



# **SCHOOL OF PHYSIOTHERAPY**

## **SELF - DIRECTED LEARNING MODULE ON FUNCTIONAL ANATOMY FOR PHYSIOTHERAPISTS**

### **Part I Lower Limbs**

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**NOTE:** The following objectives are based on notes collated and compiled by Dr Karen Ginn, Senior Lecturer, Faculty of Health Sciences, University of Sydney. They have been adapted and modified with permission by Doa El-Ansary for the purposes of postgraduate instruction.



This self directed learning module has been developed to facilitate student revision and preparation for entry into the Masters of Physiotherapy Program at the University of Canberra.

The material outlined in this module forms the basis of the theoretical background in Functional Anatomy that will be assumed knowledge.

The following learning objectives are based on material developed by and compiled by Dr Karen Ginn, Senior Lecturer, Faculty of Health Sciences, University of Sydney. They have been adapted and modified with permission by Doa El-Ansary for the purposes of postgraduate instruction.

The objectives are designed to direct and sequence your learning, Material highlighted in **bold print is to be identified practically on dissected specimens or in an anatomical atlas**. Objectives in regular print are to be answered from texts or articles provided in the general or region specific reference lists.

## REFERENCES

These are available in the library, but it is strongly recommended you own a copy of a good anatomy text for continuous professional education and reference.

### Texts:

Moore, K L and Daley: Clinically Oriented Anatomy (5<sup>th</sup> Edn), Lippincott, Williams and Wilkins, Baltimore, 2005 (ISBN 0-7817-3639-0)

Drake, R L; Vogl, W and Mitchell, A W M: Gray's Anatomy for Students. Elsevier, 2005 ISBN ( 0-443-07168-3)

Palastanga, N; Field, D and Soames, R: Anatomy and Human Movement (4<sup>th</sup> Edn), 2002. ISBN (0-7506-5241-1)

### Atlases:

Rohen, J W; Yokochi, C and Drecol, E L: Colour Atlas of Human Anatomy (5<sup>th</sup> Edn), 1993. Lippincott, Williams and Wilkins. ISBN (0-7817-3194-1)

Abrahams, P H; Marks, S C and Hutchings, R T: McMinn's Colour Atlas of Human Anatomy, 2003. Mosby. ISBN (0-7234-3212-0)

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#### Figures within referenced to:

<http://education.yahoo.com/reference/gray/subjects/>

and

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## 1. INTRODUCTORY OSTEOLOGY

- 1.1. Define the anatomical position
  
- 1.2. Define the following terms of position and direction which are related to the standardised anatomical positions:
  - 1.2.1. median (midsagittal) plane
  - 1.2.2. sagittal plane
  - 1.2.3. coronal (frontal) plane
  - 1.2.4. horizontal (transverse) plane
  - 1.2.5. anterior; posterior (ventral; dorsal)
  - 1.2.6. superior; inferior (rostral/cephalic; caudal)
  - 1.2.7. medial; lateral
  - 1.2.8. proximal; distal
  - 1.2.9. superficial; deep
  - 1.2.10. palmar; dorsal
  - 1.2.11. plantar; dorsal
  
- 1.3. Classify bones according to shape and give an example of each type.
  - 1.3.1. Long
  - 1.3.2. Short(cuboid)
  - 1.3.3. Flat
  - 1.3.4. Irregular
  - 1.3.5. Sesamoid

- 1.4. Draw a typical long bone and illustrate the following features:
- 1.4.1. diaphysis
  - 1.4.2. metaphysis
  - 1.4.3. epiphysis
  - 1.4.4. articular surfaces
- 
- 1.5. Describe and state the functions of bony markings and find an example of each type of marking.
- |                   |                 |
|-------------------|-----------------|
| 1.5.1. Condyle    | 1.5.11. Facet   |
| 1.5.2. Crest      | 1.5.12. Canal   |
| 1.5.3. Epicondyle | 1.5.13. Fissure |
| 1.5.4. Process    | 1.5.14. Foramen |
| 1.5.5. Line       | 1.5.15. Groove  |
| 1.5.6. Lamina     | 1.5.16. Meatus  |
| 1.5.7. Spine      | 1.5.17. Fossa   |
| 1.5.8. Tuberosity | 1.5.18. Notch   |
| 1.5.9. Trochanter | 1.5.19. Sulcus  |
| 1.5.10. Trochlear |                 |

## 2. INTRODUCTORY ARTHROLOGY

- 2.1. Define a joint or articulation.
  
- 2.2. Describe the general structure and the relative amount of movement available at each of the following types of joints, and give an example:
  - 2.2.1. fibrocartilaginous
  
  - 2.2.2. hyaline and fibrocartilaginous
  
  - 2.2.3. synovial
  
- 2.3. Classify synovial joints, and give an example, according to:
  - 2.3.1. structure
  
  - 2.3.2. hinge
  
  - 2.3.3. pivot
  
  - 2.3.4. ellipsoid
  
  - 2.3.5. condyloid
  
  - 2.3.6. saddle
  
  - 2.3.7. ball & socket (plane/gliding)
  
  - 2.3.8. degrees of freedom
  
  - 2.3.9. uniaxial
  
  - 2.3.10. biaxial
  
  - 2.3.11. multiaxial

- 2.3.12. complexity of organisation (shape of articular surfaces, number of mating pairs).
- 2.4. Describe 3 principal axes of motion about synovial joints.
  - 2.4.1.
  - 2.4.2.
  - 2.4.3.
- 2.5. Define and demonstrate the following types of movement about synovial joints:
  - 2.5.1. active
  - 2.5.2. passive (physiological; accessory)
- 2.6. Define the following terms with respect to the ways in which articular surfaces move in relation to each other
  - 2.6.1. spin
  - 2.6.2. roll
  - 2.6.3. glide
- 2.7. Describe the characteristics of the "close-packed" position of a joint.
- 2.8. List the anatomical features which can limit movement at a joint.



## ACTIVITIES

- Discuss the advantages and disadvantages of the types of joint classification schemes.
  
- Define and list the functions of:
  - Bursae
  
  - Discs
  
  - ligaments

## REFERENCES

Williams, P. L., Warwick, R., Dyson, M., Bannister, L. H. (ed) *Grays Anatomy*, 37th edition, Churchill Livingstone, 1989. (Highly recommended)

<http://education.yahoo.com/reference/gray/subjects/>

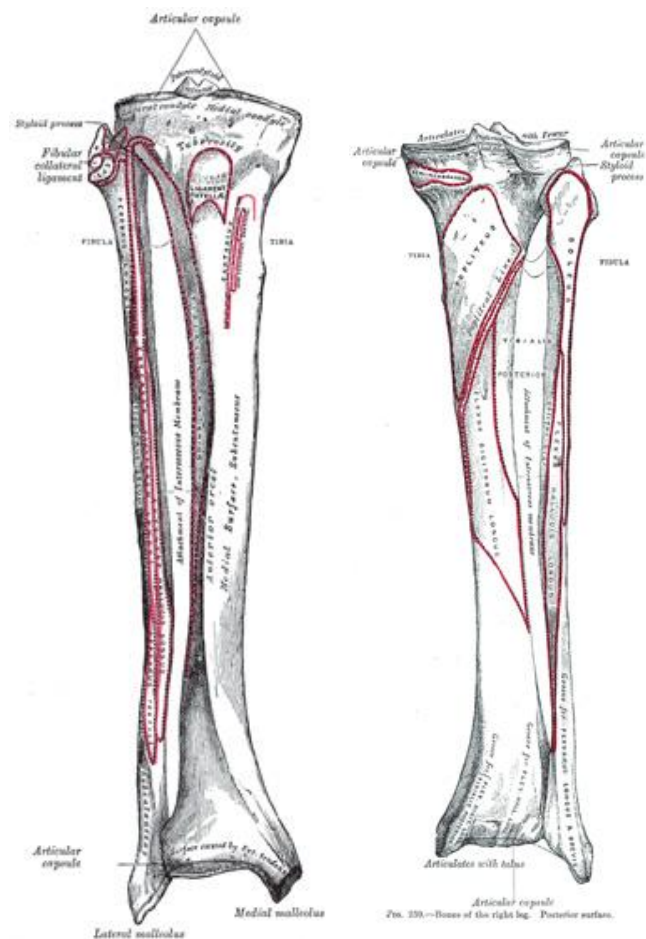
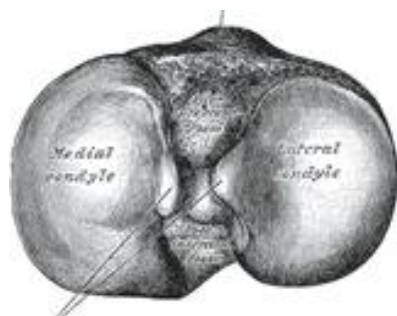
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### 3. BONES AND JOINTS OF THE LEG AND FOOT

3.1. Identify, classify and orientate the tibia.

3.2. On the tibia identify:

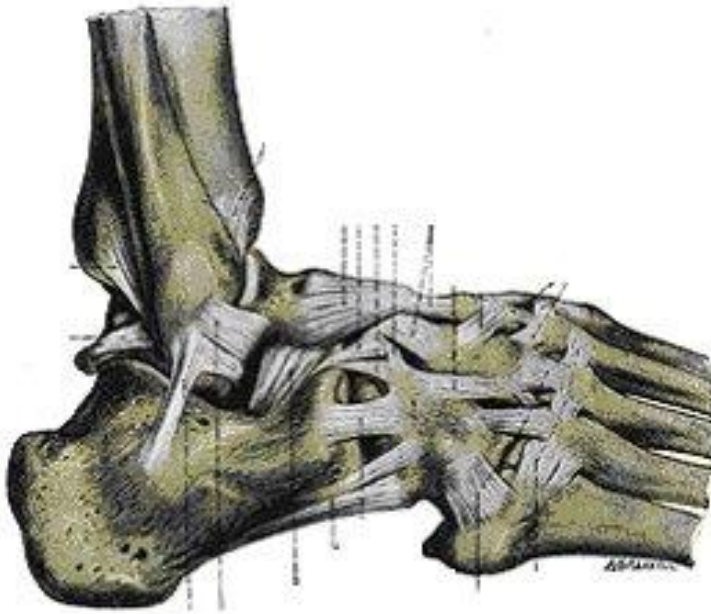
- 3.2.1. shaft
- 3.2.2. borders (interosseus, anterior, medial)
- 3.2.3. surfaces (medial/subcutaneous, lateral, posterior)
- 3.2.4. soleal line
- 3.2.5. popliteal surface
- 3.2.6. distal end
- 3.2.7. medial malleolus
- 3.2.8. articular surface
- 3.2.9. fibular notch
- 3.2.10. groove for tibialis posterior



Activity: Identify these bones, and the view (ie. Anterior or posterior)

- 3.3. Identify and classify the fibula.
- 3.4. On the fibula identify:
- 3.4.1. shaft
  - 3.4.2. interosseus border
  - 3.4.3. distal end
  - 3.4.4. lateral malleolus
  - 3.4.5. articular surface
  - 3.4.6. malleolar fossa
  - 3.4.7. groove for peroneal tendons
- 3.5. Classify the superior tibiofibular joint and describe its movements.
- 3.6. Classify the inferior tibiofibular joint and describe its anterior, posterior and interosseus tibiofibular ligaments.

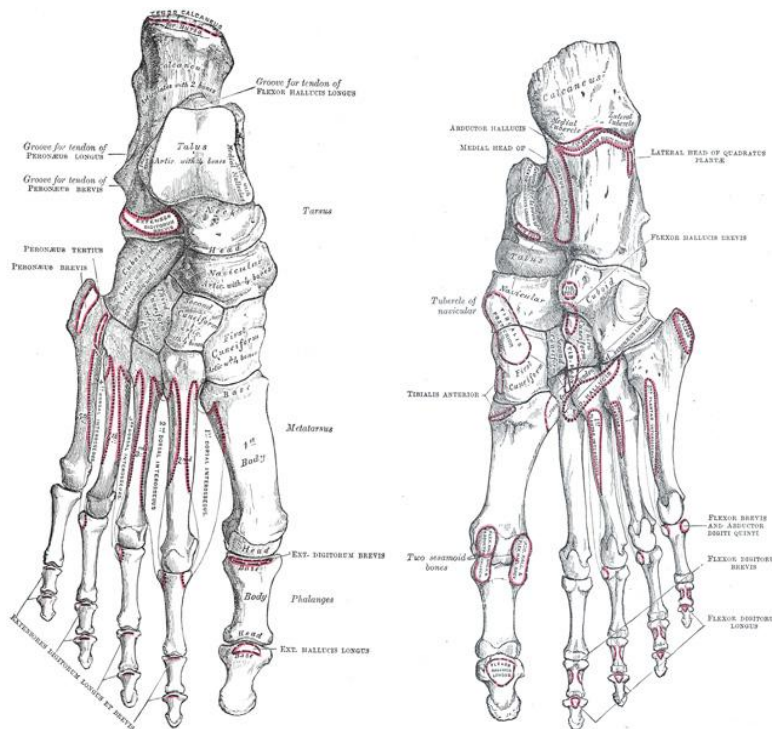




3.7. Identify and describe the functions of the interosseus membrane.

3.8. Identify the bony groups in the articulated foot:

- 3.8.1. 7 tarsals
- 3.8.2. 5 metatarsals
- 3.8.3. 14 phalanges
- 3.8.4. sesamoid bones (for this use x-rays)

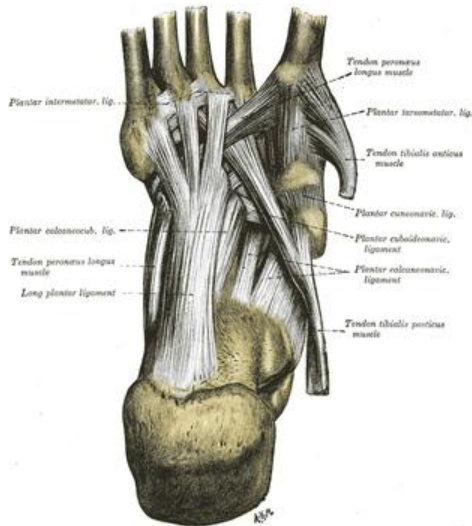


- 3.9. On the calcaneus label the:
  - 3.9.1. sustentaculum tali
  - 3.9.2. tuberosity (medial and lateral processes)
  - 3.9.3. groove for flexor hallucis longus
  - 3.9.4. sulcus calcanei
  
- 3.10. On the talus label the:
  - 3.10.1. sulcus tali
  - 3.10.2. head
  - 3.10.3. body (trochlea)
  
- 3.11. On the navicular label the navicular tuberosity
- 3.12. On the cuboid, label the groove for peroneus longus
- 3.13. Label lateral, medial and intermediate cuneiform
  
- 3.14. On the metatarsals identify:
  - 3.14.1. base
  - 3.14.2. shaft
  - 3.14.3. head
  - 3.14.4. tuberosity on fifth metatarsal
  
- 3.15. On the proximal phalanx of the second toe, label the
  - 3.15.1. base
  - 3.15.2. shaft
  - 3.15.3. head
- 3.16. Label the middle phalanx
  
- 3.17. Label the distal phalanx
  
- 3.18. List the bones constituting the medial and lateral arches of the foot.
  
- 3.19. Classify the ankle (talocrural) joint and identify and describe its:
  - 3.19.1. articular surfaces
  - 3.19.2. joint capsule

- 3.20. Label the ligaments, and state their functions
- 3.20.1. medial (deltoid)
- 3.20.2. anterior talofibular
- 3.20.3. posterior talofibular
- 3.20.4. calcaneofibular
- 3.21. Describe and demonstrate movements at the ankle joint.
- 3.22. State the close-packed position of the ankle joint.
- 3.23. Describe, demonstrate and deduce the functional significance of the movements of eversion and inversion.
- 3.24. Identify, classify, list the movements and describe certain features of the following joints:

| Identify this joint          | Classify it | What direction does it move? |
|------------------------------|-------------|------------------------------|
| Subtalar                     |             |                              |
| Talocalcaneonavicular        |             |                              |
| Calcaneocubiod               |             |                              |
| Calcaneocuboid               |             |                              |
| cuneometatarsal of great toe |             |                              |
| metatarsophalangeal          |             |                              |
| Interphalangeal              |             |                              |

- 3.25. Identify the following important ligaments of the foot. What is their function?
- 3.25.1. spring (plantar calcaneonavicular)
  - 3.25.2. bifurcate
  - 3.25.3. dorsal talonavicular
  - 3.25.4. short plantar (plantar calcaneocuboid)
  - 3.25.5. long plantar
  - 3.25.6. bifurcate (lateral)



- 3.26. State the close-packed position of the tarsal joints.
- 3.27. Identify the following ligaments of the toes, and describe their function
- 3.27.1. collateral
  - 3.27.2. plantar
  - 3.27.3. deep transverse metatarsal
  - 3.27.4. extensor aponeurosis

- 3.28. Interpret radiographs of the ankle and foot. On x-rays of the foot label each bone.







#### 4. MUSCLES OF THE LEG AND FOOT

4.1. Identify, describe attachments and deduce the actions of these muscles:

| Muscles                   | Origin | Insertion | Action |
|---------------------------|--------|-----------|--------|
| <b>Anterior group</b>     |        |           |        |
| tibialis anterior         |        |           |        |
| extensor hallucis longus  |        |           |        |
| extensor digitorum longus |        |           |        |
| peroneus tertius          |        |           |        |
| <b>Lateral group</b>      |        |           |        |
| peroneus longus           |        |           |        |
| peroneus brevis           |        |           |        |
| <b>Posterior group</b>    |        |           |        |
| gastrocnemius             |        |           |        |
| soleus                    |        |           |        |
| plantaris                 |        |           |        |
| popliteus                 |        |           |        |
| tibialis posterior        |        |           |        |
| flexor digitorum longus   |        |           |        |
| flexor hallucis longus    |        |           |        |

4.2. List the muscles involved in each of the following movements:

|                |  |
|----------------|--|
| Plantarflexion |  |
| Dorsiflexion   |  |
| Inversion      |  |
| Eversion       |  |

4.3. Identify the extensor, flexor and peroneal retinacula and describe the functions of retinacula.

4.4. Describe the position and extent of tendon synovial sheaths at the ankle and in the foot.

4.5. Identify, briefly describe attachments and define the actions of the following intrinsic muscles of the foot:

| Muscle                                 | Origin | Insertion | Action |
|--|--------|-----------|--------|
| <b>Dorsal surface</b>                  |        |           |        |
| extensor digitorum brevis              |        |           |        |
| extensor hallucis                      |        |           |        |
| plantar surface (sole)                 |        |           |        |
| <b>First layer</b>                     |        |           |        |
| flexor digitorum brevis                |        |           |        |
| abductor hallucis                      |        |           |        |
| abductor digiti minimi                 |        |           |        |
| <b>Second layer</b>                    |        |           |        |
| quadratus plantae (flexor accessorius) |        |           |        |
| lumbricals (4)                         |        |           |        |

|                        |  |  |  |
|------------------------|--|--|--|
|                        |  |  |  |
| <b>Third layer</b>     |  |  |  |
| flexor hallucis brevis |  |  |  |
| adductor hallucis      |  |  |  |
| flexor digiti minimi   |  |  |  |
| <b>Fourth layer</b>    |  |  |  |
| dorsal interossei (4)  |  |  |  |
| plantar interossei (3) |  |  |  |

- 4.6. Identify and describe the structure and function of the extensor mechanism of the toes.
- 4.7. Describe the role of interossei and lumbricals in preventing claw toe deformities.
- 4.8. List the factors involved in maintaining the arches of the foot in locomotion and static support.
- 4.9. Describe the functions of the arches of the foot.

## ACTIVITIES

Summarise features related to the arches of the foot by completing the following chart:

| ARCH | BONES INVOLVED | FACTORS INVOLVED IN ARCH MAINTENANCE |
|------|----------------|--------------------------------------|
|------|----------------|--------------------------------------|

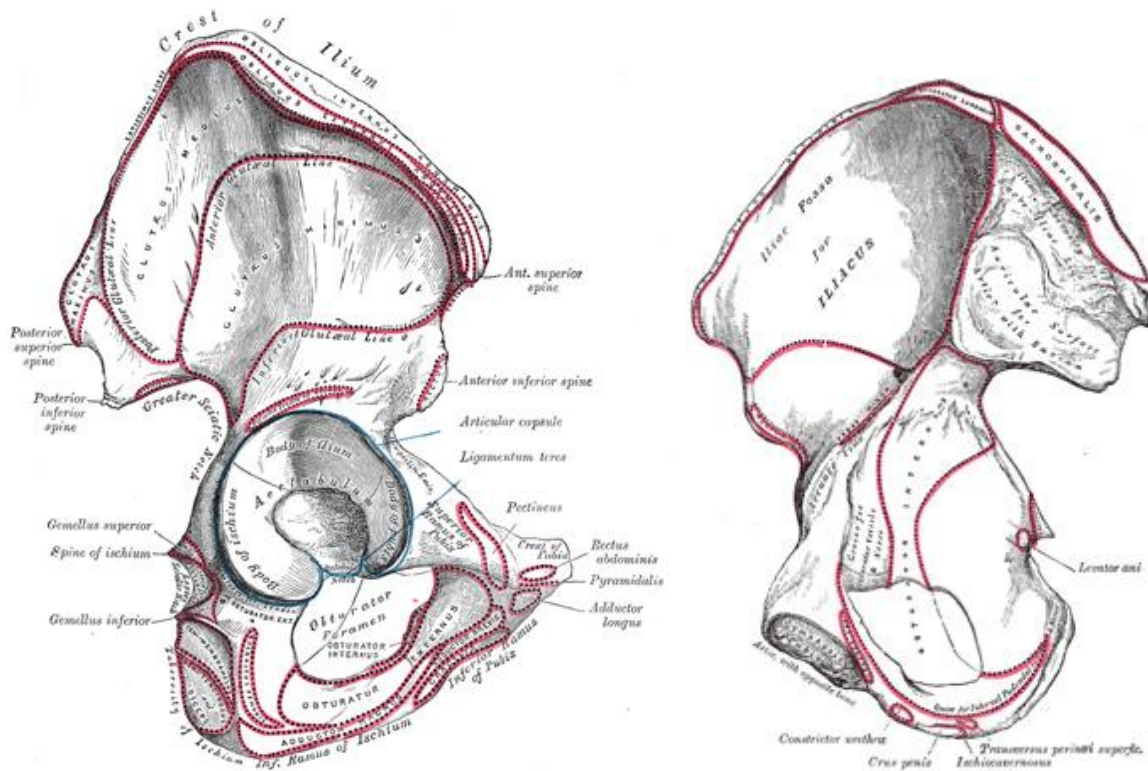
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## 5. HIP AND KNEE JOINTS

5.1. Identify and classify the bones of the pelvic girdle:

- 5.1.1. ilium
- 5.1.2. pubis
- 5.1.3. ischium
- 5.1.4. sacrum
- 5.1.5. coccyx

5.2. Delineate the three component bony parts of the isolated hip bone: ilium, ischium, pubis.



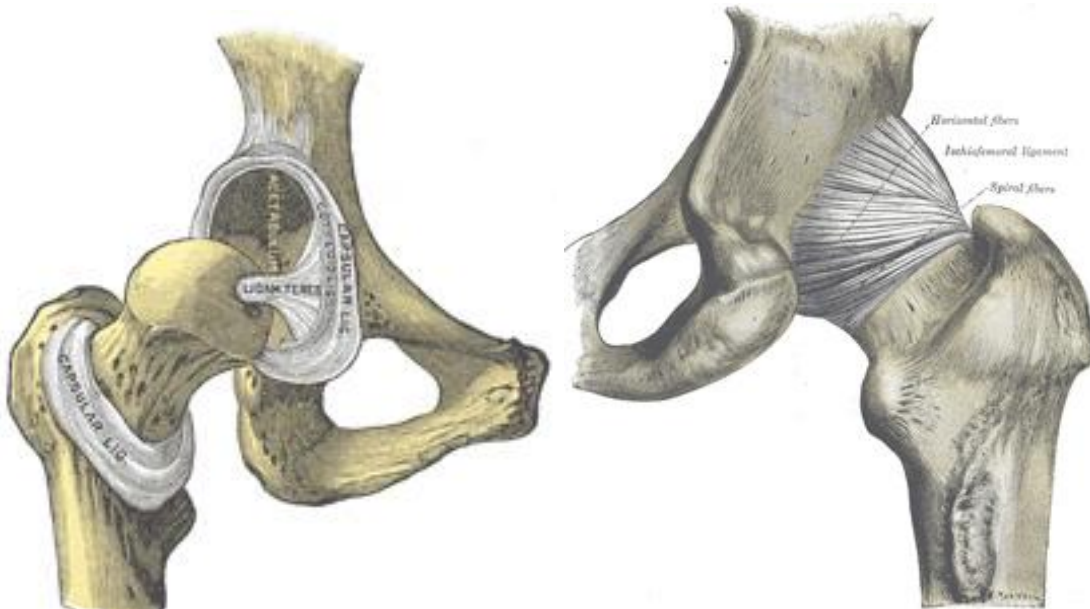
5.3. On the ilium identify:

- 5.3.1. iliac fossa
- 5.3.2. iliac crest and tubercle of the iliac crest
- 5.3.3. gluteal surface
- 5.3.4. gluteal lines (inferior, anterior, posterior)
- 5.3.5. arcuate line
- 5.3.6. auricular surface
- 5.3.7. iliac tuberosity
- 5.3.8. iliac spines:
  - 5.3.8.1. anterior superior
  - 5.3.8.2. anterior inferior
  - 5.3.8.3. posterior superior
  - 5.3.8.4. posterior inferior

- 5.4. On the ischium identify:
  - 5.4.1. Body
  - 5.4.2. Ramus
  - 5.4.3. ischial spine
  - 5.4.4. ischial tuberosity
  - 5.4.5. lesser sciatic notch
  
- 5.5. On the pubis identify:
  - 5.5.1. body
  - 5.5.2. rami (superior, inferior)
  - 5.5.3. pubic crest
  - 5.5.4. pubic tubercle
  - 5.5.5. pectineal line
  - 5.5.6. symphyseal surface
  
- 5.6. Identify the following features of the hip bone and name the component bones involved in each:
  - 5.6.1. acetabulum
  
  - 5.6.2. acetabular notch
  
  - 5.6.3. acetabular fossa
  
  - 5.6.4. obturator foramen
  
  - 5.6.5. greater sciatic notch
  
  - 5.6.6. ischiopubic ramus
  
  - 5.6.7. iliopubic eminence
  
- 5.7. Orientate the hip joint.
  
