On the Value of Bones as Diagnostic Material of Fetal Age.

By

Dr. Giichiro Takata.

(From the Institute for Forensic Medicine of the Chiba Medical School, Chiba, Japan)

Many a natural scientist studied the development of the human bones, which seems, however, in recent years to be more or less neglected. Practically we have often to diagnose the age of the fetus from a skeleton or even some pieces of bones, but we cannot find any literature thereof. Excepting that cited from Kanzler's "gerichtlich medizinische Skeleto-Nekropsie (Casper's Vierteljahresschr. f. gerichtl. Med., 1854) and a few other original records. As in other studies, the reliable statistic standard of measurements must be established from as many materials as possible. I have therefore intended to summarize those original records, adding my own measurements made on 23 cases.

I selected those bones, whose measurement is simple and of easy access : *i.e.*, clavícula, scapula, humerus, ulna, radius, femur, tibia, fibula, zygomaticus, maxilla, parietale, squama ossis occipitalis, squama ossis temporalis, squama ossis frontalis, corpus ossis sphenoidalis and pars basilaris ossis occipitalis (there are many bones of adults which are of easy, but in fetus, of difficult access).

Three of them, *i.e.*, corpus ossis sphenoidalis, pars basilaris ossis occipitalis and os zygomaticum, which were hitherto seldom measured, I, picked out particularly on account of their easy measurableness, while mandibula, costae, vertebrae, ossa pelvis, and other cranial bones than those above cited, (for example the os nasale) ossa metacarpalia, phalanges digitorum manus et pedis and ossa metatarsalia, which were all measured by many authors, I neglected because of their difficulty of orientation or measuring.

Before I tabulate my results, I will cite the measurements which I found in literature :—

- N.B. 1) For the sake of convenience I used the following abbreviations for the names of authors :
 B.=Béclard. G.=Günz. L.=Landois. M.=Meckel.
 N.=Nicolai. R.=Renault and Rambaud. S.=Senff.
 Sk.=Skrzeczka. T.=Toldt. U.=Uffelman. Fr.=
 French authors, whose names were not mentioned by
 reporters.
- N.B. 2) Nicolai, Senff and Günz used inch and line as units
 of measurement. There are, however, 3 kinds of inches: the
 German inch is equal to 27 mm., the French inch to 26 mm.
 and the English inch 25.5 mm., while the line is recognized
 as one tenth or one twelfth of an inch. Fearing that
 conversion may cause errors, I cited the original measure-
 ments as such.
- N.B. 3) With regard to the length of tubular bones, we know the
 distinct difference, according to the method of measurement
 whether including or excluding the cartilagenous parts. For
 the former I marked with stars.
- N.B. 4) As to the description of age some used the week or solar
 month as unit but I have changed all into lunar months.
 It the designations such as beginning, middle or end, or
 earlier or later half, etc. have been dropped off in order to
 avoid confusion.
- N.B. 5) Numbers with (L) in Table I, are different from those found
 in the description of Leonard Landois (*Ueber das Wachstum
 der Diaphysen der Röhrenknochen des Menschen während
 des intrauterinen Lebens.*—Virchow's Archiv, Bd. 45 (1869)),
 and they are those in lunar months obtained by calculation
 from Table III.

My materials consist of 23 Japanese of the fetus, *i.e.*, one of the
 fourth, one of the sixth, 4 of the seventh, 4 of the eighth, 4 of the tenth
 month and 9 new-born children. For measurement I adopted the Toldt's
 method (*Maschka's Handbuch der gerichtlichen Medizin*, 1882, Bd. III,
 S. 531-534): viz.

A. Flat bones are measured along the outside by means of a tape measure :

1. The height of the squama ossis occipitalis is measured by the distance between the hind rim of the foramen occipitale magnum and the farthest end of the squama occipitalis. The breadth is no other than the distance between two ends of the sutura mendosa.
2. The distance between the margo frontalis and the occipitalis as measured on a parasagittal line passing through the tuberculum parietale. The height is measured along the frontal line passing through the tuberculum, indicates the breadth of the parietal bone.
3. The height of the squama frontalis is the distance between the incisura supraorbitalis and the upper end of the bone measured on a line passing through the tuberculum frontale, while its breadth is indicated by the distance between the median line and the sutura coronalis as measured through the tuberculum.
4. The height of the squama tempolaris is measured by the distance between the hind root of the processus zygomaticus and the upper end of the squama, and its breadth by the distance from the incisura parietalis horizontally to the fore end of the squama.

