

Anthropology. — Contributions to the Anthropology of the Near-East.

I. The Armenian skull and brain. By C. U. ARIËNS KAPPERS.

(Communicated at the meeting of October 25, 1930).

The physical characteristics of the peoples of the Near-East are of great interest to anthropologists as well as to archeologists.

Of those who dealt with the features of the Armenians F. VON LUSCHAN¹⁾, E. CHANTRE²⁾, DJAWACHISCHWILI³⁾, PITTARD⁴⁾ and FRIDTJOFF NANSEN⁵⁾ should be mentioned. Some details are also found in DUDLEY BUXTON's book on the peoples of Asia.

In addition the work of E. H. R. ALTOUNYAN⁶⁾, N. KOSSOWITCH⁷⁾ and above all that of L. W. PARR⁸⁾ is of importance for our knowledge of the blood type.

Most authors agree that the Armenians belong to the Indo-European group. According to their somatic characteristics as well as to their blood type, they may be related to some groups in the Balkans, either the Dinarics (NANSEN) or — as might be deduced from the blood type — to some groups now living in Roumania⁹⁾. Their somatic features are best described by CHANTRE and DJAWACHISCHWILI. CHANTRE examined a large number and expressed his data in a curve (table A). With 297 males and 44 females from different regions he found for the males an average body height of 1.68 M. (DJAWACHISCHWILI found 1.67 M., PITTARD 1.66 M.), for the females one of 1.53 M.

The average length width index of his males was 85.71. For the females he found it to be *less* (l.c. p. 49), without giving an average figure.

¹⁾ F. VON LUSCHAN. Die anthropologische Stellung der Juden. Correspondenzblatt der Deutschen anthropologischen Gesellsch. 1892. *The same*. The early inhabitants of Western Asia. Journ. of the Roy. Anthropol. Instit. of Great Britain and Ireland, Vol. 41, 1911 (see also Smithsonian Report for 1914, Washington, 1915). *The same*. Völker, Rassen und Sprachen. Berlin, 1922.

²⁾ E. CHANTRE. Recherches anthropologiques dans l'Asie occidentale. Archives du Muséum d'histoire naturelle de Lyon, Tome VI, 1895.

³⁾ A. DJAWACHISCHWILI. Die Rassenzusammensetzung der Kaukasusvölker. Archiv f. Anthropology N. F., Bnd. XX, 1925, p. 77.

⁴⁾ PITTARD. Race and History. London and New York, 1925.

⁵⁾ F. NANSEN. Armenia and the Near East, Allen and Unwin, London 1928.

⁶⁾ E. H. R. ALTOUNYAN. Blood transfusion in Syria with analysis of 1149 blood groupings. The Lancet, 1927, p. 1342.

⁷⁾ N. KOSSOWITCH. Recherches sur la race arménienne par l'isohémagglutination. Compt. rend. de la Soc. de Biol. de Paris. Année 79, T. II, 1927.

⁸⁾ L. W. PARR. Die Blutgruppenverteilung in der Bevölkerung des nahen Osten und Nord-Afrika, Ukrain. Zentralblatt f. Gruppenforschung, Bnd. IV, 1930. See also Journ. of Immunology, 16, 1929.

⁹⁾ According to the blood type lists in SNIJDER's Bloodgrouping in relation to clinical

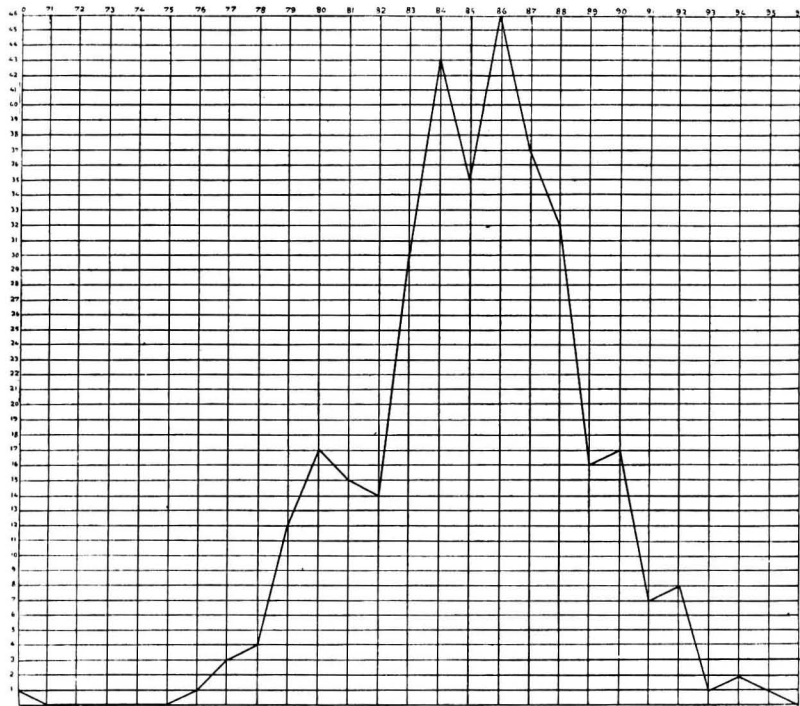


TABLE A (CHANTRE).