- 5.8. Classify the hip joint and identify and describe its:
  - 5.8.1. articular surfaces
  
  - 5.8.2. joint capsule

### 5.8.3. ligaments

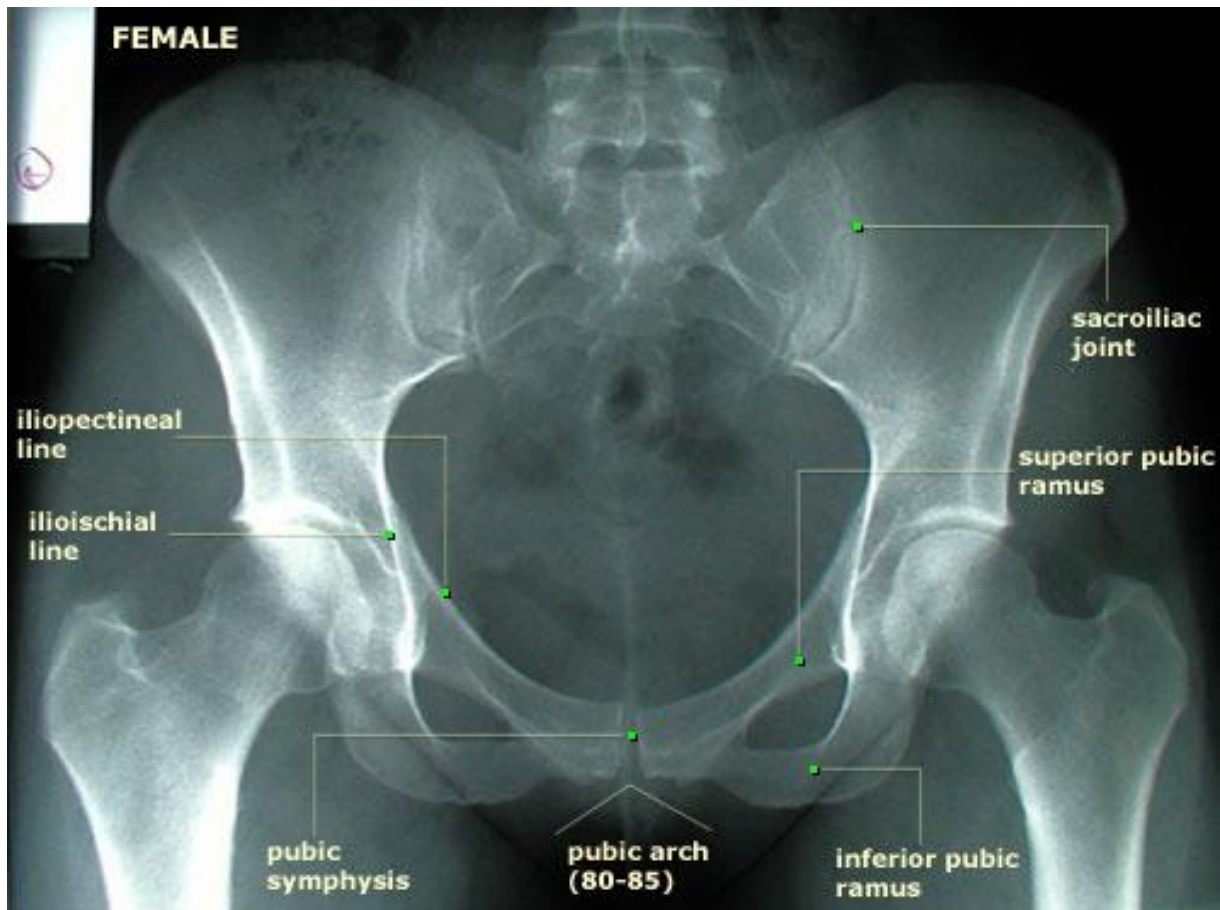
- iliofemoral
- ischiofemoral
- pubofemoral
- transverse acetabular
- head of femur



- 5.9. Define and demonstrate movements at the hip joint.
- 5.10. Describe the specific function(s) of the following features of the hip joint:
- 5.10.1. joint capsule
  - 5.10.2. acetabular labrum
  - 5.10.3. iliofemoral ligament
  - 5.10.4. ischiofemoral ligament
  - 5.10.5. pubofemoral ligament
  - 5.10.6. ligament of the head of femur
- 5.11. State the close-packed position of the hip and knee joints.



- 5.12. Interpret x-rays of the pelvis, hip joint and femur, by orientating them and labelling each bone and visible landmarks.

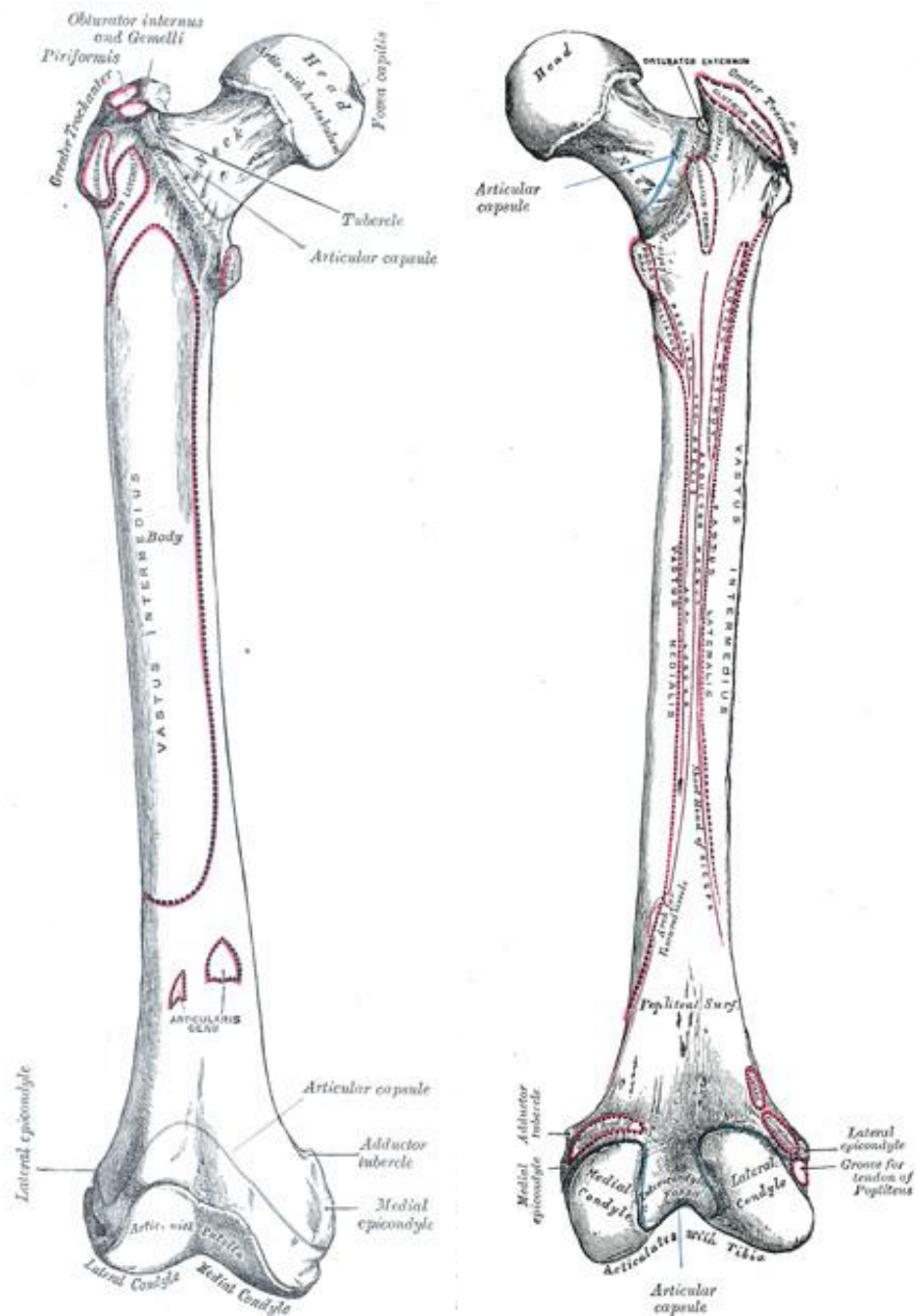


[www.dartmouth.edu/.../radiographs4.html](http://www.dartmouth.edu/.../radiographs4.html)

- 5.13. Identify and classify the femur.
- 5.14. Identify the following bony landmarks:
- 5.14.1. fovea capitis
  - 5.14.2. neck
  - 5.14.3. greater and lesser trochanters
  - 5.14.4. trochanteric fossa
  - 5.14.5. intertrochanteric line
  - 5.14.6. shaft
  - 5.14.7. linea aspera
  - 5.14.8. medial and lateral condyles
  - 5.14.9. medial and lateral epicondyles
  - 5.14.10. adductor tubercle
  - 5.14.11. intercondylar fossa

5.14.12. popliteal surface

5.14.13. patella surface



5.15. Identify, classify and state the functions of the patella.

5.15.1. anterior surface

5.15.2. articular surface

5.15.3. apex

5.16. Classify the knee joint and identify and label its:

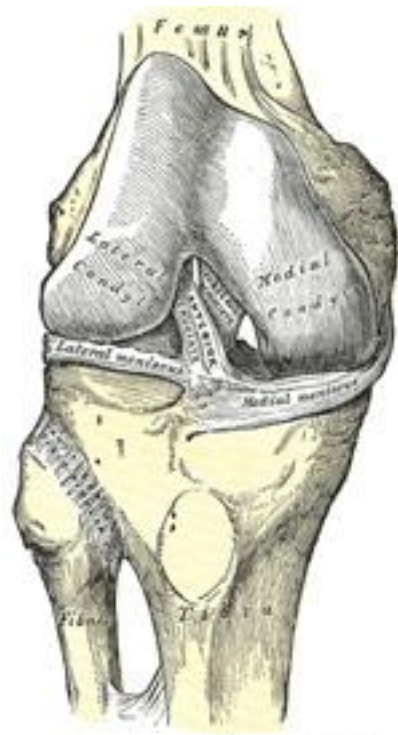
5.16.1. articular surfaces (both tibiofemoral and patellofemoral components)

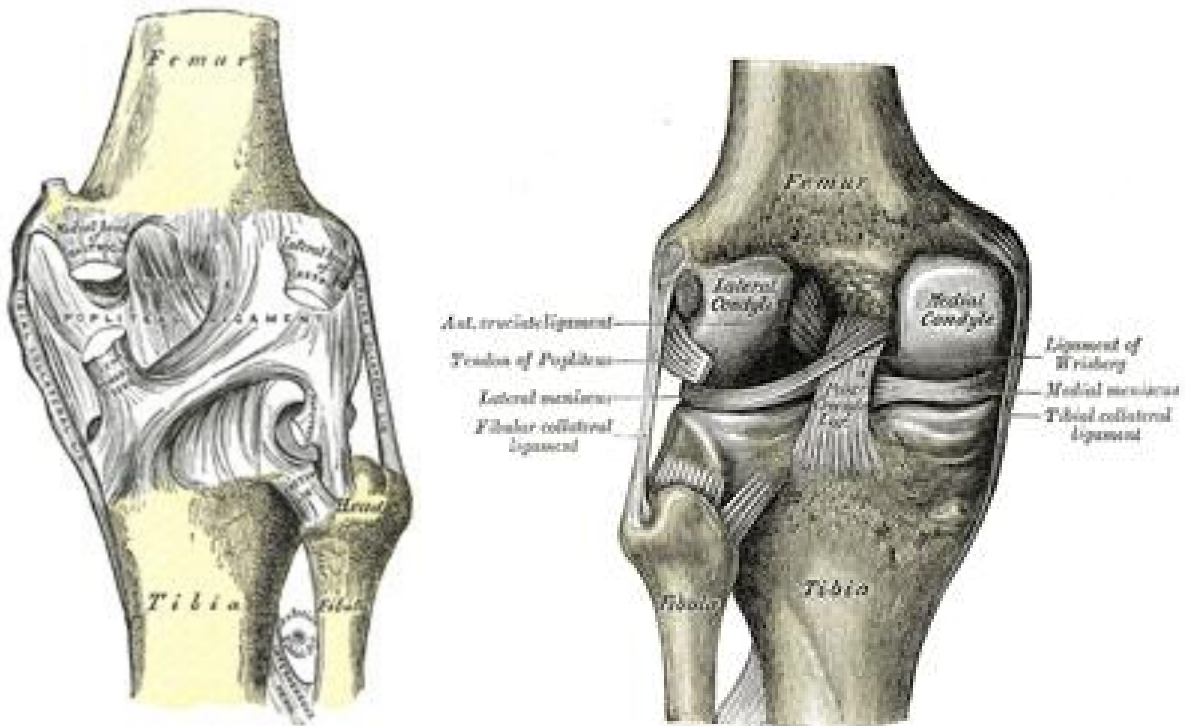
5.16.2. joint capsule

## 5.16.3. synovial cavity, suprapatellar and other bursae

5.17. Identify and label these ligaments, what is their function

| Ligament                     | Function |
|------------------------------|----------|
| patella ligament             |          |
| patella retinacula           |          |
| medial (tibial collateral)   |          |
| lateral (fibular collateral) |          |
| anterior cruciate            |          |
| posterior cruciate           |          |
| posterior meniscofemoral     |          |
| coronary                     |          |
| transverse                   |          |





- 5.18. Identify and label
- 5.18.1. the medial and lateral menisci
  - 5.18.2. Intrapatellar pad of fat
- 5.19. Describe and demonstrate the movements of the knee joint:
- 5.19.1. flexion/extension
  - 5.19.2. medial/lateral rotation
- 5.20. Deduce the specific function(s) of each of the ligaments and articular discs in objective
- 5.21. Describe the "locking mechanism" at the knee joint and its functional significance.
- 5.22. Interpret x-rays of the knee joint, by orientating them, labelling bones and visible landmarks.

## ACTIVITIES

Devise a method to test the integrity of each of the collateral and each of the cruciate ligaments of the knee joint.

Devise a method of increasing knee ROM which incorporates rotation.

## REFERENCES

Noyes, F. R., Edwards, S. G., Butler, D. L., and Malek, M., *Clinical Laxity Tests and Functional Stability of the Knee: Biomedical Concepts*, Clin. Orth. & Rel. Res. 146:84-89, 1980.

Singleton, M. C., and Leveau, B. F., *The Hip Joint: Structure, Stability Stress -A Review*, *Physical Therapy*, 55 (9): 957-963, 1975.

Cross, M. and Crichton, K., *Clinical Examination of the Injured Knee*, Gower, 1987.

## 6. MUSCLES OF THE THIGH AND GLUTEAL REGION

6.1 Identify, describe attachments and deduce the actions of the muscles of the gluteal region:

| Muscle             | Origin | Insertion | Action |
|--------------------|--------|-----------|--------|
| Gluteus maximus    |        |           |        |
| Gluteus medius     |        |           |        |
| Gluteus minimus    |        |           |        |
| Tensor fascia lata |        |           |        |

6.1. Identify and describe the functions of the:

6.1.1. fascia lata

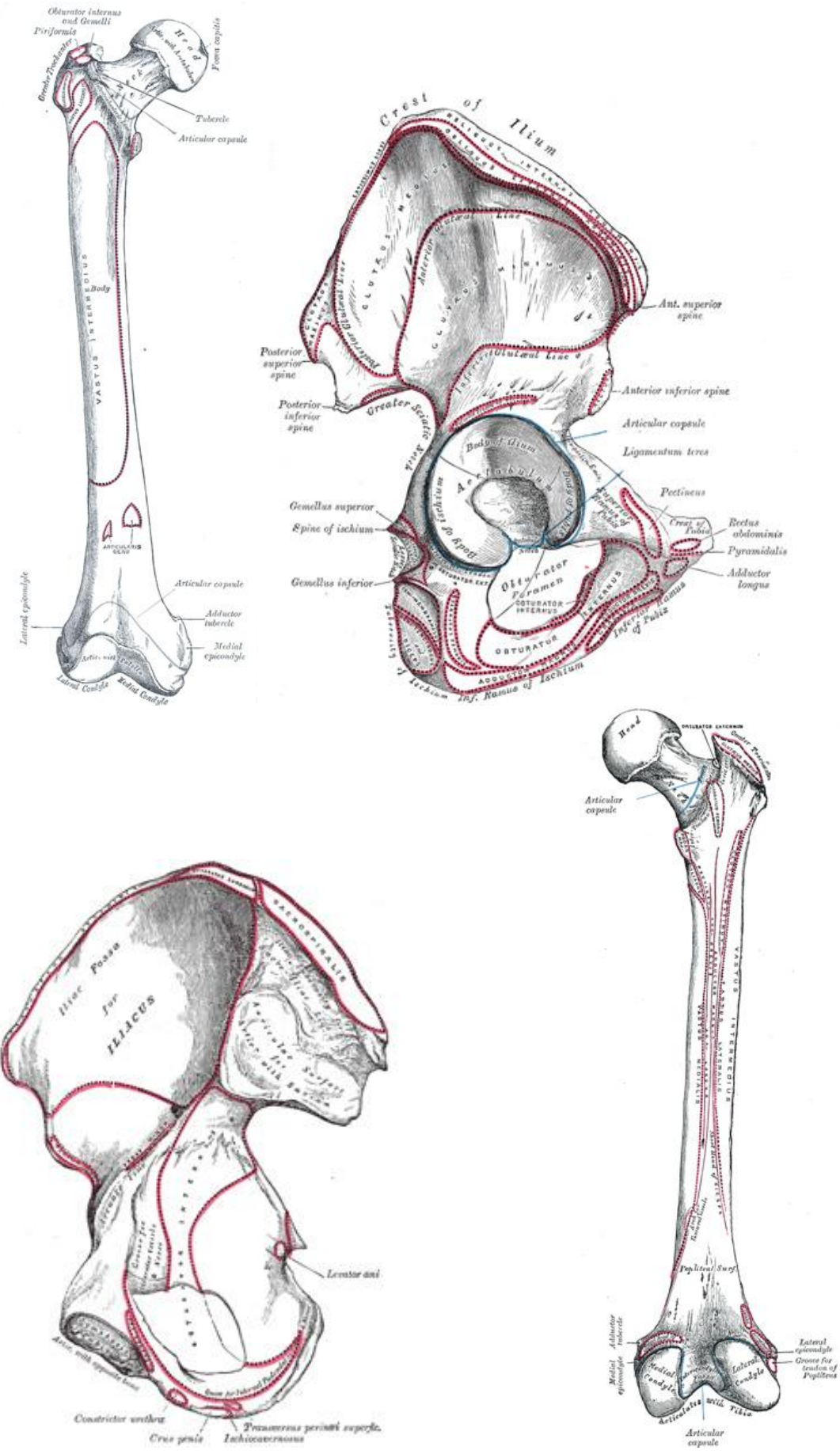
6.1.2. iliotibial tract (band)

6.2. Identify, describe the attachments and deduce the actions of the iliopsoas muscle (comprising psoas major and iliacus).

6.3. Identify and describe the attachments of the six small lateral rotators of the hip joint:

| Muscle             | Origin | Insertion | Action |
|--------------------|--------|-----------|--------|
| piriformis         |        |           |        |
| obturator internus |        |           |        |
| superior gemellus  |        |           |        |
| inferior gemellus  |        |           |        |
| quadratus femoris  |        |           |        |
| obturator externus |        |           |        |

Activity: Colour the muscle origins and insertions on the pelvis and femur, and label them.





6.4. Identify, describe the attachments and deduce the actions of the muscles of the thigh:

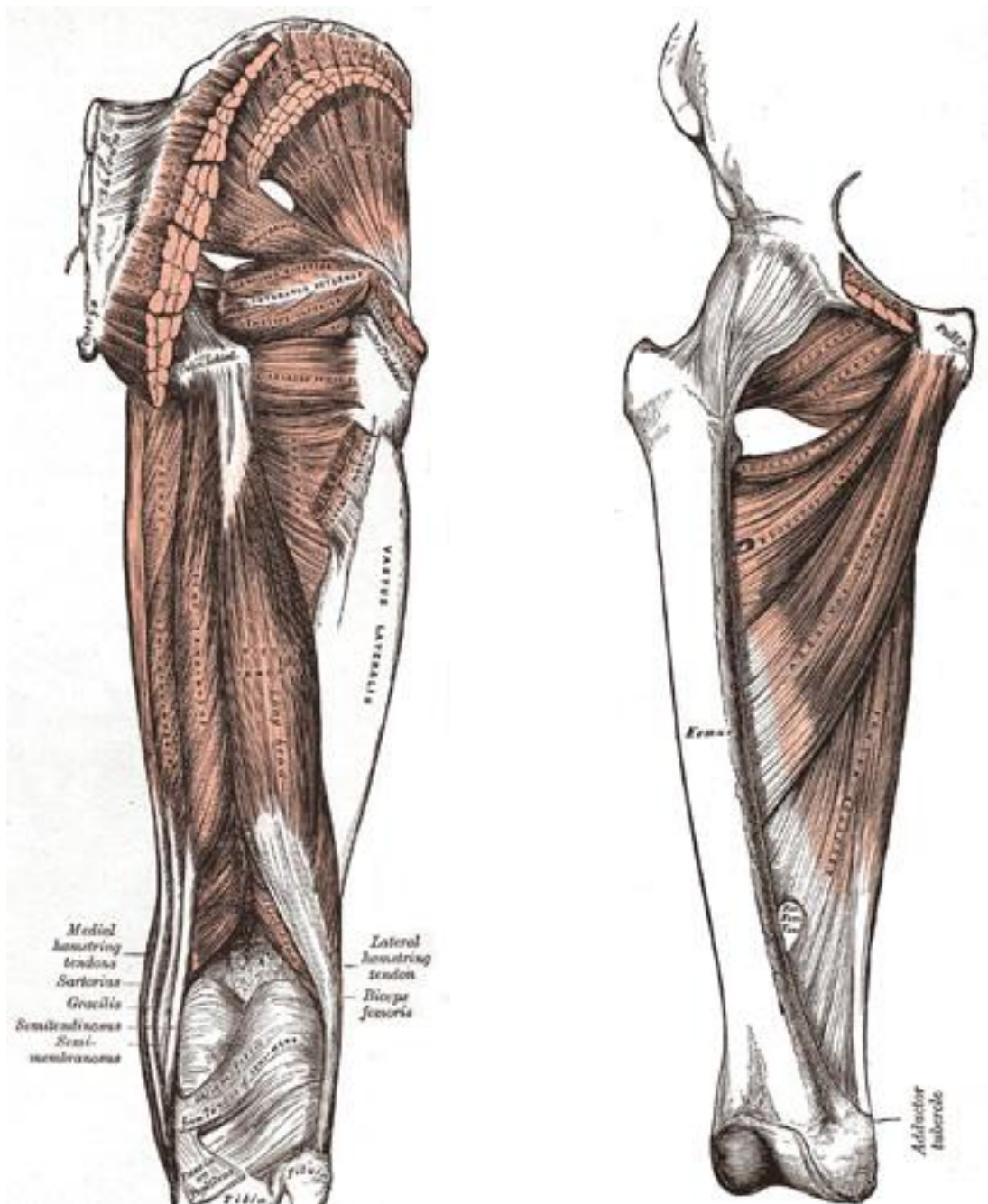
| <b>Anterior Group<br/>(Quadriceps)</b>  | <b>Origin</b> | <b>Insertion</b> | <b>Action</b> |
|---|---------------|------------------|---------------|
| sartorius                               |               |                  |               |
| rectus femoris                          |               |                  |               |
| vastus lateralis                        |               |                  |               |
| vastus intermedius                      |               |                  |               |
| vastus medialis                         |               |                  |               |
| <b>Posterior Group<br/>(hamstrings)</b> |               |                  |               |
| biceps femoris                          |               |                  |               |
| semitendinosus                          |               |                  |               |
| semimembranosus                         |               |                  |               |
| <b>Medial Group<br/>(Adductors)</b>     |               |                  |               |
| gracilis                                |               |                  |               |
| pectineus                               |               |                  |               |
| adductor longus                         |               |                  |               |
| adductor brevis                         |               |                  |               |
| adductor magnus                         |               |                  |               |

6.5. Identify and state the boundaries of the femoral triangle and adductor canal.

6.6. List the groups of muscles involved in each individual movement at the hip joint and the knee joint.

6.7. List the features responsible for maintaining stability at the hip and knee joints.

- 6.8. Explain why clinical ligament laxity tests do not always indicate ligament rupture.
- 6.9. Describe the effect on joint range of muscles which cross both hip and knee joints, ie. "two-joint muscles".
- 6.10. Describe and illustrate Lombard's paradox.
- 6.11. Describe Trendelenberg's sign, (ie. describe the function of the hip abductors during one-footed stance).



**ACTIVITIES**

Discuss the factors which confer stability at the hip and knee joint.

Discuss "two joint muscles":

(i) their effect on joint range (observe the active range of movement of the hip joint when the knee is extended and when it is flexed);

(ii) their role in co-ordinated movements about the hip and knee joints.

Describe and demonstrate the Trendelenberg sign.

**REFERENCES**

Speakman, H. G. B. and Wisberg, J. *The Vastus Medialis Controversy*, *Physiotherapy*, 63 (8): 49-254, 1977.

## 7. NERVE SUPPLY OF THE LOWER LIMB

- 7.1. Describe the formation and position of the lumbo-sacral plexus and identify some of its peripheral branches:
- 7.1.1. femoral
  - 7.1.2. saphenous - branch of femoral
  - 7.1.3. obturator
  - 7.1.4. sciatic
  - 7.1.5. tibial
  - 7.1.6. common peroneal
  - 7.1.7. superior gluteal
  - 7.1.8. inferior gluteal
  - 7.1.9. superficial peroneal
  - 7.1.10. deep peroneal
  - 7.1.11. sural
  - 7.1.12. medial plantar
  - 7.1.13. lateral plantar
  - 7.1.14. digital
- 7.2. Describe the innervation of the following joints:
- 7.2.1. hip
  - 7.2.2. knee
  - 7.2.3. ankle
- 7.3. Describe the motor functional loss and deformity resulting from a lesion to the following nerves in the area indicated:
- 7.3.1. sciatic nerve - in greater sciatic notch
  - 7.3.2. tibial nerve - in popliteal fossa
  - 7.3.3. common peroneal nerve - at head of fibula

## ACTIVITIES

- Complete the following chart to summarise the information required in Objective 7.3.

| PERIPHERAL NERVE | MOTOR DISTRIBUTION | SENSORY DISTRIBUTION |
|------------------|--------------------|----------------------|
|                  |                    |                      |

Summarise the motor and sensory nerve supply to the lower limb by completing the following charts:

| MUSCLE GROUP   | NERVE SUPPLY |
|--|--------------|
| Thigh<br>- anterior group<br>- medial group<br>- posterior group |              |
| Buttock<br>- gluteal group<br>- lateral rotators                 |              |
| Iliopsoas  |              |
| Leg<br>- anterior group<br>- posterior group<br>- lateral group  |              |
| Foot<br>- dorsum<br>- sole                                       |              |
|  |              |



| AREA OF SKIN  | NERVE SUPPLY |
|---|--------------|
| Thigh<br>- anterior<br>- medial<br>- posterior<br>- lateral |              |
| Leg<br>- anterior<br>- medial<br>- posterior<br>- lateral   |              |
| Foot<br>- dorsum<br>- medial<br>- sole<br>- lateral         |              |

## 8. BLOOD SUPPLY TO THE LOWER LIMB

- 8.1. Identify:
- 8.1.1. abdominal aorta
  - 8.1.2. common iliac arteries
  - 8.1.3. external iliac arteries
  - 8.1.4. internal iliac arteries
- 8.2. Identify and describe the course and general areas of supply of the arteries of the lower limb:
- 8.2.1. superior gluteal
  - 8.2.2. inferior gluteal
  - 8.2.3. obturator
  - 8.2.4. femoral
  - 8.2.5. profunda femoral
  - 8.2.6. popliteal
  - 8.2.7. anterior tibial
  - 8.2.8. posterior tibial
  - 8.2.9. dorsalis pedis
  - 8.2.10. peroneal
  - 8.2.11. medial plantar
  - 8.2.12. lateral plantar
  - 8.2.13. plantar arch
  - 8.2.14. metatarsal
  - 8.2.15. digit
- 8.3. Describe the arrangement of veins of the lower limb into a superficial and deep group and evaluate the functional significance of this arrangement.