B. Not-flat bones are measured not by means of a tape measure, but in linear distance with a Virchow's measure :

1. The height of the maxilla is measured by the distance from the upper end of its processus frontalis to the inferior end of the septum between the canine and the outer incisor, and the breadth by the doubled distance from the hind and lower end of its processus zygomaticus perpendicular to the processus palatinus ; for in the fetal bones it is hardly possible to measure the distance between the two zygomatic processes on account of the incompleteness of ossification.

2. In the case of tubular bones, the distance of both ends the osseous part alone is measured leaving out the cartilagenous parts.
 3. Though it takes the shape of an s, the clavicula is measured as in other tubular bones.
- N.B. Many a author has measured the height and breadth of the os parietale. As I have intended to get the average value of as many materials as possible, I have used also the above method. But in this case we can often hardly distinguish the directions of the suturae coronalis et sagittalis causing considerable errors. Hence I prefer rather the Günz's method (cited in Casper-Liman, Handbuch der gerichtlichen Medizin, Aufl. 8, Bd. II, S. 912; the original report: Günz, Der Leichnam des Nugeborenen, 1827, S. 82), according to which the length of both diagonal lines is measured by means of a tape measure.
- C. For those bones whose measuring method was not explained in literature or which were neglected but are important for our purpose, I selected the following fixed points:
1. For the height of the scapula the line connecting the median angle and the inferior angle is measured along the inside by means of a tape measure, the measuring along the outside is inconvenient by the presence of the spine, and for the breadth along the line connecting the cavitas glenoidalis and the median end of the spina scapulae.
 2. For the measurement of the rhombic cheek bone the two diagonal distances of the four angles are measured by means of a Virchow's measure.
 3. The length of pars basilaris ossis occipitalis is measured by the line connecting the fore rim of the foramen occipitale magnum and the free end of the bone, and the breadth by the distance between the two yet unnamed processes which are found in the middle of the two lateral edges.
 4. For the length of the corpus of the os sphenoidale the fronto-occipitale diameter is measured, and for the breadth the distance between the two tongue shaped unnamed processes on both sides.

N.B. The letter m in tables IV and V means the fusion of the body with the small wings of the sphenoid bone.

Tables VI and VII indicate the total average of other authors' results as well as my own. For the sake of convenience the inch was taken as 27 mm. and the line as one tenth of an inch.

N.B. The letter c, which is used in the Table VI, denotes the measurements with the cartilagenous parts and o, those of the osseous part only.

Summary.

1. The dimensions of one of the two symmetrical bones of one and the same fetus are almost always the same as those of the other (particularly in table IV).

2. Of the fetal bones some grow faster than the others, as will be seen from Table V, VI and VII. The tubular bones as a rule grow faster than the flat skull bones (*cf.* Table V and VI with Table VI and VII). This may be partly to the inaccuracy of calculating the age and partly to the disproportion between the growth of area or size and that of the weight. The latter seems to be more important as is borne out by the fact that the seeming retardation of growth is met with in flat bones, which undergo marked external changes whereas in the tubular bones the shape does not change much as they grow in weight.

3. In those bones which are not flat or whose external shape does not change much, for example, the pars basilaris ossis occipitalis, the corpus ossis sphenoidalis and the os zygomaticus, the growth is so little that we can not use it for the determination of the fetal age, (tables IV, V and VII).

4. For the above reason (2) the bones of the extremities are superior to the skull bones as material for determining of the fetal age.

I have never heard that the weight of the bones was taken into consideration in order to diagnose the fetal age, but I believe that it is more proper to weigh the bones than to measure them for our purpose. To weigh the bones we need not to have any specified method; we can easily obtain accurate results even from those bones which are hard to measure for example, the mandibula and the other skull bones of the fetus.

I have therefore weighed all my material and the results were table VIII, Table IX shows the average weight from the numbers given in the previous table. Weighing was impossible in those cases in which fusion has taken place between the corpus and the alae of the sphenoid bone, and between the pars petrosa and squama of the temporal bone, and in which the preparations were intended for demonstration and are not to be separated into components (these materials were all quite dry).

Conclusion.

From tables IV, V, VIII and IX, I have arrived at the following conclusions :

1. Increment in dimensions of the fetal bones are not always parallel to that of their weights.
 2. One of the symmetrical fetal bones has almost always the same dimensions and weight as the other, with the exception of the inborn defect of the ossification of the parietal bone etc.
 3. For the determination of the fetal age from the bones, it is more correct to weigh them than to measure them, because the difference in weight is much larger than that of dimension and moreover weighing is as a rule far easier than measuring.
-

TABLE I. Bones of the extremities.

