



Forensic Anthropology Workshop

Metric variation (from Buikstra and Ubelaker 1994)

DEFINITIONS OF CRANIAL AND POSTCRANIAL MEASUREMENTS

1. **Maximum Cranial Length (g-op):** distance between glabella (g) and opisthocranium (op) in the midsagittal plane, measured in a straight line. *Instrument:* spreading caliper. *Comment:* Place skull on side, holding one end of caliper at glabella and extending caliper until maximum diameter at posterior aspect of skull is obtained (Figure 37).
2. **Maximum Cranial Breadth (eu-eu):** maximum width of skull perpendicular to midsagittal plane wherever it is located, with the exception of the inferior temporal lines and the area immediately surrounding them. *Instrument:* spreading caliper (Figure 38).
3. **Bizygomatic Diameter (zy-zy):** direct distance between most lateral points on the zygomatic arches (zy-zy). *Instrument:* spreading or sliding caliper. (Figure 38).
4. **Basion-Bregma Height (ba-b):** direct distance from the lowest point on the anterior margin of foramen magnum (ba), to bregma (b). *Instrument:* spreading caliper (Figure 37).
5. **Cranial Base Length (ba-n):** direct distance from nasion (n) to basion (ba). *Instrument:* spreading caliper (Figure 37).
6. **Basion-Prosthion Length (ba-pr):** direct distance from basion (ba) to prosthion (pr). *Instrument:* spreading or sliding caliper (Figure 37).

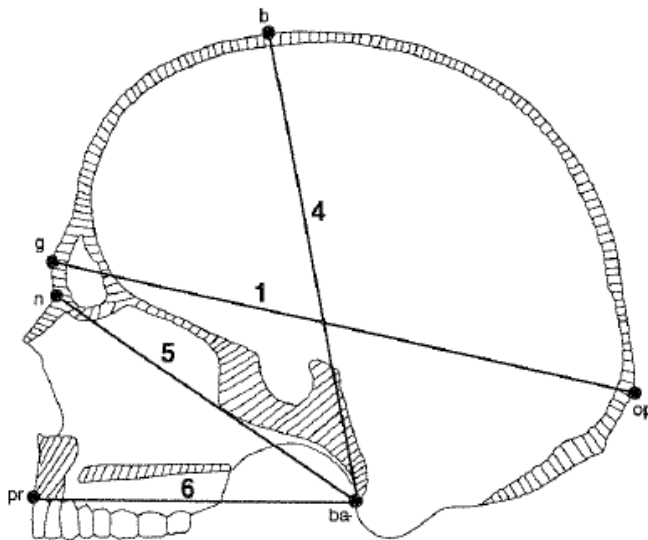


Figure 37. Cranial measurements in the sagittal plane (after Moore-Jansen et al. 1994).

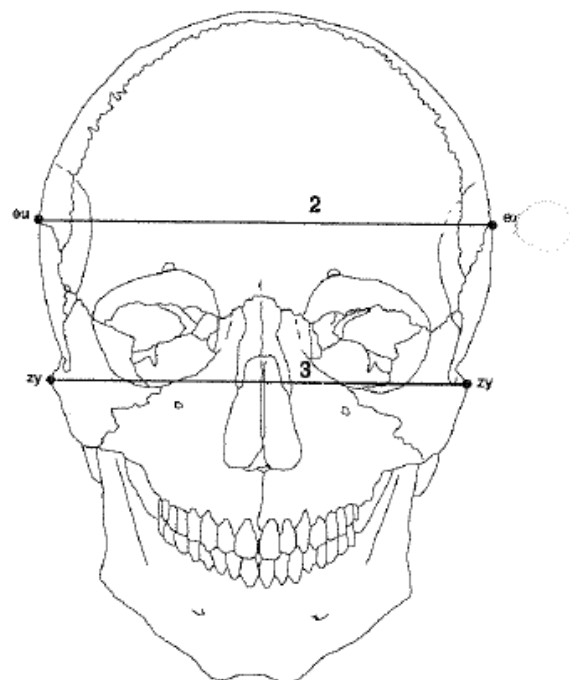


Figure 38. Maximum cranial breadth and bizygomatic diameter (after Moore-Jansen et al. 1994).

7. **Maxillo-Alveolar Breadth (ecm-ecm):** maximum breadth across the alveolar borders of the maxilla measured on the lateral surfaces at the location of the second maxillary molars (ecm). *Instrument:* spreading caliper. *Comment:* The points of measurement (ecm) are customarily *not* found on the alveolar processes, but are located on the bony segment above the second maxillary molars (Figure 39).
8. **Maxillo-Alveolar Length (pr-alv):** direct distance from prosthion (pr) to alveolon (alv). *Instrument:* spreading or sliding caliper. *Comment:* Sliding caliper applicable only if incisor teeth have been lost. Position skull with basilar portion facing up. Apply a thin wire, wooden rod, rubber band, or other similar device to the posterior borders of the alveolar arch and measure the distance from prosthion to the middle of the wire/band (on midsagittal plane) (Figure 39).
9. **Biauricular Breadth (au-au):** least exterior breadth across the roots of the zygomatic processes (au), wherever found. *Instrument:* sliding caliper. *Comment:* With the skull resting on the occiput and with the base toward the observer, measure to the outside of the roots of the zygomatic processes at their deepest incurvature, generally slightly anterior to the external auditory meatus, with the sharp points of the caliper. This measurement makes no reference to standard landmarks of the ear region (Figure 39).
10. **Upper Facial Height (n-pr):** direct distance from nasion (n) to prosthion (pr). *Instrument:* sliding caliper. *Comment:* This measurement may be estimated under conditions of minor alveolar resorption. It should not be taken if resorption is great (Figure 40).
11. **Minimum Frontal Breadth (ft-ft):** direct distance between the two frontotemporale (ft). *Instrument:* sliding caliper. (Figure 40).
12. **Upper Facial Breadth (fmt-fmt):** direct distance between the two external points on the frontomalar suture (fmt). *Instrument:* sliding caliper (Figure 40).
13. **Nasal Height (n-ns):** direct distance from nasion (n) to the midpoint of a line connecting the lowest points of the inferior margin of the nasal notches (ns). *Instrument:* sliding caliper (Figure 40).
14. **Nasal Breadth (al-al):** maximum breadth of the nasal aperture (al-al). *Instrument:* sliding caliper. *Comment:* Be certain measurement is perpendicular to the midsagittal plane (Figure 40).

