EXS 321 - Applied Anatomy

Activity 1: Skeletal System

Welcome to applied anatomy!! Kinesiology is the study of movement. In the class we will focus on the underlying anatomical structures responsible for the diversity of human movement and the mechanisms by which anatomy influences movement outcomes. It is amazing to think about the number of activities that we can participate in and the difference in skill level apparent between individuals. In order to identify how movements are generated, what the limits of motion are, how to improve performance, or diagnose and treat injuries, a good understanding of anatomy is needed.

The purpose of this lab is to begin to re-familiarize you with the skeleton system and external landmarks that are used in anatomy. Knowing how to palpate (feel) and find bony landmarks, and know where structures are in relation to these landmarks, will help you quickly observe the appropriate underlying causes of motion. During the lab today we will focus on the lower limb skeleton. Next week we will include the upper limb skeleton as part of our laboratory. Also, we will be performing measurements of skeletal segments based upon your knowledge of skeletal landmarks and anatomy. There are several sections to today's laboratory, each with its own goal.

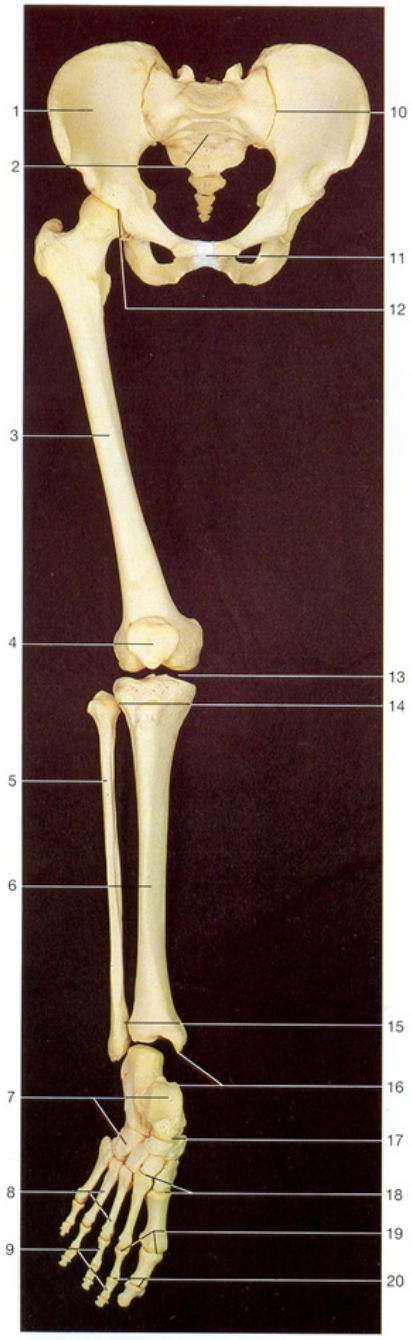
Activity #1 – Skeletal Anatomy: Lower Limb

Your goal during this portion of the lab is to use the skeleton and skeletal segments displayed in the laboratory to identify all of the landmarks described in each of the following tables. You should be able to locate and identify each landmark. In each table is a labeled picture with certain numbered landmarks. In the laboratory, each of these landmarks is labeled with a different number. Complete the worksheet at the end of the laboratory packet. On this worksheet, write the corresponding landmark next to the number from the laboratory.

Bones are typically classified as short, long, sesamoid, irregular, or flat. Write the classification for each of the following bones:

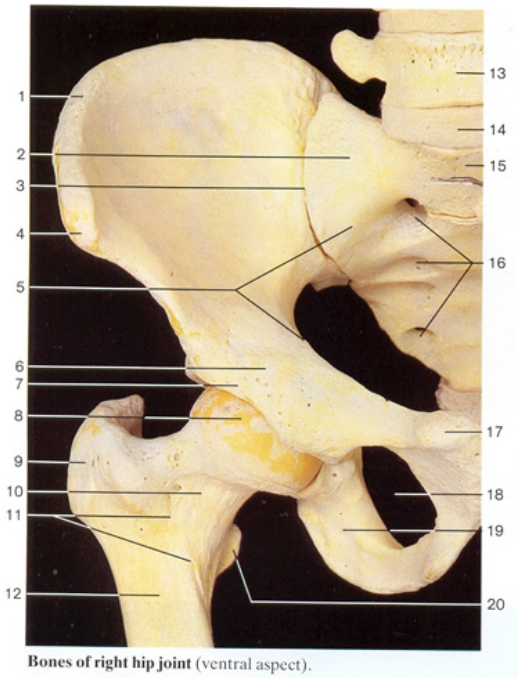
sternum	4th rib	humerus
radius	3rd metacarpal	lunate
7th cervical vertebra	femur	tibia
calcaneus	patella	5th metatarsal

Which of these bones is the most important (they are all important in one way or another)? Why do you think it is the most important?

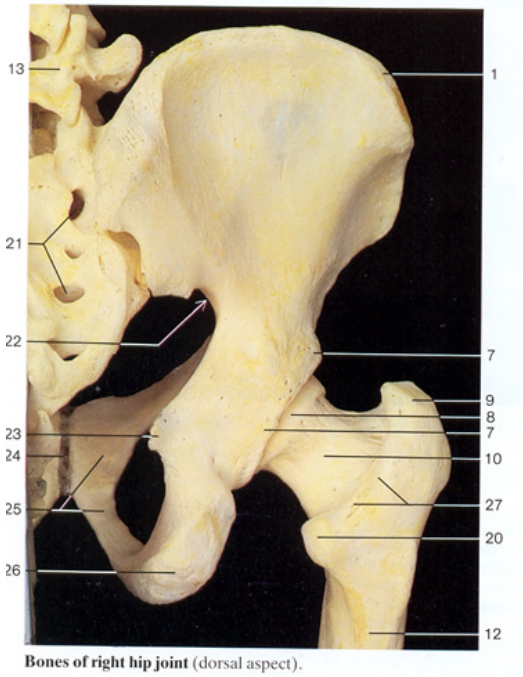


The general structures of the lower limb as identified in the picture to the left are:

1. Right hip bone (Ilium)
2. Sacrum
3. Femur
4. Patella
5. Fibula
6. Tibia
7. Tarsal bones
8. Metatarsal bones
9. Phalanges
10. Sacroiliac joint
11. Pubic symphysis
12. Hip (coxofemoral) joint
13. Knee (tibiofemoral) joint
14. Proximal tibiofibular joint
15. Distal tibiofibular joint
16. Ankle (talocrural) joint
17. Talocalcaneonavicular joint
18. Tarsometatarsal joints
19. Metatasrsophalangeal joints
20. Interphalangeal joints



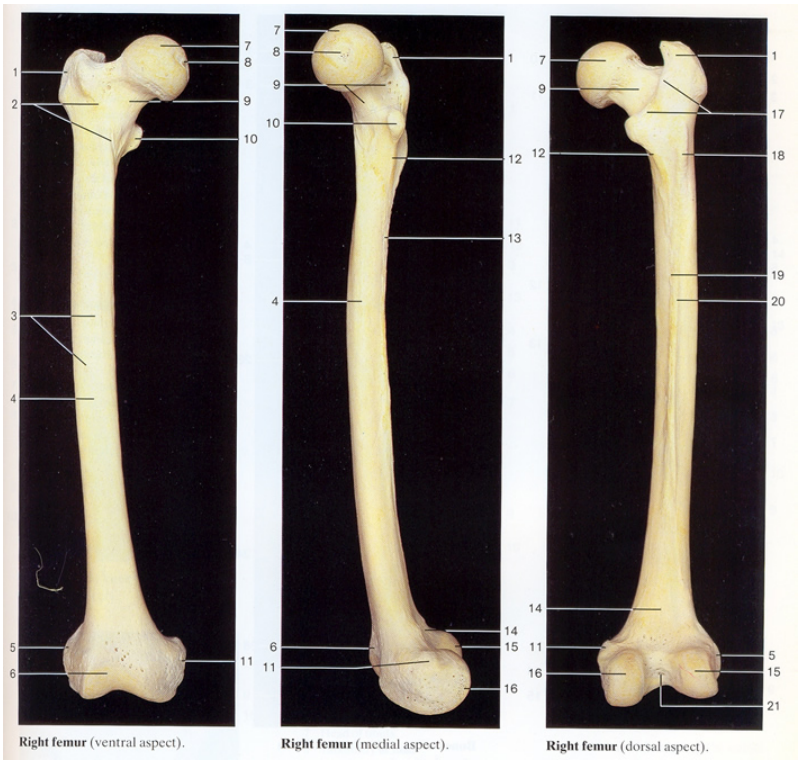
Bones of right hip joint (ventral aspect).