Fetal Month	Clavicle	Scapula		Humerus	Radius	Ulna	Femur	Tibia	Fibula
		Height	Width						
II	1-1.5'''(N) 1'''(S) 1-5'''(B)* 2'''(M)* 10mm(R)*	—	—	1'''(N) 1'''(M) 3'''(B)* 7.4mm(M)*	2.2'''(B)* 5mm(R)*	2.5'''(B)* 5mm(R)*	3'''(B)* 8-13mm(R)* 16mm(L)*	2'''(B)* 25-30mm(R)* 13mm(Fr)*	2'''(B)*
III	3'''(N) 2'''(S) 6'''(M)* 6'''(B)* 16mm(R)* 10mm(L)	1-2'''(N) 1'''(S)	1.5'''(N)	3.5'''(N) 15-20mm(M)* 12mm(L)	5.5'''(B)* 2.5'''(N) 10mm(L)	3'''(N) 6.5'''(B)* 11mm(L)	2-3'''(N) 7'''(B)* 11-15mm(L) 22mm(R)	2-3'''(N) 6'''(B)* 9mm(L) 20-25(Fr)*	2.5'''(N) 6'''(B)* 9mm(L) 20-25(Fr)*
IV	4'''(N) 4'''(S) 8-9'''(B)* 19mm(L) 26mm(R)*	5-6'''(N)	4'''(N)	8'''(N) 13'''(B)* 30-35mm(M)* 22mm(L)	7-8'''(N) 16mm(R) 19mm(L)	8'''(N) 30-35mm(R)* 21mm(L)	4-5'''(N) 14'''(B)* 23mm(L) 28-30mm(R)*	4-5'''(N) 11.5'''(B)* 20mm(L)	11.5'''(B)* 19mm(L) 25-28mm(Fr)* 30-35mm(Fr)*
V	8-10'''(N) 26mm(L)	7'''(N)	6'''(N)	13-15'''(N) 40-45mm(M)* 37mm(L)	12'''(N) 31mm(L)	13'''(N) 35mm(L)	12'''(N) 39mm(L) 40mm(Fr)	12'''(N) 35mm(L) 35mm(R)	12'''(N) 33mm(L)
VI	14'''(N) 14'''(B)* 33mm(L) 33mm(R) 25mm(T)	10'''(N)	6-7'''(N) 16mm(T)	16'''(N) 20'''(B)* 43mm(L) 38mm(T) 50mm(T)*	16'''(N) 36mm(L) 31.5mm(T) 36.5mm(T)*	17'''(N) 41mm(L) 35mm(T) 40mm(T)*	17'''(N) 21'''(B)* 48mm(L) 49-50mm(R) 40mm(T) 56mm(T)*	17'''(N) 42mm(L) 36mm(T) 43mm(T)*	16-17'''(N) 37mm(L) 33mm(T) 43mm(T)*
VII	16'''(N) 40mm(L)	12'''(N)	9'''(N)	20-22'''(N) 53mm(L)	17'''(N) 44mm(L) 33mm(R)	18'''(N) 51mm(L)	19-21'''(N) 50-60mm(R) 60mm(L)	19-21'''(N) 53mm(L)	19'''(N) 52mm(L)
VIII	17-18'''(N) 15'''(B)* 42mm(L)	15'''(N)	10'''(N)	23-24'''(N) 22'''(B)* 40mm(M) 56mm(L)	18-19'''(N) 46mm(L)	20-22'''(N) 54mm(L) 45mm(R)	24'''(N) 24'''(B)* 64mm(L)	24'''(N) 24'''(B)* 56mm(L)	21-23'''(N) 25mm(L)
IX	45mm(L) 40mm(R)	—	—	61mm(L)	51mm(L)	59mm(L)	70mm(L) 70-75mm(R) 85-90mm(R)*	63mm(L) 50-60mm(R) 50-60mm(Fr)	60mm(L) 70-75mm(Fr)* 50-60mm(Fr)
X	20'''(N) 16'''(B)* 50mm(L)	16'''(N)	11'''(N)	26-28'''(N) 27'''(B)* 71mm(L) 81mm(Sk)*	20'''(N) 22'''(B)* 55mm(L) 72mm(Sk)*	24'''(N) 26'''(B)* 55-60mm(R) 65mm(L) 76mm(Sk)	27-28'''(N) 32'''(B)* 85mm(L) 94mm(Sk)*	27-28'''(N) 27'''(B)* 70mm(L) 85mm(Sk)*	27-28'''(N) 27'''(B)* 69mm(L) 83mm(Sk)*
New-born	1'7'''(G) 51mm(L) 43.5mm(T) 46mm(T)	1'6'''(G) 33mm 34mm 41mm 46mm	1'2'''(G) 29mm 26.5mm(T)	3'''(G)* 65-80mm(M)* 63mm(U) 76mm(L) 65-66mm(T) 80-83mm(T)*	2'8'''(G)* 52mm(R) 43-48mm(U) 61mm(L) 54-55mm(T) 60-61mm(T)*	2'10'''(G)* 55mm(U) 70mm(L) 61-62mm(T) 54-55mm(T) 70-71mm(T)*	3'6'''(G)* 94mm(L) 73-75mm(T) 90-99mm(T)*	3'2'''(G)* 83mm(L) 63-67mm(T) 73-80mm(T)*	3'1'''(G)* 79mm(L) 60-63mm(T) 71-81mm(T)*

TABLE III. Landois's table (in mm.).

