

MEDICINE
KING SAUD UNIVERSITY

Revised by
شوق الأحمري & طراد الوكيل

Bones of the Lower Limb

[Editing File](#)

Color Code

- **Important**
- **Doctors Notes**
- **Notes/Extra explanation**

Objectives

- ✓ Classify the bones of the three regions of the lower limb (thigh, leg and foot).
- ✓ Memorize the main features of the
 - Bones of the thigh (femur & patella)
 - Bones of the leg (tibia & Fibula)
 - Bones of the foot (tarsals, metatarsals and phalanges)
- ✓ Recognize the side of the bone.

لا تنصدمون من عدد الشرائح نصها شرح زائد وملخصات واسئلة

Some pictures in the original slides have been replaced with other pictures which are more clear BUT they have the same information and labels.

Terminology (Team 434)

General	Term	Meaning
Processes that helps to form joints	Condyle	Large, rounded articular
	Facet	Smooth, flat surface
	Head	Enlarged portion at an end of a bone
	Ramus	Branch or extension of a bone
Processes that provide for the attachment of muscles and ligaments	Crest	Narrow ridge
	Epicondyle Linea (line)	Process on or above a condyle Narrow ridge (less prominent than a crest)
	Spine	Sharp or pointed process (spinous process)
	Trochanter	Large, irregularly shaped process (found only on the femur) (for attachment of other structures (ligaments))
	Tubercle	Small, knoblike process (trabecular : site of muscle attachment)
	Tuberosity	Large, knoblike process
	Eminence	a small projection or bump/ شيء مرتفع

Terminology (Team 434)

General	Term	Meaning
Depressions or openings (may provide passageways for blood vessels and nerves)	Notch	An indentation, (incision) on an edge or surface
	Fissure	Narrow opening
	Fontanel	Membrane-covered spaces between skull bones
	Interosseous border	Between bones (the place where the two parallel bones attach together by the interosseous membrane)
	Foramen	Round opening
	Fossa	Shallow depression
	Fovea	Pit-like depression
	Meatus	Tube-like passage
	Sinus	Interior cavity
	Sulcus"groove"	Long, narrow depression

Bones of thigh (Femur and Patella)

Femur

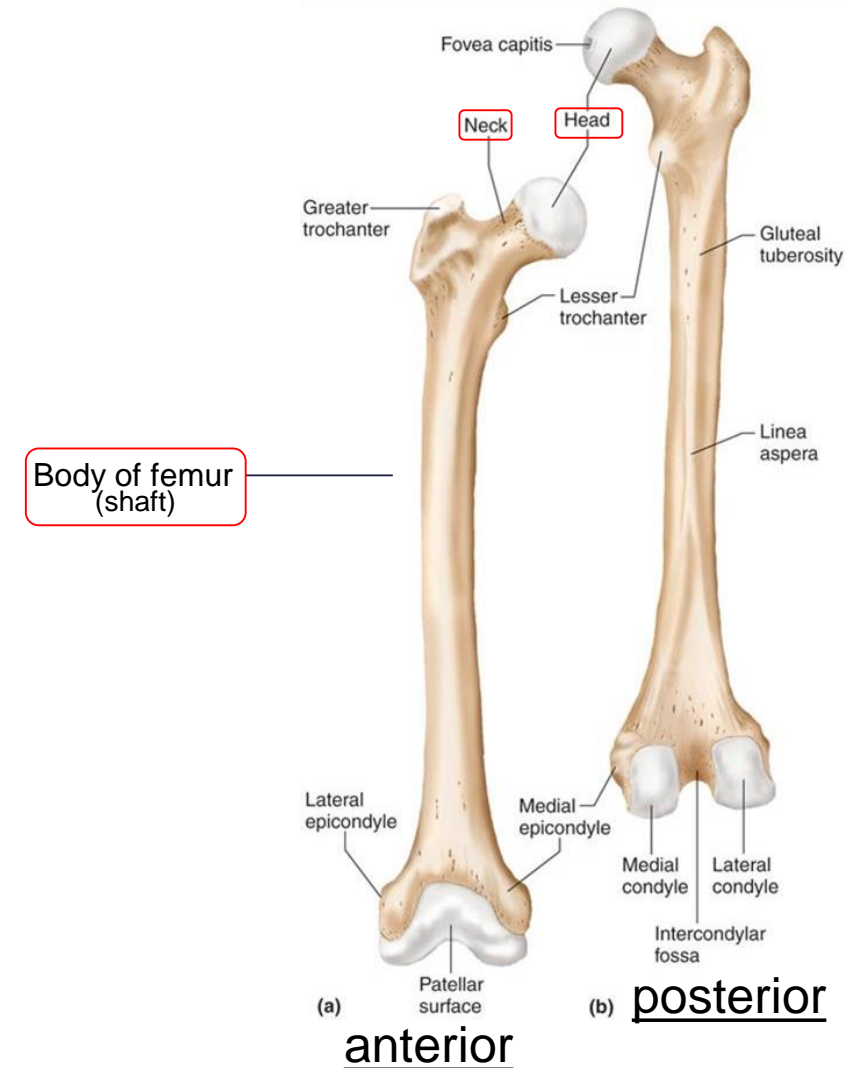
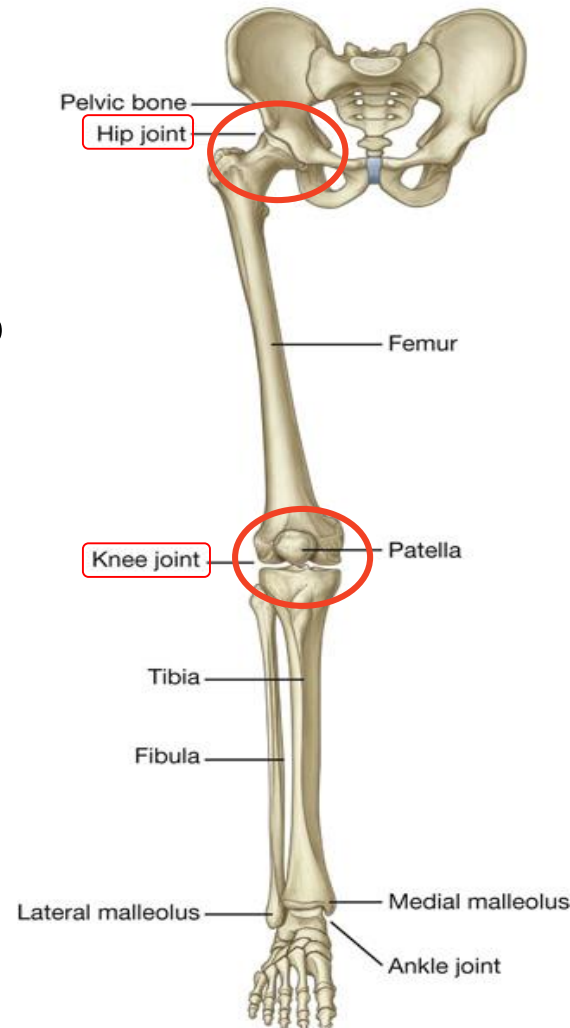
- Articulates (joins):
 - (1) above with Acetabulum of hip bone to form the **hip joint**,
 - (2) below with tibia and patella to form the **knee joint**.

- **Femur** consists of:
 - I. Upper end.
 - II. Shaft.
 - III. Lower end.

Note:

All long bones consist of three things:

- 1- upper/proximal end
- 2- shaft
- 3- lower/distal end



I. Upper End of Femur

The upper end contains:

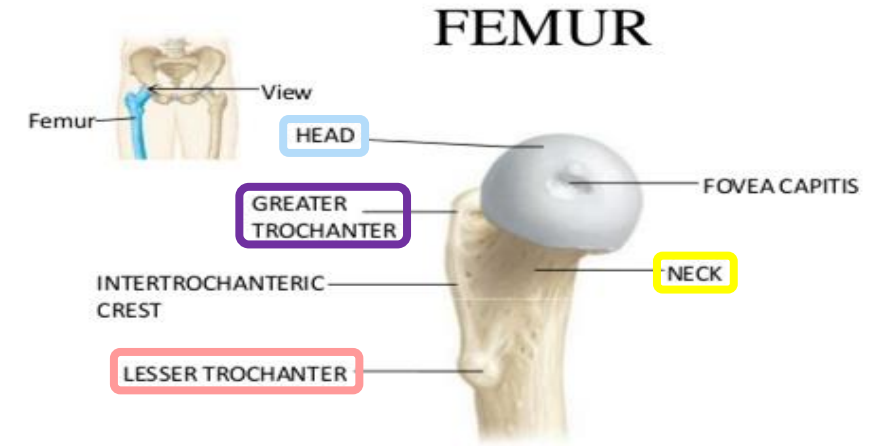
- A. Head
- B. Neck
- C. Greater trochanter &
- D. Lesser trochanter

A. Head:

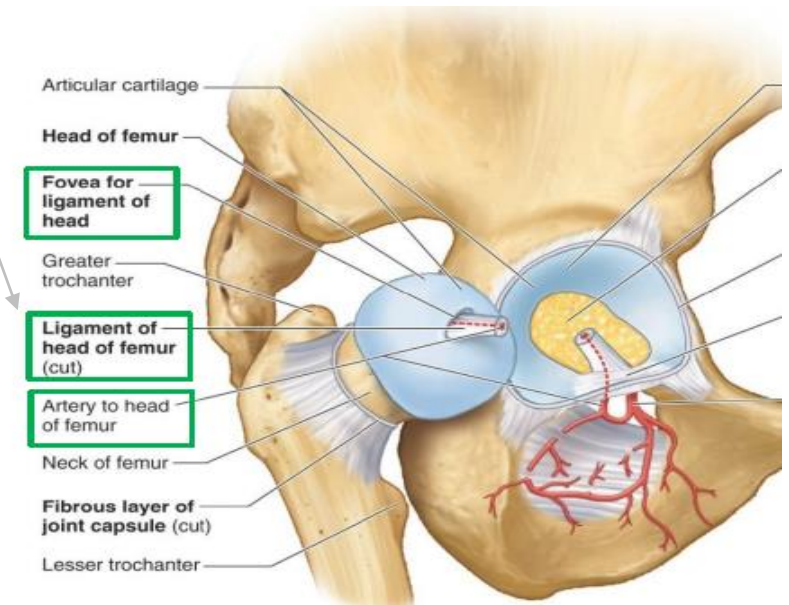
- Articulates (joins) with acetabulum of hip bone to form the **hip joint**.
- Has a depression in the center called **Fovea Capitis**.
- The fovea capitis is for the attachment of ligament of the head of Femur.
- An artery called **Obturator Artery** passes along this ligament to supply head of Femur.

B. Neck:

- Connects head to the shaft.