- 8.4. Identify the deep veins of the lower limb:
- 8.4.1. peroneal
  - 8.4.2. anterior tibial
  - 8.4.3. posterior tibial
  - 8.4.4. popliteal
  - 8.4.5. femoral
  - 8.4.6. profunda femoral
  - 8.4.7. Identify and trace the course of the superficial veins of the lower limb:
  - 8.4.8. dorsal venous arch
  - 8.4.9. great (long) saphenous
  - 8.4.10. small (short) saphenous
- 8.5. Identify the veins transporting blood from the lower limb to the heart:
- 8.5.1. external iliac
  
  - 8.5.2. common iliac
  
  - 8.5.3. inferior vena cava

## 9. SURFACE ANATOMY OF THE LOWER LIMB

- 9.1. Demonstrate on a living subject, the principal bony features of the leg and foot:
- 9.1.1. tibia
    - 9.1.1.1. anterior border
    - 9.1.1.2. medial border
    - 9.1.1.3. medial surface
    - 9.1.1.4. medial malleolus
  - 9.1.2. fibula
    - 9.1.2.1. lateral malleolus
  - 9.1.3. talus
    - 9.1.3.1. head (actively dorsiflex and invert the foot. Head of talus articulating with navicular can be felt in depression that appears immediately in front of the lateral malleolus)
  - 9.1.4. calcaneus
    - 9.1.4.1. sustentaculum tali (2.5cms below medial malleolus)
  - 9.1.5. tuberosity of fifth metatarsal
  - 9.1.6. tuberosity of navicular (3cms anteromedial to medial malleolus)
  - 9.1.7. medial cuneiform (immediately in front of navicular)
  - 9.1.8. heads of metatarsals
- 9.2. Palpate a living subject to identify some features of the joints:
- 9.2.1. the body of the talus: if felt in passive slight flexion of the foot, just anterior to the distal edge of the front of the tibia, which corresponds to the line of the ankle joint. Note that this line is 3cms above the level of the tip of the lateral malleolus.
  - 9.2.2. Calcaneofibular ligament: the transverse tarsal joint extends from just behind the tip of the lateral malleolus and tuberosity of the fifth metatarsal. Medially it marks the talonavicular joint and laterally the calcaneocuboid joint.
- 9.3. Palpate a living subject to identify the following tendons and muscles by making them stand out against resistance:
- 9.3.1. gastrocnemius
  - 9.3.2. soleus
  - 9.3.3. tendocalcaneus (achilles' tendon)
  - 9.3.4. tibialis anterior
  - 9.3.5. extensor digitorum longus tendon
  - 9.3.6. extensor digitorum brevis
  - 9.3.7. extensor hallucis longus tendon
  - 9.3.8. extensor hallucis brevis
  - 9.3.9. peroneus longus

- 9.3.10. abductor hallucis
- 9.4. Demonstrate on a living subject by palpation some features of the knee joint:
- 9.4.1. line of the knee joint
  - 9.4.2. patellar ligament
  - 9.4.3. lateral and medial collateral ligaments
- 9.5. Demonstrate on a living subject by palpation some features of the pelvic girdle, hip and knee regions:
- 9.5.1. pelvic girdle
  - 9.5.2. anterior superior iliac spine (A.S.I.S.)
  - 9.5.3. tubercle of iliac crest (5cm behind A.S.I.S.)
  - 9.5.4. iliac crest
  - 9.5.5. posterior superior iliac spine (indicated by dimple depressions)
  - 9.5.6. ischial tuberosity
  
  - 9.5.7. femur
  - 9.5.8. greater trochanter
  - 9.5.9. medial and lateral epicondyles
  - 9.5.10. adductor tubercle
  
  - 9.5.11. tibia
  - 9.5.12. medial and lateral condyles
  - 9.5.13. tibial tuberosity
  - 9.5.14. fibula
  - 9.5.15. head
  - 9.5.16. patella
- 9.6. Demonstrate the following muscles on a living subject by making them stand out against resistance:
- 9.6.1. gluteus maximus
  - 9.6.2. gluteus medius (in the erect position a hollow, the gluteal depression, is seen below the middle of the iliac crest. Gluteus medius lies in the floor of the depression above the greater trochanter.)
  - 9.6.3. sartorius
  - 9.6.4. femoral triangle
  
  - 9.6.5. gracilis - in floor of the adductor depression posterior to adductor longus extending from the pubic symphysis to the medial side of the knee, where its tendon can be felt.

- 9.6.6. adductor magnus - its tendon can be felt in the region of the adductor tubercle.
  - 9.6.7. popliteal fossa - bounded laterally by the tendon of biceps femoris and medially by the tendon of semitendinosus.
  - 9.6.8. semimembranosus - superficial in distal 2/3 of posterior thigh where it can be grasped between popliteal fossa and the adductor depression.
  - 9.6.9. iliotibial tract - marked by lateral depression in erect position. In the region of the knee the iliotibial tract lies anteriorly to the tendon of the long head of biceps femoris.
  - 9.6.10. short head of biceps - lies in depression between iliotibial tract and long head of biceps femoris in the region of the knee.
  - 9.6.11. rectus femoris
  - 9.6.12. vastus medialis
  - 9.6.13. vastus lateralis
- 9.7. Test the patella tendon and tendoachilles reflexes and deduce the spinal cord segments tested in each reflex.
- 9.8. Palpate the pulses of the lower limb in the following positions:
- 9.8.1. femoral artery, at the mid-point of the inguinal ligament which attaches to the A.S.I.S. and the pubic tubercle
  - 9.8.2. popliteal artery, in the popliteal fossa
  - 9.8.3. posterior tibial artery, in the hollow between medial malleolus and tendocalcaneus
  - 9.8.4. dorsalis pedis artery, at the lateral side of tendon of extensor hallucis longus

## FEEDBACK QUESTIONNAIRE

Thank you for assisting in the further development of the Masters of Physiotherapy Program at University of Canberra by providing some feedback on this "Self-directed learning module on Functional Anatomy for Physiotherapists".

This learning module was initiated based on feedback from students and staff, that the level of anatomy taught at Australian and overseas universities varies enormously. Students needed to know exactly where their knowledge of functional anatomy was strong enough to proceed with the course, and where it needed further work and study. So one of the aims of the learning module was to provide students with a self-assessment tool. The other was to help students catch up. This Lower Limb anatomy module is part I of 3, including the Upper Limb, and Spine and Pelvis.

Please answer these statements with the degree to which you agree or disagree with the statements:

|   |                        |               |                                 |            |                     |
|---|------------------------|---------------|---------------------------------|------------|---------------------|
| 1. The level of functional anatomy studied in my previous degree prepared me sufficiently for the Masters Degree in Physiotherapy | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 2. This module helped me identify the areas I needed to study   | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 3. The learning module gave me confidence that the level of anatomy I have studied previously is sufficient for this course.      | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 4. The instructions to follow were clear  | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 5. The areas of learning covered the anatomy of the lower limb thoroughly   | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 6. The areas of learning did not go into enough detail  | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 7. The activities did not have enough functional applications   | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 8. I would have liked more clinical applications  | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 9. This learning module will be a good reference for me in the future   | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 10. It is better to leave the choice of reference text books up to the student, rather than prescribe a single text.              | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 11. Other comments:   |                        |               |                                 |            |                     |

Please return to Allied Health Administrator by week 7 of semester.  
Thank you!



**SCHOOL OF PHYSIOTHERAPY**

**SELF - DIRECTED LEARNING MODULE ON  
FUNCTIONAL ANATOMY FOR PHYSIOTHERAPISTS**

**Part II  
The Upper Limbs**

Ms Doa El-Ansary, BAppSc(Phty)  
Dr Jennie Scarvell, BAppSc(Phty), PhD

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NOTE: The following objectives are based on notes collated and compiled by Karen Ginn, Senior Lecturer, Faculty of Health Sciences, University of Sydney. They have been adapted and modified by Doa El-Ansary for the purposes of postgraduate instruction.

This self directed learning module has been developed to facilitate student revision and preparation for entry into the Masters of Physiotherapy Program at the University of Canberra.  
The material outlined in this module forms the basis of the theoretical background in Functional Anatomy that will be assumed knowledge.

The objectives are designed to direct and sequence your learning, Material highlighted in **bold print is to be identified practically on dissected specimens or in an anatomical atlas**. Objectives in regular print are to be answered from texts or articles provided in the general or region specific reference lists.

## References

These are available in the library, but it is strongly recommended you own a copy of a good anatomy text for continuous professional education and reference.

### Texts:

Moore, K L and Daley: Clinically Oriented Anatomy (5<sup>th</sup> Edn), Lippincott, Williams and Wilkins, Baltimore, 2005 (ISBN 0-7817-3639-0)

Drake, R L; Vogl, W and Mitchell, A W M: Gray's Anatomy for Students. Elsevier, 2005 ISBN ( 0-443-07168-3)

Palastanga, N; Field, D and Soames, R: Anatomy and Human Movement (4<sup>th</sup> Edn), 2002. ISBN (0-7506-5241-1)

### Atlases:

Rohen, J W; Yokochi, C and Drecoll, E L: Colour Atlas of Human Anatomy (5<sup>th</sup> Edn), 1993. Lippincott, Williams and Wilkins. ISBN (0-7817-3194-1)

Abrahams, P H; Marks, S C and Hutchings, R T: McMinn's Colour Atlas of Human Anatomy, 2003. Mosby. ISBN (0-7234-3212-0)

.

### URL:

#### Figures within referenced to:

<http://education.yahoo.com/reference/gray/subjects/>

<http://www.bartleby.com/107/>

<http://www.vh.org/adult/provider/radiology/NormalRadAnatomy/index.html>

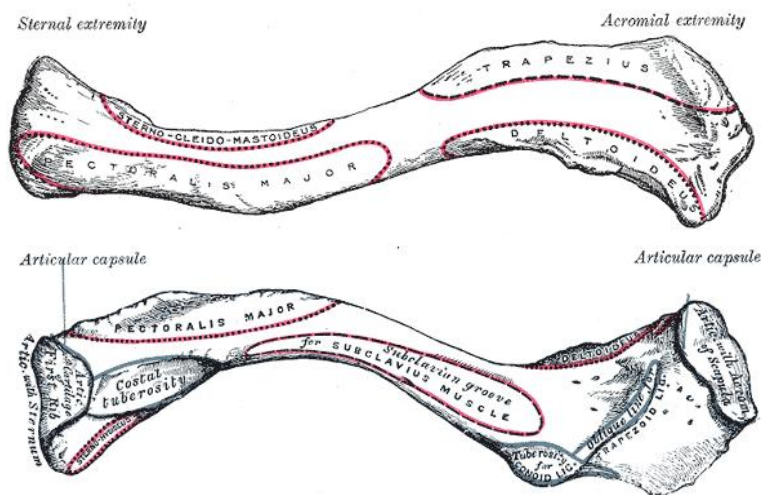


## 9. BONES, JOINTS, MUSCLES OF THE SHOULDER

9.1 Identify and classify the bones of the shoulder girdle; clavicle and scapula.

9.2 On the clavicle identify:

- (i) sternal end
- (ii) acromial end
- (iii) impression for the costoclavicular ligament
- (iv) trapezoid line
- (v) conoid tubercle



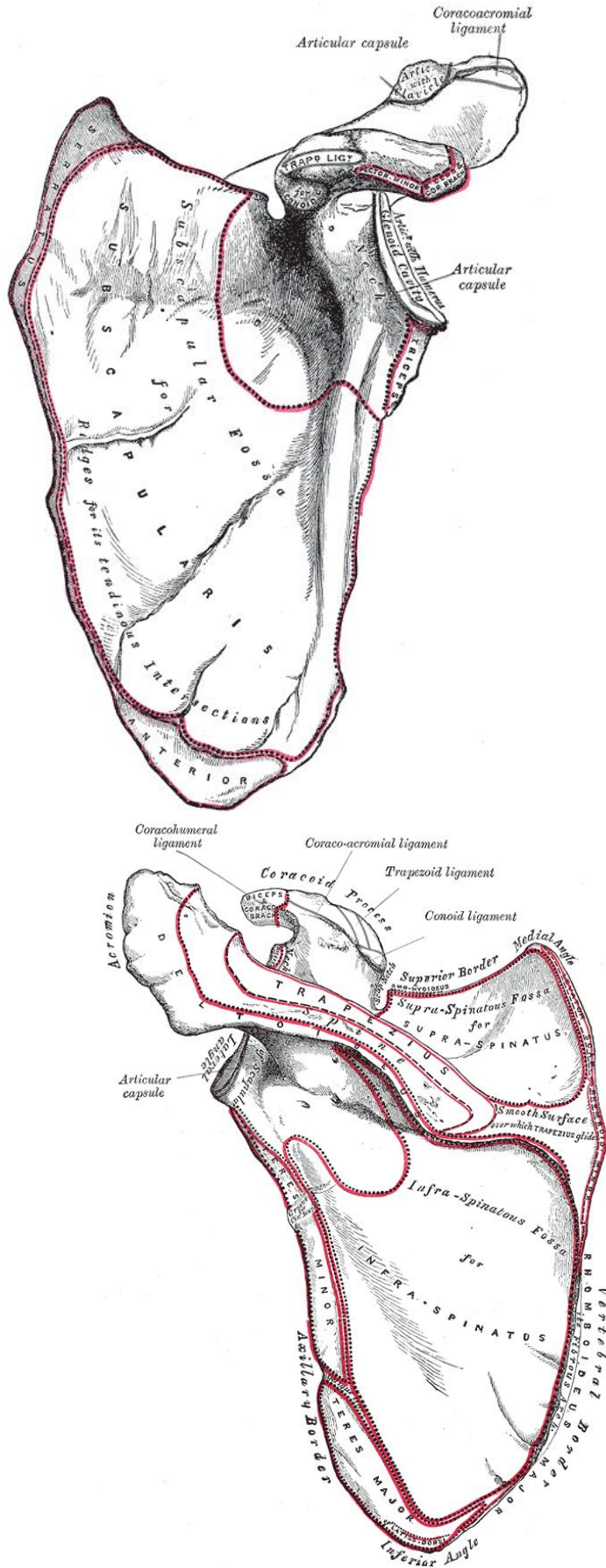
9.3 Identify the jugular notch/interclavicular notch between clavicles.

9.4 List the functions of the clavicle and state the implications of its "crank like" shape.

9.5 On the scapula identify:

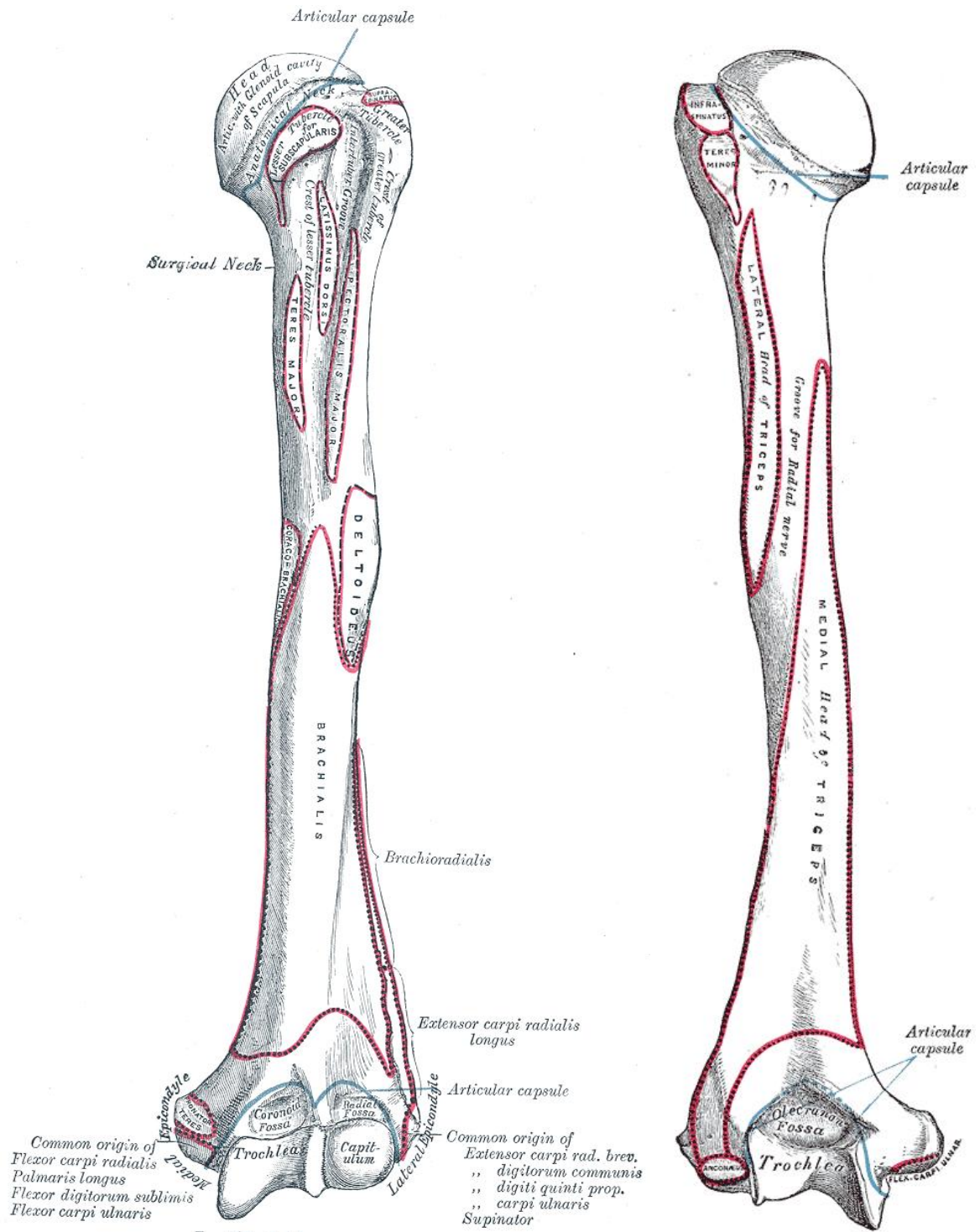
- (i) dorsal surface
- (ii) costal surface
- (iii) superior, inferior, lateral borders
- (iv) superior, inferior, lateral angles
- (v) spine
- (vi) acromion and coracoid processes
- (vii) subscapular, suprascapular, infrascapular fossae
- (viii) glenoid fossa
- (ix) suprascapular notch

(x) supraglenoid and infraglenoid tubercles

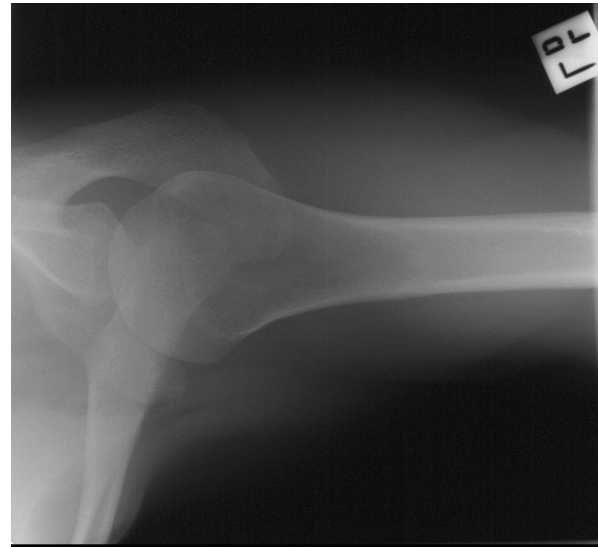


**9.6 On the humerus identify:**

- (i) proximal end**
  - head
  - anatomical and surgical necks
  - greater and lesser tubercles
  - bicipital (intertubercular) groove
  - medial and lateral lips of bicipital groove
  
- (ii) shaft**
  - medial, lateral and posterior surfaces
  - (spiral) groove for radial nerve
  
- (iii) distal end**
  - lateral and medial supracondylar ridges
  - lateral and medial epicondyles
  - capitulum
  - trochlea
  - olecranon, coronoid and radial fossae



## 9.6 Interpret x-rays of the shoulder region.

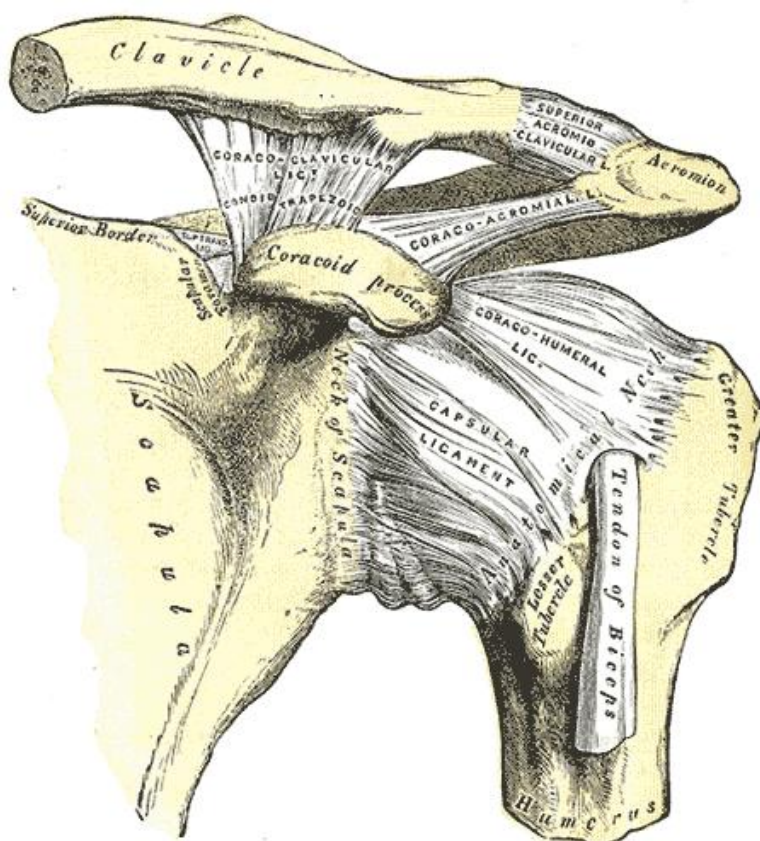


- ◆ Identify the plane of the xray:
- ◆ Name the body part, and orientate it (superior, inferior, distal, proximal)
- ◆ Name the bones, the bony landmarks, the joint surfaces:
- ◆ Identify the soft tissues visible
- ◆ Lastly, look for any abnormalities



9.7 Classify the shoulder (glenohumeral) joint and identify and describe its:

- (i) articular surfaces
- (ii) joint capsule
- (iii) ligaments
  - coracohumeral
  - glenohumeral
  - coracoacromial
  - transverse humeral



9.8 Describe the specific mechanical function(s) of the ligaments listed in objective 9.

| Ligament       | Function |
|----------------|----------|
| Coracohumeral  |          |
| Glenohumeral   |          |
| Coracoacromial |          |

|                    |  |
|--------------------|--|
| Transverse humeral |  |
|--------------------|--|

9.9 Describe the precise direction the glenoid fossa faces when the upper limb is in the anatomical position (i.e. pendant) and state the significance of this alignment.

9.10 **Identify and classify the joints of the shoulder girdle:**

- (i) **sternoclavicular joint**
- (ii) **acromioclavicular joint**

9.11 **At the sternoclavicular identify and describe its:**

- (i) **articular surfaces**
- (ii) **articular disc**
- (iii) **ligaments**
  - **costoclavicular**
  - **sternoclavicular (anterior, posterior)**

9.12 **At the acromioclavicular joint identify its:**

- (i) **articular surfaces**
- (ii) **joint capsule**
- (ii) **coracoclavicular ligament (conoid and trapezoid parts)**

9.13 Describe the specific mechanical function(s) of the ligaments listed in objectives 9.11 and 9.12.

| Ligament                               | Function |
|--|----------|
| Coracoclavicular ligament              |          |
| Sternoclavicular (anterior, posterior) |          |
| Costoclavicular                        |          |

|           |  |
|-----------|--|
| Trapeziod |  |
| Conoid    |  |

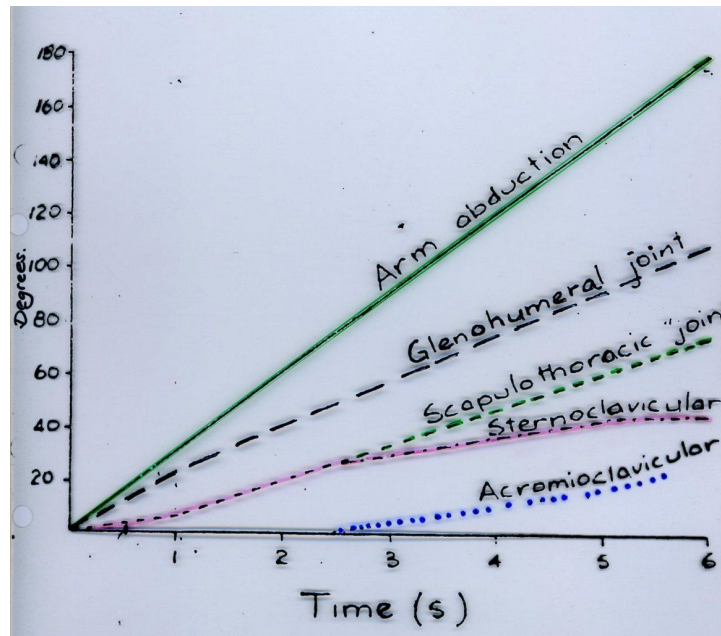
9.14 Define and demonstrate movements at the shoulder joint and movements of the scapula.

| Movement | Description | Functional activity |
|----------|-------------|---------------------|
|          |             |                     |
|          |             |                     |
|          |             |                     |
|          |             |                     |
|          |             |                     |
|          |             |                     |

9.15 Define and state the functional significance of scapulohumeral rhythm.

9.16 Interpret the angular displacement-time curves for scapulohumeral rhythm (adapted from the figures of Poppen and Walker, 1976 and Perry, 1978).