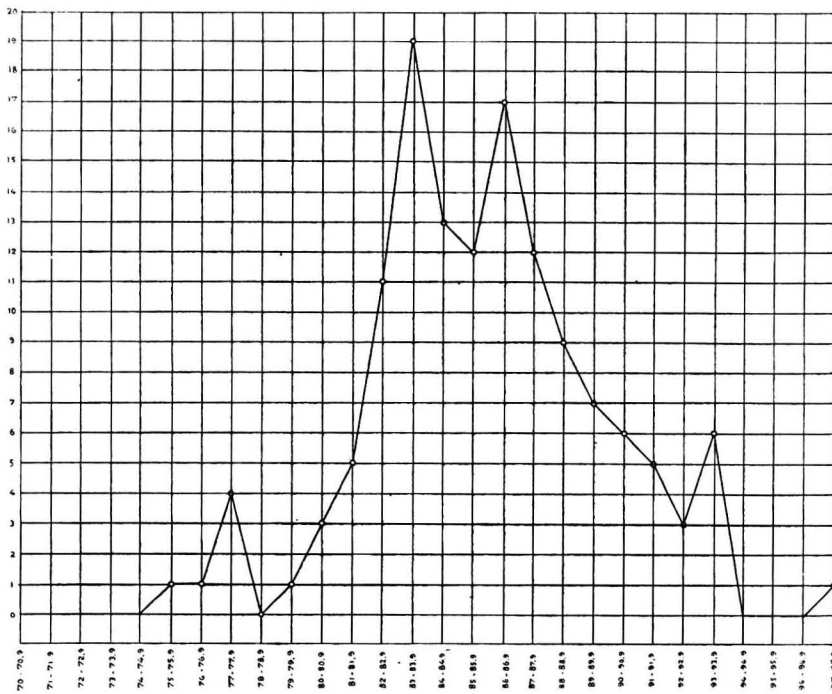


TABLE B (KAPPERS).

CHANTRE measured the auriculo-bregmatic height in 62 individuals (57 ♂ and 5 ♀). Considering the average length 18.1, the aurico-bregmatic height-length index in men is 66.85.

DJAWACHISCHWILI who (l.c.) measured 318 Armenians from the Caucasus, found an average length of 18.1, an average width of 15.7, thus an average length-width index of 86.7 in men. This author gives no height figures of the head.

As my own researches were made in view of brain anthropology I thought it desirable to gather some first hand data concerning the calotte of the head.

For this purpose I measured 141 Armenians, partly students of the American University of Beirut, partly people in the towns of Beirut and Constantinople. Five of the former came from the Armenian colony established at Isphahan, since the times of Abbas the Great. Concerning these five, see p. 795. — Of the remaining 136, 97 were males, 39 females and all were adults, or at least above 15 years. — Of each of them I measured the greatest length, the greatest width and the height of the head above the tragion (*incisura auricularis anterior*), the head being kept in the Frankfurt horizontal.

In the frequency curve of table B I give the various length-width indices found in males, and females together.¹⁾

The average measures and indices found in each sex are as follows:

Group	length	width	height	l. w. i.	w. h. i.	l. h. i.
Armenian ♂	18.20	15.54	13.13	85.38	84.49	72.14
Armenian ♀	17.51	15.01	12.38	85.72	82.48	70.70

From this it appears that the length-width index in males differs but

and legal medicine (WILLIAMS and WILKINS, Baltimore 1929) the blood types in the Balkans (apart from the Greek) are as follows:

Groups	O	A	B	A—B	p	q	r
Serbians	38.0	41.8	15.6	4.6	26.8	10.7	61.8
Mount. Rouman.	36.5	40.9	14.5	7.9	28.6	12.1	60.4
Valley Rouman.	33.5	41.2	19.0	6.3	27.5	13.6	57.8
Bulgars in Bulgar.	39.0	40.6	14.2	6.2	27.1	10.8	62.4
"Bulg." in Rouman.	30.6	44.6	16.5	8.1	31.3	13.3	55.3
Armenians (Parr)	28.3	46.7	12.0	12.4	36.1	13.4	53.3

From this it would seem to appear that the Armenians come nearest the "Bulgars" (?) in Roumania.

¹⁾ I could put them together since the average length-width indices differed very little.

little from the figure found by CHANTRE (85.71) and PITTARD¹⁾ (85.69). Whereas, however, CHANTRE, in his 44 women, found the l.w.i. to be smaller than in man, I find it slightly larger. Usually female skulls, have a somewhat higher index than male ones.²⁾

In connection with the supposed relationship of the Armenian race with the Dinarics of the Balkan (NANSEN) I give the results of my measurements of Dinaric men and those of HABERLANDT and LEBZELTER³⁾ and PITTARD⁴⁾.