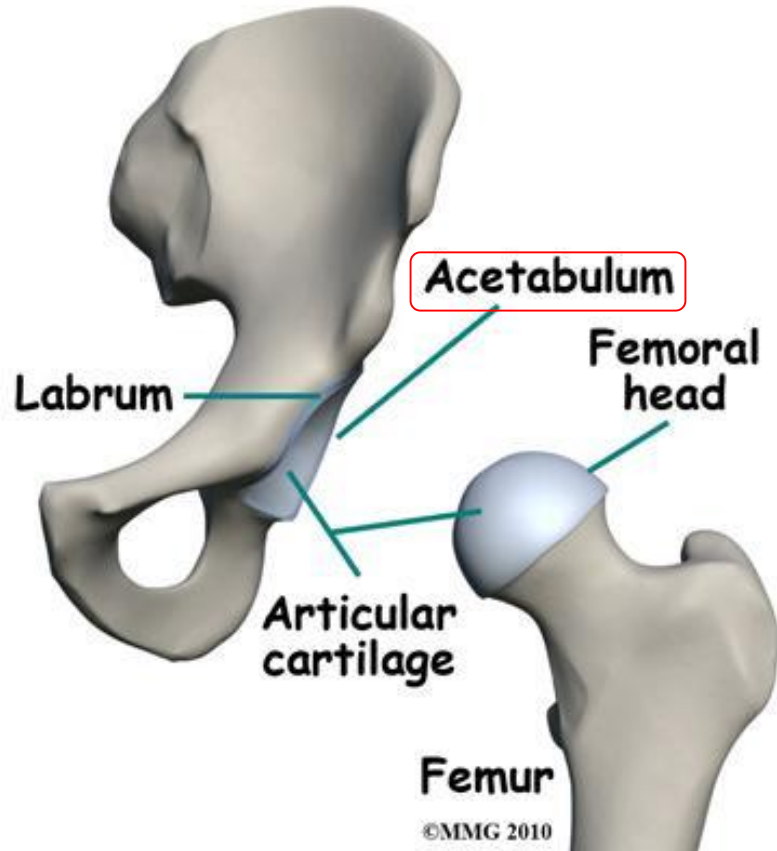


(c) Medial view of proximal end of femur

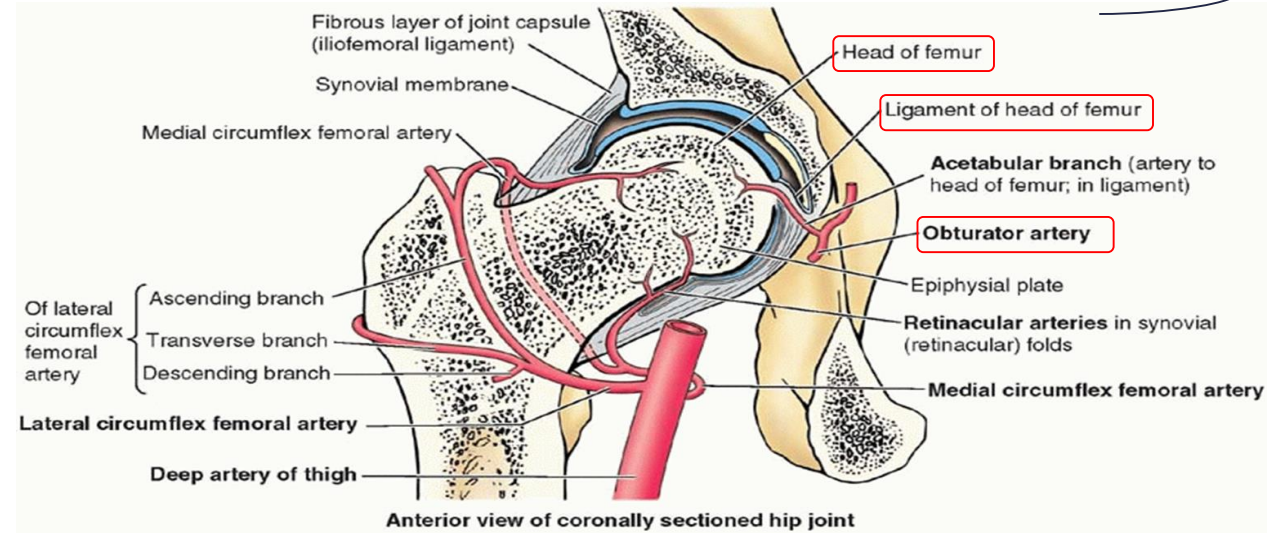


Extra picture for understanding

Extra pictures for understanding



المهم هنا فقط الأجزاء المحاطة بالأحمر



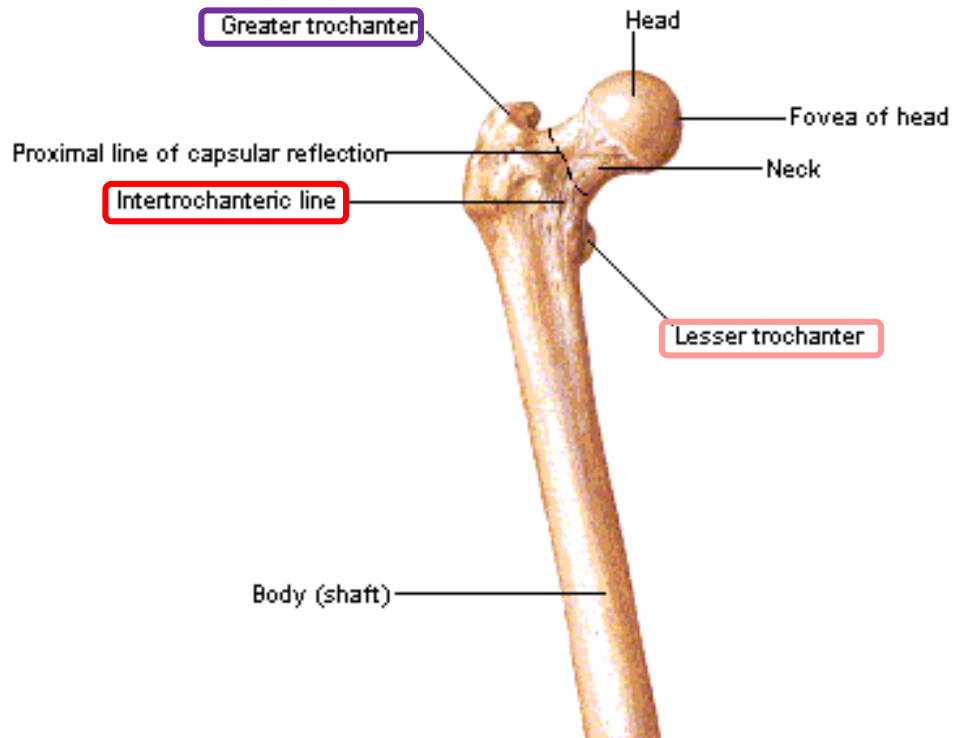
I. Upper End of Femur

C. Greater trochanter & D. Lesser trochanter

Anteriorly

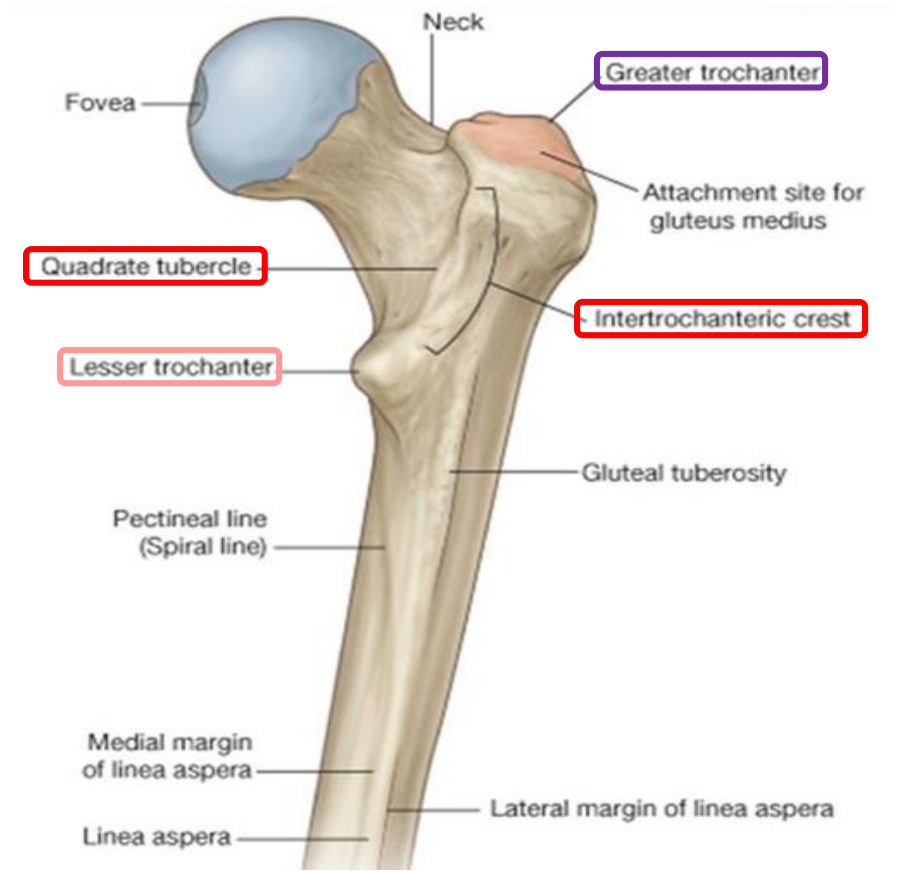
the 2 trochanters are connected by the inter-trochanteric line, where the iliofemoral ligament is attached.

The iliofemoral ligament (ilium + Femur)

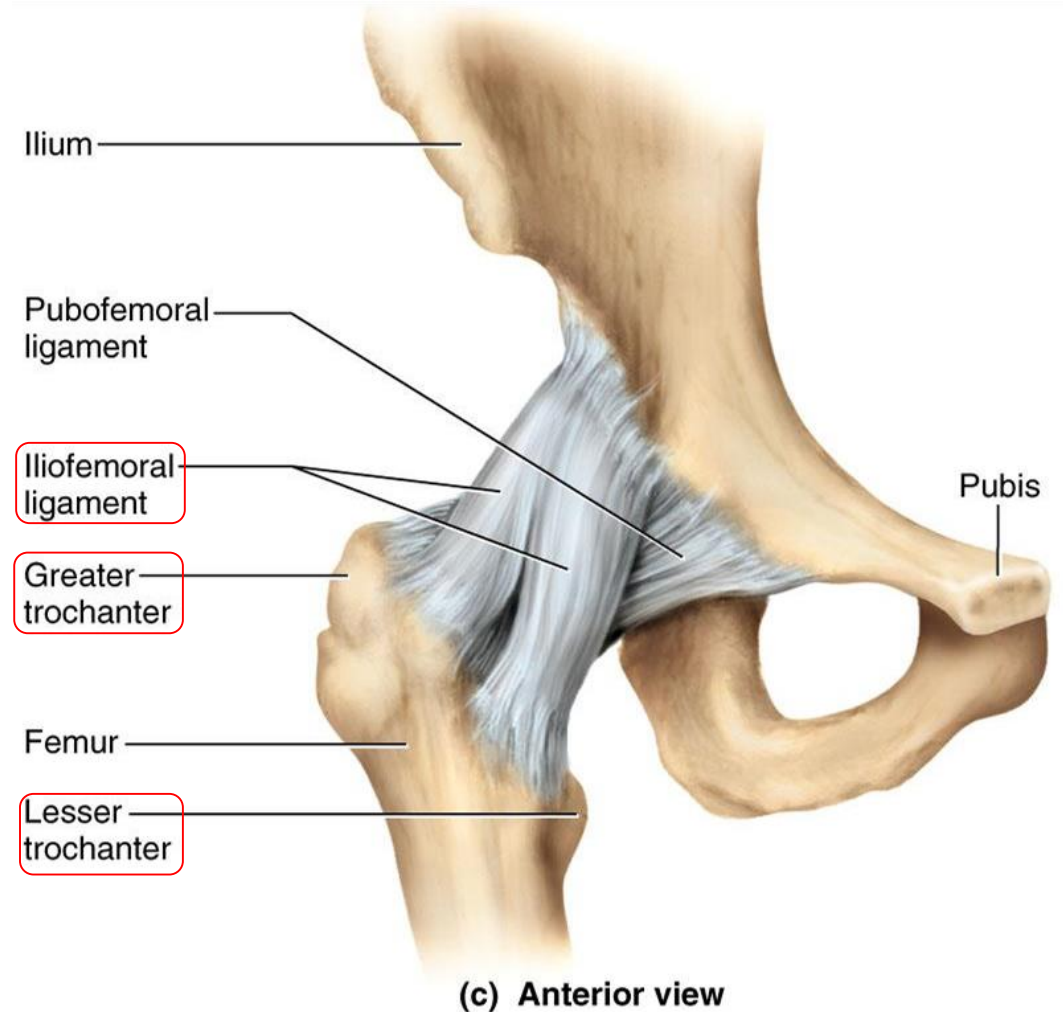
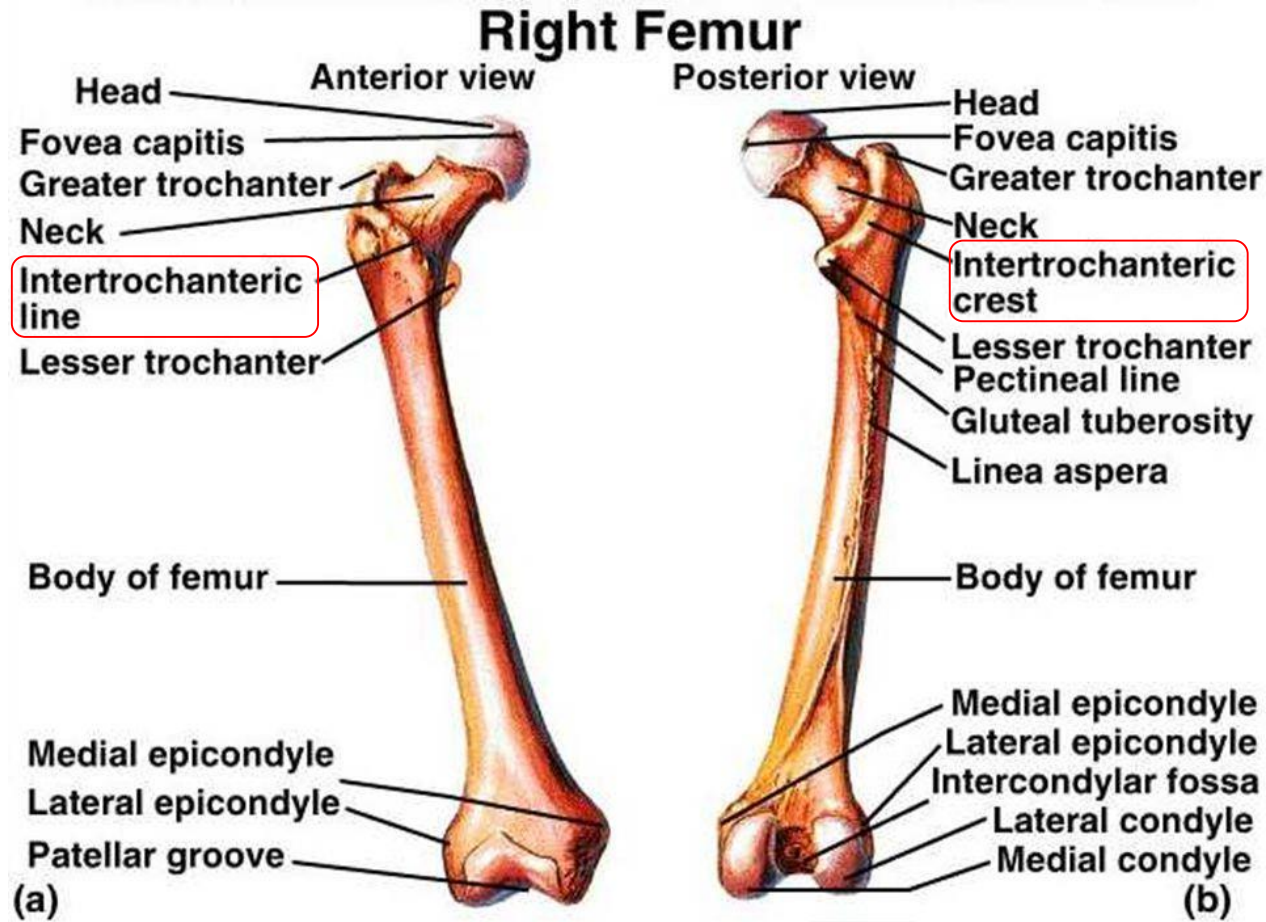


Posteriorly

the inter-trochanteric crest on which is the quadrate tubercle (Quadratus Femoris Muscle).