- 9.17 Describe the arrangement of bursae in the shoulder region.
- 9.18 Distinguish between the action and the function of a muscle.
- 9.19 Define the following terms related to the functional roles of muscles:
- (i) prime mover
  - (ii) assistant mover
  - (iii) antagonist
  - (iv) synergist/neutraliser
  - (v) fixator/stabiliser

**9.20 Identify, describe attachments and deduce the actions of the muscles of the axilla and scapula regions.**

**•muscles connecting the axial skeleton and the humerus:**

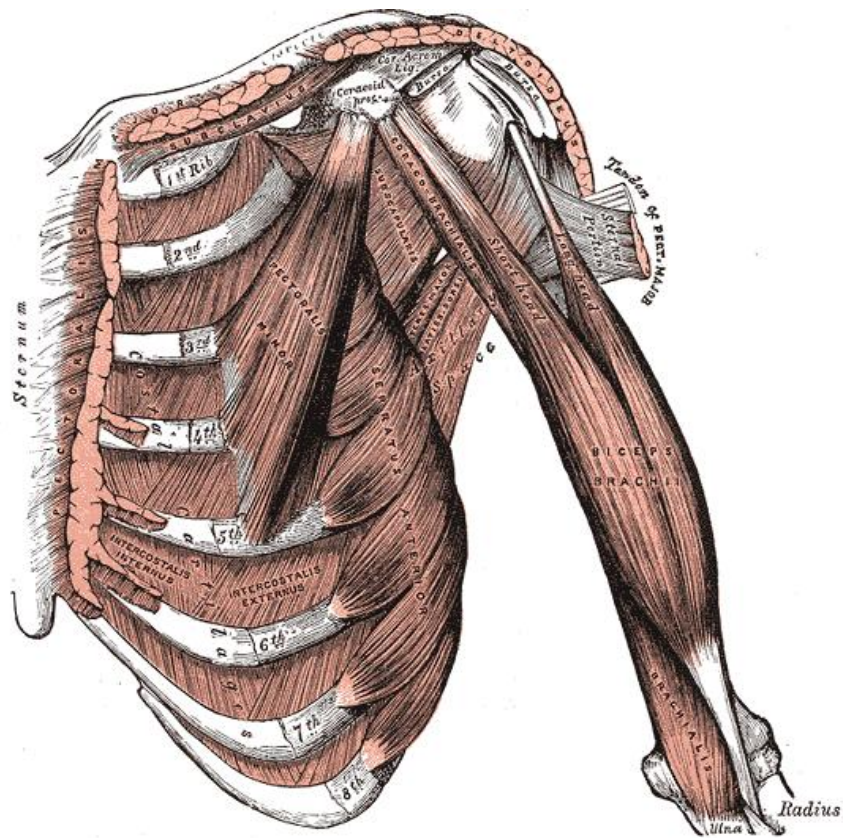
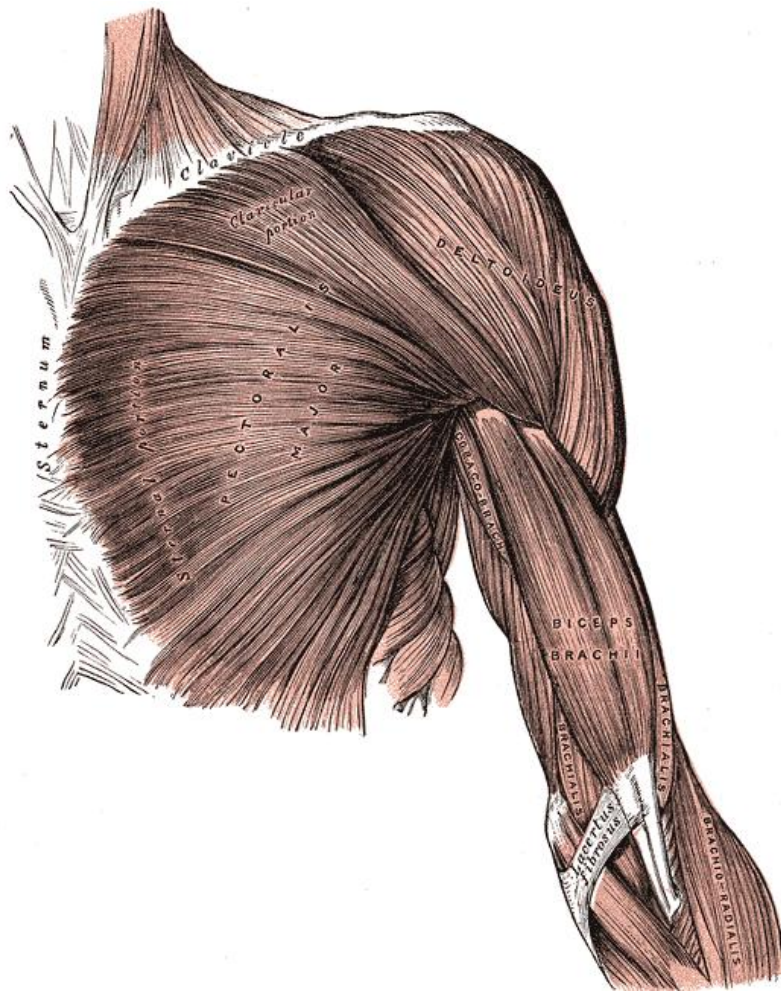
| Muscle                              | Origin | Insertion | Action | Functional activity |
|-------------------------------------|--------|-----------|--------|---------------------|
| Pectoralis major-<br>(sternal head) |        |           |        |                     |
| Latissimus dorsi                    |        |           |        |                     |

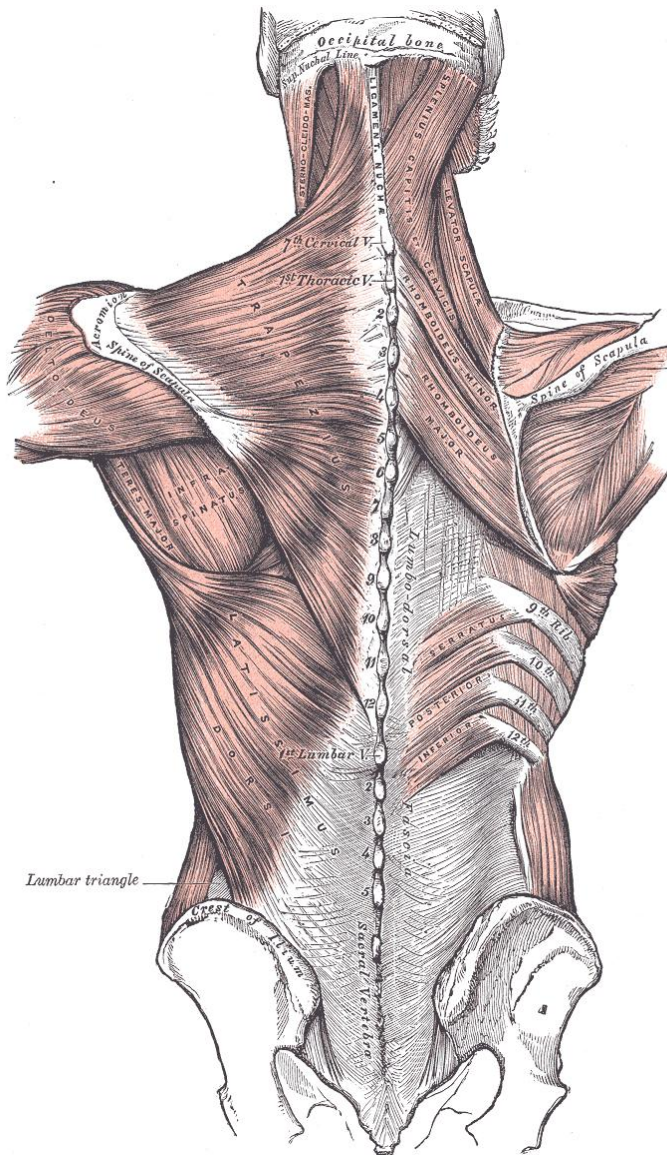
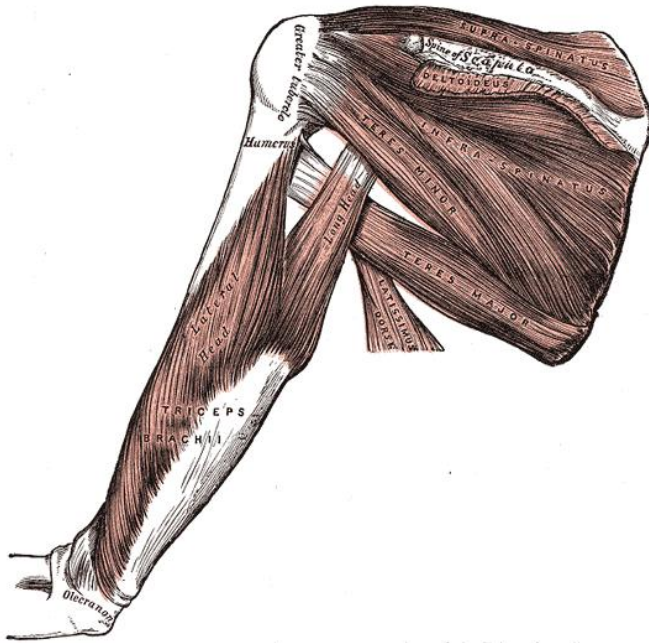
**•muscles connecting the axial skeleton and the shoulder girdle:**

| Muscle            | Origin | Insertion | Action | Functional activity |
|-------------------|--------|-----------|--------|---------------------|
| Trapezius         |        |           |        |                     |
| Rhomboid major    |        |           |        |                     |
| Rhomboid minor    |        |           |        |                     |
| Levator scapulae  |        |           |        |                     |
| Pectoralis minor  |        |           |        |                     |
| Serratus anterior |        |           |        |                     |
| Subclavius        |        |           |        |                     |

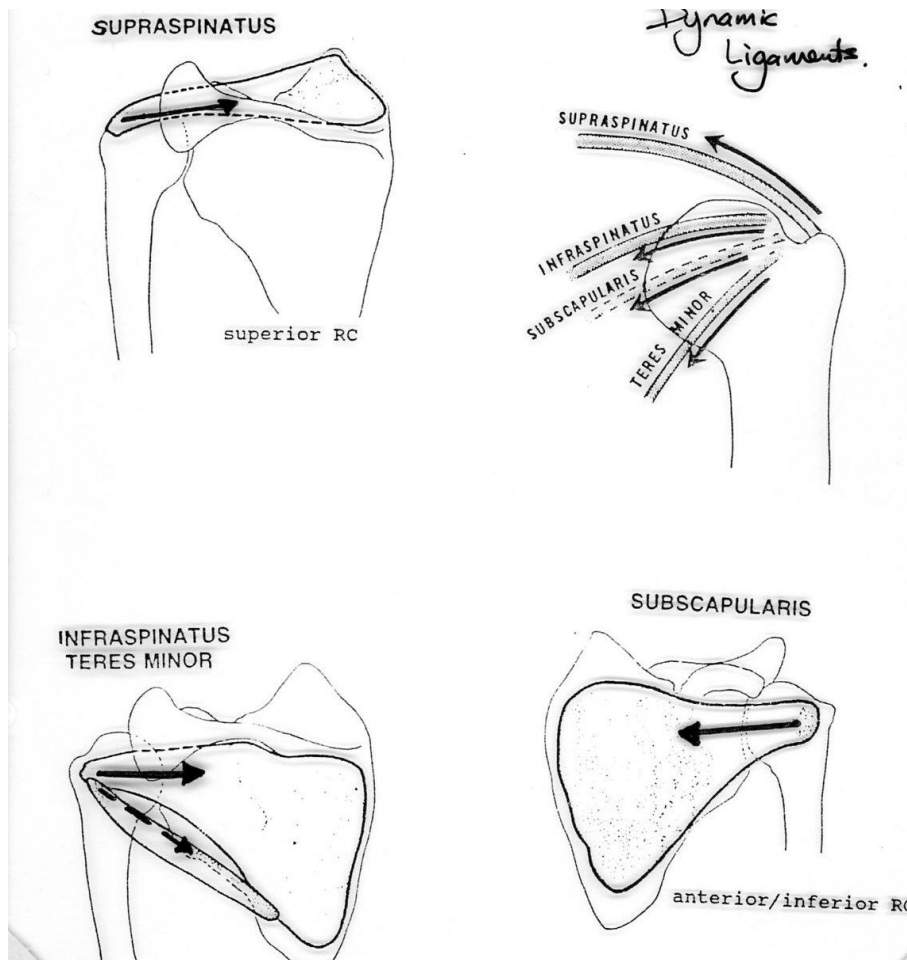
•muscles connecting the shoulder girdle and the humerus:

| Muscle                             | Origin | Insertion | Action | Functional activity |
|------------------------------------|--------|-----------|--------|---------------------|
| Pectoralis major-(clavicular head) |        |           |        |                     |
| Deltoid                            |        |           |        |                     |
| Coracobrachialis                   |        |           |        |                     |
| Teres major                        |        |           |        |                     |
| Teres minor                        |        |           |        |                     |
| Subscapularis                      |        |           |        |                     |
| Supraspinatus                      |        |           |        |                     |
| Infraspinatus                      |        |           |        |                     |





- 9.21 Name the rotator cuff muscles, and specifically describe the functional roles of the rotator cuff muscle group in providing dynamic stability at the shoulder.

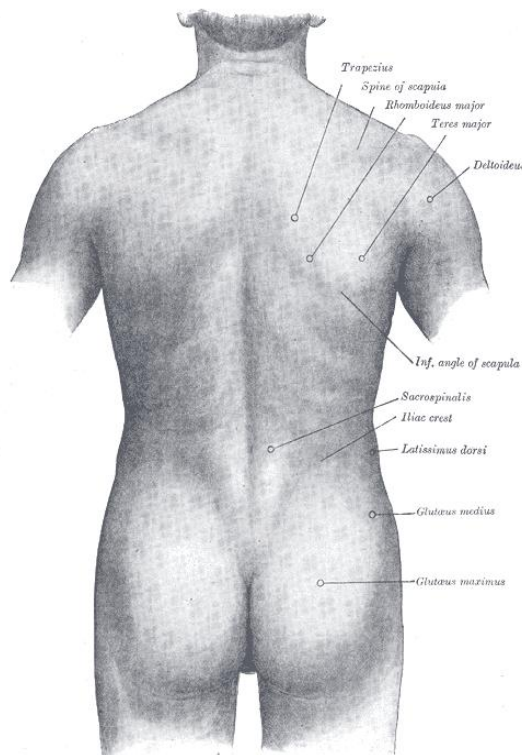


- 9.22 Describe how rotator cuff malfunction could contribute to shoulder joint pathologies e.g. supraspinatus tendonitis, anterior capsulitis, biceps tendonitis.

- 9.23 List the features of the shoulder joint which contribute to its mobility.

**9.24 Demonstrate on a *living subject* the principle bony features of the shoulder region: *remember consent first***

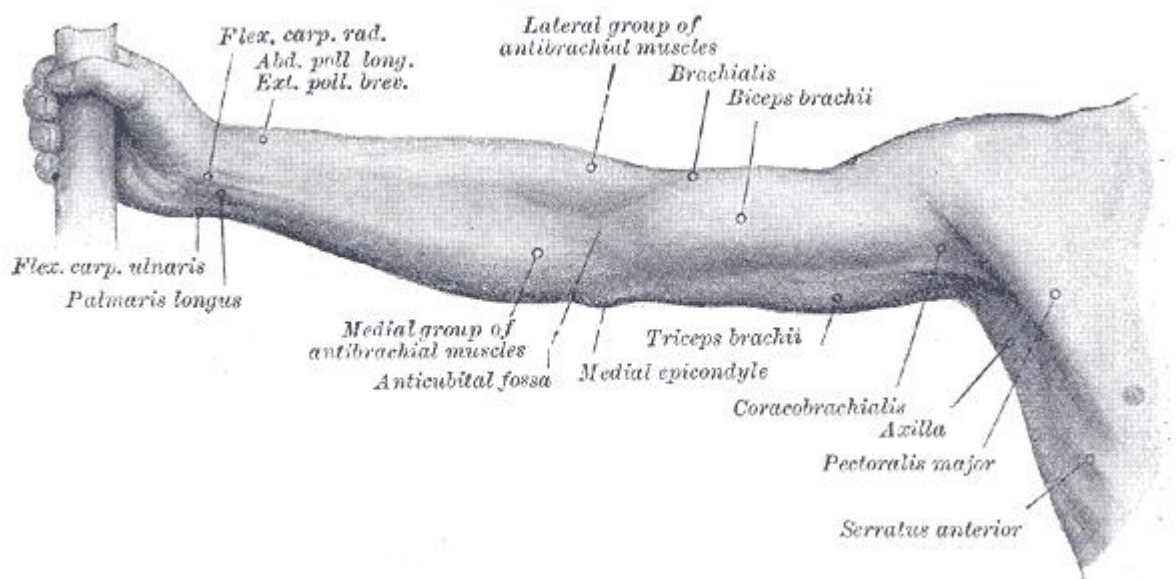
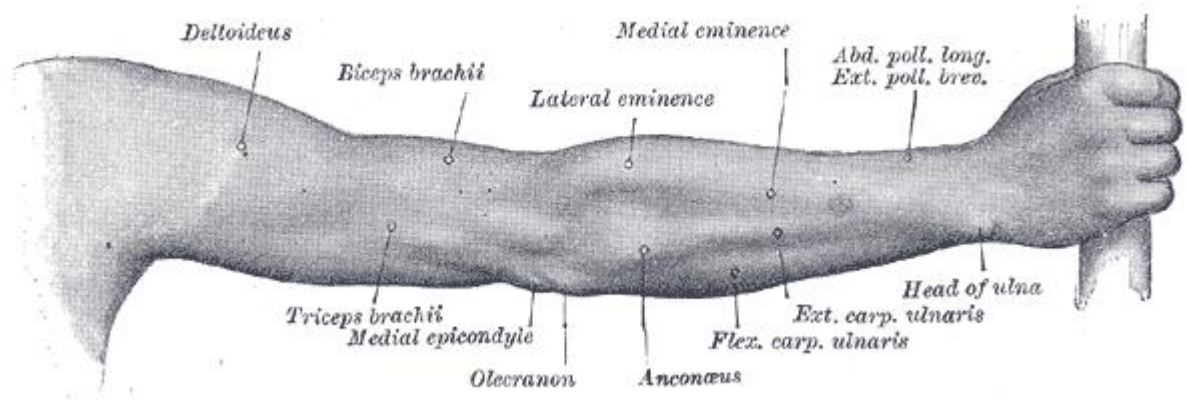
- **scapula**
  - **acromion**
  - **spine-T3**
  - **vertebral border**
  - **inferior-T7**
  - **coracoid process: press firmly upwards and laterally into the junction of the middle and lateral thirds of the clavicle**
- **clavicle**
  - **sternal end: bulbous**
  - **acromial end: flattened**
- **humerus**
  - **head**
  - **greater tubercle: most lateral part covered by deltoid**
  - **deltoid tuberosity**
  - **medial and lateral epicondyles**
  - **medial and lateral supracondylar ridges**
- **sternoclavicular joint**
- **acromioclavicular joint**





9.25 Observe and palpate the following muscles of the axilla and scapula regions in a relaxed and contracted state

- (i) trapezius
- (ii) serratus anterior
- (iii) latissimus dorsi-posterior axillary fold
- (iv) teres major
- (vi) pectoralis major-anterior fold
- (vii) deltoid
- (viii) infraspinatus
- (ix) tendons of the rotator cuff muscles



## REFERENCES

1. Carmichael, S.W. and Hart, D.L. *Anatomy of the Shoulder Joint*. J.O.S.P.T. 6(4):225-228, 1985.
2. Ginn, K.A. *The Role of the Rotator Cuff Muscle Group at the Glenohumeral Joint*, Proceedings, MTAA Symposium, 1988.
3. Ginn, K.A. *A Clinical Trial to Assess the Relationship Between Rotator Cuff Dysfunction and Shoulder Pain*. Proceedings 7th Biennial Conference MPAA, 1991.
4. Culham, E. and Peat, M. *Functional Anatomy of the Shoulder Joint*, J.O.S.P.T.18(1), 342-350, 1993.
5. Kamar, A.; Irrang, J.J. and Whitney, S.L. *Non-operative Management of Secondary Shoulder Impingement Syndrome*, J.O.S.P.T.17(5), 212-224, 1993
6. Mottram, S.L. Dynamic Stability of the scapula. *Manual Therapy* 2 (3): 123-131, 1997

## **10. BONES, JOINTS AND MUSCLES OF THE ELBOW REGION**

### **10.1 On the ulna identify:**

#### **(i) proximal end**

- olecranon and coronoid processes
- trochlear and radial notches
- supinator fossa
- ulnar tuberosity

#### **(ii) shaft**

- interosseus border
- surfaces (medial, anterolateral, posterolateral)

#### **(iii) distal end**

- head
- styloid process

### **10.2 On the radius identify:**

#### **(i) proximal end**

- head
- neck
- radial tuberosity

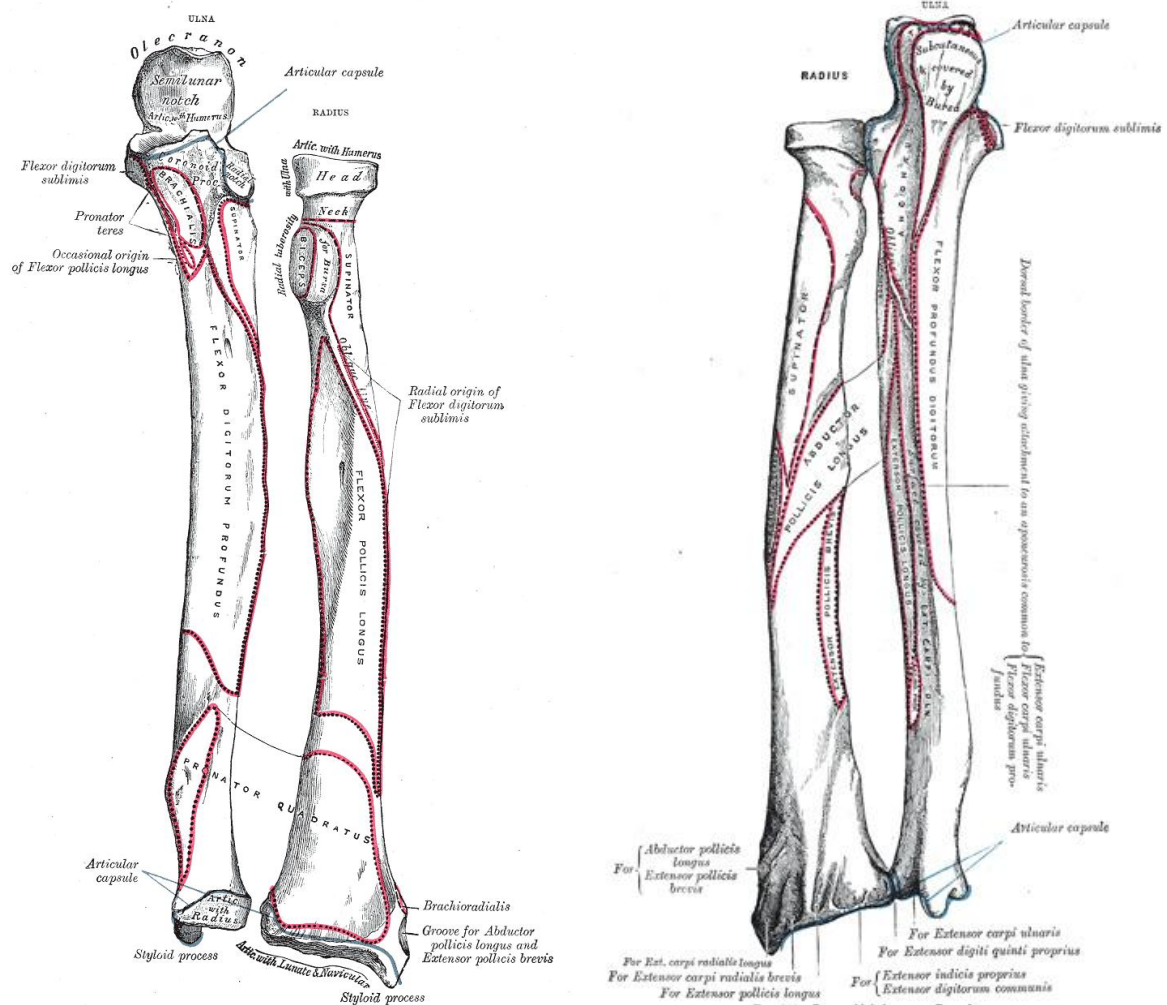
#### **(ii) shaft**

- interosseus border
- surface (lateral, anteromedial, posterolateral)
- impression for pronator teres

#### **(iii) distal end**

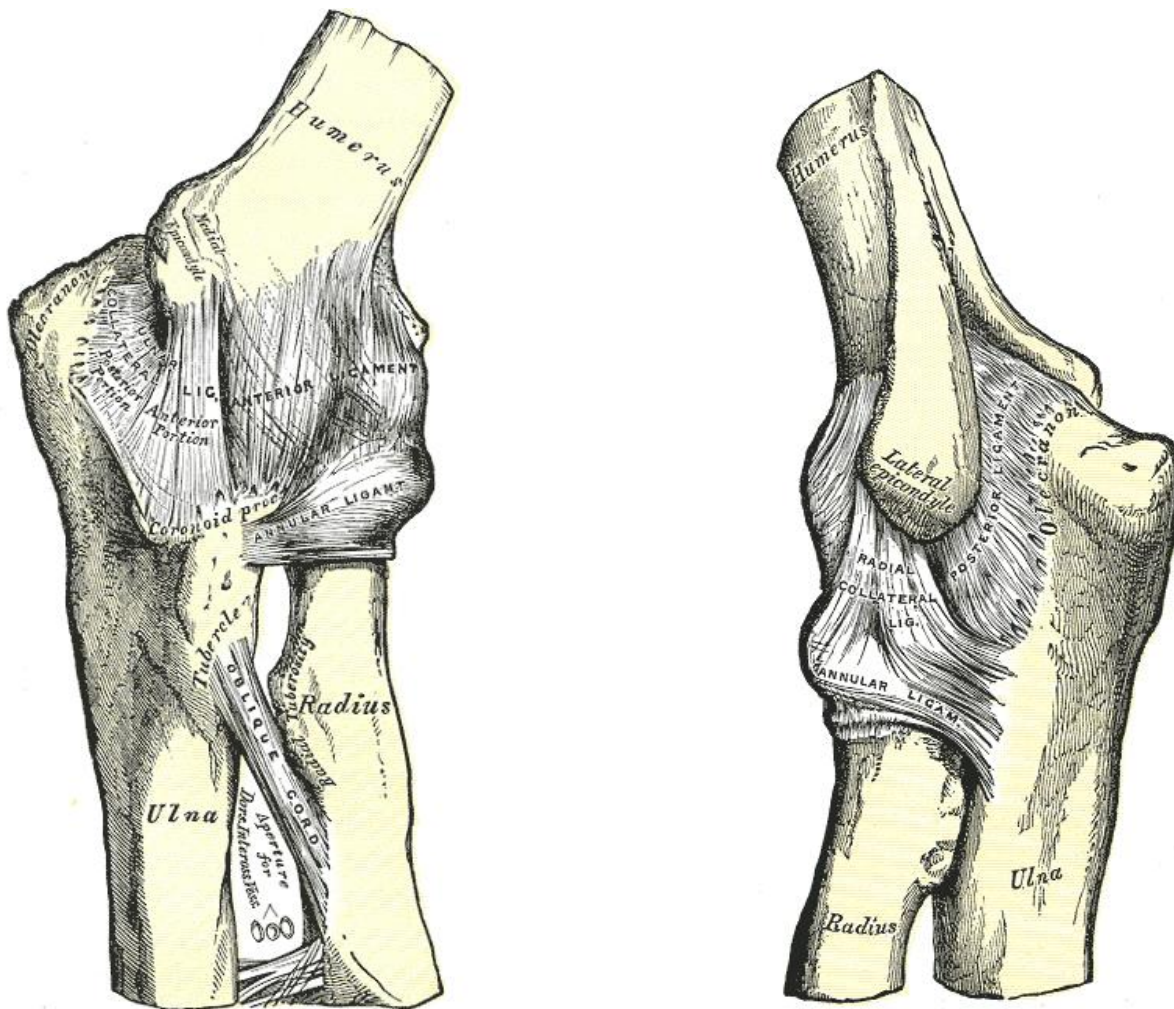
- styloid process

- ulnar notch
- carpal (inferior) articular surface



### 10.3 Classify the elbow joint and identify and describe its:

- articular
- joint capsule and synovial membrane
- ligaments and their specific functions
  - medial (ulnar collateral)
  - lateral (radial collateral)
  - anular
- subcutaneous bursae and fat pads



**10.4 Identify and classify the radio-ulnar joints:**

- (i) superior (proximal)
- (ii) inferior (distal)

**10.5 At the proximal radio-ulnar joint identify and describe its:**

- (i) articular surfaces
- (ii) joint capsule
- (iii) annular ligament and its specific mechanical functions

**10.6 At the distal radio-ulnar joint identify and describe its:**

- (i) articular surfaces
- (ii) joint capsule
- (iii) articular disc

**10.7 Identify the interosseus membrane (intermediate radio-ulnar joint) and list its functions.**

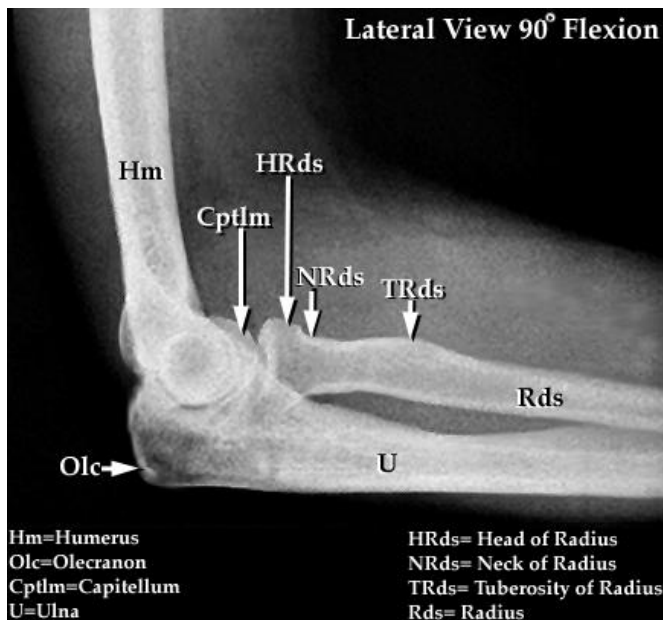
10.8 Define, demonstrate and analyse movements at the elbow joint and the radioulnar joints.

| Movement | Description | Functional activity |
|----------|-------------|---------------------|
|          |             |                     |
|          |             |                     |
|          |             |                     |
|          |             |                     |
|          |             |                     |

10.9 State the close-packed position of the elbow and radioulnar joints.

10.10 Describe the "carrying angle" of the forearm.

10.11 Interpret radiographs of the elbow region and forearm.



**10.12 Identify, describe the attachments and deduce the actions of the following muscles:**

| Muscle             | Origin | Insertion | Action | Functional activity |
|--------------------|--------|-----------|--------|---------------------|
| Biceps brachii     |        |           |        |                     |
| Brachialis         |        |           |        |                     |
| Brachioradialis    |        |           |        |                     |
| Triceps brachii    |        |           |        |                     |
| Anconeus           |        |           |        |                     |
| Pronator teres     |        |           |        |                     |
| Pronator quadratus |        |           |        |                     |
| Supinator          |        |           |        |                     |

**10.13 List the factors responsible for maintaining stability at the:**

- (i) elbow joint
- (ii) superior radioulnar joint
- (iii) inferior radioulnar joint

(think of bony architecture, passive structures (ligaments etc.), and dynamic structures (muscles etc.)

10.14 Define the following terms relating to muscle function:

- (i) spurt
- (ii) shunt

Give examples of each of these at the shoulder and the elbow joints.