Authors	length	width	height	l. w. i.	w. h. i.	l. h. i.
HABERL. & LEBZ.				87.13		
PITTARD				86.60		
KAPPERS	18.14	15.76	13.55	86.88	85.98	74.69

" I am not inclined to make conclusions concerning racial relations between these peoples, from these figures alone.

Before dealing with the brain of the Armenians, a few words concerning my Armenians from Isphahan.

Of these five only one was strongly brachycephalic (90.1) with a l. h. i. of 73.3 and a w. h. i. of 81.3. Of the four others one was sub-brachycephalic, two mesocephalic and one even dolichocephalic. The average indices of the last four were l. w. i. = 77.7; l. h. i. = 68.27, and w. h. i. = 87.90. These figures, however, approximate much more the figures I found for the Persians from Isphahan, whose l. w. i. = 77.91; l. h. i. = 68.47 and w. h. i. = 87.84, so that a predominating admixture with Persian blood is highly probable.

This experience leads me to be careful also with the mesocephalic indices found by CHANTRE, especially in some of his women (see p. 792).

The hyperbrachycephalic young Armenian from Isphahan is, however, interesting, as it shows that a family originating centuries ago from the boundary of Caucasia and Persia (the old Armenia) and whose paternal and maternal ancestors lived in the Armenian colony since Abbas the Great may thus keep its ancestral features.

The number of the brains available to me was not great. Still, thanks to the kindness of Prof. HARALD KRISCHNER, pathological anatomist at

¹⁾ PITTARD, Measured 124 men. See *Race and History*. London 1926, p. 369.

²⁾ So I found in the Samaritans 77.23 for the males and 78.97 for females, in the Lebanese 84.38 for the males, 85.40 for the females, in the Irakkians 84.50 for the males and 85.14 for the females. C.f. also R. MARTIN. *Lehrbuch der Anthropology*. 2d. Ed. Bnd. II p. 772—778, Duckworth, Morphology and Anthropology, Cambridge Univ. Press p. 262, 1904 and J. CAMERON, *Amer. Journ. of phys. anthrop.* Vol. 13, 1929, p. 171.

³⁾ HABERLANDT and LEBZELTER. *Zur physischen Anthropol. der Albanesen*. Arch. f. Anthropol. N. F. Bnd. XVII, 1919.

⁴⁾ PITTARD. *Les peuples des Balkans*, Paris, 1920 (112 ♂ with an average of 86.36) and *l'Indice cephalique de 116 Albanais* (average index 87.9). *Revue anthropologique* 32 Année, 1922. For the older literature see RIPLEY: *The peoples of Europe*, p. 412.

the American University of Beirut I received seven Armenian brains. I fixed these brains by hanging them at the basal artery in 10 % formaline, so that they did not touch the walls of the container. After a month they were taken out and, after being measured, were halved in the mediosagittal line, and further preserved lying on the flat bottom of the container, the medial wall of the hemisphere down.

In addition there was an old but very well preserved Armenian brain apparently fixed in the skull, but of unknown sex, making eight altogether.

Of the first mentioned seven brains three were of men, four of women. The old brain (N^o. VI) probably was also a female brain according to its dimensions and weight.

The weights of the male brains (after 4—9 months fixation in formaline), cut at the calamus, the meninges stripped and ventricles emptied, was 1406, 1365 and 1336 gramms, which gives an average of 1369 gr. Abstracting (with FLATAU) one percent for the influence of formaline fixation, this would make 1355 gr.

The weight of the female brains, treated the same way, was 1246, 1239, 1225, 1075 and 1017 gramms, giving an average of 1160,4 gr. Abstracting again one percent this would be 1148,8 gr.

The average body height in males according to CHANTRE being 168 cm. (according to DJAWACHISCHILI 16.71), an average brain weight of 1355 gr. would give a cephalisation coefficient of 2.733¹⁾ calculated according to DUBOIS' formula, presuming the body weight corresponding with a height of 168 cm. being 65 kg.

Similarly an average female brain weight of 1149 gr. with an average female body length of 153 cm. (CHANTRE) would give a somewhat smaller (2.623) cephalisation coefficient, presuming a body weight of 53 kg. to correspond with this height.

As two of my eight brains were not well enough kept during the voyage from Beirut to Amsterdam, I only used six brains for calculations of the indices introduced for anthropological studies on the brain²⁾. In this I was kindly assisted by Mrs. VAN BORK-FELTKAMP who constructed for this purpose an instrument, which permits the measurement of these indices with greater accuracy than on photographs.

