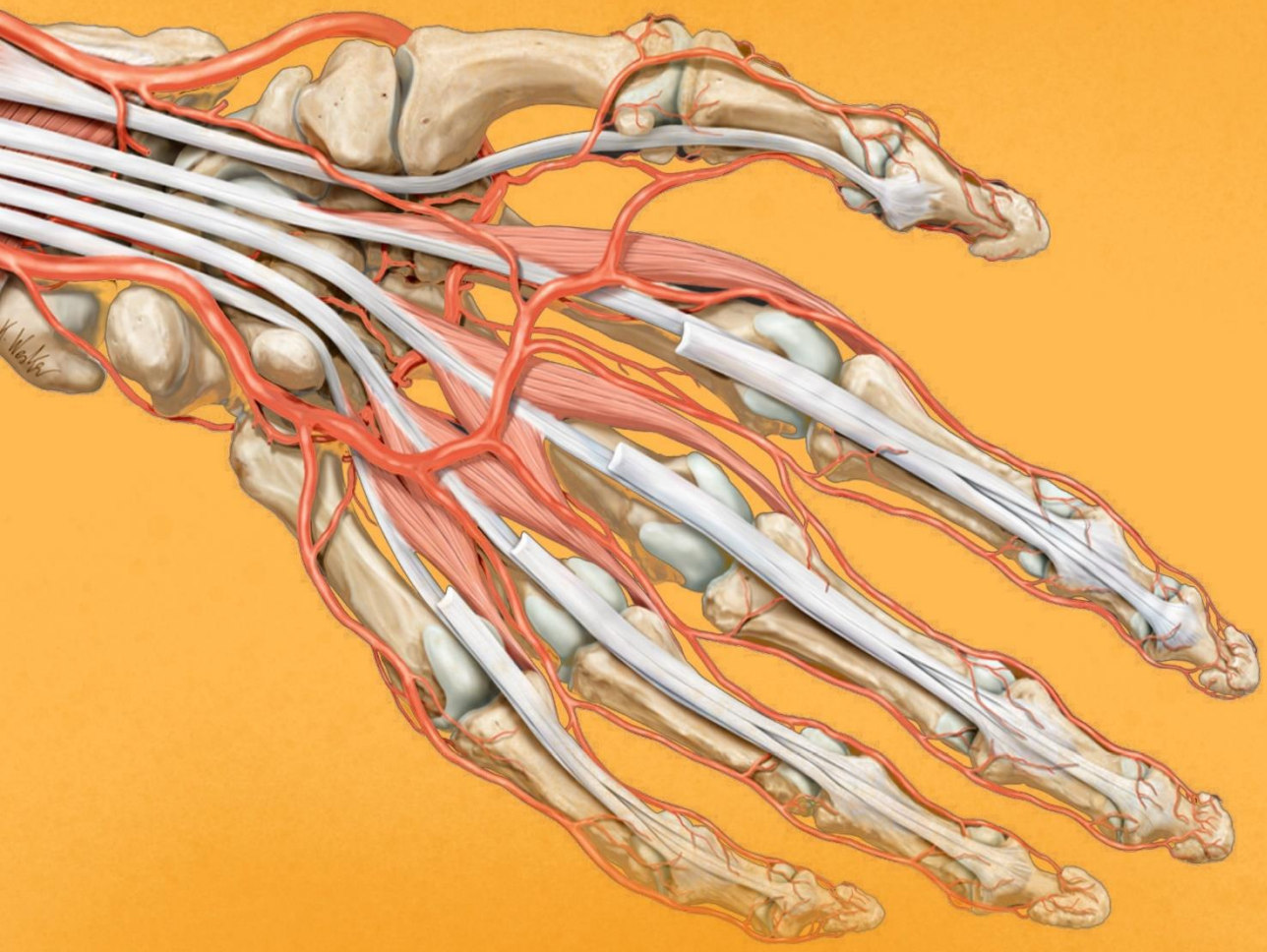
HATAHET ANATOMY



Appendicular skeleton: Lower limbs

Lecture: 3

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Lecture 3: Appendicular Skeleton: Lower limbs

We will continue talking about the other part of the appendicular skeleton in this lecture; the **Lower limbs**