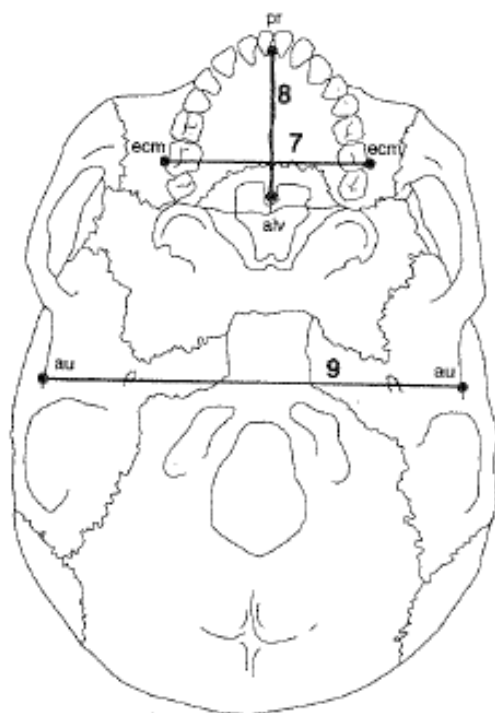


Figure 39. Cranial measurements, basilar view (after Moore-Jansen et al. 1994).

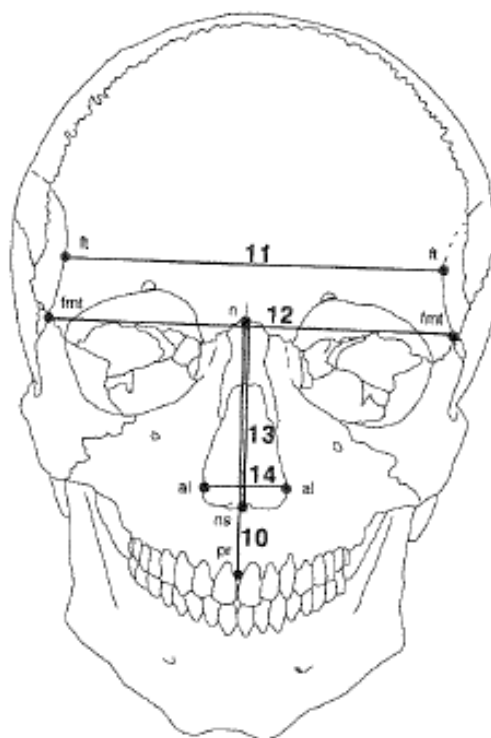


Figure 40. Cranial measurements, anterior view (after Moore-Jansen et al. 1994).

15. **Orbital Breadth (d-ec):** laterally sloping distance from dacryon (d) to ectoconchion (ec). *Instrument:* sliding caliper. *Comment:* for standardization and practical reasons, measure the left orbit. Measure the right orbit if the left is damaged, and record the side measured on the recording form (Figure 41).
16. **Orbital Height:** direct distance between the superior and inferior orbital margins. *Instrument:* sliding caliper. *Comment:* measurement is taken perpendicular to orbital breadth and similarly bisects the orbit. Avoid notches on either orbital border (Figure 41).
17. **Biorbital Breadth (ec-ec):** direct distance between right and left ectoconchion (ec). *Instrument:* sliding caliper. *Comment:* This measurement may be difficult if the anterior lateral orbital margins are sharp (Figure 41).
18. **Interorbital Breadth (d-d):** direct distance between right and left dacryon (d). *Instrument:* sliding caliper. (Figure 41).
19. **Frontal Chord (n-b):** direct distance from nasion (n) to bregma (b) taken in the midsagittal plane. *Instrument:* sliding caliper (Figure 42).
20. **Parietal Chord (b-l):** direct distance from bregma (b) to lambda (l) taken in the midsagittal plane. *Instrument:* sliding caliper (Figure 42).
21. **Occipital Chord (l-o):** direct distance from lambda (l) to opisthion (o) taken in the midsagittal plane (Figure 42).

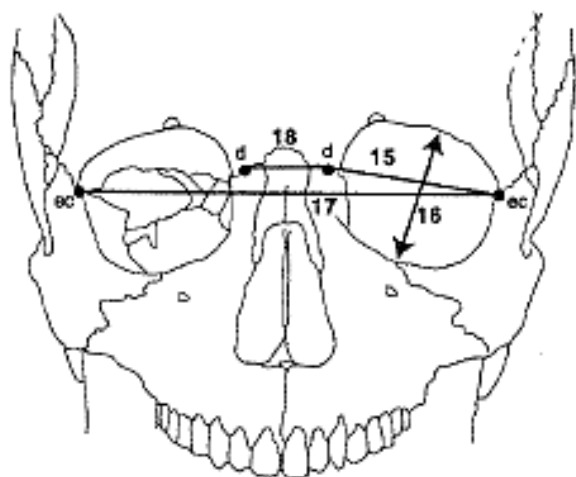


Figure 41. Measurements of the orbital region (after Moore-Jansen et al. 1994).