Bones of right hip joint (dorsal aspect).

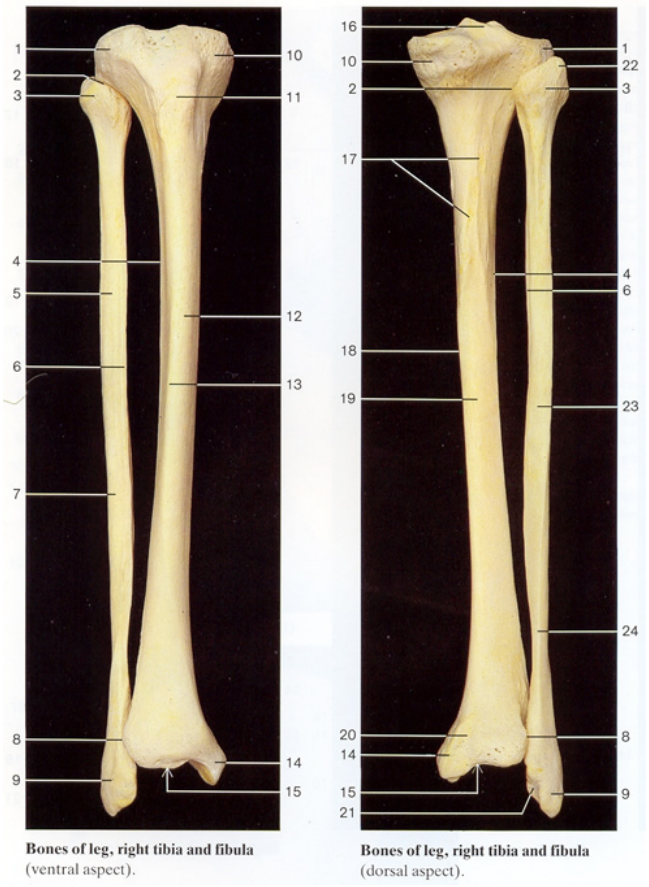
The specific structures that you should know for the hip and pelvic region are identified in the pictures to the left.

1. Iliac crest
2. Lateral part of the sacrum
3. Sacroiliac joint
4. Anterior superior iliac spine
7. Bony margin of the acetabulum
8. Head of femur
9. Greater trochanter
10. Neck of femur
12. Femoral shaft
17. Pubic tubercle
20. Lesser trochanter
24. Pubic symphysis
25. Pubis
26. Intertrochanteric crest



