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DERMATOGLYPHS ON THE MEDIAL AND PROXIMAL PHALANGES

ABSTRACT. — *The terminal phalanges of the fingers and the palms have become traditional subjects of dermatoglyphical studies. Most studies, however, very rarely deal with the middle and proximal phalanges, in spite of the fact, that they form the connecting link between terminal phalanges and palms. We can say that they form a less conspicuous but integrating element of the chiridium of the hand. The paper of Marie Ploetz-Radmann from 1937 is regarded as a classical work dealing with this problem; she arranged the ridge patterns on the two proximal finger phalanges and worked out the general statistics of the frequency of the ridge patterns on the individual fingers. She paid attention also to the direction of the ridges, as well as to the ulnar-radial problem. The fact that we still know very little about the rules of the course of papillary ridges on the medial and proximal phalanges (the problem in the Czechoslovak population has not been studied at all) gave the basic impetus for writing this paper.*

The material has been obtained from 200 probands (100 females and 100 males) through Mohr's method, with the help of argentorate powder and has been evaluated through the simplified method of Marie Ploetz-Radmann.

The statistical processing of the results enabled us to study the eventual rules in the occurrence and frequency of patterns and their direction on the II., III., IV., V. fingers (the 1st finger showed little variability of patterns, and it seemed more purposeful to omit it).

Within the framework of the following four themes, i.e.:

- 1. Distribution of the type of patterns on the individual fingers.*
- 2. Individual frequency of formation.*
- 3. Individual frequency of the ridge directions and*

4. Frequency and combinations of the ridge directions we found out certain facts, which in further research when looking for broader connections, might contribute to the clarification of the importance of the above-mentioned patterns for genetics, forensic anthropology and embryology.

KEY WORDS: *Dermatoglyphics — Medial and proximal phalanges — Czechoslovakia.*

MATERIAL AND METHODS

The material has been obtained from 200 probands (100 females and 100 males), most of them university students of the 21–23 years of age. It means that we had to process 4000 prints of phalanges (i.e. of the fingers of the left and right hands of every probant). The prints were realized with the help of Mohr's method, with the use of argentorate

powder. The powder was applied on the papillary surface (on the ventral surface of the entire finger in case of the II.–IV. fingers with the respective triradius) and by gluing a transparent plastic tape on it we removed it. Thanks to the layer of the argentorate powder the papillary patterns appeared clearly imprinted on the tape and then the tape was glued onto a transparent foil, so as to protect prints against damaging. The prints processed in this way

can be easily read on a dark background. The tapes were attached to the foil beginning with the left hand and the individual fingers were marked with numbers ranging from I. to V. (from the thumb to the little finger). The prints were further evaluated according to the classification used by Marie Ploetz-Radmann, and then we entered them under a serial numbers into our log book. Besides the type of the pattern we determined in each phalanx also the directions of the ridges. We find that it was better to exclude finger I. from the research because it showed limited variability of pattern types and directions of the papillary ridges.

The finger phalanges were marked following Marie Ploetz-Radmann in the order from the apical to proximal one: 1. apical (distal), 2. — medial, 3. — proximal. The surface of the individual phalanges was limited by the flexion creases. The marking LH MF means left hand — medial phalanx. Similarly RH stands for right hand and PF for proximal phalanx.

The study consists of four basic parts:

- I. Distribution of types and patterns on the individual fingers
- II. Individual frequency of the characters
- III. Individual frequency of the direction of ridges, and
- IV. Frequency of the combinations of the directions of ridges.

CLASSIFICATION OF DERMATOGLYPHS OF THE MEDIAL AND PROXIMAL FINGER PHALANGES

For determining the patterns the classification of Marie Ploetz-Radmann was used. It seemed, however, purposeful to simplify it:

1. *Striae* — band patterns (St)
The band patterns with the variation of oblique and crosswise bands are the simplest ones. The parallel papillary ridges continue through the entire phalanx.

2. *Hamulus* — hook-shaped patterns (H)
They are very similar to the above ones, but the ridges start or end with a small arch.

3. *Undae* — wavy patterns (U)
They are practically connected hooks, both starting and ending with an arch.

4. *Arcus* — arc patterns (Ar)
The arc-shaped patterns remind of the arches from the distal (apical) phalanges.

5. *Angulus* — angular patterns (An)
In these patterns there are two ridge directions meeting at a certain angle. One ridge is roughly parallel with the flexional crease, and the other crosses obliquely the phalanges.

6. *Angulus duplex* — double angular patterns (And)
The patterns are formed by the connection of two angles, the obliquely running ridge in the distal and

proximal part of the same phalanx forms an angle with the ridges roughly parallel with the flexional creases.

7. *Argus duplex* — double-arched patterns (Ard)
In these patterns two small arches meet with their apexes approximately at the central horizontal line of the phalanx.

The following formations are rare:

8. *Moduli inclusi* — enclosed patterns (MI)

This group of patterns is difficult to describe. They are mostly spindle-shaped units, distally and proximally enclosed by the papillary ridges. The formations have sometimes the shape of simple loops.

9. *Penna* — feather-shaped patterns (P)
These patterns remind of the shape of a feather, the ridges coming from the distal and proximal side meet roughly at the centre of the phalanges at acute and obtuse angles.

10. *Moduli rari* — rare shapes (MR)
This group includes all patterns escaping classing with any of the above groups. The course of the ridges is rather complicated and the patterns mutually differ.

I. DISTRIBUTION OF THE TYPES OF PATTERNS ON THE INDIVIDUAL FINGERS

If we arrange the fingers according to the degree of frequency of the individual formations (according to *Tab. A*), we can compare the order of frequency of the formations on the individual fingers of females and males, on the left and right hands, on the proximal and medial phalanges.

Order of frequency of patterns on the LH — MF: St in females and males: V., II., IV., III., hamulus in males: IV., III., V., II. (the frequency in the IIIrd finger corresponds to that of the Vth finger), in females: IV., III., V., II. Unda in males: IV., V., II., it does not occur on the IIIrd finger.

In females: IV., II., III., not occurring on the Vth finger. Arcus in males: III., IV., V., not occurring on the IInd finger, order in females: III., IV., II., not occurring on the Vth finger.