Extra pictures for understanding



This picture is on the doctor's slides

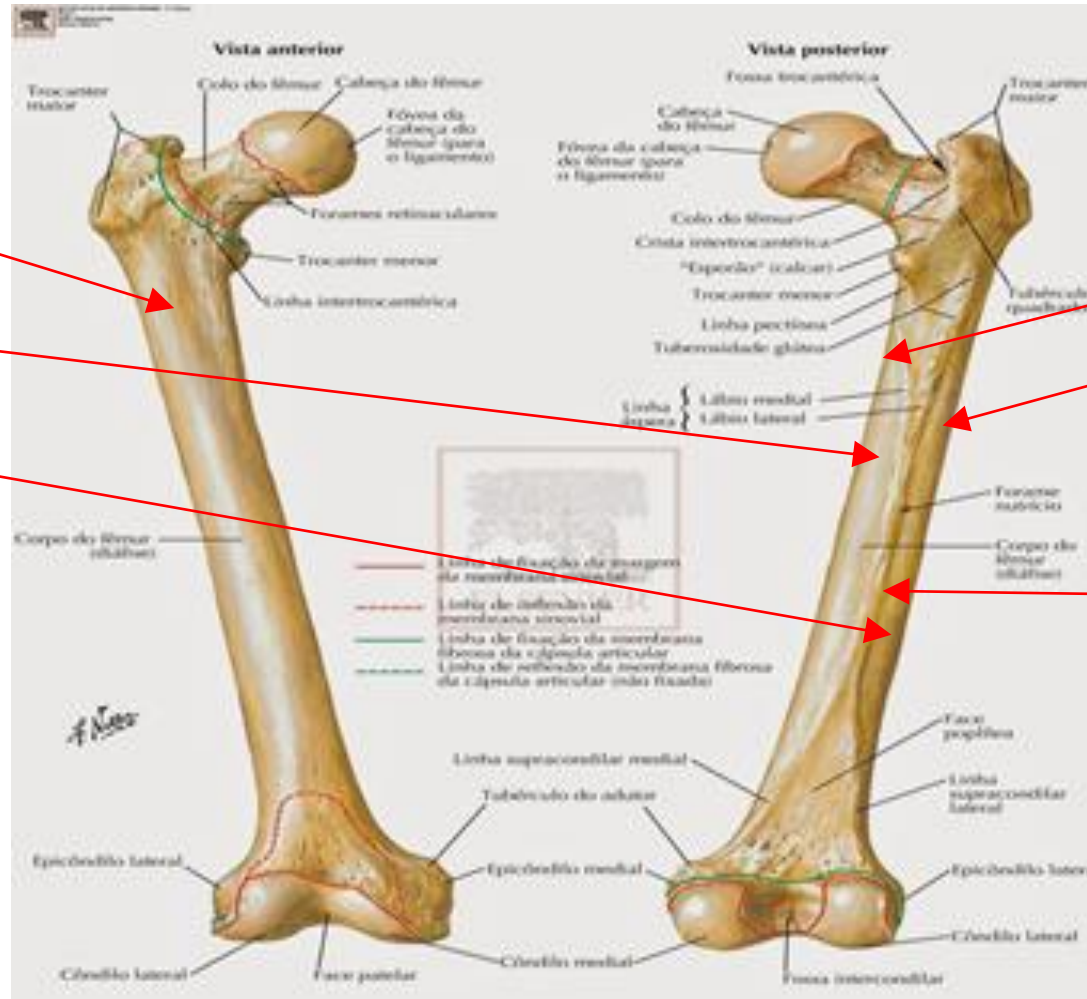
II. Shaft of femur

It has **3 surfaces**

- Anterior
- Medial
- Lateral

It has **3 borders:**

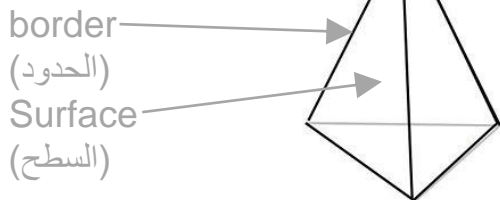
- Two rounded:
 - **medial**
 - **lateral**
- One thick **posterior** border or ridge called **linea aspera**



Anteriorly

Posteriorly

Explanation:



Between 2 borders is a surface.

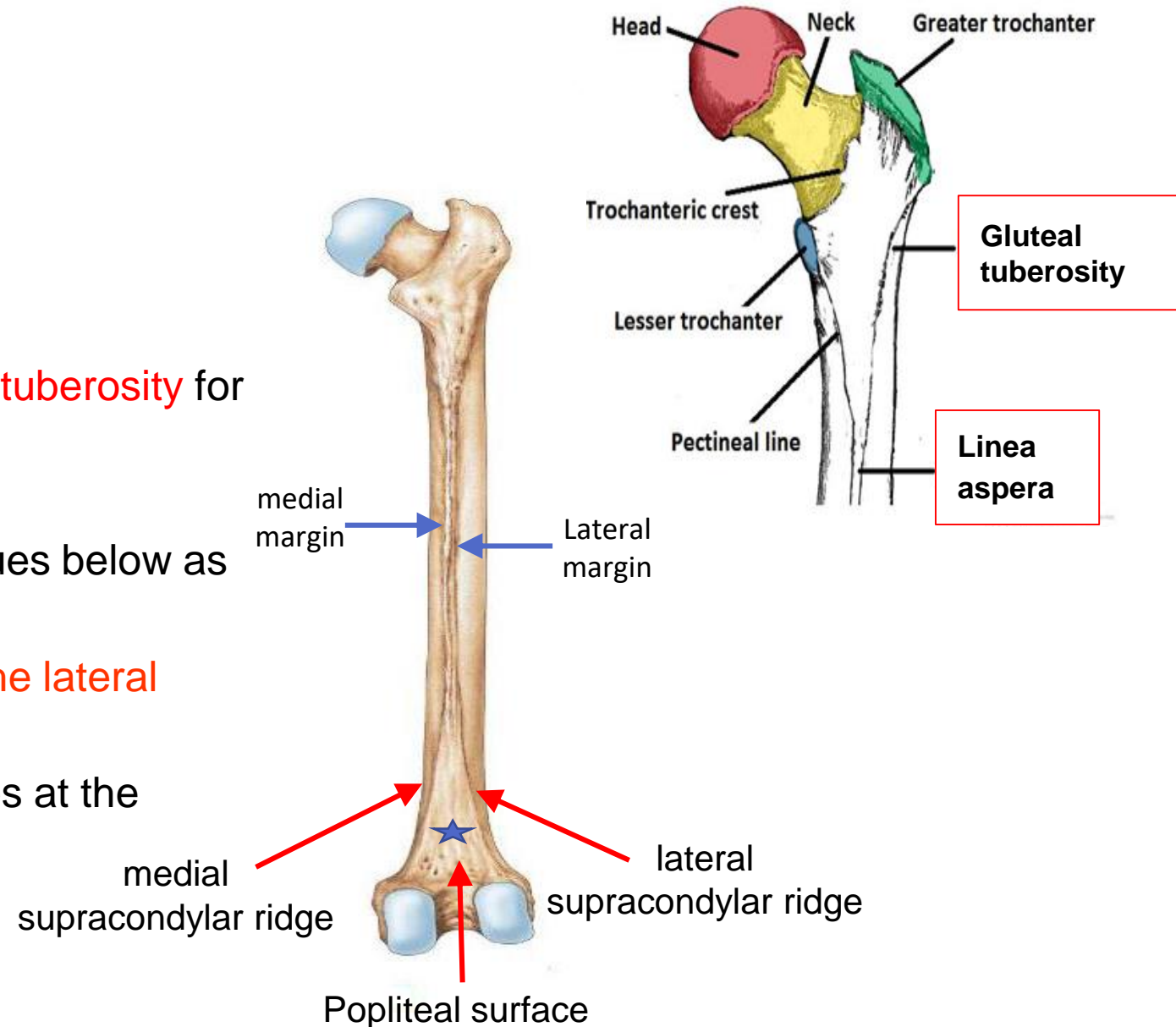
II. Shaft of femur

Anteriorly :

- is smooth and rounded.

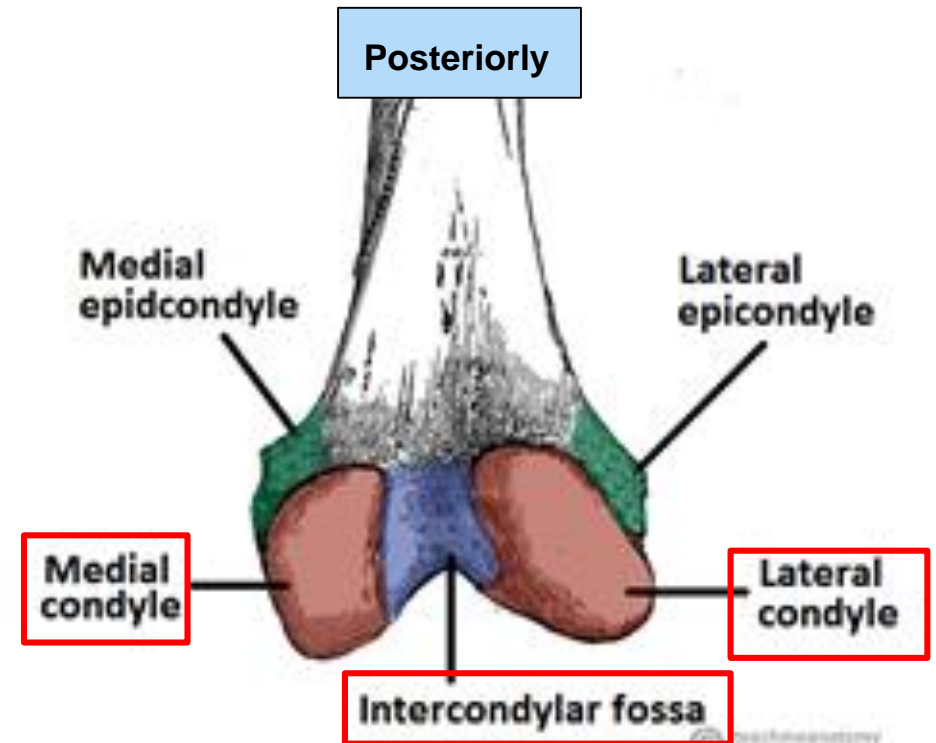
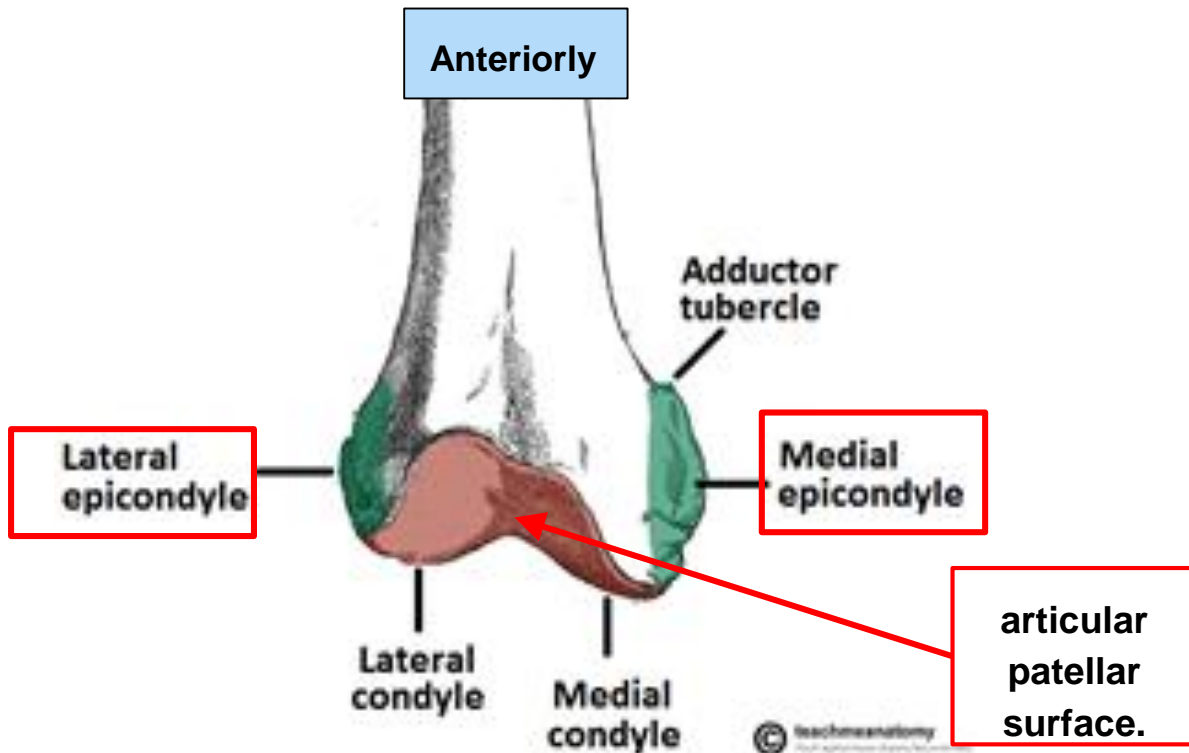
Posteriorly :

- has a ridge, the **linea aspera**.
- below the greater trochanter is **the gluteal tuberosity** for attachment of gluteus maximus muscle.
- The medial margin of linea aspera continues below as **medial supracondylar ridge**.
- The lateral margin continues below with **the lateral supracondylar ridge**.
- A Triangular area, **the popliteal surface** lies at the lower end of shaft.