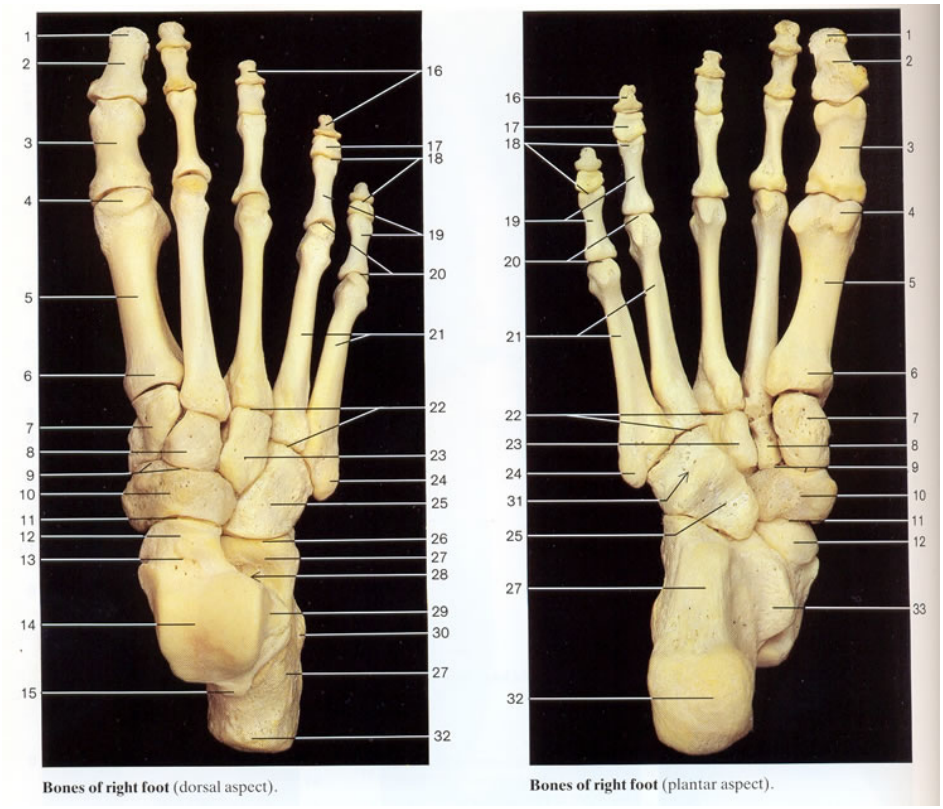
Structures to know for the femur:

1. Greater trochanter
4. Diaphysis of femur
5. Lateral epicondyle
6. Patellar surface
7. Head of femur
8. fovea of head of femur
9. Neck of femur
10. Lesser trochanter
11. Medial epicondyle
13. Linea Aspera
14. Popliteal surface
15. Lateral condyle
16. Medial condyle
21. Intercondylar fossa



Lower leg important landmarks include:

1. Lateral condyle of the tibia
2. Location of the tibiofibular joint
3. Head of fibula
5. Diaphysis of fibula
7. Lateral surface of fibula
8. Position of distal tibiofibular joint
9. Lateral malleolus
10. Medial condyle of tibia
11. Tuberosity of tibia
12. Diaphysis of tibia
14. Medial malleolus
22. Apex of the head of fibula



Bones of right foot (dorsal aspect). **Bones of right foot** (plantar aspect).

2. Distal Phalanx of big toe
3. Proximal phalanx of big toe
4. Head of 1st metatarsal bone
5. 1st metatarsal
6. Base of 1st metatarsal
7. Medial cuneiform bone
8. intermediate (middle) cuneiform
10. Navicular bone
12. -14 Talus
16. Distal phalanges
17. Middle phalanges
19. Proximal phalanges
21. Metatarsal bones
23. Lateral cuneiform bone
25. cuboid bone
27. calcaneus

Activity #1: Label Sheet
Write the full name of the bone or landmark next to the number below.

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Activity #2: Anthropometric Assessment for Body Dimensions

For this portion of the laboratory, you are going to measure the stature of the skeleton. One anatomical determinant of athletic performance is proportionality of the skeletal system. This refers to the length of skeletal segments relative to the total body size. Other measures include segment width and girth. Specific measures are used to categorize athletes. You will take a series of measurements and compare them with normative data and with specific athletic populations for which there is available data.

Basic Measures:

1. Body mass – a person's body mass in kg to the nearest 0.1 kg.
2. Stature – refers to standing height. Person should stand against a wall with heels, buttocks, and shoulders pressed against the wall.
3. Sitting height – the sitting height of the individual from the seat to the top of their head.

Girth Measures:

This is a measure of the circumference of body segments, usually taken on the person's right side. There are several sites that are regularly used for girth measures. Always take the girth measure perpendicular to the long axis. When taking these measurements, use a flexible tape. When measuring, do not forcibly pull the tape around the segment.