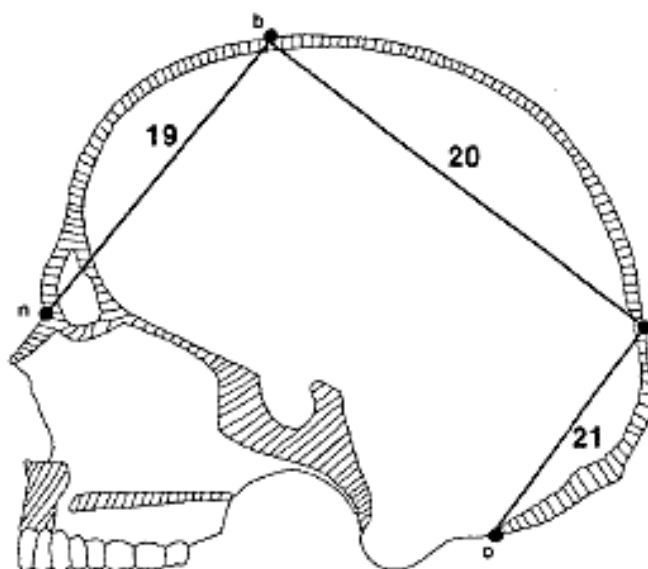


Figure 42. Frontal, parietal, and occipital chord measurements (after Moore-Jansen et al. 1994).

22. **Foramen Magnum Length (ba-o):** direct distance from basion (ba) to opisthion (o). *Instrument:* sliding caliper. *Comment:* tips of caliper should rest precisely on opposing edges of the border of foramen magnum. (Figure 43).
23. **Foramen Magnum Breadth:** distance between the lateral margins of foramen magnum at the points of greatest lateral curvature. *Instrument:* sliding caliper (Figure 43).
24. **Mastoid Length:** vertical projection of the mastoid process below and perpendicular to the eye-ear (Frankfort) plane. *Instrument:* sliding caliper (and craniophore). *Comment:* Rest skull on its right side and apply the calibrated bar of the caliper just behind the mastoid process, with the fixed flat arm tangent to the upper border of the external auditory meatus and pointing to the lower border of the orbit. Slide the measuring arm until it is level with the tip of the mastoid process. If craniophore is available, this should be used to establish the ear-eye (Frankfort) plane (Figure 44).

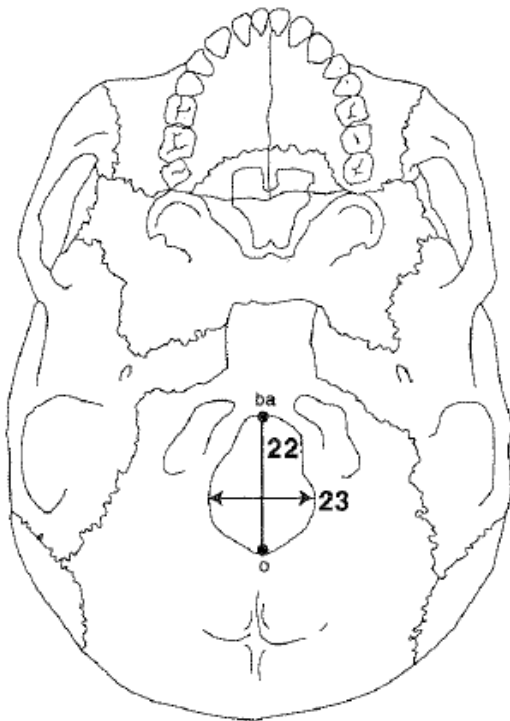


Figure 43. Foramen magnum length and breadth (after Moore-Jansen et al. 1994).

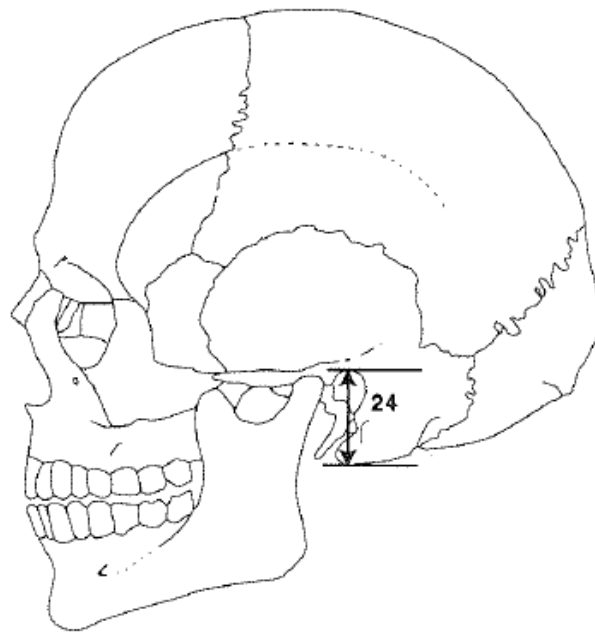


Figure 44. Mastoid length (after Moore-Jansen et al. 1994).