Angulus in males: V., II., IV., III., in females: V., II., III., IV.

Angulus duplex in males: II., III., IV., V., in females: II., IV., III., V. Arcus duplex in males: III., IV., II., not occurring on the IIIrd finger, in females: IV., II., III., not occurring on the Vth finger. Moduli inclusi, penna, moduli rari do not appear in females and their frequency in males is also very low. The principal differences appear in the distribution of pattern on the individual fingers in Unda and Arcus duplex.

Order and frequency of patterns on the RH — MF: St in males: II., IV., V., III., in females: II., V., IV., III. H. in males: III., IV., V., II., in females: III., V., IV., II. U in males: IV., III., V., II., in females: II., IV., III., V. Ar both in males and females: III., IV., II., V. And in males: II., III., IV., V., in females: V., II., IV., III. Ard in males: V., IV., III., II., in females: II., III., V., IV. Ard in males: IV., III., — not occurring on the IInd and Vth fingers, in females: IV., III., II., V.

The principal differences appear in pattern in the U an An formations. Moduli inclusi, penna, moduli rari do not appear in males and are very rare in females. We can conclude that the medial pha-

TABLE A Frequency of patterns on the individual fingers

In females LH — MF									
pattern	II	m	III	m	IV	m	V	m	Total m
St	27	4.44	7	2.55	21	4.07	42	4.94	24.25 2.14
H	4	1.96	15	3.57	18	3.84	11	3.13	12 1.62
U	3	1.71	2	1.40	7	2.55	—	—	3 0.85
Ar	14	3.47	37	4.83	18	3.84	—	—	17.25 1.89
An	23	4.21	19	3.92	13	3.36	36	4.80	22.75 2.10
And	25	4.33	17	3.76	18	3.84	11	3.13	17.75 1.91
Ard	4	1.96	3	1.71	5	2.18	—	—	3 0.85
MI	—	—	—	—	—	—	—	—	—
P	—	—	—	—	—	—	—	—	—
MR	—	—	—	—	—	—	—	—	—
LH — PF									
pattern	II	m	III	m	IV	m	V	m	Total m
St	30	4.58	19	3.92	9	2.86	80	4	34.5 2.58
H	39	4.88	35	4.77	50	5.00	18	3.84	35.5 2.39
U	11	3.13	9	2.86	24	4.27	1	0.99	11.25 1.58
Ar	3	1.71	20	4.00	12	3.25	1	0.99	9 1.43
An	7	2.55	—	—	2	1.40	—	—	2.25 0.74
And	—	—	2	1.40	—	—	—	—	0.5 0.35
Ard	—	—	—	—	—	—	—	—	—
MI	10	3.00	14	3.47	3	1.71	—	—	6.75 1.25
P	—	—	1	0.99	—	—	—	—	0.25 0.25
MR	—	—	—	—	—	—	—	—	—
RH — MF									
pattern	II	m	III	m	IV	m	V	m	Total m
St	25	4.33	4	1.96	7	2.55	15	3.57	12.75 1.67
H	9	2.86	20	4.00	10	3.00	15	3.57	13.5 1.71
U	9	2.86	5	2.18	6	2.37	4	1.96	6 1.19
Ar	4	1.96	34	4.74	18	3.84	1	0.99	14.25 1.75
An	32	4.66	16	3.67	25	4.33	41	4.92	28.5 2.26
And	19	3.92	19	3.92	17	3.76	19	3.92	18.5 1.94
Ard	1	0.99	2	1.40	12	3.25	1	0.99	16.4 0.98
MI	—	—	—	—	—	—	1	0.99	0.25 0.25
P	—	—	—	—	1	0.99	1	0.99	0.5 0.35
MR	1	0.99	—	—	4	1.96	2	1.40	1.75 0.66
RH — PF									
pattern	II	m	III	m	IV	m	V	m	Total m
St	38	4.85	11	3.13	15	3.57	64	4.80	32 2.33
H	29	4.54	26	4.39	58	4.94	25	4.33	34.5 2.38
U	17	3.76	13	3.36	8	2.71	9	2.86	11.75 1.61
Ar	2	1.40	23	4.21	12	3.25	—	—	9.25 1.45
An	6	2.37	3	1.71	—	—	1	0.99	12.5 0.78
And	4	1.96	2	1.40	2	1.40	1	0.99	2.25 0.74
Ard	—	—	1	0.99	—	—	—	—	0.25 0.25
MI	4	1.96	20	4.00	5	3.00	—	—	7.25 1.30
P	—	—	—	—	—	—	—	—	—
MR	—	—	1	0.99	—	—	—	—	0.25 0.25
In males LH — MF									
pattern	II	m	III	m	IV	m	V	m	Total m
St	13	3.36	4	1.96	5	2.18	17	3.76	9.75 1.48
H	2	1.40	8	2.71	11	3.13	8	2.71	7.25 1.30
U	1	0.99	—	—	13	3.36	4	1.96	4.5 1.04
Ar	—	—	23	4.21	10	3.00	3	1.71	9 1.43
An	29	4.54	21	4.07	25	4.33	42	4.94	29.25 2.27
And	51	5.00	35	4.77	29	4.54	25	4.33	35 2.38
Ard	1	0.99	7	2.55	7	2.55	—	—	3.75 0.95
MI	1	0.99	1	0.99	—	—	1	0.99	0.75 0.43
P	2	1.40	1	0.99	—	—	—	—	0.75 0.43
MR	—	—	—	—	—	—	—	—	—