12. Head girth - apply firm pressure to flatten hair during the measurement.
13. Neck girth – around the neck, just superior to the thyroid cartilage (Adam's apple).
14. Arm girth (relaxed) – mid-distance between the acromion and proximal radius, arm hanging by the side.
15. Arm girth flexed and tensed – measured at level of the peak of the biceps.
16. Forearm girth – taken a maximum girth of the forearm.
17. Wrist girth – minimum girth, just distal to the styloid processes.
18. Chest girth – taken mid sternum, after exhalation.
19. Waist girth – minimum girth above the iliac crests.
20. Gluteal girth – person should stand with feet together and relaxed. Measurement taken at the greatest posterior protuberance of the buttocks.
21. Thigh girth – while standing, relaxed, and weight on both feet, slide tape so that it is roughly an inch below the gluteal fold.
22. Mid-thigh – taken in the middle of the thigh.
23. Calf girth – typically at largest circumference of shank.
24. Ankle girth – minimum girth of ankle above proximal to the malleoli.

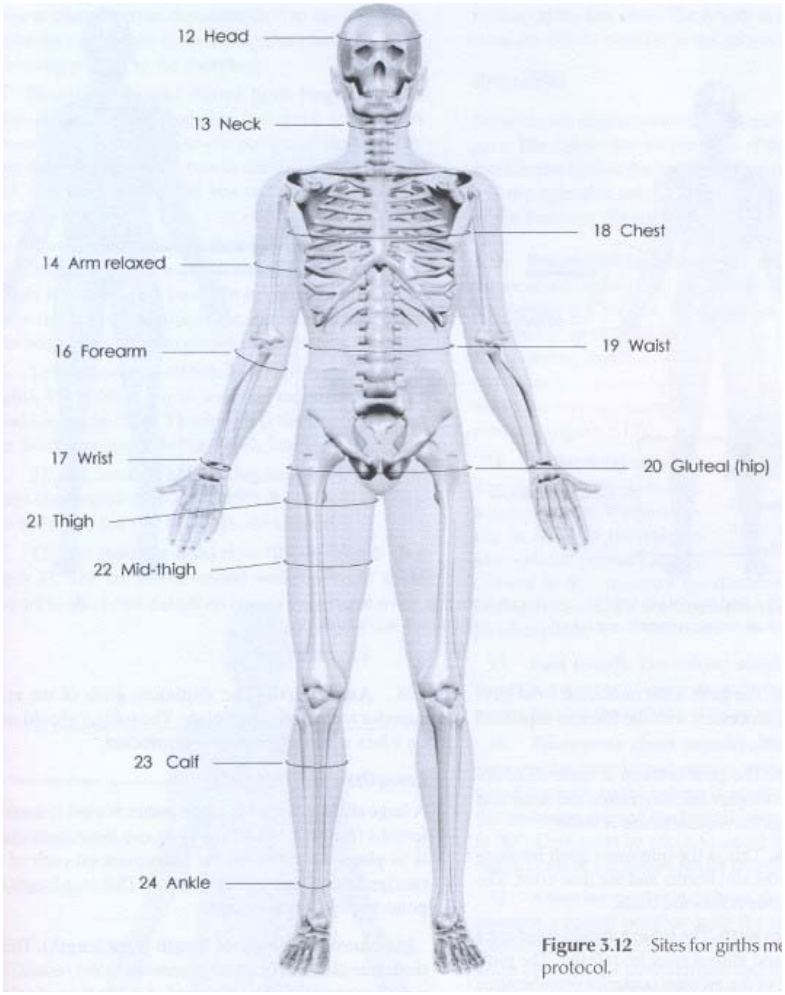
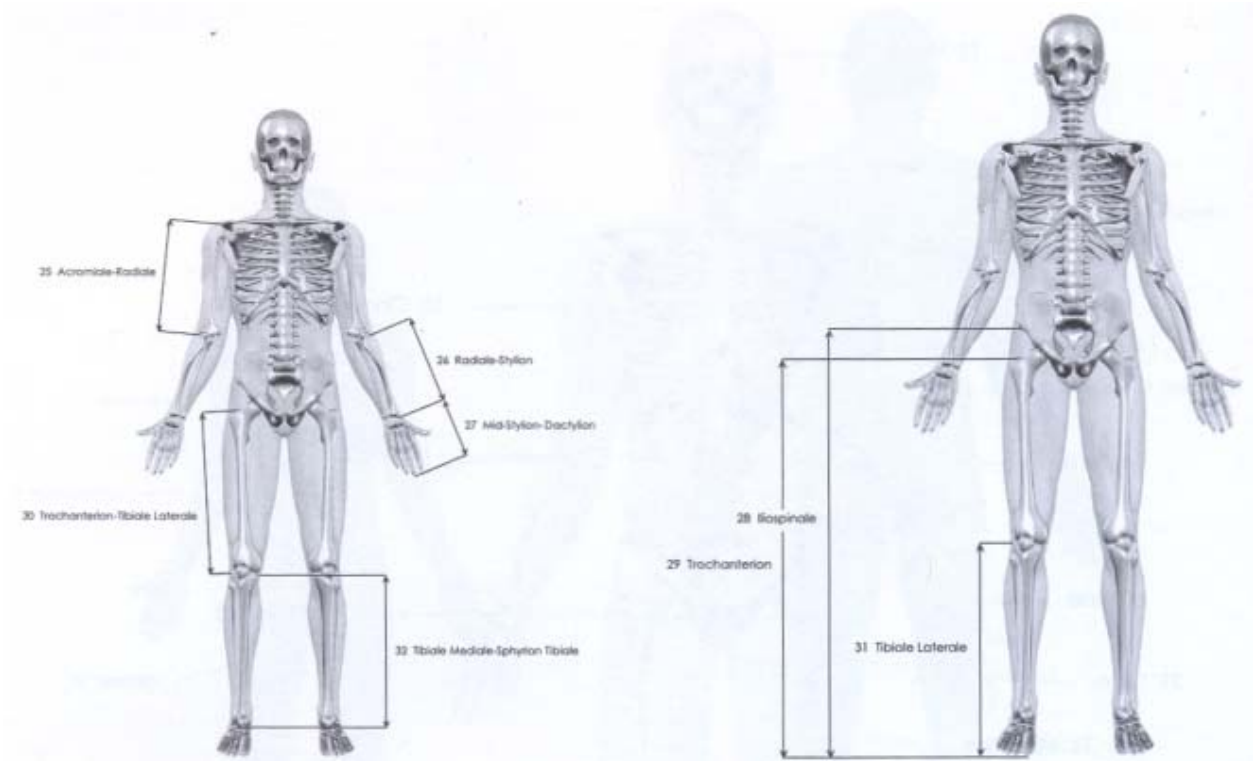