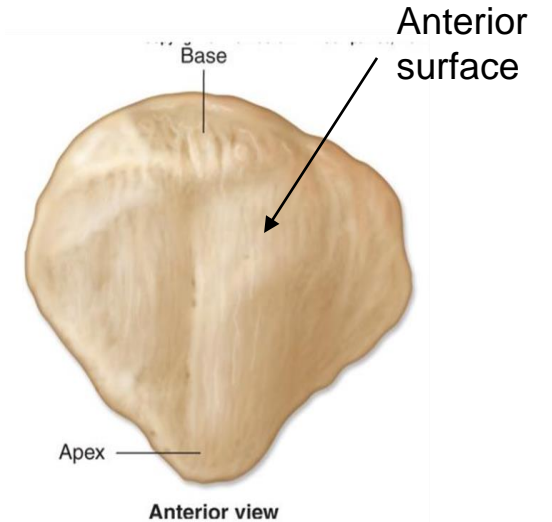
III. Lower end of femur

- Has lateral and medial **condyles**, separated
 - anteriorly by **articular patellar surface**.
 - posteriorly by **intercondylar notch or fossa**.
- The 2 condyles take part in **the knee joint**.
- Above the condyles are **the medial & lateral epicondyles**.

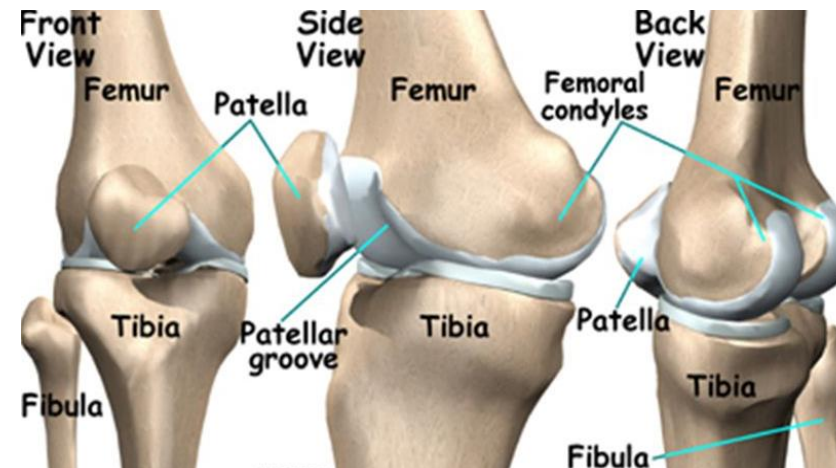


PATELLA

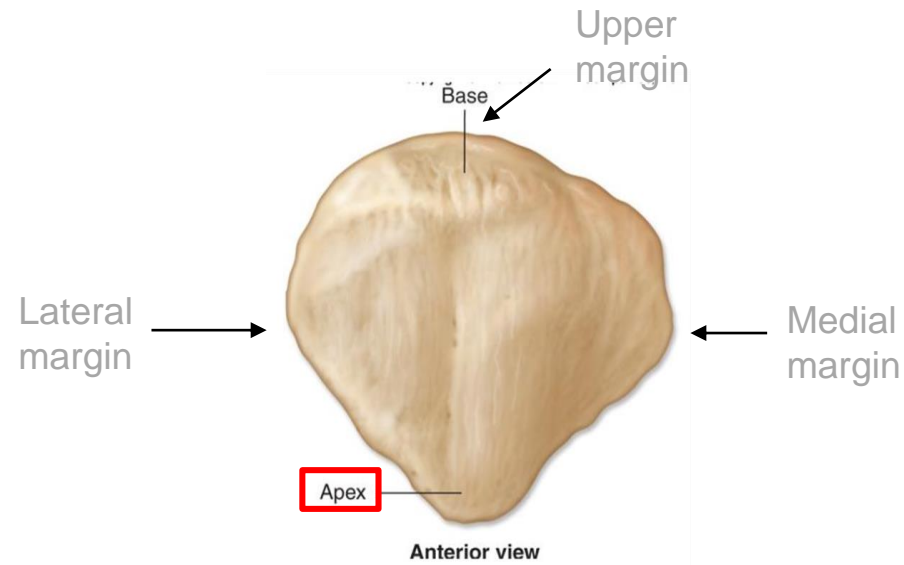
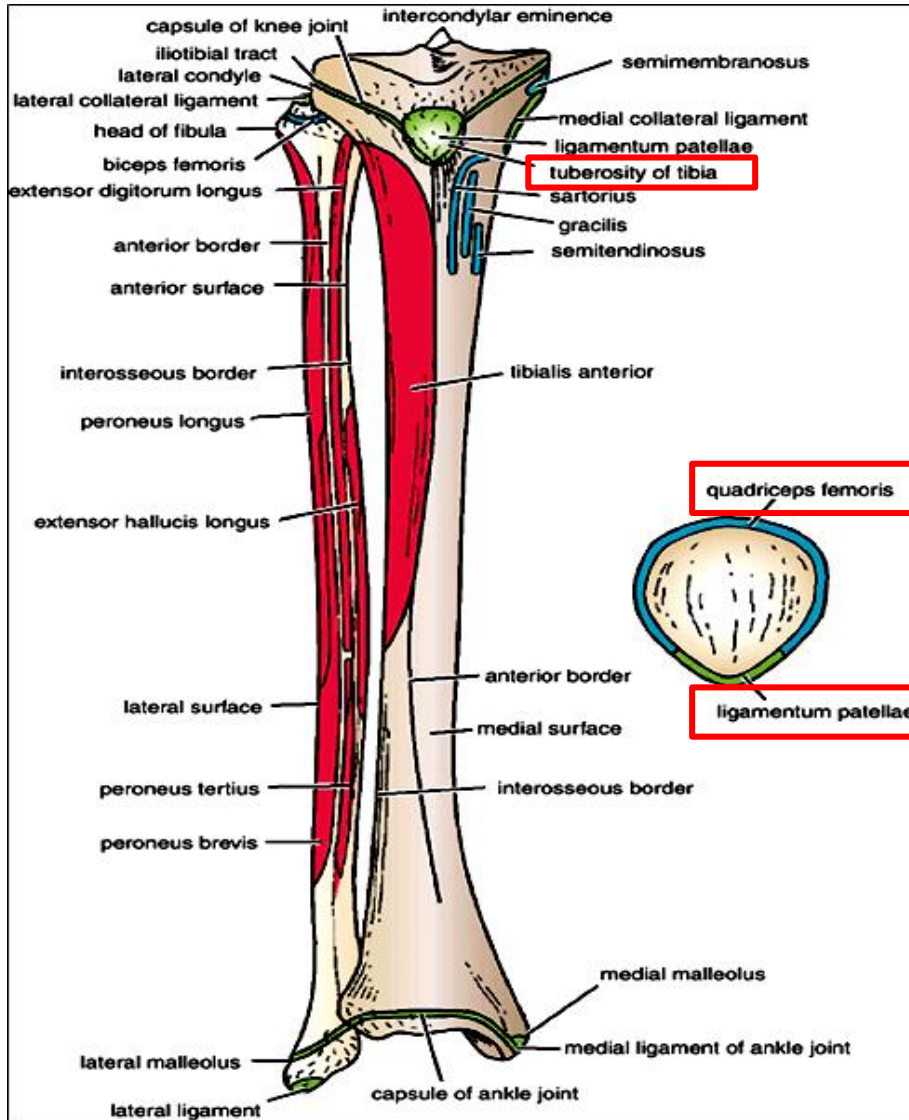
- It is a largest sesamoid bone.
- It lies inside the Quadriceps tendon (in front of knee joint).
- Its **anterior surface** is **rough** and **subcutaneous**.
- Its **posterior surface** articulates with the condyles of the femur to form **knee joint**.



sesamoid bone: is a small independent bone or bony nodule developed in a tendon where it passes over an angular structure



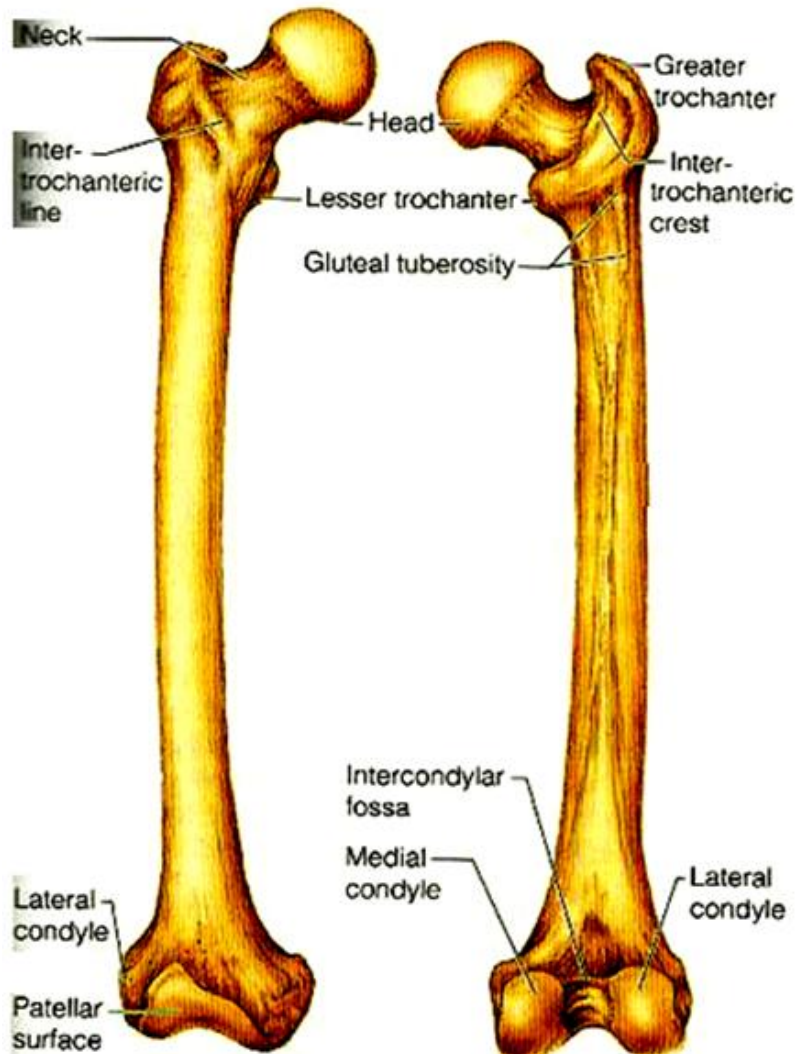
PATELLA



- Its upper, lateral, and medial margins give attachment to **Quadriceps femoris muscles**.
- Its **apex** lies **inferiorly** and is connected to tuberosity of tibia by **ligamentum patellae**.

Note: A ligament is between two bones while a tendon is between a bone and a muscle.

Position of Femur (Right or Left)



1. **Head** is directed upward & medially.
2. **Shaft** is smooth and convex anteriorly.
3. **Shaft** is rough and concave posteriorly.

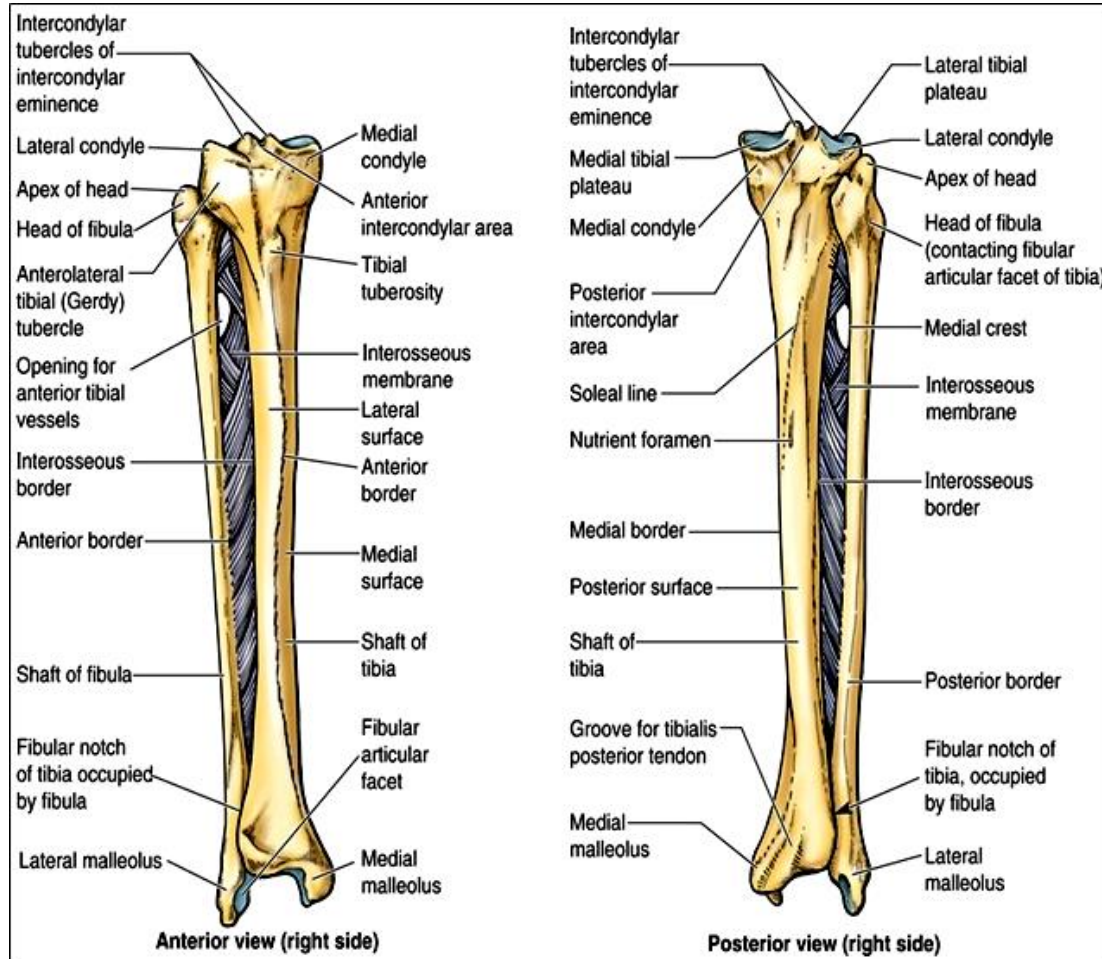
Explanation:

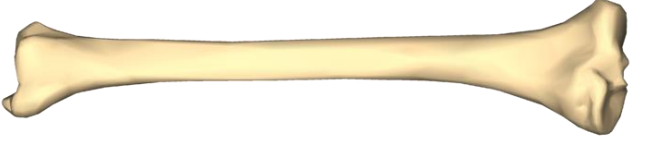

To determine if the femur bone is in the left or right thigh:

1. Make sure that the head is facing upward and is directed medially (towards the center of the body).
2. Rotate the bone until the smooth convex side of the shaft is facing anteriorly, and the rough concave side is facing posteriorly.

