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PHYSICAL ANTHROPOLOGY OF THE LENAPE OR DELAWARES, AND OF THE EASTERN INDIANS IN GENERAL

BY

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LETTER OF TRANSMITTAL

WASHINGTON, D. C., *November 10, 1915.*

SIR: I have the honor to transmit herewith a report by Dr. Aleš Hrdlička on "Physical Anthropology of the Lenape or Delawares, and of the Eastern Indians in General," and to recommend its publication as a bulletin of the Bureau of American Ethnology.

Very respectfully,

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Secretary, Smithsonian Institution.

CONTENTS

I. SKELETAL REMAINS OF THE MUNSEE

	Page
Introduction	11
Condition of the collection	15
General	15
Age and sex	15
Artificial deformation	16
Pathology	16
The crania	19
General observations: Differences in type	19
Chief descriptive features	20
Measurements	20
Form of the vault	20
Size of the skull	22
Relation of size of skull to stature	23
Size and shape of the face	25
Orbits. Nose	27
Prognathism	28
Palate	30
Foramen magnum	31
Lower jaw	32
Detailed observations on the crania	32
The vault: Forehead	32
Sagittal region	33
Temporo-parietal region	33
Occiput	34
Sutures: Serration	34
Occlusion of sutures	35
Wormian bones	35
Bregma and Inca bones	36
Parietal foramina	36
Retromastoid foramina	37
Mastoids	37
Supraorbital ridges	38
Nasion depression	39
Nasal bridge	39
Nasal bones	40
Nasal aperture	40
Nasal spine	40
Orbits	41
Suborbital fossæ	41
Malar bones. Zygomæ	42
Upper alveolar arch	42
Lower jaw	43
Palate	43

The crania—Continued.
Detailed observations on the crania—Continued. Page
Base of the skull 43
Glenoid fossæ 43
Floor of the auditory meatus 44
Styloid processes 44
Middle lacerated foramina. Posterior lacerated foramina 45
Depressions of the petrous portions 46
Pterygo-basal foramina 46
Posterior condylic foramina 47
Miscellaneous anomalies 47
The teeth 48
Dentition 48
Loss and decay 48
Wear 48
Size, quality, shovel-shaped incisors 48
Anomalies 49
Cuspids 49
Summary of measurements and observations on the crania 50
The bones 52
Humerus 52
General observations 52
Detailed observations 55
Shape of the shaft 55
Perforation of the septum 55
Supracondyloid process 56
Radius 56
Ulna 57
Femur 58
General observations 58
Measurements 58
Humero-femoral index 61
The shaft 61
Platymery 63
Special characteristics of the femora 65
Linea aspera 66
Shape of the shaft 66
Third trochanter 66
Tibia 67
Fibula 70
Clavicle 71
Sternum 72
Scapula 73
General features 73
Descriptive features 75
Type of body 75
Superior border 76
Scapular notch 78
Ribs 79
Spine 80
Sacrum 81
General observations and measurements 81
Segments 82
Curvature 82

The bones—Continued. Page
Ossa innominata and pelvis ... 83
The ossa innominata ... 83
The pelvis as a whole ... 85
Short and other bones ... 87
Patella ... 87
Bones of the hand ... 90
Bones of the feet ... 91
First metatarsal ... 91
Os calcis ... 93
Articular facets for astragalus ... 95
Astragalus ... 96
Scaphoid ... 99
Cuboid ... 102
Internal cuneiform ... 104
External and middle cuneiform ... 106
Summary of measurements and observations on parts of the Munsee skeleton other than the skull ... 106

II. EASTERN INDIAN CRANIA IN GENERAL

General observations ... 110
Cranial index ... 114
Height of skull ... 116
Size of skull ... 117
Facial measurements ... 119
Height of the face ... 119
Breadth of the face ... 119
Orbits ... 120
Nasal index ... 121
Palate ... 122
Prognathism ... 122

APPENDIX

Iroquois and most nearly related Eastern Indian crania ... 127

ILLUSTRATIONS

Page

PLATE 1. Anthropological map of the Indian population of eastern United States and Canada according to present knowledge 11
2. General view of the locality of the Munsee cemetery at Minisink, New Jersey 15
3. Plan of the Munsee burial site showing location and position of the burials 17
4. Two typical Munsee burials in moderately contracted position 18
5. Two burials in extended position 20
6. Male Munsee skull No. 285,303, U.S.N.M. (front view) 22
7. Male Munsee skull No. 285,303, U.S.N.M. (side view) 25
8. Male Munsee skull No. 285,303, U.S.N.M. (view from above), showing typical features 26
9. Male skull No. 99–6669, A. M. N. H., from Manhattan Island (front view) 28
10. Male skull No. 99–6669, A.M.N.H., from Manhattan Island (side view) 31
11. Male skull No. 99–6669, A.M.N.H., from Manhattan Island (view from above), showing long ovoid outline 32
12. Male Munsee skull No. 285,308, U.S.N.M. (front view) 34
13. Male Munsee skull No. 285,308, U.S.N.M. (side view) 37
14. Male Munsee skull No. 285,308, U.S.N.M. (view from above) 38
15. Undeformed typical female Munsee skull No. 285,309, U.S.N.M. (view from above) 40
16. Male Munsee skull No. 285,306, U.S.N.M., showing fine ovoid outline 40
17. Large male skull No. 2010–4423, A. M. N. H., from Manhattan Island, showing fine elliptical outline 40
18. Adult male skull from Manhattan Island, No. 99–6667, A. M. N. H., showing an exceptionally high and narrow face 42
19. Brachycephalic extraneous female skull, No. 285,311, U.S.N.M. (view from above), found with the Munsee Indians 44
20. Skull of Munsee child of about six years of age, No. 285,329, U.S.N.M., showing fronto-occipital compression 45
21. Base of female skull No. 285,311, U.S.N.M. (brachycephalic extraneous), found among the Munsee burials, showing excessive size of the foramina ovale, especially on the right side 48
22. Lower jaw of female Munsee skull No. 285,307, U.S.N.M., showing complete fusion of the right lower lateral incisor and canine 49
23. Supracondyloid process in a femur, and a spurious supracondyloid foramen in a humerus of the Munsee 54
24. Fusion of humerus and ulna; male Munsee skeleton No. 285,303, U.S.N.M. 58

Page

PLATE 25. *a*. The seventh cervical vertebra of female Munsee skeleton No. 285,311, U.S.N.M., with a cervical rib.
b. Scapula of female Munsee skeleton No. 285,328, U.S.N.M., showing semilunar shape of the superior border. 76
26. *a*. Male Munsee sacrum showing bilateral articulation with an extra segment introduced between the last lumbar and the sacrum.
b. Female Munsee sacrum showing bilateral articulation with extra segment..... 81
27. Female Munsee sacrum showing unilateral articulation with the fifth lumbar..... 82
28. *a*. Patella of female Munsee skeleton No. 285,311, U.S.N.M., showing marked obliquity.
b. Patellæ of female Munsee skeleton No. 285,309, U.S.N.M., showing pronounced vastus notch.
c. Internal cuneiforms of male Munsee skeleton No. 285,301, U.S.N.M., showing each a double metatarsal facet.
d. Pair of female Munsee scaphoids showing unusual broad talus facet and peculiar tuberosity..... 90
29. *a*. The right and left first metatarsal of Munsee skeleton No. 285,326, U.S.N.M., showing disproportion in size; also a canal in the smaller bone, possibly the vestige of an early fracture.
b. The calcanei of male Munsee skeleton No. 285,313, U.S.N.M., showing wide separation of the two facets for the astragalus..... 96

FIGURE 1. Map showing the location of the Munsee cemetery..... 12


77°
73°
69°
45
41
37
33
ITHROPOLOGICAL MAP
OF THE
IAN POPULATION OF
TERN UNITED STATES
AND CANADA
RDING TO PRESENT KNOWLEDGE
BY ALEŠ HRDLIČKA
1915
THE ALGONQUIAN-IROQUOIS DOLICHOCEPHALIC TYPE
THE EASTERN AND SOUTHERN BRACHYCEPHALS
77°
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PHYSICAL ANTHROPOLOGY OF THE LENAPE OR DELAWARES, AND OF THE EASTERN INDIANS IN GENERAL

I. SKELETAL REMAINS OF THE MUNSEE

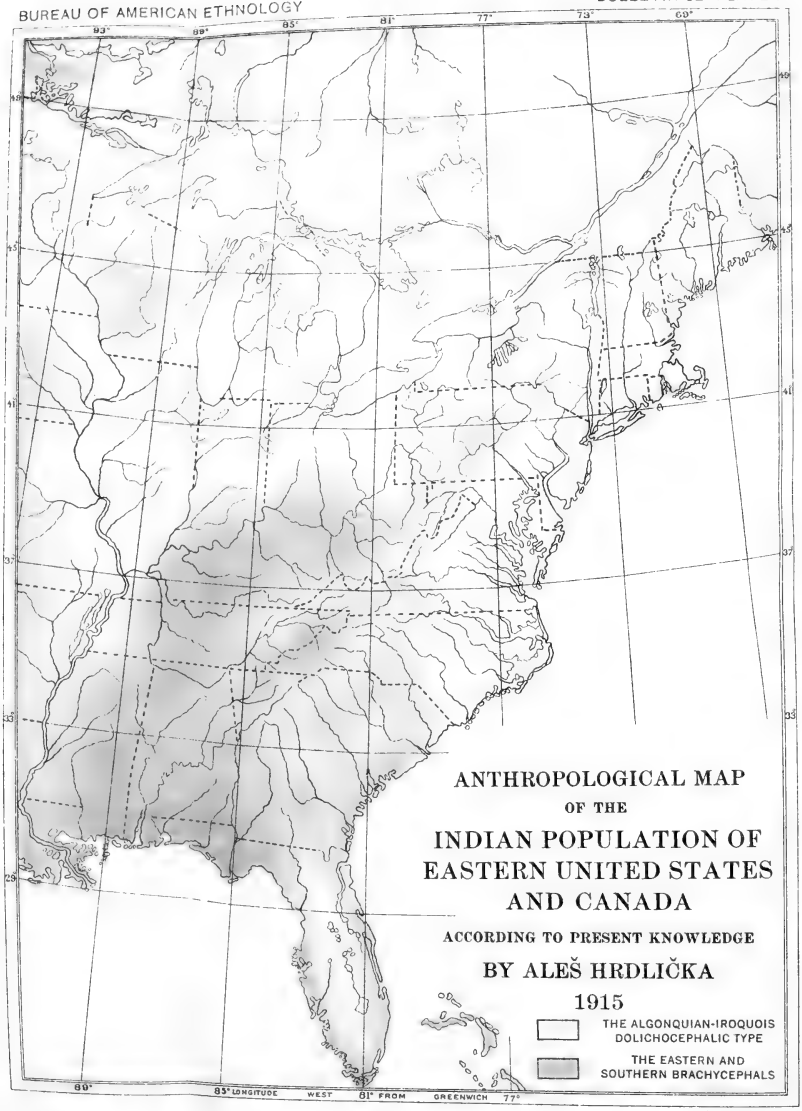
Introduction

IN 1902, in pursuance of a study of the antiquity of certain skeletal remains found in the vicinity of Trenton, New Jersey, the writer collected and described all the crania of the Lenape or Delaware Indians which at that time were preserved in our museums.[1] From that time until 1914 no further anthropological discoveries of consequence were made in the region over which the tribe once extended; but during the spring of the latter year careful archeological exploration was conducted in the upper Delaware River valley in behalf of the Museum of the American Indian in New York, by Mr. George G. Heye, with the assistance of Mr. George H. Pepper, in the course of which were found the remains of no fewer than 57 Indian skeletons.[2] The bones were not in the best state of preservation, but they were collected with scrupulous care, and shortly after the field work was completed they were presented by Mr. Heye to the United States National Museum. This skeletal material forms an important addition to the previously limited collections representing the Lenape Indians, whose physical identity it is highly desirable to establish.

The remains came from a cemetery in the form of a low mound on the New Jersey side of the Delaware River, opposite Minisink Island, 3 miles below Montague, in the northwestern corner of Sussex County, New Jersey. The accompanying map (fig. 1) shows the site of the cemetery, which lay in the heart of the region once occupied by the Munsee branch of the Lenape Indians.

[1] Hrdlička, The Crania of Trenton, New Jersey, and their Bearing upon the Antiquity of Man in that Region, *Bull. Amer. Museum of Natural History*, XVI, art. 311, New York, 1902, pp. 23–62, 22 pl., 4 fig.

[2] For details and archeological results, see George G. Heye and George H. Pepper, Exploration of a Munsee Cemetery near Montague, New Jersey, *Contributions from the Museum of the American Indian (Heye Foundation)*, II, pt. I, New York, 1915. The Heye Expedition reports some additional burials, but the skeletal remains therefrom were in a very defective condition.



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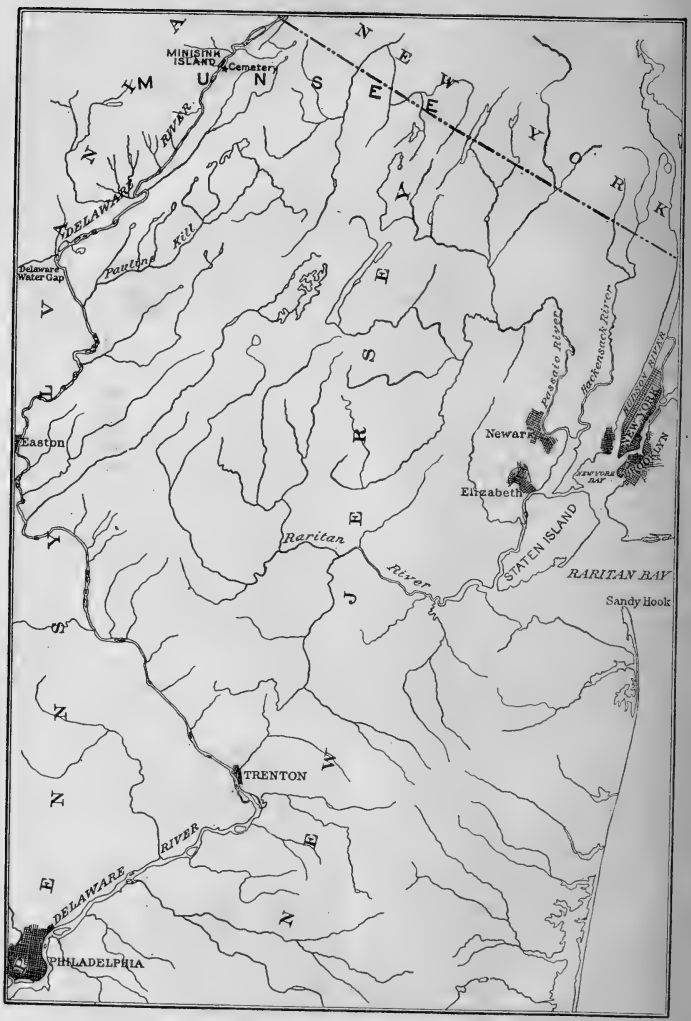


FIG. 1.—Map showing the location of the Munsee cemetery.

On the arrival of white settlers, the entire region afterward known as New Jersey belonged to the Lenape or Delawares,[1] whose settlements extended "from the Mohicannituck [Hudson River] to beyond the Potomac," and "from the heads of the great rivers 'Susquehannah' and 'Delaware' to the Atlantic Ocean" (Heckewelder). The neighboring tribes to the north (Mohegan, Narraganset, Pequot, and others), as well as those on the south (Nanticoke, the Powhatan confederacy, and others), all acknowledged relationship with the Delawares, with whom, there is no doubt, they were affiliated linguistically.

The Lenape were divided into three large groups, or, as Brinton calls them, "sub-tribes," namely, the Munsee or Minsi (the Wolf), the Unami (the Turtle), and the Unalachtigo (the Turkey).[2] These subtribes, it seems, were subdivided into numerous smaller groups with distinctive names.[3] The three branches of the tribe occupied special regions, but it has not been reported whether their boundaries were stable and definite. The Minsi, according to Heckewelder,[4]

[1] *Captain John Smith's Works*, 1608–1631, Arber ed., Birmingham, 1884; *William Penn's Letters*, 1683; G. Thomas, *History of New Jersey*, London, 1698; Thomas Campanius Holm, *Short Description of New Sweden*, Stockholm, 1702, transl. by Duponceau in *Memoirs of the Historical Society of Pennsylvania*, III, Phila., 1834; T. Acrelius, History of New Sweden, Stockholm, 1759, transl. in *Memoirs of the Historical Society of Pennsylvania*, XI, 1874; Samuel Smith, *History of the Colony of Nova Cesarea or New Jersey*, Burlington, 1765; Peter Kalm, *Travels into North America*, London, 1770–71; G. H. Loskiel, *History of the Mission of the United Brethren among the Indians in North America*, London, 1794; Geo. Chalmers, Political Annals of the Present United Colonies, etc., 1780, *New York Historical Society Collections*, 1868; John G. E. Heckewelder, History, Manners and Customs of the Indian Nations who once Inhabited Pennsylvania and the Neighboring States, Phila., 1819, *Mem. Hist. Soc. Penn.*, XII, 1876; also MSS.; James Grahame, *History of the Rise and Progress of the United States of North America*, London, 1827 (new ed., 1836, 1845); Thos. F. Gordon, *History of New Jersey*, Trenton, 1834; J. Curtis Clay, *Annals of the Swedes on the Delaware*, Phila., 1835; Yates and Moulton, *New York*, N. Y., 1824; Isaac Mickle, *Reminiscences of Old Gloucester*, Phila., 1845, Camden, 1877; A. Gifford, Aborigines of New Jersey, *Proc. N. J. Hist. Soc.*, IV, Newark, 1859, pp. 163–198; D. G. Brinton, *The Lenape and their Legends*, Phila., 1885; Handbook of American Indians, *Bull. 30, Bureau of American Ethnology*, Washington, 1907–1910.

[2] These designations are not translations of the terms given in parentheses, but "refer to the location of these sub-tribes on the Delaware River," Minsi (from *minthin*, to be scattered, and *achsin*, stone), meaning "people of the stony country" or "mountaineers"; Unami (from *nahen*, down-stream) means "people down the river"; and *Unalachtigo* (from *wunalawat*, to go towards, and *t'kow* or *t'kou*, wave) means "people who live near the ocean." Wolf, Turtle, and Turkey are the totemic designations of the three sub-tribes. (Brinton, op. cit., p. 34.)

[3] From the above tribes, in course of time, sprang many others "who, having for their own conveniency, chosen distant spots to settle on, and increasing in numbers, gave themselves names or received them from others." (Heckewelder, *Hist. Indian Nations*, p. 53; see also ibid., p. 51.)

[4] Heckewelder, *Hist. Ind. Nations*, p. 52. Brinton (op. cit., p. 37) is of the opinion, but on what grounds is not stated, that the extent of the territory of the Munsee as given here is too great. In his words, "that at any time, as Heckewelder asserts, their [the Munsee] territory extended up to the Hudson as far as tide-water, and westward 'far beyond the Susquehannah' is surely incorrect. Only after the beginning of the eighteenth century, when they had been long subject to the Iroquois, have we any historic evidence that they had a settlement on the last named river." It seems, however, that even if the presence of the Munsee on or beyond the Susquehannah may be open to contention, their presence along the Hudson is well established. Gifford (*Aborigines of New Jersey*, p. 180) states that "the Minsi tribe extended as far on the west banks of the Hudson as Tappan." Yates and Moulton (*History of New York*, I, p. 225) place the Minsi even farther east, "from Long Island to and beyond Minnisink." According to Ruttenber (*History of the Indian Tribes of Hudson's River*, p. 50) the Munsee territory "extended from the Katskill mountains to the headwaters of the Delaware and Susquehanna rivers, and was bounded on the east by the Hudson; their council-fire was lighted at Minisink [about 10 miles south of Maghackemek, New Jersey]." The Unami joined the Munsee on the south, somewhere about Stony Point. Going farther than this, Ruttenber gives (p. 93 et seq.) the various subdivisions of the Munsee along the Hudson and their location: the Waoroneck, about Dans-kammer; the Warranawonkong, from Dans-kammer to Saugerties; the Mamekoting west of Shawangunk mountains; the Wawarsink, in the district which still bears their name; the Katskills, north of Saugerties.

had "chosen to live back of the two other tribes and formed a kind of a bulwark for their protection. . . . They extended their settlements from the Minnisink, a place named after them, where they had their council seat and fire, quite up to the Hudson on the east, and to the west or southwest far beyond the 'Susquehannah'; their northern boundaries were supposed originally to be the heads of the great rivers Susquehannah and Delaware, and their southern boundaries that ridge of hills known in New Jersey by the name of Muscanecun, and in Pennsylvania, by those of Lehigh, Cohnewago, etc."[1]

This is evidently one of the rare instances in which it is possible to make a clear tribal identification of older skeletal remains in eastern North America, and it is also an instance in which the contents of graves enable a fairly close estimate of the age of the site. The artifacts found with the various burials include a number of objects introduced by early settlers, a fact that shows the cemetery to be of historic date. Furthermore, one of the skeletons is that of a tall white man of Scandinavian or Nordic type, possibly one of the Dutch, English, or Swedes who reached the upper valley after 1614. As the remainder of the skeletons do not indicate any trace of admixture of white blood, the cemetery may be regarded as dating from the period of the earlier contact of the Indian and Caucasian races, or probably from the latter part of the seventeenth or the beginning of the eighteenth century. It was surely earlier than 1740, for in that year the main body of the Munsee was forced to move from the Delaware, settling first on the Susquehanna and soon after on the Allegheny River in Pennsylvania, where some of them had gone as early as 1724.

An event of anthropological importance in connection with the Munsee before their removal from the Delaware is noted by Ruttenber.[2] In the latter part of the seventeenth century, at the outbreak of hostilities between the Five Nations and the French, the advance of the Iroquois in the south was being contested by the Shawnee, who at that time were also engaged in war with the Cherokee. "In the latter they [the Shawnee] suffered severely, and but for the timely aid of the *Mahicans* would have been destroyed. The *Lenapes* [Delawares] invited them to remove to their country; the invitation being accepted, the *Minsis* brought the matter to the attention of the government of New York, in September, 1692, on an application to permit their settlement in the Minnisink country. The council gave its assent on condition that they should first make peace with the Five Nations.[3] This was soon effected, and the messengers departed, ac-

[1] Quoted from Hrdlička, *The Crania of Trenton*, op. cit., pp. 32-33.

[2] Ruttenber, *History of the Indian Tribes of Hudson's River*, p. 178.

[3] "River Indians returned from a residence with the Shawanoes, brought with them some Shawanoes

GENERAL VIEW OF THE LOCALITY OF THE MUNSEE CEMETERY AT MINISINK, NEW JERSEY

companied by Arnout Vielle, an interpreter, and three Christians, to visit the country of the *Shawanoes* and consummate the transfer. . . . Captain Arent Schuyler visited the *Minnisinks* in February, and there learned that the Shawanoes were expected early in the ensuing summer. This expectation was realized."

From this it appears that between 40 and 50 years before their removal from the Delaware, the Munsee were joined by some Shawnee, which fact may explain certain peculiar conditions shown by the skeletal remains that will be considered in the following pages.

The mound or cemetery explored by the Museum of the American Indian was known for many years, and some human bones had been removed from it, especially by Doctor Dalrymple, who exhumed at least 15 skeletons, but unfortunately these have been lost to science.

CONDITION OF THE COLLECTION

General

As already stated, the collection from the Museum of the American Indian consists of 57 Indian skeletons, which range from nearly complete to such as are represented by only a few bones. Notwithstanding the fact that the condition of the material leaves much to be desired, many of the bones are sufficiently well preserved to afford fairly good data for study. The bones show neither vestiges of greenness nor traces of mineralization. There is no post-mortem deformation, except in a few detached bones of the skulls of infants. The color of the bones is predominantly brownish yellow, shading in some specimens to light dirty yellowish and in others to a darker brownish hue.

Age and Sex

Of the 57 individuals, 34 were adults and 23 (40 per cent) were adolescents or children. Among the adults the estimated ages of the individuals range from 24 to 70 years, and nearly half were 50 years or more. Young infants (first year) and fetuses are absent, having either been buried separately, or, more likely, had turned to dust, while the older, more substantial bones resisted disintegration. The cemetery was obviously one that served during a limited period as the communal burial place of a sedentary group of moderate population. The determination of the sex was facilitated by the good development of the sexual characteristics in the skulls, and by the presence of the pelvic and other bones of the skeleton. The results

who intended to settle with the Minnisinks, asking permission to that end. Council directed that the Shawanoes must first make peace with the Five Nations.—*Council Minutes*, Sept. 14, 1692."

show that the 34 adults were divided equally between the sexes, as might be expected in the case of the remains of adults in the cemetery of a peaceful population.[1]

Artificial Deformation

A fact of considerable interest is the presence of artificial deformation in more than half of all the skulls preserved. In the majority of cases this appears to be a simple occipital, cradle-board flattening, but there are three or four instances in which there are plain traces of bilateral frontal compression, which indicates intentional deformation and suggests that all the posteriorly flattened skulls may possibly be of this variety, though the applied pressure failed in most cases to leave a distinct mark on the frontal bone.[2] The result of no such practice has been observed in any other part of the northern or middle Atlantic States, but deformation of exactly this type was common in Arkansas and Louisiana, as well as in the area to the northeastward.[3] Among the crania of the earlier and somewhat more easterly Lenape reported by the writer[4] to the number of 25, only two (both females) showed slight occipital flattening. These facts are significant and point either to some difference in derivation between the Munsee and other Lenape and eastern Algonquian tribes, or, if of common derivation, to a connection between the Munsee and some people from the Trans-Appalachian region to the southwestward. It is in this connection that the historic accession to the Munsee of some Shawnee is suggestive, for the latter, or a part of them, lived in Kentucky and Tennessee, where the practice of fronto-occipital deformation was not uncommon, and in some parts of that area, indeed, was quite general.

Pathology

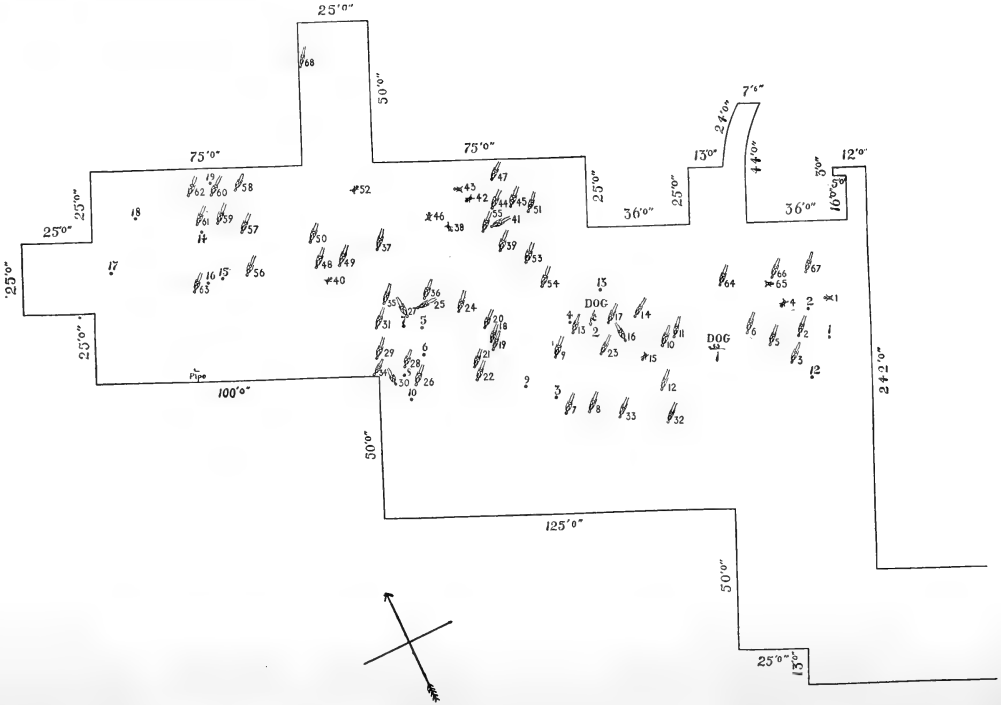
The bones in the collection are exceptionally free from the effects of injury and disease. The skulls exhibit no scars or injuries, and no disease, with the exception of a case of perforating mastoiditis in one of the children (no. 285,348). There is, however, as will be shown later, a considerable proportion of dental caries, with some indications of *pyorrhea alveolaris*.

[1] Had the cemetery, prior to its disturbance, contained the remains of as many as 200 bodies of all ages, including infants, with a yearly mortality in the tribe of 35 per thousand, it could have been in use only about 60 years by a population of 100, and proportionately less, of course, for a larger group.

[2] As happened frequently on the coast of Peru, for instance, where the same type of deformation was practiced. No board was used in these instances, the frontal compression being effected by means of pads.

[3] Report on a Collection of Crania from Arkansas, *Journal of the Academy of Natural Sciences of Phila.*, XIII, 558–563, Phila., 1908; Report on an Additional Collection of Skeletal Remains from Arkansas and Louisiana, ibid., XIV, 1909, pp. 173–210, 9 figs.; Report on Skeletal Remains from a Mound on Haley Place, near Red River, Miller County, Ark., ibid., XIV, 1912, pp. 639–640; Report on a Collection of Crania and Bones from Sorrel Bayou, Iberville Parish, La., ibid., XVI, 1913, pp. 95–100.

[4] *The Crania of Trenton*, op. cit., 1902.



PLAN OF THE MUNSEE BURIAL SITE SHOWING LOCATION AND POSITION OF THE BURIALS

In the remaining bones of the skeletons the only marks of injury or disease are as follow:

Humeri (total number present, adults,[1] 56):

Left bone of no. 285,307: Old surface injury involving lower fourth of external border, with formation of some callus and a peculiar foramen (pl. 23).

Right bone of no. 285,303: Complete ankylosis with ulna, at right angle, possibly as a result of an early fracture of the olecranon (pl. 24).

Both humeri of no. 285,320: Some periostitis on distal third.

Both humeri of no. 285,306: Osteoperiostitis, distal half.

Radii (total number, adults, 45):

Both bones of no. 285,320: Some osteoperiostitis over distal half.

Ulnæ (total number, adults, 44):

Left bone of no. 285,306: Moderate osteoperiostitis, lower bone (right healthy).

Femora (total number, adults, 60):

Pair, no. 285,306: Moderate osteoperiostitis, distal half.

Right bone of no. 285,336: Some osteoperiostitis, distal half (left healthy).

Right bone of no. 285,320: Moderate osteoperiostitis, distal half (left healthy).

Right bone of no. 285,313: Marked "mushroom head" (arthritis deformans); left healthy.

Left bone of no. 285,321: Moderate "mushroom head."

Tibiæ (total number, adults, 58):

Right bone of no. 285,301: Trace of periostitis at middle (left healthy).

Right bone of no. 285,303: Slight osteoperiostitis on external surface, middle third (left healthy).

Right bone of no. 285,306: Osteoperiostitis, proximal half (left healthy).

Left bone of no. 285,313: Moderate localized osteoperiostitis, middle (right healthy).

Right bone of no. 285,336: Moderate osteoperiostitis, middle three-fifths (left healthy).

Left bone of no. 285,309: Trace of periostitis (right healthy).

Pair of no. 285,320: Osteoperiostitis.

Left bone of no. 285,321: Slight arthritis, upper articular surface (right healthy).

Fibulæ (number present, adults, 51):

Pair, no. 285,320: Osteoperiostitis.

[1] The bones of the children show nothing pathological.

Clavicles (present, 44):

Pair, no. 285,305: Moderate osteoperiostitis.

Right, no. 285,320: Osteoperiostitis.

Sternum (present, 14):

Moderate arthritic changes in nos. 285,305, 285,309, and 285,314.

Scapulæ (present, 25): Nothing pathological.

Ribs (present, 420):

No. 285,305: Two long ribs fractured, well healed.

No. 285,309: One long rib fractured.

In addition, most of the ribs of nos. 285,305 and 285,333 show traces of arthritis.

Spine (of 25 individuals, mostly complete):

No. 285,305: Some marginal exostoses (arthritic) in the cervical and lumbar regions.

No. 285,306: Moderate arthritic exostoses, lumbar region.

No. 285,333: Advanced spondylitis deformans, involving parts of dorsal and whole lumbar region with sacrum, synostosis.

No. 285,319: Moderate arthritic exostoses on nearly all.

No. 285,311: Moderate arthritic exostoses.

No. 285,320: Moderate arthritic exostoses.

No. 285,328: Moderate arthritic exostoses in cervical and lumbar regions.

Pelvic bones (of 20 individuals):

No. 285,321, right: Some marks of arthritis about acetabulum.

Bones of the hand (number, 774):

No. 285,303: Carpal bones of right all damaged, crushed, and fused with third metacarpal.

No. 285,320: One of the carpals crushed in life.

Bones of the feet:

Os calcis (number, 61): Nothing pathological.

Astragalus (number, 58): Nothing pathological.

Other bones (number, 537):

No. 285,321: Right scaphoid, arthritis (left healthy).

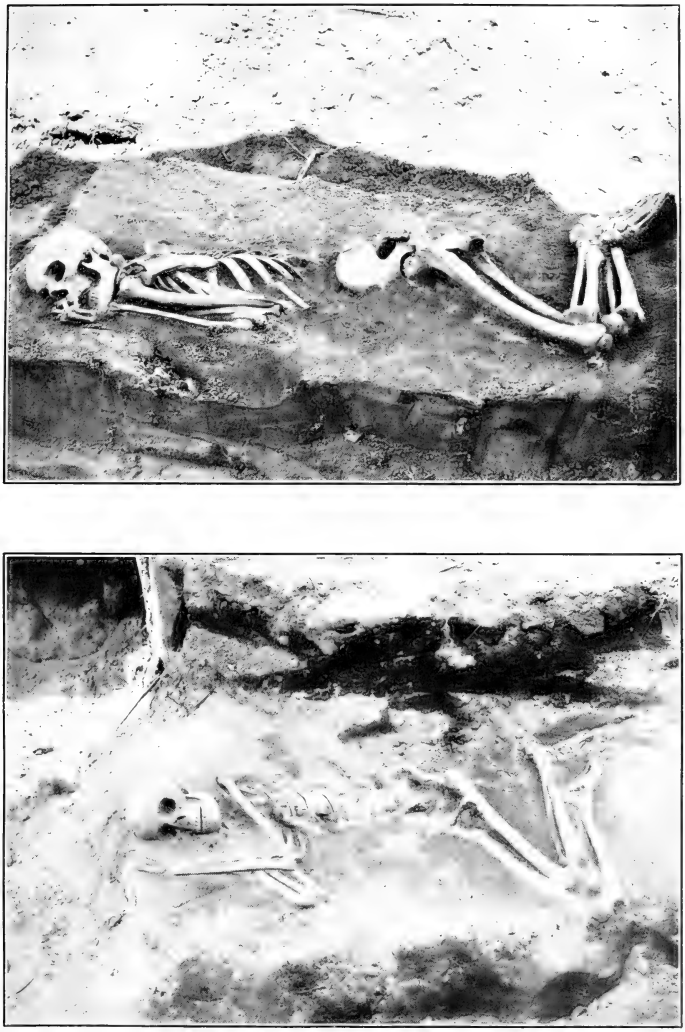
No. 285,326: First right metacarpal diminutive (may have been injured in early life).

Patellæ (number, 38):

Pair of no. 285,329: Slight arthritis.

A summary of the above details shows that there are only six, possibly seven, instances of more noteworthy injury, and of these three pertain to ribs (two in one person) and two to the wrist. These are very moderate proportions of traumatism, and show plainly that the people represented by the remains led unusually peaceful lives.

As to disease, there is evidence of only four conditions, namely: Periostitis, osteoperiostitis, arthritis, and arthritis deformans; and of



TWO TYPICAL MUNSEE BURIALS IN MODERATELY CONTRACTED POSITION

these four the first two and again the last two are closely related, being really only degrees or varieties of the same processes. It is quite possible that all four conditions are merely differing manifestations of arthritis. There is no well-founded suspicion of the existence of syphilis in the tribe, and there is no trace of either rachitis, tuberculosis, or tumors of the bones. (Dental caries will be referred to under Teeth.)

We may now approach the more strictly anthropological observations.

THE CRANIA

General Observations: Differences in Type

Although the remains comprise seventeen adult males and the same number of females, some of the skulls are so defective that measurements and notes of value could be made only on those of ten males and thirteen females.

In examining and arranging these specimens, the first realization of importance is that, while the majority clearly belong to one type, there are a few that must be classed apart. The main type, as will be noted later and more plainly from the measurements, is that characterized by dolichocephaly to mesocephaly, and agrees with that prevalent among other Lenape as well as other Eastern tribes. The additional type is brachycephalic. Among the twenty-five skulls of adults there are four of the brachycephalic type, all females. A few additional examples existed evidently among the children; and several of the remaining skulls may be transitional as a result of admixture. The brachycephaly is so marked that it can not be due to normal individual variation within the series, and if we exclude this possibility the only remaining conclusion is that the broad-heads could not have been Lenape, except by adoption. The individuals represented by these skulls might have come from western Pennsylvania, where brachycephaly seems to have prevailed at least in some districts; or from farther southwestward, from a region to which points the intentional deformation among the "Munsee" crania. These possibly represent the Shawnee, who came from that section and who, according to growing indications, while speaking Algonquian were of a different type physically.

The admixture of this type existed evidently also among other branches of the Lenape, and to a more limited extent among various other tribes of the Atlantic states. The writer called attention to this mixture in 1902,[1] and will return to the subject in the second part of this memoir, which deals with Eastern skulls in general.

[1] *Crania of Trenton*, op. cit.

Chief Descriptive Features

The skulls are of good size, but otherwise are characterized by moderate development. There is no massiveness, no heavy supraorbital arches or crests, no heavy jaws. It is plain that they did not belong to a tribe of great huntsmen or warriors.

The frontal region, though prevalently somewhat low in the females, in a large majority of the cases is well arched; the zygomæ are not excessively broad, the malar bones not heavy. The nose is rather short, the face only mildly prognathic. The dental arches, as in the majority of Indians, are very regular, and the same applies to the medium-sized teeth. The vault of the skull from above is either ovoid (58 per cent) or elliptical (42 per cent), while the outline of the norma posterior approaches more or less the pentagonal.

In addition there may be mentioned an unusual scarcity of Wormian bones and an equal sparsity of marked anomalies. These and other features are treated in detail in another part of this paper. (See pp. 35, 47.)