## REFERENCES

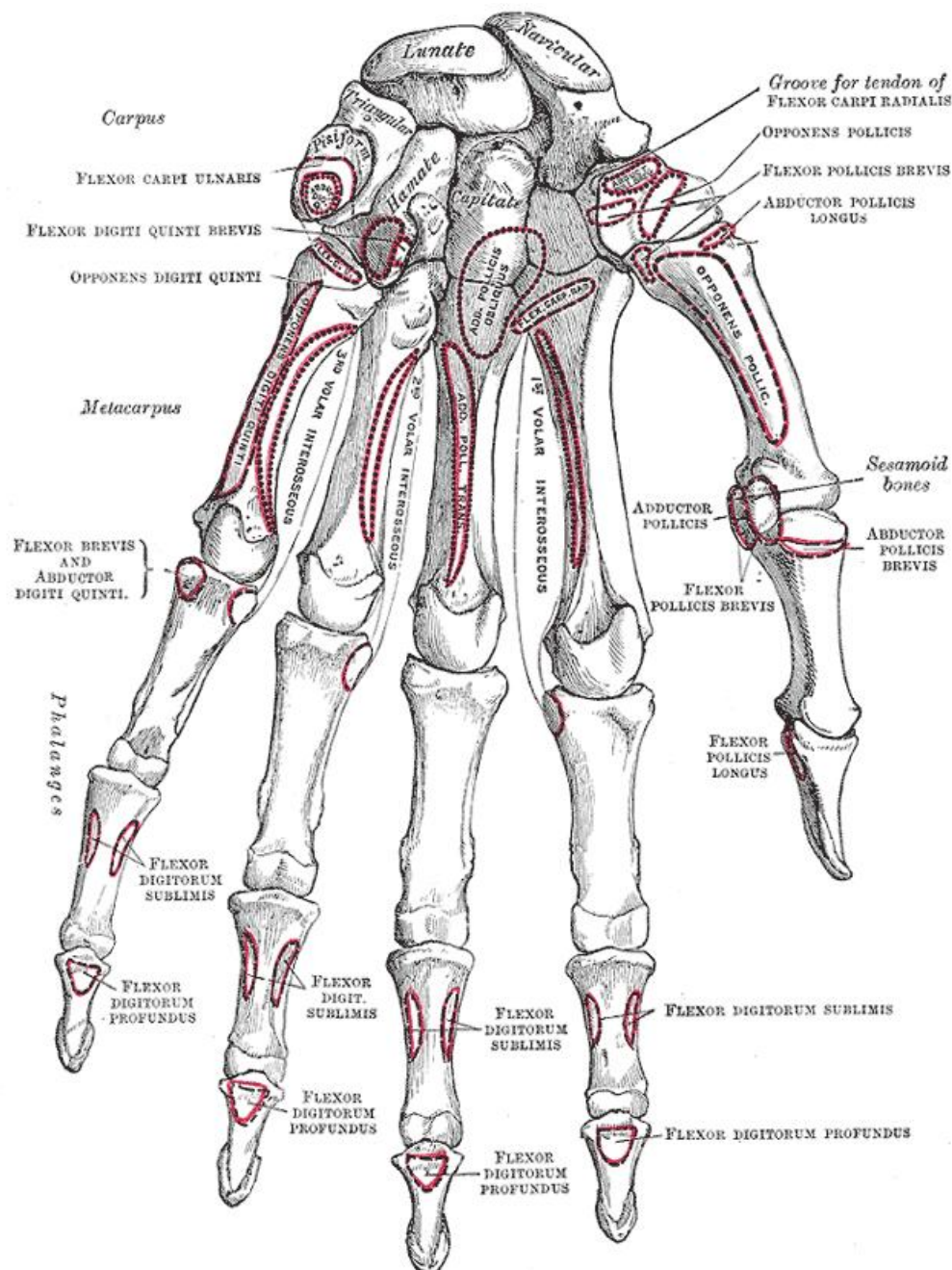
1. Josefsson, P.O., Johnell, O. and Wendeborg, B. *Ligamentous Injuries in Dislocations of the Elbow Joint*. *Clinical Orthopaedics and Related Research*, 221, 221-225, 1987.
2. Stroyan, M. and Wilk, K.E. *The Functional Anatomy of the Elbow Complex*, *J.O.S.P.T.*, 17(6), 279-288, 1993.



## 11. THE WRIST JOINT AND JOINTS OF THE HAND

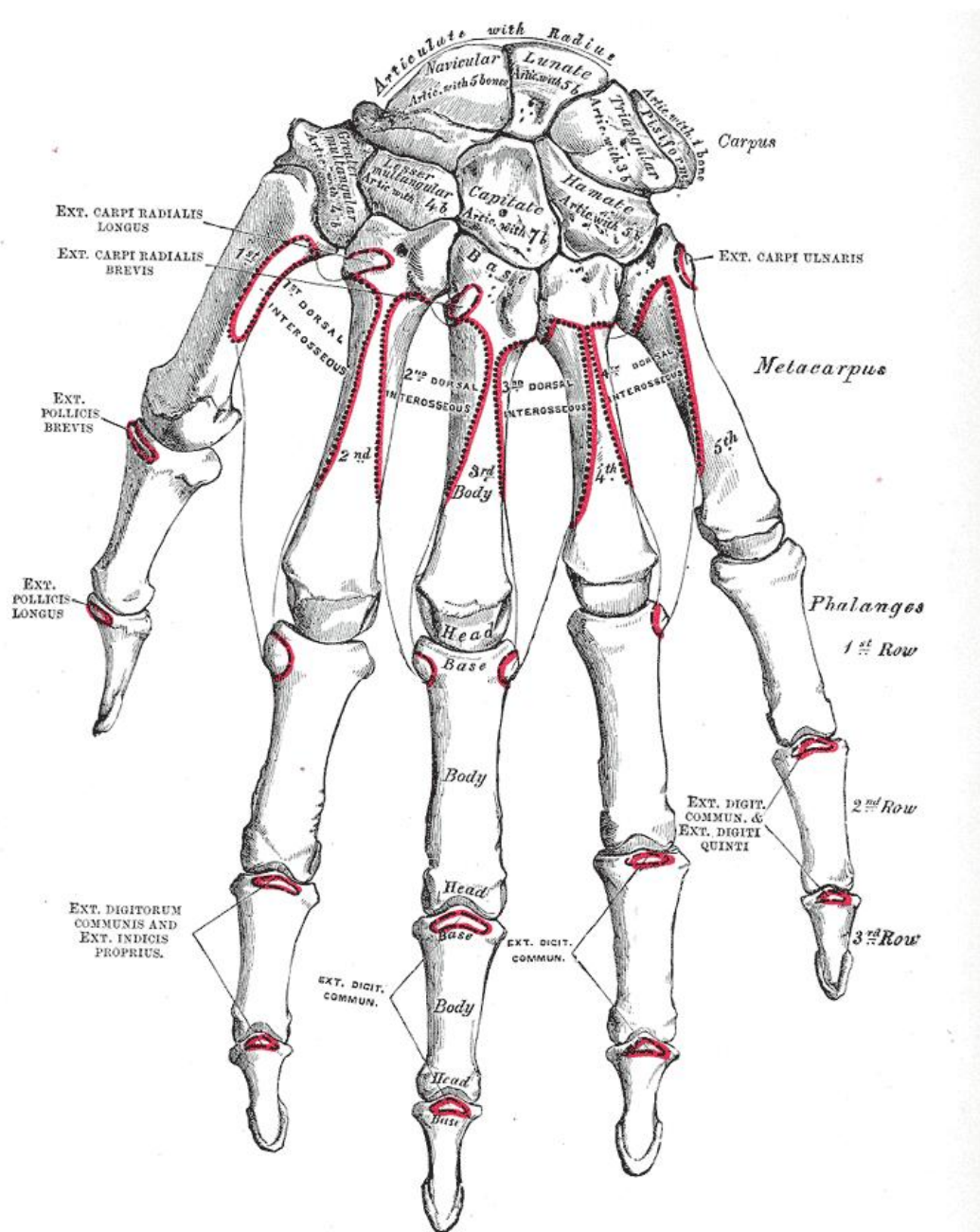
### 11.1 Identify the bony groups in the articulated hand:

- (i) 8 carpals
- (ii) 5 metacarpals
- (iii) 14 phalanges
- (iv) 2 sesamoid bones (radiographs)



11.2 Identify the individual carpal bones and some features of these carpal bones, on the articulated hand:

- (i) scaphoid and its tubercle )  
 (ii) lunate ) proximal row  
 (iii) triquetrum )  
 (iv) pisiform )  
 (v) trapezium and its tubercle )  
 (vi) trapezoid ) distal row  
 (vii) capitate )  
 (viii) hamate and its hook )



**11.3 On the metacarpals identify**

- **base**
- **shaft**
- **head**

**11.4 Identify proximal, middle and distal phalanges and on each phalanx identify:**

- **base**
- **shaft**
- **head**

11.5 Describe the axis of the hand and state the function of the axial line in regard to force transmission.

**11.6 Classify the wrist (radiocarpal) joint and describe its:**

- (i) **articular surfaces**
- (ii) **joint capsule**
- (iii) **articular disc**
- (iv) **ligaments**
  - **palmar and dorsal radiocarpal**
  - **radial and ulnar collateral**

11.7 Describe and demonstrate movements at the wrist joint.

| Movement | Description | Functional activity |
|----------|-------------|---------------------|
|          |             |                     |
|          |             |                     |
|          |             |                     |
|          |             |                     |
|          |             |                     |
|          |             |                     |

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

11.8 State the close-packed position of the wrist joint.

**11.9 Identify, classify, describe and demonstrate the movements at the following joints of the hand:**

| Movement                                  | Description | Functional activity |
|---|-------------|---------------------|
| Midcarpal<br>Movements:                   |             |                     |
|   |             |                     |
|   |             |                     |
| carpometacarpal<br>of thumb<br>movements: |             |                     |
|   |             |                     |
|   |             |                     |
| carpometacarpal<br>of other digits        |             |                     |
|   |             |                     |
|   |             |                     |

11.10 State the contributions of midcarpal and radiocarpal joints to movements of the hand.

**11.11 Identify, classify and describe certain features of the joints of the fingers:**

**•metacarpophalangeal**

- (i) articular surfaces**
- (ii) ligaments and their functions**
  - collateral
  - palmar
  - deep transverse metacarpal
  - extensor aponeurosis
- (iii) movements**
- (iv) sesamoid bones of the thumb and their functions**

**•interphalangeal**

- (i) articular surfaces**
- (ii) ligaments and their functions**
  - collateral
  - extensor aponeurosis
  - palmar
- (iii) movements**

**11.12 Interpret radiographs of the wrist and hand.**

- (i) Identify the plane of the xray:**
- (ii) Name the body part, and orientate it (superior, inferior, distal, proximal)**
- (iii) Name the bones, the bony landmarks, the joint surfaces:**
- (iv) Identify the soft tissues visible**
- (v) Lastly, look for any abnormalities**





Buckle or torus fracture in a child

## ACTIVITIES

1. Discuss the particular uses of hand/wrist x-rays in children.

## REFERENCES

1. Belliappa, P.P and Scheker, L.R. *Functional Anatomy of the Hand*, Emergency Medicine Clinics of North America, August 1993, 557-583.

## 12. MUSCLES OF THE FOREARM AND HAND

### 12.1 Identify, describe the attachments and deduce the action(s) of the muscles of the forearm:

#### •flexor (anteromedial) group:

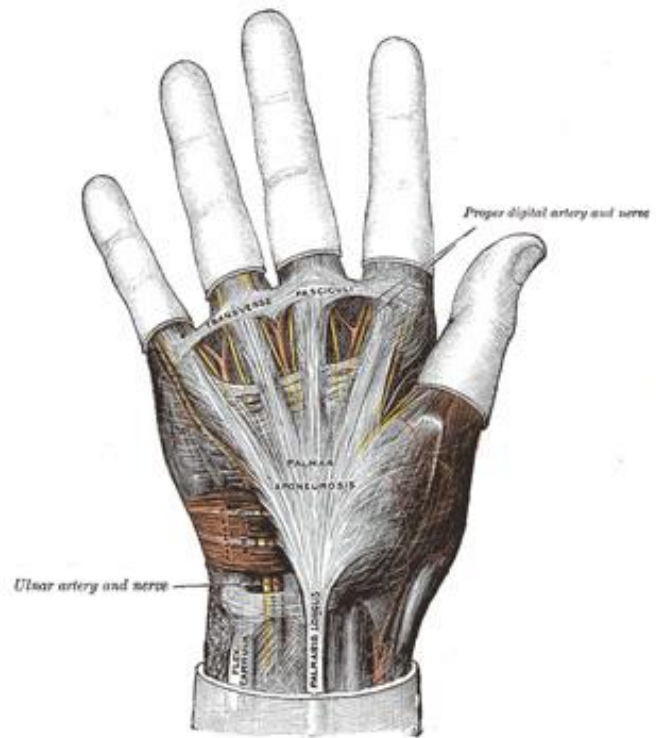
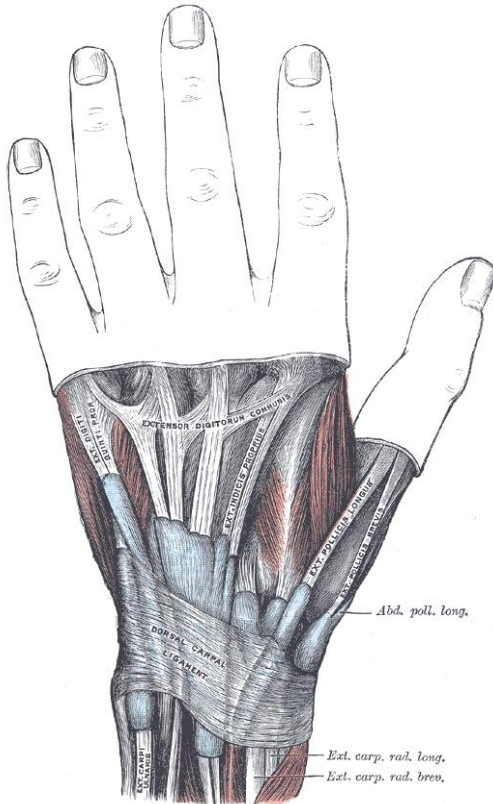
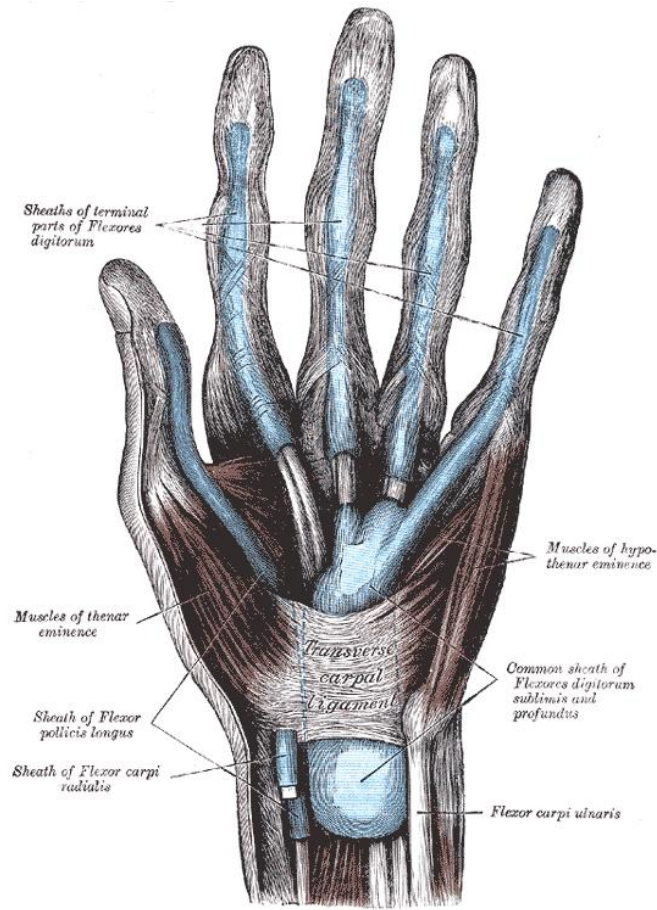
| Muscle                         | Origin | Insertion | Action | Functional activity |
|--------------------------------|--------|-----------|--------|---------------------|
| <b>Superficial layer</b>       |        |           |        |                     |
| Pronator teres                 |        |           |        |                     |
| Flexor carpi radialis          |        |           |        |                     |
| Palmar longus                  |        |           |        |                     |
| Flexor digitorum superficialis |        |           |        |                     |
| Flexor carpi ulnaris           |        |           |        |                     |
| <b>Deep layer</b>              |        |           |        |                     |
| Flexor digitorum profundus     |        |           |        |                     |
| Flexor pollicis longus         |        |           |        |                     |
| Pronator quadratus             |        |           |        |                     |



•**extensor (posterolateral) group:**

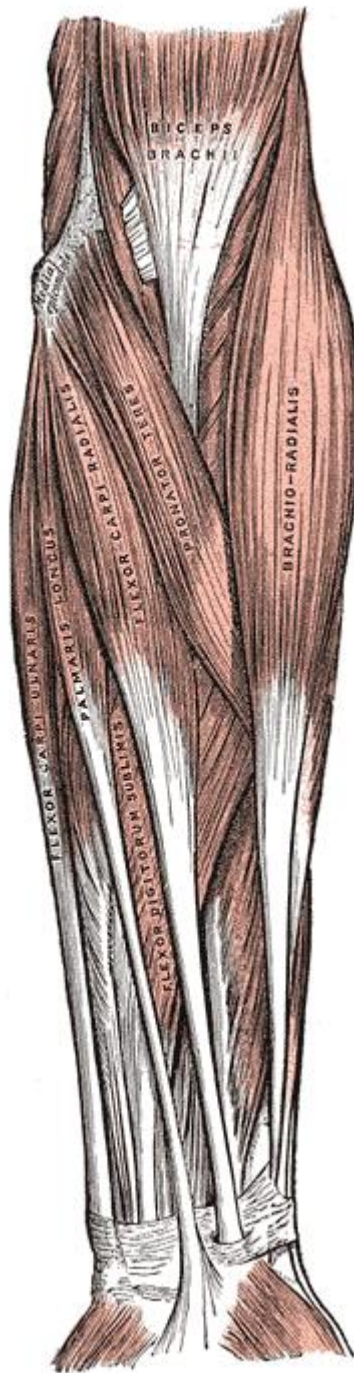
| Muscle                         | Origin | Insertion | Action | Functional activity |
|--------------------------------|--------|-----------|--------|---------------------|
| <b>Superficial layer</b>       |        |           |        |                     |
| Brachioradialis                |        |           |        |                     |
| Extensor carpi radialis longus |        |           |        |                     |
| Extensor carpi radialis brevis |        |           |        |                     |
| Extensor digitorum             |        |           |        |                     |
| Extensor digiti minimi         |        |           |        |                     |
| Extensor carpi ulnaris         |        |           |        |                     |
| Anconeus                       |        |           |        |                     |
| <b>Deep layer</b>              |        |           |        |                     |
| Supinator                      |        |           |        |                     |
| Abductor pollicis longus       |        |           |        |                     |
| Extensor pollicis brevis       |        |           |        |                     |
| Extensor indicis               |        |           |        |                     |

**12.2 Identify the flexor and extensor retinacula and state the function(s) of retinacula.**

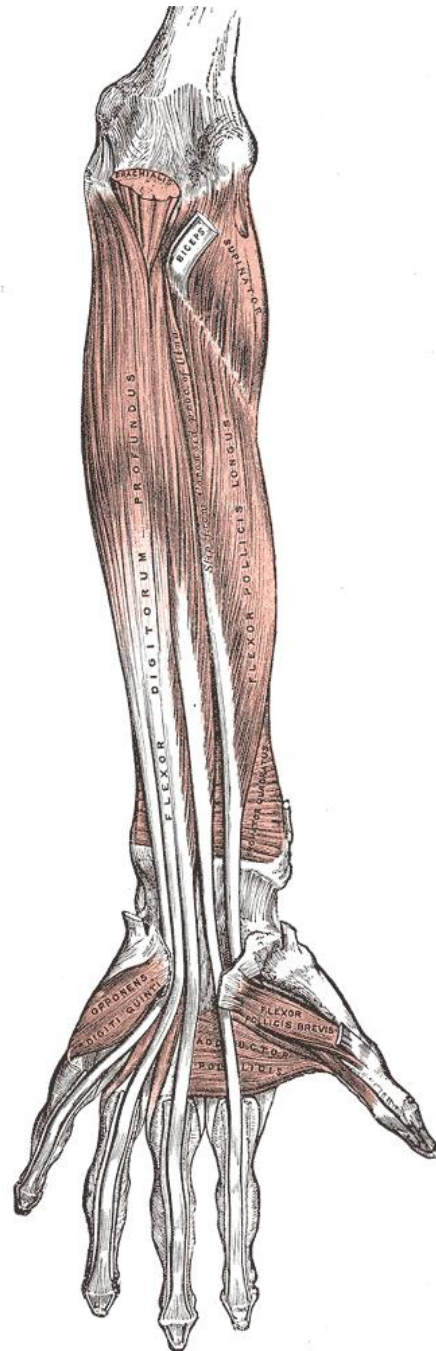


**12.3 Identify, describe the attachments and deduce the actions of the intrinsic muscles of the hand:**

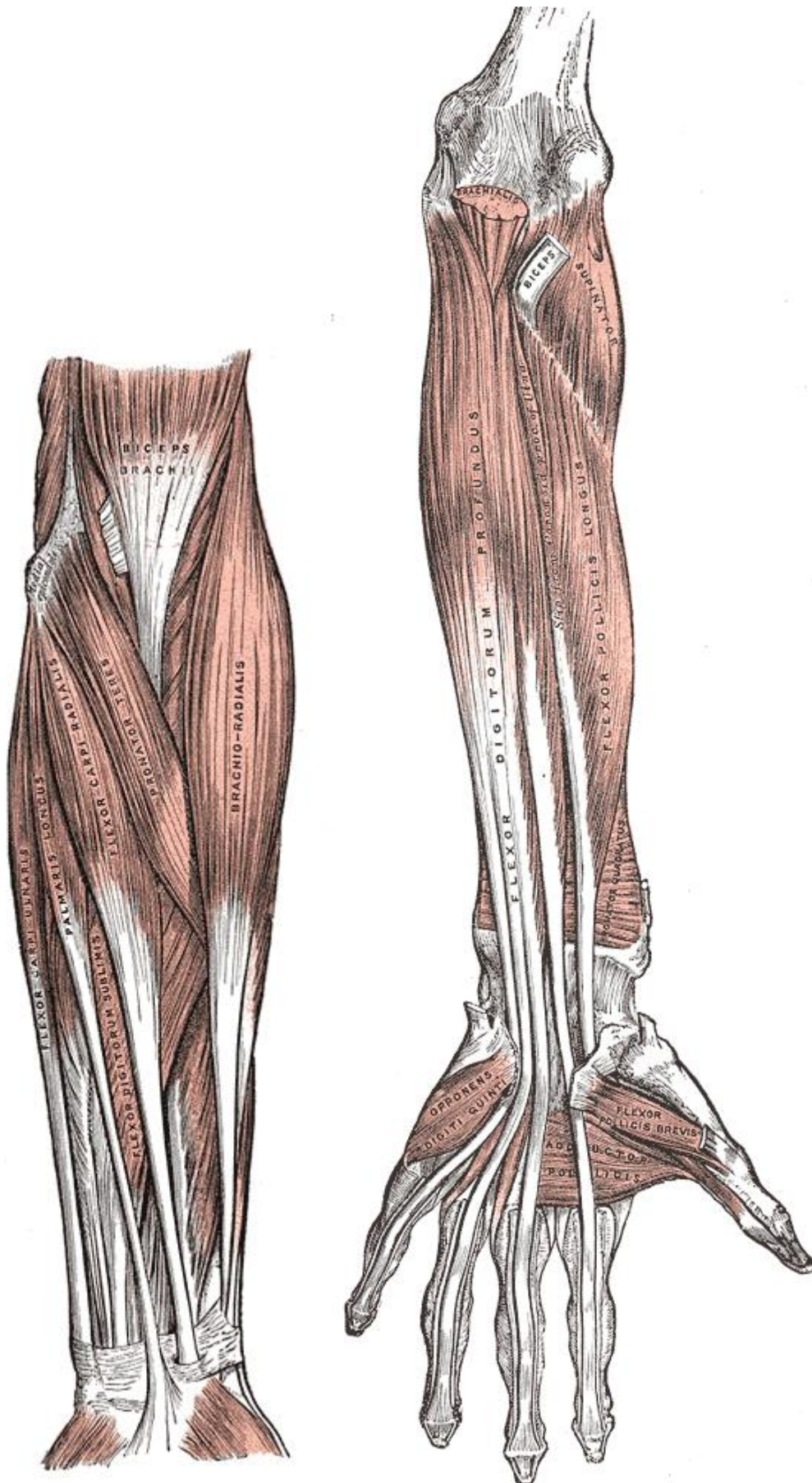
| Muscle                     | Origin | Insertion | Action | Functional activity |
|----------------------------|--------|-----------|--------|---------------------|
| flexor pollicis brevis     |        |           |        |                     |
| <b>thenar eminence</b>     |        |           |        |                     |
| abductor pollicis brevis   |        |           |        |                     |
| opponens pollicis          |        |           |        |                     |
| <b>hypothenar eminence</b> |        |           |        |                     |
| flexor digiti minimi       |        |           |        |                     |
| abductor digiti minimi     |        |           |        |                     |
| opponens digiti minimi     |        |           |        |                     |
| <b>Other Intrinsic</b>     |        |           |        |                     |
| adductor pollicis          |        |           |        |                     |
| lumbricals                 |        |           |        |                     |
| dorsal interossei          |        |           |        |                     |
| palmar interossei          |        |           |        |                     |



Anterior view  
Superficial forearm muscles



Deep forearm muscles



Posterior forearm muscles, superficial, and deep.

**12.4 Identify and describe the extent, and describe the function(s) of:**

- (i) palmar aponeurosis**
- (ii) intertendinous connections**
- (iii) synovial sheaths**
- (iv) extensor aponeurosis**

12.5 Define the position of function of the hand.

12.6 Describe the role of the interossei and lumbricals in producing normal digital sweep.

## **ACTIVITIES**

1. Demonstrate different types of precision and power grips and discuss the differences in terms of:
  - (i) the muscles involved
  - (ii) the position of the wrist and hand
  
2. With the wrist maximally extended, try to extend three fingers completely; and with the wrist maximally flexed, try to flex the fingers completely. Discuss why these activities are difficult or impossible.

### 13. SURFACE ANATOMY OF THE ARM, FOREARM AND HAND

#### 13.1 Demonstrate on a living subject:

•the principal bony features of the forearm:

- (i) ulnar
  - olecranon process
  - posterior borders-intervenes between the two functional groups of the muscles of the forearm.
  - head
  - styloid process-best felt when the forearm is pronated
- (ii) radius
  - head
  - styloid process

• the following muscles and tendons of the arm and forearm:

- (i) biceps brachii
  - (ii) triceps brachii
  - (ii) anconeus
    - this is a triangular muscle whose angles are formed by the olecranon process, lateral epicondyle, and a point on the posterior border of the ulna about 10cm distal to the olecranon process
  - (iii) brachioradialis
  - (iv) cubital fossa
  - (v) extensor compartment (group) of the forearm
  - (vi) flexor compartment (group) of the forearm
  - (vii) tendons of the following muscles on the anterior aspect of the wrist:
    - flexor carpi radialis
    - palmaris longus
    - flexor digitorum superficialis
    - flexor carpi ulnaris
  - (ix) extensor carpi radialis longus
  - (x) extensor carpi radialis brevis
- all the carpal bones and some of their features
- (i) hook of hamate

- can be felt by deep pressure in the hypothenar eminence, distal to the pisiform and closer to the centre of the palm
- (ii) tubercle of the scaphoid
  - at the proximal edge of the thenar eminence, adjacent to the distal crease of the wrist
- the following muscles and tendons of the hand:
  - (i) tendons of extensor digitorum
  - (ii) the "anatomical snuff box" (evident when the thumb is extended) bounded by the tendons of:
    - extensor pollicis longus
    - extensor pollicis brevis
    - abductor pollicis longus
  - (iii) thenar and hypothenar eminence
  - (iv) 1st dorsal interosseus muscle
- the relative mobility of the metacarpals and list them in decreasing order of mobility.