25. **Chin Height (id-gn):** direct distance from infradentale (id) to gnathion (gn). *Instrument:* sliding caliper. *Comment:* id may be estimated in slightly eroded specimens by reference to alveolus adjacent to lateral incisors. If alveolus is markedly eroded, specimen should not be measured (Figure 45).
26. **Height of the Mandibular Body:** direct distance from the alveolar process to the inferior border of the mandible perpendicular to the base at the level of the mental foramen. *Instrument:* sliding caliper (Figure 46).
27. **Breadth of the Mandibular Body:** maximum breadth measured in the region of the mental foramen perpendicular to the long axis of the mandibular body. *Instrument:* sliding caliper (Figure 45).
28. **Bigonial Width (go-go):** direct distance between right and left gonion (go). *Instrument:* sliding caliper. *Comment:* Place the blunt points of the caliper to the most prominent external points at the mandibular angles (Figure 45).
29. **Bicondylar Breadth (cdl-cdl):** direct distance between the most lateral points on the two condyles (cdl). *Instrument:* sliding caliper (Figure 45).
30. **Minimum Ramus Breadth:** least breadth of the mandibular ramus measured perpendicular to the height of the ramus. *Instrument:* sliding caliper (Figure 46).
31. **Maximum Ramus Breadth:** distance between the most anterior point on the mandibular ramus and a line connecting the most posterior point on the condyle and the angle of the jaw. *Instrument:* sliding caliper (Figure 46).
32. **Maximum Ramus Height:** direct distance from the highest point on the mandibular condyle to gonion (go). *Instrument:* sliding caliper or mandibulometer (Figure 46).
33. **Mandibular Length:** distance of the anterior margin of the chin from a center point on the projected straight line placed along the posterior border of the two mandibular angles. *Instrument:* mandibulometer. *Comment:* Apply movable board of the mandibulometer to the posterior borders of the mandibular rami and the fixed board against the most anterior point of the chin. Mandible may be stabilized by gently applying pressure (one or two fingers) to the left second molar (Figure 46).
34. **Mandibular Angle:** angle formed by the inferior border of the corpus and the posterior border of the ramus. *Instrument:* mandibulometer. *Comment:* Mandible may be stabilized by gently applying pressure (one or two fingers) to the left second molar (Figure 46).

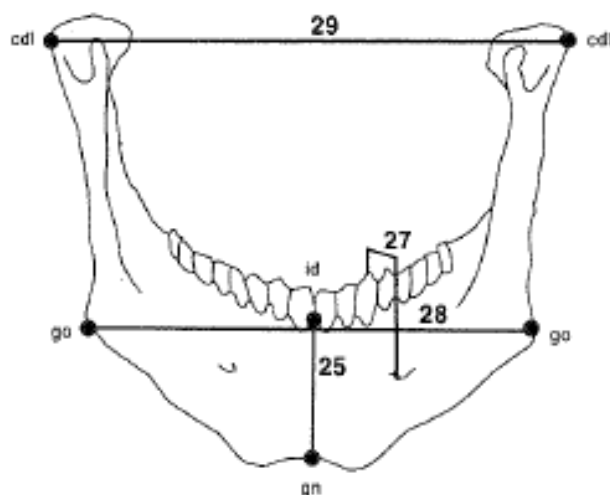


Figure 45. Measurements of the mandible, anterior view (after Moore-Jansen et al. 1994).

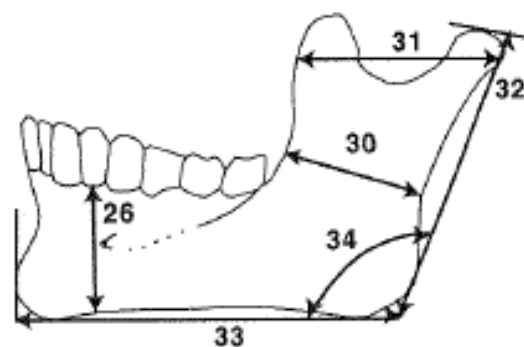


Figure 46. Measurements of the mandible, lateral view (after Moore-Jansen et al. 1994).

35. **Clavicle: Maximum Length:** maximum distance between the most extreme ends of the clavicle. *Instrument:* osteometric board (Figure 47).
36. **Clavicle: Sagittal (Anterior-Posterior) Diameter at Midshaft:** distance from the anterior to the posterior surface at midshaft. *Instrument:* sliding caliper. *Comment:* determine the midpoint of the diaphysis on the osteometric board and mark it with a pencil. Then determine sagittal diameter (Figure 47).
37. **Clavicle: Vertical (Superior-Inferior) Diameter at Midshaft:** distance from the superior to the inferior surface at midshaft. *Instrument:* sliding caliper. *Comment:* taken perpendicular to sagittal diameter (Figure 47).
38. **Scapula: Height (Anatomical Breadth):** direct distance from the most superior point of the cranial angle to the most inferior point on the caudal angle. *Instrument:* sliding caliper (Figure 48).
39. **Scapula: Breadth (Anatomical Length):** distance from the midpoint on the dorsal border of the glenoid fossa to midway between the two ridges of the scapular spine on the vertebral border. *Instrument:* spreading caliper. *Comment:* project a line through the obtuse angle of a triangle formed by the vertebral border and the two ridges of the spine, dividing it into two equal halves. The medial measuring point is located where this line intersects the vertebral border (Figure 48).

