

Importance of Pre-auricular Region in Sex Determination

(in the analysis of a medieval sample from NE Hungary)

LÁSZLÓ SZATHMÁRY

In memoriam
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Introduction

Pre-auricular region — mainly pre-auricular sulcus — is one of those characteristic features on the basis of which the sex of skeleton remains is usually determined. Besides establishing sex, the requirement of describing the degree of sexualization has grown an equally significant component in biological reconstructions of ancient populations (NEMESKÉRI 1962.).

In relation to pre-auricular sulcus most studies lay particular stress on the fact that this feature can be much more met with females and seldom if ever with males. If this should manifest itself in males, it appears shallow and narrower than in females (OLIVIER 1965., BASS 1971., FEREMBACH-SCHWIDETZKY-STLOUKHAL 1979., UBELAKER 1978., BENNETT 1987., SJØVOLD 1988.). St. HOYME and İŞCAN (1989.) also emphasize that the pre-auricular sulcus is narrow and shallow in children and males, represents a growth scar, and its greater width and depth in adult women, along with structural details, suggests that it represents the site of posterior iliac widening. Developing this train of thoughts from an ontogenetic point of view it can be mentioned that the sacroiliac joint is more movable in females, therefore the growth in the width of the pelvis may also exert an influence on the development of the sulcus next to the auricular surface. The examinations of HOUGHTON (1974., 1975.), ULLRICH (1975.) and KELLEY (1979.) performed on multiparas also refer to the same relation in an indirect way.

So that we could describe the sexualization of a human skeleton we need a multiple scale for the distribution of secondary sex characters. First GENOVÉS

(1959.) elaborated a four-scaled system of standardization for pre-auricular sulcus which, nevertheless, cannot be adjusted to the five-scaled system frequently used (ACSÁDI-NEMESKÉRI 1970.). This gives ground for the attempt the present study makes at distinguishing *the five degrees* in sexualization, in the pre-auricular region of ilium bone.

Material and method

The examinations covered skeleton remains from North-Eastern Hungary dating from the 10th to the 17th centuries (including 265 adult males and 206 adult females). The distribution of the findings is demonstrated in Table 1. The archaeological documentation is accessible in the Herman Ottó Museum in Miskolc (1), in the Jóna András Museum in Nyíregyháza (2), in the Déri Museum in Debrecen (3) and in the Hungarian National Museum in Budapest (4).

Table 1. Distribution of the examined finds

1. táblázat: A vizsgált leletek eloszlása

<i>Locality (Documentation)</i> <i>Lelőhely (Dokumentáció)</i>	<i>Century A. D.</i> <i>Évszázad i. sz.</i>	<i>Males</i> <i>Férfiak</i>	<i>Females</i> <i>Nők</i>
Ároktő – Dongó halom (1)	11th	4	2
Beszterec – Vársziget (2)	11–13th	4	6
Debrecen – Városközpont (3)	13–17th	16	14
Edelény – Cséb (1)	13–16th	27	21
Hajdúdorog – Temetőhegy (4)	11th	42	28
Hortobágy – Görbehát (3)	11–13th	13	4
Kistokaj – Homokbánya (1)	10th	12	9
Miskolc – Repülőtér (1)	10th	5	4
Nagycserkesz – Nádasi bokor (2)	10th	10	4
Nagyecséd – Sárvár (2)	12–17th	84	78
Rakamaz – Strázsa domb (2)	10th	9	1
Sály – Lator (1)	15–16th	24	18
Szabolcs – Ref. parókia (2)	10th	8	4
Tiszabercel – Mezőgazdasági Szakiskola (2)	11th	5	7
Tiszavasvári – Nagygyepáros (2)	10th	2	6
Together / Összesen		265	206

Our sample includes those skeleton remains only in which sex could be determined on the basis of at least 8 characteristic features, on the one hand, and at least 3 of these features could be found in the post-cranial bones, on the other hand. We had to adhere to these respects of sorting so that the possibility of errors coming from heterogeneous representation could be limited. Within the sample the pre-auricular sulcus and the tubercle of piriformis muscle of each skeleton were primarily examined with a view to the degrees of sexualization determined by ACSÁDI and NEMESKÉRI (1970.), which are the following: hyperfeminine (-2), feminine (-1), indifferent (0), masculine (+1) and hypermasculine (+2).