TABLE A Continuing

LH — PF									
pattern	II	m	III	m	IV	m	V	m	Total m
St	42	4.94	14	3.47	21	4.07	73	4.44	37.5 2.42
H	29	4.54	22	4.14	25	4.33	18	3.84	23.5 2.12
U	4	1.96	25	4.33	40	4.90	5	2.18	18.5 1.94
Ar	1	0.99	15	3.57	6	2.37	—	—	5.5 1.14
An	15	3.57	10	3.00	6	2.37	3	1.71	8.5 1.39
And	3	1.71	3	1.71	—	—	1	0.99	1.75 0.66
Ard	—	—	—	—	—	—	—	—	—
MI	4	1.96	11	3.13	2	1.40	—	—	4.25 1.01
P	2	1.40	—	—	—	—	—	—	0.5 0.35
MR	—	—	—	—	—	—	—	—	—
RH — MF									
pattern	II	m	III	m	IV	m	V	m	Total m
St	23	4.44	5	2.18	10	3.00	8	2.71	11.5 1.60
H	5	2.18	10	3.00	8	2.71	7	2.55	7.5 1.32
U	1	0.99	4	1.96	6	2.37	3	1.71	3.5 0.92
Ar	4	1.96	16	3.67	10	3.00	2	1.40	8 1.36
An	43	4.95	38	4.85	32	4.66	32	4.66	36.25 2.40
And	24	4.33	26	4.39	30	4.58	48	5.00	32 2.33
Ard	—	—	1	0.99	4	1.96	—	—	1.25 0.56
MI	—	—	—	—	—	—	—	—	—
P	—	—	—	—	—	—	—	—	—
MR	—	—	—	—	—	—	—	—	—
RH — PF									
pattern	II	m	III	m	IV	m	V	m	Total m
St	50	5.00	28	4.49	28	4.49	78	3.13	46 2.49
H	19	3.92	16	3.67	19	3.92	14	3.47	17 1.88
U	12	3.25	16	3.67	33	4.70	3	1.71	16 2.40
Ar	1	0.99	4	1.96	6	2.37	—	—	2.75 0.82
An	14	3.47	12	3.25	3	1.71	2	1.40	7.75 1.34
And	3	1.71	2	1.40	1	0.99	2	1.40	2 0.7
Ard	—	—	—	—	—	—	—	—	—
MI	1	0.99	22	4.14	7	2.55	1	0.99	7.75 1.34
P	—	—	—	—	3	1.71	—	—	0.75 0.43
MR	—	—	—	—	—	—	—	—	—

langes show more conspicuous intersexual differences in the distribution of the U, An and Ard patterns.

The order of frequencies of patterns on the LH — PF: St in males: V., II., IV., III., in females V., II., III., IV. H in males: II., IV., III., V., in females: IV., II., III., V. U in males: IV., III., V., II., in females: IV., II., III., V. Ar in males: III., IV., II., it does not occur on the Vth finger, in females: III., IV., II., V. An in males: II., III., IV., V., in females II., IV., they do not appear on the IIIrd and Vth fingers. And in males: II., III., V., not occurring on the IV., Vth finger, in females: it appears on the IIIrd finger only. The frequency of And is very low, both in females and males, and Ard does not occur, either in males or in females. Very interesting is the higher frequency of MI in the order in females and males: III., II., IV., and missing on the Vth finger.

The intersexual differences are most conspicuously manifested in the frequency of U and An (in this case we were unable to determine it more exactly due to the low frequency).

Order of the frequency of patterns on RH — PF: St in males: V., II., III., IV., in females: V., II., IV., III. H in males: II., IV., III., V., in females: IV., II., III., V. U in males:

IV., III., II., V., in females: II., III., V., IV. Ar in males: IV., III., II., in females III., IV., II., it is missing on the Vth finger, both in males and females. An in males: II., III., IV., V., in females II., III., V., it is missing from the Vth finger. And in males: II., III., V., IV., in females: II., III., IV., V. Ard appears very rarely, both in males and in females. Here too appear MI, in males in the following order: III., IV., II., V., in females: III., IV., II., and they are missing from the Vth finger. P and MR occur very rarely.

Higher intersexual differences in the frequency of patterns appear in U, but they are quite apparent also in Ard. They are very difficult to determine due to the low frequency of patterns.

In the proximal phalanges appear more conspicuously the intersexual differences in the frequency of patterns, U, An, And. And and Ard appear in reduced numbers. One of the characteristic features is the occurrence of MI on the LH and on the RH, namely on the IIIrd and IInd finger (LH), and on the IIIrd and IVth fingers (RH).

Generally we can say that the principal intersexual differences appear in the order of frequencies

in U, Ard, An and And. In the case of the other patterns the whole thing consists in the exchange of two neighbouring fingers, on which the frequency of the patterns differs only slightly. Characteristic of the proximal phalanges is the absence of Ard and presence of MI (Fig. 1).

In view of the more marked intersexual differences in the order of frequency on the individual fingers it is necessary to follow U, both in males and females: on the LH — MF of males it most often appears on the IV and V fingers, and on the PF on the IV and III fingers. In females on the MF and PF the order of frequency is as follows: IV., II., III., on the proximal phalanx U appears also on the Vth finger. On the RH — MF and PF in males U appears most frequently on the IVth and IIIrd fingers, while in females on the IInd finger, followed by the IVth, and on PF of IInd and IIIrd.

In case of higher intersexual differences in An we can say that on the RH — MF and PF the following formula holds: IV., III., V., II., (II., V.). It differs in females. The order of frequencies of the patterns is almost the opposite on RH — PF in males (II., III., IV., V.) and on the RH — MF in females (V., II., IV., III.).