Fetal Age	No.	Clavicle	Humerus	Radius	Uln	Femur	Tibia	Fibula
New-born Child	1	51½-52½	78	61	71	97	86	81
	2	49-50½	74½	59½	68½	91½	80	77½
X Month	1	49½-50½	71	55½	61½	85	70	69
IX Month	1	46½-48	63	52½	60½	72½	66½	64
	2	44½-46½	62	53	60½	71½	63	60
	3	42½-43½	58½	47	55½	65½	59	57½
VIII Month	1	40-41½	56½	47½	55	64	57½	56½
	2	42½-44½	56½	46	53½	64½	57½	54
	3	40-44	54	46	53½	64	53½	53
VII Month	1	40-43	54	46	53	65	56½	54
	2	38-40	54	44½	52	61½	55½	54
	3	39½-43½	54	43½	50½	61	52½	53
	4	39-42½	53	43½	50½	59½	54	50½
	5	34-36	49	42	46½	54½	49	48
VI Month	1	36½-38	49	40½	47½	56	48½	46½
	2	34½-36½	49	40	46½	53½	48	47
	3	33½-34½	47½	38	44	51½	45½	44
	4	32-35½	43	38	44	51	47	45½
XXII Week	1	30-31	41	34½	39½	45	39	38
XXI Week	1	30½-32	40½	34½	40	43½	39½	38½
	2	30-32½	40	32½	38	45½	38	36½
	3	29-32½	39½	34	39½	45½	38½	38½
	4	30½	39½	32	37	43	38	36½
XX Week	1	26-27	37	31	35½	39½	35½	33½
XIX Week	1	24½-26	36	30½	35	39	34	32½
XVI Week	1	21½-22	27	22½	25½	27½	24	23½
XV Week	1	16½	23	18½	21	23	20	19½
XIV Week	1	18-18½	21½	17½	19½	21	18½	17½
XIII Week	1	18½	19	16½	18½	19½	16½	16
XII Week	1	14½	17½	14½	15	17½	14½	13½
	2	10½	15½	13	13½	15½	12½	11½
XI Week	1	12	14½	11½	11½	13	11	10
	2	—	13½	9½	10½	13	8	9½
X Week	1	8½	9½	—	—	9½	7	6½
IX Week	1	2½	2	2	2	1½	1½	1½

TABLE II. Bones of the skull.