**13.2** Draw a pattern of the hand, and on it draw the palmar creases. Relate the following creases of the hand to the underlying joints on your drawing:

- (i) creases of the wrist:
  - proximal
  - middle
  - distal
- (ii) creases of the palm:
  - longitudinal palmar ("life line")
  - middle palmar ("destiny line")
  - proximal transverse ("head line")
  - distal transverse ("heart line")
- (iii) creases of the digits:
  - proximal
  - middle
  - distal

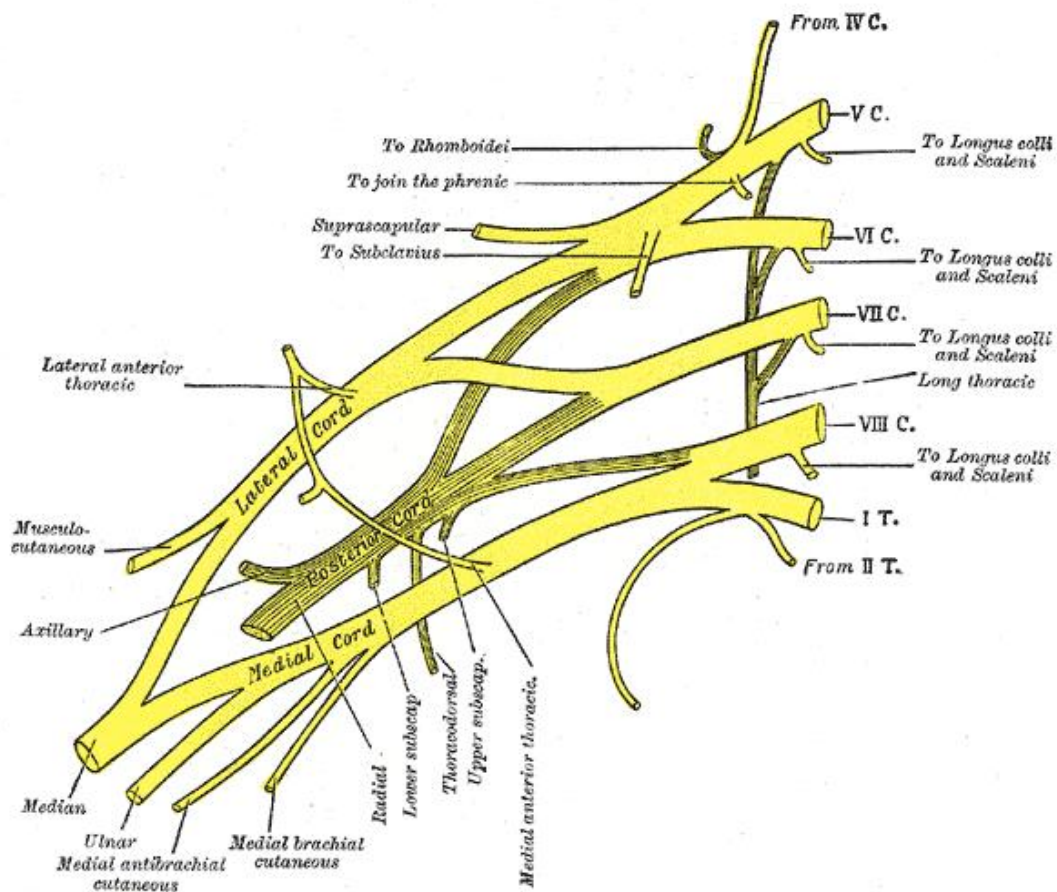
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## 14. NERVE SUPPLY TO THE UPPER LIMB

14.1 Describe the following features of the brachial plexus:

- (i) its formation from ventral rami
- (ii) its trunks
- (iii) its division
- (iv) its cords
- (v) the position of each of the above in the shoulder region



14.2 Identify the following branches of the brachial plexus and state their motor distribution (the muscles each supplies):

- (i) dorsal scapular
- (ii) long thoracic
- (iii) suprascapular
- (iv) upper subscapular
- (v) lateral pectoral
- (vi) medial scapular
- (vii) thoracodorsal

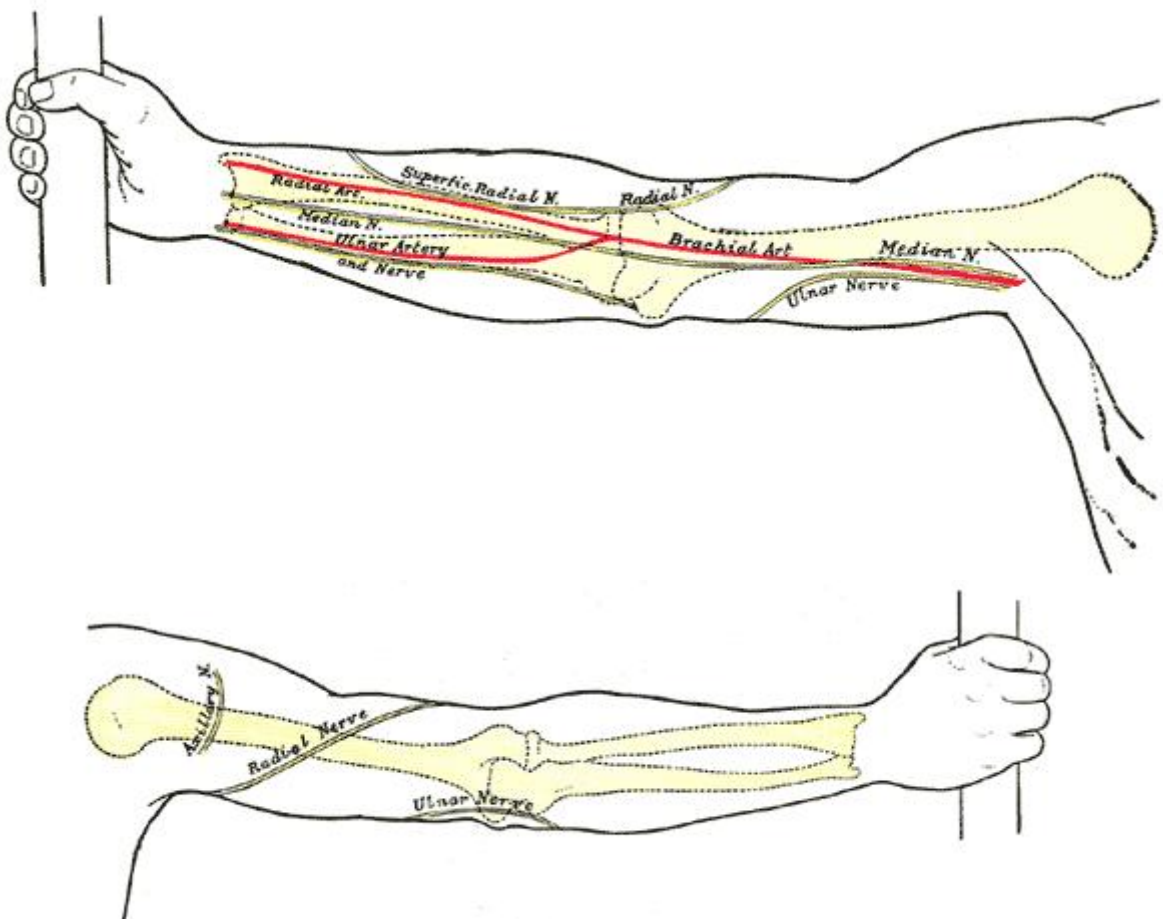
(viii) lower subscapular

14.3 Identify the following sensory branches of the brachial plexus and state the root value and distribution of each:

- (i) medial cutaneous nerve of arm
- (ii) medial cutaneous of forearm

14.4 Identify the peripheral nerves of the brachial plexus:

- (i) axillary (circumflex)
- (ii) radial and its posterior interosseus branch
- (iii) musculocutaneous
- (iv) median and its anterior interosseus branch
- (v) ulnar



14.5 For each of the peripheral nerves listed in 14.4:

- (i) state its root value
- (ii) identify its course through the upper limb
- (iii) describe its sensory distribution

(iv) describe its motor distribution

14.6 Describe the innervation of the following joints:

- (i) shoulder
- (ii) elbow
- (iii) wrist

and deduce a general rule for nerve supply to joints.

## ACTIVITIES

1. Describe the functional motor loss and deformity resulting from a lesion to the following nerves in the area indicated:
  - (i) radial nerve - in the axilla
  - (ii) ulnar nerve - at the medial epicondyle of the humerus
  - (iii) median nerve - at the wrist
  
2. Complete the following chart to summarise objective 14.5.

### PERIPHERAL NERVES TO THE UPPER LIMB

| Peripheral Nerve                            | Nerve Root Value | Motor Distribution | Sensory Distribution |
|---|------------------|--------------------|----------------------|
| Medial cutaneous nerve of arm               |                  |                    |                      |
| Medial cutaneous of forearm                 |                  |                    |                      |
| Axillary (circumflex                        |                  |                    |                      |
| Radial and its posterior interosseus branch |                  |                    |                      |
| Musculocutaneous                            |                  |                    |                      |
| Median and its anterior interosseus branch  |                  |                    |                      |
| Ulnar                                       |                  |                    |                      |

3. Draw a pattern the dorsum and palmar aspect of the hand. Colour in the distribution of cutaneous nerves to the hand

Palm

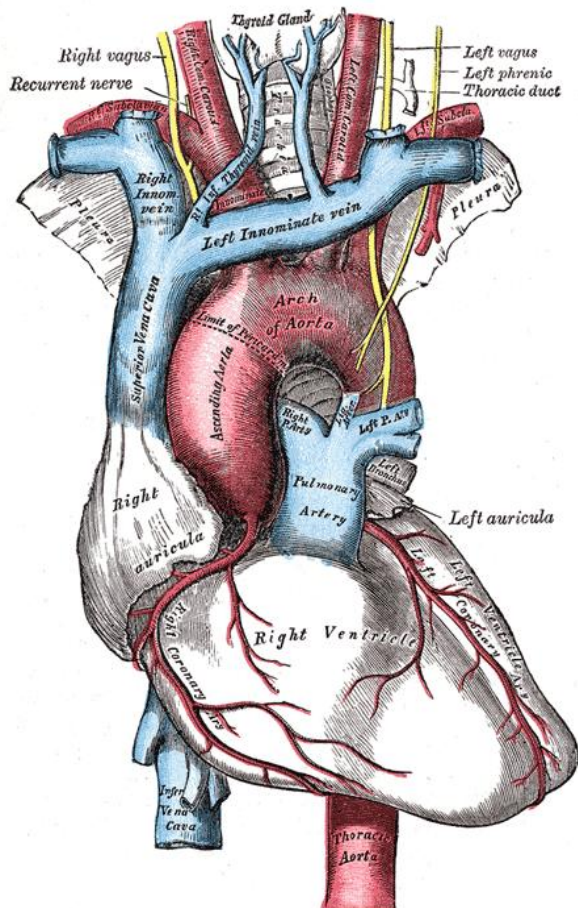
Dorsum

## 15. BLOOD SUPPLY TO THE UPPER LIMB

### Objectives

#### 15.1 Identify:

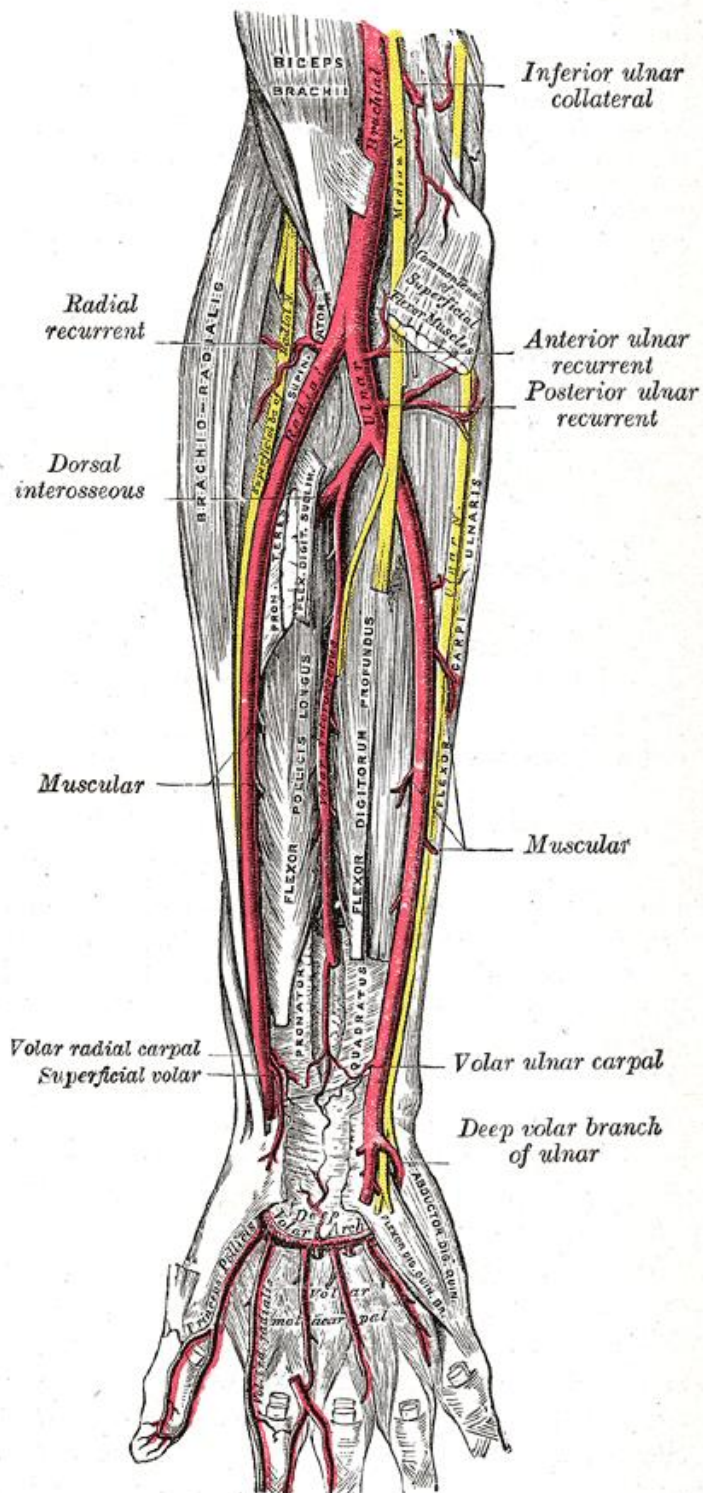
- (i) ascending aorta
- (ii) arch of aorta
- (iii) descending thoracic aorta
- (iv) brachiocephalic artery )
- (v) L common carotid artery ) branches of aorta
- (vi) L subclavian artery )
  
- (vii) R common carotid artery ) branches of brachiocephalic
- (viii) R subclavian artery ) artery



#### 15.2 Briefly state the area of supply of the arteries listed in objective 15.1

**15.3 Identify and describe the course and general areas of supply of the arteries of the upper limb:**

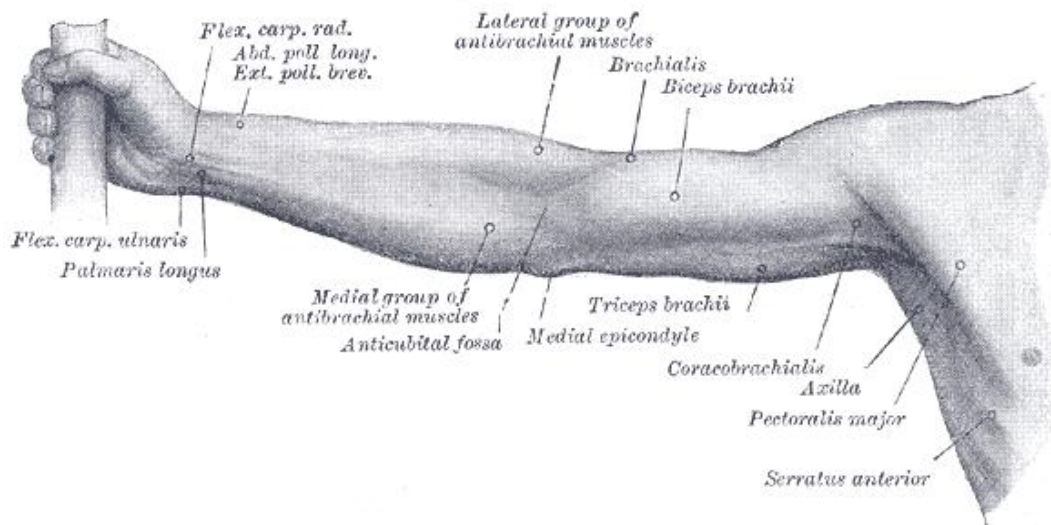
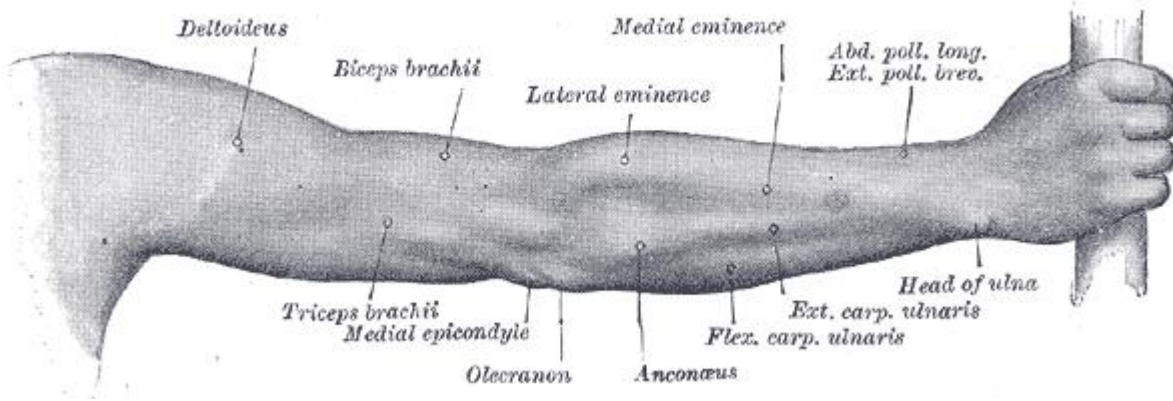
- (i) axillary**
- (ii) brachial**
- (iii) profunda brachii**
- (iv) radial**
- (v) ulnar**
- (vi) superficial palmar arch**
- (vii) deep palmar arch**



15.4 Palpate the pulses of the upper limb at the following positions:

- (i) subclavian artery - above medial end of the clavicle
- (ii) brachial artery - between the heads of biceps brachii (median bicipital furrow) and at the cubital fossa
- (iii) radial artery - on the antero-lateral aspect of the wrist
- (iv) mark on the diagrams where you found them.

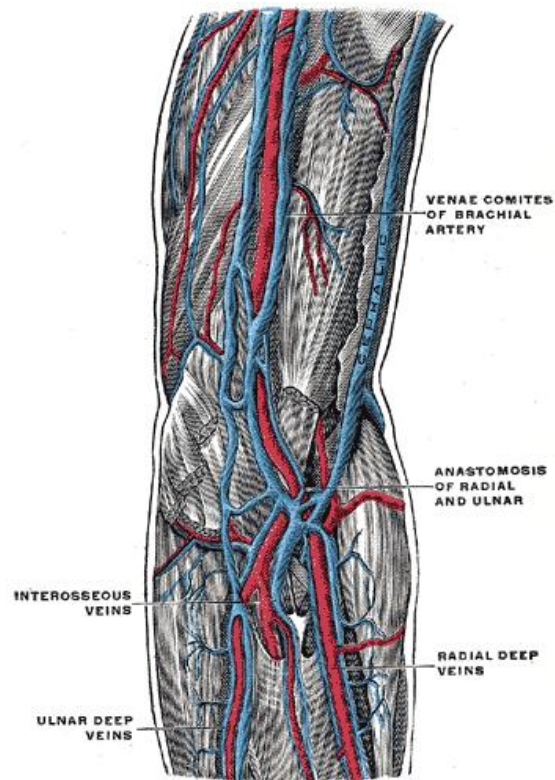




15.5 Describe the arrangement of the veins of the upper limb into a superficial and a deep group and deduce the functional significance of this arrangement.

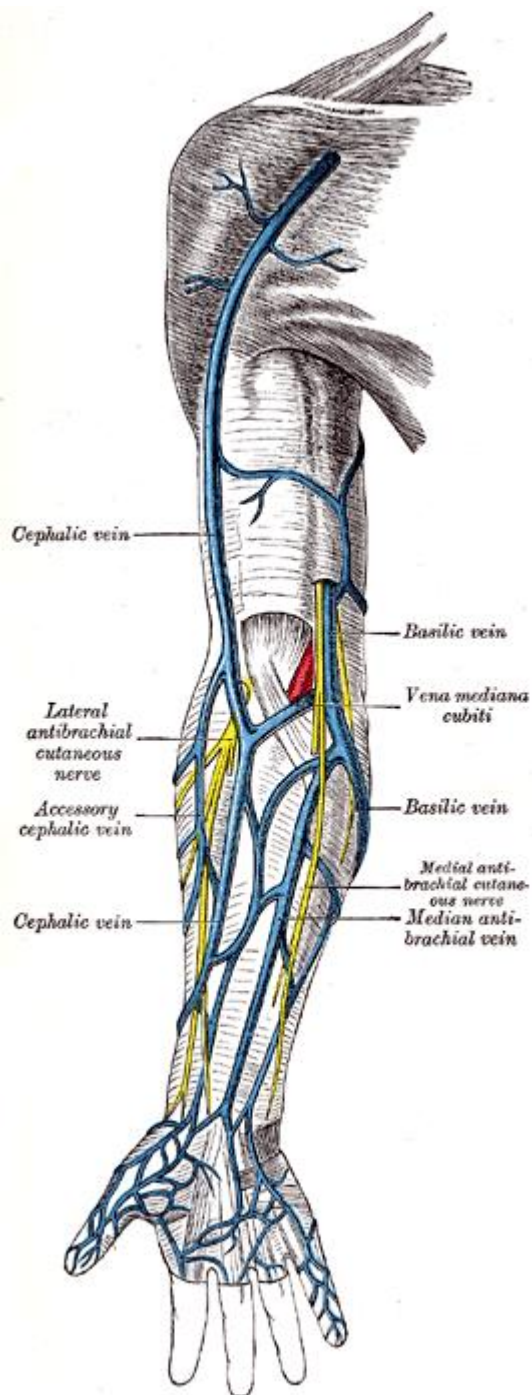
15.6 Identify and describe the course of the deep veins:

- (i) radial
- (ii) ulnar
- (iii) brachial
- (iv) axillary



**15.7 Identify and describe the course of the superficial veins of the upper limb:**

- (i) dorsal venous arch
- (ii) palmar venous arch
- (iii) cephalic
- (iv) basilic
- (v) median antebrachial
- (vi) median cubital



- 15.8 Identify the veins transporting blood from the upper limb to the heart:**
- (i) subclavian
  - (ii) brachiocephalic
  - (iii) superior vena cava

**VIVA ANATOMY!!!**

## FEEDBACK QUESTIONNAIRE

Thank you for assisting in the further development of the Masters of Physiotherapy Program at University of Canberra by providing some feedback on this “Self-directed learning module on Functional Anatomy for Physiotherapists”.

This learning module was initiated based on feedback from students and staff, that the level of anatomy taught at Australian and overseas universities varies enormously. Students needed to know exactly where their knowledge of functional anatomy was strong enough to proceed with the course, and where it needed further work and study. So one of the aims of the learning module was to provide students with a self-assessment tool. The other was to help students catch up.

This Lower Limb anatomy module is part I of 3, including the Upper Limb, and Spine and Pelvis.

Please answer these statements with the degree to which you agree or disagree with the statements:

|   |                        |               |                                 |            |                     |
|---|------------------------|---------------|---------------------------------|------------|---------------------|
| 1. The level of functional anatomy studied in my previous degree prepared me sufficiently for the Masters Degree in Physiotherapy | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 2. This module helped me identify the areas I needed to study   | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 3. The learning module gave me confidence that the level of anatomy I have studied previously is sufficient for this course.      | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 4. The instructions to follow were clear  | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 5. The areas of learning covered the anatomy of the lower limb thoroughly   | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 6. The areas of learning did not go into enough detail  | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 7. The activities did not have enough functional applications   | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 8. I would have liked more clinical applications  | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 9. This learning module will be a good reference for me in the future   | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |
| 10. It is better to leave the choice of reference text books up to the student, rather than prescribe a single text.              | 5<br>Strongly disagree | 4<br>Disagree | 3<br>Neither agree nor disagree | 2<br>Agree | 1<br>Strongly agree |

:

Other comments

**Please return to Allied Health Administrator by week 7 of semester. Thank you!**



## **SCHOOL OF PHYSIOTHERAPY**

### **SELF - DIRECTED LEARNING MODULE ON FUNCTIONAL ANATOMY FOR PHYSIOTHERAPISTS**

#### **Pack III The Anatomy of the Head Neck and Trunk**

Ms Doà El-Ansary, BAppSc(Phty)  
Dr Jennie Scarvell, BAppSc(Phty), PhD

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This self-directed learning module has been developed to facilitate student revision and preparation for entry into the Masters of Physiotherapy Program at the University of Canberra.

The material outlined in this module forms the basis of the theoretical background in Functional Anatomy that will be assumed knowledge.

The following learning objectives are based on material developed by Dr Karen Ginn, Senior Lecturer, Faculty of Health Sciences, University of Sydney. It has been added to and modified with permission by Doà El-Ansary for the purposes of postgraduate instruction.

The objectives are designed to direct and sequence your learning. Material highlighted in **bold print is to be identified practically on dissected specimens or in an anatomical atlas**. Objectives in regular print are to be answered from texts or articles provided in the general or region specific reference lists.

## REFERENCES

These are available in the library, but it is strongly recommended you own a copy of a good anatomy text and an atlas for continuous professional education and reference.