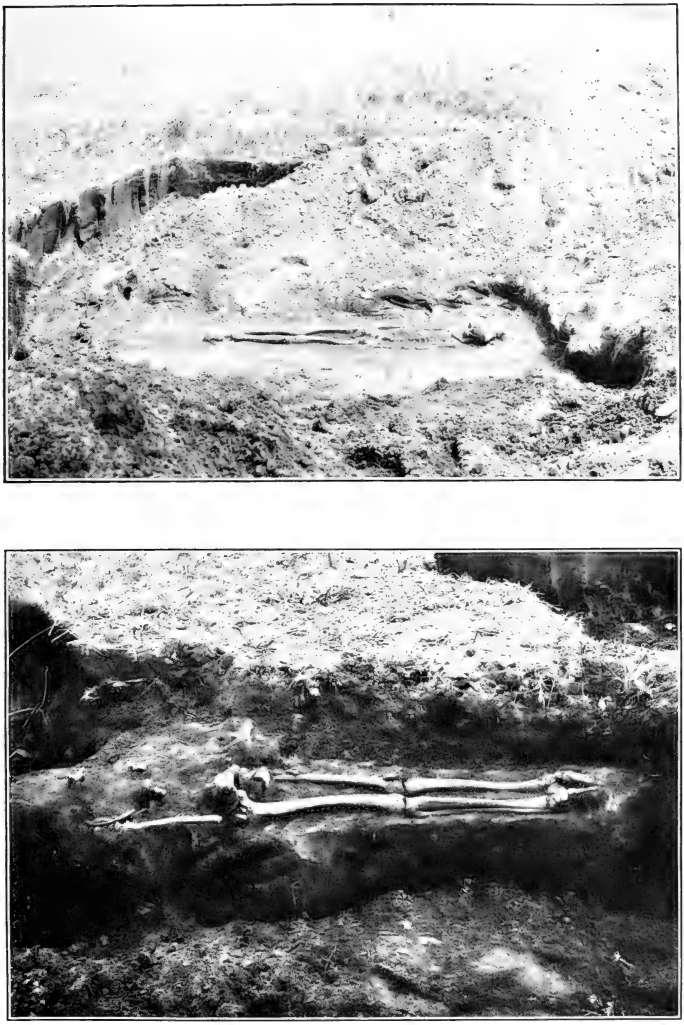
Measurements

The measurements[1] offer many points of interest, although, so far as the vault is concerned, they are considerably interfered with by artificial deformation in some of the specimens. As in certain former reports by the writer, they will be dealt with in order according to their significance.

Form of the Vault

The measurements relating to the form of the vault comprise the maximum length and breadth, and the basion-bregma height, with the resultant percentage-relations or indexes. The details are given in the accompanying table. Although the number of undeformed specimens in good condition is small, it will be seen (*a*) that there is an absence of extremes in the several dimensions, (*b*) that the crania range in type from dolichocephalic to mesocephalic, and (*c*) that they show good height. As a result of the latter, both the height-length and the height-breadth indices are high, though corresponding well with those of many other Indian tribes and those of numerous other branches of the yellow-brown race. Comparisons will be found in the second part of this report, which deals with the Eastern Indians in general.

[1] All measurements presented in this report were taken personally by the writer, with proved instruments and due care. Unless otherwise noted, the methods follow strictly the international agreements of Monaco and Geneva.



TWO BURIALS IN EXTENDED POSITION

The lower burial is of special interest as showing how much of a skeleton may be decayed or scattered without disturbance of the remainder

I. MUNSEE CRANIA: MEASUREMENTS RELATING TO THE FORM OF THE VAULT*

MALES

Cat. No., U.S.N.M.	Deformation	Length, maximum (a)	Breadth, maximum (b)	Height (basion-bregma) (c)	Cephalic index $\frac{b\times100}{a}$	Height-length index $\frac{c\times100}{a}$	Height-breadth index $\frac{c\times100}{b}$
		cm.	*cm.*	*cm.*			
285,303	(Slight asymmetry)	18.9	13.3	14.2	70.4	75.1	106.8
285,308		19.8	14.6	13.8	73.7	69.7	94.5
285,306		18.7	14	14	74.9	74.9	100.0
285,313		18.8	14.4	13.7	76.6	72.9	95.1
285,326	Slight occipital flattening	(17.7)	(13.7)	(14.4)			
285,301	Moderate occipital flattening	(17.8)	(15.1)	(14.6)			
285,305	do	(17.0)	(14.6)	(13.7)			
		(4)	(4)	(4)	(4)	(4)	(4)
	Averages of undeformed	**19.05**	**14.1**	**13.9**	**73.9**	**73.1**	**98.9**

FEMALES

285,309		18.2	13.3	13.1	73.1	72	98.5
285,327		17.6	13.1	12.4	74.4	70.5	94.7
285,307	Trace of fronto-occipital flattening†	16.9	13	12.9	76.9	76.3	99.2
285,320		17.4	13.4	13	77	74.7	97
285,347		18	14	13	77.8	72.2	92.9
285,302	Moderate occipital flattening	(16.0)	(14.1)	(13.2)			
285,304	do	(16.6)	(14.3)	(14.2)			
285,310	do	(16.9)	(14.4)	(14.2)			
285,321	Marked occipital with slight frontal flattening	(16.4)	(14.5)	(14.2)			
		(5)	(5)	(5)	(5)	(5)	(5)
	Averages of undeformed	**17.6**	**13.4**	**12.9**	**75.8**	**73.1**	**96.4**

* Arranged on the basis of the cephalic index.
† Not sufficient to vitiate the measurements.

Attention may be called to the lower value of the average cephalic index and the higher value of the average height-breadth index in the males than in the females. These conditions, due to the relatively greater length and also to the relatively greater height of the male skull, are not exceptional and will later be found to be quite general among Eastern Indians.

The identical value of the average height-length index in the two sexes is of no special significance and is probably incidental.

In the deformed skulls we see the usual effect of the flattening by the lessening of the length and a compensatory increase in both breadth and height.

SIZE OF THE SKULL

The principal determinations relating to the size of the vault are the cranial module or mean diameter, the capacity, the circumference, and the antero-posterior arc, all of which are given in the next table, where also is shown the thickness of the skull, which is of importance as a corrective to the external dimensions.

II. MUNSEE CRANIA: MEASUREMENTS RELATING TO THE SIZE OF THE VAULT*

MALES

Number	Capacity†	Cranial Module $\frac{L+B+H}{3}$	Circumference maximum (above supra-orbital ridges)	Nasion-opisthion arc	Thickness of left parietal (1 cm. above and along squamous suture)
	c. c.	*cm.*	*cm.*	*cm.*	*mm.*
285,326	1,470	15.27	49.3	36.2	4
285,306	1,505	15.57	51.5	36.6	4.5
285,303	1,515	15.47	51.7	38.3	5.5
285,301	1,515	15.83	51	36.9	6.5
285,305	1,530	15.10	49.4	35.2	5.0
285,313	1,550	15.63	51.3	37.1	5.5
285,308	1,720	16.07	55	39.5	4
	(7)	(7)	(7)	(7)	(7)
Averages	**1,544**	**15.56**	**51.3**	**37.1**	**5**

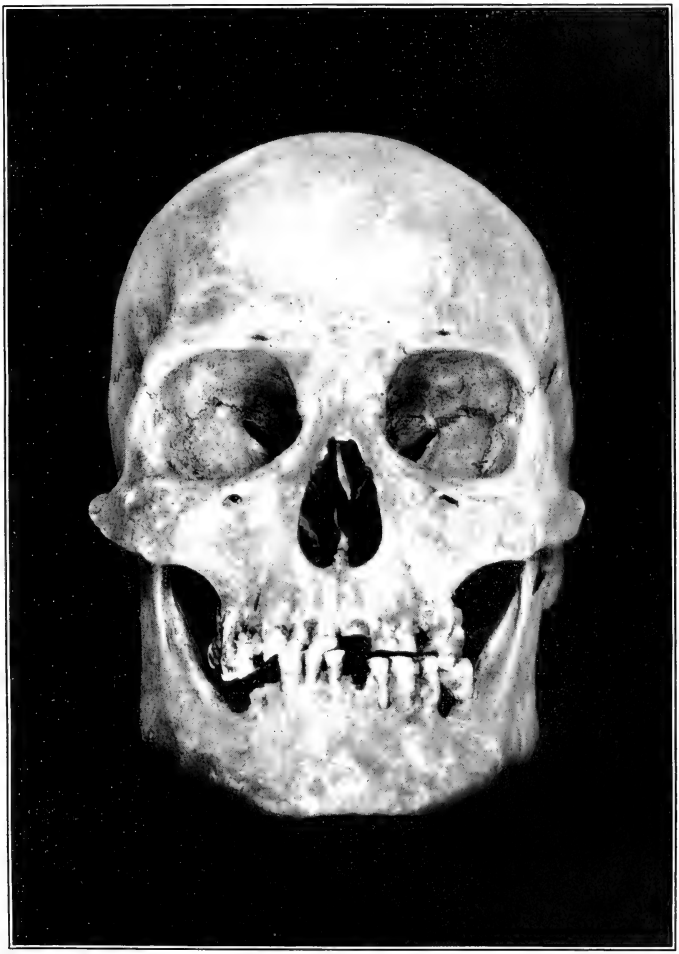
FEMALES

285,327	1,225	14.37	48.5	34.9	3.5
285,307	1,240	14.27	47.6	33.9	3.5
285,347	1,265	15.0	50.2	35.1	5.5
285,320	1,280	14.60	48.2	35.0	4.0
285,304	1,275	15.03	48.7	33.3	5.0
285,302	1,295	14.43	47.9	33.8	4.0
285,309	1,300	14.87	50.1	36.3	4.0
285,321	1,310	15.03	48.7	34.0	5.0
285,310	1,375	15.17	49.3	35.0	5.0
	(9)	(9)	(9)	(9)	(9)
Averages	**1,285**	**14.75**	**48.8**	**34.6**	**4.4**

*Arranged on the basis of capacity.

†Measured with dry mustard-seed and by the writer's method described in *Science*, XVII, 1903, pp. 1011–1014.

It will be noted that the measurements of the Munsee skulls, particularly those of the males, show fair capacity as well as external size of the vault, and also that only a few of the crania are thick-walled. An interesting feature is the unusual superiority of the measurements of the males over those of the females. This in a measure is due to the occurrence among the males of one skull of extraordinary size (1,720 c. c.); but even if we exclude this, the difference between the two sexes is somewhat greater than among other Indians. In the following table are given a few comparative data on this point.



MALE MUNSEE SKULL, NO. 285,303, U.S.N.M. (FRONT VIEW)

III. RELATION OF AVERAGES OF MEASUREMENTS RELATING TO SIZE OF VAULT IN MALES AND FEMALES

(Males=100)

Group	Number of specimens		Capacity	Module	Circumference	Nasion-opisthion arc	Thickness
	Males	Females					
Arkansas*	19	14	86.5	96	96	96.5	92.5
Louisiana*	12	7	89.5	96	97	98	88
Munsee (excepting no. 285,308)	6	9	85.0	95.5	96	94.5	88

* From A. Hrdlička, Report on an Additional Collection of Skeletal Remains from Arkansas and Louisiana, *Jour. Acad. Nat. Sci. Phila.*, XIV, 1909, pp. 171–249.

These data are of interest in a number of additional particulars. In the first place, it is seen that, barring capacity, a striking similarity exists in the relation of female to male measurements in the different groups of Indians. There are reasons to believe that such resemblances are not confined to these tribes alone or even to Indians generally, but extend, with a limited range of variation, to all races.

Another remarkable fact is that the external measurements of the skull, especially the mean diameter or module, and the circumference show practically identical percental relations in the two sexes, averaging each about 96 for the female to 100 for the male; while in capacity the difference is decidedly greater (less than 90 to 100) in favor of the male, notwithstanding the fact that the thickness of the female skulls averages smaller. In other words, a female skull only nine-tenths as thick as that of a male and which gives external measurements that compare with those of the male cranium in a ratio of 96 to 100, will stand in respect to its internal capacity toward the male skull as only 88 or 89 to 100. The cause of this must be attributed to the unequal build, in the two sexes, of those parts of the skull which are not reached by the ordinary external measurements, and the narrower and especially the lower frontal region in the female plays probably a large part in this connection.

RELATION OF SIZE OF SKULL TO STATURE

The size of the head, as is well known, increases with stature. This increase is not uniform, but progresses in a diminishing ratio. The fact holds true in all races, though the exact values of the ratio with the different racial elements have not as yet been determined definitely. In the case of skeletal remains, in which it is not possible to learn the exact stature, the most suitable manner of obtaining light on the subject is to compare the length of the femur with the cranial capacity, by which means we ascertain the number of cubic centimeters of the capacity that correspond to each centimeter of the length of the femur. The following data give the results of such

a comparison among the Munsee and on Indian skeletal remains from Arkansas and Louisiana.[1]

IV. MUNSEE CRANIA: RELATION OF SKULL CAPACITY TO STATURE*

MALES

Number	Bicondylar length of right femur	Skull capacity	Femoro-cranial index (=c.c. of skull capacity per 1.0 cm. of femoral length)
	cm.	*c. c.*	
285,305	43.4	1,530	35.3
285,301	44.2	1,515	34.3
285,308	45.1	1,720	38.1
285,303	45.1	1,515	33.6
285,313	45.3	1,550	34.2
285,326	46.6	1,470	31.5
285,306	48.1	1,505	31.3
	(7)	(7)	(7)
Averages	**(45.4)**	**(1,544)**	**(34.0)**
Exclusive of 285,308	**45.4**	**1,514**	**33.3**

FEMALES

285,302	39.4	1,295	32.8
285,327	40.2	1,225	30.4
285,320	42	1,280	30.5
285,309	42.3	1,300	30.7
285,310	43	1,375	32.0
285,321	43.5	1,310	30.1
285,304	43.8	1,275	29.1
285,307	44.7	1,240	27.7
	(8)	(8)	(8)
Averages	**42.4**	**1,288**	**30.4**

COMPARATIVE DATA

MALES

Arkansas (5)	45.1	1,446	32.1
Louisiana (7)	44.4	1,434	32.3

FEMALES

Louisiana (5)	41.7	1,330	31.9

* Arranged on the basis of stature (i. e., length of femur).

The results presented in the table show considerable individual variation in the femoro-cranial index, by reason of which there is some irregularity of alignment of the cases. This is especially true in regard to the capacity, which in this small series shows little

[1] Published by the writer in his *Report on an Additional Collection*, etc., op. cit., 1909, pp. 179, 188.

MALE MUNSEE SKULL, NO. 285,303, U.S.N.M. (SIDE VIEW)

regularity or evidence of conformity with the aforementioned general rule of increase of the size of the head with stature. The tallest of the eight females had one of the smallest heads, and the man with the largest brain was not even of average height. However, there is no doubt that if the series of skulls was considerably larger, the usual progression, showing gradual increase in the size of the brain with the height of the body, would be apparent.

The femoro-cranial index progresses much more regularly than the capacity, and shows another well-known fact, also common to all human races, namely, that while the absolute size of the brain enlarges in proportion to the stature, its relative dimensions with reference to stature diminish as the latter increases; so that while the tall man or woman may be expected to have an absolutely larger brain than the average of his group, relatively to his stature he will have less brain matter than the short individuals of the same group.

The averages in the preceding table are interesting in another particular—i. e., the difference in the value of the femoro-cranial index in the two sexes. Both the former records of the Louisiana crania and those of the Munsee now presented show these indexes to be perceptibly lower in the females than in the males. The superiority in this respect among the male crania is seen not only in the averages, but practically throughout the records, seven of the eight indexes in the females being below the minimum of the indexes in the males. It seems evident that among the Indians the brain substance in the females is not only absolutely smaller than in the males, but is also somewhat smaller for each centimeter of stature, so that men of the same height as the women would still show an advantage in this particular. This advantage is not necessarily connected with mentality, but may be due to the greater muscularity of the males.

As to the value of the femoro-cranial index in different tribes, we can as yet say nothing positive. The indications are that if differences exist, they are not of a very pronounced character.

SIZE AND SHAPE OF THE FACE

The measurements chosen, as in the writer's work previously cited, are only the most essential. They include the total and upper length of face, and the three breadth measurements—the smallest breadth of the forehead, the greatest facial breadth in the plane of the zygomatic arches, and the breadth at the angles of the lower jaw. As to the total facial length (chin-nasion), wherever the teeth were worn due allowance for the wear was made on the basis of measurements on well-preserved teeth of the same sex and in the same group.

The results, presented in the next table, show that among the Munsee the face was of only fair height and that its other dimensions were rather subdued for Indians.

V. MUNSEE CRANIA: MEASUREMENTS RELATING TO SIZE AND SHAPE OF THE FACE *

MALES

Number	Total length of face (chin-nasion)† (x)	Upper length (pros-thion-nasion) (y)	Breadth of face (diam. bizyg. max.) (z)	Facial index total $\frac{x \times 100}{z}$	Facial index upper $\frac{y \times 100}{z}$	Cephalic index of the skull (for comparison)	Diameter frontal minimum	Diameter bigonial
	cm.	*cm.*	*cm.*				*cm.*	*cm.*
285,303	11.8	6.8	13.7	86.1	49.6	70.4	9.3	11
285,306	12.2	7.0	13.9	87.8	50.4	74.9	9.5	11.9
285,326	12.1	6.9	13.6	89.0	50.7	(‡)	8.7	10.6
285,313	12.0	7.2	14.0	85.7	51.4	76.6	9.0	9.5
285,308	12.6	7.4	14.2	88.7	52.2	73.7	10.1	11.1
285,305	12.1	7.2	13.6	89.0	52.9	(§)	9.6	9.5
285,301	12.3	7.6	14.2	86.6	53.5	(§)	9.5	9.3
Averages	(7) **12.15**	(7) **7.15**	(7) **13.9**	(7) **87.6**	(7) **51.5**	.....	(7) **9.4**	(7) **10.4**

FEMALES

285,310	11.9	7.0	13.6	87.5	51.5	(§)	9.8	10.3
285,327	11.2	6.6	12.4	90.3	53.2	74.4	8.4	8.7
285,302	11.9	7.0	12.8	93.0	54.7	(§)	9.3	9.8
285,307	(?)	6.8	12.4	.....	54.8	76.9	8.5	.....
285,304	11.8	7.3	12.9	91.5	56.5	(§)	9.4	9.6
Averages	(4) **11.7**	(5) **6.9**	(5) **12.8**	(4) **90.5**	(5) **54.1**	.....	**9.1**	**9.6**

* Arranged on the basis of the Upper Facial Index.

† Where teeth were worn off, due allowance was made for the defect, the normal enameled portion of median incisors in apposition being taken as 19 mm. high, in the men.

‡ Slightly deformed.

§ Deformed.

The bizygomatic breadth, though not really small, is below the average in many other tribes of Indians, while the frontal breadth and that of the lower jaw are also somewhat below the medium. These results bear out the statement made under "General Observations" (p. 20) relative to the moderate proportions of the face of the Munsee. Comparative data given in the second part of this report indicate that in some of these respects, especially in the height of the face, the Munsee were somewhat exceptional among the Eastern tribes.

The facial indexes indicate mild chamœprosopy to mild leptoprosopy. Both the total and the upper indexes are perceptibly higher in the females, which on analysis of the measurements is seen to be due to the relatively greater narrowness of the face in the female, which, in turn, is doubtless connected with a relatively smaller development of the temporal muscles, the main muscles of mastication. The same condition was noticeable in the crania from Arkansas and Louisiana previously reported by the writer, and is probably quite general among Indians. Some of the foreheads and some of the lower jaws among the Munsee, as will be seen from the details, were relatively quite narrow.

MALE MUNSEE SKULL, NO. 285,303, U.S.N.M. (VIEW FROM ABOVE), SHOWING TYPICAL FEATURES

ORBITS. NOSE

With respect to the orbits, the writer follows his invariable custom of making measurements on both sides and recording the mean, which, in turn, gives rise to a mean index. This procedure is necessary in view of the fact that in only a minority of cases are the two orbits of equal dimensions and that sometimes they differ considerably.[1]

Among the series of Lenape crania which the writer reported on in 1902,[2] there were several specimens in which the orbits were unusually low. At that time it seemed as if this feature might be almost characteristic of these Indians; but evidently such is not the case, for low orbits are quite rare among the Munsee. As will be seen from the following figures, in only one instance (male, no. 285,313) are the orbits decidedly low and broad, giving the microseme [3] index of *78.1*. Of the remaining cases four males and two females (43 per cent) are mesoseme, while two of the males and five of the females (50 per cent) are megaseme. The extensive fluctuation of the orbital index in both sexes of the Munsee tribe is very striking, but much the same variation was observed in the Arkansas and Louisiana crania previously mentioned, and is present among the Eastern tribes in general.

VI. MUNSEE CRANIA: ORBITS,* NOSE †

MALES

Orbits				Nose			
Number	Mean height (a)	Mean breadth (b)	Mean index $\frac{b \times 100}{a}$	Number	Height	Breadth	Index $\frac{B \times 100}{H}$
	cm.	*cm.*			*cm.*	*cm.*	
285,313	3.2	4.1	78.1	285,303	5.0	2.2	44.0
285,308	3.4	3.95	86.1	285,326	5.0	2.35	47.0
285,303	3.4	3.9	87.2	285,301	5.45	2.6	47.7
285,305	3.6	4.05	87.2	285,305	5.0	2.5	50.0
285,306	3.35	3.75	89.3	285,308	5.3	2.8	52.8
285,326	3.3	3.6	91.7	285,306	5.0	2.9	58
285,301	3.6	3.9	92.9	285,313	5.15	3.0	58.3
	(7)	(7)	(7)	.....	(7)	(7)	(7)
Averages	**3.4**	**3.9**	**87.5**	.....	**5.1**	**2.6**	**51.1**

* Arranged on the basis of the Orbital Index. † Arranged on the basis of the Nasal Index.

[1] It seems advisable to mention at this point the exact method used by the writer in the measurement of the orbits, for there appears to be not a little discrepancy in this respect among different workers. The measurements are those of Broca: The breadth is from dacryon (the point of intersection of the lachrymo-frontal suture and the sharp free orbital border of the lachrymal canal) to the most distal part of the lateral boundary of the orbit, below the malo-frontal suture; while the height is the maximum height, from about the center of the lower border of the orbit. Both dimensions can be taken with fair accuracy by either a graduated rod or by the two sharp points of the *compas glissière*. The main point is that the measurements should not comprise any part of the borders of the orbits, particularly the outer one, which differs considerably in thickness and breadth, and part of which seems not infrequently to be included by those who take these measurements.

[2] *Crania of Trenton*, etc., op. cit.

[3] Broca's classification.

VI. MUNSEE CRANIA: ORBITS, NOSE—Continued

FEMALES

Orbits				Nose			
Number	Mean height (a)	Mean breadth (b)	Mean index $\frac{b \times 100}{a}$	Number	Height	Breadth	Index $\frac{B \times 100}{H}$
	cm.	*cm.*			*cm.*	*cm.*	
285,321	3.3	3.8	86.8	285,304	5.3	2.5	47.7
285,310	3.4	3.85	88.3	285,302	4.9	2.4	49
285,307	3.5	3.85	90.3	285,347	5.0	2.5	50
285,309	3.3	3.65	90.4	285,309	4.9	2.6	53.1
285,327	3.4	3.6	94.4	285,310	5.0	2.7	54
285,304	3.5	3.7	94.6	285,327	4.8	2.6	54.2
285,302	3.55	3.65	97.9	285,320	4.9	2.7	55.1
	.....	.....	.....	285,307	4.8	2.7	56.3
	.....	.....	.....	285,321	5.2	3	57.7
	(7)	(7)	(7)	.....	(9)	(9)	(9)
Averages	**3.4**	**3.72**	**91.7**	.....	**5.0**	**2.65**	**52.9**

The average orbital index in the female Munsee is higher than that in the males, as is generally the case, a fact directly due to the heavier development of the supraorbital region in the males.

The *nose* in many of the individual Munsee, in conformity with the rest of the upper face, was rather short, but occasionally it was quite broad. The indexes, according to Broca's classification, give four instances (25 per cent; 3 m., 1 f.) of leptorhinic, four cases (25 per cent; 2 m., 2 f.) of mesorhinic, and eight cases (50 per cent; 3 m., 5 f.) of moderately platyrhinic nasal aperture, the averages falling both in mesorhiny. The usual accompaniments of platyrhiny in the negro nose, however, are invariably absent, the inferior borders of the aperture being moderately sharp and the bridge showing generally a fair development.

PROGNATHISM

Measurements relating to prognathism include three basal diameters, namely, from basion to prosthion, the subnasal point and nasion; and the subnasal (alveolar) height, with the heights from prosthion and the subnasal point to nasion. These lines connected give us, in skulls in which the facial parts are well preserved, the angle of the face as a whole and also the alveolar angle, which it is important to measure separately.

An extended and meritorious report on the naso-alveolo-basilar angle such as here described was published in 1909 and 1910 by Dr. P. Rivet,[1] who commenced its determination independently by the

[1] *L'Anthropologie*, XX, 1909, pp. 35 et seq., 175 et seq.; 1910, pp. 505, 637.

MALE SKULL, NO. 99-6669, A.M.N.H., FROM MANHATTAN ISLAND
(FRONT VIEW)

VII. MUNSEE CRANIA: PROGNATHISM, FACIAL AND ALVEOLAR*

MALES

Number	Basion-prosthion line (*a*)	Basion subnasal point † (*b*)	Basion-nasion (*c*)	Prosthion-nasion height (*d*)	Prosthion-subnasal point height (*e*)	Facial angle (angle between *a* and *d*)	Alveolar angle (angle between *a* and *e*)
	cm.	*cm.*	*cm.*	*cm.*	*cm.*	°	°
285,306	10.5	9.7	10.4	7	2.1	70	62
285,308	10.2	9.2	10.3	7.4	2.2	70	58
285,301	10	8.8	10.4	7.6	2.3	72	54
285,305	9.4	8.6	10.0	7.2	2.2	74	64
285,326	9.9	8.9	10.3	6.9	2.0	74	56
285,303	9.5	8.7	10.2	6.8	1.9	77	61
	(6)	(6)	(6)	(6)	(6)	(6)	(6)
Averages	**9.9**	**9.0**	**10.3**	**7.15**	**2.1**	**73**	**59**
285,307	10.4	9.2	10.1	6.8	2.1	69	52
285,327	9.4	8.4	9.7	6.6	1.9	74	55
285,302	9.0	8.0	9.6	7.0	2.2	74	58
285,304	10	9.0	10.5	7.3	2.1	74	58
285,310	9.4	8.4	10.2	7	2.1	76	58
	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Averages	**9.6**	**8.6**	10	**6.9**	**2.1**	**74**	**57**

* Arrangement of cases based on Facial Angle.

† The "subnasal point" of the writer is the lowest point on the inferior border of the nasal aperture on the left side: it is the point from which the height of the nose is measured.

same method as that of the present writer and almost simultaneously with him; but no comparisons are as yet available in regard to the alveolar angle. It appears from Rivet's data that among modern white adults the average of the facial angle, as herein defined, ranges in round numbers from 70.5° to 73°;[1] among the negroes, the mean of Rivet's series gives 68.5°; among several groups of American Indians it was 68° to 71.5°. Rivet calculated his indexes mathematically and with the help of an "abaque," while the writer obtained his results by the direct (graphic) method, which, for small series of calculations and used with precision, seems to him preferable, although the results are probably quite comparable. By this method the writer obtained on the Arkansas and Louisiana crania, previously reported, averages ranging for the facial index from 70° to 74° for the males, and 68° to 70° for the females; while the alveolar angle gave the average of 55° to 60° in the males, and 51° to 53° in the females. The Munsee crania give the rather high average of 73° for the males and 74° for the females, with respect to the facial angle, and 59° in the males with 57° in the females for the alveolar angle. These

[1] An exceptional group of Wends reached 76.5°.

figures indicate that both the facial and the alveolar protrusion in the Munsee was exceedingly moderate for a group of Indians, although in a measure the height of the indexes is due to the shortness of the face.

PALATE

It was possible to obtain satisfactory measurements of the palate (or, more strictly speaking, the upper alveolar arch) in 13 instances, which, in view of the usually frequent defects of the arch, is a good proportion of the cases. The measurements and indexes follow Turner's method, which is quite satisfactory.[1] The greatest length recorded by Turner in 20 European male and 8 European female skulls was 6 cm., the smallest 4.7 cm.; the greatest breadth 6.9 cm., the smallest 5.6 cm. The same measurements among the Munsee range, if we take both sexes together, from 5.1 cm. to 6 cm. for length and 5.9 cm. to 7.2 cm. for breadth, showing both dimensions, though more especially the breadth, to be slightly superior in these Indians to what they are in whites. The palatal or "uranic" index averaged, in Turner's whites, 116.2 in the males and 115.6 in the females; in the Munsee the averages are 120.7 for the former and 120.5 for the latter sex, showing the palate in these Indians to be more "brachy-uranic," or relatively broader. The sexual differences in both Turner's and the present series are so small as to be practically negligible. In the different groups of Arkansas and Louisiana crania, reported in 1909 by the writer, the average palatal index ranged from 116 to 122 in the males and from 115 to 122 in the females—conditions very similar to those shown in the present observations.

It may here be pointed out that the whole subject of the dimensions of the palate or aveolar arch in the different races, and especially in the different types of skull, needs investigation. As it is, the variety in the dimensions and shape of these structures, and especially their correlation with the rest of the face and skull, are only imperfectly understood.

[1] Length: "From the alveolar point to a line drawn across the hinder borders of the maxillary bones. Breadth: Maximum external just above the molar teeth."

MALE SKULL, NO. 99-6669, A.M.N.H., FROM MANHATTAN ISLAND (SIDE VIEW)

VIII. MUNSEE CRANIA: PALATE;* LOWER JAW;** FORAMEN MAGNUM

MALES

Palate				Lower jaw						Foramen magnum	
Number	Length	Breadth	Index $\frac{B \times 100}{L}$	Number	Height at symphysis†	Thickness at 2d left molar‡	Diameter bigonial	Minimum breadth of ramus	Angle (mean)§	Number	Mean diameter $\frac{L+B}{2}$
	cm.	*cm.*			*cm.*	*cm.*	*cm.*	*cm.*	°		*cm.*
285,316	5.8	6.7	115.5	285,316	3.4	1.5	.....	3.7	.....	285,301	3.3
285,301	5.8	6.9	119	285,303	3.6	(¶)	11	3	120	285,305	3.3
285,306	5.7	6.8	119.3	285,305	3.6	1.3	9.5	3.5	117	285,303	3.5
285,315	6	7.2	120	285,313	3.6	1.4	9.5	3.6	116	285,306	3.5
285,326	5.5	6.6	120	285,301	3.7	1.3	9.3	3.6	116	285,308	3.6
285,305	5.3	6.4	120.8	285,306	3.8	1.3	9.5	3.5	117	285,326	3.6
285,308	5.7	7.0	122.8	285,326	3.8	1.3	10.6	3.2	116	285,313	3.8
285,303	5.1	6.6	129.4	285,308	3.9	1.6	11.1	3.4	121	.....	.....
.....	.....	.....	.....	285,315	3.9	1.8	10.9	4.0	121	.....	.....
	(8)	(8)	(8)		(9)	(8)	(8)	(9)	(8)		(7)
Averages..	**5.6**	**6.8**	**120.7**	.....	**3.7**	**1.5**	**10.5**	**3.5**	**118**	.....	**3.5**

FEMALES

285,327	5.1	5.9	115.7	285,324	3.2	1.5	9.6	3.3	128	285,309	3.1
285,307	5.6	6.6	117.9	285,307	3.2	1.2	8.7	.....	127	285,327	3.1
285,304	5.2	6.2	119.2	285,310	3.4	1.6	10.3	3.5	131	285,304	3.2
285,302	5.2	6.4	123.1	285,321	3.5	1.65	.....	3.5	.....	285,310	3.2
285,310	5.2	6.6	126.9	285,347	3.5	1.6	.....	3.4	128	285,302	3.3
.....	.....	.....	.....	285,302	3.7	1.5	9.8	2.8	140	285,320	3.3
.....	.....	.....	.....	285,320	.....	.....	.....	3.1	123	285,347	3.3
.....	.....	.....	.....	285,309	.....	.....	.....	.....	130	285,307	3.4
	(5)	(5)	(5)		(6)	(6)	(4)	(6)	(7)		(8)
Averages..	**5.25**	**6.35**	**120.5**	.....	**3.4**	**1.5**	**9.6**	**3.2**	**130**	.....	**3.2**

* Arranged on the basis of the Palatal Index.

** Arranged on the basis of the height at symphysis.

† The vertical height in median line.

‡ Measured with the *compas glissière* in such manner that the center of the second molar or of its aveolus corresponds to the middle of the rod of the compass between the two branches which are applied to the ramus.

§ Measured with Broca's goniometer.

¶ Moderate.

FORAMEN MAGNUM

In respect to the foramen magnum, there is so much irregularity and so little special significance in the ratio between the two main diameters, length and breadth, that the writer prefers to use the mean measurement, $\left(\frac{l+br}{2}\right)$, which stands in some relation to stature and probably to muscular development, and which may have more than passing interest in the study of racial and other groups. The average in the Munsee is, as usual, perceptibly higher in the males

than in the females. It is almost identical in both sexes with that of the Indian skeletal remains from the Louisiana mounds (Munsee, 7 males, 3.5; 8 females, 3.2: Louisiana, 10 males, 3.45; 14 females, 3.18 cm.), which were nearly alike in stature, but it is slightly superior to that of the Indians from Arkansas, who were also of practically the same height (Arkansas, 22 males, 3.3; 16 females, 3.14 cm.).

LOWER JAW

The measurements of the lower jaw show only moderate dimensions throughout. The angle (mean of the two sides, which usually differ somewhat in this respect) averages decidedly higher in the females (130°), which is not always the case in American crania. Thus among the Arkansas and Louisiana mound crania it averaged 118.5° in the males, or practically the same as in the Munsee; while it was only 122° in the females, or eight points lower than in the Munsee of the same sex.

Detailed Observations on the Crania

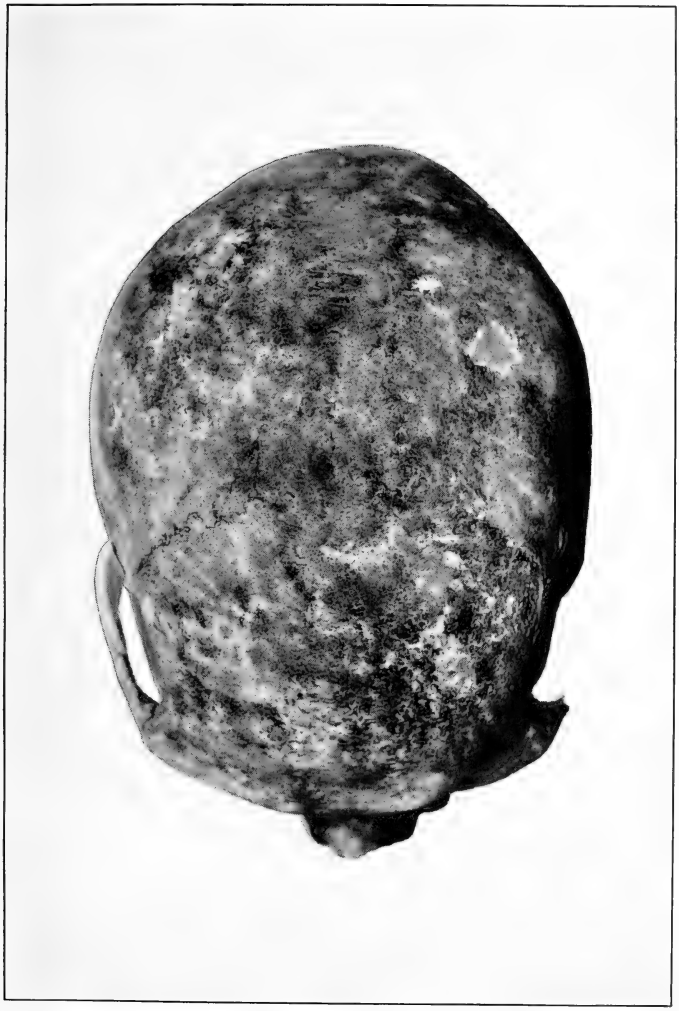
In visual examination of a series of crania or other bones of more than passing importance, general impressions are not sufficiently accurate or reliable; consequently, the writer habitually makes detailed notes of the principal features of each specimen in accordance with a definite though simple scheme. Such notes can be tabulated and analyzed almost as readily as measurements.

In choosing the points for observation, the only rule that can be formulated is to include everything of consequence, and to cover the whole specimen, which is not so easily accomplished as at first might seem. Some of the points touched upon in such a procedure will, of course, be of much less weight than others, but they serve to complete the picture and will doubtless be of some interest and value in future comparisons; while purely individual characteristics that might be included by some authors may be passed entirely.

The results of the detailed examination of the Munsee crania are as follow:

THE VAULT: FOREHEAD

The conditions found in respect to the frontal region will be clearly seen from the accompanying table. As general among Indians, this region in the Munsee skulls shows high development only in exceptional cases. In the males there is frequently more or less of a slope; in the females, where slope is rare, low foreheads prevail.



MALE SKULL, NO. 99-6669, A.M.N.H., FROM MANHATTAN ISLAND (VIEW FROM ABOVE), SHOWING LONG OVOID OUTLINE

IX. MUNSEE CRANIA: FRONTAL REGION

	9 males		11 females	
	Cases	Per cent	Cases	Per cent
Exceptionally good development			1	9
Medium	5	56	4	36
Low	1	11	5	45
Slight to moderately sloping	3	33	1	9

SAGITTAL REGION

The vault of the skull among Indians is frequently more or less arched or keeled, indicating strong development of the temporal muscles. This characteristic is of course much more frequent and pronounced in the males than in the females. The Munsee, it will be seen, show no exception in this respect. The elevation of the sagittal region is present in nearly all the males, although it is seldom pronounced. Among the females nearly half are without sagittal elevation, while in the remainder this feature is only slightly developed.

X. MUNSEE CRANIA: SAGITTAL REGION

	9 males		12 females	
	Cases	Per cent	Cases	Per cent
Oval or nearly so	1	11	5	42
Slightly elevated or keeled	4	44	5	42
Moderately keeled	2	22	1	8
Markedly keeled	2	22	1	8

TEMPORO-PARIETAL REGION

The temporo-parietal region differs in convexity with the type of the skull, being usually quite flat in pronounced dilochocephaly and decidedly convex in marked brachycephaly. Besides this, it is also subject to individual and groupal variations. In the series at hand, in two-thirds of both the male and the female skulls the region is of about medium convexity. Among the remainder of the specimens it is rather interesting to note that while in a third of the cases in the males the region is flat and in no case bulging, these conditions are practically reversed in the females. The temporo-parietal region of the brain tended evidently to a greater relative development in the females of this series than in the males.