Fetal Month	Squamosum-occipital		Basioccipital		Parietal		Frontal		Squamosal		Maxilla		Zygomatic	
	Height	Width	Length	W.	H.	W.	H.	W.	H.	W.	H.	W.	H.	W.
II	—	—	—	—	—	—	1.5'''(N)	1'''(N)	—	—	0.5'''(N)	0.7'''(N)	—	—
III	2'''(N)	3'''(N)	—	—	6-9'''(N)	3-8'''(N)	3'''(N) 1-1.5'''(N)	2.5'''(N) 2.5'''(S)	1'''(N)	1.5'''(N)	1.5'''(N)	1.8-2'''(N)	—	—
IV	1'''(N) 7mm(T)	8-10'''(N) 11mm(T)	1'''(N)	—	1'2'''(N) 15mm(T)	1'2'''(N) 12mm(T)	10-11'''(N) 4'''(S) 10mm(T)	8-9'''(N) 5'''(S) 14mm(T)	3-4'''(N) 2.5mm(T)	4-5'''(N) 4mm(T)	3-3.3'''(N) 5mm(T)	5-6'''(N) 8.5mm	—	—
V	1'''(N) 14mm(T)	1'''(N) 21mm(T)	3'''(N)	—	15-21'''(N) 30mm(T)	1'3'''(N) 28mm(T)	1'1'''-1'3'''(N) 22mm(T)	11-13'''(N) 21mm(T)	4-5'''(N) 4mm(T)	5-7'''(N) 8mm(T)	5-6'''(N) 7mm(T)	7-3'''(N) 18mm(T)	—	—
VI	1'6'''(N) 32mm(T)	1'4'''(N) 40mm(T)	3.5'''(N)	2.5'''(N)	21'''-2'''(N) 50mm(T)	2'''(N) 46mm(T)	1'6'''(N) 36mm(T)	34mm(T)	11mm(T)	17mm(T)	7-8'''(N) 13mm(T)	9-10'''(N) 30mm(T)	—	—
VII	1'6'''(N) 42mm 43mm(T)	1'4'''(N)	—	—	—	—	1'6'''(N)	1'6'''(N)	9-9.5'''(N)	—	8'''(N)	9-10'''(N)	—	—
VIII	2'''(N)	2'''(N) 45mm 49mm(T)	5'''(N)	—	69-65mm(T)	61-64mm(T)	2'''(N) 48-51mm(T)	41-43mm(T)	16-20mm(T)	21-23mm(T)	18-19mm(T)	36-41mm(T)	—	—
IX	54mm(T)	61mm(T)	—	—	71mm(T)	67mm(T)	54mm(T)	54mm(T)	19mm(T)	24mm(T)	21mm(T)	42mm(T)	—	—
X	2'4'''(N) 63mm(T)	2'6'''(N) 64mm(T)	6'''(N)	—	3'3'''(N) 84mm(T)	3'6'''(N) 79mm(T)	2'''(N) 57mm(T)	51mm(T)	11-13'''(N) 22mm(T)	1'''(N) 31mm(T)	11-12'''(N) 25mm(T)	13-14'''(N) 49mm(T)	—	—
New-born	2'''(G) 64mm 67mm 70mm	1'10'''(G) 62mm 66mm 68mm(T)	—	—	3'3'''(G) 83mm 84mm 85mm	75mm 79mm(T) 80mm	2'3'''(G) 60mm 62mm 66mm	1'10'''(G) 53mm 56mm 57mm	1'''(G) 20mm 23mm 24mm	29mm 32mm 32mm	1'''(G) 22mm 24mm 25mm	1'1'''(G) 50mm 51mm 51mm	6'''(G)	1'''(G)

TABLE IV. Size of the fetal bones (in cm.).