Pelvic Girdle

Pelvic girdle is composed of the **(Hip bones - عظام الحوض)**, which are 2 flat bones that articulate together to make an incomplete ring-like structure called (Pelvis or Coxal), these two bones articulate in 2 points:

- **Anteriorly** → together to form the **Pubic symphysis**
- **Posteriorly** → with the sacrum to form the **Sacroiliac joint**

Each hip bone is made up of 3 bones fused together, these bones are: **(Ilium, Ischium, Pubis)**

Ilium

Ilium is the superior bone that articulate with the sacrum to make the (Sacroiliac joint), it is the largest hip bone

- **Body**, the largest and thickest part of the ilium, located inferior to the ala
- **Ala (الجناح)**, flat wing-like extension coming out of the body
- **Iliac spines**, 4 iliac spines serve as attachment points for the muscles of the trunk, hip and thigh, which are:

① Anterior superior iliac spine (ASIS) ② Posterior superior iliac spine (PSIS)
③ Anterior inferior iliac spine (AIIS) ④ Posterior inferior iliac spine (PIIS)

- **Iliac crest**, the superior thick margin of the ala, located between the (ASIS) and (PSIS)
- **Gluteal lines**, 3 elevated lines in the posterior surface of the ala, serve as attachments point for the Gluteal muscles
- **Arcuate line**, delineates the boundary between the body and ala of the ilium
- **Iliac fossa**, concave depression on the medial side of the ala, and it serve as an attachment point for the Iliacus muscle
- **Auricular surface**, medial ear-shaped surface of the ilium that articulates with the sacrum to make the Sacroiliac joint
- **Iliac tuberosity**, the point of attachment of the Sacroiliac joint

Ischium

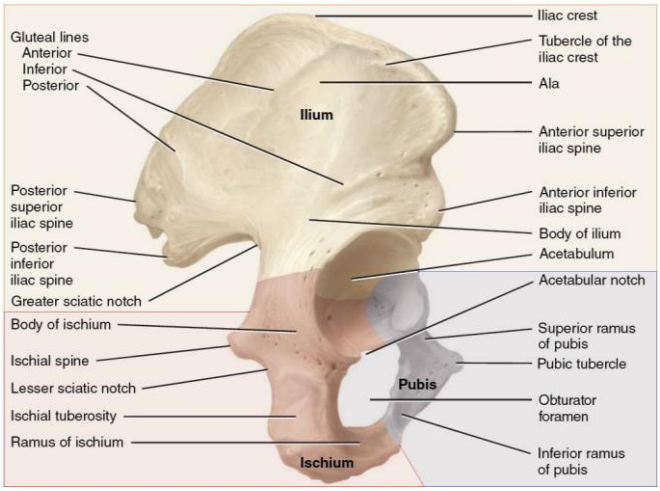
Ischium is the postero-inferior bone of the pelvis bones

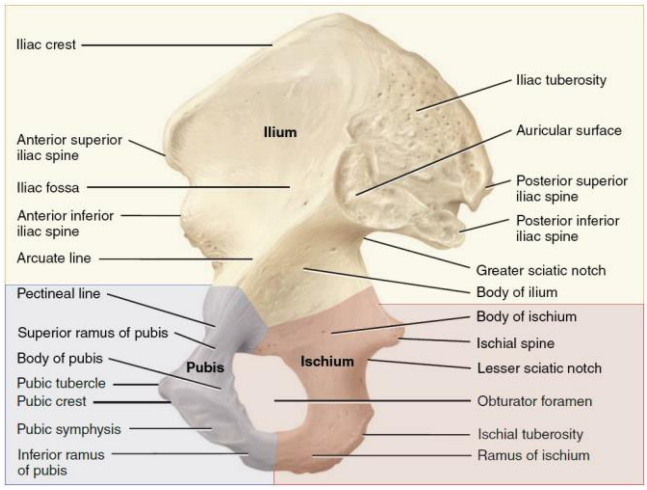
- **Body**, the largest and thickest part of the ischium
- **Ischial tuberosity**, egg-like structure, the most inferior part of the whole hip bone. It is the bone we feel when sitting
- **Ischial spine**, above it is the greater sciatic notch and below it is the lesser sciatic notch
- **Lesser sciatic notch**, allows some vessels & nerves to pass through
- **Ischial ramus**, the inferior bony extension of ischium body that links the ischium with the pubis