XI. MUNSEE CRANIA: TEMPORO-PARIETAL REGION

	9 males		12 females	
	Cases	Per cent	Cases	Per cent
Bulging			3	25
Medium convexity	6	67	8	67
Rather flat	3	33	1	8

OCCIPUT

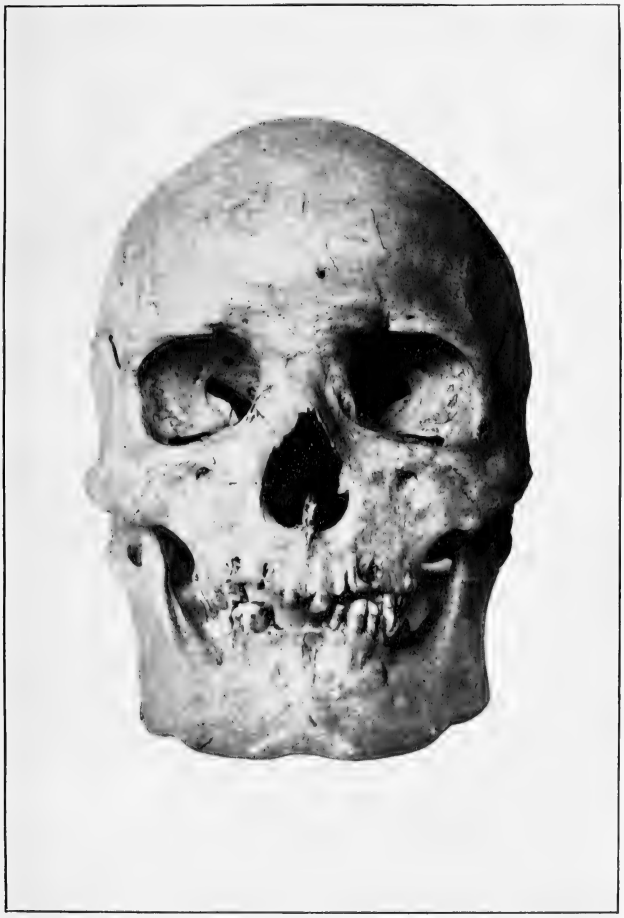
When we eliminate all the cases that show any trace of artificial flattening of the back of the skull, there remain only a few specimens for observation. Among these, three-fourths show medium convexity of the occiput, while in one-fourth the region is protruding. There is no difference in this respect in the two sexes. The external occipital protuberance and the occipital ridges do not show especially strong development in any case, and barring a single instance of the occurrence of an Inca bone, which will be spoken of in another connection, there are no anomalies of this region to be recorded.

XII. MUNSEE CRANIA: OCCIPUT (IN THE UNDEFORMED)

	4 males		4 females	
	Cases	Per cent	Cases	Per cent
Medium prominence	3	75	3	75
Protruding	1	25	1	25
Slightly asymmetric	1	(25)	1	(25)

SUTURES: SERRATION

The serration of the cranial sutures is of interest for the reason that in the skulls of whites and in superior skulls generally the knitting is often, though not invariably, quite complex, while in the majority of the skulls among the retarded races it is more or less simple and may occasionally be nearly absent. For the sake of simplicity in recording the nature of the sutures the writer refers to the serration as "medium," or about as it averages in whites; "submedium," which is self-explanatory; and "poor," or such as approaches a simple wavy line. Among the Indians the sutures range mostly from submedium to more simple, and the Munsee skulls form no exception. As seen from the actual data not one case reaches the standard of medium complexity in all the sutures, while in a large proportion of the specimens the serration of most, if not all, is decidedly inferior. No special difference exists in this respect between the skulls of different sizes.



MALE MUNSEE SKULL, NO. 285,308, U.S.N.M. (FRONT VIEW)

XIII. MUNSEE CRANIA: SERRATION OF SUTURES

	7 males		11 females	
	Cases	Per cent	Cases	Per cent
Medium (about as average in whites)				
All sutures of the vault submedium	2	29	5	45
All poor	2	29	5	45
Coronal and lambdoid submedium, sagittal medium	2	29	1	9
Coronal quite simple, sagittal and lambdoid nearly medium	1	14		

OCCLUSION OF SUTURES

In none of the specimens at hand can be detected any premature occlusion, though in this respect it is impossible to be certain as to the temporo-occipital articulations. Unfortunately, there is no possibility of giving the exact relation of age to the occlusion in any of the sutures; all that it is possible to determine is their relative involvement. The order among the males is S–C–TO–L;[1] that in the females, TO–S–C–L. It is plain that occlusions in the coronal and temporo-occipital sutures are almost as early and frequent as those in the sagittal, while those in the lambdoid are decidedly later. As to locality, the coronal suture occludes first below the temporal ridges; in the sagittal the commencement is most frequent, as usual, about obelion; in the lambdoid it is irregular; while in the temporo-occipitals in the Munsee it advances generally from the anterior or basal extremity of these sutures backward and upward.

XIV. MUNSEE CRANIA: OCCLUSION OF SUTURES (EXTERNALLY, ALL GRADES)

	9 males		12 females	
	Cases	Per cent of skulls	Cases	Per cent of skulls
Coronal	6	67	4	33
Sagittal	7	78	4	33
Lambdoid	2	22	2	17
Temporo-occipital	5	56	5	42

WORMIAN BONES

The frequency of Wormian bones in any given series of skulls, while a factor of no great importance, is always of some interest. It is certain that in this respect there is a wide difference even in different groups of the same people, such as the Indians. Among the Munsee, as already mentioned, we find a remarkable scarcity of these ossicles, especially in the males. Not only are the Wormian

[1] *S*=sagittal; *C*=coronal; *TO*=temporo-occipital; *L*=lambdoid.

bones scarce in this series, but they are also invariably small. This scarcity may in all probability be regarded as a sign of the absence of all disturbances, developmental as well as pathological.

XV. MUNSEE CRANIA: WORMIAN BONES; BREGMA AND "INCA" BONES

Total number present	8 males		12 females		According to sutures	8 males		12 females	
	Cases	Per cent	Cases	Per cent		Cases	Per cent	Cases	Per cent
None	3	38	4	33	Coronal	1	12		
One	3	38	1	8	Sagittal				
Two	1	12	1	8	Lambdoid	4	50	6	50
More than two			5	42	Temporo-occipital			6	50
Inca bone			1	8	Temporo-parietal (squamo-mastoid angle).	2	25	2	17
Bregma (fontanel) bone.	1	12							

BREGMA AND INCA BONES

Among the 20 crania in which conditions with respect to these facts could be ascertained, there was found one bregma or fontanel bone (3x3.1 cm.), and one of the so-called Inca[1] bones (diameter, 8.3x3.5 cm.). There is nothing especially noteworthy in these occurrences, both of which, particularly the Inca bone, are of the nature of developmental anomalies.

Pterions.—Among the 19 Munsee skulls in which the pterions could be determined there was no case of temporo-frontal contact. In all instances the pterion was of the H type, predominantly narrow in the males and predominantly medium to broad in the females.

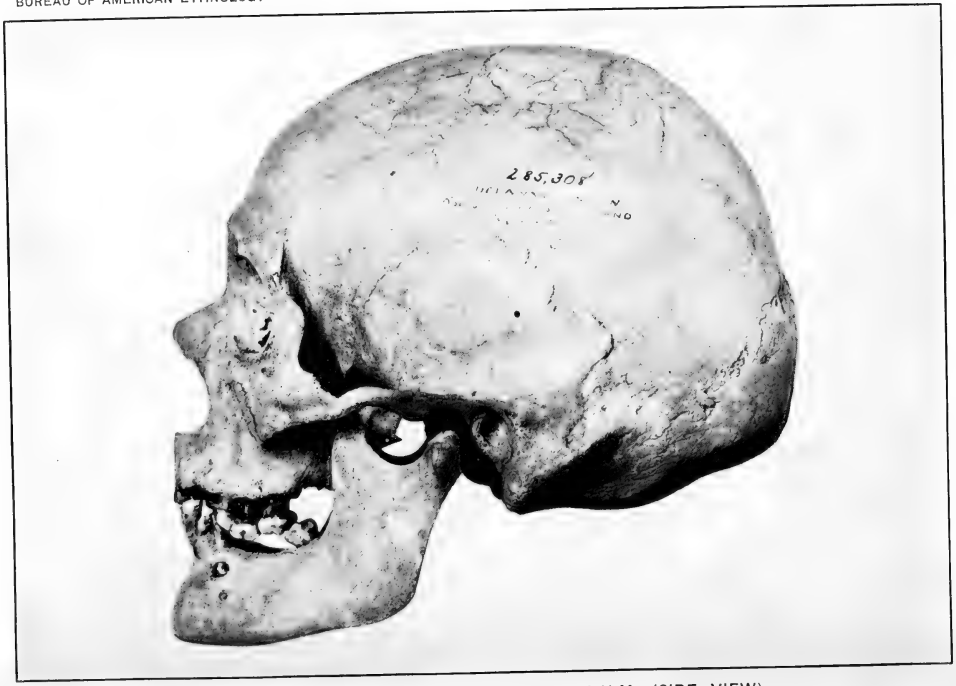
XVI. MUNSEE CRANIA: PTERIONS

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Temporo-frontal contact				
H type, narrow	4	57	1	8
H type, medium	3	43	6	50
H type, broad			5	42

PARIETAL FORAMINA

These are represented quite poorly. In almost half the skulls there are no parietal foramina at all, while in most of the remainder they range from very minute to medium size, of which latter there

[1] The term is used merely for convenience.



MALE MUNSEE SKULL, NO. 285,308, U.S.N.M. (SIDE VIEW)

is a single instance, and in only one case are there two canals of medium size. The exact significance of this showing is not clearly understood. When present these canals transmit, as is well known, a small arteriole and an emissary vein which connects the venous systems within and without the wall of the skull.

XVII. MUNSEE CRANIA: PARIETAL FORAMINA

	9 males		12 females	
	Cases	Per cent	Cases	Per cent
None	3	33	6	50
1 or 2 minute	3	33	1	8
1 medium	2	22	4	33
2 medium	1	11		
1 medium on right, 2 minute on left			1	8

RETROMASTOID FORAMINA

The retromastoid ("mastoid") foramina are most often two in number—a larger and a smaller—one of which transmits a vein from the transverse sinus within to the cutaneous occipital vein on the outside of the skull wall, and the other a smaller branch of the occipital artery. Like the parietal foramina, they show considerable individual and groupal variation in both number and size. It is not uncommon in some Indian crania to find one of these canals to be of very appreciable diameter (up to 4 mm.). While in the Munsee skulls they appear almost generally two on each side, they are in no instance above moderate size, and in several cases are quite minute. Thus in these specimens the retromastoid foramina stand in harmonious rather than compensatory relation with the small or even absent parietal foramina.

XVIII. MUNSEE CRANIA: RETROMASTOID FORAMINA

	8 males		12 females	
	Cases	Per cent	Cases	Per cent
2, moderate size, each side	7	88	5	42
2, small to minute, each side	1	12	4	33
1, moderate size, each side			1	8
2, small to minute, each side	1	12	4	33
2, medium, right side; 2 small, left side			1	8

MASTOIDS

The mastoid processes are mainly of importance as sexual characteristics. Their value in this respect, however, differs considerably

from racial group to group, and even within a single stem of people, such as the Indians. On the whole, however, it may be said that in the Indian female the mastoid is somewhat more developed than it is in the average white woman. Occasionally it is considerably more developed, reaching the subaverage or even the average dimensions of that of the males in the same tribe. The grade of development of the process is of course related to the strength and activity of the sterno-cleido-mastoid muscle, to which it gives attachment. Among the Munsee the size of the mastoids on the whole is only moderate; yet even in this series they rise in one of the female skulls to male-like proportions.

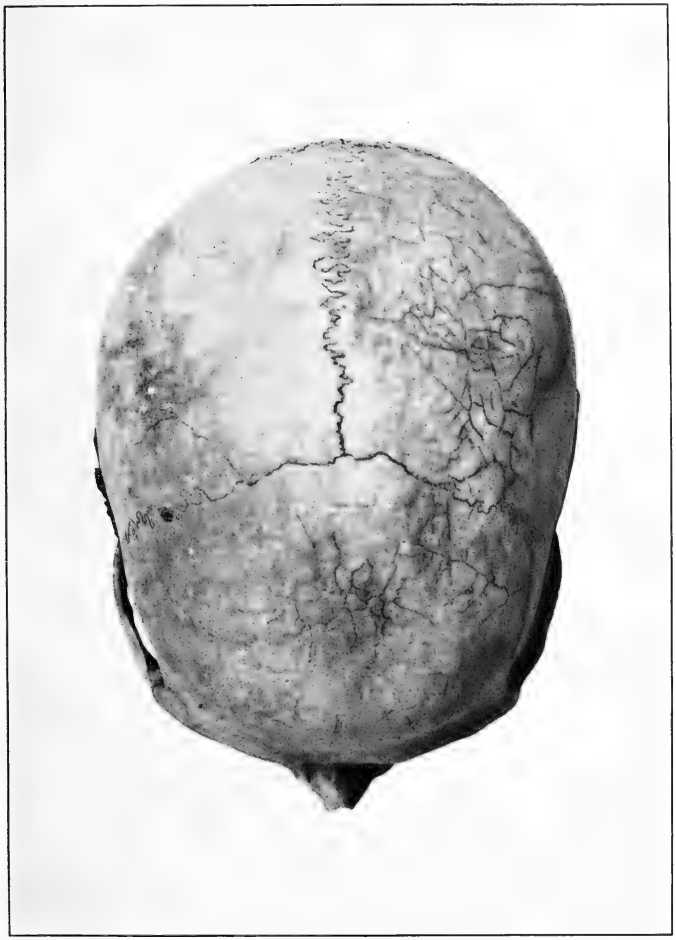
XIX. MUNSEE CRANIA: MASTOIDS

	10 males		12 females	
	Cases	Per cent	Cases	Per cent
Large (masculine)	1	10		
Medium (masculine)	6	60	1	8
Submedium (feminine)	3	30	11	92

In one of the females (no. 285,309) the apex of the left mastoid is bifid. Well developed cases of this anomaly are rare; there are only three or four other Indian crania in the large collections of the United States National Museum in which it is well represented. In another female specimen (no. 285,304) the right mastoid shows a peculiar, marked indentation in the middle of its dorsal surface, with a groove extending therefrom upward and backward and downward and backward.

SUPRAORBITAL RIDGES

These ridges, as is well known, are sexual characteristics in the main; phylogenetically they are the remains of the pronounced supraorbital arches of man's anthropoid ancestors and of early man. Like the mastoids they show also considerable individual variation in each sex among the Indians, owing to which they occasionally fail to afford aid in the determination of the sex of the specimen. As a rule they are limited in Indians to the median half to two-thirds of the supraorbital space. In the Munsee skulls at hand they are markedly developed in only one of the males; in two of the male skulls they are small, feminine like, while in two of the female skulls they are so developed as to approximate the supraorbital ridges of the average male.



MALE MUNSEE SKULL, NO. 285,308, U.S.N.M. (VIEW FROM ABOVE)

XX. MUNSEE CRANIA: SUPRAORBITAL RIDGES

	8 males		12 females	
	Cases	Per cent	Cases	Per cent
Pronounced (masculine)	1	12		
Medium (masculine)	5	63	2	17
Small (feminine)	2	25	8	67
Very small			2	17

NASION DEPRESSION

The depression at the ridge of the nose is generally well marked in male Indian crania, but is mostly shallow in the female specimens. The depression is never narrow, like a deep line, as in some of the negroes; and in the females it is usually quite wide from above downward. The skulls of the series under consideration show nothing very exceptional in this respect.

XXI. MUNSEE CRANIA: NASION DEPRESSION

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Pronounced	1	14		
Medium	5	71	2	17
Shallow	1	14	5	42
None or scarcely any			5	42

NASAL BRIDGE

The development of the nasal bridge differs among the Indians more or less from tribe to tribe, hence it would be erroneous to assume that all Indians, or even a majority in some of the tribes, had high noses. On the other hand, the nasal bridge is never flat and short as in the negro. In the females, as among the whites, the bridge is generally lower than in the males. The observations on the Munsee, among 17 cases in which the bridge is preserved, show 10 of medium height and 7 submedium to low.

XXII. MUNSEE CRANIA: NASAL BRIDGE

	7 males		10 females	
	Cases	Per cent	Cases	Per cent
Medium height	6	86	4	40
Submedium height	1	14	2	20
Low			4	40

NASAL BONES

The chief feature of the nasal bones to which the student usually directs attention is their breadth. There is on this continent a frequency of especially narrow nasals among the Eskimo. Among the Indians, narrow nasal bones occur only exceptionally; more commonly they are rather broad, though the breadth is not excessive. In the present series we find them fairly broad in all the males and in two of the females; narrow (not excessively) in only two of the females.

XXIII. MUNSEE CRANIA: NASAL BONES

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Broad	7	100	2	17
Medium			8	67
Narrow			2	17

NASAL APERTURE

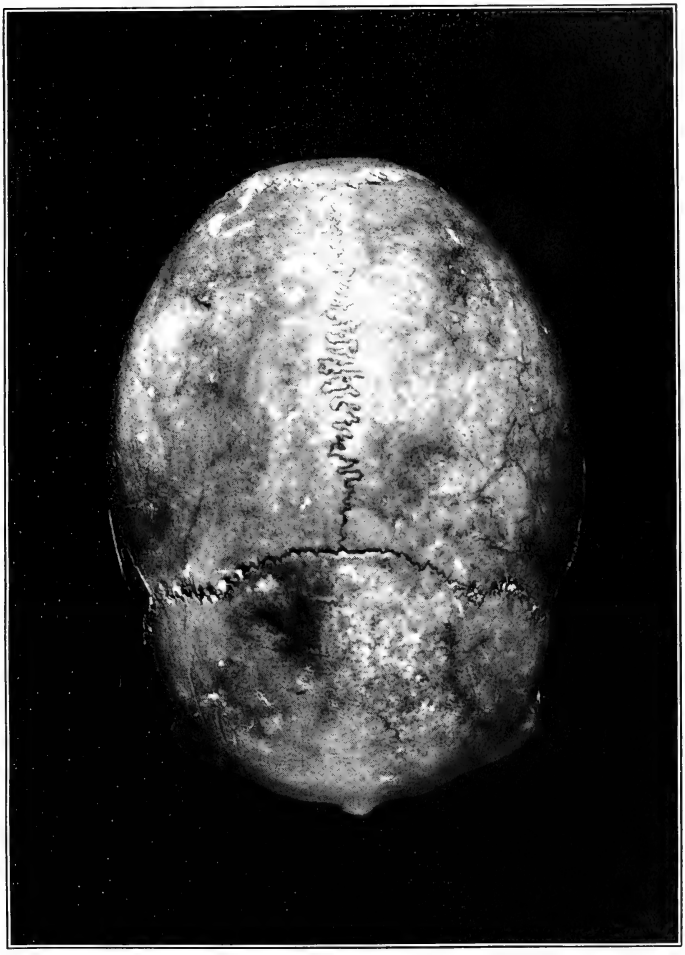
The features of chief interest with respect to the nasal aperture are the fulness or sharpness of the inferior borders, the presence or absence of subnasal fossæ or simian gutters, and pronounced asymmetry. Among the 19 Munsee skulls in which these features can be studied, there are only one instance of moderate grooves and three cases of moderate asymmetry. The lower borders are fairly sharp, more so than the average in many other Indians.

XXIV. MUNSEE CRANIA: LOWER BORDERS OF NASAL APERTURE

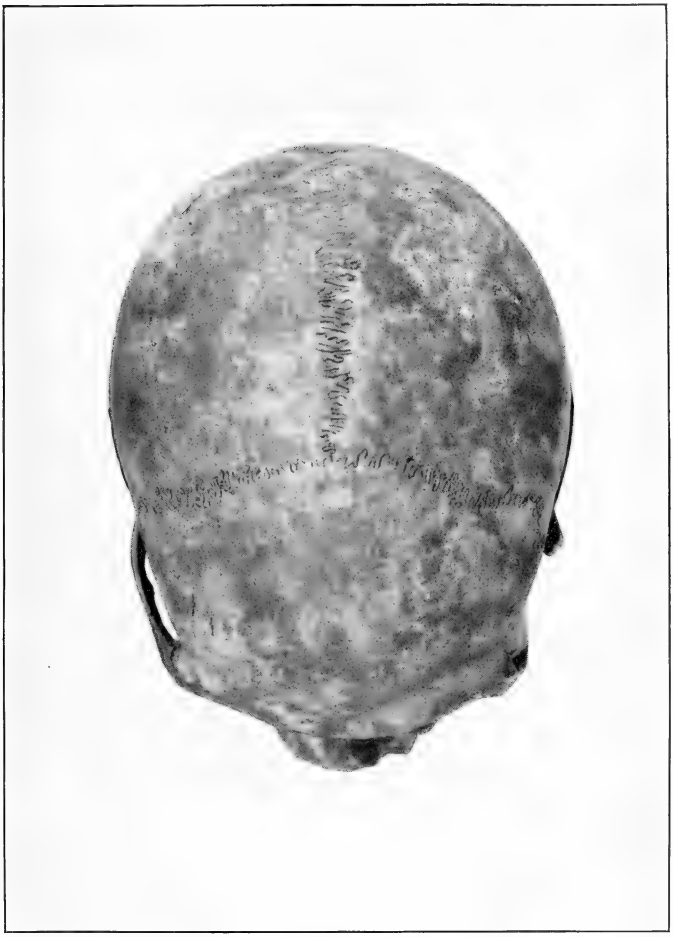
	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Normal, fairly sharp	4	57	11	92
Dull				
Asymmetric	2	29	1	8
Simian grooves	1	14		

NASAL SPINE

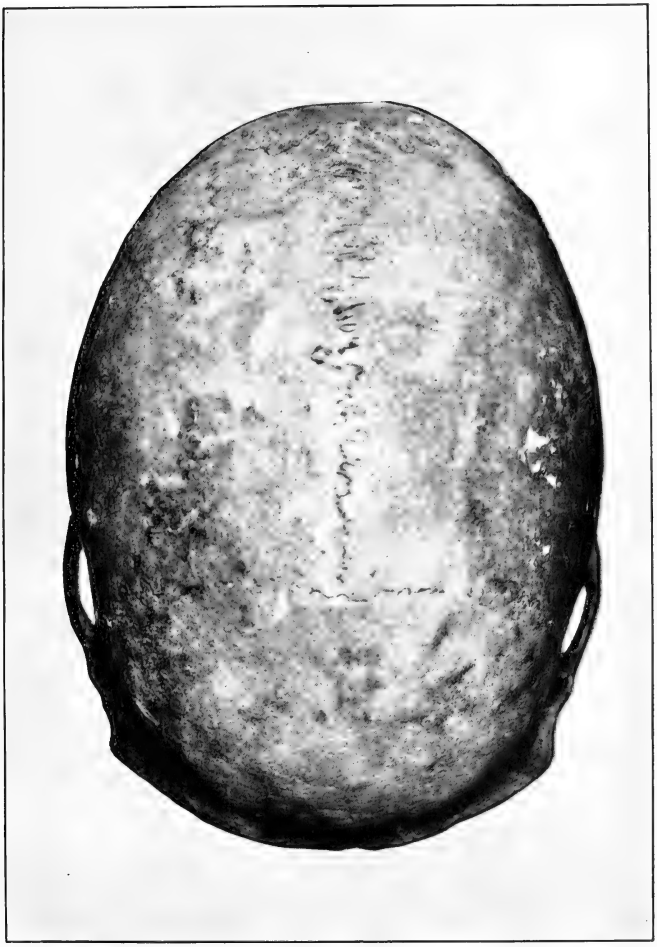
On the whole the nasal spine reaches its most pronounced development, especially in height, in the modern whites. It is rudimentary or absent in the anthropoid apes, and seldom reaches marked development in the yellow-brown and black races. Among Indians it ranges from rudimentary or very low to fairly well developed. In the Munsee, as shown by the accompanying figures, it was mostly very low to submedium.



UNDEFORMED TYPICAL FEMALE MUNSEE SKULL, NO. 285,309, U.S.N.M.
(VIEW FROM ABOVE)



MALE MUNSEE SKULL, NO. 285,306, U.S.N.M., SHOWING FINE OVOID OUTLINE



LARGE MALE SKULL, NO. 2010-4423, A.M.N.H., FROM MANHATTAN ISLAND, SHOWING FINE ELLIPTICAL OUTLINE

XXV. MUNSEE CRANIA: NASAL SPINE

	7 males		11 females	
	Cases	Per cent	Cases	Per cent
About as average in whites	1	14	3	27
Submedium	4	57	6	55
Very low	2	29	2	18

ORBITS

In the majority of skulls under consideration, the orbits offer nothing special morphologically; in a number of instances, however, there is an exceptional conformation, the details of which are shown in the table which follows. The data accentuate the fact, already shown by the measurements, of the considerable range of fluctuation in these features, which, however, seems in this case to have little if any anthropological significance, although it may be due in part to admixture with other people.

XXVI. MUNSEE CRANIA: ORBITS

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
No special features	3	43	8	67
Lateral axis of each nearly horizontal	1	14		
Lateral axis of each decidedly oblique	1	14		
Strikingly large			1	8
Strikingly small	1	14		
Exceptionally high			2	17
Exceptionally low	1	14		
Right lower and more oblique than left			1	8

SUBORBITAL FOSSÆ

These depressions in the upper maxillæ, which, strictly speaking, have only indirect relation to the canine teeth and do not deserve the old name of "canine fossæ," are generally less well marked or hollowed out in the Indian than in whites, although there is considerable individual variation. In the Munsee, in more than half the skulls, they are shallow to very shallow.

XXVII. MUNSEE CRANIA: SUBORBITAL (CANINE) FOSSÆ

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Deeply hollowed				
Medium	3	43	6	50
Shallow	3	43	6	50
Only a trace of depression	1	14		

These fossæ are of evolutionary significance. In the anthropoid apes they are either entirely wanting or very nearly so, the region being in fact often moderately convex; and the same is true, so far as the evidence is available, of early man to the latter part of the Neanderthal period.

MALAR BONES. ZYGOMÆ

The malars among the Munsee are of moderate development throughout, and none of the bones shows any complete or even appreciable partial division or other anomaly. The zygomatic processes are rather submedium in strength as compared with those of other Indians, particularly in the males.

In one of the male skulls (no. 285,313) the right zygoma is represented only by a pointed but otherwise unaltered base, the rest of the bone, up to the malar suture, being absent. In all probability this condition is the result of an old fracture, after which the larger part of the zygoma was lost or remained separated.

XXVIII. MUNSEE CRANIA: THE MALARS; ZYGOMÆ

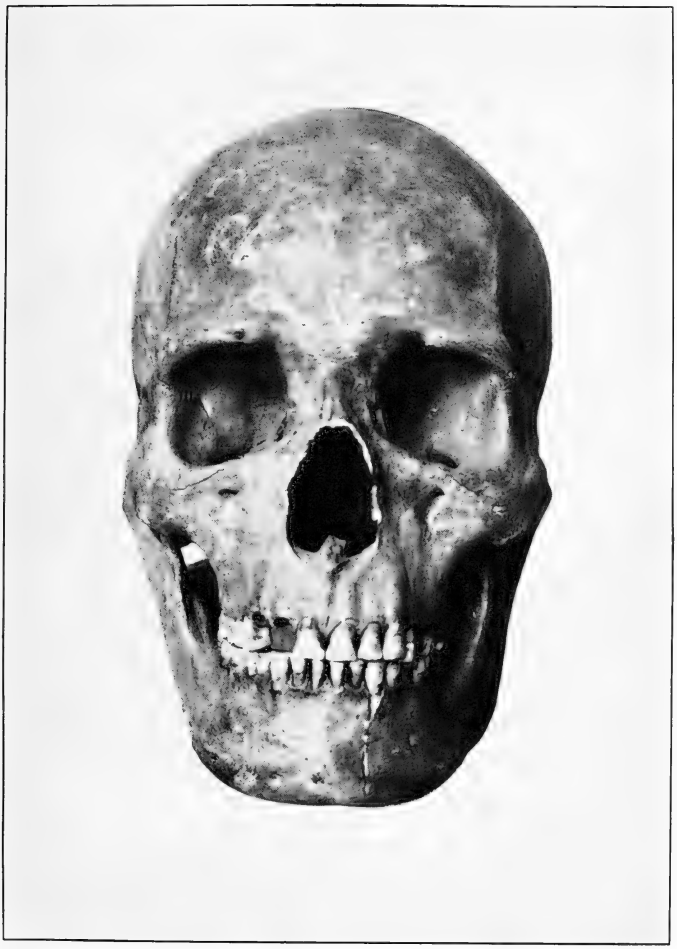
MALARS	9 males		11 females		ZYGOMÆ	7 males		11 females	
	Cases	Per cent	Cases	Per cent		Cases	Per cent	Cases	Per cent
Heavy or protruding.					Very broad				
Medium development.	9	100	10	91	Medium	3	43	10	91
Submedium development.			1	9	Submedium (for the sex and race).	4	57	1	9

UPPER ALVEOLAR ARCH

The main feature for observation of the upper dental arch is its slant or prognathism, and conditions in this respect have already been shown in the main by the measurements. The inspection confirms the fact that in three of the female skulls the arch must be described as markedly slanting. In two cases, in both of which the vault of the skull is artificially deformed, the arch is asymmetric; in one of these, however, the asymmetry is evidently due to early loss of some of the teeth. In no case is there any special massiveness of the arch.

XXIX. MUNSEE CRANIA: UPPER ALVEOLAR ARCH

	8 males		11 females	
	Cases	Per cent	Cases	Per cent
Medium slant	8	100	8	73
Marked slant			3	27
Asymmetric	1	(12)	1	(9)



ADULT MALE SKULL FROM MANHATTAN ISLAND, NO. 99-6667, A.M.N.H., SHOWING AN EXCEPTIONALLY HIGH AND NARROW FACE

LOWER JAW

In 17 of the 20 Munsee skulls in which the lower jaw is present, the latter is of ordinary (Indian) dimensions and form; in one male and in one female it shows strong development. In a single instance only is the chin square; in the others it is moderately rounded. The prominence of the chin in all cases may be described as approximately medium.

XXX. MUNSEE CRANIA: LOWER JAW

	9 males		11 females	
	Cases	Per cent	Cases	Per cent
Ordinary Indian form and moderate development	7	78	10	91
Square chin	1	11	.....	.....
Jaw very strong	1	11	1	9

PALATE

The shape of the palate is determined by that of the upper dental arch. Of the skulls at hand, in 11 of the 22 cases the outlines of both the arch and the palate are elliptic, in 7 ovoid, and in 4 parabolic. The tendency toward the parabolic form is more marked in the females than in the males. The height of the palate shows nothing exceptional, and there is no torus worthy of notice.

XXXI. MUNSEE CRANIA: PALATE

	10 males		12 females	
	Cases	Per cent	Cases	Per cent
Ovoid	3	30	4	33
Elliptic	6	60	5	42
Parabolic	1	10	3	25
Torus	.....	.....	.....	.....

BASE OF THE SKULL

Glenoid fossæ.—In general the glenoid fossæ of the Indian skulls resemble those among the whites, but there is considerable individual variation, particularly in spaciousness of the hollows. Among the 22 Munsee crania, in 14 the fossæ are of ordinary form and of about medium dimensions; in one they are narrow antero-posteriorly, in 4 wide; in 1 case their axis is decidedly oblique, and in 2 the fossæ differ in depth on the two sides. The wide fossæ are more frequent in the females.

XXXII. MUNSEE CRANIA: GLENOID FOSSÆ

	10 males		12 females	
	Cases	Per cent	Cases	Per cent
Ordinary form and dimensions	8	80	6	50
Narrow (antero-posteriorly)	1	10		
Wide (antero-posteriorly)	1	10	3	25
Decidedly oblique (laterally)			1	8
Left shallow, right medium			2	17

Floor of auditory meatus.—Among the Indians, and particularly in the young, there are frequently found more or less pronounced defects or dehiscences (Hyrtl) in the floor of the auditory meatus. The frequency of these defects differs from locality to locality and probably from tribe to tribe. They are rather scarce in the Munsee, two-thirds of the crania showing no defect whatever, while of the remainder in only one instance was the perforation large. There seems to be a predominance of this condition in the females.

XXXIII. MUNSEE CRANIA: DEFECTS IN FLOOR OF AUDITORY MEATUS

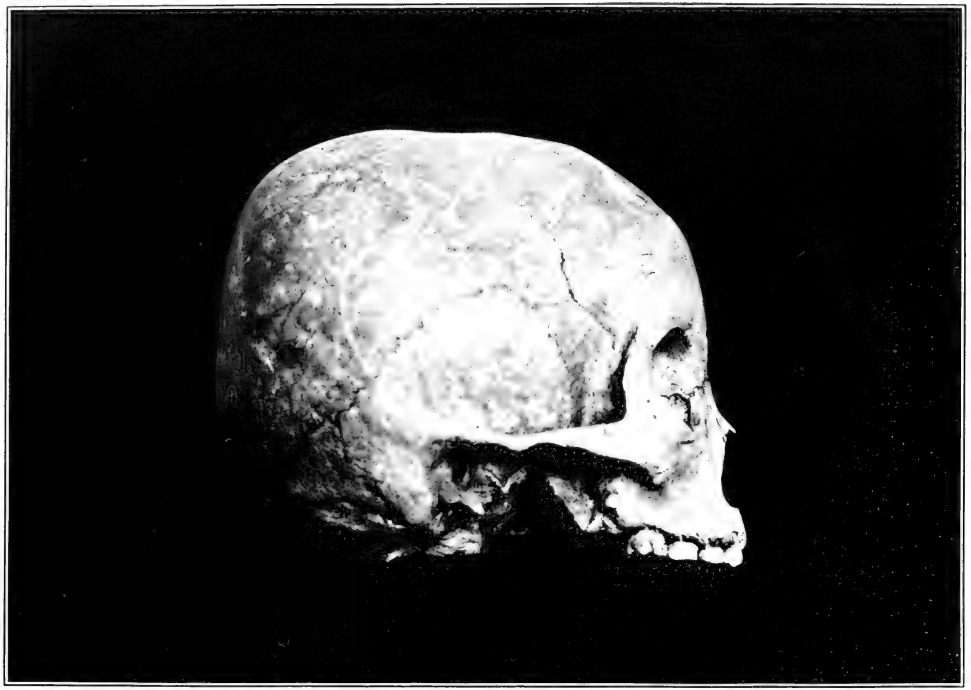
	10 males		12 females	
	Cases	Per cent	Cases	Per cent
None	8	80	8	67
Slight, each side	1	10	2	17
Moderate, each side	1	10	1	8
Large, each side			1	8

Styloid processes.—Among the Indians the styloid processes seldom reach good development, although there is some difference in this respect among the tribes. In a great majority of Indian crania the styloid processes are more or less diminutive, and not seldom they are quite rudimentary or even absent, in the latter case usually only small bases being discernible. In the Munsee only four of the twenty-two skulls show styloids which approach the medium or average in whites; in seven the processes are decidedly submedium; and in eleven they are rudimentary.

XXXIV. MUNSEE CRANIA: STYLOID PROCESSES

	10 males		12 females	
	Cases	Per cent	Cases	Per cent
Medium (about average in whites)	2	20	2	17
Submedium	5	50	2	17
Rudimentary	3	30	8	67

BRACHYCEPHALIC EXTRANEOUS FEMALE SKULL, NO. 285,311, U.S.N.M. (VIEW FROM ABOVE), FOUND WITH THE MUNSEE INDIANS



SKULL OF MUNSEE CHILD OF ABOUT SIX YEARS OF AGE, NO. 285,329, U.S.N.M., SHOWING FRONTO-OCCIPITAL COMPRESSION

Middle lacerated foramina. Posterior lacerated foramina.—As repeatedly pointed out by the writer on former occasions, the middle lacerated foramina are structures of some importance. They are very small in the anthropoid apes, generally small in negro skulls, submedium to medium in the yellow-brown races and in less developed whites, and reach their maximum spaciousness in civilized modern white men. These differences are connected with the increase in the size of the brain. A growing brain not accompanied with a proportionate or equally rapid increase in the bony structures of the base of the skull (which seems to be most frequently the case) will cause a spreading and bulging of the basal parts, one result of which will be the increased size of the middle lacerated foramina. In the Munsee, in only two of the nineteen skulls in which the basal region is sufficiently well preserved for examination, the foramina about equal in size the average in whites; in nearly half of the remaining skulls they are submedium, and in slightly more than half they are small.

XXXV. MUNSEE CRANIA: MIDDLE LACERATED FORAMINA; POSTERIOR LACERATED FORAMINA

	7 males		12 females			7 males		12 females	
	Cases	Per cent	Cases	Per cent		Cases	Per cent	Cases	Per cent
Medium (about as average in whites)	1	14	1	8	Of equal size	1	14	1	8
Submedium	5	71	3	25	Right larger	5	71	8	67
Small	1	14	8	67	Left larger	1	14	3	25

The posterior lacerated or jugular foramina are of interest chiefly because of their frequent and often marked inequality in size, which signifies inequality in the size of the lateral sinuses and especially of the internal jugular veins. The right foramen is frequently larger than the left, a phenomenon which has been associated with the prevailing right-handedness in man. In the nineteen Munsee skulls in which the foramina could be examined, they are of about equal size in only two instances; the right is larger in thirteen, or in two-thirds of the cases, while the left is the larger in only four instances. As the proportion of left-handed persons among the Indians averages only about three per cent, it is evident that in some instances the relation between a larger jugular canal and habitual greater use of the arm of the same side would not maintain; besides, we know the motor centers for the right arm and hand to be on the left side of the brain. Possibly greater blood pressure on the right side in right-handed persons, due directly and mechanically to the

greater muscular activity on that side, would be a more satisfactory explanation.

Depressions of the petrous portions.—In examining the petrous parts in the usual way, with the skull turned base upward, it is observed that in modern men of all races, in the majority of cases, these parts are more or less depressed below the niveau of the surrounding parts. In reality, of course, the surrounding parts have been pressed outward by the developing brain, while the prismatic and resistant petrous parts remained behind. The grade of depression of the petrous parts stands generally in close correlation with the size of the middle lacerated foramina and is of parallel significance.[1] Among the anthropoid apes even a slight depression of the petrous portions is very rare, and most frequently, especially in the orang, these portions rise slightly above the surrounding structures. In the African negro, and occasionally in individual skulls of other inferior races, they are level with the surrounding parts. In better developed negro skulls, as in the majority of those of other primitive peoples, they are slightly to moderately depressed. In white men, and in superior skulls in general, the depression is frequently pronounced, especially, it seems, in the brachycephals. The Indian stands in a practically intermediate position between superior whites and the negroes, and the Munsee are no exception. In two of the skulls the depression is well marked; in three males and seven females it is less than the average in whites; and in two males and five females it is only slight. The females, it will be noted, make a poorer showing in this respect than the males.

XXXVI. MUNSEE CRANIA: DEPRESSION OF PETROUS PORTIONS

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Medium (about as average in whites)	2	29	.....	.....
Submedium	3	43	7	58
None or almost none	2	29	5	42

Pterygo-basal foramina. Posterior condylic foramina.—Interesting features of the base of the skull, to which Gruber and (in this country) Harrison Allen have called attention, are the foramina found occasionally at the base (or proximal part) of the external pterygoid plates. These foramina are seldom complete. They may be single, double, or even triple. They are formed by a process or by processes of bone which proceed upward and backward, and in some cases more or less outward, from the border of the external pterygoid plate. According to the insertion of these processes, the foramina to which

[1] See Hrdlička, Certain Racial Characteristics of the Base of the Skull, *Science*, 1901, p. 309; Proc. Assoc. Amer. Anatomists, 15th Sess., in *Amer. Jour. of Anatomy*, 1, 1901–2, pp. 508–9.

they give rise can be divided into two classes, namely, the more frequent pterygo-spinous and the rarer pterygo-sphenoidal.