Besides, 22 secondary sex characters were analysed according to the stages of sexualization (Table 2.) so that the importance of pre-auricular region in sex determination could be valued.

Results

From the results of preliminary examinations three conclusions could be drawn:

1. Masculine variants can't be differentiated unambiguously from hypermasculine variants, so it is impossible to distinguish five degrees of sexualization relying on pre-auricular sulcus alone.

2. It hits against difficulties to distinguish feminine variants from hyperfeminine ones on the basis of the tubercle of piriformis muscle alone.

3. It's advisable to consider these two characteristics together.

On the basis of this the 5 stages of sex-variants can be characterized as follows (Fig. 1.):

Hyperfeminine (-2) The primary feature of feminine variants is the sulcus. The sulcus is deep, its border on both longitudinal sides can be distinguished easily. There's no tubercle, but rarely the edge of the sulcus may be mildly uneven because of the sticking piriformis muscle (Fig. 2.).

Feminine (-1) The sulcus extent but shallow, it hasn't got a definite border but it goes over to the surface of ilium bone unbrokenly. If there is any tubercle at all, then it is of eminence character, small, and it takes a slightly outward direction¹ from the pelvis instead of levelling with the plane determined by the arms of the greater sciatic notch (as it is in the case of masculine variant), because that place is occupied by the sulcus (the tubercle usually takes an oblique position to the above mentioned plane - Fig. 3.).

Indifferent (0) The sulcus is almost planed and can hardly be perceived. Tubercle can generally be found, then it's narrow and in most cases its surface isn't rough (Fig. 4.).

1 By the direction of the tubercle I mean the straight line, in the elongation of the crest of tubercle.

Table 2. Distributions secondary sex characters in the degrees of sexualization
2. táblázat A másodlagos nemi jellegek megoszlása a szexualizációs fokozatok szerint

Skull Koponya	Males/Férfiak						Females/Nők					
	N	+2	+1	0	-1	-2	N	+2	+1	0	-1	-2
Frontal and parietal eminences	170	14	51	61	35	9	161	3	6	82	44	26
Glabella; superciliary arch	146	17	58	51	19	1	135	-	10	32	64	29
Mastoid process	134	21	70	34	9	-	120	3	15	32	48	22
External occipital protuberance	150	19	62	46	20	3	145	-	22	63	48	12
Occipital squama	122	16	58	33	15	-	103	1	11	37	47	7
Supraorbital margin and orbit	141	24	72	31	12	2	151	4	14	65	57	11
Zygomatic arch	101	16	39	32	11	3	90	-	6	23	44	17
Malar surface	120	28	54	27	11	-	124	2	13	44	44	21
Body of mandible (at height of M2)	163	18	63	51	24	7	158	10	32	61	41	14
Mental protuberance	151	23	64	50	14	-	127	5	17	32	63	10
Mandibular angle	167	32	73	49	13	-	120	2	6	57	49	6
Head of mandible	124	9	49	41	21	4	110	10	10	40	46	12
Post-cranial skeleton Posztkraniális váz												
Greater pelvis	89	17	45	22	10	-	73	-	5	31	29	8
True pelvis	94	20	46	18	12	1	78	-	3	23	35	18
Pubic angle	111	20	52	31	8	-	96	-	2	28	32	34
Greater sciatic notch	147	44	61	27	13	2	140	1	9	13	66	49
Obturator foramen	112	19	39	40	15	3	108	2	9	31	41	25
Ichium-pubic index (GAILLARD 1961)	91	7	56	20	8	-	88	-	5	22	24	37
Cotylo-sciatic index (SAUTER-PRIVAT 1955)	106	38	52	8	7	1	94	2	2	21	43	26
Sacrum	82	9	38	19	14	2	71	2	7	16	34	12
Sagittal diameter of femoral head	182	74	72	21	13	3	174	1	14	52	85	42
Linea aspera	168	43	61	41	21	2	159	4	14	71	44	26
Pre-auricular region	131	37	74	15	5	-	118	-	11	10	67	30