Pubis

Pubis is the antero-inferior V-shaped bone that articulates with its other pair in the Pubic symphysis

- **Body**, the largest and thickest part of the pubis, located between both rami of the pubis
- **Pubic crest**, the superior border of the body
- **Pubic tubercle**, projection at the medial end of the pubic crest
- **Pubic symphysis**, the point where both pubis bones articulate together anteriorly
- **Pectineal line**, a sharp ridge that runs along the superior ramus, and serves as an attachment point for the Pectineus muscle. It is the inferior extension of the arcuate line that arises from the pubic tubercles
- **Superior ramus**
- **Inferior ramus**





Features of the Entire pelvis

These structures are made by parts of different pelvic bones:

- **Acetabulum**, cup-shaped socket that is formed by the articulation of the 3 bones of the hip; forming the **Triradiate cartilage**. This socket is where the head of the femur articulates
- **Acetabular notch**, converted into a foramen by the **Acetabular ligament**, and serve for 2 purposes

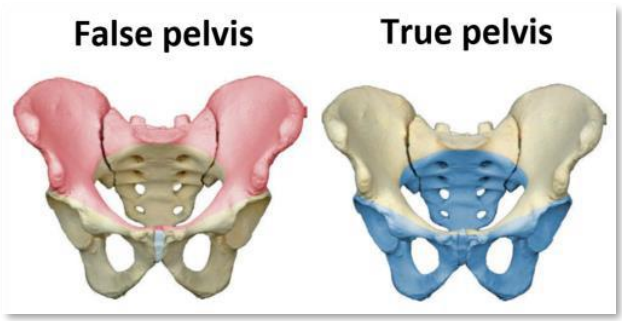
  ① Blood vessels and nerves run through it
  ② Attachment point for the ligament of the head of the femur

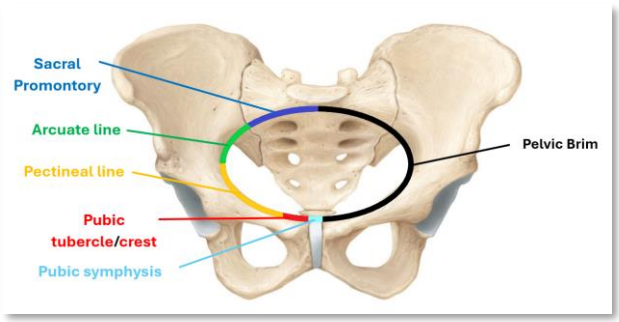
- **Obturator foramen**, the largest foramen in the skeleton, formed by both ischium & pubis
- **Greater sciatic notch**, belongs to the ilium & ischium

True pelvis Vs False pelvis

▪ **Pelvic brim**: imaginary boundary that connects the: **Sacral promontory**, **Arcuate line**, **Pectineal line**, **Pubic crest**, **Pubic symphysis** together. Anatomists divided the pelvis into 2 parts based on their locations in relation to the pelvic brim:

Pelvis / Differences	True Pelvis (Lesser Pelvis)	False Pelvis (Greater Pelvis)
Definition	• the inferior part of the pelvis; below the pelvic brim • a part of the **pelvic cavity**	• the superior part of the pelvis; above the pelvic brim • a part of the **abdominal cavity**
Boundaries	• **Anterior** → Pubic bones • **Posterior** → Sacrum and Coccyx • **Lateral** → Inferior ilium and ischium	• **Anterior** → Abdominal wall • **Posterior** → Lumbar vertebrae • **Lateral** → Superior ilium and ischium
Contents	• Rectum, Urinary bladder • Vagina, Cervix, Uterine in **FEMALES** • Prostate in **MALES**	• Urinary bladder when filled, Lower intestines • Uterus, Ovaries, Uterine tubes in **FEMALES**