Figure 3.12 Sites for girths me
protocol.

Skeletal Lengths

These represent the lengths of the appendicular skeletal segments. All measures should be of the person's right side. The segment lengths are illustrated in the figure below.

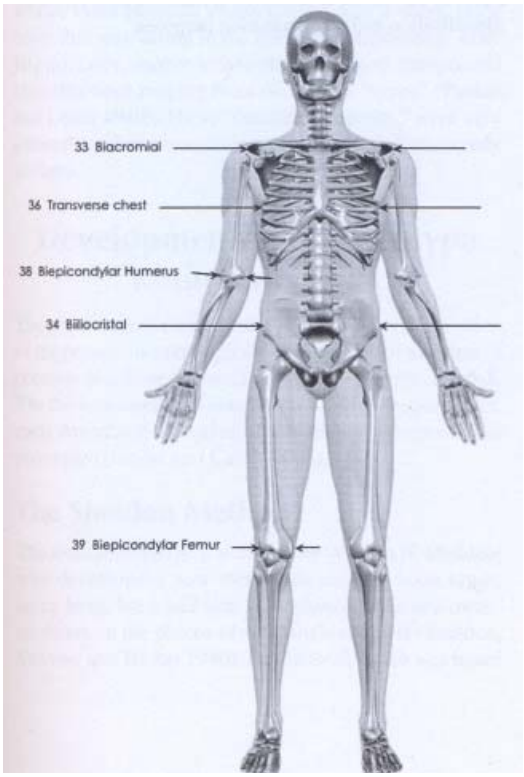
25. Upper arm – linear distance from the acromion to the proximal radius.
26. Forearm – the distance from the proximal radius to the styloid process.
27. Hand – from the styloid process to the end of the third finger.
29. Leg length – while standing with feet together, measure from the superior femoral trochanter to the floor.
30. Thigh – while standing with feet together, measure from the superior femoral trochanter to the proximolateral tibia.
32. Lower leg – while sitting with right ankle on the left knee, measure from the proximolateral tibia to the distal malleolus.