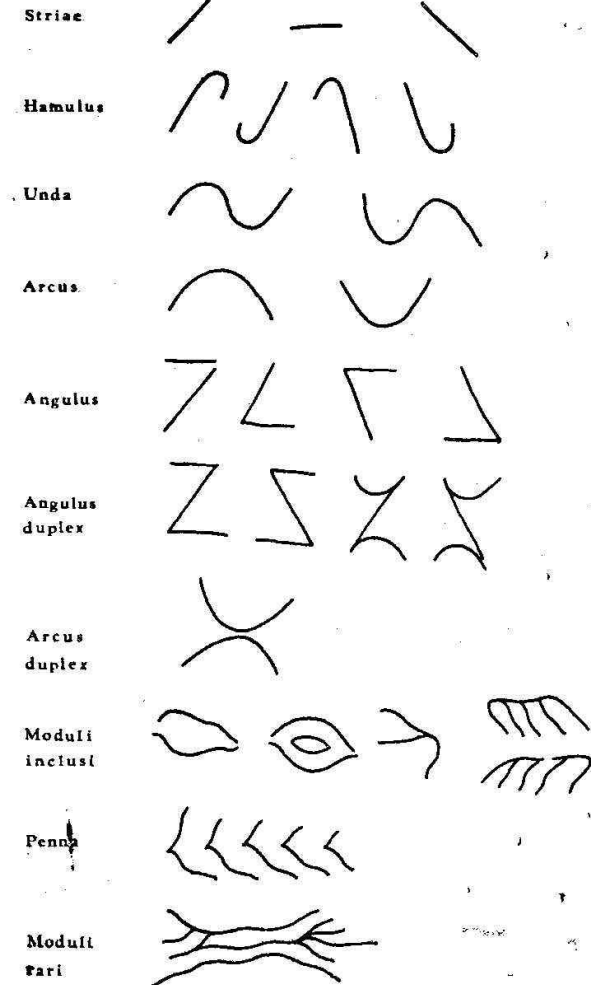
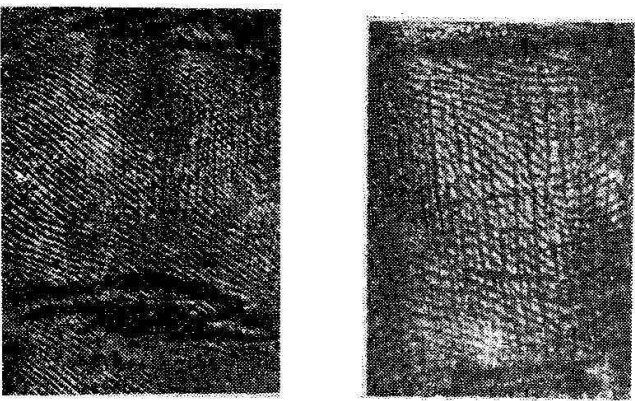
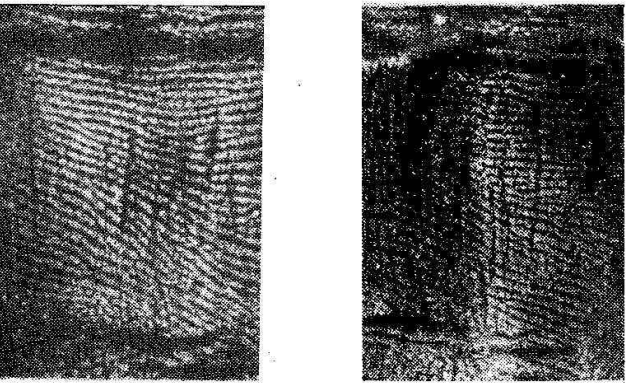


FIGURE 1a Symbols for the classification of dermatoglyphic pattern.



STRIAE HAMULUS



ANGULUS ANGULUS DUPLEX

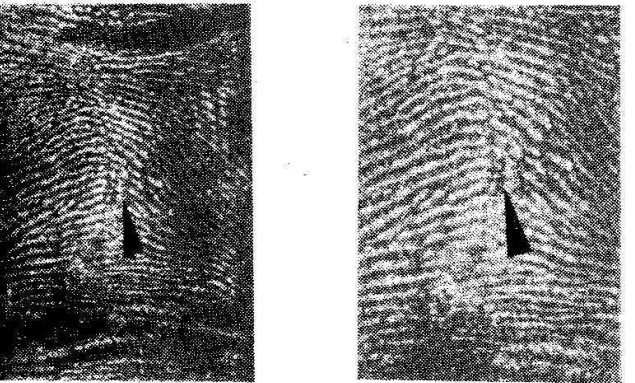


FIGURE 1b Examples of dermatoglyphic patterns. The photos were obtained by exposing the foil with prints on photographic paper (the lines are white).

On following the order of frequencies on the RH and LH the differences in frequencies are more conspicuous on MF. In general the order of the patterns is as follows: U on the LH: IV., III., II., V., and on the RH: IV., II., III., V. An on the LH: V., II., III., IV., on the RH: II., V., III., IV. And on the LH: II., III., IV., V., on the RH: V., IV., II., III. Ar on the LH: IV., III., II. it does not appear on the Vth finger, on the RH: IV., III., II., V. MI on the LH: III., II., IV., V., on the RH: III., IV., II., V. P occurs on the LH on the IIrd and IIIrd fingers only, on the RH on the IVth and Vth fingers. MR does not occur on the LH. Its order on the RH is: IV., V., II. and III.

For the other patterns, both the LH and RH have the same order of fingers: St: V., II., IV., III. H: IV., III., II., V., Ar: III., IV., II., V.

In the distribution of patterns on the individual fingers there are more frequent the bilateral differences than the intersexual ones. In the case of intersexual differences there is in general a more different frequency (according to the order of fingers) in four formations, in case of bilateral differences in seven.

INDIVIDUAL FREQUENCY OF THE FORMATIONS

According to table A we can determine the highest frequency of patterns for the individual fingers:

In males: LH — MF:

- II. And (58%), An (28%), St (13%)
- III. And (35%), Ar (23%), An (21%)
- IV. And (29%), An (25%), U (13%)
- V. An (42%), And (25%), St (17%)

PF:

- II. St (42%), H (24%), An (15%); MI (4%)
- III. U (25%), H (22%), Ar (15%); MI (11%)

- IV. U (40%), H (25%), St (21%)
- V. St (73%), H (18%)

RH — MF:

- II. An (43%), And (24%), St (23%)
- III. An (38%), And (26%), Ar (16%)
- IV. An (32%), And (30%), St, Ar (10%)
- V. And (48%), An (32%), St (8%)

PF:

- II. St (50%), H (19%), An (14%)
- III. St (28%), H, U (16%), An (12%); MI (22%)
- IV. U (33%), St (28%), H (19%); MI (7%) P (3%)
- V. St (78%), H (14%)

In females: LH — MF:

- II. St (27%), And (25%), An (23%)
- III. Ar (37%), An (19%), And (17%)
- IV. St (21%), Ar, Ard, H (18%)
- V. St (42%), An (36%), And, H (11%)

PF:

- II. H (39%), St (30%), U (11%)
- III. H (35%), Ar (20%), St (19%); MI (14%)
- IV. H (50%), U (24%), Ar (12%)
- V. St (80%), H (18%)

RH — MF:

- II. An (32%), St (25%), And (19%)
- III. Ar (34%), H (20%), And (19%)
- IV. An (25%), Ar (18%), And (17%); MR (4%)
- V. An (41%), And (19%), St, H (15%); MR (2%)

PF:

- II. St (38%), H (29%), U (17%)
- III. H (26%), Ar (23%), U (13%); MI (20%)
- IV. H (58%), St (15%), Ar (12%); MI (5%)
- V. St (64%), H (25%), U (9%)

On the LH — MF in males most frequent are And (35%), An (29, 25%), St (9, 75%), Ar (9%), on PF they are St (37, 5%), H (23, 5%), U (18, 5%). On the RH — MF most often appear An (36, 25%), And (32%), St (11%), Ar (8%), on the PF appear St (46%), H (17%), U (16%). On the LH — MF in females we found most frequently St (24, 25%), An (22, 75%), And (17, 75%), Ar (17, 25%), on PF — H (35, 5%), St (34, 5%), U (11, 25%). Most frequent on the RH are: MF — An (28, 5%), And (18, 5%), Ar (14, 25%), PF — H (34, 5%), St (32%), U (11, 75%).

TABLE B Intersexual differences in the individual frequency of patterns

RH pattern	n males	%	m	n females	%	m	t
St	230	28.75	1.60	179	22.38	1.47	2.93
H	98	12.25	1.15	192	24.00	1.51	6.18
U	78	9.75	1.04	71	8.88	1.01	0.60
Ar	43	5.38	0.79	94	11.75	1.14	4.59
An	176	22.00	1.46	124	15.50	1.28	3.35
And	136	17.00	1.33	83	10.38	1.08	3.87
Ard	5	0.63	0.26	17	2.13	0.51	2.62
MI	31	3.88	0.68	30	3.75	0.67	0.13
P	3	0.38	0.22	2	0.25	0.17	0.45
MR	—	—	—	8	1.00	0.34	—
LH pattern	n males	%	m	n females	%	m	t
St	189	23.63	1.50	235	29.38	1.61	2.62
H	123	15.38	1.27	190	23.75	1.50	4.24
U	92	11.50	1.13	57	7.13	0.91	3.01
Ar	58	7.25	0.90	105	13.13	1.19	3.94
An	151	18.88	1.38	100	12.50	1.17	3.53
And	147	18.38	1.37	73	9.13	1.02	5.44
Ard	15	1.88	0.46	12	1.50	0.42	0.60
MI	20	2.50	0.54	27	3.38	0.64	1.04
P	5	0.63	0.26	1	0.13	0.14	1.67
MR	—	—	—	—	—	—	—

Characteristic of the medial phalanges is the occurrence of the An, And, Ar and St patterns, and for the proximal phalanges the occurrence of H, St and U patterns. The rare patterns (MI, P) appear most often on the proximal phalanges. MR patterns were found on the medial phalanges only.

In general most frequently appear, both on the LH and RH the St, H, An and And patterns. There are small bilateral differences in the frequency, more marked are the intersexual differences (Tab. B). (Fig. 2, 3.)

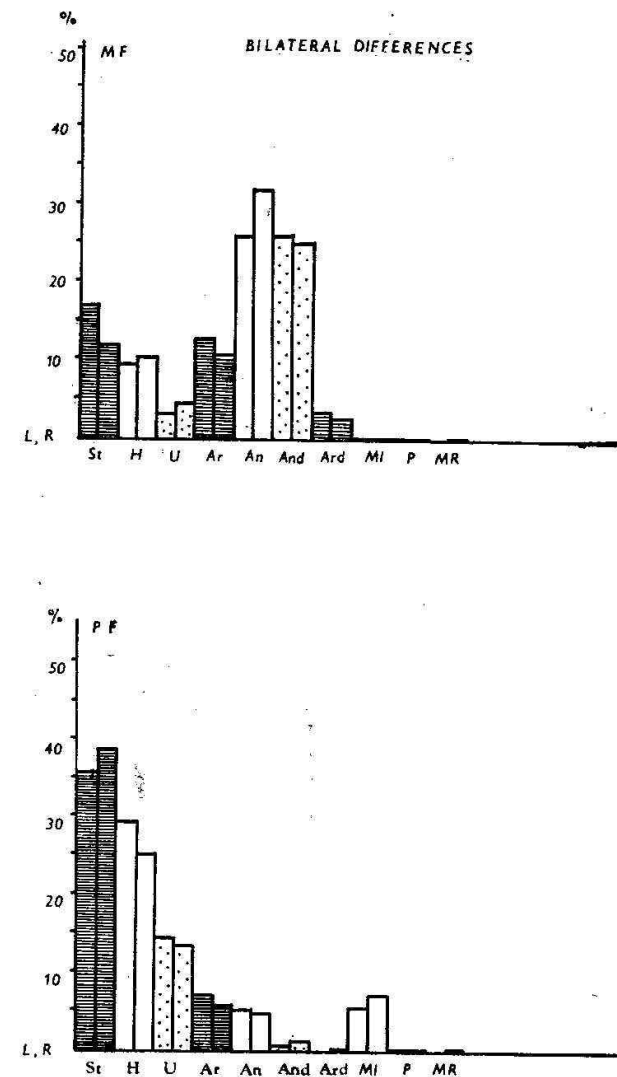


FIGURE 2.

We can conclude that St, An and And patterns are more frequent on the right hands of men. Characteristic of men's left hands are the U, but also An and And patterns, in females' left hands we find St, but also H and Ar patterns, similarly as on the right hand (the difference in the frequency of these formations has been highly significant).