Free Lower Limbs

Femur

Proximal (Upper) end

- **Head**, more that half-a-sphere process and more rounded than the head of the humerus, it will insert in the acetabulum
- **Fovea capitis**, depression in the head of femur, it serves as an attachment point of a ligament that fixes the femur with acetabulum
- **Anatomical neck**, constriction inferior to the head, it is an evident structure
- **Surgical neck**, located below the whole upper end
- **Greater trochanter**, large lateral bony elevation for the attachment of thigh & buttock muscles
- **Lesser trochanter**, small inferior bony elevation for the attachment of thigh & buttock muscles
- **Intertrochanteric line**, anterior non-elevated line that continues posteriorly as the Intertrochanteric crest

Shaft (Body)

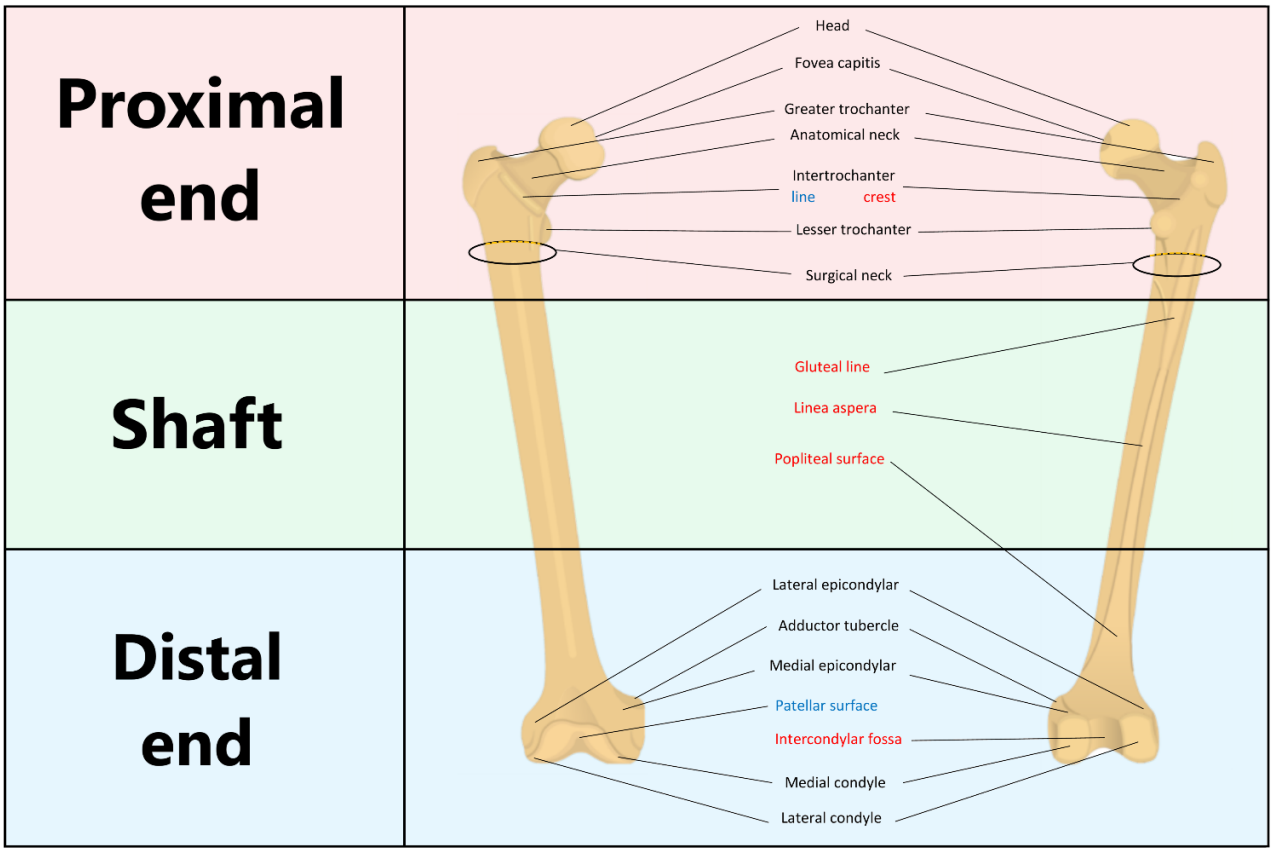
- **Gluteal tuberosity**, long elevation that serves as an attachment point for the Gluteal muscle
- **Linea aspera**, long elevation that starts as one line then, as it goes down, it splits into 2 lines:

  ① Medial supracondylar line
  ② Lateral supracondylar line

- **Popliteal surface**, the triangular area between the medial & lateral supracondylar lines

Distal (Lower) end

- **Medial condyle**, medial oval-shaped elevation
- **Lateral condyle**, lateral oval-shaped elevation
- **Intercondylar fossa/notch**
- **Medial epicondyle**
- **Lateral epicondyle**
- **Adductor tubercle**, located above the medial & lateral epicondyles and serves as an attachment point for the adductor muscles
- **Patellar surface**, hyaline-covered area anteriorly for the patella to sit in

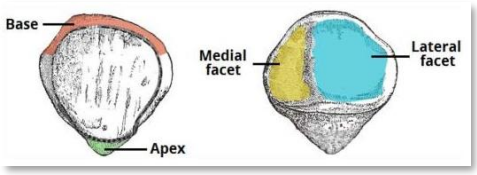


Patella

- **Patella (Kneecap)**: sesamoid triangular bone, its base is proximal, and its apex is distal, located in the **Quadriceps femoris tendon**

➢ Functions of patella:

❶ protects the knee joint
❷ maintains the position of the tendons in that area
❸ increases the leverage (the mechanical advantage) of the joint



➢ The articular surface of the patella is located in **its posterior surface**, and it consists of 2 unequal facets:

- **Medial facet**, the smaller facet that articulate with the medial condyle of the femur
- **Lateral facet**, the larger facet that articulates with the lateral condyle of the femur

Leg bones

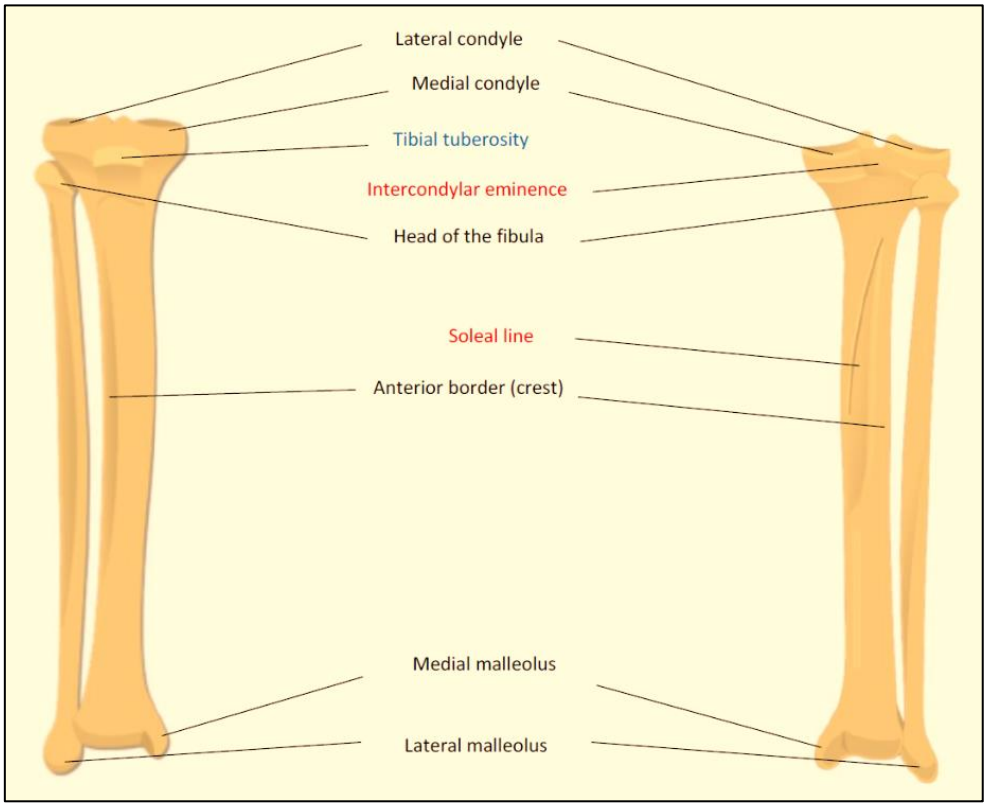
➢ Tibia (Shin bone)