Bones of the Leg (Tibia and Fibula)

To remember:
TIBIA -> **MEDIAL**
FIBULA -> **LATERAL**



Tibia	Fibula
<ul style="list-style-type: none"> • It is the <u>medial bone</u> of <u>leg</u>. 	<ul style="list-style-type: none"> • It is the <u>lateral bone</u> of <u>leg</u>.
<ul style="list-style-type: none"> • <u>Each of them</u> has: <ol style="list-style-type: none"> I. upper end II. shaft III. lower end 	
	

TIBIA

I. Upper end of Tibia

The upper end contains:

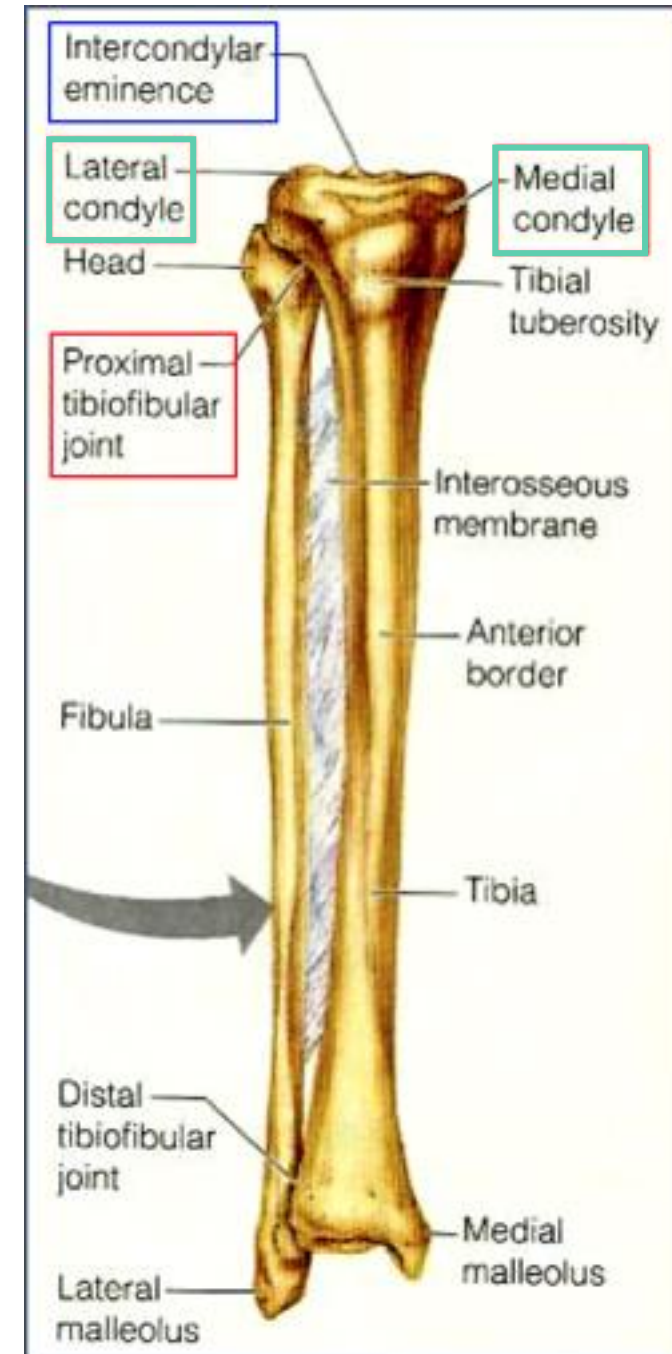
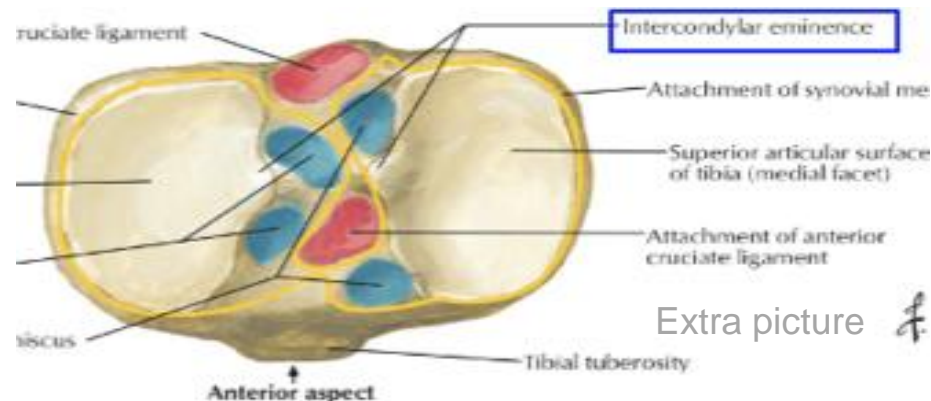
- A. Two tibial condyles
- B. Intercondylar area

A- Two tibial condyles:

Condyle	Size	Articulates with	Other
Medial condyle	Larger	Medial condyle of femur	has a groove on its <u>posterior</u> surface for semimembranosus muscle
Lateral condyle	Smaller	Lateral condyle of femur	has facet on its lateral side for articulation with head of fibula to form <u>proximal tibio-fibular joint</u> .

B- Intercondylar area:

- Rough.
- Has **intercondylar eminence**.



II. Shaft of Tibia

The shaft contains:

- A. Tibial tuberosity
- B. 3 borders
- C. 3 surfaces

A. Tibial tuberosity

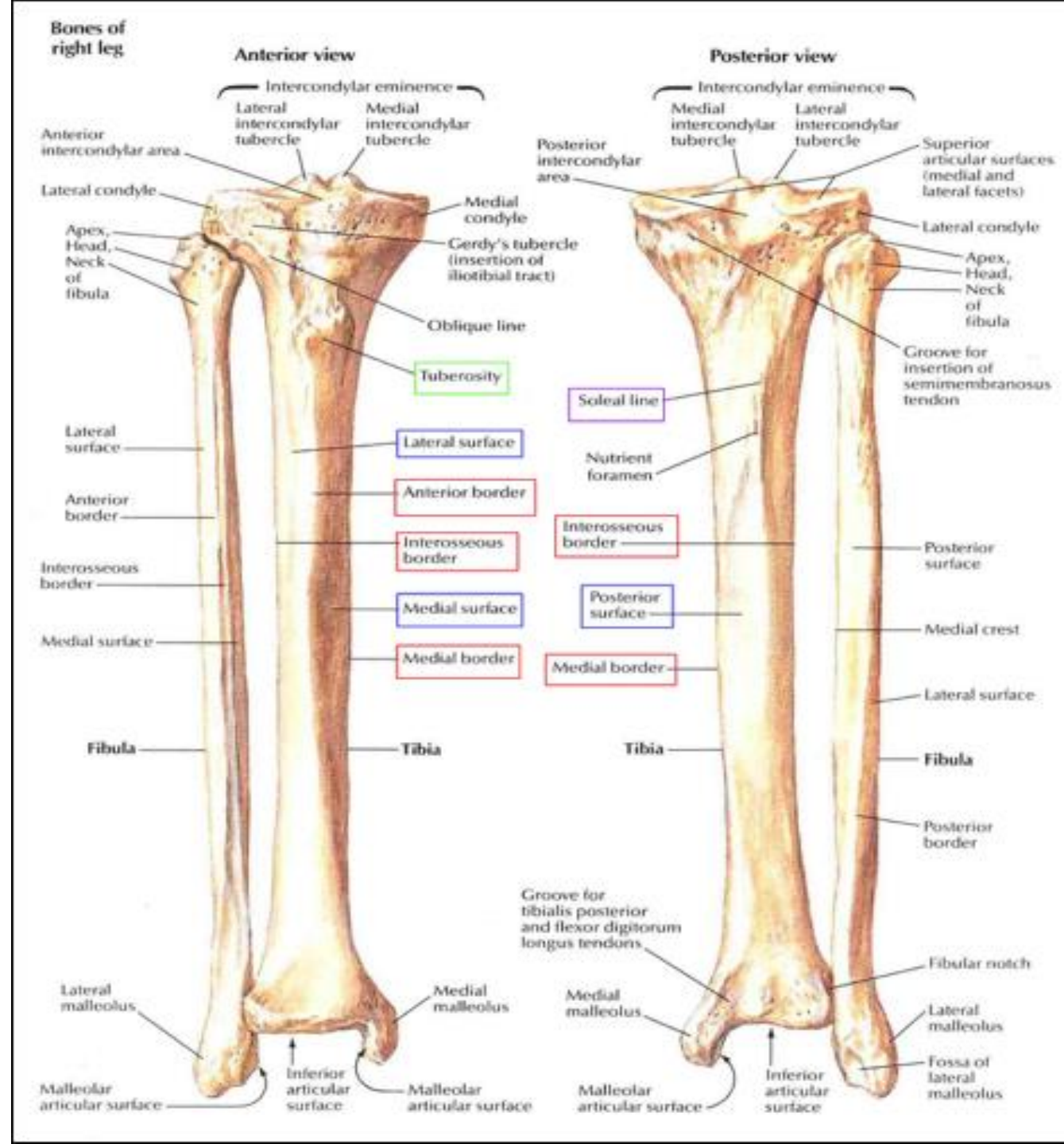
- *Upper smooth part*: gives attachment to **ligamentum patellae**.
- *Lower rough part*: **subcutaneous**.

B. 3 borders

- *Anterior border*: **sharp** and **subcutaneous**.
- *Medial border*.
- *Lateral border* **or interosseous** border.

C. 3 surfaces

- *Medial*: **subcutaneous**.
- *Lateral*.
- *Posterior*: has an oblique line, **soleal line** for attachment of **soleus muscle**.



III. Lower end of Tibia

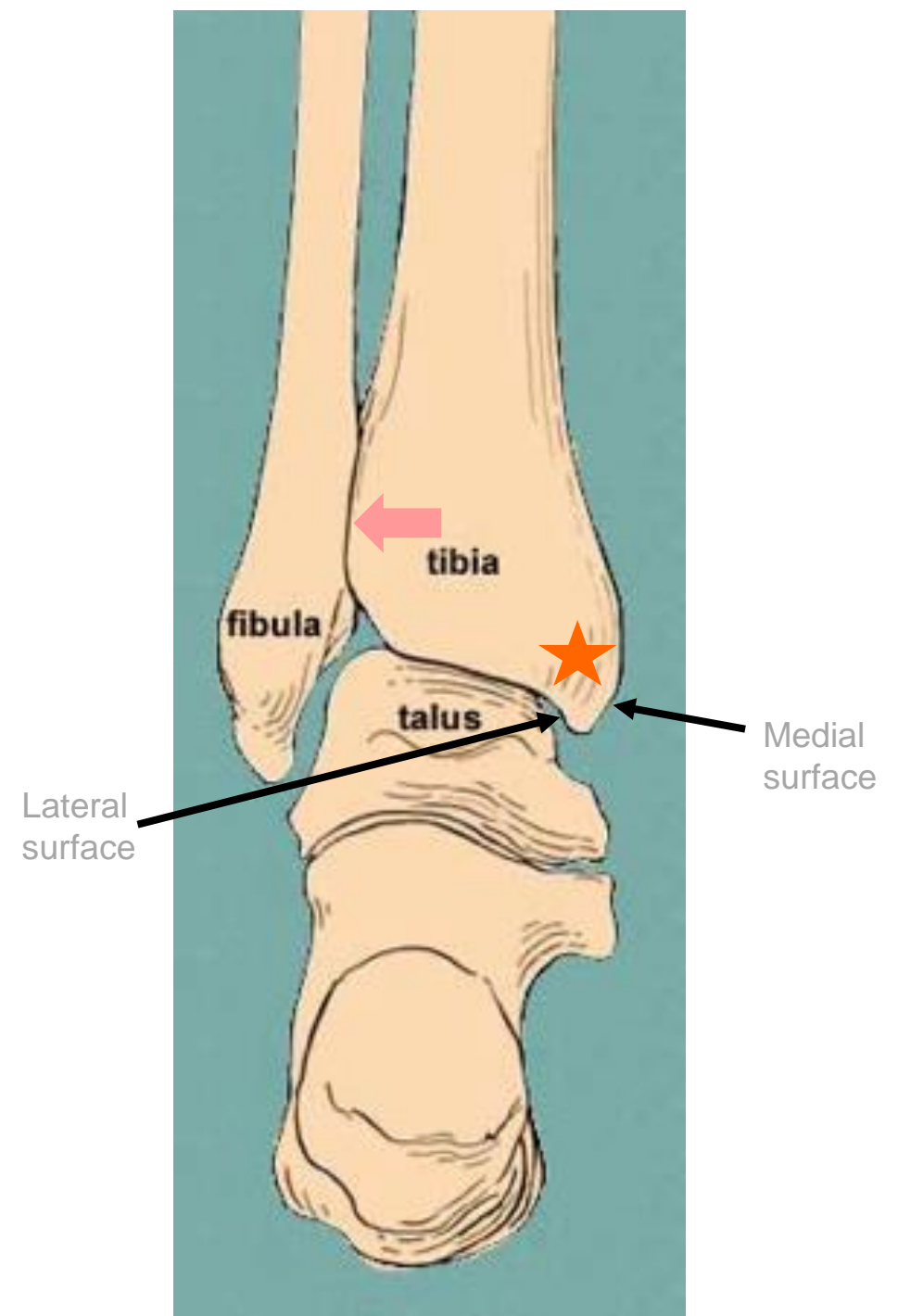
- Articulates with **talus** for formation of **ankle joint**.
- The lower end contains:
 - A. Medial malleolus
 - B. Fibular notch

A- Medial malleolus:

- *Medial surface* is **subcutaneous**.
- *Lateral surface* articulates with talus.