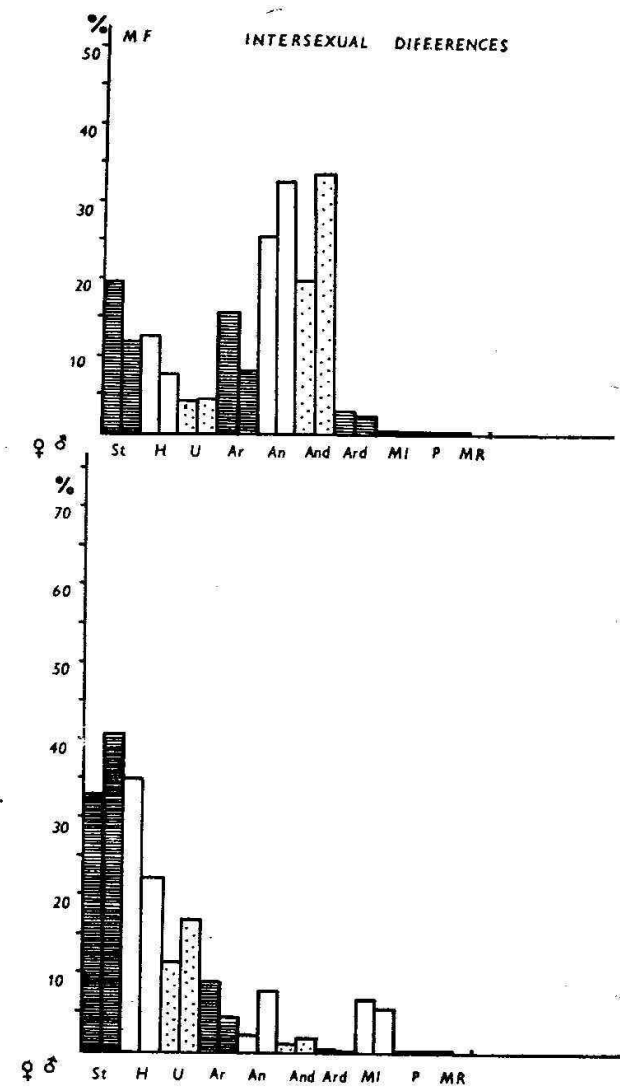


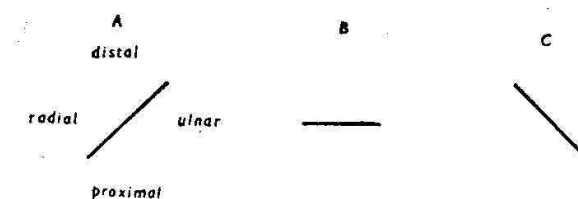
FIGURE 3.

III. INDIVIDUAL FREQUENCY OF THE DIRECTION OF RIDGES

When following the direction of papillary ridges on the medial and proximal finger phalanges we distinguished 3 basic directions:

A — radial (from distal — of the ulnar side up to proximal-radial side), B — horizontal and C — ulnar (from distal — radials side to proximal — ulnar side).

DIRECTIONS



The point in this part of the paper was to determine characteristic directions for the individual fingers, and the eventual regularities in their course (according to Tab. C) (Fig. 4).

TABLE C Individual frequency of the direction of ridges in %

In males — RH — MF										
direction	II	m	III	m	IV	m	V	m	Total	m
A	99	0.99	73	4.44	68	4.66	4	1.96	61	2.44
B	1	0.99	22	4.14	23	4.21	4	1.96	12.50	1.65
C	—	—	5	2.18	9	2.86	92	2.17	26.50	2.21
PF										
direction	II	m	III	m	IV	m	V	m	Total	m
A	97	1.71	64	4.80	20	4.00	2	1.40	45.75	2.49
B	3	1.71	31	4.62	42	4.94	2	1.40	19.50	1.98
C	—	—	5	2.18	38	4.85	96	1.96	34.75	2.38
LF — MF										
direction	II	m	III	m	IV	m	V	m	Total	m
A	93	2.55	24	4.27	15	3.57	4	1.96	34	2.37
B	7	2.55	25	4.33	20	4.00	5	2.18	14.25	1.75
C	—	—	51	5.00	65	4.77	91	2.86	51.75	2.50
PF										
direction	II	m	III	m	IV	m	V	m	Total	m
A	95	2.18	18	3.84	2	1.40	—	—	28.75	2.26
B	5	2.18	37	4.83	24	4.27	—	—	16.50	1.86
C	—	—	45	4.97	74	4.39	100	—	54.75	2.49
In females RH — MF										
direction	II	m	III	m	IV	m	V	m	Total	m
A	93	2.55	60	4.90	48	5.00	23	4.21	56	2.48
B	4	1.96	34	4.74	39	4.88	7	2.55	21	2.04
C	3	1.71	6	2.37	13	3.36	70	4.58	23	2.11
PF										
direction	II	m	III	m	IV	m	V	m	Total	m
A	91	2.86	39	4.88	15	3.57	9	2.71	38.50	2.43
B	8	2.71	38	4.85	24	4.27	7	2.55	19.25	1.97
C	1	0.99	23	4.21	61	4.88	84	3.67	42.25	2.47
LH — MF										
direction	II	m	III	m	IV	m	V	m	Total	m
A	75	4.33	15	3.57	13	3.36	5	2.18	27.00	2.22
B	18	3.84	35	4.88	18	3.84	3	1.71	18.50	1.94
C	7	2.55	50	5.00	69	4.62	92	2.71	54.50	2.49
PF										
direction	II	m	III	m	IV	m	V	m	Total	m
A	92	2.71	23	4.21	4	1.96	2	1.40	30.25	2.30
B	8	2.71	36	4.80	16	3.67	2	1.40	15.50	1.81
C	—	—	41	4.92	80	4.00	96	1.96	54.25	2.49

INDIVIDUAL FREQUENCY OF THE RIDGE DIRECTIONS

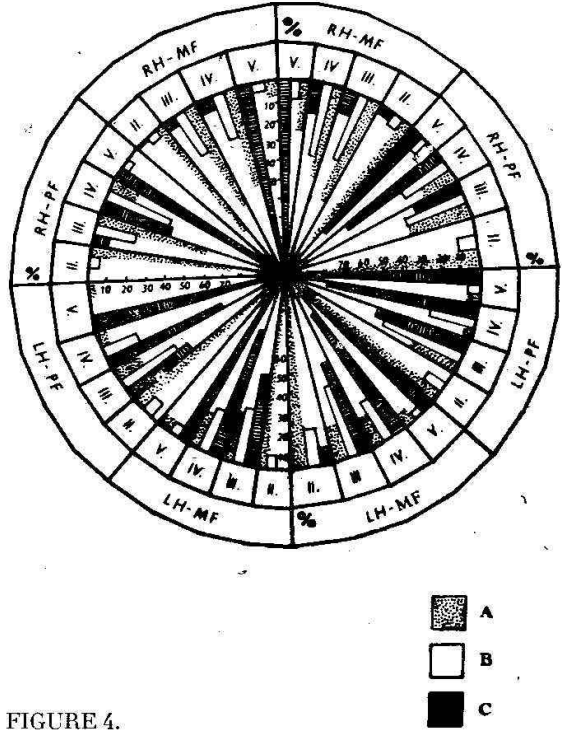


FIGURE 4.