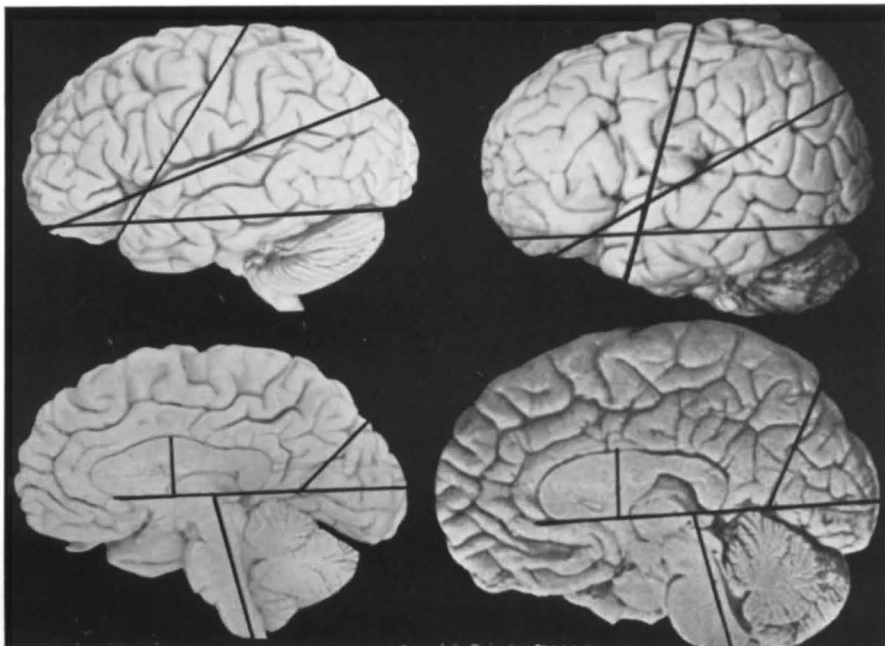
In the following table I give the brain indices of these brains whose l.w. index varied from 85.1 to 91.1 and who consequently were all hyperbrachycephalic.

Comparing the Armenian indices with the indices in brachycephalic and mesocephalic Dutch brains, we see that the callosum index in my Armenian brains is about the same as in my hyperbrachycephalic Groningen brains (index varying from 85.7 to 89.81) being in both considerably larger than in mesocephalics.

¹⁾ This agrees very well with the coefficient of European males (2.74).

²⁾ See Evolution of the Nervous system in Invertebrates, Vertebrates and Man (Bohn, Haarlem, 1928) p. 217.

C. U. ARIËNS KAPPERS: CONTRIBUTIONS TO THE ANTHROPOLOGY
OF THE NEAR-EAST. I. THE ARMENIAN SKULL AND BRAIN.



Dutch mesocephalic cerebrum
(index 77).

Sylvian angle 72°
 Rolandic angle 34°
 Cunningham's Rolandic angle 55°
 Stem angle 105°
 Parieto-occ. angle 43°
 Par. occ. relation 1 : 1.
 Callosum ind. 0.327.

Dutch brachycephalic cerebrum
(index 89.81).

Sylvian angle 63°
 Rolandic angle 19°
 Cunningham's Rolandic angle 70°
 Stem angle $101\frac{1}{2}^{\circ}$
 Parieto-occ. angle 59°
 Par. occ. relation 1 : 0.8
 Callosum ind. 0.367.

PLATE I

It further appears that the stem angle in the Armenians is smaller than in Dutch mesocephalics. This is to be correlated with the relatively more frontal position of the foramen magnum in brachycephalics as pointed out by BOLK. The same occurs in Dutch brachycephalics.

Brain indices	Armenians	Hyper-Brachyc. Groningen	Amsterdam (mesocephalics)
General height ind.	0.528	0.522	0.491 ²⁾
Tempor. depth ind.	0.166	0.160	0.145 ²⁾
Tempor. length ind.	0.747		(0.751)
Frontal height ind.	0.496		(0.448)
Frontal length ind.	0.395		(0.364)
Sylvian angle mihi	57.43	56.6	65.0 ²⁾
Rolandic angle Cunn.	70.8°	70.33°	64.56° ³⁾
Rolandic angle mihi	25.0°	22.2°	25.8° ⁴⁾
Stem angle ¹⁾	101.0°	100.75°	106.0° ²⁾
Parieto-occ. angle	54°	49°	44.6°
Callosum index	0.394	0.400	0.321 ²⁾

There is hardly any difference in the averages of my Rolandic angle (the angle between the Rolandic fissure and the perpendicular on the lateral horizontal). It appeared to me that this angle varies very much (from 19° to 32°) in both groups, so that its value for the anthropology of the brain seems rather doubtful, although examination on a larger material may render it more useful.

There is, however, a considerable difference in the Rolandic angle as measured by CUNNINGHAM ⁵⁾, being the angle between the average course of the central sulcus and a tangent on the brain, where this fissure indents the mesial wall. Apparently this way of measuring is very use-

¹⁾ The stem angles seen in the photographs of table I and II are no more accurate on account of slight deformation.