- **Medial condyle**, articulates with the medial condyle at the lower end of the femur
- **Lateral condyle**, articulates with the lateral condyle at the lower end of the femur
- **Intercondylar eminence**, spiky posterior elevation between the condyles of the tibia
- **Tibial tuberosity**, a rough subcutaneous surface in the anterior side of the upper end of the tibia
- **Anterior border (Anterior crest)**, a sharp subcutaneous ridge at the lateral surface of the tibia
- **Soleal line**, oblique ridge that serves as an attachment point for the Soleus muscle
- **Medial malleolus**, a subcutaneous projection at the distal end of the tibia that articulates with the Talus bone
- **Fibular notch**, it is where the fibula attaches distally with the tibia to make the Tibiofibular joint

➢ Fibula

- **Head**, articulates with the inferior surface of the lateral condyle.
- **Lateral malleolus**, a subcutaneous projectile that articulates with Talus bone

***Note**: Knee joint **(Tibiofemoral joint)** is made of the distal condyles of the femur & the proximal condyles of the tibia



Foot bones

Tarsals, which are the 7 ankle bones, divided into:

❶ **Proximal row:**

- **Talus**, receives the body weight from the tibia and articulates with medial malleolus & lateral malleolus, **forming the Ankle joint**
- **Calcaneus (Calcaneum)** [the heel bone], the largest and the most posterior tarsus, it is the first bone to reach the ground when we walk
- **Navicular** [boat-shaped], articulates with talus and receives a part of the weight

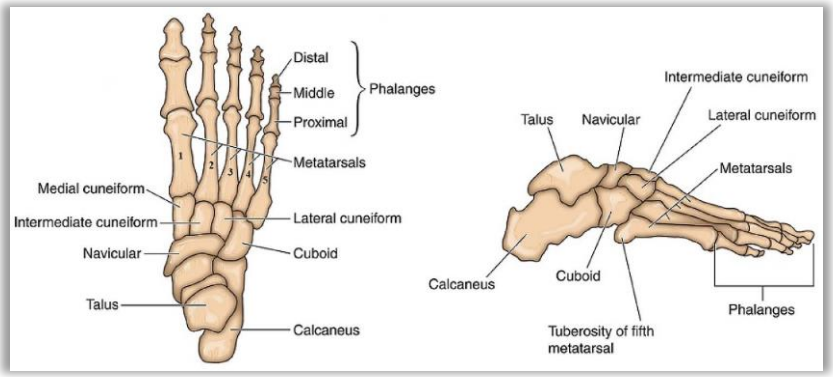
❷ **Distal row:**

- **Cuboid** [4-sided cube-shaped], articulates with the 4th & 5th toes
- **Medial cuneiform (1st cuneiform)**, articulates with the big toe (Hallux)
- **Intermediate cuneiform (2nd cuneiform)**, articulates with the 2nd toe
- **Lateral cuneiform (3rd cuneiform)**, articulates with the 3rd toe

Metatarsals, 5 long bones that connect tarsals with phalanges, and each metatarsal has: **proximal base, shaft, distal head**

Phalanges, each toe consists of 3 phalanges except for the big toe which lacks one phalanx, these bones are divided into 3 groups:

❶ **Proximal phalanges**
❷ **Intermediate (Middle) phalanges**, and the big toe lacks an intermediate phalanx
❸ **Distal phalanges**



➢ Joints of all bones of the hand and wrist can be listed as the following:

① **Intertarsal joints** → between tarsals themselves
② **Tarsometatarsal joint** → between tarsals and metatarsals
③ **Metatarsophalangeal joint** → between metatarsals and phalanges
④ **Interphalangeal joint** → between phalanges of each toe, can be proximal or distal except for the big toe
⑤ **Talocrural joint (Ankle joint)** → between talus, tibia and fibula

***Notes**:

- Metatarsals of each foot can be labelled with the numbers (I-V) starting with the big toe (I) to the little toe (V)
- The thumb is called (Pollex) and the big toe is called (Hallux)

✪ To summarize the body weight-bearing mechanism, the body weight is transferred as the following sequence:

Vertebral column → Sacrum → Humerus → Tibia → Navicular → Distal tarsals & Metatarsals

Femur, Mace of Nature

A prehistoric human had to use whatever was available for survival; rocks for throwing, sticks for poking, but a **femur bone** was next-level.