From tables C follow the most frequent directions of ridges (with regards to direction BP) for the individual fingers: It seems that most stabile is direction A, in all cases on finger II. and direction C, in all cases on finger V. On the IIIrd finger most frequently appear: on the LH, both in females and males direction C, on RH direction A. On the IVth finger most frequent are the following directions: on the LH, both in females and males direction C, on the RH — MF A, on PF in females C, in males B (the second most important direction is C).

No intersexual differences appear in the individual frequency of ridge direction. They are more marked bilaterally (Tab. D), appearing most markedly on the III rd and IVth fingers.

Marie Ploetz-Radmann came to the general conclusion that radial direction appears most frequently on the first three fingers, while on the IVth and Vth fingers the ulnar direction is more frequent.

The occurrence of the ulnar pattern or Ar on the IIIrd finger is frequent — the same holds for the occurrence of the radial pattern on the IVth finger.

TABLE D Bilateral differences in the individual frequency of ridge direction

II	A	B	C	III	A	B	C	IV	A	B	C	V	A	B	C
RH	380	16	4	RH	236	125	39	RH	151	128	121	RH	38	20	342
LH	355	38	7	LH	80	133	187	LH	34	78	288	LH	11	10	379
X ² — 10.6				X ² — 174.2				X ² — 154.32				X ² — 20.1			

TABLE E Frequency of ridge direction combination in %

In females											
LH/MF	%	m	PF	%	m	RH - MF	%	m	PF	%	m
1. AAAC	1	0.99	AAAC	1	0.99	AAAA	1	0.99	AAAA	1	0.99
2. AABC	1	0.99	AABC	4	1.96	AAAB	3	1.71	AAAC	4	1.96
3. AACC	9	2.86	AACB	1	0.99	AAAC	29	4.54	AABB	2	1.40
4. ABAA	1	0.99	AACC	17	3.76	AABA	4	1.96	AABC	7	2.55
5. ABAC	3	1.71	ABAC	3	1.71	AABB	1	0.99	AACB	1	1.40
6. ABBC	1	0.99	ABBC	6	2.37	AABC	12	3.25	AACC	20	4.00
7. ABBC	5	2.18	ABCA	2	1.40	ABCA	2	1.40	ABAA	2	1.40
8. ABBC	1	0.99	ABCC	22	4.14	AACC	4	1.96	ABAC	2	1.40
9. ABCC	16	3.67	ACBC	5	2.18	ABAA	1	0.99	ABBA	2	1.40
10. ACAC	2	1.40	ACCB	1	0.99	ABAB	1	0.99	ABBB	1	0.99
11. ACBC	7	2.55	ACCC	30	4.58	ABAC	14	3.47	ABBC	9	2.86
12. ACCA	2	1.40	BBBC	1	1.40	ABBA	1	0.99	ABCA	3	1.71
13. ACCB	1	0.99	BBCC	2	1.40	ABBB	1	0.99	ABCB	1	0.99
14. ACCC	25	4.33	BCCC	5	2.18	ABBC	8	2.71	ABCC	15	3.57
15. BAAB	1	0.99				ABCB	1	0.99	ACAB	1	0.99
16. BAAC	1	0.99				ABCC	5	2.18	ACAC	5	2.18
17. BACC	2	1.40				ACAC	2	1.40	ACBC	2	1.40
18. BBBC	1	0.99				ACBC	2	1.40	ACCB	1	0.99
19. BBBC	1	0.99				ACCC	1	0.99	ACCC	12	3.25
20. BBCC	3	1.71				BAAC	1	0.99	BACC	3	1.71
21. BCAC	3	1.71				BABC	2	1.40	BBBC	1	0.99
22. BCBC	2	1.40				BBAC	1	0.99	BBCC	2	1.40
23. BCCC	4	1.96				CAAC	1	0.99	BCCC	2	1.40
24. CBCC	3	1.71				CBAC	1	0.99	CBCC	1	0.99
25. CCAC	1	0.99				CCAC	1	0.99			
26. CCBC	1	0.99									
27. CCCC	2	1.40									

In males											
LH/MF	%	m	PF	%	m	RH - MF	%	m	PF	%	m
1. AAAB	1	0.99	AACC	12	3.25	AAAA	2	1.40	AAAC	16	3.67
2. AAAC	4	1.96	AABC	5	2.18	AAAB	1	0.99	AABA	1	0.99
3. AABBB	1	0.99	ABAC	2	1.40	AAAC	47	4.99	AABB	1	0.99
4. AABC	3	1.71	ABBC	11	3.13	AABA	1	0.99	AABC	27	4.44
5. AACA	1	0.99	ABCC	22	4.14	AABB	1	0.99	AACC	18	3.84
6. AACC	13	3.36	ACBC	7	2.55	AABC	14	3.47	ABAA	1	0.99
7. ABBC	6	2.37	ACCC	36	4.80	AACC	7	2.55	ABAC	3	1.71
8. ABCB	1	0.99	BACC	1	0.99	ABAA	1	0.99	ABBC	12	3.25
9. ABCC	16	3.67	BBCC	2	1.40	ABAC	13	3.36	ABCB	1	0.99
10. ACAB	1	0.99	BCBC	1	0.99	ABBB	1	0.99	ABCC	12	3.25
11. ACAC	9	3.86	BCCC	1	0.99	ABBC	5	2.18	ACCC	5	2.18
12. ACBC	8	3.71				ABCC	2	1.40	BACC	1	0.99
13. ACCA	3	1.71				ACAB	1	0.99	BBBC	1	0.99
14. ACCB	1	0.99				ACAC	2	1.40	BBCC	1	0.99
15. ACCC	25	4.33				ACBC	1	0.99			
16. BACC	1	0.99				BAAC	1	0.99			
17. BBBC	1	0.99									
18. BBCC	1	0.99									
19. BCBC	1	0.99									
20. BCCC	3	1.71									

table E: On the LH - MF in females ACCC (25 %), ABCC (16 %), AACC (9 %), in males - ACCC (25 %), ABCC (16 %), AACC (13 %). On PF in females - ACCC (30 %), ABCC (22 %), AACC (17 %), in males - ACCC (36 %), ABCC (22 %), AACC (12 %).