²⁾ These indices concern brains of a length width index varying from 75—80. The indices put between brackets concern brains varying from 75—82. The skull index being smaller also these may be considered mesocephalic.

³⁾ CUNNINGHAM found 71.7 (l.c. 174) in adults, 73.6° in the six months fetus. As the latter usually have a much higher index than adults, the increase of this figure in the fetus may be also correlated with its brachycephaly.

⁴⁾ The fairly equal average of my Rolandic angle confirms CUNNINGHAM's statement (l.c. p. 192) that the average position of this fissure in all adult brains is a rather constant one (even more constant than the coronal suture, he says).

⁵⁾ CUNNINGHAM. Surface anatomy of the cerebral hemispheres. Roy. Irish Academy. CUNNINGHAM Memoires N°. VII, 1892.

full for anthropological purposes¹⁾. A similar increase was observed in the Dutch hyperbrachycephalics.

A still greater difference is observed in my Sylvian angle (between the average course of the Sylvian fissure and a perpendicular on the lateral horizontal) and this difference again holds good for my Dutch hyperbrachycephalics.

In my mesocephalics this angle varied from 60° — 72° , in my Armenians from 53° — 62° , in my Dutch hyperbrachycephalics from 54° — 60° . Apparently the Sylvian angle, as I proposed to measure it, is of great value for the anthropology of the brains, indicating the greater steepness of the Sylvian fissure in brachycephalics and specially in hyperbrachycephalics.

It is strange that CUNNINGHAM contested the influence of the skull index on the course of the Sylvian fissure (l.c. 135), although the angle he called the Sylvian angle was measured in a way not very different from the way I measure it.

CUNNINGHAM drew a line through the longest axis of the cerebrum and then measured the angle between the average course of the Sylvian fissure and the perpendicular on this longitudinal axis. As I measure it between the fissure and the perpendicular on the lateral horizontal, which deviates only slightly from CUNNINGHAM's longitudinal axis, the difference between his angle is not so large. This also appears from our figures. So my Sylvian angle in brains of an index varying between 74 and 81 is 65.7 , while CUNNINGHAM found 66.8 as an average in 16 brains from 74—80.7 skull index. CUNNINGHAM, however, compared eight brains of a 74—77 index with eight brains of a 78.2—80.7 index and found the averages in the first group 66.5 , in the second 67.1 . It is, however, evident that these differences in skull index are too small to allow a conclusion, all his skulls being mesocephalic. Comparing brains of a skull index from 74 to 81 on one hand and from 85.1 to 91.1 on the other, i.e. mesocephalic skulls with hyperbrachycephalic skulls I found a very striking and constant difference.

This angle is larger in mesocephalic brains. In conformity herewith I found it still larger in the dolichocephalic brains of the Australian aboriginals, described by FLASHMAN²⁾, DUCKWORTH³⁾ (brain I) and WOOLLARD⁴⁾, where it varies from 66° to 75° , the average being 70.0° . In an Australian aboriginals brain of my institute the average of both sides is 70.5° .