Table 3. Sexualization of secondary sex characters and the parameters of efficiency of sex determination
3. táblázat A másodlagos nemi jellegek szexualizációja és a nemi meghatározás hatékonyságának paraméterei

Skull.	Males/Férfiak		Females/Nők		Sex diff	
	Sex	Sex id%	Sex	Sex id%	Sex diff	Sex id%
Frontal and parietal eminences	+0.15	38.2	-0.52	43.5	0.67	40.9
Glabella; superciliary arch	+0.48	51.4	-0.83	69.3	1.31	60.4
Mastoid process	+0.77	67.9	-0.63	58.3	1.36	63.1
External occipital protuberance	+0.49	54.0	-0.34	47.7	0.83	50.9
Occipital squama	+0.61	60.7	-0.47	52.4	1.08	56.6
Supraorbital margin and orbit	+0.74	68.1	-0.39	65.6	1.13	66.9
Zygomatic arch	+0.53	54.5	-0.80	56.2	1.33	55.3
Malar surface	+0.83	68.3	-0.56	60.4	1.39	64.4
Body of mandible (at height of M2)	+0.37	49.7	-0.11	29.1	0.48	39.4
Mental protuberance	+0.64	57.6	-0.44	57.6	1.08	57.6
Mandibular angle	+0.74	62.9	-0.43	45.8	1.17	54.4
Head of mandible	+0.37	46.8	-0.51	49.8	0.88	48.3
Post-cranial skeleton Posztkraniális váz						
Greater pelvis	+0.78	69.7	-0.55	50.7	1.33	60.2
True pelvis	+0.89	70.2	-0.87	67.9	1.76	69.1
Pubic angle	+0.77	64.9	-1.02	68.8	1.79	66.9
Greater sciatic notch	+0.90	71.4	-1.11	89.6	2.01	77.5
Obturator foramen	+0.51	51.8	-0.72	61.1	1.22	56.5
Ichium-pubic index (GAILLARD 1961)	+0.68	64.2	-1.06	69.3	1.74	66.8
Cotylo-sciatic index (SAUTER-PRIVAT 1955)	+1.12	84.9	-0.95	73.4	2.07	79.2
Sacrum	+0.46	57.3	-0.66	64.8	1.12	62.6
Sagittal diameter of femoral head	+1.11	80.2	-0.76	61.5	1.87	70.9
Linea aspera	+0.73	61.9	-1.59	44.0	1.19	53.0
Pre-auricular region	+1.09	84.7	-0.96	82.2	2.05	83.5

Masculine (+1) There's no sulcus and on its place the surface is slightly 'flat'. The tubercle is moderate, it levels with the plane determined by the two arms of the greater sciatic notch (it is usually parallel with this plane), and it takes a nearer position on to the border of auricular facies than in the case of feminine variants (Fig. 5.).

Hypermasculine (+2) There's no sulcus but on its place the surface is slightly convex-shaped. The tubercle is of great extent (it has got a wide basis), it seems nearly like a ridge having a direction similar to that of the masculine variant. Its peak, (if it's got any at all), is directed downwards or towards the sacrum. It's got a marked muscular ridge (Fig. 6.).

In the case of masculine stages (mostly in the hypermasculine cases in the series investigated) between the tubercle and the border of the auricular facies, sometimes, a narrow sulcus can be found, and this fact might easily be deceiving. But this sulcus is not identical with the normal pre-auricular sulcus (feminine variants), which sometimes has got a tubercle beside and in this case the tubercle takes a farther position from the margin of the auricular facies, because the sulcus is wide. This explains the difference between the masculine tubercle and the feminine one, both in direction and in frame.

After distinguishing the five stages, the degree of sexualization was again determined on the basis of 23 secondary sex characters in the case of each skeleton. Four parameters were calculated in the case of each characters: the sexualization (Sex), the sex-difference of sexualization (Sex_{diff}), the proportion of the cases (expressed in percentage) in which the defined sex and the sexualization of the character were identical in signs ($Sex_{id\%}$) and the common average of these values of both females and males ($Sex_{id\%X}$). The opinion of the efficiency of sex characteristics was formed on the basis of the four parameters above (Table 2. and 3.).