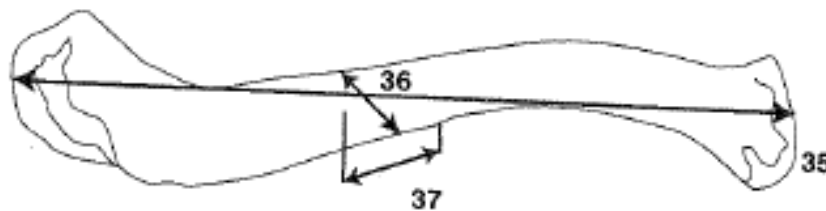


Figure 47. Measurements of the left clavicle, superior view (after Moore-Jansen et al. 1994).

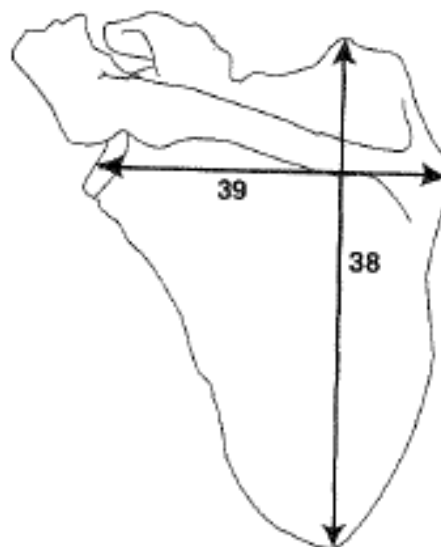


Figure 48. Measurements of the left scapula, dorsal view (after Moore-Jansen et al. 1994).

40. **Humerus: Maximum Length:** direct distance from the most superior point on the head of the humerus to the most inferior point on the trochlea. Humerus shaft should be positioned parallel to the long axis of the osteometric board. *Instrument:* osteometric board (Figure 49).
41. **Humerus: Epicondylar Breadth:** distance of the most laterally protruding point on the lateral epicondyle from the corresponding projection of the medial epicondyle. *Instrument:* osteometric board. *Comment:* Place the bone with its posterior surface resting on the osteometric board. Put the medial epicondyle against the vertical endboard and apply the movable upright to the lateral epicondyle (Figure 49).
42. **Humerus: Vertical Diameter of Head:** direct distance between the most superior and inferior points on the border of the articular surface. *Instrument:* sliding caliper (Figure 49).
43. **Humerus: Maximum Diameter at Midshaft:** maximum diameter at midshaft. *Instrument:* sliding caliper. *Comment:* determine the midpoint of the diaphysis on the osteometric board and mark with a pencil. Record maximum diameter wherever it occurs (Figure 49).
44. **Humerus: Minimum Diameter at Midshaft:** minimum diameter of midshaft. *Instrument:* sliding caliper. *Comment:* determine the midpoint of the diaphysis on the osteometric board and mark with a pencil. Record minimum diameter wherever it occurs (Figure 50).
45. **Radius: Maximum Length:** distance from the most proximally positioned point on the head of radius to the tip of the styloid process without regard for the long axis of the bone. *Instrument:* osteometric board (Figure 50).
46. **Radius: Anterior-Posterior (Sagittal) Diameter at Midshaft:** distance between anterior and posterior surfaces at midshaft. *Instrument:* sliding caliper. *Comment:* determine the midpoint of the diaphysis on the osteometric board and mark with a pencil. Measure sagittal diameter at that point. This measurement is almost always less than the medial-lateral diameter (Figure 50).
47. **Radius: Medial-Lateral (Transverse) Diameter at Midshaft:** distance between medial and lateral surfaces at midshaft. *Instrument:* sliding caliper. *Comment:* perpendicular to anterior-posterior diameter (Figure 50).

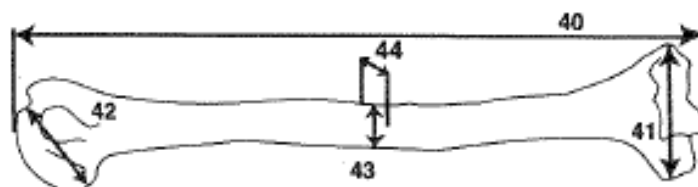


Figure 49. Measurements of the left humerus, anterior view (after Moore-Jansen et al. 1994).

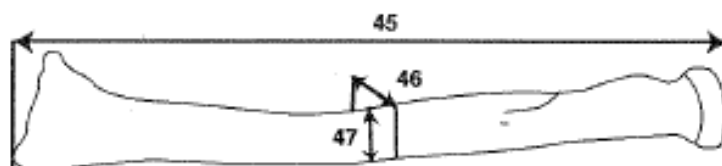


Figure 50. Measurements of the left radius, anterior view (after Moore-Jansen et al. 1994).

48. **Ulna: Maximum Length:** distance from the most superior point on the olecranon to the most inferior point on the styloid process. *Instrument:* osteometric board (Figure 51).
49. **Ulna: Anterior-Posterior (Dorso-Volar) Diameter:** maximum diameter of the diaphysis at the level of greatest crest development in anterior-posterior (dorso-volar) plane. *Instrument:* sliding caliper (Figure 51).
50. **Ulna: Medial-Lateral (Transverse) Diameter:** distance between medial and lateral surfaces at the level of greatest crest development. *Instrument:* sliding caliper. *Comment:* taken perpendicular to anterior-posterior diameter (Figure 51).
51. **Ulna: Physiological Length:** distance between the most distal (inferior) point on the surface of the coronoid process and the most distal point on the inferior surface of the distal head of the ulna. *Instrument:* spreading caliper. *Comment:* do not include the styloid process or the groove between the styloid process and the distal surface of the head. Be certain that the proximal point is at the deepest concavity of the coronoid process (Figure 51).
52. **Ulna: Minimum Circumference:** least circumference near the distal end of the bone. *Instrument:* metal tape (Figure 51).
53. **Sacrum: Anterior Length:** distance from a point on the promontory positioned in the midsagittal plane to a point on the anterior border of the tip of the sacrum measured in the midsagittal plane. *Instrument:* sliding caliper. *Comment:* place the pointed tips of the caliper on the promontory and the antero-inferior border of the fifth sacral vertebra. If a sacrum exhibits more than five segments, note this on the recording form, and then measure all true sacral units (Figure 52).
54. **Sacrum: Anterior Superior Breadth:** maximum transverse breadth of the sacrum at the level of the anterior projection of the auricular surface. *Instrument:* sliding caliper (Figure 52).
55. **Sacrum: Maximum Transverse Diameter of Base:** direct distance between the two most laterally projecting points on the sacral base measured perpendicular to the midsagittal plane. *Instrument:* sliding caliper (Figure 52).