### Texts:

1. Moore, K L and Daley: **Clinically Oriented Anatomy** (5<sup>th</sup> Edn), Lippincott, Williams and Wilkins, Baltimore, 2005 (ISBN 0-7817-3639-0)
2. Drake, R L; Vogl, W and Mitchell, A W M: **Gray's Anatomy for Students**. Elsevier, 2005 ISBN (0-443-07168-3)
3. Palastanga, N; Field, D and Soames, R: **Anatomy and Human Movement** (4<sup>th</sup> Edn). 2002. ISBN (0-7506-5241-1)
4. Field, D: **Anatomy Palpation and Surface Markings** (3<sup>rd</sup> Edn). Butterworth Heinemann, 2003. ISBN (0-750-64618-7)
5. Bogduk, N: **Clinical Anatomy of the Lumbar Spine and Sacrum** (4<sup>th</sup> Edn). Churchill Livingstone, 2005. ISBN (0-443-10119-1)

### Atlases:

1. Rohen, J W; Yokochi, C and Drecoll, E L: **Colour Atlas of Human Anatomy** (5<sup>th</sup> Edn), Lippincott, Williams and Wilkins, 1993. ISBN (0-7817-3194-1)
2. Abrahams, P H; Marks, S C and Hutchings, R T: **McMinn's Colour Atlas of Human Anatomy**. Mosby, 2003. ISBN (0-7234-3212-0)

### URL:

Figures within referenced to:

<http://education.yahoo.com/reference/gray/subjects/>

and

<http://www.bartleby.com/107/>

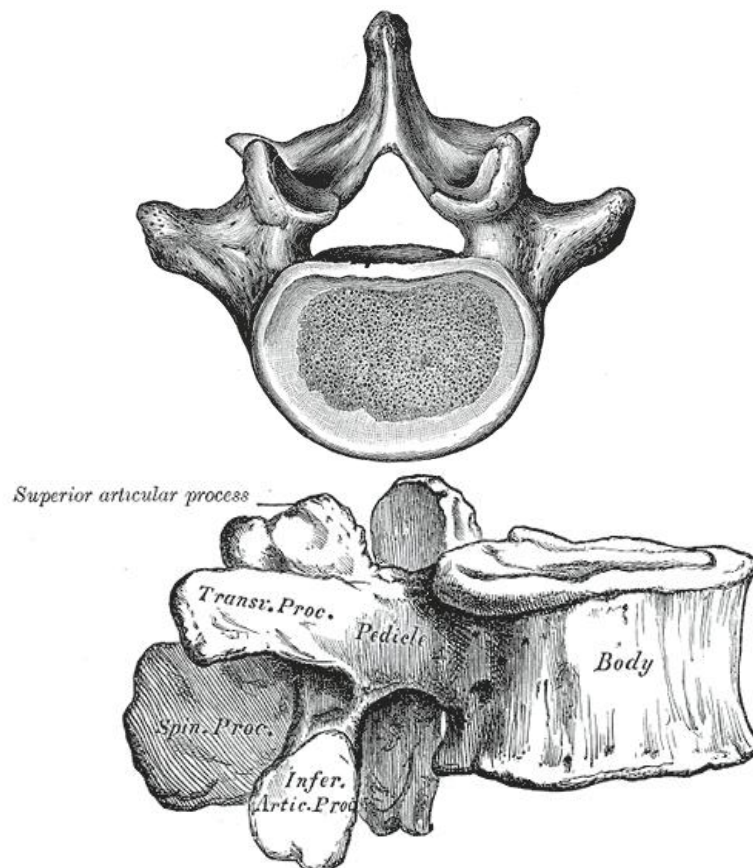
# 1. BONES AND JOINTS OF THE VERTEBRAL COLUMN

1.1 Record the number of vertebrae in each region of the vertebral column:

|           |  |
|-----------|--|
| Cervical  |  |
| Thoracic  |  |
| Lumbar    |  |
| Sacral    |  |
| Coccygeal |  |

1.2 On a typical vertebra (thoracic or lumbar) identify:

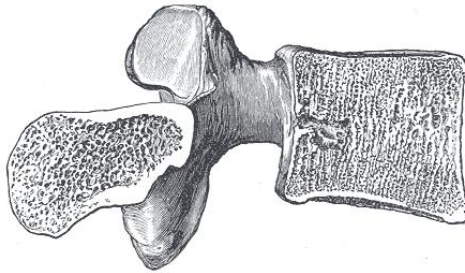
- (i) body
- (ii) vertebral foramen
- (iii) pedicle
- (iv) lamina
- (v) transverse process
- (vi) spinous process
- (vii) superior and inferior articular facets
- (viii) superior and inferior vertebral notches
- (ix) pars interarticularis
- (x) mamillary process
- (xi) accessory process





1.3 List the distinguishing features of a typical vertebra from cervical, thoracic and lumbar regions of the vertebral column (refer to Table 1 in the “Activities”).

1.4 Relate the distinguishing features of a lumbar vertebrae to its different function.

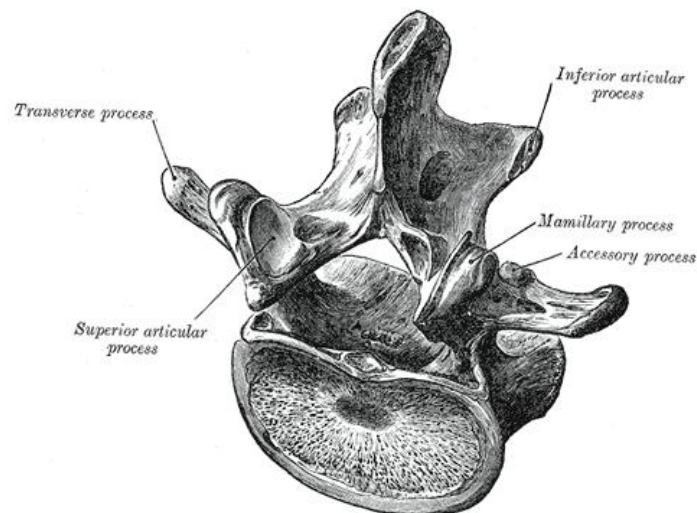


1.5 On an articulated vertebral column identify:

- (i) intervertebral foreman
- (ii) vertebral canal
- (iii) interlamina spaces

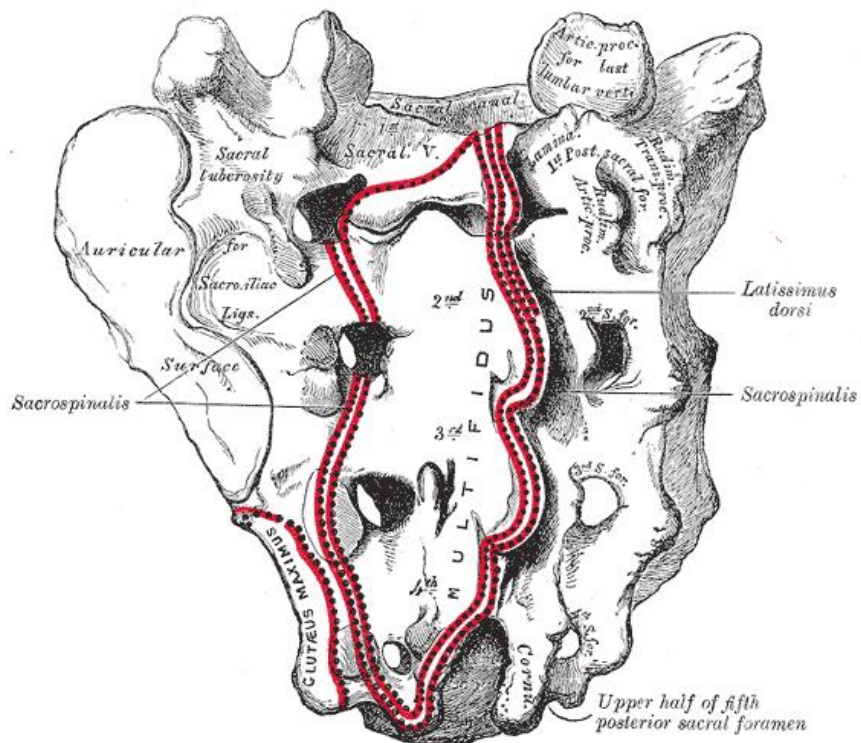
1.6 Identify the main features of the following vertebrae:

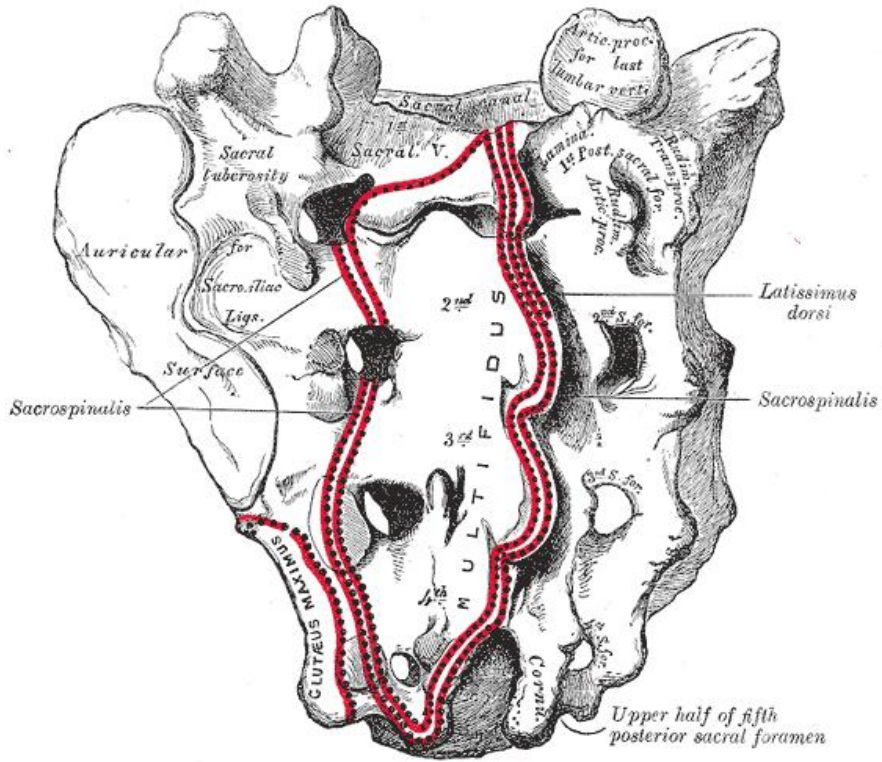
- (i) Lumbar sacral
  - superior and inferior process
  - transverse process
  - spinous process
  - mamillary process
  - vertebral body
  - vertebral foramen
  - accessory process



## (ii) sacrum

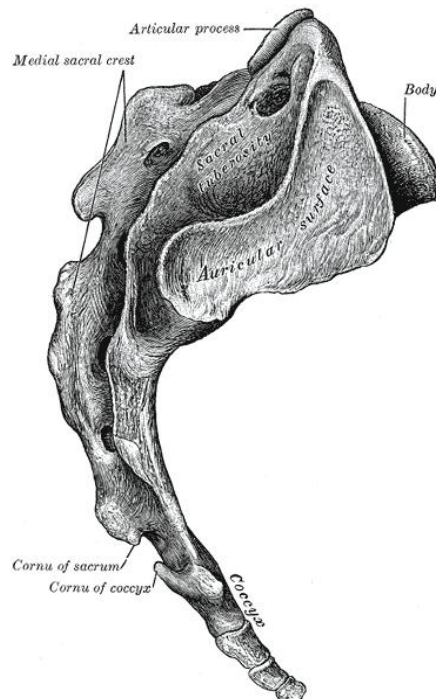
- base
- apex
- pelvic and dorsal surfaces
- auricular surface
- sacral tuberosity
- sacral foramina:
  - pelvic (anterior)
  - dorsal (posterior)
- sacral canal
- superior articular facet
- median sacral crest
- sacral cornua



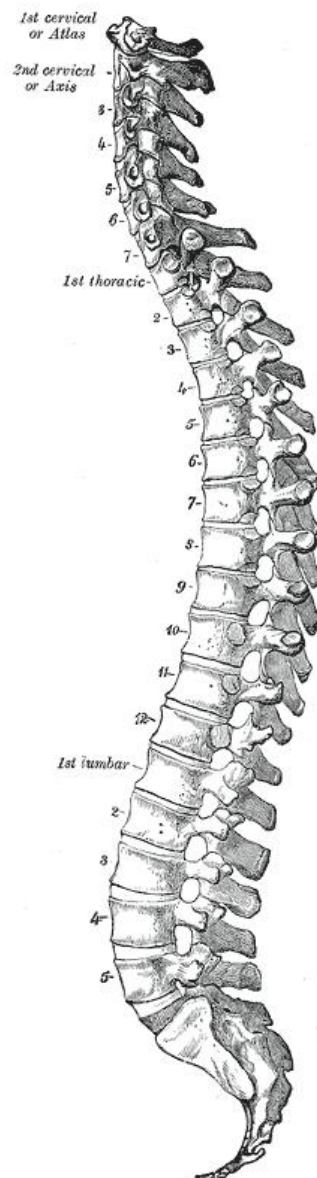


(iii) coccyx

- coccygeal cornua

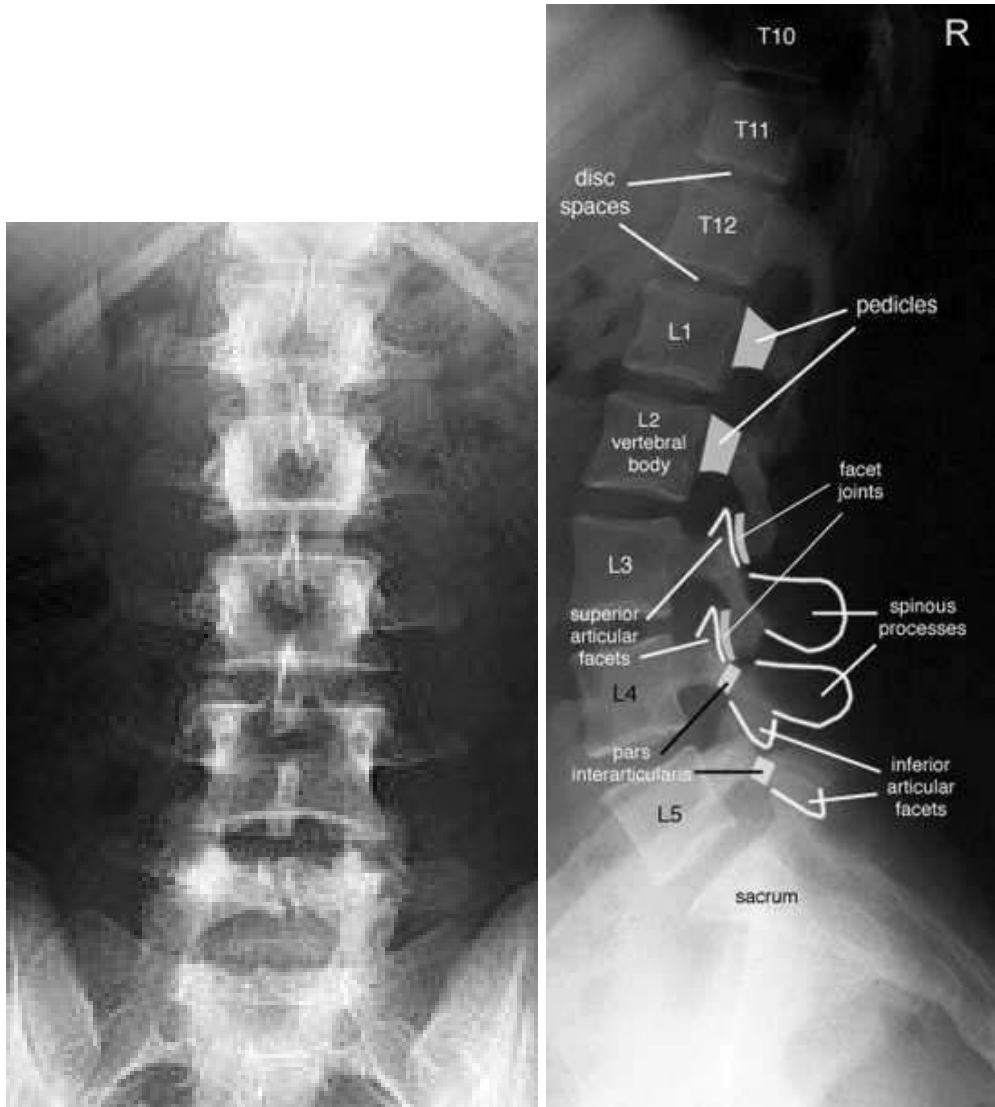


1.7 Identify the primary and secondary curvatures of the articulated vertebral column and explain their significance.



1.8 Describe the line of gravity in relation to the vertebral column.

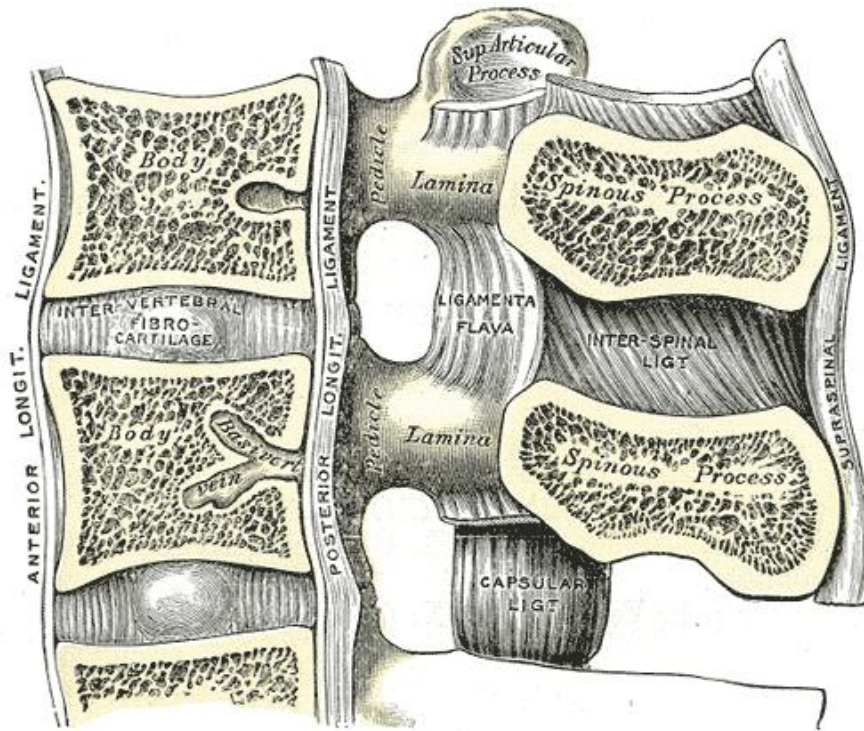
- 1.9 Identify on radiographs of the vertebral column:
- i. body
  - ii. vertebral foramen
  - iii. pedicle
  - iv. lamina
  - v. transverse process
  - vi. spinous process
  - vii. superior and inferior articular facets
  - viii. superior and inferior vertebral notches
  - ix. pars interarticularis



- 1.10 Identify and classify the joint between adjacent vertebral bodies - the "intervertebral disc".

1.11 Describe the structure and function(s) of the "intervertebral disc" and its components:

- (i) anulus fibrosus
- (ii) nucleus pulposus



1.12 Identify, classify and state the function(s) of the zygapophyseal (facet) joint and its components:

- (i) capsule
- (ii) intra-articular structures

1.13 Identify and describe the structure, location and function of the following ligaments/membranes of the vertebral column:

- (i) anterior longitudinal
- (ii) posterior longitudinal
- (iii) ligamenta flava
- (iv) supraspinous
- (v) interspinous
- (vi) intertransverse
- (vii) iliolumbar
- (viii) transforaminal
- (ix) mamillo-accessory

1.14 Deduce the movements of the vertebral column as a whole by examining living specimens and the skeleton (particularly the orientation of the superior and inferior articular facets).

## ACTIVITIES

- Complete the following chart to summarise the distinguishing features of vertebrae from the different vertebral column regions.

Table 1

|                                       | C1-C7 | T1 - T12 | L1 - L4 | L5 |
|---------------------------------------|-------|----------|---------|----|
| Relative size of body                 |       |          |         |    |
| Shape and size of vertebral foramen   |       |          |         |    |
| Shape & angulation of spinous process |       |          |         |    |
| Transverse processes                  |       |          |         |    |
| Orientation of articular facets       |       |          |         |    |
| Primary movement                      |       |          |         |    |

- Determine the type and extent of movement occurring in each vertebral region:
  - cervical
  - thoracic
  - lumbar
  
- Relate the orientation of the zygapophyseal joints to mobilisation techniques used in the treatment of the lumbar spine.
  
- Determine the direction of combined movements that take place in the lumbar spine with flexion and extension.

## REFERENCES

Bogduk, N: **Clinical Anatomy of the Lumbar Spine and Sacrum** (4<sup>th</sup> Edn). Churchill Livingstone, 2005. ISBN (0-443-10119-1).

## 2. MUSCLES OF THE TRUNK

2.1 Identify, describe the attachments and deduce the action(s) of the muscles of the anterolateral abdominal wall:

|                      | Origin | Insertion | Action |
|----------------------|--------|-----------|--------|
| rectus abdominis     |        |           |        |
| external oblique     |        |           |        |
| internal oblique     |        |           |        |
| transverse abdominis |        |           |        |
| pyramidalis          |        |           |        |

Identify and describe the structure and functional significance of:

|                   | Describe Structure | Function |
|-------------------|--------------------|----------|
| linea alba        |                    |          |
| inguinal ligament |                    |          |
| inguinal canal    |                    |          |
| umbilicus         |                    |          |

2.3 Identify and describe the attachments and deduce the action(s) of the muscles of the posterior abdominal wall:

|                    | Origin | Insertion | Action |
|--------------------|--------|-----------|--------|
| quadratus lumborum |        |           |        |
| psoas major        |        |           |        |
| psoas minor        |        |           |        |
| iliacus            |        |           |        |



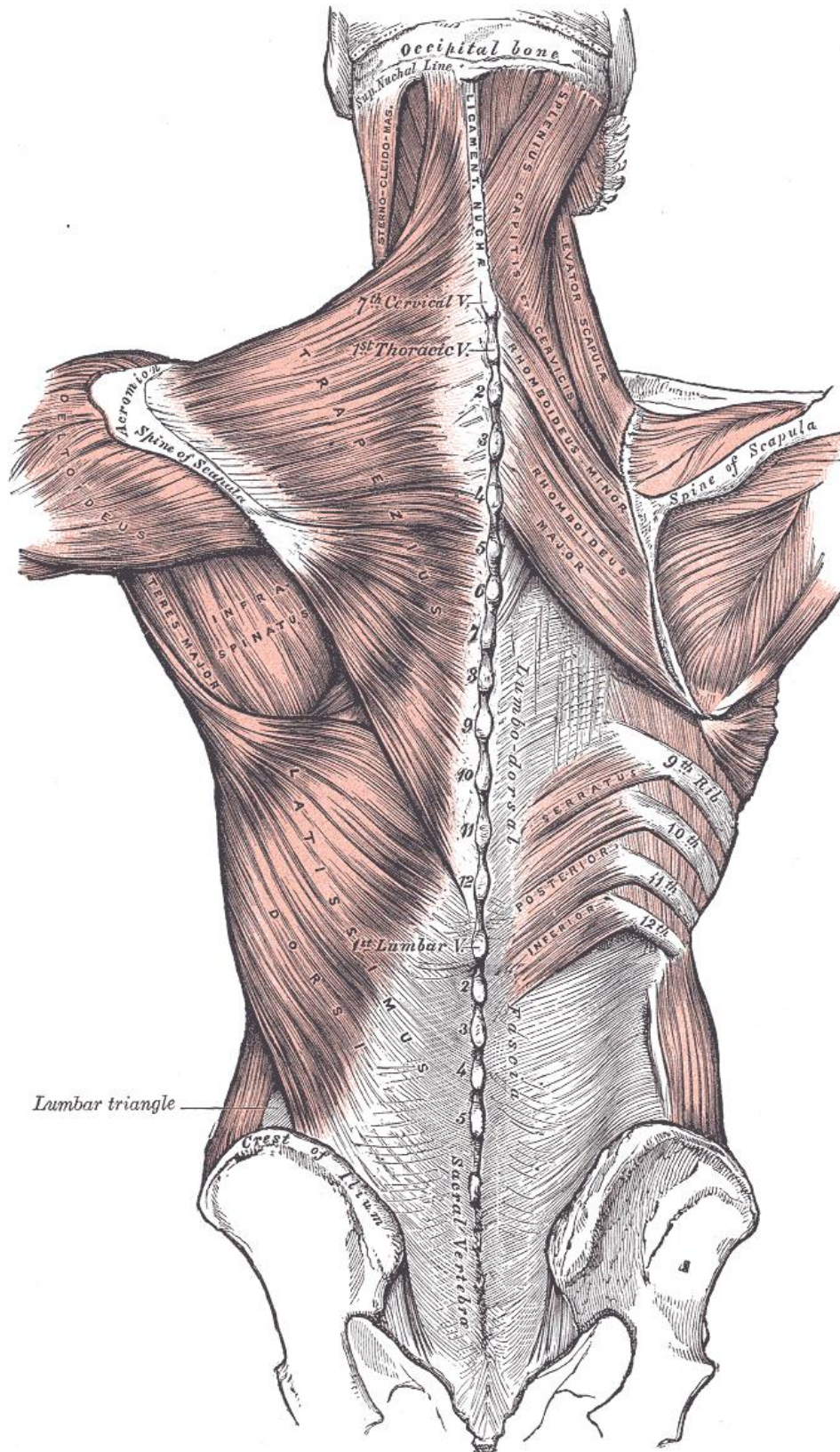
**2.4 Identify the intermediate layer of muscles of the back:**

|                                    | Origin | Insertion | Action |
|------------------------------------|--------|-----------|--------|
| <b>serratus posterior superior</b> |        |           |        |
| <b>serratus posterior inferior</b> |        |           |        |

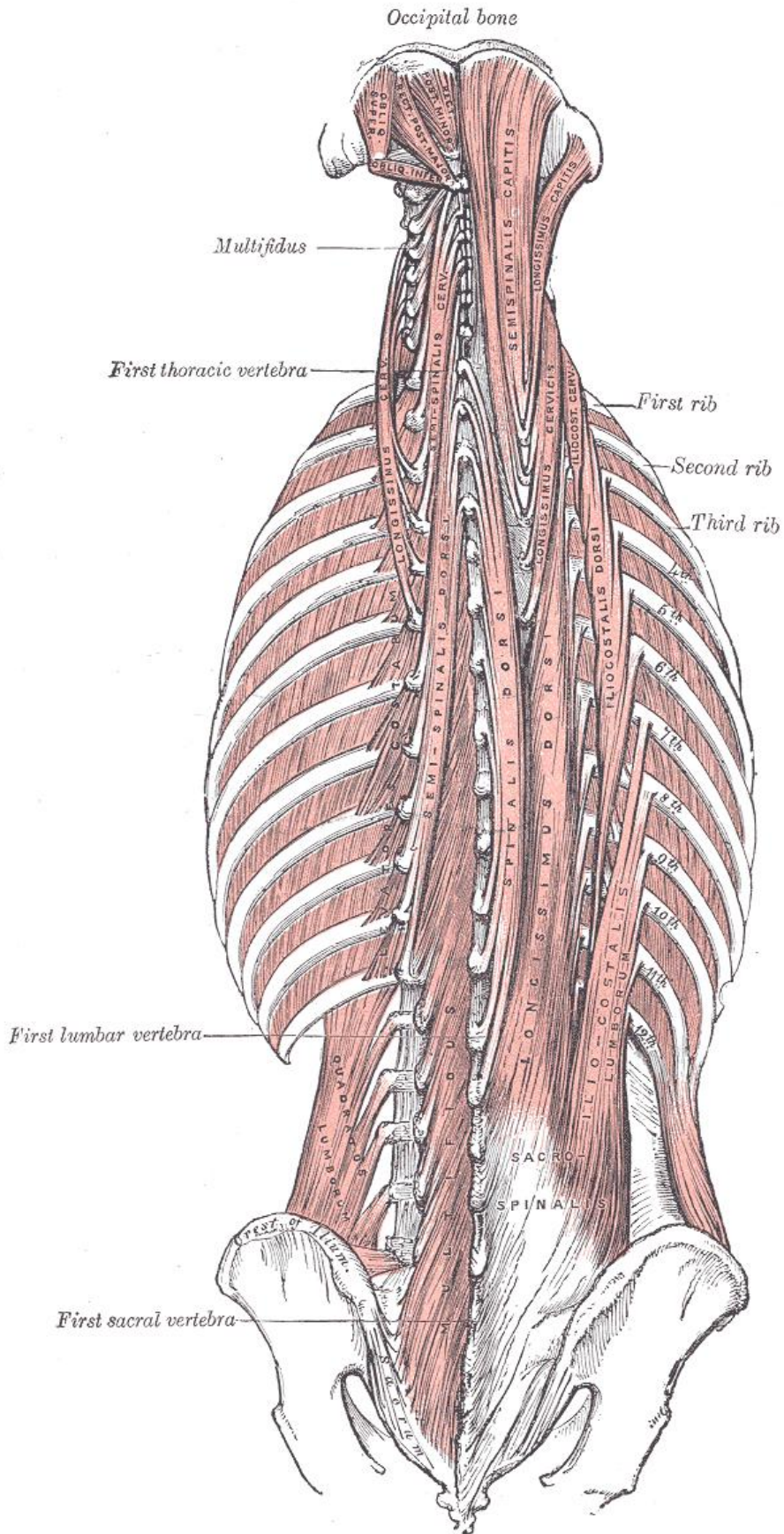
**2.5 Identify and/or describe the basic arrangement, nerve supply and actions of the deep muscles of the back:**

|   | Describe | Nerve supply | Action |
|---|----------|--------------|--------|
| <b>erectores spinae (sacrospinalis)</b><br><b>iliocostalis</b><br><b>lumborum</b><br><b>thoracis</b><br><br><b>longissimus - thoracis</b><br><br><b>spinalis - thoracis</b> |          |              |        |
| <b>transversospinalis</b><br><br><b>semispinalis - thoracis</b><br><br><b>multifidus</b><br><br><b>rotatores</b>  |          |              |        |
| <b>short segmental muscles</b><br><br><b>interspinalis</b><br><b>intertransversarii</b>   |          |              |        |

**2.6 Distinguish between the roles of the erectores spinae and transversospinalis muscle groups.**



Muscles connecting the upper extremity to the vertebral column



Deep muscles of the back.