1. *Sexualization (Sex)*: it occurs only in the case of post-cranial characters that its average is over or below $\pm 1.00^2$ (males: cotylo-sciatic index, femoral head, pre-auricular region; females: pubic angle, greater sciatic notch, ischium-pubis index, linea aspera). Only in the case of mastoid process and malar surface ranges the value from 0.75 to 1.00 with males' skull. The sexualization of glabella and zygomatic arch is similar with females. Of post-cranial characters it is only the obturator foramen, the sacrum (in the case of both sexes), the ischium-pubis index, the linea aspera (males) and the greater pelvis (females) that don't reach this value.

2. The sexualization of a feature is characteristic of a population. We can form a somehow much more general view on the basis of *sex-difference of sexualization* (Sex_{diff}). Difference over 1.75 could be only experienced on post-cranial skeleton (true pelvis, pubic angle, greater sciatic notch, cotylo-sciatic index, pre-auricular region). If the value ranges from 1.25 to 1.75, skull-character can occur (glabella, mastoid process, zygomatic arch, malar surface). On

2 The limit values used here and later are ad libitum, based on discretion, making examinations easier.

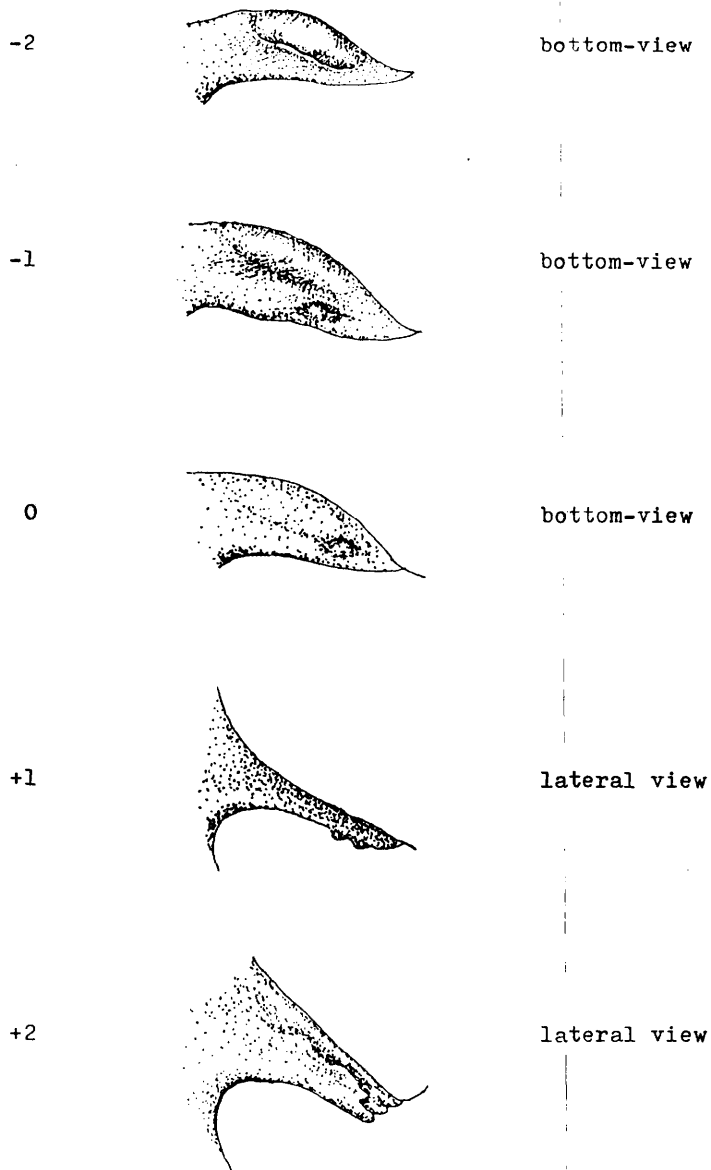


Fig. 1. Degrees of sexualization on the pre-auricular region
1. kép A pre-auricularis régió szexualizációs fokozatai