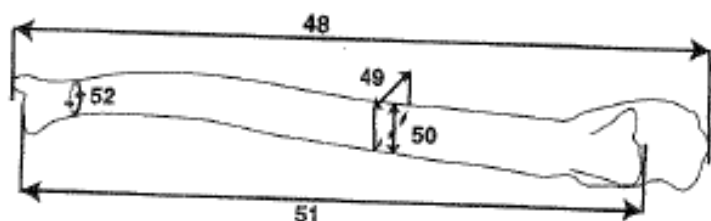


Figure 51 Measurements of the left ulna, anterior view (after Moore-Jansen et al. 1994).

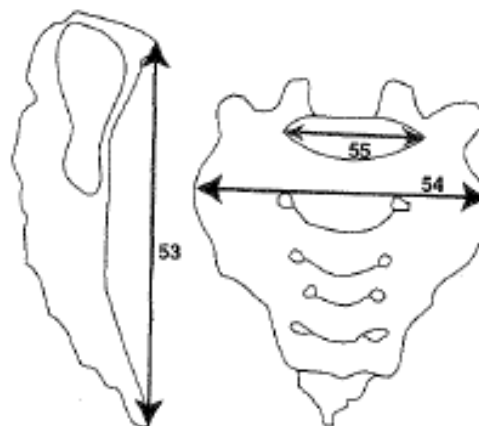


Figure 52. Measurements of the sacrum (after Moore-Jansen et al. 1994).

56. **Os Coxae: Height:** distance from the most superior point on the iliac crest to the most inferior point on the ischial tuberosity. *Instrument:* spreading caliper or osteometric board (Figure 53).
57. **Os Coxae: Iliac Breadth:** distance from the anterior-superior iliac spine to the posterior-superior iliac spine. *Instrument:* spreading caliper (Figure 53).
58. **Os Coxae: Pubis Length:** distance from the point in the acetabulum where the three elements of the os coxae meet to the upper end of the pubic symphysis. *Instrument:* sliding caliper. *Comment:* the measuring point in the acetabulum may be identified in the adult by (1) an irregularity which is frequently visible, both on the acetabular and pelvic surfaces; (2) a change in thickness which may be seen by holding the bone up to a light; (3) a notch often present in the border of the articular surface in the acetabulum. In measuring the pubis, care should be taken to hold the caliper parallel to the long axis of the bone (Figure 53).
59. **Os Coxae: Ischium Length:** distance from the point in the acetabulum where the three elements meet to the point in which the axis of the ischium crosses the ischial tuberosity. *Instrument:* sliding caliper. *Comment:* ischium length should be measured approximately perpendicular to pubis length (after Schultz 1930) (Figure 53).
60. **Femur: Maximum Length:** distance from the most superior point on the head of the femur to the most inferior point on the distal condyles. *Instrument:* osteometric board. *Comment:* Place the medial condyle against the vertical endboard while applying the movable upright to the femoral head (Figure 54).
61. **Femur: Bicondylar Length:** distance from the most superior point on the head to a plane drawn along the inferior surfaces of the distal condyles. *Instrument:* osteometric board. *Comment:* Place both distal condyles against the vertical endboard while applying the movable upright to the femoral head (Figure 54).
62. **Femur: Epicondylar Breadth:** distance between the two most laterally projecting points on the epicondyles. *Instrument:* osteometric board (Figure 54).
63. **Femur: Maximum Head Diameter:** the maximum diameter of the femur head, wherever it occurs. *Instrument:* sliding caliper (Figure 54).
64. **Femur: Anterior-Posterior (Sagittal) Subtrochanteric Diameter:** distance between anterior and posterior surfaces at the proximal end of the diaphysis, measured perpendicular to the medial-lateral diameter. *Instrument:* sliding caliper. *Comment:* be certain that the two subtrochanteric diameters are recorded perpendicular to one another. Gluteal lines and/or tuberosities should be avoided (Figure 54).
65. **Femur: Medial-Lateral (Transverse) Subtrochanteric Diameter:** distance between medial and lateral surfaces of the proximal end of the diaphysis at the point of its greatest lateral expansion below the base of the lesser trochanter. *Instrument:* sliding caliper. *Comment:* be certain that the two subtrochanteric diameters are recorded perpendicular to one another (Figure 54).