Fetal Month	Number	Bones of the skull																				Bones of the upper extremity												Bones of the lower extr.															
		Squa- mosum- occipital		Basi- occipital		Squamosum- frontal				Parietal				Squamosum- squamosal				Maxilla				Zygomatic				Body of Sphe- noid		Clavicle		Scapula			Hu- merus		Ulna		Radius		Femur		Tibia		Fibula						
Height	Width	Length	Width	Height		Width		Sagittal diameter		Frontal diameter		Height		Width		Height		Width		Height		Width		Length	Width	Length	Right	Left	Length	Right	Left	Length	Right	Left	Length	Right	Left	Length	Right	Left	Length	Right	Left						
IV	1	1.5	1.9	0.65	0.4	2.0	—	1.9	—	—	2.3	—	1.6	—	0.8	—	1.0	0.9	0.8	1.0	1.0	—	0.7	—	1.0	—	—	1.6	1.6	1.2	1.2	0.95	1.0	2.2	—	2.0	1.9	—	—	2.1	2.1	1.85	1.85	1.8	1.8				
VI	1	5.6	4.4	1.0	0.9	4.8	4.8	4.8	4.8	5.7	5.8	6.1	6.2	1.85	1.8	2.6	2.8	1.8	1.9	1.8	1.9	1.7	1.7	2.3	2.2	0.7	1.5	3.3	3.2	2.5	2.4	2.2	2.1	4.6	4.6	4.4	4.4	3.85	3.85	5.1	5.1	4.5	4.6	4.4	4.4				
VII	1	3.7	3.9	—	—	3.8	3.8	3.2	3.1	5.8	5.8	5.6	5.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
	2	4.4	5.0	1.1	1.1	4.7	4.8	3.9	3.9	6.7	6.6	6.5	6.4	1.8	2.0	2.6	2.5	1.9	1.9	2.0	2.0	1.7	1.6	2.1	2.3	0.75	2.0	3.3	3.3	2.4	2.5	2.3	2.3	4.6	4.6	4.3	4.3	3.9	3.8	5.1	5.1	4.6	4.5	4.5	4.5				
	3	4.5	4.9	0.9	1.0	4.8	4.7	3.9	4.0	6.2	6.2	6.3	6.2	1.9	1.9	2.5	2.4	2.0	1.9	1.9	2.0	1.6	1.6	1.9	2.0	0.75	1.3	3.1	3.2	2.7	2.7	2.0	2.0	4.4	4.4	4.2	4.3	3.7	3.7	4.85	4.75	4.3	4.3	4.2	4.15				
	4	4.8	5.4	1.0	1.15	—	—	—	—	—	—	—	—	—	1.8	1.8	2.7	2.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
VIII	1	5.5	5.5	1.1	1.7	5.3	5.4	4.2	4.4	7.1	6.9	7.8	7.8	2.2	2.1	2.7	2.8	2.05	2.2	2.1	2.0	1.9	1.9	2.2	2.1	1.0	1.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
	2	4.9	5.0	—	—	4.5	4.3	3.9	3.8	7.4	6.8	7.0	7.0	2.0	2.0	3.0	3.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
	3	4.7	4.9	1.1	1.0	4.7	4.9	4.1	3.9	5.8	6.0	6.0	6.0	1.9	2.0	2.7	2.9	2.2	2.0	2.0	2.1	1.8	1.7	2.0	2.0	1.0	1.6	3.5	3.4	2.8	2.7	2.3	2.3	5.0	4.9	4.8	4.7	4.2	4.25	5.65	5.65	5.0	5.0	4.8	4.85				
	4	4.8	5.5	—	—	4.5	4.6	4.0	4.2	6.8	6.8	7.0	6.9	—	—	—	—	—	1.7	—	2.1	—	—	—	—	—	—	—	3.5	—	2.8	2.8	2.4	2.3	5.1	5.0	4.7	4.7	4.2	4.2	—	—	4.9	—	—	—			
X	1	—	6.8	—	—	—	—	—	—	8.0	8.0	8.2	7.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	2	—	—	—	—	5.6	5.5	4.8	4.8	8.4	7.8	7.9	7.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
	3	—	—	1.0	1.4	5.5	5.7	4.9	4.8	8.4	8.6	8.9	9.0	3.0	3.0	3.6	3.5	2.7	2.5	2.4	2.4	2.0	2.0	2.6	2.8	—	—	4.1	4.2	3.7	3.7	3.0	3.0	5.95	6.05	5.7	5.7	4.9	4.9	6.8	6.8	5.9	6.0	—	5.8				
	4	6.2	7.0	—	—	6.2	6.1	4.5	4.6	7.8	7.5	8.4	8.4	—	—	—	—	2.6	2.4	2.6	2.7	—	—	—	—	—	—	—	—	—	—	—	—	—	6.0	6.0	5.7	5.7	5.0	5.05	—	—	—	—	—	—			
New-born	1	—	—	—	—	—	—	—	—	8.3	—	8.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	2	—	—	—	—	—	—	—	—	8.4	8.2	8.5	8.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	3	—	—	—	—	—	—	—	—	8.5	8.7	9.4	9.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	4	6.4	6.5	—	—	—	—	—	—	8.0	7.9	8.4	8.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	5	7.8	6.6	—	—	5.5	6.0	4.8	4.8	7.3	7.1	8.4	8.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
	6	6.3	6.0	1.3	1.6	6.4	6.5	5.3	5.2	8.1	8.0	8.5	8.2	2.7	2.7	3.5	3.5	2.5	2.6	2.6	2.6	2.0	2.0	2.7	2.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
	7	—	—	1.4	1.5	—	—	—	—	—	—	—	—	—	2.6	—	3.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
	8	5.3	6.3	—	—	—	—	—	—	7.9	7.5	8.0	8.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	9	7.0	6.8	—	—	—	—	—	—	7.5	7.7	7.9	8.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE V. Average of the cases of table IV (in cm.).

Fetal Month	Bones of the skull																Bones of the upper extremity						Bones of the lower extr.		
	Squamosum-occipital		Basi-occipital		Frontal		Parietal		Squamosal		Maxilla		Zygomatic		Body of sphenoid		Clavicle	Scapula		Humerus	Ulna	Radius	Femur	Tibia	Fibula
	Height	Width	Length	Width	Height	Width	W.	H.	H.	W.	H.	W.	H.	W.	L.	W.	L.	H.	W.	L.	L.	L.	L.	L.	L.
IV	1.5	1.9	0.7	0.4	2.0	1.9	2.3	1.6	0.8	1.0	0.9	1.0	0.7	1.0	—	—	1.6	1.2	1.0	2.2	2.0	—	2.1	1.9	1.8
VI	5.6	4.4	1.0	0.9	4.8	4.8	5.8	6.2	1.8	2.7	1.9	1.9	1.7	2.3	0.7	1.5	3.3	3.5	2.2	4.6	4.4	3.9	5.1	4.6	4.4
VII	4.4	4.8	1.0	1.1	4.4	3.7	6.2	4.4	1.9	2.6	1.9	2.0	1.6	2.0	0.7	1.6	3.2	2.6	2.2	4.5	4.3	3.8	5.0	4.4	4.3
VIII	5.0	5.0	1.1	1.4	4.8	4.1	6.7	6.9	2.0	2.9	2.0	2.1	1.8	2.0	1.0	1.6	3.5	2.8	2.3	5.0	4.7	4.2	5.7	5.0	4.8
X	6.2	6.9	1.0	1.4	5.8	4.7	8.1	8.3	3.0	3.6	2.6	2.5	2.0	2.7	—	—	4.2	3.7	3.0	6.0	5.7	5.0	6.8	6.0	5.8
New-born	6.6	6.4	1.4	1.6	6.1	5.0	8.0	8.4	2.7	3.5	2.6	2.6	2.0	2.7	1.2 (m)	1.8	—	—	—	—	—	—	—	—	—