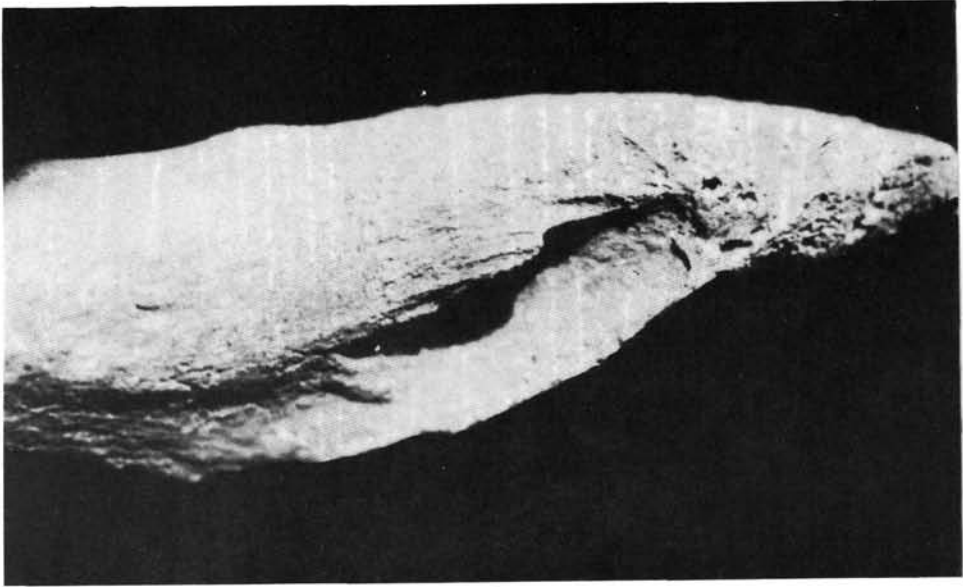


Fig. 2. Pre-auricular region — hyperfeminine variant
in the bottom view

2. kép A preauricularis régió — hyperfeminin variáns, alulnézetből

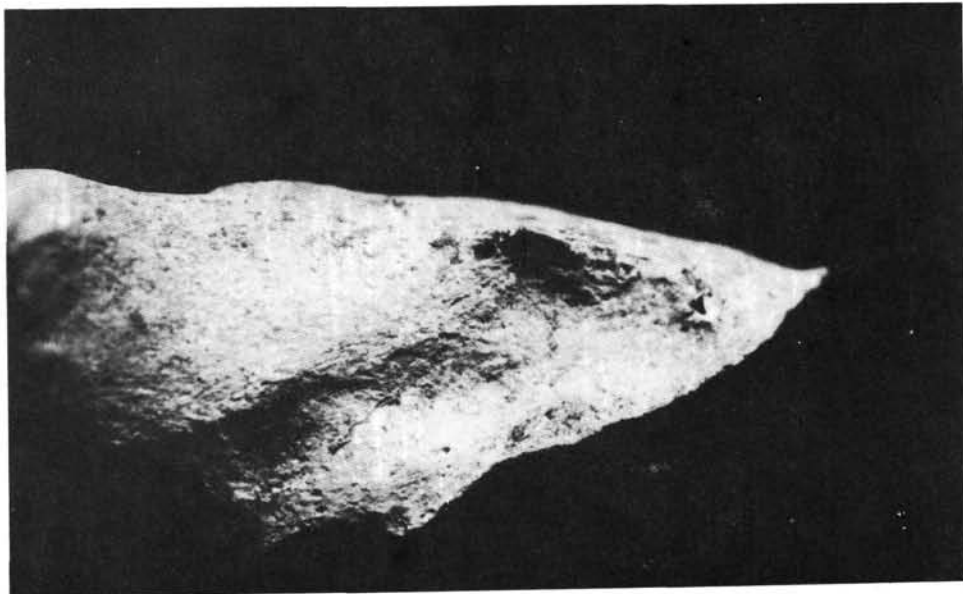


Fig. 3. Pre-auricular region — feminine variant in the bottom view

3. kép A preauricularis régió — feminin variáns, alulnézetből