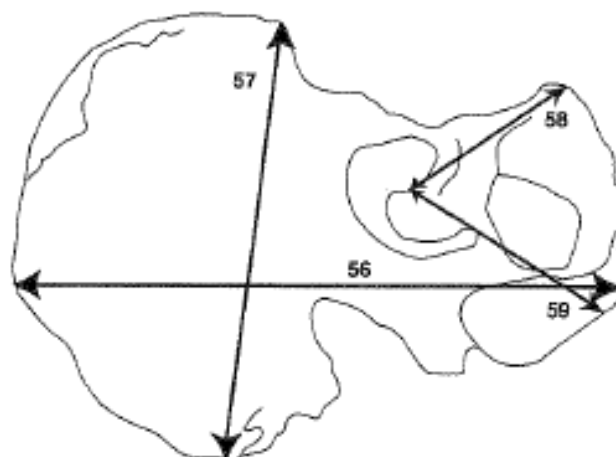


Figure 53. Measurements of the os coxae (after Moore-Jansen et al. 1994).

66. **Femur: Anterior-Posterior (Sagittal) Midshaft Diameter:** distance between anterior and posterior surfaces measured approximately at the midpoint of the diaphysis, at the highest elevation of linea aspera. *Instrument:* sliding caliper. *Comment:* The sagittal diameter should be measured perpendicular to the anterior bone surface (Figure 54).
67. **Femur: Medial-Lateral (Transverse) Midshaft Diameter:** distance between the medial and lateral surfaces at midshaft, measured perpendicular to the anterior-posterior diameter (#66). *Instrument:* sliding caliper (Figure 54).
68. **Femur: Midshaft Circumference:** circumference measured at the level of the midshaft diameters (#66 and 67). If the linea aspera exhibits a strong projection which is not evenly expressed across a large portion of the diaphysis, then this measurement is recorded approximately 10 mm above the midshaft. *Instrument:* metal tape (Figure 54).
69. **Tibia: Length:** distance from the superior articular surface of the lateral condyle to the tip of the medial malleolus. *Instrument:* osteometric board. *Comment:* place the tibia on the board, resting on its posterior surface with the longitudinal axis parallel to the instrument. Place the lip of the medial malleolus on the vertical endboard and press the movable upright against the proximal articular surface of the lateral condyle (Figure 55).
70. **Tibia: Maximum Proximal Epiphyseal Breadth:** maximum distance between the two most laterally projecting points on the medial and lateral condyles of the proximal articular region (epiphysis). Tibia diaphysis should parallel the upright of the osteometric board. *Instrument:* osteometric board (Figure 55).
71. **Tibia: Maximum Distal Epiphyseal Breadth:** maximum distance between the two most laterally projecting points on the medial malleolus and the lateral surface of the distal articular region (epiphysis). *Instrument:* osteometric board (Figure 55).
72. **Tibia: Maximum Diameter at the Nutrient Foramen:** distance between the anterior crest and the posterior surface at the level of the nutrient foramen. *Instrument:* sliding caliper (Figure 55).
73. **Tibia: Medial-Lateral (Transverse) Diameter at the Nutrient Foramen:** straight line distance of the medial margin from the interosseous crest at the level of the nutrient foramen. *Instrument:* sliding caliper (Figure 55).
74. **Tibia: Circumference at the Nutrient Foramen:** circumference measured at the level of the nutrient foramen. *Instrument:* metal tape (Figure 55).

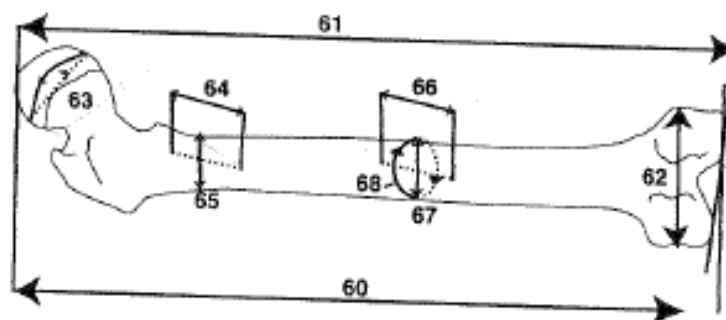


Figure 54. Measurements of the left femur, posterior view (after Moore-Jansen et al. 1994).

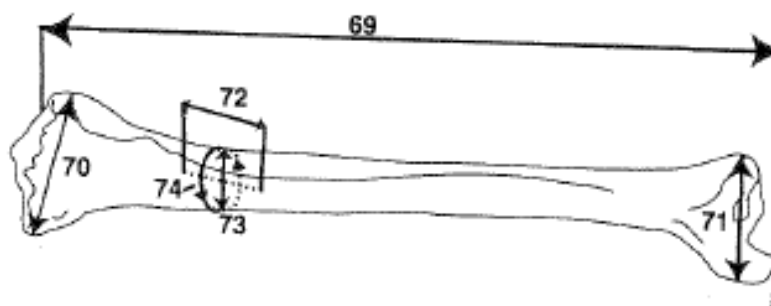


Figure 55. Measurements of the left tibia, anterior view (after Moore-Jansen et al. 1994).

75. **Fibula: Maximum Length:** maximum distance between the most superior point on the fibula head and the most inferior point on the lateral malleolus. *Instrument:* osteometric board (Figure 56).
76. **Fibula: Maximum Diameter at Midshaft:** maximum diameter at midshaft. *Instrument:* sliding caliper. *Comment:* maximum diameter is most commonly located between the anterior and lateral crests. Find the midpoint of the diaphysis using the osteometric board and mark with a pencil. Place the diaphysis of the bone between the two branches of the caliper while turning the bone to obtain the maximum diameter (Figure 56).
77. **Calcaneus: Maximum Length:** distance between the most posteriorly projecting point on the tuberosity and the most anterior point on the superior margin of the articular facet for the cuboid measured in the sagittal plane and projected onto the underlying surface. *Instrument:* sliding caliper. *Comment:* measurement is taken in the sagittal plane and projected onto the underlying surface (Figure 57).
78. **Calcaneus: Middle Breadth:** distance between the most laterally projecting point on the dorsal articular facet and the most medial point on the sustentaculum tali. *Instrument:* sliding caliper. *Comment:* the two measuring points lie at neither the same height nor in a plane perpendicular to the sagittal plane. Accordingly, the measurement is projected in both dimensions. Span the calcaneus from behind with the square branches of the caliper so that the ruler is positioned in a flat and transverse plane across the bone (Figure 57).