Their significance is not yet so clearly understood as is desirable. They are of some anthropological interest and occur quite frequently among Indians, especially in certain localities. Among the Munsee they were rather scarce, particularly in the females.

XXXVII. MUNSEE CRANIA: PTERYGO-BASAL FORAMINA; POSTERIOR CONDYLIC FORAMINA

	7 males		12 females			5 males		12 females	
	Cases	Per cent	Cases	Per cent		Cases	Per cent	Cases	Per cent
None or only a trace	3	43	11	92	Two, normal	3	60	12	100
Pterygo-spinous complete on left, four-fifths on right	1	14	.....	.....	Left absent	1	20	.....	.....
Pterygo-spinous incomplete, both sides	1	14	1	8	Right, diminutive	1	20	.....	.....
Incomplete pterygo-sphenoidal, left side	1	14	.....	.....					
Complete pterygo-sphenoidal on left (absent on right)	1	14	.....	.....					

Posterior condylic foramina.—These are canals which transmit the posterior condylic vein and are of interest only because of their more or less frequent absence from one or both sides in different racial groups. In the Munsee they are exceptionally normal, as will be seen from the preceding figures.

MISCELLANEOUS ANOMALIES

In addition to the peculiarities shown in the preceding paragraphs, the Munsee skulls present a number of anomalous conditions which deserve to be mentioned.

In male skull no. 285,306 the right occipital condyle is flat, the left being normal; there was no injury or arthritis.

In male skull no. 285,326 there is an accessory facet posteriorly to the left condyle.

In female skull no. 285,311 there are two moderate precondylar tubercles.

In male skull no. 285,313 and female skull no. 285,312 there is a moderate medio-basilar ("pharyngeal") fossa.

In female skull no. 285,320 the carotid canals in the petrous parts are usually large, measuring 7 mm. in major diameter.

In female skull no. 285,311 a canal, 6 by 4.5 mm., is present just posteriorly to the right angular process, in the frontal bone and the spheno-frontal suture.

Finally, there is a series of anomalies relating to the spinous and oval foramina. They are as follows:

Male skull no. 285,303: The median wall of the left foramina spinosum and ovale is deficient.

Female skull no. 285,310: Median wall of right spinous foramen deficient.

Female skull no. 285,347: Median wall of left spinous foramen deficient.

Female skull no. 285,320: Median wall of each spinous foramen deficient.

Female skull no. 285,323: Right foramina spinosum and ovale connected, and the median wall of both deficient.

Female skull no. 285,311: The left foramen ovale is unusually large, 8.5 by 4.5 mm., while the right is enormous, 10 by 8 mm. (pl. 21).

The Teeth

Dentition.—Of the 22 skulls of Munsee adults at hand it is possible to ascertain the state of dentition in 14. In 11 of these cases there were 32 teeth in each, while in three there were 31. The congenital deficiency consisted in one case of the third left upper molar; in the second, the third left upper molar is completely absent, while the right corresponding tooth is rudimentary; and in the third there is a congenital absence of the left lower lateral incisor, while on the right side we find the very rare condition of a complete fusion of the lower lateral incisor and the canine (pl. 22).

Loss and decay.—Teeth lost through caries and the presence of decay are common in this series, more so than in other Indian groups. Among the males, 13 per cent of all the teeth were lost in life, while 12 per cent of those still present show more or less decay; among the females 21 per cent were lost in life and 16 per cent of those present show caries—this notwithstanding the fact that the average age of the female skulls was less than that of the males. The teeth lost or affected were mostly the molars, especially those in the lower jaw.

Wear.—In every instance the remaining teeth show more or less pronounced effects of wear. Where the wear is advanced, it is generally also irregular. The detailed notes show that the wear is slight in eight, moderate in five, and advanced in nine of the 22 specimens.

Size, quality, shovel-shaped incisors.—In size the Munsee teeth in all cases are medium. Where not decayed or worn off they show invariably regular and normal development. The upper incisors present in every case the cingulum which gives their lingual surface a more or less pronounced shovel-shaped character, common to and characteristic of all Indians, with rare individual exceptions.

BASE OF FEMALE SKULL NO. 285,311, U.S.N.M. (BRACHYCEPHALIC EXTRANEOUS), FOUND AMONG THE MUNSEE BURIALS, SHOWING EXCESSIVE SIZE OF THE FORAMINA OVALE, ESPECIALLY ON THE RIGHT SIDE

LOWER JAW OF FEMALE MUNSEE SKULL NO. 285,307, U.S.N.M., SHOWING COMPLETE FUSION OF THE RIGHT LOWER LATERAL INCISOR AND CANINE

Anomalies.—The anomalies of the teeth are always of considerable interest, being mainly either reversive or degenerative (progressively) in character. The skulls observed indicate the following conditions:

Male no. 285,301: A small supernumerary tooth between and on the labial side of the left lower second and third molars. The lateral upper incisors in this skull are somewhat abnormal lingually, their surface appearing as if rolled together from side to side, so that the tooth is cylindrical in form and its shovel-like hollow has become almost a cavity.

In male no. 285,303: The third right upper molar is diminutive.

In male no. 285,305: The third lower right molar is impacted, its vertical axis tending forward and upward.

In male no. 285,326: The third right upper molar is diminutive.

In female no. 285,305 is present the aforementioned fusion of the right lower lateral incisor and canine. The resultant tooth appears like a broad stout incisor (pl. 22).

In female no. 285,310: The crown of the right lower third molar is unusually large (13.5 mm. long by 12 mm. broad) and looks like that of a fused double tooth, but both first and second molars are present. The opposite tooth is also larger than ordinary, but the upper corresponding teeth are normal.

Finally, in no. 285,311 the third right upper molar is rudimentary.

Cuspids.—Many of the molars present were so worn that a determination of their cuspid formulæ was impossible. The better preserved teeth showed the interesting conditions detailed in the following table:

XXXVIII. MUNSEE CRANIA: MOLARS; CUSPIDARY FORMULÆ

UPPER MOLARS

MALES

First molar			Second molar			Third molar		
Cusps	Number of teeth examined	Per cent	Cusps	Number of teeth examined	Per cent	Cusps	Number of teeth examined	Per cent
4	15	100	4	4	30	3 2/2	1	11
			*3 1/2	7	54	2 2/2	3	33
			3	1	8	2 1/2	1	11
			2 3/2	1	8	†Pursed	4	44

*1/2=one small cusp; 2/2=two small (or half) cusps, etc.

†Appearing like the mouth of a tightly drawn tobacco-pouch or purse.

XXXVIII. MUNSEE CRANIA: MOLARS; CUSPIDARY FORMULÆ—Continued

UPPER MOLARS—Continued

FEMALES

First molar			Second molar			Third molar		
Cusps	Number of teeth examined	Per cent	Cusps	Number of teeth examined	Per cent	Cusps	Number of teeth examined	Per cent
4	14	100	3 1/2	13	100	3	2	15
						2 3/2	1	8
						2 2/2	1	8
						Pursed	9	69

LOWER MOLARS

MALES

5	4	100	5	1	33	5	2	50
			4 1/2	1	33	4 2/2	1	25
			4	1	33	4	1	25

FEMALES

5	1	100	4 1/2	2	67	4	4	67
			4	1	33	Pursed	2	33

It will be observed that the 29 first upper molars have all four regular cusps, while all the first lower molars have five. The second upper molars vary in the males, but show all three ordinary and one small cusp (the posterior lingual) in the females. The wisdom teeth fluctuate considerably in both sexes, both as to size and to form.

SUMMARY OF MEASUREMENTS AND OBSERVATIONS ON THE CRANIA

A summary of the results of the examination and measurements of the Munsee skulls includes the following points of interest:

A number of the specimens show traces of intentional fronto-occipital deformation, which is completely absent among other Indian tribes of the northeastern and Middle Atlantic States; and several of the skulls are of distinctly extraneous type. Both of these conditions point to admixture, which in all probability came from the southwestward and may have been due to Shawnee influence during the last few decades of the occupancy by the Munsee of the upper Delaware.

The crania that can be safely accepted as belonging to the Munsee themselves, and which are not deformed, are characterized by moderate dolichocephaly to mesocephaly and a high vault. They are not thick-walled and show fair capacity.

The face is of moderate dimensions and lacks prognathism. The facial index ranges from mild chamœprosopy to mild leptoprosopy.

The orbits are very variable, but the majority are mesoseme.

The nose is rather short, but fairly broad; the average index is mesorhinic.

The palate is of only moderate length, but fairly broad; its index in both sexes is brachyuranic.

The lower jaw is of moderate dimensions throughout.

The teeth are medium in size.

Descriptive features.—The forehead is chiefly of medium development in the males, in the females frequently somewhat low.

The sagittal region shows more or less arching, in no case extreme; the temporo-parietal region and the occiput present mostly medium forms.

Serration of cranial sutures is submedium to very submedium. Wormian and other intercalated bones are scarce. The order of occlusion of sutures among the males was S–C–TO–L; among the females TO–S–C–L (see page 35).

The pterions are all of the H type, with tendency to narrow in males, medium to broad in females.

Parietal foramina are few in number and small, retromastoid foramina moderate to small.

The mastoid processes and the supraorbital ridges present ordinary development and variation; no excess.

The nasion depression is well marked in the males, mostly shallow in the females; nasal bridge is medium to submedium, nasal bones of fair breadth; lower borders of the nasal aperture are mostly fairly sharp, and with one exception there are no simian grooves or subnasal fossæ; nasal spine ranges from very low to submedium.

The orbits show exceptional variation in form, as they do in measurements; suborbital (canine) fossæ are shallow to medium; malar bones are of but moderate development, without anomalies; zygomæ average somewhat submedium as compared with those of other Indians.

The upper alveolar arch is mostly of very moderate slant and free from abnormalities. The lower jaw is of ordinary form, without anomalies. The palate in half the cases is elliptic, in two-thirds of the remainder ovoid, and in one-third parabolic; it is in no case exceptionally low or very high, and there is no torus.

Base.—The glenoid fossæ in a majority of the crania show usual form and medium dimensions, but tend to wideness in a number of the females; dehiscences in the floor of the auditory meatus are, for Indians, scarce.

The styloid processes reach medium development in but few instances, and they are frequently rudimentary.

The middle lacerated foramina are mostly submedium to small; depression of petrous portions prevalently submedium to slight. The posterior lacerated or jugular foramina are, as usual, in a majority of the cases larger on the right side. Pterygo-basal foramina are scarce.

Anomalies observed on the skulls pertain mostly to the basal structures, particularly the condyles and the sphenoidal foramina.

Teeth.—Dentition was remarkably regular, but decay and loss of teeth in life were relatively more frequent than in other Indians; upper incisors, especially the middle, are shovel-shaped lingually, as usual in Indians. More or less wear of the teeth in the adults is present in every instance. Dental anomalies, while few in number, comprise a case of special interest: a perfect fusion of canine and incisor.

THE BONES

By reason of the care with which the bones were collected from the Minisink cemetery, those of the different adult skeletons were kept apart as found and are thus perfectly identifiable as to individuals. Excluding those of adolescents and children, there are present the bones of 32 adult skeletons, and in the majority of cases these are almost complete. Of these 32 individuals, 17 were male and 15 female, thus affording a fair series for comparison.

The bones in general are practically normal and almost free from important anomalies. They indicate people of medium to somewhat above medium stature, and of good though not excessive muscular development. In their morphological features they approximate in many respects the bones of whites, yet differ in numerous interesting particulars.

Although a number of the subjects represented by the skeletal remains were old people, there is an absence of light bones or of other evidences of senility. The proportion of such bones in modern whites is in fact much larger than among any of the Indians, either prehistoric or modern, a fact of considerable physiological importance.

Humerus

GENERAL OBSERVATIONS

There are present 46 adult humeri, mostly perfect and almost all paired. The principal measurements of these are given in the following table:

XXXIX. MUNSEE: HUMERI

MALES

Right					Left				
Number of adult humeri	Length, maximum	Diameters at middle*		Index of shaft (b×100)/a	Number of adult humeri	Length, maximum	Diameters at middle*		Index of shaft (b×100)/a
		Major (a)	Minor (b)				Major (a)	Minor (b)	
Average:	cm.	cm.	cm.		Average:	cm.	cm.	cm.	
Paired (13)	**32.5**	**2.24**	**1.65**	**73.6**	Paired (13)	**32.6**	**2.2**	**1.64**	**74.6**
Total present (14)	32.5	2.25	1.65	73.4	Total present (13)	32.6	2.2	1.64	74.6
Minimum:					Minimum:				
Total present (14)	31.1	1.9	1.5	65.2	Total present (13)	31.–	1.85	1.4	65.2
Maximum:					Maximum:				
Total present (14)	34.4	2.6	1.85	81.6	Total present (13)	34.7	2.55	1.95	81.4

FEMALES

Average:					Average:				
Paired (12)	**30.6**	**2.09**	**1.43**	**68.4**	Paired (12)	**30.2**	**2.01**	**1.4**	**69.8**
Total present (15)	30.7	2.08	1.41	67.7	Total present (12)	30.2	2.01	1.4	69.8
Minimum:					Minimum:				
Total present (15)	28.5	1.9	1.2	61.9	Total present (12)	28.5	1.75	1.25	63.6
Maximum:					Maximum:				
Total present (15)	32.3	2.3	1.7	77.3	Total present (12)	31.9	2.2	1.7	77.3

* Diameter major=parallel to the flat anterior surface; diameter minor=at a right angle to the preceding.

The averages are in no way exceptional. Reference to the writer's report on the Indian skeletal remains from Arkansas and Louisiana[1] will show that the humeri of that collection had practically the same dimensions.

The relation of the average of paired female humeri to that of paired male humeri is as 94.2 to 100, which is somewhat higher than existed among the Arkansas and Louisiana Indians (91.34 for 86 humeri), among Indians in general (91.2 for 602 humeri), and also among whites (91.8 for 2,700 humeri), but is lower than in the American negro (94.6 for 164 humeri). As no error in the sexual identification entered into the present series, the disparity here shown is difficult to explain, except perhaps by the result of some peculiar local occupational differences in the two sexes or a local hereditary multiplication of an individual peculiarity.

[1] *Jour. Acad. Nat. Sci. Phila.*, XIV, 1909, pp. 211–212.

The right and left humeri are of practically the same length in the males, while in the females the average of the left bones is slightly inferior to that of the right, as is usual in most Indian tribes and also among the white and other races. The equal length of the arm bones in the males indicates probably a lack of specialized occupation.

The dimensions of the shaft of the humerus at the middle and their percental relation or index are interesting in several respects, as shown by the following data:

XL. COMPARISON IN DIMENSIONS OF MUNSEE WITH OTHER RACIAL HUMERI

	Males				Females			
	Whites	American negroes	Munsee	Other Indians	Whites	American negroes	Munsee	Other Indians
Number of humeri (both sides)	(1,930)	(112)	(26)	(348)	(770)	(52)	(24)	(254)
Length, cm	32.53	32.7	*32.55*	31.67	29.8	30.9	*30.4*	28.9
Mean diameter of shaft at middle, cm	2.02	2.09	*1.93*	1.91	1.83	1.89	*1.78*	1.69
Index of shaft	**83**	**84.1**	**74.1**	**73.1**	**79.3**	**79.2**	**69.1**	**70.3**

In the first place it will be seen that although the Munsee arm bones are practically of the same average length as those of the miscellaneous American whites, their strength in both sexes, and especially in the males, is greater in the whites. It will further be noted that the disproportion is especially pronounced in the thickness of the bone, the humerus of whites, both male and female, being the stouter, as a result of which the shaft index is decidedly higher in the whites than in the Indians—the Munsee humerus, in other words, is more platybrachic. Much the same distinction exists between the Munsee humeri and those of the American negro; while on the other hand it will be noted that in this respect there is close harmony between the Munsee and other Indians.

Referring again to the table on page 53, and contrasting the bones of the two sides, it will be observed that the left humerus in both sexes is on the average weaker, though the difference is quite small; also that the shaft index in both sexes is larger on the left side. Exactly the same conditions have been observed by the writer on the several series of arm bones of whites and negroes, and also on other Indians, as are presented in preceding tables, which fact shows that we are dealing with no accidental phenomena. The difference in the index between the two sides is due exclusively to the relatively greater breadth (i. e., the antero-posterior diameter) of the right bone, the thickness of the humerus being very nearly the same on the two sides of the body.

SUPRACONDYLOID PROCESS IN A FEMUR, AND A SPURIOUS SUPRACONDYLOID FORAMEN IN A HUMERUS OF THE MUNSEE

DETAILED OBSERVATIONS

Shape of the shaft.—A number of years ago the writer[1] called attention to the fact that in transverse sections at the middle the bones show each a considerable variety in the shape of the shaft, and that these varieties can be reduced for each bone to several distinct types of both functional and racial significance. As to the humeri, the most frequent shapes are the p. c., plano-convex or infantile form; type 1, or ordinary prismatic; type 2, lateral prismatic; and type 4, in which the anterior border is broadened out to a distinct fourth surface.

Among the Munsee the occurrence of shapes was as follows:

XLI. MUNSEE HUMERI: SHAPE OF SHAFT

Type	Male				Female			
	Right		Left		Right		Left	
	Specimens	Per cent	Specimens	Per cent	Specimens	Per cent	Specimens	Per cent
pc—plano-convex	3	21	2	15	2	13.3	3	23
1—ordinary prismatic or near	6	43	6	46	9	60	5	39
2—lateral prismatic	1	7	2	15	.....	.....	....	....
4—quadrilateral	2	14	.....	....	2	13.3	3	23
Various intermediate	2	14	3	23	2	13.3	2	15

The most frequent shape is the ordinary prismatic; the next in frequency is the plano-convex; the lateral prismatic is the least common. The significance of these conditions must be left for future consideration, when our data, especially on the American Indians, are more extensive.

Perforation of the septum.—The septum between the olecranon and coronoid fossæ in Indians often shows a smaller or a larger perforation. The frequency of this developmental anomaly or condition differs from tribe to tribe, and it differs also between the sexes, being as a rule more common in females. In the Munsee male humeri only six instances of such perforation exist, three in right and three in left bones, the total amounting to 22 per cent of the bones. In only one instance is the opening large; in three it is medium; in one small, and in one of pin-point size. In the 29 female humeri which could be examined for this feature the conditions are quite different, the perforation being present in no fewer than 17 cases, or nearly 59 per cent of the bones. Eight of the 17 are right (47 per cent), nine left (53 per cent). As to size of the perforation, one is pin-point, eight small, and eight medium; none is large.

[1] Hrdlička, Typical Forms of Shaft of Long Bones, *Proceedings of the Association of American Anatomists*, 14th Sess., Dec. 1900, pp. 55-60, figs. 1-2, Washington, 1901.

Supracondyloid process.—This process, which in a more or less rudimentary form, and especially in the form of a ridge, is not rare in whites, is very uncommon in the Indians, though even in this race in the majority of humeri some roughness, or even a slight ridge, can be detected in its position. Among the Munsee humeri no specimen shows more than a trace of the anomaly.

The rarity of this process in the Indian is of additional interest from the fact that it seems to be shared by other branches of the yellow-brown race, and also by the blacks; moreover, the process appears to be absent, or nearly so, in the humeri of all known apes. The problem as to why a feature of this nature, which appears clearly to be reversive, should be more common in modern whites than in the more primitive races and even in the anthropoid apes and the lower primates, offers a fruitful field for investigation.

Radius

The total number of radii in condition to be measured is 41, 19 male and 22 female. Taking the paired bones in the males, we find that their length is equal on the two sides, as was very nearly the case with the humeri; in the females the right radius averages slightly longer than the left, again as in the arm bones of this sex. The arms as a whole were therefore of very nearly the same length on the two sides in the males, but the right was generally slightly longer than the left in the females, a condition which in all probability was connected with the relatively greater use of the right hand and arm in the latter sex.

The percental relation between the length of the radius and that of the humerus approximates 79 on both sides in the males and 78 in the females. Indians of other localities show much the same condition, the index approximating in the males 78 on both sides and in the females 77 on both sides. In whites the same index is only 73.6 in the males and 72.8 in the females; while the American negro gave to the writer 77.4 for the male and 76.8 for the female sex. This means that the forearm in the Munsee and in Indians generally is relatively long; it is decidedly longer in relation to the humerus than in the whites, and so far as the Munsee are concerned it is even slightly longer than in the average American negro; and in all the groups it is to a slight extent relatively longer in the males than in the females.

In strength, curvature, and other features the Munsee radii show nothing exceptional. In fact, this bone is of secondary importance in the anthropology of modern races except in its relative proportions.

XLII. MUNSEE: RADIUS

MALES

Number of bones	Right			Left			
	Length, maximum	Number of cases	Radio-humeral index $\frac{R \times 100}{H}$	Number of bones	Length, maximum	Number of cases	Radio-humeral index $\frac{R \times 100}{H}$
Average:	*cm.*				*cm.*		
Paired (9)	**25.7**	(8)	**78.8**	(9)	**25.7**	(8)	**78.8**
Total present (11)	25.65	(10)	78.9	(9)	25.7	(8)	78.8
Minimum, total present (11)	24.6	(10)	74.9	(9)	24.6	(8)	76.1
Maximum, total present (11)	26.6	(10)	82.5	(9)	26.4	(8)	82.1

FEMALES

Average:							
Paired (10)	**23.7**	(10)	**77.5**	(10)	**23.45**	(10)	**78**
Total present (11)	23.66	(10)	77.5	(12)	23.54	(11)	78
Minimum, total present (11)	22	(10)	74.8	(12)	24.6	(11)	74.7
Maximum, total present (11)	24.7	(10)	80.1	(12)	24.6	(11)	80.1

Ulna

Like the radius, the Munsee ulna shows nothing specially noteworthy as regards its form. The curvature is moderate, as a rule, and so is the strength of the bone. The dimensions are presented in table XLIII.

As with the other two long-bones of the upper limb, the length of the ulna is practically the same on the two sides in the males, and slightly shorter on the left than on the right in the females.

XLIII. MUNSEE: ULNA

	Males				Females			
	Right		Left		Right		Left	
	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum
Average:		*cm.*		*cm.*		*cm.*		*cm.*
Paired	6	**27.6**	6	**27.5**	10	**25.5**	10	**25.2**
Total present	8	27.5	9	27.7	11	25.45	11	25.3
Minimum	8	26.6	9	26.1	11	23.7	11	23.4
Maximum	8	28.6	9	29.3	11	26.5	11	26.5

FEMUR

GENERAL OBSERVATIONS

The total number of adult femora in condition for measurement is 60—33 males, 27 females.

The bones, as a rule, are normally developed and with one exception free from anomalies. The exception is the left femur of male subject no. 285,301, which shows a large spinous process on the mesial border of the bone above the internal condyle (*proc. supracondyloideus femoris*), as exhibited in plate 23. The linea-aspera, while mostly well developed, is in no case exceptionally high. The curvature and torsion show nothing exceptional.

MEASUREMENTS

As this is the most important of the long-bones, a number of measurements besides the length were taken, as indicated below.

The mean bicondylar length of the Munsee femora, taking both sides together, is 45.5 cm. in the males and 42 cm. in the females. Judging from observations on whites and on other Indians, these lengths correspond to the average stature of approximately 167 cm. in the male and 156 cm. in the female Munsee. These figures are very close to those obtained by the help of the well-known Manouvrier and Rochet tables, and may therefore be safely accepted. They show that the Munsee were somewhat above the medium, but not really tall in stature.

XLIV. MUNSEE: FEMORA

MALES

	Right													
	Number of bones	Length bicondylar	Length maximum	Number of cases	Humero-Femoral Index $\frac{H \times 100}{F}$	Number of cases	Diameter antero-posterior at middle* (b)	Diameter lateral at middle† (b)	Index of shaft $\frac{b \times 100}{a}$	Number of cases	Diameters at upper flattening: Maximum (c)	Diameters at upper flattening: Minimum (d)	Platymeric index $\frac{d \times 100}{c}$
Average:		*cm.*	*cm.*				*cm.*	*cm.*			*cm.*	*cm.*	
Paired	12	**45.2**	**45.8**	8	**71.8**	16	**2.92**	**2.55**	**87.1**	15	**3.23**	**2.37**	**73.3**
Total present	14	45.26	45.8	11	72.1	17	2.91	2.53	87.1	17	3.22	2.35	73.1
Minimum	14	43.4	43.8	11	69.6	17	2.5	2.2	73.5	17	2.9	2	64.6
Maximum	14	48.1	48.7	11	76.3	17	3.3	2.95	100	17	3.75	2.7	90
	Left												
Average:													
Paired	12	**45.4**	**45.9**	8	**71.7**	16	**2.9**	**2.61**	**89.9**	15	**3.33**	**2.38**	**71.6**
Total present	15	45.82	46.3	9	71.3								
Minimum	15	43.7	44	9	67.7	16	2.5	2.25	75	15	2.9	2.1	59.5
Maximum	15	49.2	50	9	75.7	16	3.3	2.9	107.7	15	3.7	2.7	93.7

* Maximum. † Linea aspera midway between the two branches of the compass.

FUSION OF HUMERUS AND ULNA; MALE MUNSEE SKELETON, NO. 285,303, U.S.N.M.

XLIV. MUNSEE: FEMORA—Continued

FEMALES

	Right													
	Number of bones	Length bicondylar	Length maximum	Number of cases	Humero-Femoral Index $\frac{H \times 100}{F}$	Number of cases	Diameter antero-posterior at middle* (a)	Diameter lateral at middle† (b)	Index of shaft $\frac{b \times 100}{a}$	Number of cases	Diameters at upper flattening: Maximum (c)	Diameters at upper flattening: Minimum (d)	Platymeric Index $\frac{d \times 100}{c}$
Average:		*cm.*	*cm.*				*cm.*	*cm.*			*cm.*	*cm.*	
Paired	13	**42.1**	**42.65**	10	**72.6**	13	**2.58**	**2.35**	**91.2**	12	**2.88**	**2.17**	**75.5**
Total present	14	.....	.....	12	72.7	14	2.56	2.37	91.6	14	2.89	2.14	74
Minimum	14	39.4	40	12	70.6	14	2.3	2	82.1	14	2.5	1.85	56.9
Maximum	14	44.7	45.1	12	74.4	14	2.95	2.6	106.2	14	3.25	2.45	84.5
	Left												
Average:													
Paired	13	**41.9**	**42.6**	10	**71.65**	13	**2.48**	**2.38**	**93.1**	12	**3.03**	**2.17**	**71.7**
Total present	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Minimum	13	39.6	40	10	69.4	13	2.25	2	83.3	12	2.6	1.8	56.1
Maximum	13	44.5	45.4	10	73.2	13	3	2.65	113	12	3.35	2.45	87.7

* Maximum. † Linea aspera midway between the two branches of the compass.

The two lengths of the femur, the bicondylar and the maximum, differ somewhat as a rule in favor of the latter. The difference is due and proportional to the inclination of the axis of the shaft and the development of the internal condyle, and ranges in different individuals from 0.5 mm. to 15 mm. In whites in all the groups studied it is moderate, not reaching 4 mm. in the average. In the American negro (who often has some white blood), the disproportion between the two lengths is slightly higher than in the whites, but additional observations are needed. Among Indians, however, the difference is perceptibly higher than among the whites, and is especially pronounced among the Munsee, where it reaches the average of nearly 5 mm. in the males (taking the mean of the two sides) and 6 mm. in the females. As the Munsee bones are perfectly normal, the explanation of this peculiarity must be sought either in an unusual breadth of the pelvis or in a somewhat greater length of the neck of the femur, and may be connected with some functional characteristic of these people, such as possibly a more than usual prevalence of the habit of squatting.

XLV. MUNSEE AND OTHER FEMORA: RELATIONS BETWEEN THE BICONDYLAR AND MAXIMUM LENGTH OF THE BONES

	Munsee		Other Indians		United States whites		Italians		American negro	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Number of paired bones	12	12	55	22	100	50	31	8	12	8
Average excess of the maximum over the bicondylar length:										
Right, cm	5.35	5.6	4	3.8	3.05	3.78	3	2.6	4	3.2
Left, cm	4.2	6.45	4.2	3.2	2.55	3.8	2.58	2.1	3.25	3.5

The difference between the maximum and bicondylar length of the femur in some racial groups averages greater in the females than in the males, while in others the condition is reversed. Among the Munsee the females show the greater difference (6 mm. to slightly less than 5 mm. in the males); but this peculiarity is not shared by other Indian groups. A condition similar to that of the Munsee exists in this respect among the United States whites, where the difference between the two lengths averages 3.8 mm. in the females and only 2.8 mm. in the males; while among the Italians, and to a less extent the negroes, the disproportion is greater in the males (Italians: m. 2.8, f. 2.35 mm; negroes: m. 3.6, f. 3.35 mm.). The excess of the difference in males in these groups was unexpected, the usual impression being that the axis of the female femur is generally more oblique than that of the male; and the more oblique the axis, the greater should be the difference between the bicondylar and maximum length of the bone.

As to the two sides of the body, in the majority of the groups whose femora were studied, greater average differences were found between the two lengths of the bone on the right than on the left; in a few groups, however, such as the Munsee, the United States whites, and the United States negro females, the condition was reversed.

These interesting conditions and exceptions make it probable that an extended special study of the relations of the two femoral lengths would be well repaid by the results.

The relation in bicondylar length of the Munsee female to the male femora is as 92.7 to 100, and practically the same result was obtained in other Indians (92.65 to 100). In United States whites the proportion is as 93 to 100; in American negroes, as 93.1 to 100. These are striking similarities in people so far apart racially.

HUMERO-FEMORAL INDEX

The percental relation in length of the femur to the humerus in the Munsee, the humero-femoral index $\left(\frac{\text{maximum length of humerus} \times 100}{\text{bicondylar length of femur}}\right)$, approximates in both sexes 72, which is very near the average in human races generally. The similarity of this important relation in different racial groups, as may be seen from the measurements by the writer in the next table, is quite remarkable.

As a rule the humero-femoral index is in both sexes slightly higher on the right than on the left side, and the Munsee form no exception in this particular. As to sex, while in all branches of the whites, as well as in the United States negroes, the male index on both sides is slightly higher, in the Munsee, as well as in other Indians, the index in the male is slightly lower than that in the female. These features are all connected, of course, with the peculiarities of the length of the Indian humerus as well as the femur, outlined in other chapters.

XLVI. HUMERO-FEMORAL INDEX IN THE MUNSEE AND IN OTHER RACIAL GROUPS

	Male			Female		
	Subjects	Right	Left	Subjects	Right	Left
Munsee	8	71.8	71.7	10	72.6	71.7
Other Indians	100	72.3	71.6	61	72.7	71.8
United States whites	200	72.2	71.7	63	71.8	70.9
Irish	22	72.6	71.9	35	71.7	70.6
Germans	86	72.8	72	21	72.4	71.3
Italians	39	72.5	72.3	11	72.6	72
Other whites	53	73.9	73	15	72.9	71.3
United States negroes	25	71.7	71.5	13	70.3	70.2

THE SHAFT

The measurements taken at the middle of the shaft in the Munsee femora indicate generally a moderate development. The mean diameter is smaller in both sexes than it is in ordinary American whites and negroes[1] of the same stature. The same condition, though in a somewhat lesser degree, was observable in the Arkansas and Louisiana Indian femora, and there are reasons to believe that it is common to other Indian tribes, if not general in the race. The whites and negroes used here for comparison are of course those of the working classes, or such as find their way into dissecting rooms.

As to the strength of the femur on the two sides of the body, the difference in the Munsee, as well as in other Indians and racial groups, is very small. However, in the males a slightly higher average mean diameter is seen in the left femur, while in the females the

[1] Males: Munsee, 2.74; United States whites, 2.9; United States negroes, 2.91 cm.
Females: Munsee, 2.54; United States whites, 2.69; United States negroes, 2.6 cm.

condition is reversed. Curiously the same slight excess in strength of the left femur in the male and of the right in the female is exhibited also by the United States whites, while in the UnitedStates negroes, in both sexes, the bones of the two sides are exactly equal, as is shown in the following table:

XLVII. STRENGTH OF THE FEMUR ON THE TWO SIDES OF THE BODY

MEAN DIAMETER AT THE MIDDLE OF THE SHAFT

	Munsee	United States whites	United States negroes
Male:	*cm.*	*cm.*	*cm.*
Right	2.73	2.89	2.91
Left	2.75	2.91	2.91
Female:			
Right	2.46	2.74	2.60
Left	2.43	2.64	2.60

Taking the antero-posterior and lateral diameters at the middle of the shaft separately, we find several more interesting points. The antero-posterior diameter in the Munsee (and the same is true of the United States whites and United States negroes, as will be seen by the following table) is practically equivalent in the right and left femora in the males; but except in the whites it is perceptibly smaller on the left side in the females of all groups. On the other hand, the lateral diameter, excepting in the probably too small male negro series, is invariably larger on the left than on the right side in both males and females. Thus it may be said that the left femur is almost invariably slightly broader on the average than the right, and this especially in the females of probably all racial groups.

These interesting conditions are most clearly shown by the shaft index $\left(\frac{\text{diameter lateral}\times 100}{\text{diameter antero-posterior}}\right)$, which in both sexes and in all the racial subdivisions is higher on the left side.

The index in the Munsee femora is noteworthy in another respect: It is decidedly smaller in both sexes of this group than it is in the American negro and especially in the United States whites. Judging from data on other Indians in the writer's possession, it seems very probable that the characteristic shown by the Munsee in this regard is common to Indians in general. As may be seen by reference to the figures in the following table, the low shaft index in the Munsee is due entirely to smaller breadth; the Munsee femur is relatively narrower than that of both whites and negroes.

XLVIII. COMPARISON OF THE PROPORTIONS AND INDEX OF THE SHAFT OF THE FEMUR AT MIDDLE, IN MUNSEE, WHITES, AND NEGROES. PAIRED BONES

MALES

	Right			Left		
	Diameter antero-posterior	Diameter lateral	Index	Diameter antero-posterior	Diameter lateral	Index
Munsee:	*cm.*	*cm.*		*cm.*	*cm.*	
Specimens	(16)	(16)	(16)	(16)	(16)	(16)
Average	**2.92**	2.55	**87.1**	2.90	2.61	**89.9**
United States whites:						
Specimens	(66)	(66)	(66)	(66)	(66)	(66)
Average	2.95	2.84	**96.3**	2.95	2.87	**97.4**
United States negroes:						
Specimens	(6)	(6)	(6)	(6)	(6)	(6)
Average	3.06	2.77	**90.5**	3.06	2.77	**90.5**

FEMALES

Munsee:						
Specimens	(13)	(13)	(13)	(13)	(13)	(13)
Average	2.58	2.35	**91.2**	2.48	2.38	**93.1**
United States whites:						
Specimens	(28)	(28)	(28)	(28)	(28)	(28)
Average	2.64	2.58	**97.7**	2.65	2.63	**99.5**
United States negroes:						
Specimens	(7)	(7)	(7)	(7)	(7)	(7)
Average	2.68	2.53	**94.4**	2.63	2.58	**98.1**

PLATYMERY

Another anthropologically important region of the femur is the subtrochanteric flattening, which, as well known, has been studied in whites and in other races by Manouvrier and other observers.[1] The flattening in question is situated below the minor trochanter, reaching its maximum at approximately 3 cm. below that point. It yields itself to two measurements, the maximum and the minimum diameter, and the percental relation of the latter to the former constitutes the platymeric index. This index is generally quite high in whites, in whom the flattening is but moderate.

The next table shows the conditions found in this respect with regard to the Munsee, the United States whites, and the United States negroes.

[1] See Hrdlička, Report on Additional Skeletal Remains from Arkansas and Louisiana, *Jour. Acad. Nat. Sci. Phila.*, XIV, 1909, pp. 215–216.

XLIX. COMPARISON OF THE PROPORTIONS AND INDEX OF THE SHAFT OF THE FEMUR AT THE SUBTROCHANTERIC FLATTENING, IN THE MUNSEE, WHITES, AND NEGROES. PAIRED BONES

MALES

	Right			Left		
	Diameter maximum	Diameter minimum	Index	Diameter maximum	Diameter minimum	Index
Munsee:	*cm.*	*cm.*		*cm.*	*cm.*	
Specimens	(15)	(15)	(15)	(15)	(15)	(15)
Average	3.23	2.37	**73.3**	3.33	2.38	**71.6**
United States whites:						
Specimens	(66)	(66)	(66)	(66)	(66)	(66)
Average	3.25	2.69	**82.8**	3.24	2.73	**84.1**
United States negroes:						
Specimens	(6)	(6)	(6)	(6)	(6)	(6)
Average	3.07	2.68	**87.3**	3.17	2.73	**86.3**

FEMALES

Munsee:						
Specimens	(12)	(12)	(12)	(12)	(12)	(12)
Average	2.88	2.17	**75.5**	3.03	2.17	**71.7**
United States whites:						
Specimens	(28)	(28)	(28)	(28)	(28)	(28)
Average	2.94	2.39	**81.1**	3.0	2.39	**79.6**
United States negroes:						
Specimens	(7)	(7)	(7)	(7)	(7)	(7)
Average	3.02	2.42	**80.1**	2.97	2.44	**82**

It will be observed, in the first place, that at the middle of the shaft the mean of the two diameters at the upper flattening in the Munsee is smaller in both sexes and on both sides than that in either the whites or the negroes, thus indicating that the bone is more slender.

The most striking points brought out by the data are, however, those relating to the degree of the flattening in the subtrochanteric region in the different racial groups. The Munsee femora are decidedly flatter than those of the whites, which in turn are slightly flatter than those of the negro. As a result the platymeric index in the Munsee is considerably below that in both the other races.

Taking the two diameters separately it will be observed that the diameter maximum or breadth is frequently larger in the left than in the right femur. This is true in both sexes among the Munsee and in the white females and negro males. In the white males the measurement is equal on the two sides, and in the negro females it is slightly larger on the right than on the left. In all probability the tendency of the left femur to be slightly broader than the right at the subtrochanteric flattening is quite universal.

The lateral diameter or thickness is also slightly larger in the left femur in nearly all the racial and sex groups, but the excess is less than with the breadth. It is thus evident that the left femur at this point is in general slightly stronger than the right. But, as already indicated, the mean excess in breadth is mostly greater than that in thickness, the result of which in most of the groups is a slightly lower platymeric index on the left side.

As to sexes, the platymeric index in the Munsee is slightly higher on both sides in the females than in the males. This is exceptional for Indians, the condition being usually the reverse. In the United States whites and United States negroes, and in Indian tribes other than the Munsee examined by the writer, the male femur as a rule gives a somewhat higher average index on both sides than the female, indicating that the flattening in the male is of lesser degree.

As to the sides, in the majority of the groups, and particularly in the Munsee, the right platymeric index is slightly higher than the left. In the Arkansas and Louisiana Indians it was very nearly equal on the two sides in both sexes. In the series of United States white males used here for comparison, and in the United States negro females, the right index is higher. Evidently, while the preponderant tendency is for the right platymeric index to be slightly higher than the left, there are not infrequent exceptions, but the differences are not of much importance.