Breadths

Represent the width of certain skeletal segments. These measurements are typically done with large sliding calipers. The measures that we will use are listed below.

33. Biacromial – distance between the most lateral points on the acromion process. Typically measured while standing behind the individual.
34. Biiliocristal – distance between left and right, lateral ilia.
35. Foot length
38. Biepicondylar humerus – distance between medial and lateral epicopndyles. Measure when the subjects arm is flexed at the shoulder and 90° at the elbow.
39. Biepicondylar femur – while subject is sitting with knee flexed to 90°, measure the distance between medial and lateral epicondyles of the femur.
40. Arm span – while facing the wall, the person extends arms horizontally along wall.



Data recording and analysis

In order to provide some analysis and meaning to your data, you are going to compare your data to a phantom data set compiled by Ross and Marfell-Jones (1971) based upon cadaveric data. This phantom data is from a combined male and female population. The actual phantom data as a mean and standard deviation are in the first column of data. In the second column of data, I have provided all of the length, girth, and breadth measures as a percentage of the stature of the phantom data. In the next column, you can record the raw data of your measures for each variable. In the last column take each of the length, girth, and breadth measure and divide by your stature. This provides a relative measure. You can then compare your relative score with those of the phantom.

Measure	Phantom Data (mean ± s.d.)	Phantom Relative to Stature (%)	Your Raw Data	Your Data Relative to Stature (%)
Body Mass (kg)	64.58 ± 8.60			
Stature (cm)	170.18 ± 6.29			
Sitting Height (cm)	89.92 ± 4.50	52.84 ± 2.64		
Head girth (cm)	56.00 ± 1.44	32.91 ± 0.85		
Neck girth (cm)	34.91 ± 1.73	20.51 ± 1.02		
Arm girth, relaxed	26.89 ± 2.33	15.80 ± 1.37		
Arm girth, flexed	29.41 ± 2.37	17.28 ± 1.39		
Forearm girth	25.13 ± 1.41	14.77 ± 0.83		
Wrist girth	16.35 ± 0.72	9.61 ± 0.42		
Gluteal	87.86 ± 5.18	51.63 ± 3.04		
Thigh	55.82 ± 4.23	32.80 ± 2.49		
Calf girth	35.25 ± 2.30	20.71 ± 1.35		
Ankle girth	21.71 ± 1.33	12.76 ± 0.78		
Upper Arm length	32.53 ± 1.77	19.11 ± 1.04		
Forearm Length	24.57 ± 1.37	14.44 ± 0.81		
Hand Length	18.85 ± 0.85	11.08 ± 0.50		
Leg Length	86.40 ± 4.32	50.77 ± 2.54		
Thigh Length	41.37 ± 2.48	24.31 ± 1.46		
Lower Leg length	36.81 ± 2.10	21.63 ± 1.23		
Biacromial Breadth	38.04 ± 1.92	22.35 ± 1.13		
Biiliocristal breadth	27.92 ± 1.74	16.41 ± 1.02		
Foot length	25.50 ± 1.16	14.98 ± 0.68		
Biepicondylar humerus	6.48 ± 0.35	3.81 ± 0.21		
Biepicondylar femur	9.52 ± 0.48	5.59 ± 0.28		
Arm span	172.35 ± 7.41	101.28 ± 4.35		

How do the relative lengths of your segments compare to the phantom data? To others in the class? Share your data with at least two other students in the class. Briefly describe differences and similarities between your data.