On the RH - MF in females AAAC (29 %), ABAC (14 %), AABC (12 %), in males - AAAC (47 %), AABC (14 %), ABAC (13 %). On the PF in females AACC (20 %), ABCC (15 %), ACCC

(12 %), in males - AABC (27 %), AACC (18 %), AAAC (16 %).

According to the most frequent combinations we can judge that the left hand tends towards ulnar-radial difference between the II. and III. fingers. It is characteristic of the medial phalanges to be most frequent between the IV. and V. fingers, for the proximal it is most frequent between the III. and IV. fingers, i.e. there are fewer directions ending proximo-ulnarly (C).

TABLE F Intersexual differences in the occurrence of the most frequent combinations of papillary ridges

LH - MF					
combina- tion	% in fe- males	m	% in ma- les	m	t
AACC	9	2.68	13	3.36	0.90
ABCC	16	3.67	16	3.67	—
ACAC	2	1.40	9	3.86	1.75
ACCC	25	4.33	25	4.33	—

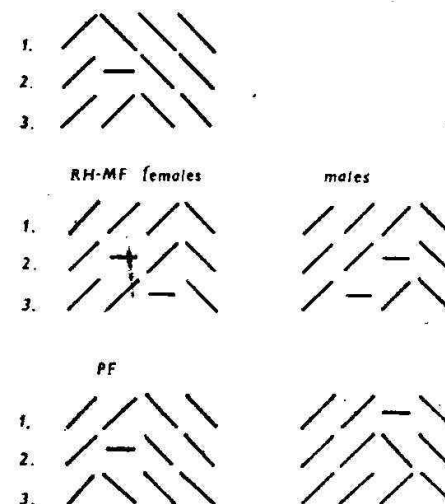
PF					
combina- tion	% in fe- males	m	% in ma- les	m	t
AACC	17	3.76	12	3.25	1.00
ABBC	6	2.37	11	3.13	1.31
ABCC	22	4.14	22	4.14	—
ACCC	30	4.58	36	4.80	0.90
BCCC	5	2.18	1	0.99	1.67

RH - MF					
combina- tion	% in fe- males	m	% in ma- les	m	t
AAAC	29	4.54	47	4.99	2.67
AABC	12	3.25	14	3.47	0.42
ABAC	14	3.47	13	3.36	0.21
ABBC	8	2.71	5	2.18	0.70

PF					
combina- tion	% in fe- males	m	% in ma- les	m	t
AAAC	4	1.96	16	3.67	2.88
AABC	7	2.55	27	4.44	4.12
AACC	20	4.00	18	3.84	0.36
ABBC	9	2.86	12	3.25	0.69
ABCC	15	3.57	12	3.25	0.63
ACCC	12	3.25	5	2.18	1.84

MOST FREQUENT COMBINATIONS OF THE DIRECTION RIDGES

LH-MF and PF in females and males



We must add, that in the future it will be very useful to concentrate on the combination of the ridge directions on the MF and PF on the same finger of the same hand.

CONCLUSION

The paper deals with the study of papillary ridges on the medial and proximal finger phalanges (II., III., IV., V.). The statistical processing of the material enabled us to study certain regularities in the occurrence of patterns and their directions. The material was obtained from 200 probands through Mohr's method and processed according to the simplified classification of Marie Ploetz-Radmann. The paper consist of four parts:

I. Distribution of pattern types on the individual fingers

We can put each pattern into a characteristic descending sequence of fingers, according to their frequency, but with certain inaccuracies due to similar frequency of patterns in certain cases. Bilateral differences appear to be more significant (in 7 patterns) than the intersexual ones (4 patterns).

II. Individual frequency of formations

The occurrence of Angulus, Angulus duplex and Arcus patterns is characteristic of the medial phalanges. Hamulus and Unda are typical of the proximal phalanges. The most significant intersexual differences are: in males more frequently appears the Angulus, Angulus duplex, Striae (on the right hand), and Unda (on the left hand) patterns; in females prevail Hamulus, Arcus and Arcus duplex (on the right hand) and Striae (on the left hand). The occurrence of MI in the proximal phalanges is probably connected with the formation of accessory pads at the embryonic stage. Characteristic of the "marginal" fingers (II., V.) are the patterns expressing the direction, while the "internal" fingers are characterized by horizontal patterns.

III. Individual frequency of the ridge directions

When studying the directions of the patterns we distinguished three directions (A-radial, B-horizontal and C-ulnar). They showed more significant bilateral differences namely on the III. and IV. fingers. The most frequent direction on the III. finger of the left hand is C, while on the same finger of the right hand it is direction A. On the IV. finger of the left hand it is again direction C, on the RH — MF direction A and on PF directions C and B. In gen-

eral the left hand shows a tendency towards ulnar direction, while the right towards radial direction.

IV. Frequency of ridge direction combinations

In this part we paid attention to the occurrence of ridge directions on the identical phalanges of the same hand. The largest number of combinations (27) was recorded in females, but the intersexual differences are small, more conspicuous are the bilateral ones. According to the most frequented combinations we can say that the left hand shows a tendency towards ulnar-radial difference in the course of the ridges between the II. and III. fingers (ACCC combination). A similar tendency can be observed on the right hand on the medial phalanges between the IV. and V. fingers (AAAC), and on the proximal ones between the III. and IV. fingers (AACC, but also AABC combinations and this fact further increases the inaccuracy of our conclusions).

In the frequency of papillary patterns on the medial and proximal phalanges we can see without doubt certain regularities, which, after further research, in new and broader considerations, might contribute to revealing the significance of these patterns for genetics, forensic anthropology and embryology.

ACKNOWLEDGMENTS

I express my thanks to doc. RNDr. Milan Pošpišil, CSc., for his kind help and advice.

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