To summarize, it may be stated that at the subtrochanteric flattening the Munsee femur shows a decidedly greater compression than the femora of the United States whites, and especially those of United States negroes; it shows a slightly greater relative flatness in the male than in the female, which is exceptional; and in the majority of cases it is relatively slightly flatter on the left than on the right side of the body.

These details may seem rather involved, and perhaps in some instances of no great consequence. But when at some time we shall be able to examine scores of records where we have now but few, and each series of records extending to hundreds instead of to only tens of specimens, the above points will assume a definite morphological importance, demonstrating on the one side the presence of astonishingly uniform and persistent laws relating even to secondary characteristics of bones, and, on the other, to clear, conspicuous, racial sexual and other group differences.

SPECIAL CHARACTERISTICS OF THE FEMORA

As to special descriptive characteristics of the Munsee femora, special attention was paid to the linea aspera, the shape of the shaft at middle, and the presence and development of the third trochanter.

Linea aspera.—The linea aspera was found to be generally well developed, but seldom high and in no case excessively rough, indicating well but not exceptionally developed musculature.

Shape of the shaft.—As to the shape of the shaft at middle, in a fourth of the males and in nearly half the females this was found to be more or less prismatic, and in 9 per cent of the males and 7.5 per cent of the females, plano-convex; the remainder of the bones showing, with one exception, intermediary or not well-defined shapes. None of the femora present the cylindrical (juvenile) type, or type 4 (anterior surface divided in two by a long vertical ridge), and in but one bone is the shape clearly elliptical. Among the whites the last named (elliptical) form is much more common, while the plano-convex type is less frequent than in the Indians.[1]

Third trochanter.—Respecting the third trochanter, this presents itself as a more or less marked ridge, or an oblong tuberosity, or a round tuberosity; and in any of these forms it may be slight, medium, or pronounced. In some instances there will be found a depression, instead of an elevation, in the bone at or near this locality. These different forms have no separate morphological significance. They all serve for or are due to the attachment of the gluteus maximus muscle, and merge into each other by transitional stages. In the Munsee, conditions in regard to the third trochanter were as follows:

L. MUNSEE AND WHITE FEMORA: THIRD TROCHANTER OR GLUTEAL TUBEROSITY

	Subjects	Third trochanter absent	Ridge		Oblong tuberosity		Round tuberosity	
			Moderate	Pronounced	Moderate	Pronounced	Moderate	Pronounced
Munsee:		*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Male	(17)	30	40	.....	26	.....	6	.....
Female	(14)	32	36	.....	22	3.5	3.5	3.5
Whites:								
Male	(200)	43	32	4.5	9	5	3.5	3
Female	(120)	45	31	5	12.5	1.7	5	.....

It is here seen that the third trochanter is strictly absent in less than a third of the male as well as of the female bones of the Munsee; a small to pronounced oblong tuberosity exists in 26 per cent of the males, and practically the same proportion (25.5 per cent) of the females, while a rounded tuberosity is found in 6 per cent of the males and in 7 per cent of the females. Among the previously reported Arkansas and Louisiana Indian femora, the frequency of the third trochanter in most of its forms was somewhat greater. Among the ordinary American whites, it will be observed from the above figures, there is in both sexes a more frequent complete absence of the third

[1] Compare *Arkansas and Louisiana Femora*, op. cit., p. 217.

trochanter in any form than in the Munsee; there is less frequency of the moderate ridge and moderate oblong tuberosity; and a greater frequency of pronounced grades of both ridge and oblong tuberosity, while the occurrence of round tuberosity is about even in the two groups. Subtrochanteric fossa in place of or beside a prominence was observed in Munsee adults in five cases—four males and one female. In adolescents it was more frequent.

Tibia

The results of the several measurements obtained on the Munsee tibiæ are shown below.

The mean length of the bone, taking the two sides together, is 38.5 cm. in the males and 35.3 cm. in the females. The length of the female bone stands to that of the male as 91.7 to 100, which is lower than was obtained on the tibiæ from Louisiana, where the proportion was 93.7, or than that prevailing among whites, where it is even slightly higher (94.6 in miscellaneous New York whites). The Munsee female tibiæ are therefore relatively somewhat short, paralleling to some extent what was found with reference to the radius. Lesser differences of the same nature is found in probably all larger racial groups. Why the feature should be more pronounced in the Munsee than in other Indians is difficult of explanation; but, as will be seen later, this is not the only peculiarity of the female Munsee tibiæ.

LI. MUNSEE: TIBIÆ

MALES

	Number of bones	Length*	Number of cases	Diameter† antero-posterior at middle (a)	Diameter ‡ lateral at middle (b)	Index of shaft at middle $\frac{b \times 100}{a}$	Number of cases	Tibio-femoral index $\frac{T \times 100}{F}$
		Right						
Average:		*cm.*		*cm.*	*cm.*			
Paired	(11)	**38.3**	(14)	**3.28**	**2.14**	**65.4**	(19)	**84.4**
Total present	(12)	38.5	(14)	3.28	2.14	65.4	(10)	84.6
Minimum	(12)	36	(14)	3.05	1.95	56.3	(10)	81.1
Maximum	(12)	40.5	(14)	3.55	2.4	69.7	(10)	86.9
		Left						
Average:								
Paired	(11)	**38.6**	(14)	**3.25**	**2.16**	**66.6**	(9)	**84.5**
Total present	(12)	38.8	(15)	3.23	2.16	67.1	(11)	84.9
Minimum	(12)	36.7	(15)	2.8	1.95	54.9	(11)	79.4
Maximum	(12)	40.9	(15)	3.55	2.4	80.4	(11)	90.0

* On Broca's *planche ostéometrique*, with the spine in the opening of the vertical portion of the instrument and the condyles applied to the board on both sides of the opening, the rest of the bone lying immobile on the horizontal board.

† Maximum.

‡ With anterior border of the bone midway between the two branches of the compass that are applied to the sides of the bone.

LI. MUNSEE: TIBIÆ—Continued

FEMALES

	Right							
	Number of bones	Length	Number of cases	Diameter antero-posterior at middle (a)	Diameter lateral at middle (b)	Index of shaft at middle $\frac{b \times 100}{a}$	Number of cases	Tibio-femoral index $\frac{T \times 100}{F}$
Average:		*cm.*		*cm.*	*cm.*			
Paired	(13)	**35.3**	(13)	**2.6**	**1.98**	**76.1**	(12)	**83.7**
Total present	(14)	35.3	(13)	2.6	1.98	76.1	(12)	83.7
Minimum	(13)	32.4	(13)	2.25	1.65	70.2	(12)	81.4
Maximum	(13)	37.1	(13)	2.85	2.3	86.7	(12)	87.7
	Left							
Average:								
Paired	(13)	**35.2**	(13)	**2.6**	**1.93**	**74.5**	(12)	**83.7**
Total present	(14)	35.2	(14)	2.64	1.96	74.6	(12)	83.7
Minimum	(14)	32.4	(14)	2.25	1.5	58.8	(12)	81.5
Maximum	(14)	36.7	(14)	2.8	2.35	82.2	(12)	86.1

As to the two sides, the Munsee left tibia averages somewhat longer in the males than the right, which on the whole in slight measure is also the condition among the whites, but to which individual and even group exceptions are not infrequent. In the Munsee females, on the other hand, the average length of the left tibia is slightly less (by 1 mm.) than that of the right.

The percental relation of the length of the tibia with the bicondylar length of the femur, or the *tibio-femoral index*, averages in whites approximately 82 in the males and slightly less in the females. In the Munsee it is somewhat more elevated in both sexes. As in the whites and other racial groups, a moderate excess of the male over the female index is present on both sides, indicating the slightly greater relative shortness of the female leg bones aforementioned. Judging from the available data on the tibio-femoral index among other Indians,[1] that in the Munsee comes very near to the average of the race.

The strength of the Munsee tibia (and the same is probably true of many other Indian tribes) is surprising, being nearer that of the whites than is the case with either the humerus or the femur. The antero-posterior diameter of the Indian tibia is, in fact, in almost all the Indian groups somewhat greater than in the whites. The index of the shaft is invariably and quite perceptibly lower in the Indians

[1] Compare S. Bello y Rodriguez, *Le fémur et le tibia, chez l'homme et les anthropoïdes*, *Thèse*, Paris, 1909, p. 109.

than in the whites, excepting the Munsee females, in whom, curiously enough, the index is relatively quite high, exceeding both that of the other Indians available for comparison and of the whites. No satisfactory explanation of this and other exceptional features of the Munsee tibia can be given. The condition can scarcely be regarded as accidental, for on examining the individual shaft indexes it is observed that in but one of the female bones is the index below 60, giving thus a pronounced platycnemy; in five it is between 60 and 70; in ten between 70 and 80, and in no fewer than eleven it rises to 80 or over. Among the twenty-nine male Munsee tibiæ there is but one that gives a shaft index of slightly above 80.

LII. MEAN DIMENSIONS OF THE TIBIA (THE TWO SIDES BEING TAKEN TOGETHER) IN THE MUNSEE AND OTHER INDIANS, AND IN WHITES

	Length	Mean diameter antero-posterior at middle* (a)	Mean diameter lateral at middle* (b)	Module†	Index of shaft at middle $\frac{b \times 100}{a}$	Tibio-femoral index $\frac{T \times 100}{F}$
Males:	*cm.*	*cm.*	*cm.*	*cm.*		
Munsee	38.45	3.27	2.15	2.71	66	84.45
Arkansas	38.4	3.35	2.18	2.76	65.15	82.35
Louisiana	37.1	3.3	2.2	2.75	68.47	84.25
Whites (miscellaneous)	36.5	3.14	2.22	2.68	71.1	82
Females:						
Munsee	35.25	2.6	1.96	2.28	75.3	83.7
Arkansas	33.15	2.8	1.98	2.39	69.25	82.35
Louisiana	34.75	2.9	1.88	2.39	64.2	83.9
Whites (miscellaneous)	34.56	2.65	1.96	2.3	71.9	81.6

*$\frac{\text{Right} + \text{left}}{2}$ †$\frac{\text{Diameter antero-posterior} + \text{diameter lateral, right and left.}}{4}$

The Munsee tibiæ, barring a few moderate inflammatory lesions referred to in another section, are normal throughout and free from anomalies. The inclination of the head is in no case especially marked.

As to the shape of the shaft at middle, conditions were found as follows:

LIII. MUNSEE TIBIÆ: SHAPE OF SHAFT AT MIDDLE*

	1	2	3	4	5	6	I
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Males	11	13.5	7	24	3.5	.....	41
Females	44	11	.....	15	3.5	.....	26

*1=ordinary prismatic; 2=lateral prismatic; 3=external surface concave; 4=posterior surface divided into two by vertical ridge; 5=interior border indistinct, posterior half of bone oval; 6=plano-convex; I=indefinite.

It is interesting to note that in the female Munsee tibia, type 1 is decidedly frequent and much more common than in the males; type 3, which is usually associated with considerably developed leg muscles, is absent in the females; type 4 is relatively frequent in both sexes; type 6 is wholly absent.

In the next table are shown for comparison the proportions of the different types found by the author in different racial groups. For the purpose of elucidating these data, both sexes are taken together. It is seen that well-differentiated type 1 is most common in the Indians; that type 2 is relatively scarce in the negro; type 3, most common in the white (laboring class), was not met with in a pronounced form in the negro; type 4 is decidedly more common in the Indian than in the other two races; and type 6, absent in the Indians and rare in the whites, is fairly frequent in the negro. These differences show that the shape of the shaft of the tibia, as that of the femur, humerus, and other bones, has a considerable racial significance, which, as our data are increased, will doubtless become accentuated.

LIV. COMPARISON OF MUNSEE AND OTHER INDIAN WITH WHITE AND NEGRO TIBIÆ WITH REFERENCE TO SHAPE OF SHAFT AT MIDDLE*

Types	1	2	3	4	5	6	I
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Munsee (all—56)	27	12	3.5	20	3.5	.....	34
Arkansas and Louisiana	.....	.....	.....	.....	.....	.....	.....
Miscellaneous whites (1975)	18	15	9	5	.5	2	45
United States negroes (55)	20	9	.....	7	7	11	45

* For the significance of the denominations see the note to the preceding table.

Fibula

While of secondary importance, the fibula often presents interesting features which make it worthy of closer attention than it usually receives. One of these features concerns its length on the two sides of the body, which, in some Indians at least, is more uniform than that of its companion bone, the tibia. It was found so by the writer in the skeletal collections from Arkansas and Louisiana mounds, and the feature appears again in the Munsee. The slight differences presented by the Munsee fibulæ in this particular harmonize with those of the tibiæ.

The percental relation of the female to the male fibula averages 93.5 (the male bone = 100), while in the tibia it was only as 91.7 to 100.[1] This anomaly is due to the unexplained relative shortness of the female Munsee tibiæ.

[1] Taking only cases where all four bones of one body are available for measurement, we obtain 92 for the relation of female to male tibiæ and 94.6 for that of the fibulæ, numbers which stand to each other very much as do those above given.

As to the shape of the shaft, which in the fibula differs more than in any other bone, the prevalent tendency, as in the Arkansas and Louisiana specimens, is toward type 2, or the lateral prismatic; a good many of the bones, however, show also a more or less marked fluting of one or two of the surfaces. The details are given in the following table:

LV. MUNSEE FIBULA: LENGTH

	Males				Females			
	Right		Left		Right		Left	
	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum.
Average:		*cm.*		*cm.*		*cm.*		*cm.*
Paired	(5)	**36.9**	(5)	**37**	(4)	**34.9**	(4)	**34.8**
All	(6)	37.1	(6)	37.1	(9)	34.7	(7)	34.7
Minima	(6)	35.3	(6)	35.8	(9)	32	(7)	31.8
Maxima	(6)	39	(6)	38.8	(9)	36.8	(7)	36.9

LVI. MUNSEE AND OTHER INDIAN FIBULÆ—SHAPE OF SHAFT AT MIDDLE*

Types [1]	Males						Females					
	1	2 and 2a	3	5	6	4	1	2	3	5	6	4
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Munsee	4	48	4	15	11	18	5	32	18	5	14	27
Arkansas and Louisiana	27	40	9	9	3	12	17	42	4	4	17	17

*1=Ordinary quadrilateral, approaching prismatic; anterior surface nearly absent to moderate; posterior surface facing directly backward or nearly so. 2=Lateral prismatic; posterior surface facing backward and inward; medial surface much less in area than lateral; anterior surface narrow to broad. 2a=Relation between medial and lateral surface reversed, the latter being the narrower. 3=Medial surface fluted. 4=Lateral surface differentiated into two surfaces. 5=Lateral surface fluted. 6=Both medial and lateral surfaces fluted.

Clavicle

The Munsee clavicle, in paired bones and in average, measures 15.3 cm. in length on the right and 15.25 cm. on the left in the males, and 13.7 cm. on the right with 13.9 cm. on the left in the females. This gives the ratio of 90.4 (female) to 100 (male), which is lower than that in any of the long-bones and indicates a relative shortness of the clavicle in the Munsee females.

The right clavicle is very slightly longer than the left in the male, but is perceptibly shorter than the left in the female skeletons. One pair of the male and a pair of the female bones show pronounced curves; otherwise there is nothing special. The strength of the bones is moderate to medium; none is massive.

LVII. MUNSEE CLAVICLE: LENGTH

	Males				Females			
	Right		Left		Right		Left	
	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum
Average:		*cm.*		*cm.*		*cm.*		*cm.*
Paired	(8)	**15.35**	(8)	**15.3**	(9)	**13.7**	(9)	**13.9**
All	(9)	15.4	(10)	15.3	(11)	13.8		
Minima	(9)	14.4	(10)	14.2	(11)	12.7	(9)	12.9
Maxima	(9)	16.5	(10)	16.3	(11)	14.9	(9)	15.6

STERNUM

The total number of sterna present is 14, 8 males and 6 females. In 13 of these specimens the manubrium is completely detached, which in general is the most usual condition, while in the 14th there is partial attachment. Much the same condition was found by the writer in the Indian sterna from Arkansas and Louisiana.

The measurements of the sternum, given in the next table, are found to be moderate throughout. Unfortunately there are few available measurements of the sternum in other races for comparison.

LVIII. MUNSEE STERNUM: DIMENSIONS

MALES

	Number of bones	Total length (less xiphoid and epi-sternals)* (a)	Greatest breadth of body (b)	Sternal Index $\frac{b \times 100}{a}$	Maximum thickness of body
Average:		*cm.*	*cm.*		*cm.*
Paired	(6)	**15.7**	**3.7**	**23.8**	**1.2**
All		15.7	3.7	23.8	1.2
Maxima	All.	14.6	3.4	21.1	1
Maxima	All.	17.5	4.2	25.8	1.3

FEMALES

Average:					
Paired	(6)	**13.8**	**3.5**	**25.7**	**0.9**
Average	All.	13.8	3.5	25.7	0.9
Minima	All.	12.8	2.8	21.5	0.8
Maxima	All.	16.2	3.9	30.5	1

* Where present and attached to upper sternal tubercle (three instances).

As to the rib facets, two of the 11 sterna in which the notches can be counted show seven on each side; in female skeleton no. 285,307, with normal number of ribs, there are seven notches on the right and but six on the left; in female no. 285,311, with 24 regular ribs

and a right cervical, there are six facets on the right and seven on the left, and all the facets on the right side are situated perceptibly higher than those on the opposite side of the bone; in four instances there are six facets on each side; in two (male no. 285,301 and female no. 285,330, the former with the normal number of ribs and the latter uncertain) the sternum shows six facets on the right and but five on the left side; finally, in female no. 285,310, with 24 ribs, we find but five sternal facets on each side—this subject, however, was not fully adult. These details show that there are considerable irregularities in the sternal facets among the Munsee, even in the presence of the normal number of ribs.

The antero-posterior curvature of the Munsee sternum ranges from slight to moderate. The xiphoid appendix is attached to the body of the sternum in only one instance—a male. In one male (no. 285,314) the left clavicular facet is considerably larger than the right.

Three of the male and one female sterna show on one or both sides attached episternal tubercles. In three of the cases the anomaly is unilateral—twice left and once right—while in one of the males it is bilateral, but the tubercle is more pronounced on the left.

The breadth-length index of the sternum shows considerable individual variation in both sexes, but on the average it is higher in the females, the bone in this sex being relatively shorter.

Scapula

General features

This is one of the most interesting bones of the body, and although it has been reported on by a number of observers, it presents a variety of features that deserve further study. It is a bone which in all particulars shows great individual variation, but on close scrutiny it is found that these variations differ more or less from group to group and are therefore of anthropological importance, and that they are subject to certain laws which evidently are universal to human kind.

In collections derived from graves, such as those of the Munsee, the scapulæ, on account of their frailness, are often damaged, so that relatively few specimens are available for examination. There are nevertheless in the Munsee collection five male and nine female bones in fair condition, and their study gives some satisfactory results. To contrast these results properly the writer presents in the following table data not only of the Munsee, but also those on several other Indian groups as well as on the whites and the United States negroes.

LIX. MUNSEE SCAPULÆ: COMPARISON

	Specimens	Total height	Infraspinous height	Breadth	Scapular index	Infraspinous index
		cm.	*cm.*	*cm.*		
MALES						
Munsee	(4)	15.2	11.2	10.6	69.5	94.2
Southern Utah cliff-dwellers	(18)	15.1	11.6	10.15	67.4	87.7
Pima and Pueblo	(5)	15.5	12	11.05	71	93
Various Mexican Indians	(9)	15.8	12	10.4	65.5	86.6
Indians, Peru	(55)	15.83	12	10.17	64.2	84.8
Indians, Peru (Livon) [1]	(17)	15.1	11.3	10	63.8	85.6
United States whites (various nationalities)	(70)	16.4	12.25	10.7	65.3	87.3
Whites (Livon) [1]	(73)	16.8	12.4	10.6	63	85.5
United States negroes	(46)	16.25	11.6	10.9	66.8	92.1
FEMALES						
Munsee	(9)	13.9	10.4	9.9	70.7	95.3
Southern Utah cliff-dwellers	(10)	13.7	10.25	9.7	70.6	94.2
Pima and Pueblo	(5)	13.8	10.25	9.95	72	97
Various Mexican Indians	(12)	13.75	10.25	9.75	70.7	94.9
Mexican Indians [2] (Livon) [1]	(2)	13.17	10.16	10.17	77.2	100
Indians, Peru	(39)	13.78	10.47	9.17	66.5	87.5
Indians, Peru (Livon) [1]	(6)	13.5	10	9	67	88.4
United States whites (various nationalities)	(44)	14.4	10.9	9.6	66.7	88.4
Whites (Livon) [1]	[3] (51)	(13.5)	(10.25)	(9.1)	67.5	88.8
United States negroes	(18)	14.2	10.2	9.25	65	90.7

[1] M. Livon, *De l'omoplate*, etc., *Thèse*, Paris, 1879, pp. 41–42.

[2] One subject.

[3] The averages of the measurements are exceptionally small in this series.

The above data show that the Indian scapula is on the whole somewhat smaller than that of either the whites or the American negroes, except in the females, where the bone, while shorter, is slightly broader than that in the other two races. The Munsee scapulæ compare fairly well with those of other Indian tribes, the apparent differences being doubtless due in a measure to the small number of specimens.

The scapular index in the Munsee is high, indicating that the shortness of the bone is both absolute and relative. The different Indian tribes offer considerable variation in this respect, but, as will be noted, except in the Peruvians, the index in all is above that of the whites and in the majority of cases even above that of the negroes. These high scapular indexes in the Indian approximate those of the anthropoid apes, but it remains to be determined if the phenomenon in the two genera is homologous.

In the female Munsee the scapular index is perceptibly higher than in the males, and this characteristic, owing to a relatively greater breadth of this bone in the females, is common to all the other given groups, excepting the negro.

The infraspinous index is also high in the Munsee as compared with other Indians, the whites, and even the negroes. This is particularly the case in the males, in whom the infraspinous height is exceptionally low.

The female index again exceeds that of the males in the Munsee and in all other Indian groups, as well as in the whites, owing to the relatively greater breadth of the female scapula. The negroes show here once more an exception to the rule, and it would be interesting to trace how far this peculiarity may be prevalent in that race.

High indexes, such as those of the Indians, have been reported by Livon, Broca, Ranke, and others,[1] among some of the African negroes, the Melanesians, the Malays, the Guanches, and the Egyptians.

DESCRIPTIVE FEATURES

The principal points for visual observation to which attention has been given in this instance were (*a*) the shape of the scapula as a whole, with the development of the *teres major* region; (*b*) the form of the superior border of the bone; and (*c*) the development of the notch in the superior border.

Type of body.—The scapula as a whole may be more or less neatly triangular or wedge-shaped, which form will be designated as type 1. Again, it may be more acutely wedge-shaped, with both its axillary and vertebral border markedly concave, a type which the author classes as 3.[2] It may be quadrilateral, type 4, with the axillary border augmented by a shorter but well-marked inferior border, due to a development of a process or angle by the influence of the *teres major* muscle. It may be pentagonal, when the preceding type is augmented by a distinct angle in the axillary border at or above the spine, which divides it into two well-marked borders—type 5. Finally, we may have a shape resembling that in many lower mammals and characterized by marked convexity of the axillary border, which will be referred to as type 6.

Among the 19 Munsee scapulæ, a large majority show types 4 and 5, the few remaining specimens approaching type 1. There is no instance of the relatively rare type 3, nor of type 6, which is quite common in other Indians, particularly the males. The following table gives several series of records for comparison, including that of

[1] For literature, see R. Martin, *Lehrbuch der Anthropologie*, 1914; also A. C. Schück, Das Schulterblatt des Menschen und der Anthropoiden, *Mitteil. Anthr. Ges. Wien*, XL, 1910.

The few published reports on Indian scapulæ give scapular and infraspinous indexes as follows: Matiegka (Santa Rosa, Cal., Indians), 64.9; 90.8; Dorsey (Northwest Coast), 65.1; 83.2 (?); Martin (Fuegians), 65.4; 90.8; Martin (Peruvians), 66.6; 89; Matthews (Ancient Pueblos of Arizona), 71.1.

In the anthropoid apes the scapular index averages between 69 and 76 (Livon); but the infraspinous index is enormous, ranging from slightly over 100 in the orang to 156 in the chimpanzee.

[2] This form and various approaches to it have been referred to as "scaphoid" by Graves (*Jour. Amer. Med. Asso.*, 1910, p. 12), and wrongly attributed to faulty development of the body.

United States whites. Analysis of the data shows some marked sexual as well as racial differences, the full value of which can not, however, be determined in the absence of more ample records. It is very plain, however, that type 1, or a close approach to it, and types 3 and 5 are, on the whole, more common in the females than in the males; while type 6 is decidedly more frequent in the males. Type 3 is relatively frequent in the whites, type 5 relatively scarce. In all probability the Indians differ considerably among themselves with respect to the shape of the scapulæ, as shown by the Munsee and Peruvian males, though the two series of specimens are very unequal in numbers. Minor differences in records of this nature can not be given any weight, for naturally the matter of classification of the different shapes is less perfect than that of accurate measurements.

LX. THE FORM OF THE SCAPULA: MUNSEE AND COMPARATIVE

MALES

People	Specimens	Indefinite	Type 1 or near 1	Type 3	Type 4*	Type 5	near 5	Type 6	near 6
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Munsee	(8)	.....	12	.....	38	50	.....	.....	.....
Peruvian Indians	(57)	10.5	21	3.5	5	5	.....	37	17.5
United States whites (miscellaneous)	(168)	4.8	28	9.5	9.5	17.9	7.7	14.3	8.3
United States negroes	(40)	.....	22.5	5	17.5	32	2.5	15	5

FEMALES

Munsee	(11)	.....	27	.....	27	27	18	.....	.....
Peruvian Indians	(38)	.....	29	5	5	39	11	8	3
United States whites (miscellaneous)	(118)	1.7	32.2	13.6	15.2	16.1	8.5	8.5	4.2
United States negroes	(16)	.....	.....	25	19	37.5	6	.....	12.5

* The fourth, or *teres major*, border is present also, of course, in all instances of type 5, and in most specimens of type 4. It is particularly common in the Peruvian scapulæ.

Superior border.—The form of the superior border of the scapula can be divided for purposes of description into (1) horizontal or slightly rising and forming a right or nearly right angle with a vertical line passing upward from the base of the coracoid; (2) moderately rising or oblique and straight or but slightly curved, forming with the coracoid vertical an angle of between 85 and 55°; (3) markedly oblique, forming with the coracoid vertical an angle of less than 55°; (4) angular or deep saddle-shaped, which is of special importance anthropologically; and (5) markedly concave or semilunar (see pl. 25). In rare instances a form (6) occurs, in which the border is low and moderately convex, and another (7) in which it is markedly

a THE SEVENTH CERVICAL VERTEBRA OF FEMALE MUNSEE SKELETON NO. 285,311, U.S.N.M., WITH A CERVICAL RIB

b SCAPULA OF FEMALE MUNSEE SKELETON NO. 285,328, U.S.N.M., SHOWING SEMILUNAR SHAPE OF THE SUPERIOR BORDER

concavo-convex; and, finally, there occurs now and then an indeterminate form (I), which can not be classified.

LXI. FORM OF THE SUPERIOR BORDER OF THE SCAPULA IN THE MUNSEE AND IN OTHER RACIAL GROUPS

Group	Specimens	Types*						
		1	2	3	4 and near 4	5 and near 5	6	7
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Munsee	(16)	.....	.....	31.2	25	43.8	.....	.....
Northwest Coast Indians	(82)	6.7	27.5	35.4	25.6	4.9	.....	.....
Southern Utah cliff-dwellers	(53)	16.9	54.7	20.7	7.6	.....	.....	.....
Mexican Indians	(41)	37.8	39.1	15.8	4.8	2.4	.....	.....
Peruvian Indians	(95)	.....	37.9	15.8	17.9	26.3	.....	(†)
United States whites (miscellaneous)	(1,032)	15	48.5	11	8.2	16.7	0.3	0.5

*Type 1=horizontal or but slightly inclined; 2=moderate to medium obliquity; 3=pronounced obliquity; 4=deep saddle-shaped; 5=semilunar; 6=convex; 7=markedly concavo-convex.

†In two specimens (2 per cent) the form of the border was unclassifiable.

The data obtained in this particular on the Munsee and other Indian groups, as well as on a large series of whites, are given in the next table. It is very evident that racial and tribal differences of some importance exist in the shape of the border. Among the whites its most common form is type 2, or moderate to medium oblique, pronounced obliquity being infrequent; types 4 and 5 occur but rarely. In the Munsee there is a curious but doubtless local prevalence of the semilunar type 5, the next most frequent form being that of pronounced obliquity; and one-fourth of the cases show the saddle form or an approach to it. Among other Indians the conditions differ. The cliff-dwellers of southern Utah come, on the whole, near to the whites; among the Mexican Indians low borders prevail, while among the Northwest Coast tribes we find the opposite condition—high borders, with a relative frequency of the angular or saddle-shaped type (4 or near 4). It is an interesting fact that the last named form (4) is frequent and often highly developed in the Eskimo.

The question occurs as to how the form of the superior border differs in the two sexes and on the two sides, and the next table throws some light on these problems. It will be observed that among the Indians the differences between the males and the females are not striking, though there is a tendency toward greater obliquity of the border in the males. Among the whites, types 1 and 4 are more common in the females than in the males; type 2 occurs about the same number of times in the two sexes, while types 3 and 5 are more frequent in the males.

LXII. FORM OF THE SUPERIOR BORDER IN MUNSEE AND OTHER INDIAN SCAPULÆ ACCORDING TO SEX AND SIDE

Sex and side	Specimens	Types						
		1	2	3	4	2–4	3–4	5
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Males (both sides)	(84)	11.9	34.5	33.3	5.9	3.6	3.6	71
Females (both sides)	(110)	20	35.5	21.8	5.5	4.5	7.3	5.5
Right (both sexes)	(104)	18.3	33.6	22.1	8.7	5.8	6.7	4.8
Left (both sexes)	(90)	14.4	37.8	31.1	2.2	2.2	4.5	7.8

As to the two sides, we find that a slightly lesser tendency to marked obliquity of the border exists in the left than in the right scapula; while the bone of the right side shows greater frequency of the angular or deep saddle-shaped (type 4 or near 4).

Scapular notch.—The notch in the scapular border, at the base of the coracoid, which, as is well known, transmits the suprascapular nerve, may be absent, shallow, medium deep, or converted into a complete foramen. Among the 21 scapulæ of the Munsee and 431 of whites, the conditions in this respect, with reference to sex and side, are as follows:

LXIII. SCAPULAR NOTCH IN THE MUNSEE AND IN WHITES

Sex	Specimens	Form 1 (absent)	Form 2 (shallow)	Form 3 (medium)	Form 4 (deep)	Form 5 (complete foramen)
Munsee:		*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Male	(9)	.....	22	.....	67	11
Female	(12)	8	66	.....	16	.....
Peruvian Indians:						
Male	(57)	3.5	15.8	70.2	10.5	.....
Female	(37)	5.4	24.3	67.6	2.7	.....
Whites:						
Male	(267)	0.7	15.4	57.3	22.8	3.7
Female	(164)	3.7	15.2	64	16	1.2
Side						
Munsee:						
Right side	(11)	.....	40	.....	50	20
Left side	(10)	10	60	.....	30	.....
Peruvian Indians:						
Right side	(50)	4	22	68	6	.....
Left side	(44)	4.5	15.9	70.5	9.1	.....
Whites:						
Right side	(215)	2.3	14	62.3	18.6	2.8
Left side	(216)	1.4	17.6	56.5	21.8	2.8

It is plain that while among the whites the medium form of the notch very largely predominates, among the Munsee this form is absent, though this is doubtless accidental to some extent at least, owing to the relatively small number of specimens. The complete foramen is much more frequent in the Munsee than in the whites.

As to the sexes, in both the Munsee and the whites there is observable a predominance of the deeper forms and the complete foramen among the males, and of the shallower forms and the complete absence of the notch in the females.

As to sides, no characteristic differences in the notch appear.

Ribs

Owing to careful collection, a large majority of the ribs from the Munsee cemetery were preserved and are with their respective skeletons, thus facilitating their study. Furthermore, we possess nearly all the bones of the spines, which show the rib facets.

The ribs present are marked throughout by medium and normal development. Fractures are very rare, there being only two (in one subject) among the 166 ribs of the males, and but one in 196 ribs of the females.[1] This speaks well for the peaceful life of the community.

The number of ribs is normal (24) in every one of the adult males; among the females, however, there are two interesting anomalies—namely: In female no. 285,311 there are 25 ribs, the additional one being well developed, 6.5 cm. long, right cervical; this rib approaches in form the ordinary first rib, while both the latter are unusually long, being about one-third longer than any of the other female first ribs in the series. The spinal formula in this case, curiously enough, is only 7–12–4, the fifth lumbar being attached to the sacrum. The second anomaly is present in female skeleton no. 285,321, with the spinal formula of 7–11–5, and consists of the absence of the last pair of ribs. The congenitally absent dorsal vertebra is the twelfth.

The first rib generally repays special examination, particularly as to its shape. This shows three main types—(1) the curved; (2) the mono-angular or pistol-shaped, with a nearly straight neck and straight body; and (3) the biangular, in which, besides the angle between the neck and the body, there is another distinct angle in the body itself, so that the rib appears as if it consisted of three segments. The relative frequency of these forms the author has reason to believe will be found to differ in the race and sex, but as a rule it is the same on both sides. In the Munsee the shapes found were as follows:

LXIV. MUNSEE: SHAPE OF RIBS

	Subjects	Type 1 or near 1	Type 2 or near 2	Type 3 or near 3
		Per cent	*Per cent*	*Per cent*
Males	(10)	70	20	10
Females	(12)	75	25	.....

[1] Or 8 in 1,000. Among the whites, dissecting-room material, in a total of 16,300 ribs examined, the author found fractures in the first rib in the proportion of 4 in 1,000; in the second rib, 20 in 1,000; and in the ribs below the second, 49.3 in 1,000.

The biangular form, which is fairly frequent in whites, is nearly absent in the Munsee, the one pair in the males presenting merely an approach to the form.

Spine

The entire number of vertebræ of 21 skeletons has been preserved, thus affording an excellent opportunity for studying the numerical relations of the bones, as well as other particulars.

The bones are entirely normal, with the exception of the frequent slightly to moderately developed marginal exostoses (which, unless premature or excessive, the author regards more and more as the usual manifestations of age rather than of disease), and one case of advanced spondylitis deformans, resulting in fusion of the lower half of the spine and the sacrum. The bones show moderate to medium development and are free from gross anomalies.

As to numbers, the cervical vertebræ show but one exception to the normal—namely, in male skeleton no. 285,326, in which only six vertebræ are present in this region. The locus of the (congenitally) missing one is between the third and the sixth, its exact identity being difficult to determine. In one of the females (no. 285,311) the seventh cervical, as already mentioned, gives attachment on the right to a well developed cervical rib (pl. 25, *a*).

The vertebræ of the dorsal region are also normal in number in all cases but one, which has been mentioned in connection with the ribs; it is no. 285,321, female, and presents a congenital absence of the twelfth vertebra.

The numbers of the lumbar vertebræ show frequent variation. In two of the ten males and two of the eleven females there are but four lumbars, while in one female there are six. In detail we find the following abnormalities:

In male skeleton no. 285,316, the fifth lumbar shows a transitional, sacral form, though not attached to the sacrum, and it also presents a detachment of the posterior part of its neural arch.

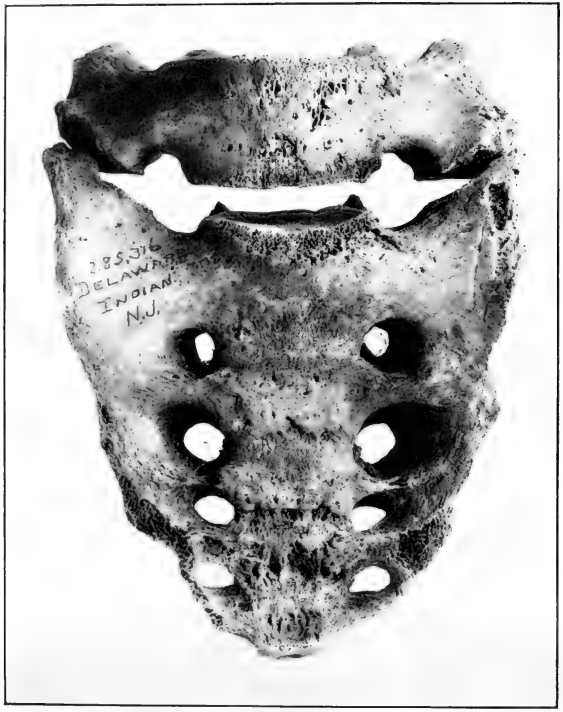
In male no. 285,326, one of the lumbar vertebræ between the second and fifth is absent congenitally.

In female no. 285,310, one of the lumbar vertebræ is missing congenitally; the last lumbar in this case is in form like the fifth; the upper segment of the sacrum is somewhat lumbar-like, but the bone possesses only five segments and a normal curvature.

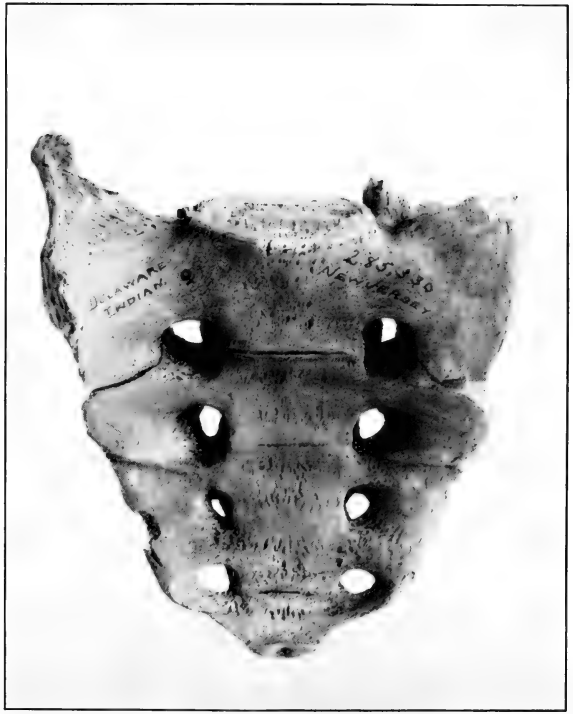
In female no. 285,311, with four lumbar vertebræ, the fifth, somewhat modified, is attached to the sacrum (pl. 27).

In female no. 285,326, where we have six lumbar vertebræ, the last, like the lowest lumbar in male no. 285,316, shows a separation of the posterior portion of the neural arch.