Its **bulbous head** acted like a built-in club, concentrating force on a single point, making it perfect for **crushing skulls or breaking bones**, it is nature's own mace.

Multiple Choice Questions

1) Which of the following bones is NOT a part of the pelvic girdle?

A. Ilium
B. Ischium
C. Femur
D. Pubis

Answer: C

2) The structure that forms the anterior articulation of the two pubic bones is called:

A. Acetabulum
B. Pubic symphysis
C. Sacroiliac joint
D. Iliac crest

Answer: B

3) The greater sciatic notch is part of which bone?

A. Pubis
B. Ilium
C. Ischium
D. Sacrum

Answer: B

4) The fovea capitis is located on which part of the femur?

A. Greater trochanter
B. Head
C. Intertrochanteric crest
D. Medial condyle

Answer: B

5) The patella increases the mechanical advantage of which muscle?

A. Soleus
B. Iliacus
C. Quadriceps femoris
D. Gluteus maximus

Answer: C

6) Which bone bears the most weight in the leg?

A. Fibula
B. Patella
C. Tibia
D. Talus

Answer: C

7) The acetabulum is formed by the fusion of the ilium, ischium, and pubis. This statement is:

A. True
B. False

Answer: A

8) The lateral malleolus is a part of the tibia. This statement is:

A. True
B. False

Answer: B

9) A patient presents with pain in the anterior lower leg after falling. X-rays reveal a fracture at the tibial tuberosity. This structure serves as the attachment for which of the following?

A. Adductor muscles
B. Quadriceps femoris tendon
C. Iliacus muscle
D. Soleus muscle

Answer: B

10) A 30-year-old woman is involved in a car accident and suffers a posterior hip dislocation. Which structure is most likely to be injured?

A. Pubic symphysis
B. Sacroiliac joint
C. Acetabulum
D. Obturator foramen

Answer: C

11) A patient complains of difficulty extending their knee. Examination shows damage to a sesamoid bone there. Which bone is affected?

A. Talus
B. Patella
C. Navicular
D. Calcaneus

Answer: B

12) The iliopectineal line is formed by which two structures?

A. Iliac crest and arcuate line
B. Arcuate line and pectineal line
C. Sacral promontory and pectineal line
D. Acetabulum and arcuate line

Answer: B

13) The linea aspera divides into which two lines distally?

A. Medial and lateral gluteal lines
B. Medial and lateral supracondylar lines
C. Medial and lateral intertrochanteric lines
D. Medial and lateral epicondylar lines

Answer: B

14) Which bone directly articulates with the talus at the ankle joint?

A. Tibia
B. Fibula
C. Both A and B
D. Calcaneus

Answer: C

15) The femoral neck is at greatest risk for fractures in which of the following conditions?

A. Young athletes
B. Patients with osteoporosis
C. Patients with rheumatoid arthritis
D. Infants

Answer: B

16) Which structure converts the acetabular notch into a foramen?

A. Acetabular ligament
B. Iliofemoral ligament
C. Ischiofemoral ligament
D. Pubofemoral ligament

Answer: A

17) The medial condyle of the femur articulates with which structure?

A. Medial malleolus
B. Lateral condyle of tibia
C. Medial condyle of tibia
D. Talus

Answer: C

18) The adductor tubercle serves as an attachment site for which muscle?

A. Adductor magnus
B. Pectineus
C. Gracilis
D. Sartorius

Answer: A

19) The greater sciatic notch allows the passage of which major nerve?

A. Sciatic nerve
B. Femoral nerve
C. Obturator nerve
D. Pudendal nerve

Answer: A

20) The navicular bone is located in which part of the foot?

A. Proximal row of tarsals
B. Distal row of tarsals
C. Metatarsals
D. Phalanges

Answer: A

21) What is the first bone to contact the ground when walking?

A. Talus
B. Calcaneus
C. Cuboid
D. Navicular

Answer: B

22) Which of the following bones forms the medial arch of the foot?

A. Cuboid
B. Calcaneus
C. Navicular
D. Lateral cuneiform

Answer: C