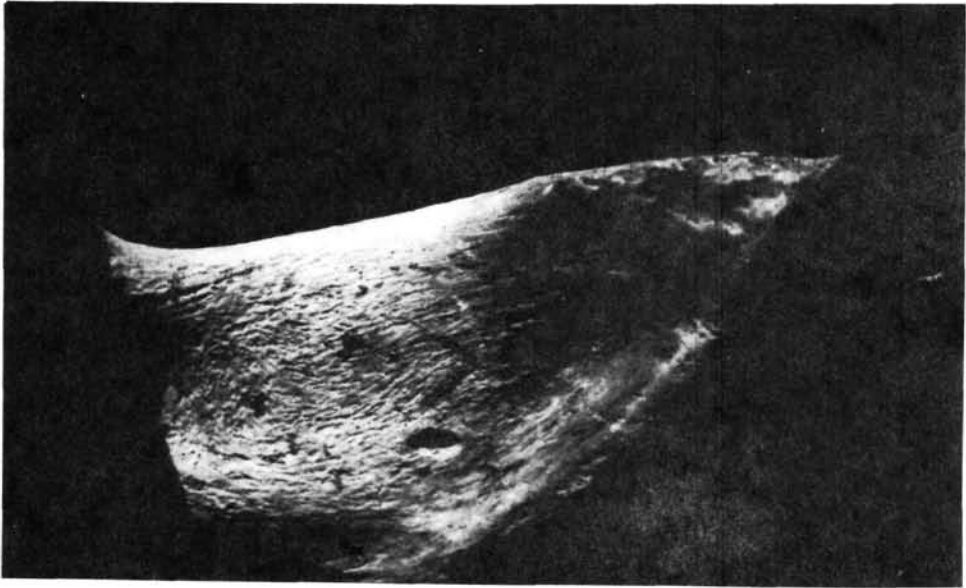


Fig. 4. Pre-auricular region — indifferent variant in the bottom view
4. kép A preauricularis régió — indifferens variáns, alulnézetből

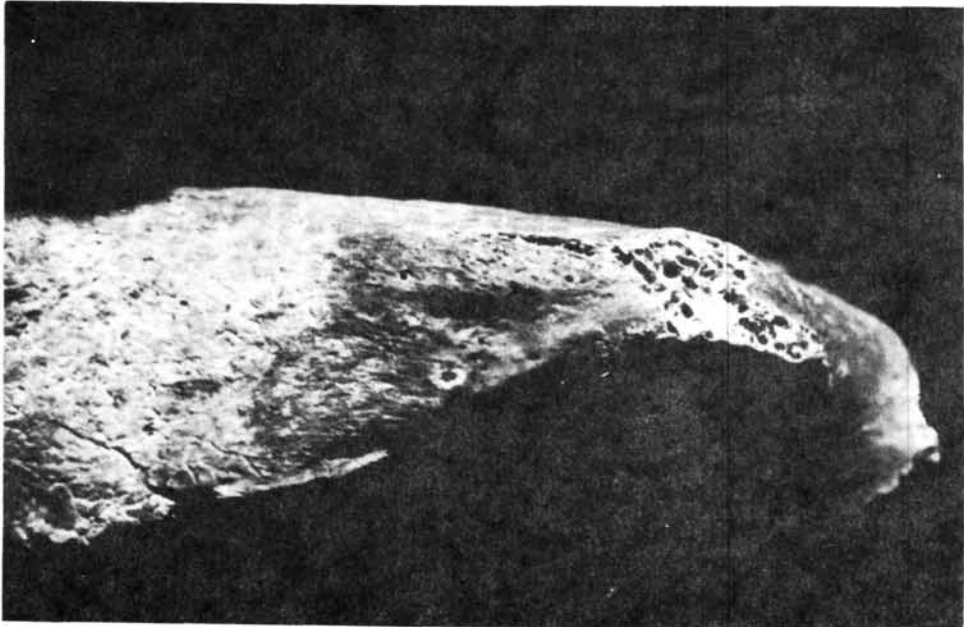


Fig. 5. Pre-auricular region — masculine variant in the bottom view
5. kép A preauricularis régió — masculin variáns, alulnézetből

