition to the environmental etiology, genetic factors might have been present too, but in no case was there PKU.

**Other Controls**

In addition other populations from various sources were used for comparison. Because of a certain degree of personal interpretation, normal and pathological populations are best analyzed by the same person. Therefore, former papers of the author were used, comprising normal populations, cerebrally damaged, emotionally disturbed and mentally retarded children.

**Results**

The most striking observation in our PKU patients was the lack of patterns or the prevalence of pattern-free fields in their palms as compared with the controls. Table 1 gives a survey in percentage of various dermatoglyphic characteristics.

<table>
<thead>
<tr>
<th>Table 1. Dermatoglyphics in PKU patients and in environmentally conditioned mental deficiency control group from Dixon State School in percentage</th>
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<tbody>
<tr>
<td>C-line reduced or lacking (CxCo)</td>
</tr>
<tr>
<td>Interdigital III pattern</td>
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<tr>
<td>Interdigital IV pattern</td>
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<tr>
<td>Hypothenar pattern</td>
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<tr>
<td>Thenar/Interdigital I pattern</td>
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</tbody>
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Hypothenar: full pattern, vestiges + A r are included. Thenar/Interdigital I: full pattern only observed.

* Compared with the thenar/I pattern frequencies of about 15% in normal populations, the thenar/I pattern were very high (31%) in this control group.

Hypothenar and thenar patterns *per person* in the PKU patients, against the control group are demonstrating the difference to be significant (Table 2 and 3). Fig. 1 shows the empty hand of a PKU patient.