TABLE VI. Total average of the extremity-bones (in mm.).

Fetal Month	Clavicle		Scapula		Humerus		Ulna		Radius		Femur		Tibia		Fibula	
	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O
II	8	3	—	—	8	3	6	—	6	—	17	—	16	—	9	—
III	16	14	4	4	15-20	11	17	10	15	9	21	10	16	8	20	8
IV	24	14	13	11	34	23	30-35	22	—	19	34	19	31	17	32	21
V	—	20	19	16	40-45	33	—	35	—	32	—	37	—	34	—	33
VI	38	32	28	19	52	43	40	40	37	39	57	40	43	43	43	40
VII	—	38	29	23	—	52	46	16	—	42	—	55	—	50	—	49
VIII	41	42	35	25	59	52	49	19	—	48	65	61	65	57	—	54
IX	—	43	—	—	—	61	—	19	—	51	5-90	71	—	60	70-75	58
X	43	47	40	30	77	68	73	59	65	55	90	76	79	68	78	67
New-born	—	47	41	30	78	68	76	62	68	53	96	84	81	74	80	70

TABLE VII. Total average of the skull bones (in cm.).

Fetal Month	Squa-mosum-occipital		Basi-occipital		Parietal		Frontal		Squa-mosal		Maxilla		Zygoma-tic		Body of sphenoid	
	H	W	L	W	Sagittal diameter	Frontal diameter	H	W	H	W	H	W	H	W	L	W
II	—	—	—	—	—	—	4	3	—	—	1	2	—	—	—	—
III	5	8	—	—	16-24	8-22	6	7	3	5	5	3-5	—	—	—	—
IV	8	18	5	4	23	20	17	18	7	9	8	11	7	10	—	—
V	8	24	8	—	37	32	27	27	8	12	11	19	—	—	—	—
VI	43	41	9	8	54	54	42	41	15	22	18	21	17	23	7	15
VII	44	43	10	11	62	44	44	40	22	26	20	23	16	20	7	16
VIII	52	50	12	14	67	65	51	42	19	26	20	39	18	20	10	16
IX	54	61	—	—	71	67	54	54	19	24	21	42	—	—	—	—
X	63	68	13	14	84	86	57	49	28	31	27	37	20	27	—	—
New-born	64	63	14	16	85	81	62	54	26	33	29	41	18	27	12	18

TABLE IX. Average of the cases of table VIII (in. gr.).

Fetal Month	Bones of the skull											Bones of the upper extremity					Bones of the lower extr.		
	Occipital			Frontal	Parietal	Squamosal	Maxilla	Mandible	Zygomatic	Sphenoid		Clavicle	Scapula	Humerus	Ulna	Radius	Femur	Tibia	Fibula
	Squa-mosum	Basio-occ.	Ex-occ.							Great wing	Body								
IV	8	2	—	7	5	2	4	5	2	—	—	8	5	8	3	—	9	6	2
VI	92	16	21	102	137	20	28	38	17	28	13	15	33	65	30	23	127	84	19
VII	93	20	26	89	124	27	27	37	14	31	17	17	31	62	27	22	123	75	16
VIII	137	30	32	123	191	29	45	50	21	44	27	19	41	83	37	27	167	94	20
X	376	61	65	263	468	—	95	112	39	95	—	60	143	200	91	64	450	272	57
New-born	409	51	63	296	503	*65	84	105	42	89	(m)	—	—	—	—	—	—	—	—

TABLE VIII. Weight of the fetal bones (in gr.).