In male no. 285,308, the twelfth dorsal and the first lumbar show complete and evidently early non-pathological fusion.



a MALE MUNSEE SACRUM SHOWING BILATERAL ARTICULATION WITH AN EXTRA SEGMENT INTRODUCED BETWEEN THE LAST LUMBAR AND THE SACRUM



b FEMALE MUNSEE SACRUM SHOWING BILATERAL ARTICULATION WITH EXTRA SEGMENT

Sacrum

GENERAL OBSERVATIONS AND MEASUREMENTS

The total number of serviceable specimens of sacra is 17, only 13 of which, however (six males and seven females), are five-segment bones and sufficiently well preserved to afford the necessary measurements. The results show that, as usual, the male sacrum, while in breadth nearly equal to that of the female, is perceptibly higher, in consequence of which the sacral index, or percental relation of breadth to height, is lower in the males.

A comparison of the Munsee sacra with those of other Indians and United States whites shows marked agreement both in size and in the relative proportions of the bone in the males, but less in the females. As will be seen by the next table, the Munsee female sacrum is somewhat lower than that of any of the other series.[1]

LXV. MUNSEE SACRUM: DIMENSIONS

	Males				Females			
	Number of specimens	Height*	Breadth, maximum	Index $\frac{B \times 100}{H}$	Number of specimens	Height	Breadth, maximum	Index $\frac{B \times 100}{H}$
		cm.	*cm.*			*cm.*	*cm.*	
Average	(6)	**10.7**	**11.6**	**108.2**	(7)	**9.9**	**11.7**	**118.5**
Average (including damaged specimens)	All	.....	.....	.....	(11)	.....	11.5	.....
Minimum (including damaged specimens)	All	9.9	11.3	102.6	(11)	8.9	11	104.7
Maximum (including damaged specimens)	All	11.5	12.0	114.1	(11)	10.7	12.8	126.0

*Sacra of five segments only included; height measured with sliding compass, points of instrument applied to middle of promontory and to middle of anterior inferior border of V sacral vertebra.

Emmons, who a few years ago, with the writer's assistance, conducted an examination of 217 Indian female pelves,[2] obtained as a total average of his specimens (which however include also sacra of more than five segments), for the height 10 cm., breadth 11.5 cm., and index 115.8—figures which stand in close accord with the above. In the Negro race and in the Australians the sacrum, as is well known, is relatively narrower; and in much larger degree this is also the case in the anthropoid apes. The relatively broad and short sacrum of the whites and the Indians may therefore be regarded as a feature of an advanced evolutionary character.

[1] The sacra from the Arkansas and Louisiana mounds, of which a small series was reported previously by the writer (*Remains from Arkansas and Louisiana*, op. cit.), appeared unusually high; in the much larger series here presented, however, they are seen to form no exception in this respect to those of other Indians.

[2] A. B. Emmons, A Study of the Variations in the Female Pelvis, Based on Observations made on 271 Specimens of the American Indian Squaw, *Biometrika*, IX, 1913, pp. 34-57.

LXVI. SACRUM: COMPARATIVE DATA

People	Males				Females			
	Number of specimens *	Height	Breadth	Index	Number of specimens	Height	Breadth	Index
		cm.	*cm.*			*cm.*	*cm.*	
Munsee	(6)	10.7	11.6	108.2	(7)	9.9	11.7	118.5
Arkansas and Louisiana mounds	(18)	10.95	12.2	111.6	(22)	10.2	11.96	117.2
Southern Utah cliff-dwellers	(22)	10.8	11.55	106.9	(10)	10.1	11.33	112.2
Southwest and Mexico	(15)	10.7	11.36	106.2	(18)	10.4	11.5	110.6
United States whites (various nationalities)†	‡ (56)	10.62	11.67	109.9	(25)	10.18	11.75	115.4

* Five-segment sacra only.

† There were two separate series which gave remarkably similar results:

(*a*) Males: (26) H. 10.6, B. 11.7, Ind. 115; females: (12) H. 10.2, B. 11.73, Ind. 115.

(*b*) Males: (30) H. 10.63, B. 11.64, Ind. 115.8; females: (13) H. 10.16, B. 11.77, Ind. 115.8.

‡ Forty-six additional five-segment adult sacra, both sexes together, gave the writer—height 10.4, breadth 11.76, index 113.

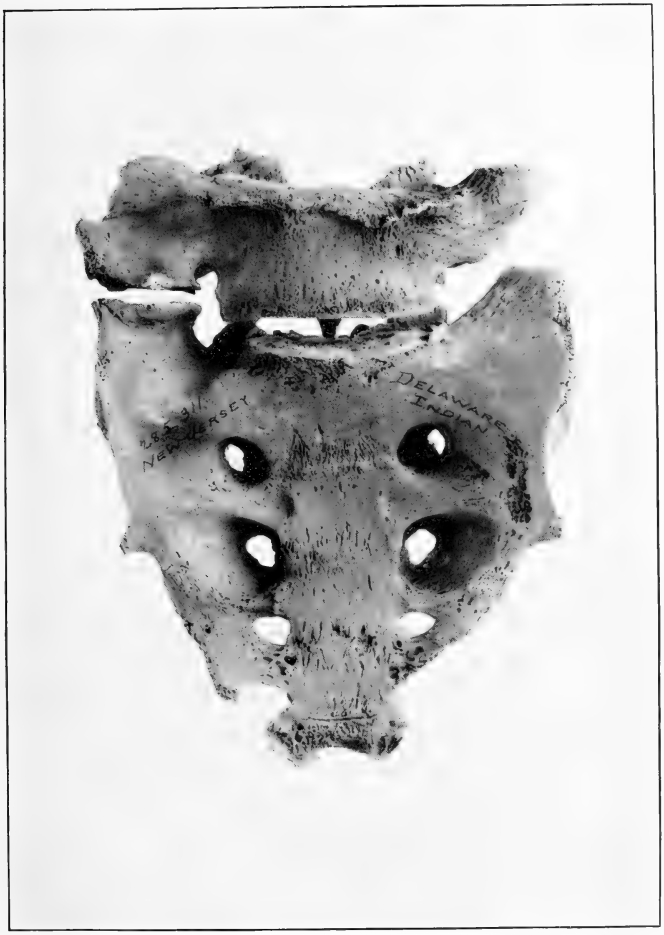
SEGMENTS

Among the eight male Munsee sacra in which determination of the number of segments is feasible, six show five and two show six vertebræ, while among the 12 female bones there are 10 with five and two with six segments. We have thus four six-segmented sacra in 20, or 20 per cent. Emmons, in 217 female Indian pelves, found six segments in 19.8 per cent of the cases.

Among additional specimens examined by the writer, in 53 sacra of the southern Utah cliff-dwellers, five vertebræ were present in 37, or 70 per cent; six in 15, or 28 per cent; and seven in one, or 2 per cent. Of 42 sacra of Southwestern and Mexican Indians, 31, or 74 per cent, showed five; 10, or 24 per cent, six; and one, or 2 per cent, seven segments. As to whites, among 503 sacra of miscellaneous Americans of both sexes, five segments were present in only 66.4 per cent of the bones; six segments in 31 per cent; seven segments in 2 per cent, and eight in 0.4 per cent, while the whole coccyx was attached, non-pathologically, in one instance. The frequency of more than five vertebræ in the sacrum is therefore slightly to decidedly less in probably all the tribes of Indians than in the United States whites.

CURVATURE

The curvature of the sacrum in the Munsee can be described in 18 of the 20 specimens as medium, while in two (one male and one female) it is submedium. This agrees closely with the author's observations on this feature in other Indians. In the United States whites the proportion of regular and medium forms is smaller, while not infrequently there exists in the sacrum of whites a pronounced



FEMALE MUNSEE SACRUM SHOWING UNILATERAL ARTICULATION WITH THE LAST FIFTH LUMBAR

curvature, which is very rare in the Indian. Among 115 Indian sacra from Arkansas, Louisiana, the Southwest, and Mexico, the writer found moderate or medium curvature in 75, or 65 per cent; submedium to slight in 24, or 21 per cent; and pronounced (though never excessively) in 16, or 14 per cent. Among the 217 specimens examined by Emmons, moderate or medium curvature was present in 148, or a little more than 67 per cent; submedium in 52, or 24 per cent; and pronounced in 18, or 8 per cent.

The curve of the sacrum begins in the Munsee (and the same is true of other Indians) in a majority of cases with the first or uppermost segment, but in numerous instances with the second vertebra. More in detail, among the 20 Munsee sacra, in 13, or 65 per cent, the curve began with the first; in six, or 30 per cent, with the second; and in one, or 5 per cent of the cases, with the third vertebra. Among 113 sacra of both sexes from Arkansas, Louisiana, the Southwest, and Mexico, examined by the writer, the curve began in 52, or 46 per cent of the cases, with the first; in 42, or 37 per cent, with the second; in 14, or 12 per cent, with the third; and in five, or 4 per cent, with the fourth vertebra. In the female series studied by Emmons, the curve began in 41.5 per cent of the cases with the first; in 27 per cent with the second; in 22.5 per cent with the third; in 7.4 per cent with the fourth; and in 1.8 per cent with the fifth segment. Among whites, in 224 sacra of five segments examined by the writer, the curve began with the first vertebra in 87 per cent; with the second in 5.4 per cent; and with the third in 7.6 per cent of the cases. It is therefore evident that the anterior curve of the sacrum begins more frequently higher up in the whites than in the Indians. This peculiarity is probably connected with a somewhat greater curvature, even on the average, in the sacrum of whites.

Ossa Innominata and Pelvis

the ossa innominata

The total number of adult innominate bones of the Munsee, available for examination and measurement, is 37, and in general the bones are remarkable for their regular development, with complete freedom from pathological conditions and from the more important anomalies. They are also of medium dimensions and weight throughout.

The measurements of the bones show that in the paired specimens, in both sexes, they are of nearly the same dimensions on the two sides. The male bones exceed those of the female in both height and breadth, and especially in the former, but relatively to its height the female innominate is broader than that of the male, as a result of which the innominate height-breadth index is higher in the females.

LXVII. MUNSEE: INNOMINATE BONES

MALES

	Right						Left					
	Number of bones	Height maximum (ischio-iliac) (a)	Number of bones	Breadth maximum (of ilium) (b)	Number of cases	Innominate index $\frac{b \times 100}{a}$	Number of bones	Height maximum (a)	Number of bones	Breadth maximum (of ilium) (b)	Number of cases	Innominate index $\frac{b \times 100}{a}$
Average:		cm.		cm.				cm.		cm.		
Pairs	(5)	**21.2**	(5)	**15.6**	(5)	**73**	(5)	**21.2**	(5)	**15.6**	(5)	**73.2**
All	(7)	21.2	(6)	15.6	(6)	73.8	(6)	21.3	(5)	15.6	.....	.....
Minimum	(7)	20.8	(6)	15.1	(6)	70.7	(6)	20.8	(5)	15.2	.....	70.7
Maximum	(7)	22.2	(6)	16.2	(6)	75.1	(6)	21.8	(5)	16	.....	74.5

FEMALES

Average:												
Pairs	(11)	**20.1**	(5)	**14.95**	(5)	**75.6**	(11)	**20.1**	(5)	**14.9**	(5)	**75.1**
All	(11)	20.1	(8)	15.2	(8)	75.9	(13)	20	(10)	14.75	(10)	74.5
Minimum (all)	(11)	18.5	(8)	13.6	(8)	72	(13)	18.5	(10)	13.5	(10)	69.5
Maximum (all)	(11)	20.7	(8)	16	(8)	78.9	(13)	20.8	(10)	15.8	(10)	78

Comparative data on the innominate bones are given in the next table. The Arkansas and Louisiana specimens, as well as those of other Indians, agree closely with those of the Munsee. The innominate of the whites, on the other hand, is both higher and especially broader, hence it shows a higher index in both sexes. Emmons, from his 217 Indian female pelves, obtained as an average height of the innominate 19.3 cm., and as the breadth 14.5 cm., with a mean index of 74.8. These results agree closely with those of the writer and strengthen the evidence that the innominate bones in the Indians average somewhat smaller in both dimensions, and are also somewhat narrower relatively than those in the whites.

LXVIII. COMPARISON OF THE MUNSEE OSSA INNOMINATA WITH THOSE OF OTHER INDIANS AND OF WHITES

MALES

Group	Right				Left		
	Specimens (pairs)	Height maximum (ischio-iliac)	Breadth maximum	Innominate index	Height maximum (ischio-iliac)	Breadth maximum	Innominate index
		cm.	cm.		cm.	cm.	
Munsee	(16)	21.3	15.6	73.4	21.2	15.6	73.2
Arkansas and Louisiana	(13)	21.2	15.4	72.7	21.3	15.35	72.1
Southern Utah cliff-dwellers	(20)	20.5	15.0	73.2	20.5	15	73.3
Southwest and Mexico	(12)	20.7	15.2	73.7	20.7	15.2	73.5
United States whites	(32)	22.03	16.43	74.6	22.1	16.47	74.45

LXVIII. COMPARISON OF THE MUNSEE OSSA INNOMINATA WITH THOSE OF OTHER INDIANS AND OF OTHER WHITES—Continued

FEMALES

Group	Right				Left		
	Specimens (pairs)	Height maximum (ischio-iliac)	Breadth maximum	Innominate index	Height maximum (ischio-iliac)	Breadth maximum	Innominate index
		cm.	*cm.*		*cm.*	*cm.*	
Munsee	(11)	20.1	14.95	75.6	20.1	14.9	75.1
Arkansas and Louisiana	(8)	19.8	15	75.7	19.95	15.1	76.1
Southern Utah cliff-dwellers	(7)	19	14.3	75.4	19.1	14.2	74.6
Southwest and Mexico	(12)	19.1	14.6	76.6	19.2	14.75	76.8
United States whites	(20)	20.2	15.73	77.9	20.1	15.7	78.1

THE PELVIS AS A WHOLE

The Munsee pelves available for measurement comprise those of six males and ten females. They are free from all deformation, and present the usual sexual characteristics with regard to massiveness, the flare of the ilia, the subpubic angle, and the width of the great sciatic notch.

The articulated pelves, with a slight space left for the pubic cartilage, gave measurements shown in the table below. The male pelvis, it is seen, is somewhat larger than the female in both of its mean external dimensions, and is also somewhat higher relatively, as a result of which it shows a higher height-breadth index.

LXIX. MUNSEE: PELVIS AS A WHOLE

MALE

	Number	Mean height of ossa innominata	Breadth maximum of pelvis	Pelvic index*	Superior Strait		
					Breadth maximum (*a*)	Diameter† antero-posterior (*b*)	Brim index $\frac{b \times 100}{a}$
		cm.	*cm.*		*cm.*	*cm.*	
Average	(6)	21.2	26.7	78.9	12.1	10.6	87.8
Minimum	(6)	20.8	24.4	76.6	11.6	9.6	78.7
Maximum	(6)	21.5	28.2	85.9	12.8	11.2	98.3

FEMALE

Average	(10)	19.95	25.9	77.0	13.0	11.0	84.5
Minimum	(10)	18.5	24.1	73.3	12.3	9.4	70.7
Maximum	(10)	20.7	27.8	80.4	13.8	12.5	94.4

*$\frac{\text{Mean height of innominate bones} \times 100}{\text{maximum breadth of pelvis}}$

† Promontory of sacrum to nearest point on the inner lip of pubic bones.

The pelvic cavity at the superior strait or brim is more spacious, both antero-posteriorly and laterally, in the Munsee female than in the male, and it is also somewhat broader relatively to its depth, as a result of which it gives a somewhat lower depth-breadth index.

On comparison with the pelves of the mound-building Indians of the Arkansas and Louisiana mounds, those of the Southwest and Mexico, and those of United States whites, it is seen that the Munsee pelvis, as a whole, is of moderate dimensions, especially in its breadth, which is slightly smaller than that in any of the other groups in the males and in most of the females. Because of this fact, the height-breadth index of the pelvis in the Munsee is relatively high—higher than that of any of the other Indians. It is exceeded in this respect only by the pelvis of the white males.

An even more marked peculiarity of the Munsee pelvis applies to its inlet or brim. As will be seen by a glance at the figures, this is relatively narrow and deep in both sexes; the lateral diameter, with a single minor exception, is the lowest, and the diameter antero-posterior the highest of all the groups. As a result of this condition, the brim index of the Munsee in both males and females is exceptionally high.

LXX. COMPARISON OF THE MUNSEE PELVIS WITH THAT OF OTHER INDIANS AND OF WHITES

MALES

Group	Specimens (pairs)	Mean height of ossa innominata	Greatest breadth of pelvis (between outer lips of crests)*	Pelvic index	Diameter lateral maximum of brim	Diameter antero-posterior maximum of brim	Brim index
		cm.	*cm.*		*cm.*	*cm.*	
Munsee	(6)	21.2	26.7	78.9	12.1	10.6	87.8
Arkansas and Louisiana	(23)	21.55	28.1	76.7	13	10.4	79.8
Southern Utah cliff-dwellers	(23)	20.6	26.85	76.7	12.4	10	80.6
Southwest and Mexico	(15)	20.6	27	76.2	12.3	9.7	78.7
United States whites	(32)	22.06	27.1	81.4	12.7	9.64	75.9

FEMALES

Munsee	(10)	19.95	25.9	77.0	13	11	84.5
Arkansas and Louisiana	(12)	19.7	26.8	73.5	13.33	10.74	81.4
Southern Utah cliff-dwellers	(7)	19.05	25.4	74.5	13.1	10.1	77.4
Southwest and Mexico	(12)	19.15	25.7	74.4	12.9	10.75	83.1
United States whites	(20)	20.16	27.05	74.5	13.35	10.73	80.4

*The pelvis being held in articulation.

The brim index in general shows unexpected irregularity from group to group and between the two sexes. In the Munsee and the

southern Utah cliff-dwellers it is higher in the males; in the other Indians and in the whites it is higher in the females; and the range of its groupal as well as individual variation is considerable. As all the specimens were measured by the author with the same instruments, by the same method, and with equal care, the differences can not be attributed to error, hence the only reasonable conclusion is that even under normal conditions (for these series contain no deformed or pathological pelves) the absolute as well as the relative dimensions of the superior strait are capable of not a little fluctuation, attributable, it seems, in some measure at least, to an early unequal development of the soft parts both within and without the pelvic cavity.

In order to satisfy himself further on this point, the writer extracted a number of the larger series of pelvic measurements from Emmons's data, and from the next table it will be seen that, although they relate to females only, the groupal variation is also marked. Yet these differences among the Indians rarely if ever fall below what may be considered normal limits, or such a limit as would in the female still permit of safe childbirth under other normal conditions. They are therefore what may be called infunctional or *transfunctional* fluctuations.

LXXI. FEMALE INDIAN PELVIS: SUPERIOR STRAIT*

Group	Specimens	Diameter antero-posterior	Diameter lateral	Index
		cm.	*cm.*	
Northwest coast	(31)	12.99	10.7	82.39
California	(16)	13.2	10.56	80
Sioux	(12)	13.03	10.98	84.26
Tennessee	(6)	13.32	10.93	82.01
Kentucky	(8)	13.09	10.66	81.42
New Mexico	(10)	13.26	10.43	78.65
Arizona	(57)	12.87	9.52	74.01
Mexico	(15)	12.71	10.93	85.55
Peru	(13)	12.71	10.12	79.58

*Emmons's series.

Short and Other Bones

PATELLA

The patella, the largest of the sesamoid bones, offers three dimensions for measurements, namely, the maximum height, the maximum breadth, and the maximum thickness; and the mean of these diameters, the *patellar module*, is a convenient unit for comparing the size of the bone.

The 30 patellæ present in the Munsee collection give proportions which are tabulated below. The male bone is perceptibly larger in all dimensions than the female. There are but small differences as

to side, and they are probably due in a measure, if not entirely, to the small number of specimens. The mean diameter or module is practically the same on both sides in both the male and the female. The breadth-height index averages slightly over 100 and offers nothing definitely distinctive either as to sex or to side. It varies in males from 91.7 to 107.4, in the females from 93.8 to 107.9.

LXXII. MUNSEE: PATELLÆ

MALES

	Right							
	Number	Height, maximum	Number	Breadth, maximum	Number	Thickness, maximum	Number	Breadth-height index
		cm.		*cm.*		*cm.*		
Average:	(4)	**4.5**	(4)	**4.6**	(4)	**2.11**	(4)	**102.8**
Pair	(6)	4.41	(6)	4.57	(6)	2.06	(6)	103.6
All	(6)	4.2	(6)	4.4	(6)	1.95	(6)	97.8
Minimum (all)	(6)	4.6	(6)	4.8	(6)	2.3	(6)	105.9
Maximum (all)								
	Left							
Average:								
Pairs	(4)	**4.6**	(4)	**4.55**	(4)	**2.1**	(4)	**98.9**
All	(10)	4.36	(11)	4.38	(12)	2.04	(10)	100.5
Minimum (all)	(10)	4	(11)	3.9	(12)	1.85	(10)	91.7
Maximum (all)	(10)	4.8	(11)	4.7	(12)	2.25	(10)	107.4

FEMALES

	Right							
	Number	Height, maximum	Number	Breadth, maximum	Number	Thickness, maximum	Number	Breadth-height index
		cm.		*cm.*		*cm.*		
Average:								
Pairs	(5)	**3.93**	(5)	**4.02**	(8)	**1.73**	(5)	**102.3**
All	(9)	3.93	(9)	3.97	(11)	1.75	(9)	100.4
Minimum (all)	(9)	3.7	(9)	3.7	(11)	1.5	(9)	93.8
Maximum (all)	(9)	4.1	(9)	4.3	(11)	1.9	(9)	107.9
	Left							
Average:								
Pairs	(5)	**3.93**	(5)	**4.05**	(8)	**1.76**	(5)	**103.1**
All	(5)	3.95	(5)	4.05	(8)	1.76	(5)	103.1
Minimum (all)	(5)	3.8	(5)	3.85	(8)	1.5	(5)	96.2
Maximum (all)	(5)	4.05	(5)	4.1	(8)	1.95	(5)	107.9

Module (mean diameter)—Males: right, 3.74; left, 3.75; females: right, 3.23; left, 3.25.

A comparison of the Munsee patella with that of whites shows that the latter is slightly larger in both sexes and on both sides; its relative proportions, however, are very much the same, except that the bone in white males on both sides appears to be relatively

slightly higher than in the females, which, while also true of the Munsee on the right side, does not hold true for the left.

LXXIII. PATELLÆ: MUNSEE AND WHITES

MALES

Group	Specimens (pairs)	Right				Left			
		Height	Breadth	Thickness	Breadth-height index	Height	Breadth	Thickness	Breadth-height index
		cm.	*cm.*	*cm.*		*cm.*	*cm.*	*cm.*	
Munsee	(8)	4.5	4.6	2.11	102.8	4.6	4.55	2.1	98.9
United States whites.	*(200)	4.56	4.64	2.15	101.7	4.52	4.66	2.17	103.2

Module (mean diameter)—Males: Munsee, right, 3.74; left, 3.75; whites, right, 3.78; left, 3.78.

FEMALES

Munsee	(10)	3.93	4.02	1.73	102.3	3.93	4.05	1.76	103.1
United States whites.	*(100)	4.02	4.03	1.9	100.2	3.97	4.08	1.9	102.7

Module—Females: Munsee, right, 3.23; left, 3.25; whites, right, 3.32; left, 3.32.
* Males: 100 right, 100 left; females: 50 right, 50 left patellæ.

The Munsee patella, while in general slightly smaller than that of the whites, will be seen from the comparative data in the accompanying table to average somewhat larger than that of other Indians available for comparison. The larger size in all dimensions of the white man's patella than that of the Indian is doubtless due to the greater muscularity of the white subjects from which the bones were derived and who belonged almost exclusively to the laboring classes.

Of the 30 Munsee patellæ, 15 show a moderate to well developed semilunar notch in the lateral border of the bone, for the *vastus lateralis* (pl. 28, *b*). The patellæ of female skeleton no. 285,311 are decidedly oblique, especially that on the left side; and the patellæ of female no. 285321 show each an exceptionally long apex.

LXXIV. THE MODULE OR MEAN DIAMETER OF THE PATELLA IN THE MUNSEE AND OTHER GROUPS

Group	Male		Female	
	Right	Left	Right	Left
	cm.	*cm.*	*cm.*	*cm.*
Munsee	3.74	3.75	3.23	3.25
Arkansas and Louisiana	3.54	3.50	3.17	3.17
Southern Utah cliff-dwellers	3.61	3.58	3	3
Southwest and Mexico	3.49	3.49		
United States whites	3.78	3.78	3.32	3.32

BONES OF THE HAND

While the total number of bones of the hands in the Munsee material aggregate nearly 700, there are very few complete sets. It is nevertheless possible to ascertain that in general the hand of the Munsee was of moderate to medium development, and remarkedly normal in conformation. Among the females, some of the bones are quite small. The only anomaly worthy of mention is the presence of rudimentary hamuli on both unciforms in one of the male subjects (no. 285,308).

The proportional length of the hand can be judged from the measurements of the first metacarpal, and from the relation of this length to that of the humerus on the same side. The following table gives these dimensions. It is seen that the length of the first metacarpal in the male exceeds somewhat that of the female, and also that the length of the right bone exceeds slightly that of the left. The metacarpo-humeral index is somewhat higher on the right in the males, indicating a somewhat greater length of the hand on the right side in that sex. In the females the small number of specimens makes the result in this respect uncertain.

LXXV. MUNSEE: FIRST METACARPAL

MALES

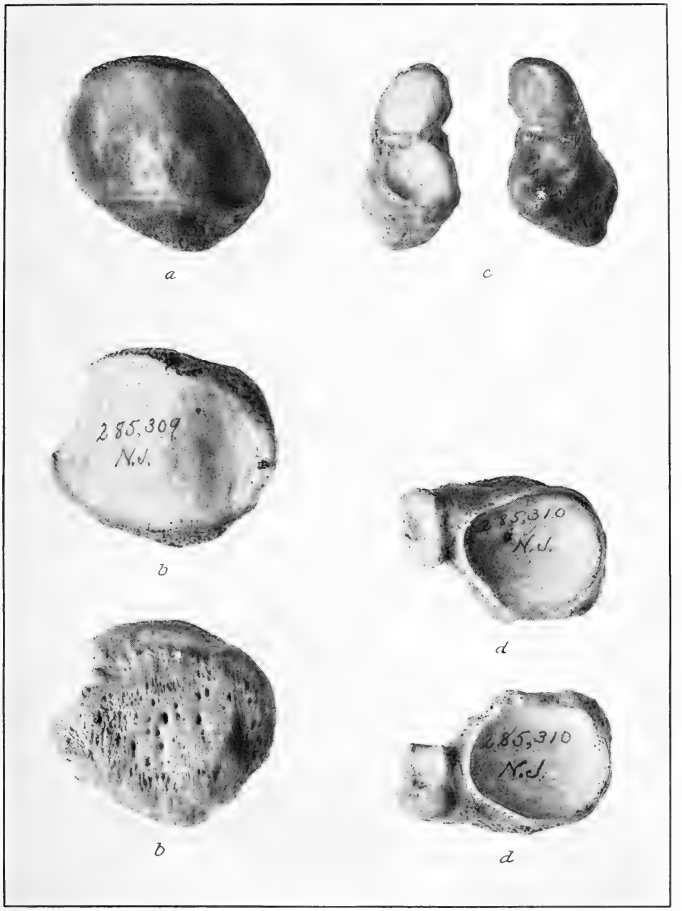
	Right			Left		
	Number of specimens	Length, maximum	*Metacarpo-humeral index $\frac{mc \times 100}{H}$	Number of specimens	Length, maximum	Metacarpo-humeral index
Average:		*cm.*			*cm.*	
Pairs	(5)	**4.6**	**14.5**	(5)	**4.5**	**14.1**
Total present	(8)	**4.7**	**14.5**	(5)	**4.5**	**14.1**
Minimum (total present)	(8)	4.2	12.9	(5)	4.25	12.9
Maximum (total present)	(8)	5.1	16.2	(5)	4.8	15

FEMALES

Average:						
Pairs	(5)	**4.3**	**14**	(5)	**4.3**	**14.3**
Total present	(8)	**4.4**	**14.3**	(7)	**4.2**	**13.9**
Minimum (total present)	(8)	3.9	13.2	(7)	3.75	12.8
Maximum (total present)	(8)	4.8	15.3	(7)	4.8	15.8

* $\frac{\text{Maximum length of first metacarpal} \times 100}{\text{Maximum length of humerus.}}$

A comparison of the first metacarpal in the Munsee and in the United States whites shows that this bone in the Munsee on both sides (and in both sexes) is somewhat shorter, indicating a smaller



a PATELLA OF FEMALE MUNSEE SKELETON NO. 285,311, U.S.N.M., SHOWING MARKED OBLIQUITY
b PATELLÆ OF FEMALE MUNSEE SKELETON NO. 285,309, U.S.N.M., SHOWING PRONOUNCED VASTUS NOTCH
c INTERNAL CUNEIFORM OF MALE MUNSEE SKELETON NO. 285,301, U.S.N.M., SHOWING EACH A DOUBLE METATARSAL FACET
d PAIR OF FEMALE MUNSEE SCAPHOIDS SHOWING UNUSUAL BROAD TALUS FACET AND PECULIAR TUBEROSITY

hand. This is also apparent in the metacarpo-humeral index, which on both sides in the whites is higher than in the Munsee. The absolute and relative smallness of the Indian hand, particularly in the males and on the right side, is doubtless due to its lesser use.

LXXVI. FIRST METACARPAL IN MUNSEE AND IN WHITES

Both sexes	Specimens	Length, maximum	Metacarpo-humeral index	Specimens	Length, maximum	Metacarpo-humeral index
		cm.			cm.	
Munsee	(16)	4.55	14.4	(12)	4.35	14.0
United States whites	(94)	4.69	14.9	(65)	4.43	14.3

BONES OF THE FEET

Owing to their larger size and greater differentiation, a number of the bones of the feet, particularly of the tarsus, yield material for measurement and special observation, and have received rather extended attention by anatomists and anthropologists,[1] but as yet there is no perfect uniformity in the methods of measurement or of description. The writer's object in selecting his measurements and points for description was to employ only those that appear to be the most sensible and significant, the most readily standardized, and involving no details, save in cases that may be of special importance.

First Metatarsal

As the first metacarpal serves in a measure as an index of the size of the hand, so the first metatarsal gives an indication of that of the foot. The proportional length of the foot can further be judged from the percental relation of the first metatarsal to the femur. The relation between the size of the feet and that of the hands is expressed by the pollex-hallux index, or percental relation between the first metacarpal and the first metatarsal.

There are in all 36 first metatarsals among the Munsee bones, the measurements and relations of which are given in the above table. It will be seen that the length of the bone is, on the average, greater in the males than in the females, but it does not differ perceptibly on the two sides of the body in either sex.

The hallux-femur index is practically equal on the two sides (differing only in centesimals), and is larger in the males than in the females, showing that the foot of the Munsee male was not only somewhat larger than that of the female, but was also larger

[1] S. P. Lazarus, Zur Morphologie des Fufsskelettes, *Morphol. Jahrb.*, XXIV, H. 1, repr., 8°, Leipzig, 1896; W. Pfitzner, Beiträge zur Kenntniss des menschlichen Extremitätenskelets, *Morphol. Arbeiten*, I, H. 1, Jena, 1891; Th. Volkov, *Variations squelettiques du pied chez les primates et dans les races humaines; Thèse doctorale de la Faculté des Sciences*, Paris, 1905; Chas. Fraipont, *L'Astragale de l'homme Moustérien*, etc., 8°, Bruxelles, 1912; M. Reicher, Beitrag zur Anthropologie des Calcaneus, *Archiv für Anthropologie*, N. F., XII, H. 2, 1913; S. Poniatowski, Badania Antropologiczne nad Kóscia Skokowa (Anthropological Studies of the Talus), *Prace Towarzystwa Naukowego Warszawskiego*, 1913.

in that sex in relation to the length of the femur and the stature. This relative excess of the foot is more marked than was that of the hand, and in all probability is a result of greater functional activity, the male Indians being excessive walkers and runners.

A comparison of the first metatarsal in the Munsee and in the United States whites shows that in the latter, in both sexes, the bone is longer, indicating, on the average, a longer foot. The difference is especially marked on the left side and is probably both racial and functional.

As a result of the greater length of the bone in the United States whites, whose average stature is very nearly that of the Munsee, we find that their hallux-femur index is decidedly higher than that of the Munsee, especially on the left side. The white man's foot is therefore not only longer absolutely, but also relatively as compared with the femur and, indirectly, the stature.

The foot of the whites is also somewhat longer relatively to the hand, than that of the Munsee, and especially on the left side, which gives us a lower pollex-hallux index for the whites.

LXXVII. MUNSEE: FIRST METATARSAL

MALES

	Right						Left					
	Number of specimens	Length, maximum	Number of cases	Pollex-hallux index *	Number of cases	Metatarso-femoral index †	Number of specimens	Length, maximum	Number of cases	Pollex-hallux index	Number of cases	Metatarso-femoral index
Average:		*cm.*						*cm.*				
Pairs	(6)	**6.5**	(4)	**70.4**	(5)	**14.7**	(6)	**6.5**	(4)	**69.2**	(5)	**14.7**
Total present	(11)	6.5	(8)	72.4	(9)	14.5	(8)	6.48	(4)	69.2	(7)	14.2
Minimum (total present)	(11)	6.1	(8)	65.1	(9)	13.8	(8)	6.3	(4)	65.4	(7)	12.9
Maximum (total present)	(11)	6.8	(8)	76.6	(9)	15.1	(8)	6.8	(4)	71.1	(7)	15.2

FEMALES

Average:												
Pairs	(7)	**6.0**	(4)	**73.2**	(6)	**14.2**	(7)	**6.0**	(4)	**73.9**	(6)	**14.2**
Total present	(8)	5.97	(7)	72.2	(7)	14.1	(9)	5.91	(6)	72.4	(7)	14.1
Minimum (total present)	(8)	5.5	(7)	70.9	(7)	13.5	(9)	5.45	(6)	67	(7)	13.5
Maximum (total present	(8)	6.45	(7)	75.4	(7)	15.1	(9)	6.4	(6)	77.4	(7)	15.2

* $\frac{\text{Maximum length of first metacarpal} \times 100}{\text{Maximum length of first metatarsal.}}$

† $\frac{\text{Maximum length of first metatarsal} \times 100}{\text{Bicondylar length of femur.}}$

LXXVIII. THE FIRST METATARSAL IN THE MUNSEE AND IN UNITED STATES WHITES

Both sexes	Right				Left			
	Specimens	Length, maximum	Hallux-femur index	Pollex-hallux index	Specimens	Length, maximum	Hallux-femur index	Pollex-hallux index
		cm.				*cm.*		
Munsee	(19)	6.3	14.3	72.3	(17)	6.2	14.15	71.1
United States whites*	(51)	6.6	15.3	71.1	(33)	6.7	15.5	66.1

* The indexes in whites are close approximations.

Os Calcis

Being the largest bone of the tarsus, and the most important functionally, the os calcis, or calcaneus, seems to deserve closer attention by anthropologists than it usually receives.

The bone presents three different and fairly easily ascertainable dimensions: (1) the greatest length of the whole bone; (2) the minimum breadth or thickness of the body; and (3) the height of the body at its greatest constriction. It further offers several interesting points for visual observation.

The total number of calcanei in the Munsee material is 51, which gives a fair male and female series. The following table shows the measurements on 40 of those that are paired and hence most suitable for comparison.

LXXIX. MUNSEE BONES: OS CALCIS

	Specimens (pairs)	Length, maximum	Breadth, minimum of body *	Height of body †	Breadth-length index	Breadth-height index
		cm.	*cm.*	*cm.*		
MALES						
Average	10	8.1	2.74	4.07	33.9	67.4
	10	8.05	2.72	4.07	33.87	66.9
Minimum	10	7.7	2.5	3.7	30.1	61.6
	10	7.5	2.45	3.8	28.1	62.2
Maximum	10	8.5	3	4.5	37.7	72.5
	10	8.5	3	4.5	37.3	73.7
FEMALES						
Average	10	7.35	2.4	3.6	32.9	66.9
	12	7.3	2.38	3.6	33.1	66.4
Minimum	10	6.7	2	3.2	28.2	60.6
	12	6.7	1.95	3.3	28.7	59
Maximum	10	7.7	2.65	3.8	34.7	71.6
	12	7.8	2.65	3.9	34.3	70.4

* Branches of *compas glissière* applied to the sides of the bone in the region of minimum thickness of the body.

† Maximum height at greatest constriction of body, obtained by moving the bone from side to side between the points of the branches of the *compas glissière*.

It will be observed that, as is usual with other parts of the skeleton, the male bone is somewhat larger than the female; also that the right os calcis averages very slightly larger than the left in length and breadth, but is equal in both sexes to that of the left side in height. Reducing the three average measurements to a mean diameter, or module, we obtain for the males on the right, 4.97 cm.; on the left, 4.95 cm.; for the females, right, 4.45 cm.; left, 4.43 cm. showing that the difference in the mass of the bones on the two sides is very small.

The three measurements of the os calcis give rise to two indexes: one expressing the percental relation between its breadth and length, the other showing a similar relation between its breadth and height. The breadth-length index is somewhat higher in the males than in the females, but in the paired bones does not differ very appreciably on the two sides. Taking all the bones, as in the next table, we see that the index in the males predominates slightly over that in the females, which, judging from the constancy of the condition in the several series of specimens used for comparison, is probably also the true condition in the Munsee. It indicates a tendency in the males toward not only absolutely but also relatively slightly thicker calcaneus.

The breadth-height index, like the breadth-length proportion, is also slightly higher on both sides in the males than in the females, and in both sexes on the right than on the left side. As the height is the same on the two sides, this shows exactly the slightly greater relative thickness of the bone in the males than in the females, and on the right than on the left side. The phenomenon is doubtless connected with difference of stress to which the bone is subjected in the two sexes and on the two sides of the body.

The comparative data given in the following table show that, as with many other bones of the body, the os calcis in the Munsee and in other Indians in both sexes, and especially in the males, is smaller in all dimensions than it is in the whites. The relative proportions of the bone are quite alike in the different racial groups of males, but differ in an interesting way in the females, in which, among the whites, the bones show lower indexes than in the other groups. The white female os calcis is longer and higher, but equal in slenderness to that of the Indian.

LXXX. OS CALCIS: COMPARISON

MALES

Group	Number of specimens	Length, maximum	Breadth, minimum of body	Height, minimum of body	Module	Breadth-length index	Breadth-height index
		cm.	*cm.*	*cm.*	*cm.*		
Munsee	(29)	8.07	2.77	4.04	4.76	34.1	67.9
Arkansas and Louisiana	(34)	8	2.75	3.97	4.91	34.5	69.3
Southern Utah cliff-dwellers	(50)	7.72	2.81	4.05	4.86	36.4	69.4
Southwest and Mexico	(16)	7.85	2.67	4.01	4.84	34	66.5
United States whites	(55)	8.33	2.85	4.20	5.13	34.1	67.7
FEMALES							
Munsee	(22)	7.3	2.4	3.6	4.43	32.6	66.2
Arkansas and Louisiana	(12)	7.3	2.45	3.5	4.42	33.7	70.3
Southern Utah cliff-dwellers	(30)	6.92	2.43	3.56	4.30	35.1	68.3
Southwest and Mexico	(13)	7.1	2.4	3.43	4.31	33.8	70.1
United States whites	(30)	7.87	2.43	3.81	4.71	30.9	63.7

Articular Facets for Astragalus

As to visual observations on the os calcis, the greatest interest attaches probably to the number and conformation of the articular facets for the astragalus. These facets may be two in number, anterior and posterior. But the anterior facet may be divided into two by a ridge; or it may be replaced by two facets, anterior and median, completely separated by a narrow to moderately broad groove or space; or, finally, in place of the single oblong anterior facet there may be a small to rudimentary anterior and a medium sized median facet, separated by a broad and deep notch.