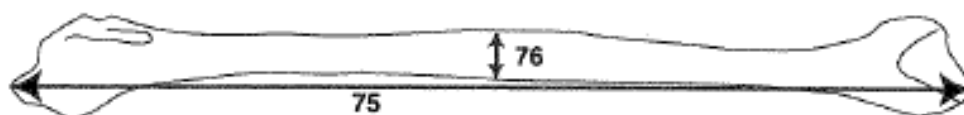


Figure 56. Measurements of the left fibula, lateral view (after Moore-Jansen et al. 1994).

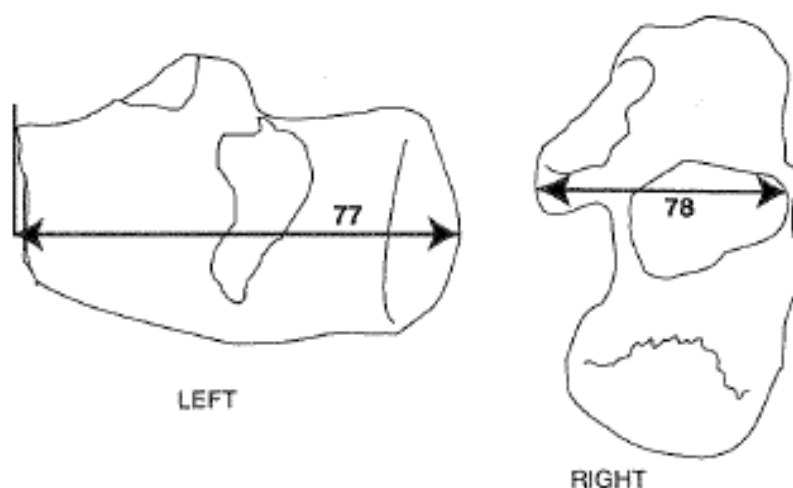


Figure 57. Measurements of the calcaneus (after Moore-Jansen et al. 1994).

Stature

- Application of **regression equations** to the maximum length of **complete** long bones (Trotter, M. and Gleser, G.C. 1952. Estimations of stature from long bones of American Whites and Negroes. AJPA 10:463-514)
- Based on ratios of body parts relative to total height
- Based on various modern populations (i.e. northern Chinese, male Germans, Finns and American Whites and Blacks)

Table 19.2

Equations Used to Estimate Stature, in Centimeters, with Standard Error, from the Long Bones of Various Groups of Individuals between 18 and 30 Years of Age^a

White Males					Black Males								
3.08	×	Hum	+	70.45	±	4.05	3.26	×	Hum	+	62.10	±	4.43
3.78	×	Rad	+	79.01	±	4.32	3.42	×	Rad	+	81.56	±	4.30
3.70	×	Uln	+	74.05	±	4.32	3.26	×	Uln	+	79.29	±	4.42
2.38	×	Fem	+	61.41	±	3.27	2.11	×	Fem	+	70.35	±	3.94
2.68	×	Fib	+	71.78	±	3.29	2.19	×	Fib	+	85.65	±	4.08
White Females					Black Females								
3.36	×	Hum	+	57.97	±	4.45	3.08	×	Hum	+	64.67	±	4.25
4.74	×	Rad	+	54.93	±	4.24	2.75	×	Rad	+	94.51	±	5.05
4.27	×	Uln	+	57.76	±	4.30	3.31	×	Uln	+	75.38	±	4.83
2.47	×	Fem	+	54.10	±	3.72	2.28	×	Fem	+	59.76	±	3.41
2.93	×	Fib	+	59.61	±	3.57	2.49	×	Fib	+	70.90	±	3.80
East Asian Males					Mexican Males								
2.68	×	Hum	+	83.19	±	4.25	2.92	×	Hum	+	73.94	±	4.24
3.54	×	Rad	+	82.0	±	4.60	3.55	×	Rad	+	80.71	±	4.04
3.48	×	Uln	+	77.45	±	4.66	3.56	×	Uln	+	74.56	±	4.05
2.15	×	Fem	+	72.57	±	3.80	2.44	×	Fem	+	58.67	±	2.99
2.40	×	Fib	+	80.56	±	3.24	2.50	×	Fib	+	75.44	±	3.52

^a To estimate stature of older individuals, subtract 0.06 (age in years, 30) cm; to estimate cadaveric stature, add 2.5 cm. From Trotter (1970). The tibia is not included; see text for rationale. All lengths used are maximum lengths

The Fully Method

- Devised by Georges Fully (1956) on French WWII soldiers' skeletal remains
- Revised by Raxter et al (2006, AJPA 130:374–384)
- Summed measurements of body segments with correction factor for soft tissue

1. skull height (Ba-Br)
2. vertebral heights (all CV except C1, all TV, all LV + S1)
3. bicondylar length of femur
4. length tibia (excluding spines)
5. ankle height (talus + calcaneus in articulation).