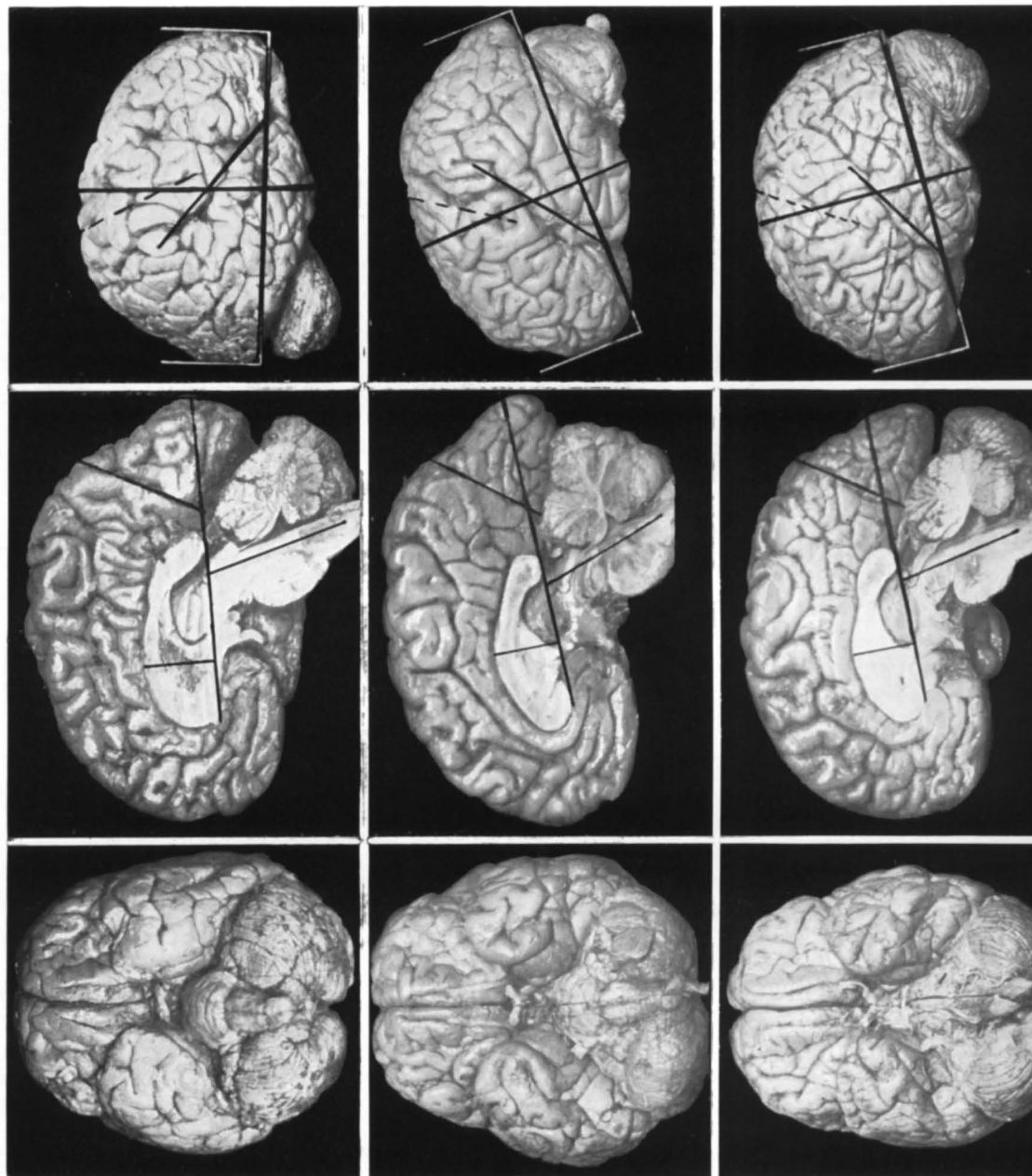
The difference in the Sylvian angles of the brachycephalic and mesocephalic brain is reflected in the temporal length and height indices, the former being smaller, the latter larger in the Armenian brains. The

¹⁾ The reason that this angle shows great differences in brachycephalic and dolicho- or mesocephalic brains and increases with the skull index seems to be due to the rounder form of the brachycephalic brain in the occipito-frontal plane, correlated with the fact that the central fissure indentation in the mesial wall always lies behind the perpendicular through its ventral end. So CUNNINGHAM's angle shows an increase in the rounder brain.

²⁾ FLASHMAN, Description of sulci of four brains of Australian Aborigines (brain I, fig. III) Report from the pathological laboratory of the lunacy department New South Wales, Vol. I, part 1, 1903.

³⁾ DUCKWORTH. On the brain of the aboriginal natives of Australia etc. Part I Journ. of Anatomy and Phys. Vol. 42, 1907.