B- Fibular notch:

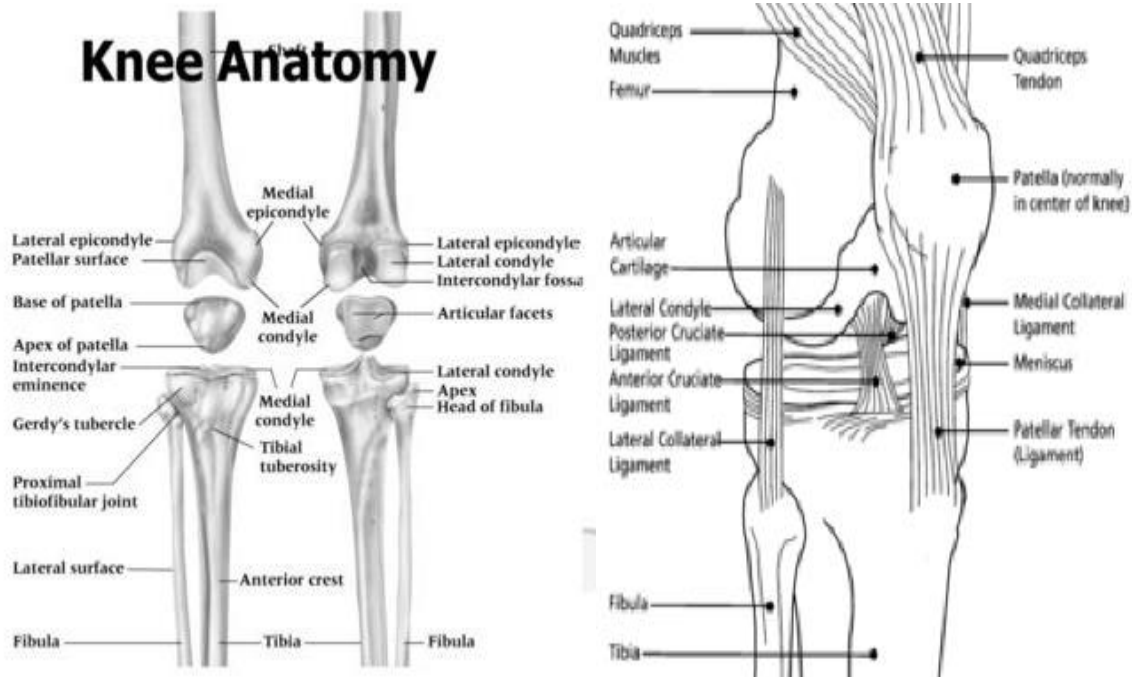
- Lies on its lateral surface of lower end to form **distal tibiofibular joint**.



Overview of the joints

Knee joint:

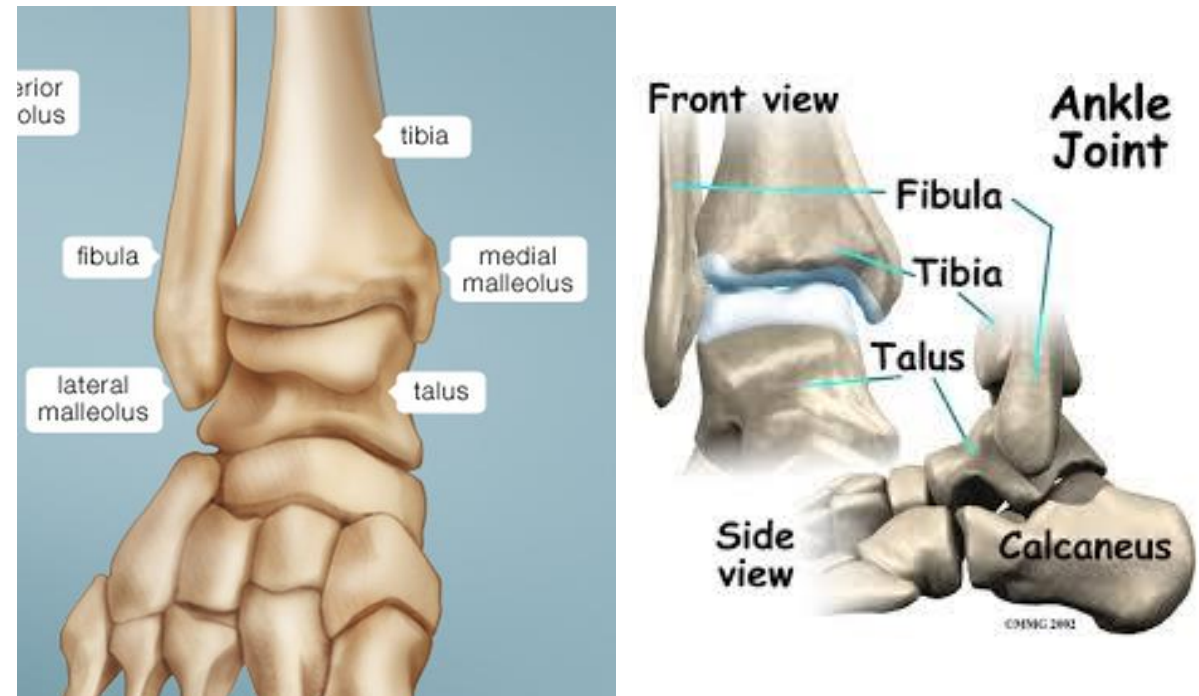
1. Femur (medial and lateral condyles)
2. Patella (posterior surface)
3. Tibia (medial and lateral condyles)



These pictures are extra

Ankle joint:

1. Tibia (lower end/lateral surface of medial malleolus)
2. Fibula (medial surface of lower end)
3. Talus



These pictures are extra

Position of Tibia (Right or Left)

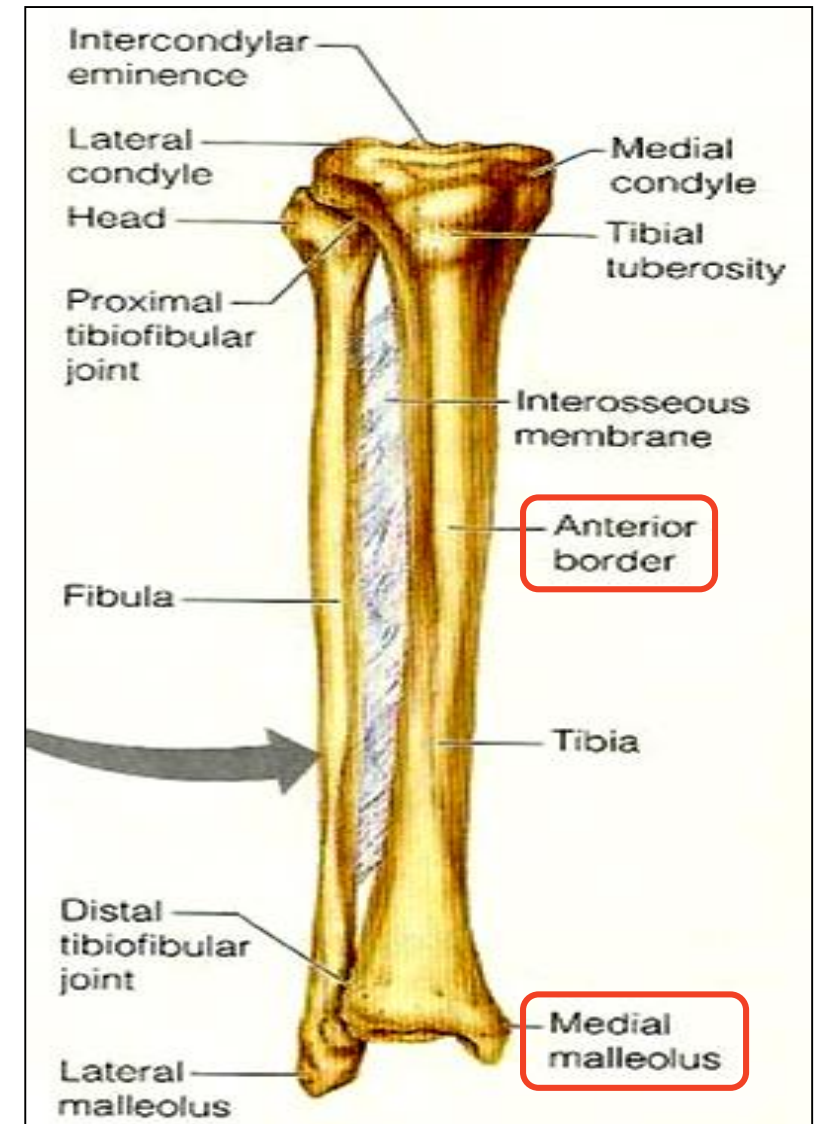
- **Upper end** is larger than lower end.
- **Medial malleolus** is directed downward and medially.
- **Shaft** has sharp anterior border.

Explanation:

To determine if the tibia is in the right or left leg:

1- Turn the bone so that the larger part is at superior/upper, and the medial malleolus is inferior/downward.

2- Rotate the bone so that the sharp anterior border is facing anteriorly.



FIBULA

It is the slender (thin) lateral bone of the leg.

It takes no part in articulation of knee joint

Bones involved in the knee joint are the femur, tibia and patella.

I. Upper end of Fibula

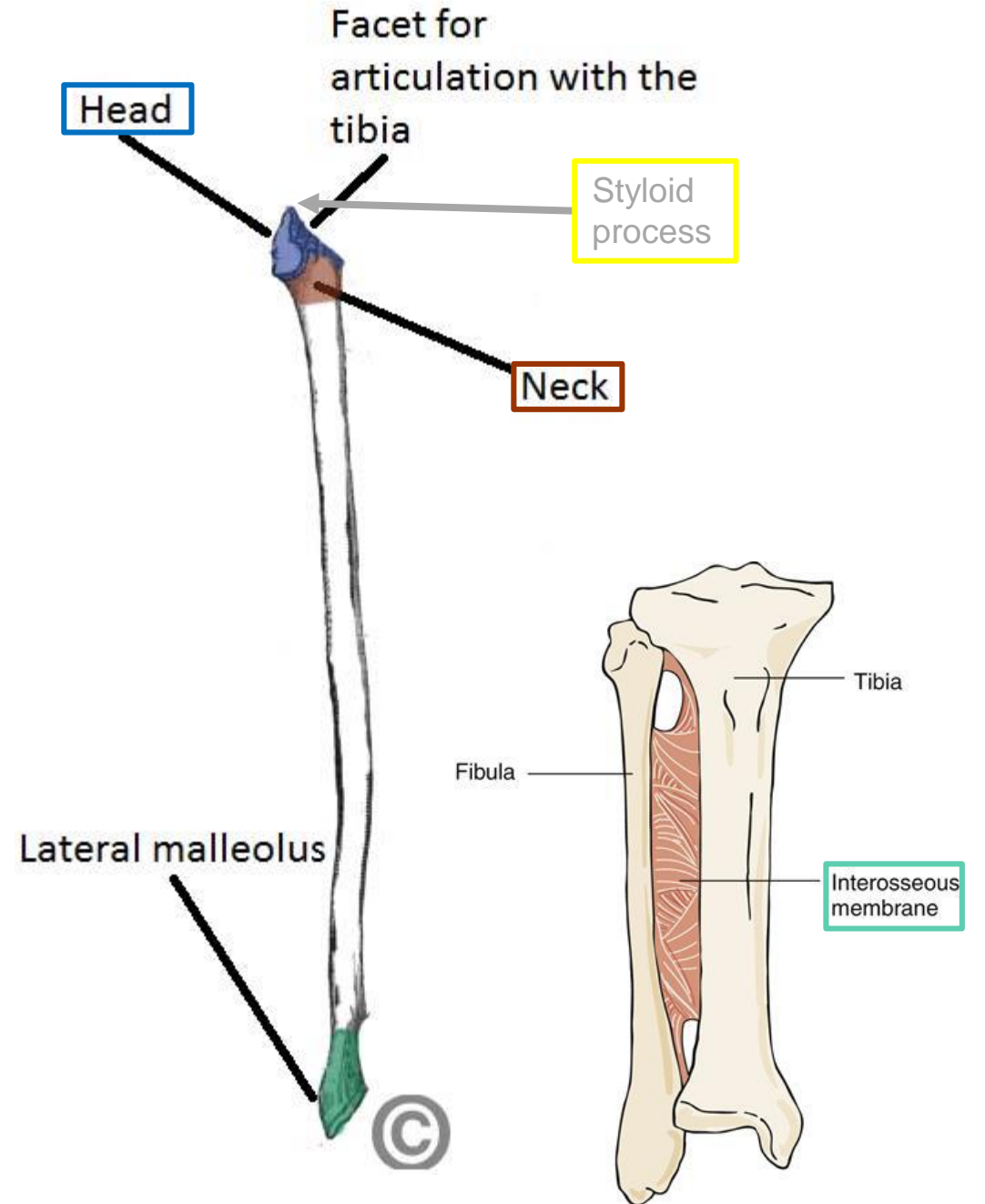
The upper end contains:

- A. Head : articulates with lateral condyle of tibia.
- B. Styloid process
- C. Neck

II. Shaft of Fibula:

- 4 surfaces
- 4 borders: the medial border (interosseous border) gives attachment to interosseous membrane

*note: Femur and tibia each have 3 surfaces and 3 borders
BUT fibula has 4 surfaces and 4 borders