Fetal Month	No.	Bones of the skull																			Fetal Month	No.	Bones of the upper extremity										Bones of lower extr.							
		Occipital		Ex-occipital		Frontal		Parietal		Squamosal		Maxilla		Mandible		Zygomatic		Sphenoid					Clavicle		Scapula		Humerus		Ulna		Radiu		Femur		Tibia		Fibula			
																		Great wing	Body																					
		Squa- mosum	Basi- occ.	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	Body			R	L	R	L	R	L	R	L	R	L	R	L	R	L				
IV	1	8.0	2.0	—	—	7.0	—	—	5.0	—	2.0	3.5	4.0	5.0	5.0	—	2.0	—	—	—	IV	1	3.0	3.0	5.0	5.0	8.0	—	2.5	3.0	—	—	9.0	9.0	6.0	6.0	2.0	2.0		
VI	1	92.0	16.0	21.0	21.0	103.0	100.5	135.0	138.0	21.0	19.0	28.0	28.0	38.0	38.0	16.5	16.5	28.0	28.0	13.0	VI	1	16.0	14.5	33.0	33.0	65.0	66.0	30.0	31.0	23.0	24.0	128.0	127.0	84.0	85.0	19.5	19.0		
VII	1	52.0	—	—	—	52.0	55.0	80.0	75.0	—	—	—	—	—	—	—	—	—	—	—	VII	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	2	104.0	20.0	25.0	26.0	119.0	115.0	170.0	183.0	31.0	31.0	35.5	36.0	45.0	46.0	16.0	15.0	43.0	43.0	16.0		2	18.0	18.0	41.0	41.0	72.0	72.0	32.0	32.0	26.0	25.0	136.0	133.0	87.5	87.0	18.0	19.0		
	3	90.0	15.0	17.0	17.0	94.0	94.0	115.0	117.0	22.0	22.0	18.0	18.0	33.0	34.0	12.0	12.0	17.0	19.0	12.0		3	16.0	15.0	20.0	20.0	52.0	49.0	22.0	22.0	17.0	17.0	106.0	97.0	63.0	60.0	13.0	12.0		
	4	127.0	26.0	32.0	32.0	—	—	—	—	29.0	29.0	—	—	—	—	—	—	—	—	23.0		4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
VIII	1	189.0	34.0	38.0	38.0	149.0	168.0	258.0	255.0	40.0	41.0	46.0	48.0	60.0	60.0	24.0	24.0	53.0	52.0	32.0	VIII	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	2	106.0	—	—	—	100.0	104.0	176.0	177.0	24.5	23.5	—	—	42.0	42.0	—	—	—	—	—		2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	3	105.0	26.0	29.0	30.0	91.0	102.0	124.0	134.0	25.0	20.0	34.0	32.0	52.0	41.0	14.0	14.0	34.0	36.0	23.0		3	16.0	20.0	37.0	37.0	81.0	91.0	36.0	38.0	27.0	27.0	167.0	167.0	101.0	101.0	20.0	20.0		
	4	148.0	—	29.0	29.0	136.0	137.0	213.0	192.0	—	—	—	56.0	—	—	—	—	—	—	—		4	19.0	—	43.0	48.0	80.0	80.0	38.0	35.0	29.0	27.0	—	—	—	87.0	—	—	—	
X	2	—	—	—	—	276.0	295.0	461.0	468.0	—	—	—	—	121.0	120.0	—	—	—	—	—	X	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	3	—	61.0	66.0	64.0	359.0	356.0	547.0	437.0	(m)	(m)	103.0	108.0	115.0	121.0	38.0	40.0	93.0	98.0	—		3	61.0	60.0	133.0	154.0	251.0	251.0	120.0	113.0	82.0	85.0	454.0	447.0	255.0	290.0	—	—	—	57.0
	4	376.0	—	—	—	251.0	244.0	459.0	439.0	—	—	94.0	78.0	—	98.0	—	—	—	—	—		4	—	—	—	—	148.0	152.0	65.0	67.0	45.0	44.0	—	—	—	—	—	—	—	
	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Newborn	1	—	—	—	—	—	—	559.0	—	—	—	—	—	—	—	—	—	—	—	—	Newborn	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3	—	—	—	—	—	—	619.0	621.0	—	—	—	—	—	—	—	—	—	—	—		3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4	430.0	—	—	—	—	—	505.0	505.0	—	—	—	—	—	—	—	—	—	—	—		4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5	394.0	—	—	—	—	—	567.0	564.0	—	—	—	—	—	—	—	—	—	—	—		5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6	343.0	49.0	66.0	69.0	296.0	294.0	524.0	497.0	61.0	70.0	85.0	83.0	98.0	99.0	44.0	44.0	92.0	86.0	—		6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	7	—	53.0	—	58.0	—	—	—	—	(m)	(m)	—	—	110.0	—	—	—	39.0	88.0	(m)		7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	8	276.0	—	—	—	—	—	—	410.0	371.0	(m)	(m)	—	—	—	—	—	—	—	—		8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9	605.0	—	—	—	—	—	—	362.0	373.0	—	—	—	—	—	—	—	—	—	—	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		