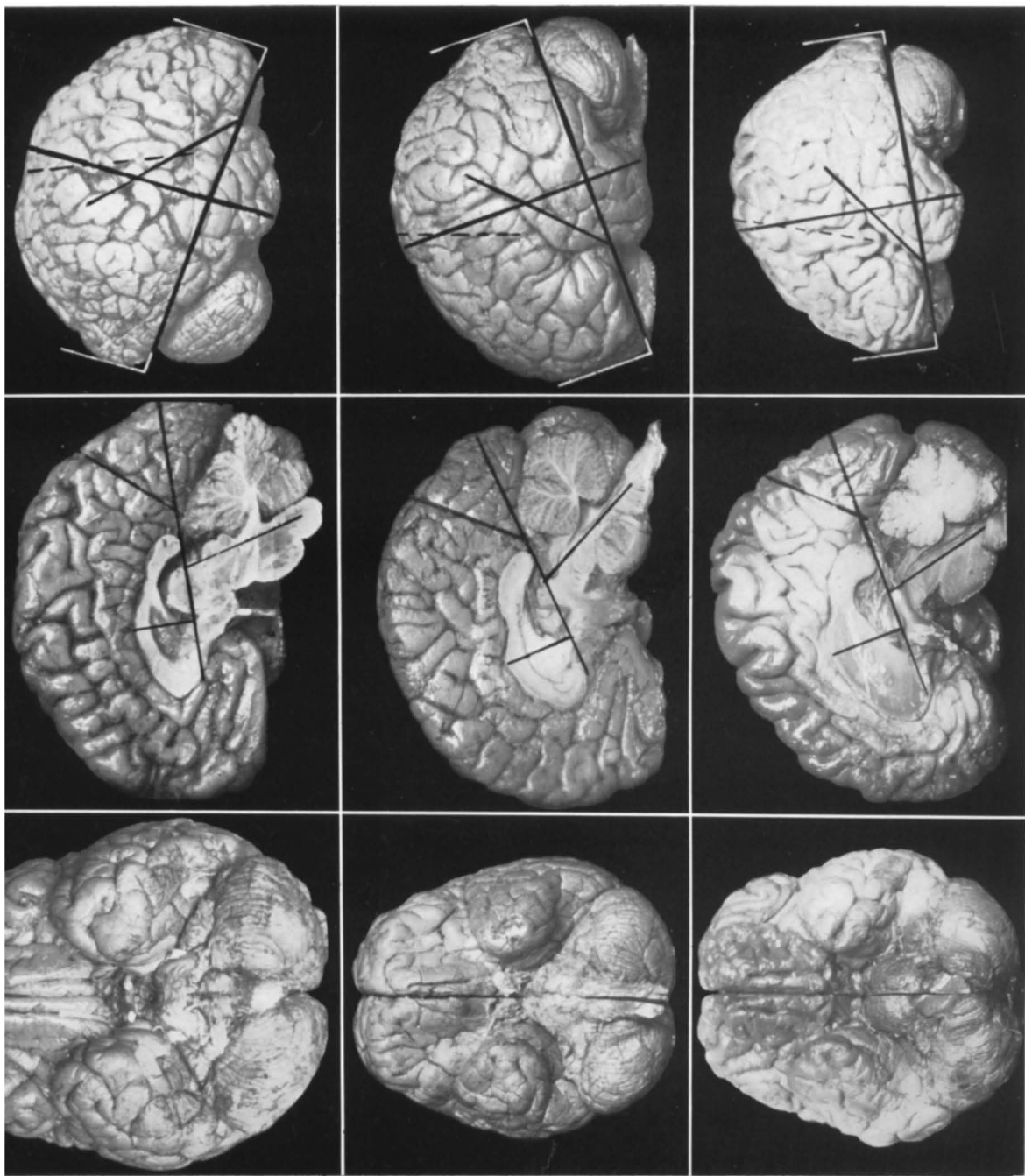
⁴⁾ WOOLLARD. The Australian aboriginal brain. Journ. of Anat. Vol. 63, part II, 1929.



I ♂

II ♀

III ♀



IV ♂

V ♂

VI ♂

smaller relative length of the temporal lobe is an expression of the occipito-frontal pressure, which influences specially the (parietal and) temporal lobe, so its relative length (compared to the total length) becomes less, while the frontal length index becomes larger. This compression is, however, more evident in the height index of the temporal lobe and would show still more if the height of the temporal lobe could be expressed by a perpendicular on the fissura Sylvii at corresponding points in brachycephalics and mesocephalics.

If we now consider the way these indicial differences influence the fissuration we see at once that the fissuration of the temporal lobe of the Armenians is peculiar by the fact that in the region below the superior temporal fissure the short irregular fissures, which usually represent the second (inferior mihi) temporal sulcus are represented by rather perpendicular grooves of a quite considerable height, provided with oblique branches. Even the superior temporal sulcus is more undulating than usually in dolichocephalics. In one or two hemispheres the posterior half of this fissure was broken in irregular transverse pieces. The occipito-frontal compression also appears in the form of the Sylvian fissure itself which, in addition to its steepness, often shows a more pronounced curve in its frontal part and a dorso-ventral bifurcation at the end.

Parallel to this process is the great constancy on the inferior parietal lobe of the perpendicular fissures, that may or may not connect with the superior temporal: the r. ascendens temporalis superioris (or parallelus superior), the fissura angularis, and the occipitalis anterior (c.f. also SHELLSHEAR)¹⁾. For comparison I used the result of WANG HWEI-WEN's²⁾ and my studies on the parietal lobe of fifty Dutch mesocephalics.

On the mesial wall of the hemispheres the compression of the parietal lobe in an occipito-frontal direction is shown by the course of the parieto-occipital sulcus. The best way to express this relation is to draw a line through the parieto-occipital sulcus and to elongate the basal callosum line backward, so that it intersects the parieto-occipital and then to measure the posterior angle between those lines. I propose to call this angle the "parieto-occipital angle" (see plate I, II, and III).

The value of this angle in the dolichocephalic Australian aboriginals brain, preserved and halved in the skull, as photographed by FLASHMAN,³⁾ appears to be 38°. In ten of my Dutch mesocephalics the average was 44.6°, in my Dutch brachycephalics the average is 49°, in a Dutch

¹⁾ J. SHELLSHEAR. The evolution of the parallel sulcus. Journ. of Anatomy, Vol. 61, 1927.

²⁾ WANG HWEI-WEN and KAPPERS. Some features of the parietal and temporal lobe of the human brain and their morphological significance. China medical Journal, September, 1924.