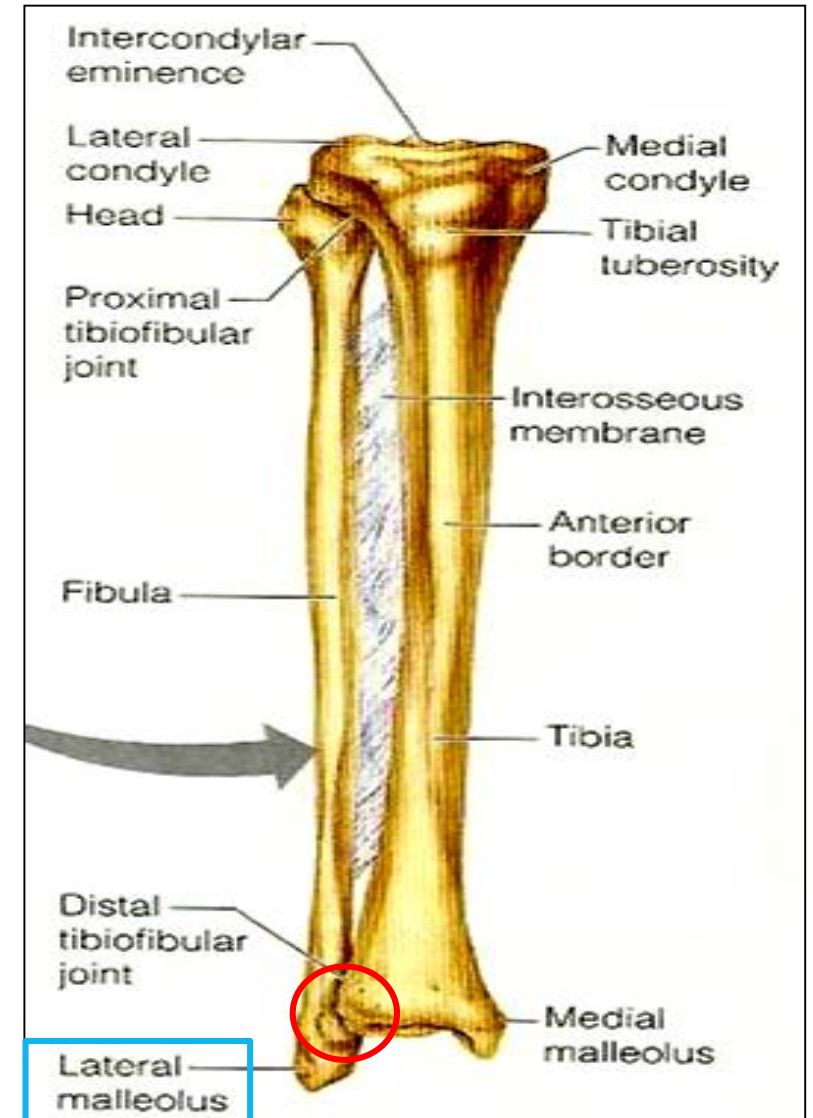
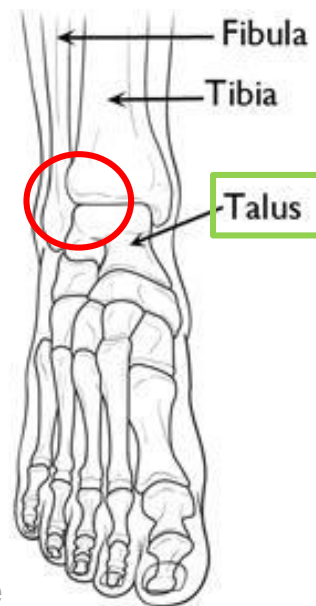
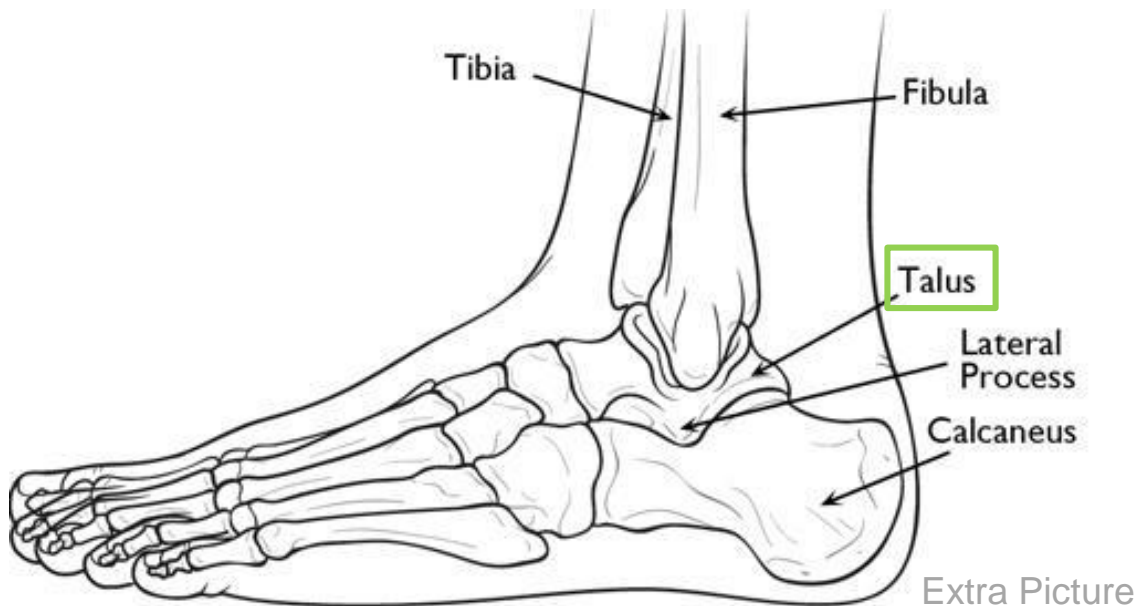


II. Lower end of Fibula

A. Lateral malleolus (**subcutaneous**)

Its *medial* surface is smooth for articulation with talus to form **ankle joint**.

*note: for each leg we have 2 malleolus :
1st the medial one comes from the tibia
2nd the lateral one comes from fibula



Comparing the long bones

	Femur	Tibia	Fibula
Articulates	1- with acetabulum to form hip joint. 2- with tibia to form knee joint.	1- with femur to form knee joint. 2- with fibula to form proximal and distal tibiofibular joint 3- with talus to form ankle joint	1- with tibia to form proximal and distal tibiofibular joint. 2- with talus to form ankle joint.
Surfaces	3 (medial, lateral, anterior)	3 (medial, lateral, posterior)	4
Borders	3 (medial, lateral, posterior)	3 (medial, lateral, anterior)	4 (interosseous)

Bones of foot (26 bones in each foot)

7 tarsal bones

They start to ossify before birth and end ossification by 5th year in all tarsal bones.

(The process of *ossification* allows bones to form while a fetus is still in the womb. The process converts various types of connective tissue into bone)

They are:

Calcaneus

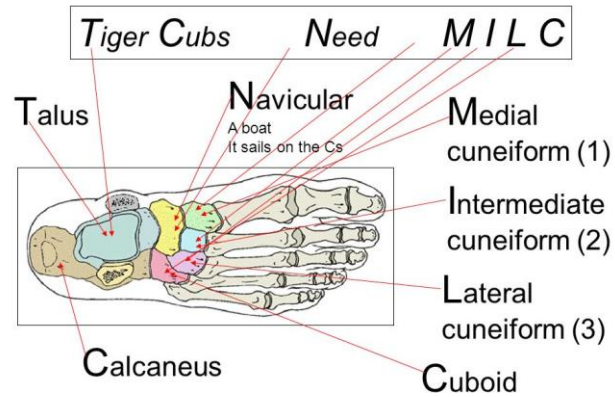
Talus

Navicular

Cuboid

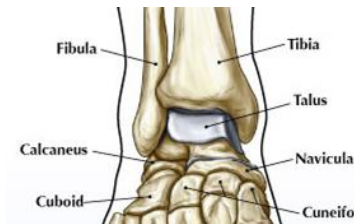
3 Cuneiform bones

Mnemonic for Learning Tarsal Bones:



Note that:

- **Calcaneum is the largest** bone of foot forming the "heel".
- **ONLY TALUS** articulate with tibia and fibula at the **ankle joint**.



Mnemonics for the Tarsal Bones (Team 432)

The Circus Needs More Interesting Little Clowns.

T: Talus

C: Calcaneus

N: Navicular

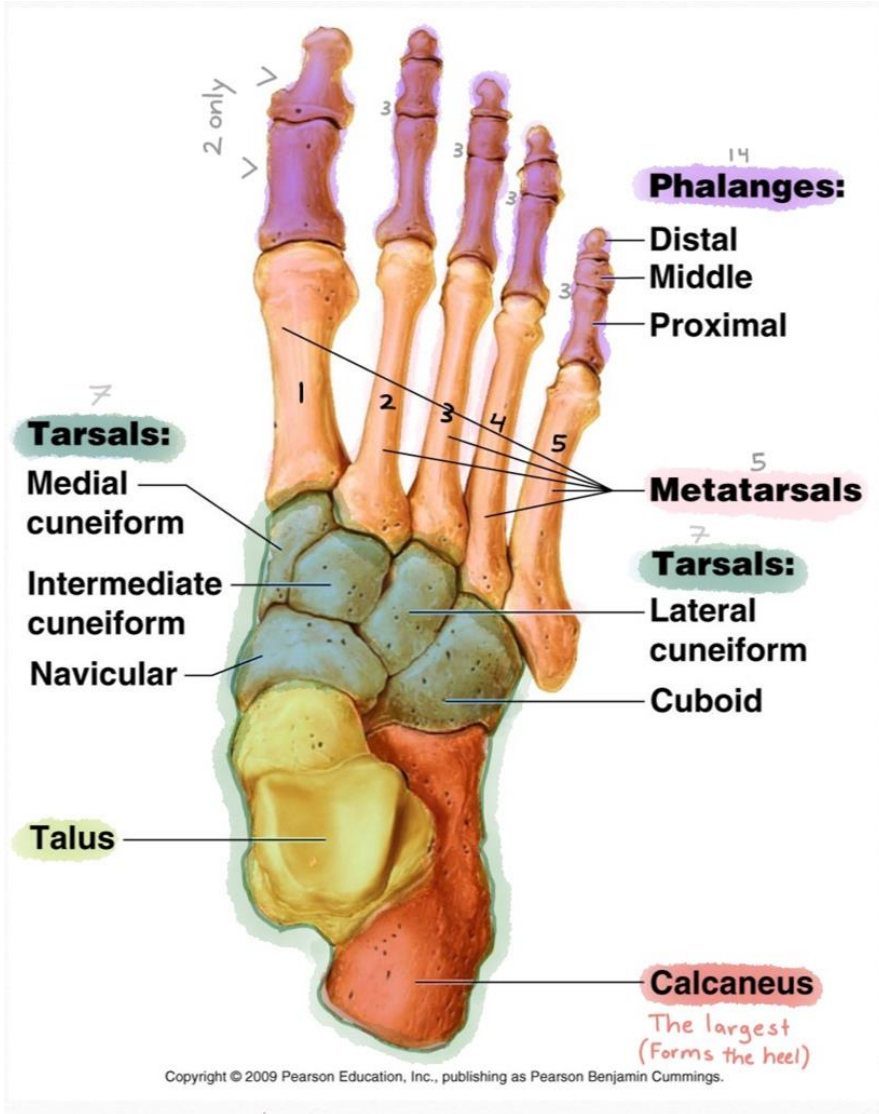
M: Medial cuneiform

I: Intermediate cuneiform

L: Lateral cuneiform

C: Cuboid

تهاني کت کباب ونيفا وثلاث
کتاکیت



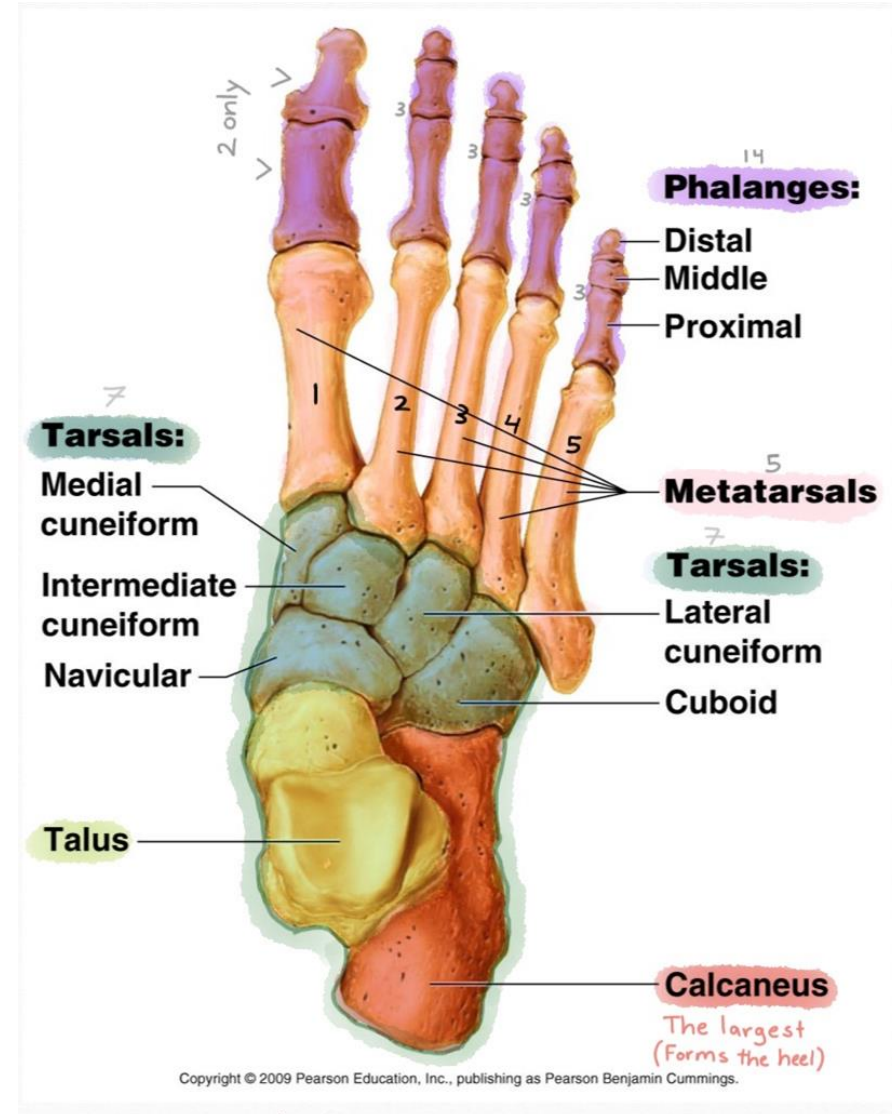
Bones of foot (26 bones in each foot)

14 phalanges:

- Only **2** phalanges for big two (proximal and distal only) while the rest 4 toes have **3** phalanges for each (*proximal, middle, and distal*)
- Each phalanx has base, shaft, and head.