The percental distribution of these facets among the Munsee, the Arkansas and Louisiana mound Indians, and the United States whites, is given below. There is a remarkable similarity in the frequency of occurrence of the two main forms (two and three facets) in all three groups among the males, but the females show slight irregularity.

LXXXI. OS CALCIS: MUNSEE AND COMPARATIVE: ARTICULAR FACETS FOR ASTRAGALUS

Group	Male			Female		
	Specimens	Two facets	Three facets	Specimens	Two facets	Three facets
		Per cent	*Per cent*		*Per cent*	*Per cent*
Munsee	(31)	26	74	19	48	52
Arkansas and Louisiana	(39)	26	74	33	37	63
United States whites	(55)	25.5	74.5	30	40	60

The agreement above set forth might lead us to suppose that practically no racial differences are connected with the facets, at least between the whites and some of the Indians; but this assumption is not borne out by a detailed study of these characters. The next table shows the more detailed observations on the number and character of these facets in the Munsee and in whites, and also with reference to sex and side. Here we notice, in the first place, that the frequency of two facets only is much higher in both groups in the females than in the males, while three facets are correspondingly more frequent in the males. But we observe further that the condition of three facets in which the anterior and median are separated by a wide notch is very much more frequent among the whites than among the Indians.

As to sides, differences between the right and left are irregular; if we combine the two series of Munsee and whites they almost disappear.

LXXXII. OS CALCIS IN THE MUNSEE AND IN UNITED STATES WHITES: ARTICULAR FACETS FOR ASTRAGALUS

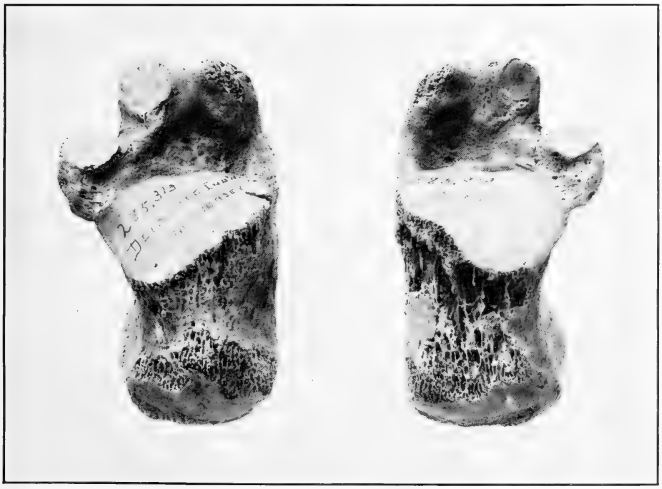
	Specimens	Two facets	Three facets, but the two anterior separated only by a ridge	Three facets completely disconnected	Three facets, disconnected, with a wide notch between the anterior two
Males:		*Per cent*	*Per cent*	*Per cent*	*Per cent*
Munsee	(31)	25.8	19.4	35.5	19.4
United States whites	(55)	25.5	7.3	29.1	38.2
Females:					
Munsee	(29)	48.3	10.3	41.4	.....
United States whites	(30)	40	16.7	20	23.3
Right:					
Munsee	(31)	42	6.5	42	9.7
United States whites	(51)	29.4	15.7	21.6	33.3
Left:					
Munsee	(29)	31	24	34.5	10.3
United States whites	(34)	32.4	2.9	32.4	32.4

An additional point of some interest in connection with the calcaneus is the development of the peroneal spine. Among the Munsee this was found frequently to be very moderate and never pronounced; among the whites, cases with a much more marked development of the spine are met with occasionally, especially among the males.

Astragalus

Next to the calcaneus, the most interesting bone of the tarsus is the astragalus. The bone exhibits wide and characteristic variations

a THE RIGHT AND LEFT FIRST METATARSAL OF MUNSEE SKELETON NO. 285,326, U.S.N.M., SHOWING DISPROPORTION IN SIZE; ALSO A CANAL IN THE SMALLER BONE, POSSIBLY THE VESTIGE OF AN EARLY FRACTURE



b THE CALCANEI OF MALE MUNSEE SKELETON NO. 285,313, U.S.N.M., SHOWING WIDE SEPARATION OF THE TWO FACETS FOR THE ASTRAGALUS

among the higher mammals and may well be expected to show some groupal differences in man. It yields itself to three measurements, the maximum length, breadth, and height, from which in turn we obtain the module or mean diameter, useful in comparing the size of the bone, and the breadth-length and breadth-height indexes, which show its shape.

There are 60 astragali in the Munsee material, and the measurements of 52 paired bones are given below. They show the bone in the male to be absolutely larger in every dimension than in the female. As to the side, there is practically no difference among the males, but among the females the average measurements of the left astragalus are all slightly higher than those of the right bone. The module is practically identical on the two sides in the males, and slightly higher

LXXXIII. MUNSEE: ASTRAGALUS

MALES

	Right						
	Specimens (pairs)	Length, maximum*	Breadth, maximum†	Height, maximum‡	Module	Breadth-length index	Height-length index
		cm.	cm.	cm.	cm.		
Average	(12)	5.7	4.27	3.27	4.41	74.9	57.4
Minimum		5.3	4.1	3.05	4.41	70.7	54.7
Maximum		6.2	4.6	3.5	4.41	83.3	62.5

	Left					
	Length, maximum	Breadth, maximum	Height, maximum	Module (mean diameter)	Breadth-length index	Height-length index
	cm.	cm.	cm.	cm.		
Average	5.7	4.28	3.25	4.41	75.1	57.1
Minimum	5.3	4.05	3.05		72.3	53.8
Maximum	6.3	4.7	3.5		79.2	60.7

FEMALES

	Right						
	Specimens (pairs)	Length, maximum*	Breadth, maximum†	Height, maximum‡	Module	Breadth-length index	Height-length index
		cm.	cm.	cm.	cm.		
Average	(14)	5.19	3.9	3	4.02	75	57.8
Minimum		4.7	3.5	2.7	4.02	70.5	54.4
Maximum		5.7	4.1	3.3	4.02	83.7	62.3

* Stem of calipers applied to lowest (most prominent) parts on medial surface of the bone.

† Distal branch of calipers applied to lowest (most prominent) parts on medial surface of the bone.

‡ On osteometric plane (Broca), all three lowest points of inferior surface of the bone touching the vertical board while the square is applied to the most prominent part of the bone from the opposite direction.

LXXXIII. MUNSEE: ASTRAGALUS—Continued

FEMALES

	Left					
	Length, maximum	Breadth, maximum	Height, maximum	Module (mean diameter)	Breadth-length index	Height-length index
	cm.	*cm.*	*cm.*	*cm.*		
Average	5.22	3.93	3.03	4.06	75.2	58
Minimum	4.8	3.6	2.7	.....	69.9	52.8
Maximum	5.7	4.15	3.4	.....	83.7	61.5

on the left in the females. As to the relative proportions, there is great similarity between the two sexes, as well as on the two sides of the body.

The results presented in this table would not be wholly satisfactory without the possibility of comparing them with similar observations, obtained by the same methods, on the bones of the whites. Such comparative data, furnished in the next table, show a number of points of considerable interest. In the first place, as with the calcaneus and other parts of the skeleton, the Munsee bones are seen throughout to be of more moderate dimensions than the bones of the whites. The module in the latter is very perceptibly higher.

There are, however, also notable differences in the relative proportions of the bones in the two races. Among the whites in both sexes the astragalus is relatively longer and also higher than it is among the Indians, as a result of which both of the indices of the bone in the whites are lower. The differences in this respect are too large and regular to be accidental.

LXXXIV. ASTRAGALUS IN THE MUNSEE AND IN UNITED STATES WHITES

MALES

Group	Specimens	Length, maximum	Breadth, maximum	Height, maximum	Module	Breadth-length index	Height-length index
		cm.	*cm.*	*cm.*	*cm.*		
Munsee	(24)	5.7	4.28	3.26	4.42	75.0	57.2
United States whites	(50)	6.29	4.48	3.32	4.7	71.2	52.8
FEMALES							
Munsee	(28)	5.2	3.91	3	4.04	75.1	57.9
United States whites	(33)	5.75	4.02	3.11	4.29	69.8	54

In the examination of the os calcis, special attention was directed to its facets, especially the middle and anterior, for the astragalus. Inspection of the corresponding facets on the astragalus shows that these do not harmonize fully with those of the os calcis. They are less differentiated and more frequently connected or fused. Thus we have among 60 Munsee astragali, 28, or approximately 47 per cent

which show only one facet corresponding to the anterior and middle facets of the calcaneus, without any dividing line; 29, or 48 per cent, with one facet divided more or less completely by a ridge; and only three specimens, or 5 per cent, in which there are two distinct facets, though in but one of these are they separated by a moderate space. In the astragalus of the whites the proportions of these different forms are by no means the same as in the Munsee. Thus among 82 bones there are but 24, or 29 per cent, with one facet not divided by any ridge; 35, or 43 per cent, with one facet divided by a ridge; and no fewer than 23, or 28 per cent, of those in which there are two distinct facets, in 19 of which they are completely separated by a narrow to moderate space. The frequency of two facets well separated is therefore much greater among the whites than among the Munsee, which is another interesting distinction in the astragalus of these two groups and possibly of the two races which they represent. This is the more remarkable as no corresponding difference has been found in the facets on the os calcis.

Scaphoid

There are three additional bones of the tarsus which deserve somewhat detailed scrutiny, namely, the scaphoid or navicular, the cuboid, and the internal cuneiform. Although irregular in shape, each one of these bones yields to three measurements, which differ in the two sexes as well as racially, and each presents a number of points for observation.

The measurements taken by the writer on the scaphoid as well as on the other tarsal bones are, it may be repeated, the most practicable ones, and relate as closely as possible to the three principal dimensions of the specimens. In the case of the scaphoid they are the greatest breadth, height, and stoutness.

The results of the measurements of the scaphoid in the Munsee appear in the next table. The bone in the male is very perceptibly larger than that in the female, and that of the right foot is in both sexes and in all dimensions somewhat larger than that of the left. These conditions are shown nicely by the module or mean diameter of the bone.

The three measurements give rise to two indexes, which indicate the relative proportions of the scaphoid. The height-breadth index is somewhat larger on both sides in the females than in the males, which, as will readily be seen by reference to the actual dimensions, is due to the relatively greater breadth of the Munsee scaphoid in the males. No special difference is observable on the two sides of the body in the males, but in the females the right bone is relatively higher than the left.

The stoutness-breadth index offers no special differences either on the two sides or in the two sexes.

LXXXV. MUNSEE: SCAPHOID

MALES

	Number of specimens, pairs	Right: Breadth,* maximum	Right: Height,† maximum	Right: Stoutness,‡ maximum	Right: Module (mean diameter)	Right: Height-breadth index	Right: Stoutness-breadth index
		cm.	*cm.*	*cm.*	*cm.*		
Average	(6)	4.20	2.11	2.61	2.98	50.2	62.3
Minimum		3.9	1.9	2.5	2.66	48.4	62.2
Maximum		4.55	2.2	2.85	3.2	55.4	64.1

	Number of specimens	Left: Breadth	Left: Height	Left: Stoutness	Left: Module (mean diameter)	Left: Height-breadth index	Left: Stoutness-breadth index
		cm.	*cm.*	*cm.*	*cm.*		
Average	(6)	4.05	2.04	2.55	2.88	50.4	63
Minimum		3.65	1.7	2.45	2.6	46.6	60.5
Maximum		4.5	2.25	2.75	3.16	53.7	67.1

FEMALES

	Number of specimens, pairs	Right: Breadth,* maximum	Right: Height,† maximum	Right: Stoutness,‡ maximum	Right: Module (mean diameter)	Right: Height-breadth index	Right: Stoutness-breadth index
		cm.	*cm.*	*cm.*	*cm.*		
Average	(6)	3.75	1.96	2.35	2.69	52.2	62.7
Minimum		3.5	1.75	2.25	2.5?	48.1	60
Maximum		4.05	2.15	2.5	2.85	56.1	66.7

	Number of specimens	Left: Breadth	Left: Height	Left: Stoutness	Left: Module (mean diameter)	Left: Height-breadth index	Left: Stoutness-breadth index
	cm.	*cm.*	*cm.*	*cm.*	*cm.*		
Average	(6)	3.72	1.89	2.31	2.64	50.8	62.2
Minimum		3.4	1.7	2.15	2.43	45.7	50.8
Maximum		4.05	2.05	2.45	2.97	55.4	68

* From the extremity of the tuberosity ad maximum.

† Use calipers with broad branches; hold instrument vertical; lay bone on movable branch on talus facet and raise the branch until the bone touches the under surface of the immovable branch.

‡ Same instrument as for last; lay bone on movable branch on its dorsal or superior surface; let it assume a natural position and raise the branch until the most prominent part of the plantar surface of the bone touches the under surface of the movable branch.

A comparison of the measurements of the Munsee scaphoid with those obtained on the United States whites shows a number of interesting conditions. The bone in the whites is again in both sexes and in all dimensions somewhat larger than in the Indian. The height-breadth index is identical in the females of the two races, but is more elevated, owing to a relatively greater height of the bone, in the white than in the Munsee males. The stoutness-breadth index is decidedly higher in both sexes in the whites, though more particularly so in the males. It may therefore be stated that the scaphoid in the United States whites is, in both sexes, not only absolutely but also relatively stouter, and in the males also relatively somewhat higher, than that in the Munsee Indians.

LXXXVI. SCAPHOID IN MUNSEE AND IN UNITED STATES WHITES

	Number of specimens	Breadth	Height	Stoutness	Module	Height-breadth index	Stoutness-breadth index
			MALES				
		cm.	*cm.*	*cm.*	*cm.*		
Munsee	(19)	4.13	2.08	2.59	2.93	50.4	62.8
United States whites	(52)	4.33	2.23	2.96	3.17	51.5	68.5
			FEMALES				
Munsee	(19)	3.75	1.94	2.35	2.68	51.7	62.7
United States whites	(36)	3.94	2.03	2.54	2.84	51.6	64.3

An inspection of the Munsee scaphoid shows a number of interesting particulars. A facet for the cuboid is present in only 23.5 per cent of the cases (15 per cent males and 30 per cent females); among the United States whites its frequency is nearly twice as great, or 39 per cent (40 per cent males and 37 per cent females), and Manners Smith reported an even higher proportion in England.[1]

The facet for the talus differs quite markedly as to shape in the Munsee and the whites. In the whites, and particularly in the females, it is predominantly more or less pyriform, and only seldom quadrilateral or nearly so; while in the Munsee conditions are reversed and a more or less quadrilateral facet is present in a large majority of the cases, especially in the males, while the pyriform type is scarce.

The tuberosity of the scaphoid differs also somewhat in the two races. In general, it may be more or less pointed, or decidedly blunt, or squarish; the first two forms are common among the whites, while

[1] Quoted by Cunningham, *Anatomy*, 3d ed., p. 245.

the squarish or angular, rare in the whites, is not infrequent in the Indians. (See pl. 28, *d*.)

The processus plantaris is found generally to be quite pronounced in the Munsee, more frequently so than in the United States whites; and occasionally there exists in the Indian scaphoid an additional tuberosity, separated from the regular one by a groove continuous with that situated between the processus plantaris and the tuberosity.

Cuboid

The cuboid bone, though so irregular, can be fairly conveniently measured as to its maximum length, breadth, and thickness. The method of taking the dimensions is explained in the next table.

There are 19 pairs of cuboids in the Munsee material—9 male and 10 female. Their measurements show the usual predominance of the male bone over the female on both sides and in all dimensions; as to sides, however, the differences are very small, the mean diameter being, in fact, equal on the right and left in both sexes.

LXXXVII. MUNSEE: CUBOID

MALES

	Right						
	Number of specimens (pairs)	Length, maximum*	Breadth, maximum †	Thickness, maximum ‡	Module (mean diameter)	Breadth-length index	Thickness-length index
		cm.	*cm.*	*cm.*	*cm.*		
Average	(9)	3.77	2.85	2.5	**3.04**	**75.7**	**66.5**
Minimum		3.55	2.7	2.3	2.88	70	62
Maximum		4	3.15	2.65	3.18	79.7	69.4

	Left						
	Number of specimens (pairs)	Length, maximum	Breadth, maximum	Thickness, maximum	Module (mean diameter)	Breadth-length index	Thickness-length index
		cm.	*cm.*	*cm.*	*cm.*		
Average	(9)	3.74	2.85	2.53	**3.04**	**76.2**	**67.7**
Minimum		3.55	2.75	2.3	2.86	71.8	62.8
Maximum		3.95	3	2.65	3.13	80	74.3

* Between the most prominent points on the superior and inferior borders of the distal or metatarsal facet of the bones and the point of the bone at the inferior medial angle ("calcanean process").

† Maximum breadth, with the cuboid resting on its medial surface in such position as it naturally assumes. This and the measurement given in the next note are obtained readily by the *compas glissière* with broad branches.

‡ Maximum thickness, with the cuboid resting on its anterior surface in such position as it naturally assumes.

LXXXVII.—MUNSEE: CUBOID—Continued

FEMALES

	Right						
	Number of specimens (pairs)	Length, maximum	Breadth, maximum	Thickness, maximum	Module (mean diameter)	Breadth-length index	Thickness-length index
		cm.	*cm.*	*cm.*	*cm.*		
Average	(10)	3.54	2.66	2.26	**2.82**	**75.1**	**64**
Minimum		3.25	2.3	2.1	2.58	67.6	59.5
Maximum		3.85	2.95	2.4	3.03	81.5	67.7

	Left						
	Number of specimens	Length, maximum	Breadth, maximum	Thickness, maximum	Module (mean diameter)	Breadth-length index	Thickness-length index
		cm.	*cm.*	*cm.*	*cm.*		
Average	(10)	3.55	2.65	2.26	**2.82**	**74.4**	**63.6**
Minimum		3.25	2.35	2.1	2.65	67.1	59.7
Maximum		4.8	2.95	2.5	3.03	81.5	71.4

As in the case of the scaphoid, the three measurements of the cuboid give rise to two indexes which express the relative proportion of the bone. Both of these indexes, as seen by the table, are higher in the males than in the females, especially on the left side, showing that the male bone is relatively broader as well as thicker.

The indexes also show slight differences on the two sides, but these are not parallel in the two sexes; in the males both are slightly higher on the right side, while in the females the condition is reversed owing to the fact that while in the males the length of the bone is slightly less on the left, in the females it is slightly greater on that side than on the right.

The Munsee cuboid contrasted with that of the United States whites is, as in all the other bones of the tarsus, slightly smaller in every dimension, and it differs also from the latter to a moderate degree in its relative proportions; but these differences, as seen in the following table, are somewhat irregular and can not be regarded as established before a larger series of specimens is examined.

LXXXVIII. THE CUBOID IN MUNSEE AND IN UNITED STATES WHITES

MALES

	Number of specimens	Length	Breadth	Thickness	Module	Breadth-length index	Thickness-length index
		cm.	*cm.*	*cm.*	*cm.*		
Munsee	(22)	3.75	2.85	2.52	3.04	75.8	67.1
United States whites	(48)	3.96	3.02	2.59	3.19	76.3	65.5
FEMALES							
Munsee	(24)	3.51	2.63	2.26	2.80	75	64.3
United States whites	(36)	3.62	2.67	2.37	2.89	73.7	65.5

As to points for observation, some interest attaches to the cuneiform and talus facets. In the United States whites the facet for the external cuneiform is single in 70 per cent of the cases, divided by a well-marked ridge in 23 per cent, and double, though mostly connected, in 7 per cent of the specimens. In the Munsee, in 45 bones, a single facet is present in 42, or 93 per cent; and one with a ridge in three, or approximately 7 per cent, while two facets occur in no instance.

In the United States whites a facet for the talus was found by the writer in four specimens out of the 82 examined, or approximately 5 per cent. Among 44 cuboids of the Munsee it occurred in only one instance (2.3 per cent), and in this case it was small.

The anterior or metatarsal facet of the cuboid is on the average flatter in the whites than in the Munsee, especially from side to side and in the bones of the males.

Internal Cuneiform

The internal cuneiform is the largest of the cuneiforms and yields two measurements—the greatest height and smallest breadth—which with their indexes are suitable for comparison. There are 45 of these bones in the Munsee material.

The results of the measurements, given in the next table, show the bone in the males to be as usual somewhat larger than in the females. With respect to the sides, the left bone is as high as and very slightly broader than the right in the males (in paired bones); but in the females the left internal cuneiform is very slightly lower and more perceptibly narrower than the right.

The breadth-height index on both sides is higher in the females, which shows that in this sex the bone is not only absolutely but also relatively lower than in the males.

LXXXIX. MUNSEE: INTERNAL CUNEIFORM

MALES

Right				Left			
Number of specimens	Height, maximum*	Breadth†	Breadth-height index	Number of specimens	Height, maximum	Breadth	Breadth-height index
Average:	*cm.*	*cm.*			*cm.*	*cm.*	
Pairs.....(8)..	**3.2**	**2.27**	**70.8**	(8)	**3.2**	**2.29**	**71.6**
All.....(9)..	3.17	2.24	70.7	(12)	3.17	2.3	72.7
Minimum (all).....(9)..	2.9	2.05	66.7	(12)	3	2.15	65.2
Maximum (all).....(9)..	3.35	2.4	77.4	(12)	3.35	2.55	79.7

FEMALES

Average.....(11)..	**2.86**	**2.11**	**73.8**	(11)	**2.84**	**2.06**	**72.6**
	2.86	2.11	73.8	(13)	2.86	2.08	73
Minimum.....(11)..	2.6	1.95	68.9	(13)	2.6	1.9	70
Maximum.....(11)..	3.05	2.4	80	(13)	3	2.3	78.6

*Lower (proximal) branch of the calipers applied to the most prominent parts of the inferior surface of the bone.

†Breadth minimum, in middle of bone, upper branch of calipers resting on both lips of the scaphoid facet: the only practicable breadth in all specimens.

A comparison of the internal cuneiform in the Munsee and in the United States whites shows the bone in both sexes of the latter to be greater in height as well as in breadth. But, as indicated by the indexes, this bone in the whites is in general also relatively higher than in the Indians, as the result of which we have a lower index in the whites in both sexes. This reveals another interesting difference in the osteology of the two groups, which may prove to be of definite racial significance.

The relatively greater narrowness of the internal cuneiform in the female than in the male is equally well pronounced in the whites and in the Munsee, and is probably a universal characteristic.

XC. THE INTERNAL CUNEIFORM IN THE MUNSEE AND IN UNITED STATES WHITES

	Males				Females			
	Specimens	Height	Breadth	Breadth-height index	Specimens	Height	Breadth	Breadth-height index
		cm.	*cm.*			*cm.*	*cm.*	
Munsee.....	(21)	3.17	2.28	71.8	(24)	2.86	2.10	73.4
United States whites.....	(50)	3.48	2.43	69.9	(37)	3.16	2.24	71.1

In descriptive features the internal cuneiform of the Munsee offers only minor differences from that of the whites. There seems to be present in the Indians, however, a somewhat greater tendency toward the occurrence of a double anterior or metatarsal facet. Two distinct

facets are present in five of the 45 Munsee bones (11 per cent), as against only one in the 87 bones of the whites (1.1 per cent). On the other hand, an approach to two facets (hour-glass shape, or a division of the one facet by a ridge) occurs in the Munsee in a little more than 13 per cent of the specimens, and in the whites in a little more than 10 per cent.

External and Middle Cuneiform

The external and middle cuneiform bones in the Munsee resemble closely those of the whites, but average slightly smaller in size.

Among 35 external cuneiforms, 10, or approximately 30 per cent, show absence of the facet for the fourth metatarsal, and one an absence of both facets for the second metatarsal.

As to the middle cuneiform, the central ligamentous depression on its medial surface, and especially the canal running downward from this, are characteristic features of the Indian bone and are more pronounced in both sexes than is the average in whites.

Summary of Measurements and Observations on Parts of the Munsee Skeleton other than the Skull

The bones of the Munsee skeleton agree closely, in a general way, with those of other Eastern Indians. Contrasted with those of whites they present many close resemblances, but also certain marked differences, one of which being that they are less stout.

Humerus.—The mean length of the humerus is in no way exceptional. In the female this bone is relatively long. The right and left humeri are of the same length in males, but the left is slightly shorter than the right in females. The shaft is flatter than in whites, in consequence of which the shaft index is lower. The breadth or antero-posterior diameter of the shaft of the right bone is greater than that of the left, while the thickness is practically the same. The shape of the shaft is frequently plano-convex (juvenile). Perforation of the septum exists in 22 per cent of the males and in 59 per cent of the females. Of the supracondyloid process there are only slight traces.

Radius.—The radius is decidedly long in the Munsee in relation to the humerus in both sexes, the result of which is a high radio-humeral index. The right and left radii are of equal length in males, but, as with the humerus, the left radius averages slightly shorter in the females.

Ulna.—The ulna presents nothing exceptional; it is shorter on the right in females, as in the case of the radius.

Femur.—The form of the femur is generally ordinary. The length corresponds to the average stature of 167 cm. in males and 156 cm. in females.

The excess of maximum over bicondylar length is greater than in whites, indicating greater obliquity of axis. The relation in length of the female femur to that of the male is very nearly the same as in whites; and the same applies to the relation of the femoral to humeral length.

At the middle of its shaft the femur is slightly broader on the right side than on the left, in consequence of which the shaft index is higher on the left. This index is decidedly smaller in both sexes of the Munsee than in whites, owing to the lesser breadth of the shaft in the Indian.

The subtrochanteric flattening is quite pronounced, giving a platymeric index considerably below that of the whites, but agreeing with that in other Indians. The index is lower on the left side than on the right, and slightly higher in females than in males.

The shape of the shaft is most frequently the ordinary prismatic. The elliptic type is rare. Cylindrical and four-surface types are absent.

The third trochanter in some form and degree exists in more than two-thirds of the bones, but is rarely pronounced.

Tibia.—The female Munsee tibia is not only absolutely but also relatively shorter than that of males; nevertheless, in both sexes the bone is relatively longer than in whites, in consequence of which the tibio-femoral index is high.

Platycnemy is infrequent; in the females the shaft is stout in many instances. In the shape of the shaft there is a frequency of the four-surface type.

Fibula.—The shape of the fibula is most frequently lateral prismatic or fluted.

Clavicles.—The clavicle in the female is relatively short. The right clavicle is slightly longer than the left in the males, shorter in the females.

Sternum.—The manubrium is generally detached; the bone is of moderate dimensions; frequent minor asymmetries; rib facets irregular in number. Curvature and measurements moderate; sternum of female relatively shorter.

Scapula.—The scapula is smaller than that of ordinary whites, especially in height. Scapular index high, showing the bone to be relatively broad, particularly in the females. Infraspinous index also high, even by comparison with that in other Indians.

The shape of the body is mostly quadrilateral or pentagonal. The superior border is frequently semilunar. The scapular notch in the males is often deep or converted into a foramen.

Ribs.—The ribs show remarkable freedom from fractures. Cervical rib present in one instance, 22 ribs only in another. In three-fourths of the cases the first ribs are semilunar in form.

Spine.—The spine is of moderate regular development. There are several numerical and structural anomalies.

Sacrum.—The dimensions of the sacrum are close to those of white males, but the female Munsee sacrum is shorter. The sacral index is not far from that in whites.

The sacrum shows the presence of six segments in one-fifth of the cases. The curvature is moderate to medium, and begins rather frequently below the first segment.

Pelvis.—Innominate bones absolutely smaller but relatively broader in females than in males. Breadth-height index lower than in whites. The pelvis as a rule is free from deformation. Male pelvis larger and relatively higher than the female, giving higher height-breadth index. Pelvic cavity in no case abnormal, but differs considerably in measurements; in general it is relatively deep at the brim, as a result of which it gives a high brim index.

Short and other bones: Patellæ.—The patella averages somewhat smaller in size than in whites. Male bone larger than female, but no difference in either sex on the two sides. The male Munsee patella is relatively somewhat shorter than that of the whites. Frequency of vastus notch.

Bones of hand.—Very free from anomalies. Moderate dimensions throughout. Metacarpo-humeral index lower than in whites, indicating relatively small hand.

Bones of feet.—First metatarsal shorter, both absolutely and relatively to the femoral length, than in whites, indicating relatively smaller feet.

Os calcis.—Bones of the two sides almost equal in size; very slight excess on right. Male bone relatively stouter than female, giving higher breadth-length and breadth-height indexes. The bone is smaller in all dimensions than that in ordinary whites of similar stature. The female os calcis is shorter and lower, but as slender as that of the whites.

The numerical variation of the facets for the astragalus is much the same as in whites, but in the latter the anterior and middle facets are much more frequently wide apart.

Astragalus.—Smaller in all dimensions than in whites. Equal on the two sides in males, but slightly higher on the left than on the right in the females. This bone is not only absolutely but relatively shorter and lower than that among the whites.

The facets for the os calcis do not harmonize fully with those on the os calcis itself, being less differentiated and more frequently connected or fused.

Scaphoid.—The scaphoid is smaller than in whites, also relatively less stout and frequently relatively less high than in the whites. The right scaphoid is larger than the left.

Cuboid facets are less common than among whites, and the facet for the astragalus differs markedly in shape from that of the white scaphoid. There are likewise differences in tuberosity and in processus plantaris.

Cuboid.—The cuboid is smaller than in whites; differences in the relative proportions are irregular. The right and the left bone are about equal.

Racial differences exist in cuneiforms and talus facets.

Internal cuneiform.—Smaller than in whites, also relatively lower. The female bone is relatively narrower than the male; there are some differences as to side.

Relative frequency of double metatarsal facet.

Middle cuneiform.—The depression in the medial surface and also the canal running from this are more pronounced in both sexes than in whites.

II. EASTERN INDIAN CRANIA IN GENERAL

General Observations

In connection with the study of the Munsee and in order to clarify, if possible, the physical affiliations of this important group of the Lenape, the writer undertook an examination of all crania of the Eastern Indians that now exist in the collections of the United States National Museum, the Peabody Museum of American Archæology and Ethnology at Cambridge, Phillips Academy at Andover, the American Museum of Natural History in New York, The Academy of Natural Sciences of Philadelphia, and the Valentine Museum at Richmond, in addition to a number of specimens sent to him from other institutions.[1] The total number of crania studied in the course of this investigation aggregated 253, of which 121 were of males and 132 of females.

Former records on American crania from Eastern Indians are scarce, and in most instances so imperfect or antiquated as to be of little value. The earliest data are those of Morton and Meigs,[2] based on the collections now in The Academy of Natural Sciences of Philadelphia. In 1862 Sir Daniel Wilson, of Toronto, published his *Prehistoric Man*, in two volumes, in the second volume of which he gives measurements of 39 male and 18 female Huron (Iroquois) skulls. Unfortunately these measurements are few in number, are recorded in inches, and were determined with instruments of whose character there is no record, although presumably they were such as had been used by Morton and Meigs. Later brief references to eastern Canadian crania by Dr. David Boyle will be found in the *Annual Archæological Reports* of Ontario. In 1867 measurements of five Algonquian and Iroquois skulls were included by Dr. J. Barnard Davis in his *Thesaurus Craniorum* (pp. 224–5), and in 1879 a few measurements of four Huron skulls were given by Quatrefages and Hamy in their *Crania Ethnica* (parts 10–11, p. 472).

In 1880 there appeared, in the *Memoirs of the Boston Society of Natural History*, a paper of 10 pages, with 2 plates, by Lucien Carr, at that time assistant curator of the Peabody Museum at Cambridge, on the crania of New England Indians, in which measurements of 67 skulls are given; but, as the present writer found subsequently by

[1] See the Appendix, page 127.

[2] *Crania Americana*, *Catalogue*, and other contributions. See the bibliographies in the writer's Physical Anthropology in America, *Amer. Anthropologist*, 1914, XVI, pp. 508–554.

examination and remeasurement of some of the same specimens, the sexual identification, as well as the measurements, were too faulty to warrant their use in this report. During the same year there appeared *A List of the Specimens in the Anatomical Collections of the United States Army Medical Museum*, by Dr. George A. Otis, which gave measurements of hundreds of American crania, including a number from the Eastern states; but these measurements also in many instances were made imperfectly, so that the records can not be profitably utilized. Flower's *Catalogue* gives the measurements of one Mohawk skull. Virchow, in his *Crania Ethnica Americana*, includes no specimen from the central or northern states bordering on the Atlantic. In 1899 Dr. Frank Russell [1] published some observations and measurements on Indian crania, among which were included a number from the New England states, more particularly from Massachusetts; and finally, in 1902, the writer published his *Crania of Trenton*,[2] which gave measurements of all the Lenape skulls, as well as those of some other Eastern Indians, then known.[3]

All the specimens described by the American authors above mentioned and that could still be located (which was possible in a large majority of the cases), were reexamined, consequently the following records are based solely on the measurements and observations by the present writer. Important additional Huron material, which it was found impracticable to include in these studies, exists in the museum of Laval University at Quebec and in the Provincial Museum at Toronto.

The 283 crania here included are not distributed evenly over the Atlantic states. There are fairly representative series from eastern Canada, Massachusetts, New York, New Jersey, and Virginia, but only a few specimens from Connecticut, and very few from Delaware, Maryland, and Pennsylvania. The climatic conditions and the soil of the more southerly of these states are not favorable to the preservation of skeletal remains, which, moreover, were probably never very abundant. Furthermore, many of the specimens available for examination were found more or less damaged, so that not all the important measurements could be obtained. Owing to these conditions the present study must necessarily leave many points for future corroboration or correction; however, the results obtained

[1] *American Naturalist*, 1899, p. 33.

[2] *Bulletin Amer. Museum of Natural History*, XVI, pp. 23–62.

[3] Just as this memoir is about to go to the printer, there appears a study, by Marian Vera Knight, on *The Craniometry of Southern New England Indians* (Yale Univ. Press, 1915, IV, pp. 1–36, 9 pl.), constituting a report on approximately 90 skulls, many of them imperfect, from Massachusetts and Rhode Island. A majority of the specimens are those that have already been studied by Carr and Russell, and more especially by the present writer. The results agree closely with those shown in this report, although Miss Knight includes some specimens that may safely be regarded as extraneous, and has not been entirely fortunate in the matter of some of her measurements and comparisons.

shed much light on the physical characteristics and relations of the Eastern Indians.

As above noted, the collections included cover the territory from southeastern Canada to Virginia, and, roughly speaking, from the easternmost lakes and the Appalachian mountains to the Atlantic. From northward and northwestward of this region skeletal material is scarce, and the same is true of the Southern states until we reach Florida; while to the westward the conditions are more complex and will best form part of a separate discussion.

The entire region covered by the collections, with a single exception, is characterized by a complete absence of both intentional and cradleboard deformation of the skull; the exception applies to the Munsee, among whom prevailed to a moderate extent the practice of frontal (fronto-occipital) compression. As this practice was very general to the southward and southwestward of the section here involved and was completely absent elsewhere beyond its boundaries, its occurrence among the Munsee, even to a limited extent, indicates that this tribe had some close connection in those directions, in which respect it differs from the rest of the Lenape. The well-known accession to the tribe, in the latter part of the seventeenth century, of some Shawnee, whose home was to the southwestward as far as Kentucky and Tennessee, may, as already suggested, explain this occurrence.

A consequential result of the study of the Eastern crania here included is that they all belong to one and the same fundamental type, which we now know in the northeast as that of the Algonquian and Iroquois, in the west as the Shoshonean, farther south as the Piman-Aztec, and in South America as the Andean, "Lagoa Santa," or Pampas type. However, in the territory under consideration, as elsewhere, this type is far from being homogeneous, differing sometimes in an important way almost from tribe to tribe. The differences are evidently due partly to intermixture with the other or brachycephalic American type and partly to locally developed or perpetuated variations.

In the several series of skulls here dealt with there is plain evidence of admixture in the majority of the groups, which, though mostly slight, increased from the north to the south. This admixture consists uniformly of brachycephalic elements, in some localities males, in others females, which doubtless were derived from farther west, southwest, and south. There are only four groups from which such admixture is absent, namely, those from Maine, Massachusetts, Connecticut, and Long Island. The conditions in this respect are presented in the following table:

XCI. PRESENCE OF BRACHYCEPHALIC INDIVIDUALS AMONG EASTERN TRIBES

Tribe or district	Males		Females	
	Skulls examined	Brachycephals in the group	Skulls examined	Brachycephals in the group
Hurons of southeastern Canada	15	2	5	.....
Maine	6	.....	6	.....
New Hampshire	.....	.....	1	.....
Massachusetts	14	.....	25	.....
Rhode Island	7	1	6	1
Connecticut	4	.....	4	.....
New York	19	.....	18	3
Manhattan Island	3	1	.....	.....
Long Island	7	.....	5	.....
Staten Island	6	2	3	.....
Munsee	10	.....	13	4
Other Lenape	11	3	23	3
Maryland	6	2	4	.....
Virginia	30	4	32	4
Total	138	*15	145	†15

* 10.9 per cent. † 10.3 per cent.

In all these cases the brachycephaly, and frequently other features of the skulls, were such that they could not possibly be attributable to a mere fluctuation of the prevalent type.

The individuals whom such specimens represent were probably recent accretions by the tribes through marriage or adoption. Other increments of similar nature doubtless occurred in the past, and, blending more or less thoroughly with the tribes, modified the physical types of these to a greater or less extent. It is evidently due to this influence that, as will be shown later, the more southerly tribes of the region under consideration—those which were nearest the more westerly, southwesterly, and southerly brachycephals—show a higher cranial index than the more northerly and purer tribes.

The principal numerical results of the measurements derived from the Eastern Indian crania are given at the end of this section. These may be summarized briefly: The type is characterized by marked to moderate dolichocephaly in the males, and by moderate dolichocephaly to mesocephaly in the females; by medium to high vault, with occasionally a low forehead; by good size of the skull as a whole, and lack of unusual thickness of its bones; by moderately high to high face, the latter especially frequent in the males; by moderate, seldom great, breadth of face; by considerably varying orbital dimensions and index, with a predominance of mesoseme forms, but reaching, even in the averages, from microseme to megaseme; by the frequency of moderate size in the nasal aperture; by variable nasal index, with a large predomi-

nance, however, of the mesorhinic form; by a rather short palate in many instances; and by a moderate degree of facial as well as of alveolar prognathism.