³⁾ FLASHMAN. The relation of brain to skull with a special reference to the Australian aboriginal. Report of the pathological laboratory of the Lunacy Department of N. South Wales, Vol. III, 1916.

brachycephalic, fixed in the skull, it was 58° . In my Armenians it varies from 47° to 63° with an average of 54.0° .

As a consequence of the forward deviation of the parieto-occipital the frontal angle at the junction of this fissure with the calcarina anterior in the Armenians is less obtuse than it usually is in mesocephalics.

The frontal deviation of the parieto-occipital seems to react on the precuneus in such a sense that its mass wedges in more between the ascending hind limb of the calloso-marginal, so that the latter is often lifted up more than usually and the distance between the hind part of the calloso-marginal and callosum is larger than in dolichocephalics, a fact also correlated with the compensation in height of the brain and skull (c.f. brain I, II and VI). Mrs. VAN BORK-FELTKAMP¹⁾ found the same in the (hypsicephalic) Chinese brain.

This compression of the mesial parietal wall may be also proved in a way, as used by CUNNINGHAM to control what he calls the parietal and occipital indices of the brain (l.c. p. 54), i.e. by comparing on the mesial edge of the brain the distance between the Rolandic indentation and parieto-occipital indentation on one hand and the distance between the latter and the lower edge²⁾ of the occipital lobe on the other. I found the average relation between these values in the mesocephalic Dutch to be (with great variations) 5.2 occ. : 5.0 par. (1 : 1) in the Armenians 3.9 occ. : 2.9 par. (1 : 0.75), in a Dutch brachycephalic (see plate I) 1 : 0.8, so that in the brachycephalics the parietal length is more compressed than the occipital. The difference in the occipital lobe of these brains and mesocephalic brains lies more in the steeper course of this lobe in the Armenians than in the size of its circumference.

As an indication of a pressure on the occipital lobe Mrs. VAN BORK mentioned in the Chinese the tendency of the posterior calcarine fissure to form a sharp knee, pointing dorsally, sometimes provided with a processus acuminis, a phenomenon more observed in those hypsicephalic brains than in the Dutch, although also here — and even in Australian aborigines — flexures of the calcarine often occur. Although also in my Armenians slight flexures are very common (ten hemispheres) only in two hemispheres (Brain VI) did a sharp knee occur. In both hemispheres of one brain³⁾ the flexure went downward, in both hemispheres of another brain (V) the calcarina posterior was straight.

A striking feature of the calcarina posterior in my Armenians is its tendency to run quite a long distance on the convexity (in ten of sixteen hemispheres). In one case (N^o. VI r.) this extension ran along the whole lower edge of the occipital lobe for about 5 cm. Besides this fissure has, in all cases except one, a bifurcation on the convexity, in one case also

¹⁾ Mrs. VAN BORK-FELTKAMP. Uitkomsten van een onderzoek van een zestigtal hersenen van Chinezen. Uitgeversmaatsch. VERSLUYS, Amsterdam. Inaugural dissertation, Amsterdam, 1930.

²⁾ This method seems less exact than the use of the parieto-occipital angle, as the determination of what should be taken as the lower edge of the occipital lobe is more or less arbitrary.

³⁾ Brain Larohe; not photographed.

perpendicular branches on the mesial wall. As these features are so frequent, they may be a result of the occipito-frontal compression.

The lunate sulcus is very evident in thirteen of the sixteen hemispheres, six times on the left and seven times on the right. Apparently there is no predominance of this sulcus on the left as occasionally found in other races e.g. Dutch. Also the ypsiliform fissure or vestiges of it are very frequent, but the prelunate is rare (clearly developed in five cases only) which probably again has to be considered as a result of the occipito-frontal compression of the parietal lobe.

Concerning the inferior *occipito-temporal region* I may first mention the vertical position of the uncus hippocampi as often observed in high brains (Mrs. VAN BORK, KURZ).

The occipito-temporal and collateral sulci, in addition to the usual variations, show a great tendency to making transverse branches (cf. also Mrs. VAN BORK's dissertation).

The orbital surface of the brain, as appears from my photo's, is fairly broad — and the orbital fissures very well developed. The "fissure en hache" of BROCA is clearly pronounced, and in some cases even has a double outer limb. Also my subfrontal fissure is very evident in most cases (see e.g. brain I, VI and V).

As far as concerns the frontal lobe I cannot detect any difference from the Dutch, even no signs of pressure, which seems to exert its influence chiefly behind the Rolandic fissure, as appears from my description. This may be correlated with the fact that the brachycephaly of the Armenians is of the type with short postauricular development and fairly large frontal development, which was recognized by FRETS¹⁾ as the dominant form of brachycephaly.

¹⁾ FRETS. Nouvelles observations sur l'hérédité de l'indice céphalique. IIIième Session de l'Institut international d'anthropologie tenue à Amsterdam, Sept. 1927. Rapport publié en 1928.