5 metatarsal bones:

- Numbered from **medial** (big finger) to **lateral**.
- First metatarsal is large and lies medially
- Each metatarsal has a base (proximal), a shaft, and a head (distal).

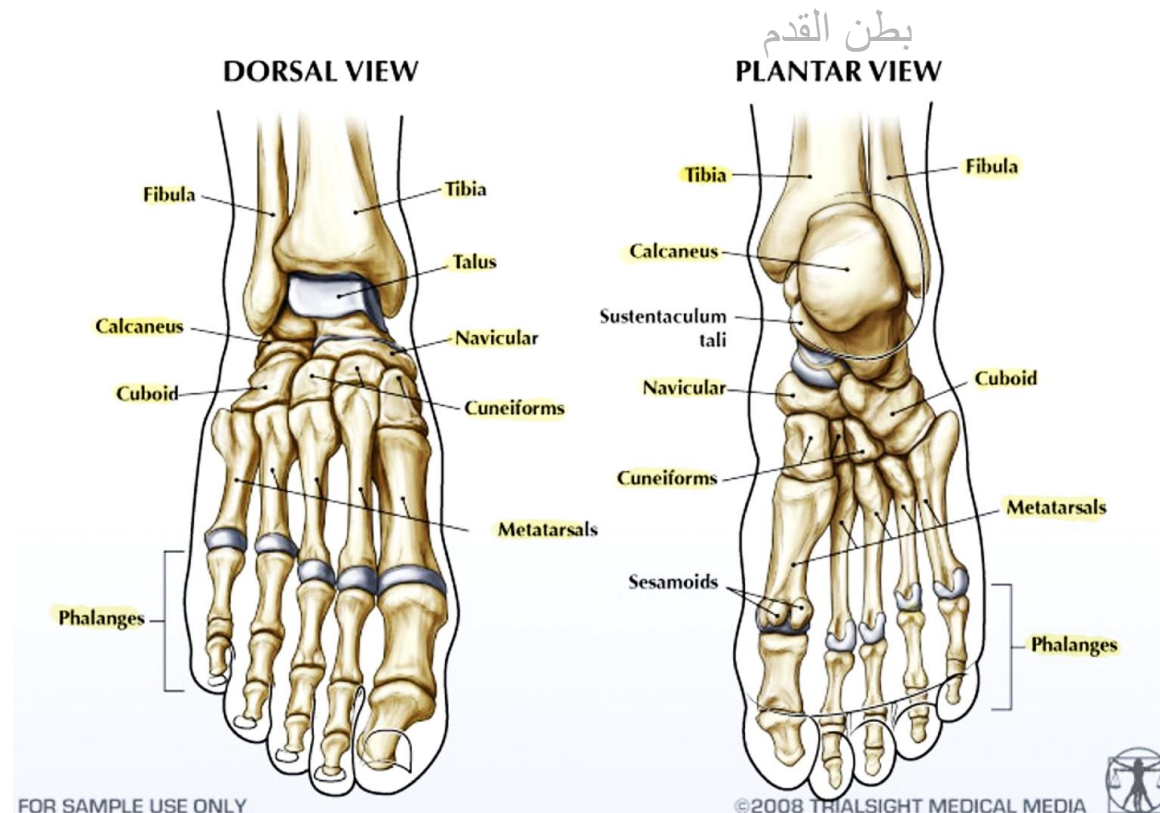


Notes about the bones of foot:

The foot is a complex structure,

- There are 26 bones in each foot alone.
- The foot is also well muscled and is supported by **ligaments and tissue known as fascia**.
- Support is of prime importance in the foot, as it bears the weight of the body and must adopt different configurations to permit locomotion.

Additional
picture for
understanding



Summary

Skeleton of lower limb consists of:

- **Femur:** is the bone of thigh
- **Tibia:** the medial bone of the leg
- **Fibula:** the lateral bone of the leg

Skeleton of foot:

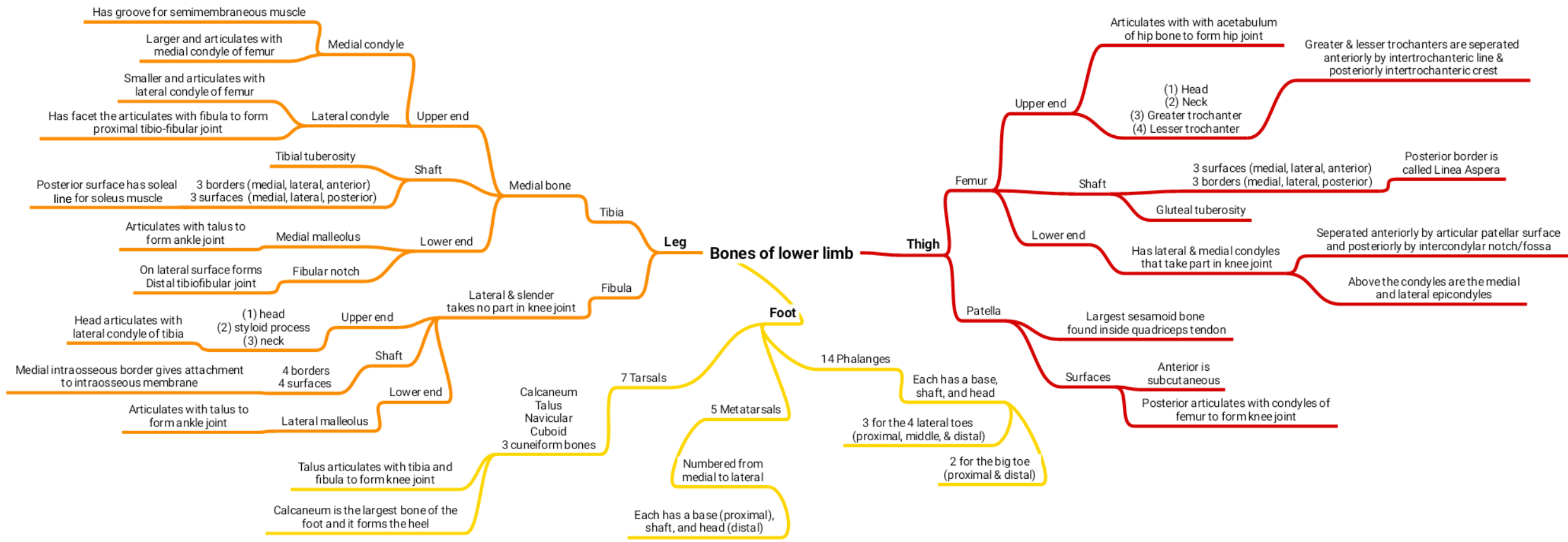
- **Tarsal bones** (7 in number) and one of them is the calcaneum (the largest bone in foot forming the heel)
- **Metatarsal bones** (5 in number)
- **Phalanges** (14 in number)

The subcutaneous parts of bones in the lower limb are: (IMPORTANT)

1. Patella
2. Anterior border of the tibia
3. Tibial tuberosity
4. Medial surface of shaft of tibia
5. Medial malleolus of tibia
6. Lateral malleolus of fibula.

Don't Forget!

Name	Character
Fovea capitis	depression in the center of Head in femur
Obturator artery	passes along this ligament to supply head of femur.
Inter-trochanteric line	where the iliofemoral ligament is attached.
Linea aspera	posterior border OF FEMUR
Gluteal tuberosity	below the greater trochanter, for attachment of gluteus maximus muscle.
Popliteal surface	Triangular area, lies at the lower end of shaft, OF FEMUR
Patella	largest sesamoid bone
Intercondylar eminence	Intercondylar area in the Upper end of tibia (rough)
Soleal line	Surface of TIBIA, for attachment of soleus muscle Posterior
Calcaneus	the largest bone of foot, forming the heel.
Styloid process	Process in the upper end of fibula



We HIGHLY recommend you visit these websites

<http://teachmeanatomy.info/>

http://www.med.umich.edu/lrc/coursepages/m1/anatomy2010/html/courseinfo/mich_quiz_index.html

To download Essential Anatomy 5

https://twitter.com/Med_436/status/807971055524515841

Questions

1. A thick border found posteriorly in the femur:

- a) Axillary border
- b) Medial border
- c) Linea aspera

2. What is below the greater trochanter?

- a) Articular patellar surface.
- b) Gluteal tuberosity
- c) Intercondylar notch or fossa.

3. The medial margin of linea aspera continues below as medial supracondylar ridge.

- a) T
- b) F

4. A Triangular area, lies at the lower end of the shaft.

- a) popliteal surface.
- b) lateral epicondyles.
- c) intercondylar notch or fossa

5. What do lateral and medial condyles form?

- a) intercondylar notch or fossa.
- b) knee joint
- c) linea aspera

6. The largest sesamoid bone in our body is:

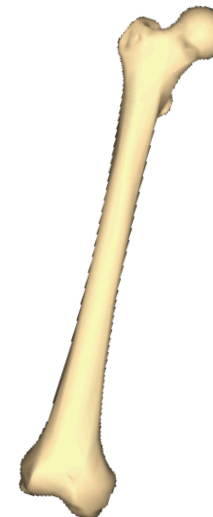
- a) Petalle
- b) Tibia
- c) Patella
- d) Fibula

7. Apex of the patella lies inferiorly and is connected to:

- a) Quadriceps femoris muscles.
- b) Fibula
- c) Condyles of the femur
- d) Tuberosity of tibia

8. This is the :

- a) Right humerus
- b) Left humerus
- c) Right femur
- d) Left femur



Answers :

- 1. c
- 2. b
- 3. a
- 4. a
- 5. b
- 6. c
- 7. d
- 8. c

Questions

9. The lateral bone of leg is :

- a) Patella
- b) Fibula
- c) Humerus
- d) Tibia

10. The patella:

- a) Lies on the back of the knee joint.
- b) Has apex lying superiorly.
- c) Has smooth articulating anterior surface.
- d) Gives attachment to quadriceps femoris tendon.

11. The tarsal bones of foot consists of:

- a) 7 bones
- b) 8 bones
- c) 9 bones
- d) 10 bones

12. Which one of the foot bones contributes in the ankle joint?

- a) Calcaneum
- b) Talus
- c) Cuboid
- d) Navicular

13. Which one of the following bones forms the heel of foot?

- a) Talus
- b) Calcaneum
- c) Cuboid
- d) Navicular

14. Which one of the following bones is the largest bone in the foot?

- a) Cuboid
- b) Cuneiform
- c) Navicular
- d) Calcaneum

Answers :

9. b

10. d

11. a

12. b

13. b

14. d

Questions

15. The medial bone of the leg is:

- a) Femur
- b) Humerus
- c) Tibia
- d) Fibula

16. The cuboid bone of the foot is considered:

- a) Metatarsal and is located on the medial side of the foot
- b) Tarsal and is located on the medial side of the foot
- c) Metatarsal and is located on the lateral side of the foot
- d) Tarsal and is located on the lateral side of the foot

17. Tibia's Shaft has three surfaces: Medial, Lateral and

- a) Anterior.
- b) Posterior.
- c) Interosseous.

18. The lower end of the articulates with the talus for formation of ankle joint.

- a) Tibia
- b) Femur
- c) Humerus

19. The fifth toe of the foot doesn't have a middle phalanx

- a) True
- b) False

20. The tarsal, metatarsal, and phalanges bones in the foot are respectively:

- a) 8, 5, 14
- b) 7, 5, 15
- c) 7, 5, 14
- d) 7, 4, 14

Answers:

15. c

16. d

17. b

18. a

19. b

20. c

Questions

21. List all the bones in the three regions of the lower limb.
22. Lateral condyle has facet on its lateral side for articulation with head of fibula to form?
23. An oblique line that attaches soleus muscle?
24. What are the parts of upper end of fibula?
25. How many surfaces and borders do the tibia and fibula have?
26. Fibular notch of the tibia forms?

Answers:

21. Bones of the thigh (femur & patella)
Bones of the leg (tibia & Fibula).
Bones of the foot (tarsals, metatarsals and phalanges)
22. Proximal tibio-fibular joint.
23. Soleal line.
24. Head, styloid process and neck.
25. The tibia has 3 surfaces and 3 borders and the fibula has 4 surfaces and 4 borders.
26. Distal tibiofibular joint.



Leaders:

Nawaf AlKhudairy
Jawaher Abanumy
Ghada Almazrou

Members:

Dania Alkelabi
Deena AlNowiser
Jawaher Alkhayyal
Nourah Al Hogail
Rawan Alharbi
Razan AlQahtani
Safa Al-Osaimi



anatomyteam436@gmail.com



[@anatomy436](https://twitter.com/anatomy436)