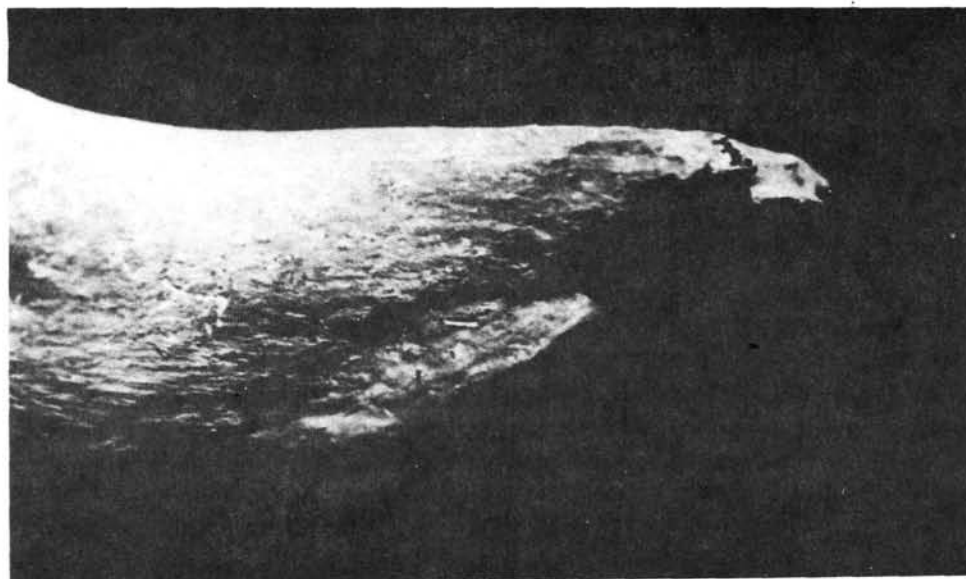


Fig. 6. Pre-auricular region — hypermasculine variant
in the bottom view

6. kép A preauricularis régió — hypermasculin variáns, alulnézetből

post-cranial skeleton the greater pelvis and ischiumpubis index fall into this category.

3. The degree of sexualization (with females: -2 and -1; with males: +2 and +1) corresponded to the given sex in a proportion *more than 75 percent* ($Sex_{id\%}$: over 75), it occurred in the case of cotylo-sciatic index, the head of femur, the pre-auricular region (males), just as the greater sciatic notch and the pre-auricular region (females). Additionally the following characters were relatively solid ($Sex_{id\%}$: *between 60 and 75*): the supraorbital margin and orbit, the malar surface, the true pelvis, the pubic angle, the ischium-pubis index (in the case of both sexes), – the mastoid process, the occipital squama, the mandibular angle, the greater pelvis, the greater sciatic notch, the linea aspera (only with males), – the glabella, the obturator foramen, the cotylo-sciatic index, the sacrum and the head of femur (only with females).

4. *Considering the two sexes together using by a similar method* the most reliable characters of sex determination ($Sex_{id\%}\bar{X}$: *over 75*) were: the cotylo-sciatic index, the greater sciatic notch and the pre-auricular region. The following characters fall into the range *between 60 and 75 percent*: the glabella, the mastoid process, the supraorbital margin and orbit, the malar surface, the greater pelvis, the true pelvis, the pubic angle, the ischium-pubis index, the sacrum and the head of femur.

Summing up the factors and results discussed above (on the basis of the series examined) the pre-auricular region is one of those characters on the basis of which the determination of sex is the surest. The greater sciatic notch, the pubic angle, the cotylo-sciatic index, the true pelvis and the head of femur belong to this group.

In the second place the mastoid process, the malar surface, the greater pelvis and the ischium-pubis index, possibly even the glabella, the supraorbital margin and orbit, the zygomatic arch, the sacrum and the linea aspera may be mentioned.

On the basis of the occipital squama, the external occipital protuberance, the mental protuberance, the mandibular angle and the obturator foramen, the determination of sex may be quite unsure.

Considering the examined skeleton-remains the following conclusions may be drawn: knowing only the frontal and parietal eminences, the body of mandible (at M_2) and the head of mandible, we can form our opinion of the probable sex only with the greatest possible care.

All these results accentuate NOVOTNY's conclusions (1972.), as relying upon the pre-auricular region the sex of human skeletons can be determined correctly in about 80 per cents of the cases.

The results presented above primarily differ from the distribution supposed to be standard (FEREMBACH-SCHWIDETZKY-STLOUKHAL 1979.) in the weighting of the frontal and the parietal eminences as well as that of the occipital squama.

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