Cranial Index

The distribution of the most important characteristic of the skulls, the *cranial index,* will be more clearly apparent from the next table. Owing to the paucity of crania in some of the series, there are irregularities between the males and females of the same group, and the position of the different groups in the line is probably not in every case correct. Nevertheless, certain conditions are clearly brought out. It is seen on the whole that the dolichocephaly decreases in a slight ratio from the north to the south; but its lower extreme is found on Long Island, Staten Island, and Manhattan Island, New York. The crania from these three localities show striking resemblances, and though there are also certain differences, the conclusion seems to be justified that they belong to one group. It has been suggested [1] that the Indians of Staten Island were a branch of the Lenape, but the evidence offered by the skeletal remains gives no corroboration of this. There may have been Lenape women, or even some Lenape admixture, in the Staten Island tribe, but the crania of the men show almost uniformly distinct features which identify them clearly with the Indians of Manhattan Island and Long Island.

XCII. EASTERN INDIAN CRANIA: CRANIAL INDEX

	Males		Females	
	Number of specimens	Index	Number of specimens	Index
Long Island	(7)	70.7	(5)	74.3
Manhattan Island	(2)	71.7	(1)	71.8
Staten Island	(4)	71.7	(3)	75.4
Connecticut	(4)	72.4	(4)	74.6
Maine	(6)	72.7	(6)	74.7
Massachusetts	(14)	72.8	(25)	74.7
Southeastern Canada	(14)	73.4	(5)	76.9
New York State	(19)	73.5	(15)	74.8
Maryland	(4)	73.6	(4)	74.0
Rhode Island	(6)	73.7	(5)	75.6
New Jersey (Heye collection)	(4)	73.9	(5)	75.8
New Jersey (earlier)	(6)	74.6	(19)	75.1
Virginia	(27)	75.5	(28)	76.3

There is remarkable similarity in the average index of the crania of all the more northerly states as far as New Jersey. The Indians of both sexes from Maine and Massachusetts are particularly close in

[1] See A. Skinner in The Indians of Greater New York and the Lower Hudson, edited by Clark Wissler, *Anthropological Papers of the American Museum of Natural History,* III, 1909.

this respect, and, as will be seen later, these two groups, while not entirely homogeneous, show many other close similarities.

The most important result is that shown by the crania from southeastern Canada, which are almost entirely Huron or Iroquois; and by the specimens from New York State, which also are largely of Iroquois derivation. The Iroquois, as is well known, are regarded as a linguistic stock distinct from the Algonquian, though there are some lexical resemblances in the two languages. But the measurements of the skulls of representatives of the two stocks show no such distinction. In fact, the Iroquois occupy, with reference to nearly all important cranial features, more or less of a median position among the Algonquian groups, and there is no basis on which they can legitimately be segregated as belonging to any different physical group of Indians. It is quite possible that some of the Iroquois tribes may have been derived, in smaller or larger part, from other peoples of the westward or the southwestward, or that in course of time they became mixed with such; but the greater proportion of the Iroquois can henceforth be no more separated in physical anthropology from the Algonquians than can any of the subgroups of the latter.

Another important result of these studies relates to the Lenape. The Munsee and other Delaware Indian skulls, while nearing (and in the case of females slightly surpassing) the upper limits of dolichocephaly, are nevertheless sufficiently closely related to the crania from the neighboring states to show that the Munsee, and the Lenape as a whole, were in all probability only subdivisions of the eastern Algonquians. Resemblances in other important features of the skull, as well as of the skeleton, make this conclusion quite definite, thus eliminating the theory of the migration of the Lenape from beyond the Mississippi, for if such were the case, they could scarcely fit so precisely into the anthropological position they occupy between the neighboring tribes. Yet, as previously mentioned, there is some evidence, especially that afforded by the Munsee, that the Lenape had some connection, probably earlier as well as recent, with tribes living southwestward from the Appalachian mountains.

From the limited Pennsylvania material it appears that the eastern lowlands were occupied by Indians of the Algonquian or Lenape type, while in the more westerly parts brachycephaly was frequent if not common.

As to the Virginia Algonquians, they show the highest cranial indexes of all the groups here considered, and had doubtless considerable foreign blood, derived from the west or the south. It would be interesting to compare the Virginia Indians with the Siouan tribes, to which they seem to bear close affinity.

Height of Skull

Next to the cranial index, the most important feature of the vault of the skull is its height, and the Eastern crania, as already stated, are characterized by good to pronounced development in this direction. The averages of the measurements, and those of the ordinary height-length and height-breadth indexes, will be found in the final tables, but none of these are very satisfactory for showing the true value of this dimension, which on the one hand is proportionate to the size of the skull, and on the other stands in a more or less compensatory relation with both the length and breadth of the vault. It has long been felt by the writer that some expression of the real relative value of the height measurement was required, and this need led him ultimately to compare it not with the very variable length or breadth of the skull, but with the mean of these two measurements. The resultant index, which may be called simply the height index of the vault, gives us a new means of comparison and classification of the skull and promises to prove much more satisfactory than the two older indexes. In the Eastern crania here described, it ranges from 83 to almost 90, and the arrangement of the various tribes on its basis is harmonious and of considerable interest. The main points brought out by the index are as follow:

In the northernmost tribes the height of the skull is on the whole relatively lower than in those farther south. The Munsee and other Lenape crania agree with those of the more northerly groups, but differ somewhat from each other, the skulls in the Heye collection being in both sexes perceptibly lower than those of the other Lenape. The Staten Island, Manhattan Island, and Long Island skulls are again grouped, so far as the more important male skulls are concerned, and are all high. Of the Virginia collections, the first series, from various eastern localities, shows a medium height or slightly above; but the Valentine collection, from a more westerly part of the state,[1] gives in both sexes the highest index of all the groups, showing the greatest relative height and indicating that this group had been subjected to influences which did not affect equally the Indian population of other parts of the state.

[1] For details concerning this collection, see Report of the Exploration of the Hayes Creek Mound, Rockbridge County, Virginia, *Publ. Valentine Museum*, Richmond (*ca.* 1892).

XCIII. EASTERN INDIAN CRANIA: HEIGHT INDEX*

	MALES		FEMALES	
	Number of specimens	Index	Number of specimens	Index
Maine	(6)	83	(6)	83.5
New Jersey (Heye collection)	(4)	83.9	(5)	83.2
New York	(19)	84.4	(15)	83.6
Southeastern Canada	(14)	84.4	(5)	85.7
Massachusetts	(14)	84.6	(25)	86.1
Rhode Island	(6)	85.3	(5)	86.4
New Jersey (earlier)	(6)	86.1	(21)	85.1
Virginia (miscellaneous)	(12)	86.5	(7)	85.25
Connecticut	(4)	86.5	(4)	85.4
Staten Island	(4)	87.5	(3)	84.2
Manhattan Island	(2)	87.5	(1)	(88.4)
Long Island	(7)	88.1	(5)	84
Virginia (Valentine collection)	(15)	89.8	(21)	86.7

$$*H \times 100 \div \frac{(L+B)}{(2)}$$

Size of Skull

The size of the skull of the Eastern Indian, as expressed by the cranial module, shows again a grouping of much interest, though here more than in other series, owing to the small number of specimens, the position of some of the tribes can not be regarded as definitely fixed. The Munsee, as well as other Lenape skulls, stand with those of Rhode Island at the lower end of the scale, showing the smallest heads, although the Indians of these localities were not tribes of smaller stature than most of the other Eastern Indians. The more northerly Algonquians (with the exception of those of Rhode Island) and the Iroquois, occupy a median position. In the Virginia tribes the size of the skull ranges from medium to slightly above in the more easterly, but slightly below medium in the more westerly tribes. The crania from Manhattan, Long Island, and Staten Island are again grouped and occupy the highest position in the series, showing the largest heads; but they were also among the tallest, if not the tallest, of the Eastern Indians.

XCIV. EASTERN INDIAN CRANIA: CRANIAL MODULE

	Males		Females	
	Number of specimens	Cranial module	Number of specimens	Cranial module
		cm.		*cm.*
Rhode Island	(6)	15.22	(4)	14.84
New Jersey (earlier)	(4)	15.33	(14)	14.64
New Jersey (Heye collection)	(7)	15.44	(9)	14.75
Virginia (Valentine collection)	(11)	15.46	(13)	15.0
Southeastern Canada	(14)	15.48	(5)	14.77
Maine	(6)	15.55	(5)	14.92
Connecticut	(2)	15.55	(3)	14.84
Massachusetts	(12)	15.56	(22)	14.72
Virginia (miscellaneous)	(6)	15.58	(2)	14.74
New York State	(17)	15.62	(14)	14.71
Manhattan Island	(2)	15.67	(1)	14.93
Long Island	(5)	15.71	(5)	14.91
Staten Island	(4)	16.04	(3)	14.73

XCV. EASTERN INDIAN CRANIA: VAULT*

MALES

Group	Number of specimens	Length	Breadth	Height	Cranial module	Cranial index	Height-length index	Height-breadth index	Cranial capacity	Thickness left parietal
		cm.	*cm.*	*cm.*	*cm.*				*c. c.*	*mm.*
Southeastern Canada	(14)	18.84	13.82	13.78	15.48	73.4	73.1	99.7		
Maine	(6)	19.1	13.9	13.7	15.55	72.7	71.9	98.8		
Massachusetts	(14)	18.93	13.78	13.94	15.56	72.8	73.5	101		
Rhode Island	(6)	18.43	13.58	13.65	15.22	73.7	74.1	100.5		
Connecticut	(4)	18.65	13.5	13.9	15.55	72.4	73.5	100.4		
New York State	(19)	19	13.97	13.92	15.62	73.5	73.6	99.5		
Manhattan Island	(2)	19.05	13.65	14.3	15.67	71.7	75.1	104.8		
Long Island	(7)	19.1	13.5	14.36	15.71	70.7	74.9	105.7		
Staten Island	(4)	19.5	14	14.66	16.04	71.7	75.2	104.9		
New Jersey (earlier)	(6)	18.5	13.8	13.9	15.33	74.6	75.8	101.2		
New Jersey (Heye collection)	(7)	19.05	14.1	13.9	15.44	73.9	73.1	98.9	1544	5
Delaware	(1)	(19)	(14)			(73.7)				
Maryland	(4)	19.2	14.15	(13.6)	(15.57)	73.6	(71.6)	(96.5)		
Virginia (miscellaneous)	(12)	18.6	14	14.1	15.58	75.5	76.2	99.3		
Virginia (Valentine collection)	(15)	18.2	13.75	14.35	15.46	75.5	79	103.2		

*Measurements in parentheses are derived from a single specimen.

XCV. EASTERN INDIAN CRANIA: VAULT—Continued

FEMALES

Group	Number of specimens	Length	Breadth	Height	Cranial module	Cranial index	Height-length index	Height-breadth index	Cranial capacity	Thickness left parietal
		cm.	*cm.*	*cm.*	*cm.*				*c. c.*	*mm.*
Southeastern Canada	(5)	17.55	13.5	13.3	14.77	76.9	75.7	98.3	.....	.....
Maine	(6)	18.1	13.5	13.2	14.92	74.7	73.4	97.8	.....	.....
New Hampshire	(1)	(17.8)	(12.6)	.....	.....	(70.8)	.....	.....	.....	.....
Massachusetts	(25)	17.7	13.2	13.3	14.72	74.7	75.5	100.9	.....	.....
Rhode Island	(5)	17.8	13.45	13.5	14.84	75.6	76.6	100.2	.....	.....
Connecticut	(4)	17.85	13.3	13.3	14.84	74.6	74.9	98.8	.....	.....
New York State	(15)	17.8	13.3	13	14.71	74.8	72.5	96.6	.....	.....
Manhattan Island	(1)	(18.1)	(13)	(13.7)	(14.93)	(71.8)	(75.7)	(105.4)	.....	.....
Long Island	(5)	18.1	13.45	13.25	14.91	74.3	73.2	98.5	.....	.....
Staten Island	(3)	17.7	13.4	13.1	14.73	75.4	73.9	98	.....	.....
New Jersey (earlier)	(21)	17.6	13.2	13.1	14.64	75.1	74.9	97	1326	.....
New Jersey (Heye collection)	(9)	17.6	13.4	12.9	14.75	75.8	73.1	96.4	1285	4.3
Maryland	(4)	18.1	13.4	.....	(14.87)	74	(70.1)	(97)	.....	.....
Virginia (miscellaneous)	(7)	17.7	13.5	13.3	14.74	76	75	100.7	.....	.....
Virginia (Valentine collection)	(21)	17.75	13.6	13.6	15	76.4	76.9	99	.....	.....

Facial Measurements

HEIGHT OF THE FACE

The height of the face stands largely, though not absolutely, in correlation with the length of the head, a feature which becomes apparent also in our series. The collections from more westerly Virginia and the Lenape groups, all of which show rather short crania, give also the shortest faces. Maine and Massachusetts follow, with Rhode Island and New York. The Indians of Staten Island, Long Island, and Manhattan Island, so far as the males are concerned, all find a place in the upper half of the series, with long faces, and the same is true of the few more easterly Virginia specimens in which the face could be measured, and of the males of southeastern Canada. The latter, with those of Manhattan Island, occupy the upper limit of the scale. The females throughout show more uniformity than the males in their measurements.

BREADTH OF THE FACE

The breadth of the face, as measured by the diameter bizygomatic maximum, stands in a measure in correlation with the breadth of the head, but as it depends very largely on the degree of development of the temporal muscles and as a pronounced development of these muscles, while broadening the zygomatic arches, tends at the same

time to restrict the development of the skull in breadth, there are many irregularities in this correlation. In our series, Rhode Island, Maine, Massachusetts, and Connecticut occupy the lowest positions in the scale, showing faces that for Indians are decidedly narrow. Among the Lenape the faces are about medium, and the same is true of the more westerly Virginians. On Manhattan Island and Staten Island the face was well above the medium in breadth, but not so on Long Island, although the somewhat exceptional position of the Long Island Indians in this respect may be accidental. The Indians of southeastern Canada and New York State, as well as some of the Virginia Indians, had faces decidedly broader than the averages of those of the northeastern states bordering on the Atlantic.

Comparing the average facial breadth with facial height, it is seen that in most of the tribes noted the two measurements occupy a similar position in the scale, the narrow faces being also short, and vice versa; but there are several exceptions.

XCVI. EASTERN INDIAN CRANIA: FACE

Prosthion-nasion height					Diameter bizygomatic maximum				
Group	Males		Females		Group	Males		Females	
	Number of specimens	P.-N.	Number of specimens	P.-N.		Number of specimens	D. biz. max.	Number of specimens	D. biz. max.
		cm.		*cm.*			*cm.*		*cm.*
New Jersey (Heye collection)	(7)	7.15	(5)	6.9	Rhode Island	(6)	13.35	(3)	13
New Jersey (earlier)			(11)	6.8	Maine	(2)	13.45	(4)	12.95
Virginia (Valentine collection)	(4)	7.3	(5)	6.9	Massachusetts	(7)	13.7	(8)	12.7
Maine	(3)	7.4	(4)	6.8	Connecticut	(2)	13.8	(2)	12.3
Massachusetts	(8)	7.4	(15)	7	Long Island	(4)	13.85	(4)	12.95
Rhode Island	(3)	7.4	(4)	7.1	Virginian (Valentine collection)	(4)	13.85	(6)	13.1
Connecticut			(2)	6.85	New Jersey (earlier)			(9)	12.7
New York State	(10)	7.4	(11)	6.9	New Jersey (Heye collection)	(7)	13.9	(6)	12.8
Staten Island	(3)	7.45	(2)	6.5	New York State	(13)	14.05	(9)	13.1
Virginia (miscellaneous)	(2)	7.5			Eastern Canada	(9)	14.1	(5)	12.6
Long Island	(4)	7.5	(4)	7	Manhattan Island	(1)	14.3		
Southeastern Canada	(7)	7.8	(5)	6.75	Staten Island	(3)	14.7	(2)	12.65
Manhattan Island	(2)	7.95			Virginia (miscellaneous)	(2)	14.7		

Orbits

While describing, in 1902, the skulls of the more easterly Lenape, the writer was impressed by the occasional appearance of very low orbits, and considered at the time the possibility of this feature being characteristic of the tribe. The present examination shows,

however, that remarkably low orbits were frequent among some of the tribes of the eastern Algonquians, and that the Munsee and Lenape skulls occupy, with respect to the average orbital index, only a median position. The lowest orbits in the mean were found among the males of Long Island and of the North Atlantic states. Maine and Massachusetts again stand exceedingly close together, with fairly low indexes, while Manhattan Island and Staten Island are about medium. The females of Staten Island show in this, as in other respects, a lack of harmony with the males, with lower index. The highest orbits are found in the skulls from southeastern Canada and Rhode Island, and in both of the series from Virginia. On the whole, the extensive variation of the absolute and relative dimensions of the orbits among the eastern Algonquians (and Iroquois) is very remarkable. Its chief cause in the males is the unequal development of the supraorbital ridges; in the females, excepting in two or three groups, the proportions and indexes are more nearly alike.

XCVII. EASTERN INDIAN CRANIA: FACE

Group	Orbital index				Group	Nasal index			
	Males		Females			Males		Females	
	Number of specimens	O. I.	Number of specimens	O. I.		Number of specimens	N. I.	Number of specimens	N. I.
Long Island	(5)	82.6	(5)	87.4	Manhattan Island	(2)	44.9	.....	.....
Connecticut	(2)	84.6	(3)	92.1	Maine	(4)	45.6	(4)	50
Maine	(4)	86.2	(4)	86.2	Long Island	(5)	46.7	(5)	49
Massachusetts	(10)	86.3	(2)	88.8	Connecticut	(2)	49	(2)	54.7
New York State	(16)	86.8	(13)	88.6	Southeastern Canada	(8)	49.1	(5)	53.4
Manhattan Island	(2)	87.4	(1)	87.8	Massachusetts	(10)	49.7	(20)	49.5
New Jersey (earlier)	.....	.....	(13)	87.2	Virginia (miscellaneous)	(3)	50.6	(1)	52
New Jersey (Heye collection)	(7)	87.5	(7)	91.7	New Jersey (earlier)	.....	.....	(13)	51.5
Staten Island	(3)	87.6	(3)	83	New Jersey (Heye collection)	(7)	51.1	(9)	52.9
Southeastern Canada	(10)	87.8	(5)	89.5	New York State	(15)	51.8	(13)	53.2
Virginia (Valentine collection)	(10)	87.9	(6)	89	Rhode Island	(6)	52.5	(5)	52.1
Virginia (miscellaneous)	(5)	88.9	(2)	85.6	Staten Island	(3)	53.1	(3)	54.4
Rhode Island	(6)	90	(5)	89	Virginia (Valentine collection)	(8)	53.5	(6)	54.3

Nasal Index

Among the Eastern Indians, the nose, as already mentioned, is in general relatively small, and the aperture presents often fairly sharp borders, an exceptional feature among Indians of most other parts of the continent. The nasal aperture, or more properly the

relation of the breadth to the height of the nose, expressed by the nasal index, differs considerably in the different tribes. The index is low in the northeastern states, on Manhattan Island and Long Island, and in southeastern Canada; medium among the Munsee and other Lenape, among the more easterly Virginia tribes and in New York State; and elevated on Staten Island and in the more westerly Virginians. It was also elevated in both sexes in Rhode Island, which is of interest in that the specimens from that state show a somewhat exceptional position in other respects. On Staten Island, the crania of which stand in regard to nasal index apart from those of Manhattan Island and Long Island, with which they are otherwise so closely related, the character may have been influenced by admixture through the accession of females.

Palate

The relative proportions of the dental arch, as expressed by the "palatine" index, show shortest palates in the northeastern states and longest among the Lenape; but the differences are not very marked.

XCIII. EASTERN INDIAN CRANIA: FACE

Group	Palatine index				Group	Angle of facial prognathism			
	Males		Females			Males		Females	
	Number of specimens	P. I.	Number of specimens	P. I.		Number of specimens	Angle, degrees	Number of specimens	Angle, degrees
Massachusetts	(5)	113.2	(8)	115.4	Connecticut			(2)	68
Manhattan Island	(2)	113.2			Rhode Island	(3)	69	(2)	73
Maine	(3)	113.8	(4)	113.8	New York State	(7)	71	(10)	72.5
Virginia (Valentine collection)	(3)	114.1	(5)	116.4	Southeastern Canada	(5)	72	(3)	72
New York State	(2)	116			Maine			(3)	72
Rhode Island			(3)	116.1	Massachusetts	(4)	73	(3)	71
Staten Island	(2)	116.5			New Jersey (Heye collection)	(6)	73	(5)	74
Southeastern Canada	(4)	117.3	(3)	115.8	Long Island	(4)	74	(3)	71
New Jersey (Heye collection)	(8)	120.7	(5)	120.5	Virginia (Valentine collection)			(5)	74
New Jersey (earlier)			(2)	121.2	Staten Island	(3)	76	(1)	75

Prognathism

Facial prognathism did not differ very greatly in the different groups, yet there is a perceptible tendency toward a greater orthognathy among Indians of the northeastern states and Canada, and to somewhat greater protrusion among those of Long Island and Staten Island, the Munsee, and the Virginians of the Valentine collection. Alveolar prognathism (see table for details) was most

pronounced on Manhattan Island, Long Island, and Staten Island; east among the New York Indians and among those of southeastern Canada, Maine, and Massachusetts.

It is evident from the data presented above, that the eastern Algonquian (and Iroquois) Indians, while essentially of one type, approached purity of type much more in the northeastern Atlantic states and in southeastern Canada than farther south. It is further plain that the stock presented numerous and occasionally marked localized or tribal as well as individual variations, and that in several of the states, and possibly even in Rhode Island, it was modified more or less by admixture with individuals of both sexes from across the Appalachians or the south. A locally differentiated group which in many respects already stood more or less apart from the neighboring tribes and was also characterized especially by more than average development, is the cluster of tribes of Manhattan Island, Long Island, and Staten Island. The Munsee and other Lenape stand in close relation in many important respects, though they exhibit also some differences; and both of them, as already shown, agree with the rest of the eastern Algonquians, more especially with their immediate neighbors to the north and south.

The tables of detail measurements of the Eastern Indian crania follow.

XCIX. EASTERN INDIAN CRANIA: FACE (DETAILS)

MALES

Group	Number of specimens	Upper height	Facial breadth	Facial index, upper	Number of specimens	Orbits		
						Height	Breadth	Index
		cm.	*cm.*			*cm.*	*cm.*	
Southeastern Canada	(7)	7.8	14.1	55.2	(10)	3.47	3.96	87.8
Maine	(3)	7.4	13.45	53.2	(4)	3.36	3.9	86.2
Massachusetts	(8)	7.4	13.7	54.3	(10)	3.42	3.96	86.3
Rhode Island	(3)	7.4	13.35	55.5	(6)	3.5	3.9	90
Connecticut	(2)	.....	13.8	.....	(2)	3.25	3.8	84.6
New York State	(10)	7.4	14.05	51.7	(16)	3.4	3.9	86.8
Manhattan Island	(2)	7.95	(14.3)	(54.5)	(2)	3.47	3.97	87.4
Long Island	(4)	7.5	13.85	54	(5)	3.3	4	82.6
Staten Island	(3)	7.45	14.7	50.5	(3)	3.48	4	87.6
New Jersey (Heye collection)	(7)	7.15	13.9	51.5	(7)	3.4	3.9	87.5
Maryland	.....	.....	.....	.....	(1)	(3.48)	(3.98)	(87.4)
Virginia (miscellaneous)	(2)	7.5	14.7	51	(7)	3.55	4	88.9
Virginia (Valentine collection)	(4)	7.3	13.85	56	(10)	3.33	3.8	87.9

XCIX. EASTERN INDIAN CRANIA: FACE (DETAILS)—Continued

FEMALES

Group	Number of specimens	Upper height	Facial breadth	Facial index, upper	Number of specimens	Orbits		
						Height	Breadth	Index
		cm.	*cm.*			*cm.*	*cm.*	
Southeastern Canada	(5)	6.75	12.6	52.9	(5)	3.38	3.78	89.5
Maine	(4)	6.8	12.95	52.7	(4)	3.28	3.81	86.2
Massachusetts	(15)	7	12.7	56.2	(21)	3.36	3.79	88.8
Rhode Island	(4)	7.1	13	55.2	(5)	3.45	3.87	89
Connecticut	(2)	6.85	12.3	55.7	(3)	3.32	3.6	92.1
New York State	(11)	6.9	13.1	52.9	(13)	3.35	3.8	88.6
Manhattan Island					(1)	(3.25)	(3.7)	(87.8)
Long Island	(4)	7	12.95	53.1	(5)	3.26	3.73	87.4
Staten Island	(2)	6.5	12.65	(51.6)	(3)	3.19	3.84	83
New Jersey (earlier)	(11)	6.8	12.7	53	(13)	3.38	3.87	87.2
New Jersey (Heye collection)	(5)	6.9	12.8	54.1	(7)	3.4	3.72	91.7
Virginia (miscellaneous)					(2)	3.2	3.8	85.6
Virginia (Valentine collection)	(5)	6.9	13.1	52.4	(6)	3.31	3.72	89

C. EASTERN INDIAN CRANIA: FACE (DETAILS)

MALES

Group	Number of specimens	Nose		Index	Number of specimens	Palate		
		Height	Breadth			Height	Breadth	Index
		cm.	*cm.*			*cm.*	*cm.*	
Southeastern Canada	(8)	5.46	2.7	49.1	(4)	5.8	6.8	117.3
Maine	(4)	5.1	2.3	45.6	(3)	5.8	6.6	113.8
Massachusetts	(10)	5.2	2.6	49.7	(5)	5.75	6.5	113.2
Rhode Island	(6)	5	2.65	52.5	(1)	(6)	(7.3)	(121.7)
Connecticut	(2)	5	2.45	49				
New York State	(15)	5.3	2.75	51.8	(2)	5.95	6.9	116
Manhattan Island	(2)	5.9	2.65	44.9	(2)	6.05	6.85	113.2
Long Island	(5)	5.3	2.47	46.7				
Staten Island	(3)	5.1	2.7	53.1	(2)	5.75	6.7	116.5
New Jersey (Heye collection)	(7)	5.1	2.6	51.1	(8)	5.6	6.8	120.7
Maryland	(1)	(5.4)	(2.7)	(50)				
Virginia (miscellaneous)	(3)	5.4	2.7	50.6				
Virginia (Valentine collection)	(9)	5.23	2.74	53.5	(3)	5.9	6.7	114.1

C. EASTERN INDIAN CRANIA: FACE (DETAILS)—Continued

FEMALES

Groups	Nose				Palate			
	Number of specimens	Height	Breadth	Index	Number of specimens	Height	Breadth	Index
		cm.	cm.			cm.	cm.	
Southeastern Canada	(5)	5	2.67	53.4	(3)	5.3	6.1	115.8
Maine	(4)	4.9	2.45	50	(4)	5.6	6.4	113.8
Massachusetts	(21)	4.97	2.46	49.5	(8)	5.5	6.4	115.4
Rhode Island	(5)	5.14	2.68	52.1	(3)	5.6	6.5	116.1
Connecticut	(2)	4.75	2.6	54.7				
New York State	(13)	5	2.67	53.2	(1)	(5.5)	(7)	(127.3)
Long Island	(5)	4.9	2.3	49				
Staten Island	(3)	4.75	2.58	54.4				
New Jersey (earlier)	(13)	4.87	2.5	51.5	(2)	5.2	6.3	121.2
New Jersey (Heye collection)	(9)	4.98	2.63	52.9	(5)	5.25	6.35	120.5
Virginia (miscellaneous)	(1)	(5)	(2.6)	(52)				
Virginia (Valentine collection)	(6)	5	2.72	54.3	(5)	5.5	6.4	116.4

CI. EASTERN INDIAN CRANIA: FACE (DETAILS)

MALES

Group	Number of specimens	Diameter frontal minimum	Number of specimens	Basion-prosthion	Basion subnasal point	Basion nasion	Angle of facial prognathism	Angle of alveolar prognathism
		cm.		cm.	cm.	cm.	°	°
Southeastern Canada	(14)	9.7	(5)	10.6	9.3	10.7	72	53
Maine	(6)	9.35	(1)	(10.4)	(9.1)	10.8	(75)	(55)
Massachusetts	(12)	9.5	(5)	10.4	9.2	10.7	73	58
Rhode Island	(6)	9.6	(3)	10.5	9.1	10.3	69	58.5
Connecticut	(4)	9.1	(2)			10.3		
New York State	(16)	9.5	(8)	10.5	9.4	10.6	71	54
Manhattan Island	(2)	9.5	(1)	(11)	(10.2)	11.2	(72.5)	(64)
Long Island	(1)	(9.3)	(4)	10.3	9.5	10.8	74	64
Staten Island	(2)	9.2	(3)	10.7	9.8	11.2	76	62
New Jersey (Heye collection)	(8)	9.4	(6)	9.9	9	10.3	73	59
Maryland	(2)	9.9				(10.8)		
Virginia (miscellaneous)	(12)	9.5	(1)	(10.2)	9.6	10.6	(74)	(60)
Virginia (Valentine collection)	(14)	9.7	(1)	(10.2)	9.2	10.6	(71)	(54)

CI. EASTERN INDIAN CRANIA: FACE (DETAILS)—Continued

FEMALES

Group	Number of specimens	Diameter frontal minimum	Number of specimens	Basion prosthion	Basion subnasal point	Basion nasion	Angle of facial prognathism	Angle of alveolar prognathism
		cm.		*cm.*	*cm.*	*cm.*	°	°
Southeastern Canada	(4)	9.2	(3)	9.6	8.9	9.9	72	56
Maine	(6)	9.3	(3)	9.9	9.1	10.2	72	57
Massachusetts	(23)	9	(10)	10.1	9	10	71	56.5
Rhode Island	(4)	9.4	(2)	10.1	8.7	10.2	73	50
Connecticut	(3)	8.9	(2)	10.2	(8.5)	9.8	68	(51)
New York State	(13)	8.95	(11)	9.9	9	10.1	72.5	57.5
Long Island	(5)	9	(3)	10	(9)	10	71	(59)
Staten Island	(3)	9.2	(1)	(9.2)	(8.8)	9.9	(75)	.....
New Jersey (earlier)	(7)	9.2	(4)	9.8	8.7	9.9	70	54
New Jersey (Heye collection)	(9)	9	(5)	9.6	8.6	10	74	57
Maryland	(3)	9.1	.....	.....	.....	(10.1)	.....	.....
Virginia (miscellaneous)	(6)	9.1	.....	.....	(9.4)	(10.3)	.....	.....
Virginia (Valentine collection)	(18)	9.2	(5)	9.9	8.9	10.25	74	56

APPENDIX

One of the most important conclusions reached in connection with the studies dealt with in these pages is that of the physical identity of the Iroquois with the eastern Algonquian tribes. To test this conclusion the writer subsequently examined the valuable collection of Iroquois skeletal material in possession of the Buffalo Society of Natural Sciences,[1] consisting of 34 male and 22 female adult skulls, well identified and in good condition. The results of this additional study are given in the following tables and need little comment except that the conclusions presented in the body of this report as to the physical identity of the Iroquois and eastern Algonquian peoples are fully verified. In every respect the measurements and indexes of the new series fit closely among those of the other Eastern tribes, and in not a single feature do they drop out of line or even equal the extremes of variation in the skeletal remains of the tribes previously studied. In view of these facts the essential identity of the physical characters of the Iroquois and Algonquians, as determined by their skeletal remains, may, it seems, be regarded as definitely established.

IROQUOIS AND MOST NEARLY RELATED EASTERN INDIAN CRANIA

CRANIAL INDEX

Male			*Female*		
Connecticut	(4)	72.4	Connecticut	(4)	74.6
Maine	(6)	72.7	Maine	(6)	74.7
Massachusetts	(14)	72.8	Massachusetts	(25)	74.7
Iroquois	(*34*)	*73.1*	*Iroquois*	(*22*)	*74.0*
Southeastern Canada	(14)	73.4	Southeastern Canada		
New York State	(19)	73.5	New York State	(15)	74.8
Maryland	(4)	73.6	Maryland	(1)	74.0
Rhode Island	(6)	73.7	Long Island	(5)	74.3
Delaware	(1)	73.7	Delaware		
New Jersey (Munsee)	(4)	73.9	Lenape	(19)	75.1

HEIGHT-LENGTH INDEX

Male			*Female*		
Southeastern Canada	(14)	73.1	Southeastern Canada	(5)	75.7
Massachusetts	(12)	73.5	Massachusetts	(24)	75.5
Connecticut	(2)	73.5	Connecticut	(3)	74.9
New York State	(17)	73.6	New York State	(14)	72.5
Iroquois	(*32*)	*74.0*	*Iroquois*	(*21*)	*74.4*
Rhode Island	(6)	74.1	Rhode Island		
New Jersey	(7)	74.2	New Jersey	(20)	74.4
Long Island	(5)	74.9	Long Island	(5)	73.2
Staten Island	(4)	75.2	Staten Island	(3)	73.9

[1] Grateful acknowledgment for courtesies in this connection are extended to Mr. Henry R. Howland, superintendent of the museum of this Society.

HEIGHT-BREADTH INDEX

Male			*Female*		
Southeastern Canada	(14)	99.7	Southeastern Canada	(5)	98.3
Connecticut	(2)	100.4	Connecticut	(3)	98.8
Rhode Island	(6)	100.5	Rhode Island	(4)	100.2
Iroquois	(*32*)	*101.0*	*Iroquois*	(*21*)	*100.5*
Massachusetts	(12)	101.0	Massachusetts	(22)	100.9
New Jersey (earlier)	(3)	101.2	New Jersey (earlier)	(14)	97.0
Virginia (all)	(17)	101.8	Virginia (all)	(15)	99.2

HEIGHT INDEX
(Hrdlička)
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Male			*Female*		
Maine	(6)	72.3	Maine	(5)	74.1
Long Island	(5)	72.8	Long Island	(5)	74.1
Connecticut	(2)	73.0	Connecticut	(3)	74.7
Massachusetts	(12)	73.2	Massachusetts	(22)	75.1
Southeastern Canada	(14)	73.3	Southeastern Canada	(5)	76.3
Manhattan Island	(2)	73.4	Manhattan Island	(1)	73.7
Staten Island	(4)	73.5	Staten Island	(3)	74.6
New York State	(17)	73.6	New York State	(14)	73.7
Iroquois	(*32*)	*73.6*	*Iroquois*	(*21*)	*74.2*
Delaware	(1)	73.7	Delaware		
Rhode Island	(6)	73.9	Rhode Island	(4)	76.1
New Jersey (all)	(17)	74.3	New Jersey (all)	(20)	74.8

CRANIAL MODULE

Male			*Female*		
Rhode Island	(6)	15.22	Rhode Island	(4)	14.84
New Jersey (miscel.)	(4)	15.33	New Jersey	(14)	14.64
Iroquois	(*32*)	*15.41*	*Iroquois*	(*21*)	*14.80*
New Jersey (Munsee)	(7)	15.44	New Jersey	(9)	14.75
Virginia (Valentine coll.)	(11)	15.46	Virginia (Valentine coll.)	(13)	15.00
Southeastern Canada	(14)	15.48	Southeastern Canada	(5)	14.77
Maine	(6)	15.55	Maine	(5)	14.92
Connecticut	(2)	15.55	Connecticut	(3)	14.84
Massachusetts	(12)	15.56	Massachusetts	(22)	14.72

FACE: NASION-PROSTHION HEIGHT

Male			*Female*		
Massachusetts	(8)	7.4	Massachusetts	(15)	7.0
Rhode Island	(3)	7.4	Rhode Island	(4)	7.1
New York State	(10)	7.4	New York State	(11)	6.9
Staten Island	(3)	7.45	Staten Island	(2)	6.5
Iroquois	(*22*)	*7.45*	*Iroquois*	(*17*)	*7.0*
Virginia (miscel.)	(2)	7.5	Virginia (miscel.)		
Long Island	(4)	7.5	Long Island	(4)	7.0
Southeastern Canada	(7)	7.8	Southeastern Canada	(5)	6.75

DIAMETER BIZYGOMATIC MAXIMUM

Male			*Female*		
Rhode Island	(6)	13.35	Rhode Island	(3)	13.0
Maine	(2)	13.45	Maine	(4)	12.95
Massachusetts	(7)	13.7	Massachusetts	(8)	12.7
Iroquois	(24)	*13.75*	*Iroquois*	(17)	*12.9*
Connecticut	(2)	13.8	Connecticut		
Long Island	(4)	13.85	Long Island	(4)	12.95
Virginia (Valentine coll.)	(4)	13.85	Virginia (Valentine coll.)	(6)	13.1

ORBITAL INDEX

Male			*Female*		
Maine	(4)	86.2	Maine	(4)	86.2
Massachusetts	(10)	86.3	Massachusetts	(21)	88.8
New York State	(16)	86.8	New York State	(13)	88.6
Iroquois	(27)	*87.0*	*Iroquois*	(17)	*88.5*
Manhattan Island	(2)	87.4	Manhattan Island	(1)	87.8
Staten Island	(3)	87.6	Staten Island	(3)	83.0
Southeastern Canada	(10)	87.8	Southeastern Canada	(5)	89.5
Virginia (Valentine coll.)	(10)	87.9	Virginia (Valentine coll.)	(6)	89.0

NASAL INDEX

Male			*Female*		
Massachusetts	(10)	49.7	Massachusetts	(20)	49.5
Virginia (miscel.)	(3)	50.6	Virginia (miscel.)	(1)	52.0
New Jersey (Munsee)	(7)	51.1	New Jersey (Munsee)	(9)	52.9
Iroquois	(26)	*51.7*	*Iroquois*	(17)	*51.9*
New York State	(15)	51.8	New York State	(13)	53.2
Rhode Island	(6)	52.5	Rhode Island	(5)	52.1
Staten Island	(3)	53.1	Staten Island	(3)	54.4

DENTAL ARCH ("PALATAL") INDEX

Male			*Female*		
Virginia (Valentine coll.)	(3)	114.1	Virginia (Valentine coll.)	(5)	116.4
New York State	(2)	116.0	New York State		
Iroquois	(14)	*116.2*	*Iroquois*	(15)	*114.3*
Staten Island	(2)	116.5	Staten Island		
Southeastern Canada	(4)	117.3	Southeastern Canada	(3)	115.8

ANGLE OF FACIAL PROGNATHISM

Male			*Female*		
Rhode Island	(3)	69°	Rhode Island	(2)	73°
New York State	(7)	71	New York State	(10)	72.5
Iroquois	(17)	*72*	*Iroquois*	(15)	*72*
Massachusetts	(4)	73	Massachusetts	(3)	71
Long Island	(4)	74	Long Island	(3)	71

The preceding statements must not, of course, be regarded as implying any lessening of our interest in the Iroquois group. This large and important body of Indians was a complex of tribes, some of which, as yet, are represented but poorly in our collections, so far as their skeletal remains are concerned. It is possible that more abundant material will exhibit some differences between these tribes, owing to their varied earlier associations and perhaps to other agencies. In any event, the Iroquois are well worthy of further study, even though there may not be strong probability that the chief conclusion reached in this work, namely, their close physical relation with the Algonquians, can be seriously modified.

Much also remains to be done with respect to the Algonquians. The Canadian tribes have scarcely been touched as yet; there are numerous gaps in the skeletal collections from our Eastern states; and data on skeletal parts other than the skull in the principal tribes are very deficient.