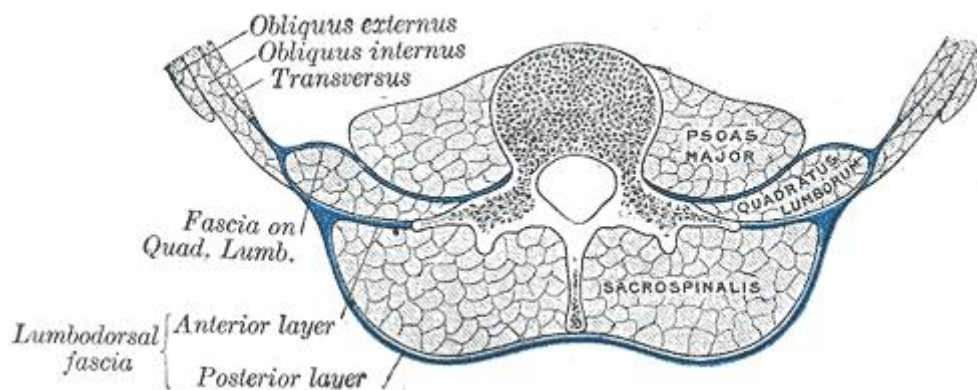


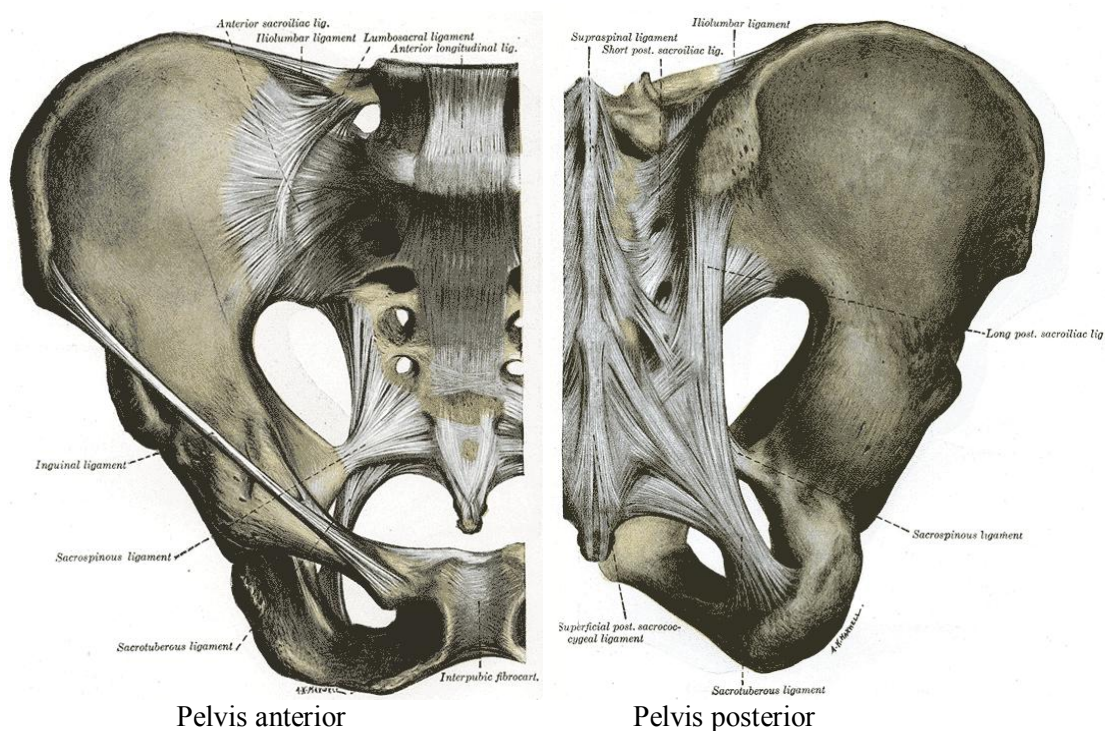
Diagram of a transverse section of the posterior abdominal wall, to show the disposition of the lumbodorsal fascia.

- 2.7 Describe the role of the lumbar fascia.
- 2.8 List those muscles involved in each movement of the vertebral column:
- (i) flexion
  - (ii) extension
  - (iii) lateral flexion - ipsilateral
  - (iv) rotation - ipsilateral and contralateral
- 2.9 Describe the course and distribution of the medial and lateral branches of the dorsal rami of spinal nerves.
- 2.10 Describe the course and distribution of the:
- (i) ventral rami
  - (ii) sympathetic nerves
  - (iii) sinuvertebral nerves
- 2.11 Briefly describe the blood supply to the vertebral body, spinal nerves and the vertebral disc.

### 3. THE PELVIS, PELVIC FLOOR AND PERINEUM

#### 3.1 Describe the osteoligamentous structure of the pelvis:

- (i) hip bones
- (ii) sacrum
- (iii) coccyx
- (iv) major (false) pelvis
- (v) minor (true) pelvis
- (vi) pelvic inlet
- (vii) pelvic outlet
- (viii) sacral promontory
- (ix) sacrospinous ligament
- (x) sacrotuberous ligament
- (xi) interosseus sacroiliac ligaments



#### 3.2 Identify and classify the following joints of the pelvis:

- (i) pubic symphysis
- (ii) sacro-iliac
- (iii) sacro-coccygeal

#### 3.3 Orientate the pelvis (when one is standing erect).

#### 3.4 Describe the functions of the sacrotuberous, sacrospinous and interosseus sacroiliac ligaments.

#### 3.5 Identify the muscles of the pelvic wall:

- (i) piriformis
- (ii) obturator internus

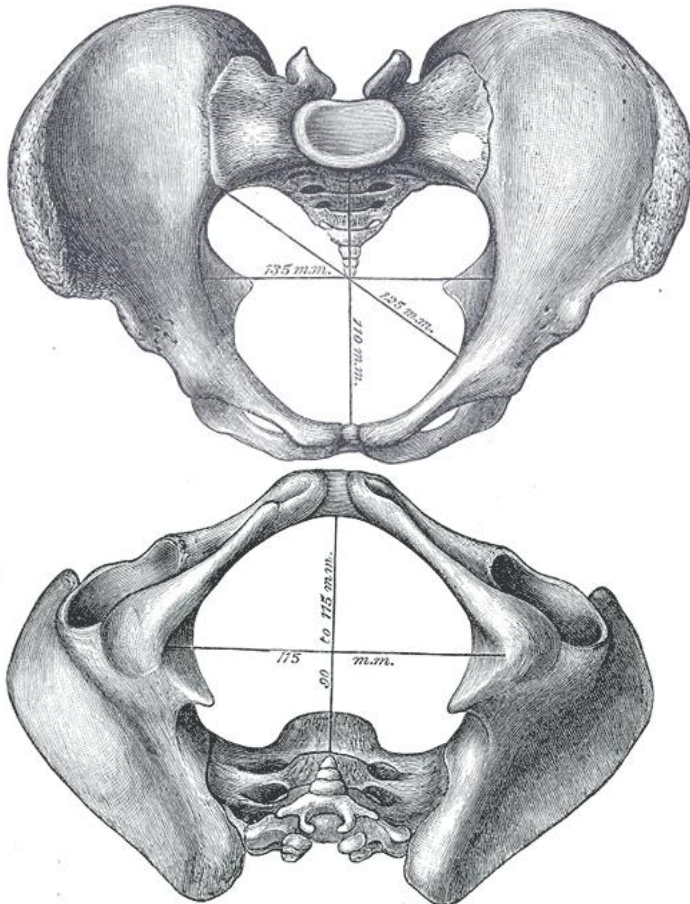
3.6 List the functions of the true pelvis.

3.7 Describe the diameters of the true pelvis:

- (i) conjugate (anteroposterior)
- (ii) transverse
- (iii) oblique

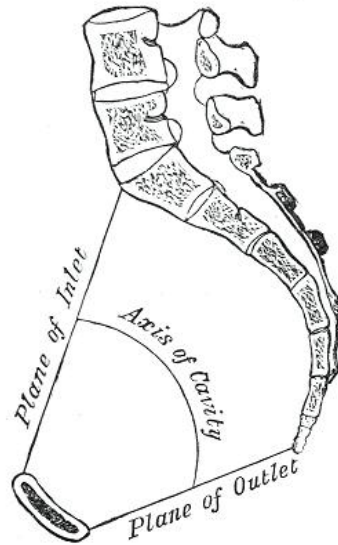
3.8 Classify pelvis with respect to shape of inlet:

- (i) anthropoid
- (ii) gynecoid
- (iii) platypelloid
- (iii) android



3.9 Describe the axis of the birth canal and identify/describe the following measurements important in radiographic pelvimetry to predict difficulty during parturition:

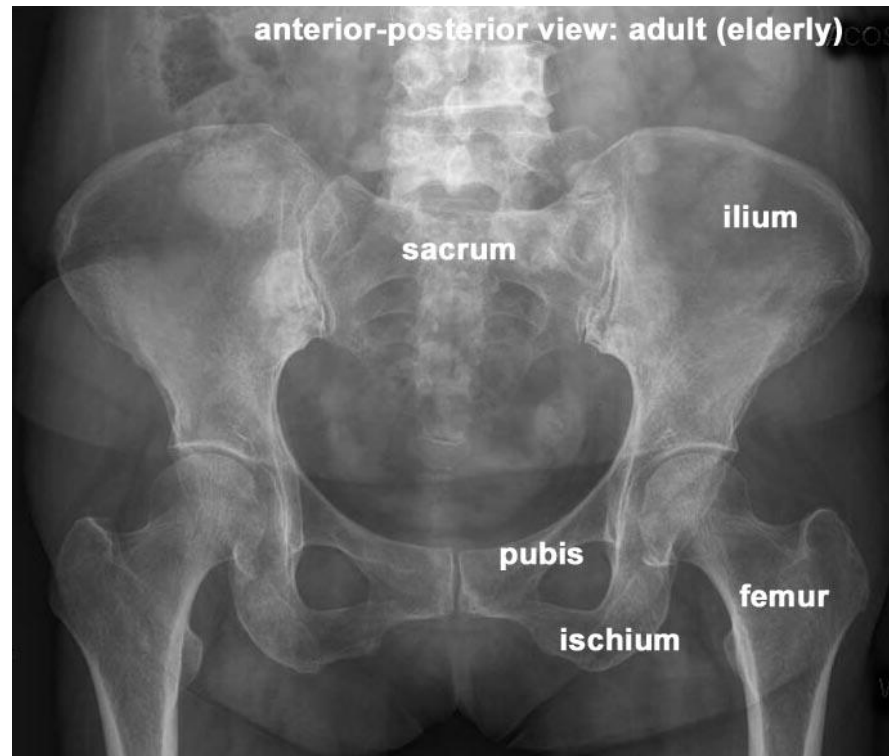
- (i) transverse diameter of inlet
- (ii) obstetric conjugate
- (iii) distance between ischial spines
- (iv) posterior sagittal diameter



3.10 In terms of the conjugate (anteroposterior), transverse, and oblique diameters of the pelvis, describe the critical differences between the bony structure of male and female pelvis for the function of child-bearing.

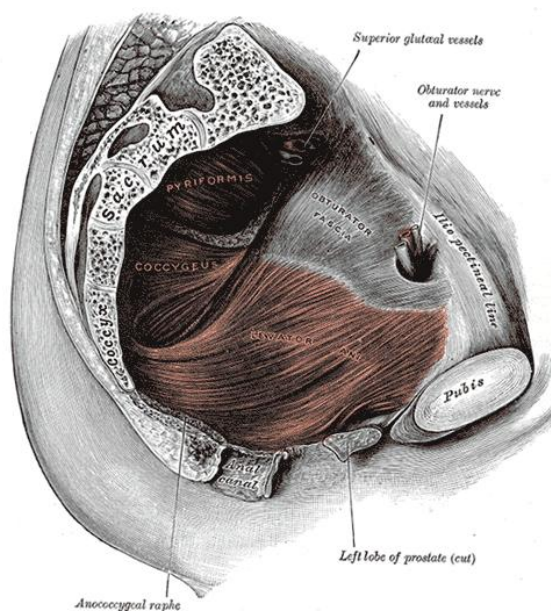
3.11 On radiographs of the pelvis, find:

- (i) sacroiliac joint
- (ii) hip joint
- (iv) iliac crest
- (v) anterior superior iliac spine
- (vi) inferior pubic ramus
- (vii) superior pubic ramus
- (viii) pubic symphysis
- (ix) obturator foramen
- (x) greater trochanter
- (xi) articular surface of acetabulum
- (xii) spinous process of L5
- (xiii) ischial tuberosity
- (xiv) dorsal sacral foramen



**3.12 Identify/describe and state the functions of the muscles of the pelvic floor:**

- (i) **pubococcygeus**
- (ii) **puborectalis**
- (iii) **iliococcygeus**
- (iv) **pubovaginalis**
- (v) **sphincter vaginae**
- (vi) **coccygeus**



Left Levator ani from within.



3.13 Identify the perineum and its divisions:

- (i) anal triangle
- (ii) urogenital triangle

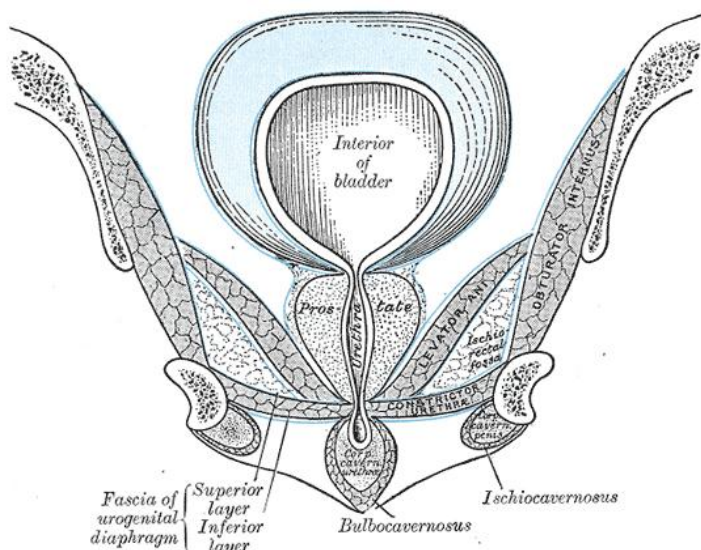
3.14 Identify the perineal body and state its function(s).

3.15 Identify and state the functions of the components of the anal triangle:

- (i) ischioanal fossa
- (ii) anus
- (iii) external anal sphincter

3.16 Identify and state the functions of the components of the urogenital triangle:

- (i) superficial perineal space
    - superficial transverse space
    - ischiocavernosus muscle
    - bulbospongiosus muscles
    - root of penis/female external genital organs
  - (ii) deep perineal space
    - deep transverse perineal muscle
    - sphincter urethrae
- urogenital  
diaphragm



**REFERENCE**

Moore, K L and Daley: Clinically Oriented Anatomy (5<sup>th</sup> Edn), Lippincott, Williams and Wilkins, Baltimore, 2005 (ISBN 0-7817-3639-0)

#### **4. SURFACE ANATOMY OF THE LUMBAR REGION**

- 4.1 Demonstrate on a living subject, the principal bony features of the lumbar region:**
- (i) L4-5 spinous processes - the L4-5 interspace lies at the same level as the superior part of the iliac crests.**
  - (ii) L4-1 spinous processes - move superiorly to palpate L1-4 spinous processes.**
  - (iii) S2 spinous process lies on the middle of a line drawn between the posterior superior iliac spines.**
- 4.2 Palpate the following structures posteriorly:**
- (i) L3-4 disc space - lies at the level of the umbilicus.**
  - (ii) L5-S1 articulation - located just below the umbilicus (gently, but with increasing pressure, push into the abdomen through the linea alba while encouraging the subject to relax).**
  - (iii) supraspinous ligaments - palpate down the line of the spinous processes. Note any tenderness and thickening.**
- 4.3 To palpate the sciatic nerve, ask the subject to lie on their side and flex their uppermost hip. Locate the midpoint between the ischial tuberosity and the greater trochanter.**
- 4.4 Demonstrate the erector spinae on a living subject by making them stand out.**
- 4.5 The Pelvic Region:**
- (i) pubic tubercles - with your fingers anchored on the greater trochanter, move your thumbs along the inguinal creases medially and obliquely downward until you can palpate the pubic tubercles (they are at the same level as the greater trochanters).**
  - (ii) SIJ - an imaginary line drawn between the PSISs crosses the centre of the SIJ.**

#### **REFERENCE**

Hoppenfeld, S., **Physical Examination of the Spine and Extremities**, Appleton Century Crofts, 2005.

## 5. BONES, MUSCLES, JOINTS & NERVES OF THE THORACIC REGION

5.1 Identify the bones and cartilages of the upper thoracic region:

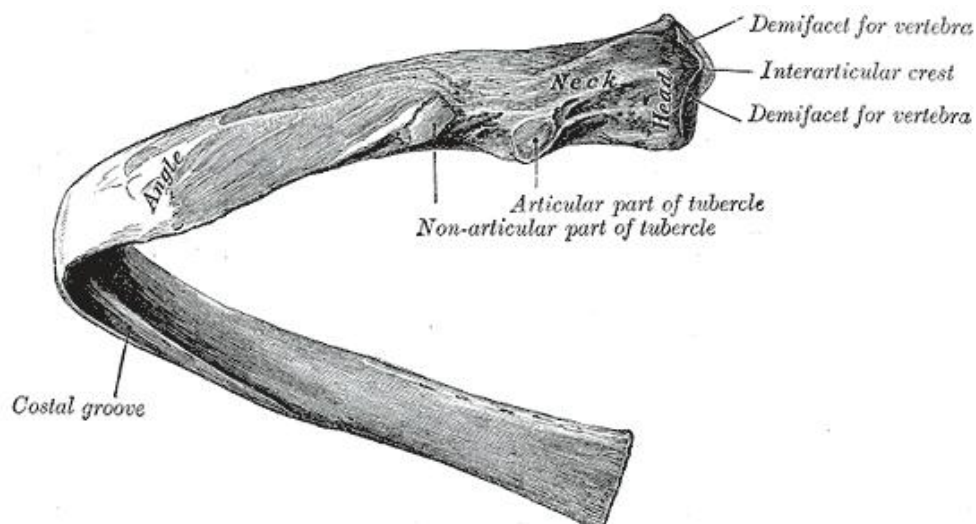
- (i) ribs
- (ii) costal cartilages
- (iii) vertebrae
- (iv) intervertebral discs
- (v) sternum

5.2 On the sternum identify:

- (i) manubrium
  - jugular notch
  - clavicular notch
  - facet for 1st costal cartilage
- (ii) sternal angle (fibrocartilaginous joint)
  - facet for 2nd costal cartilage
- (iv) body
  - facet for 3rd-7th costal cartilages
- (v) xiphoid process

5.3 On the ribs identify:

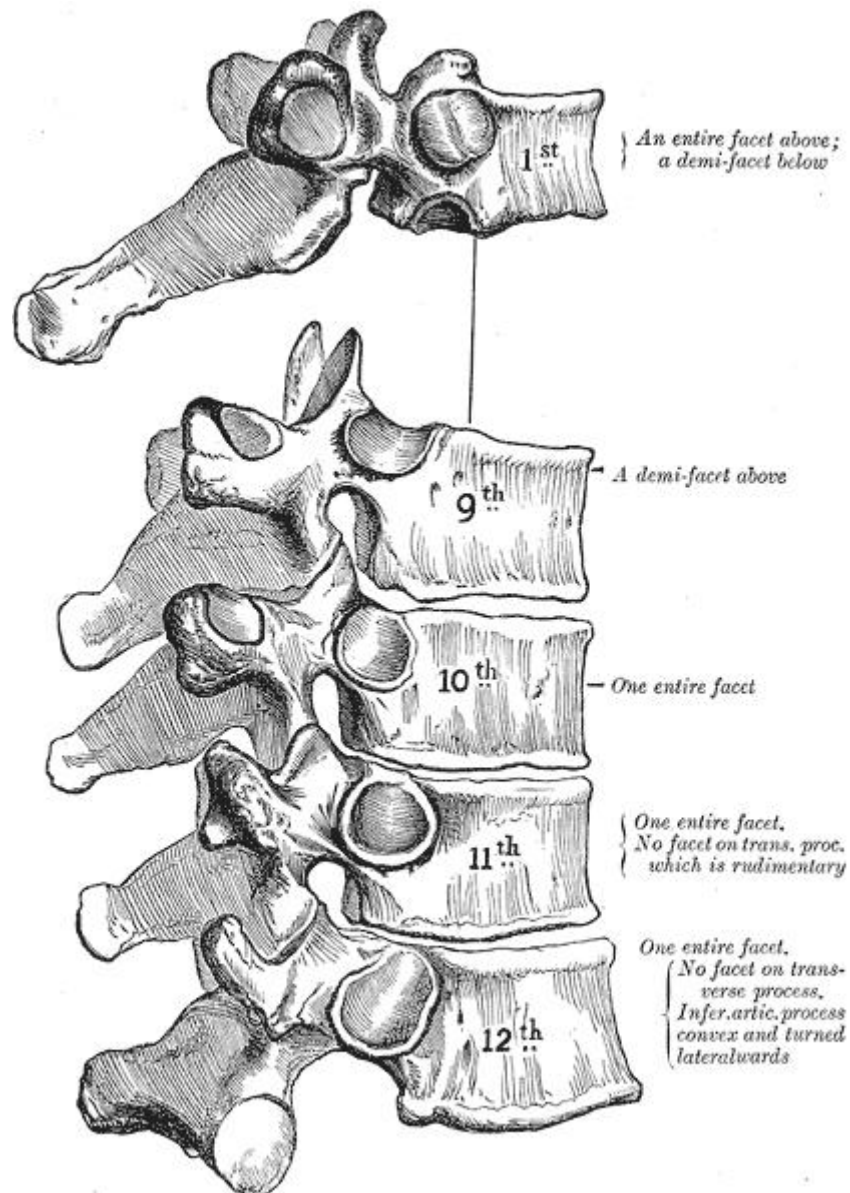
- (i) head
- (ii) neck
- (iii) tubercle
- (iv) angle
- (v) shaft
- (vi) attachment of costal cartilage



A central rib of the left side, viewed from behind.

5.4 On a typical thoracic vertebrae identify:

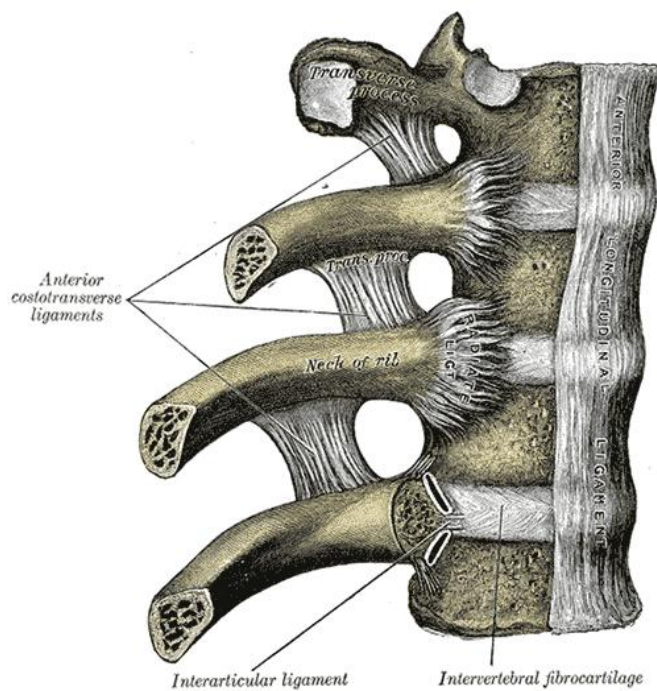
- (i) spinous process
- (ii) lamina
- (iii) superior articular facet
- (iv) transverse process with costal facet
- (v) pedicle
- (vi) vertebral foramen
- (vii) inferior articular facet
- (viii) superior costal facet
- (ix) inferior costal facet

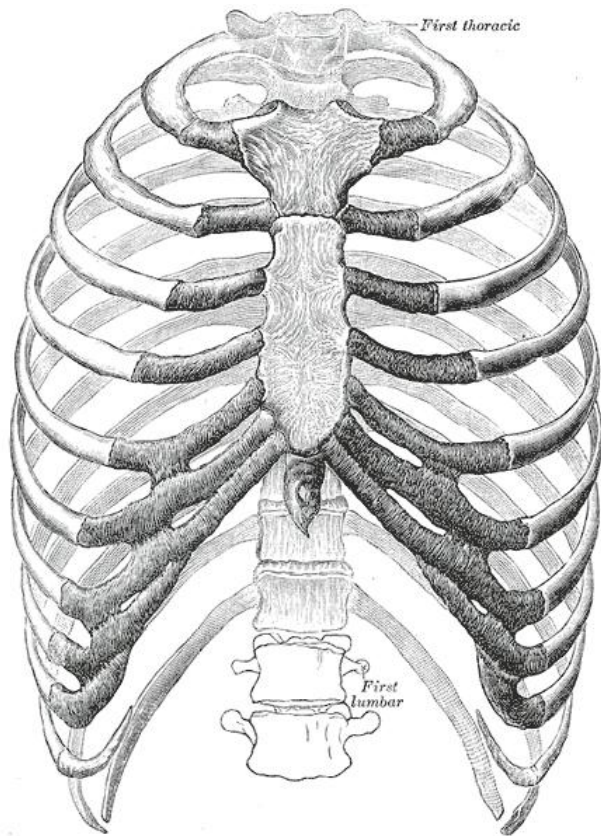


5.5 Distinguish between and list the true, false and floating ribs.

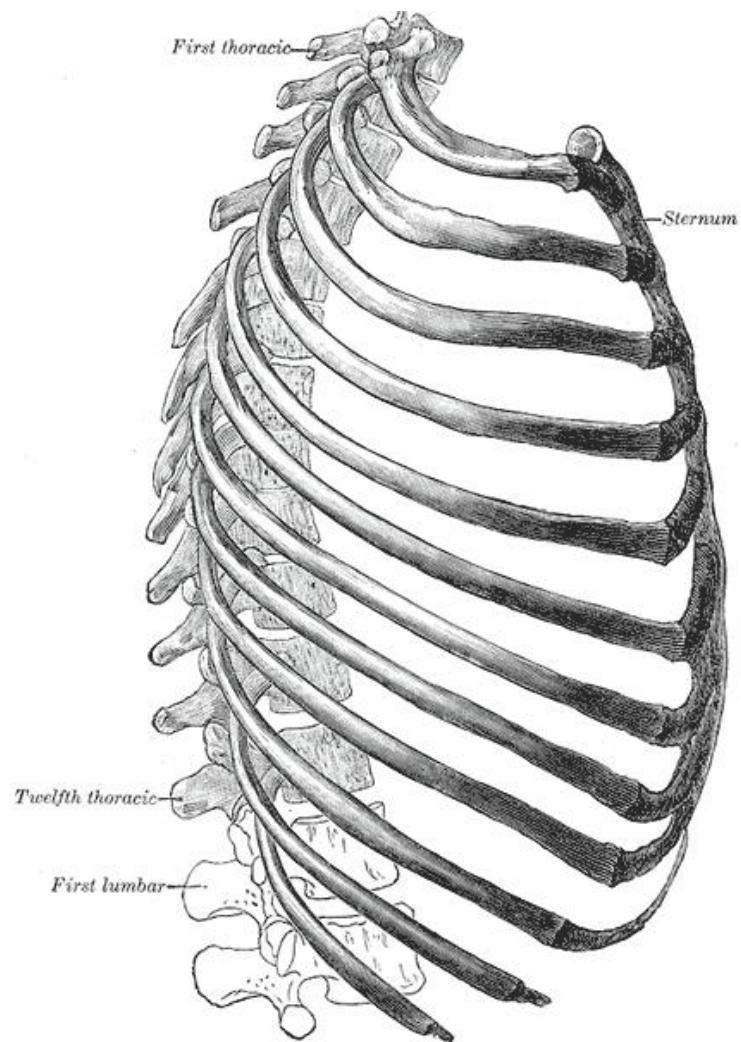
5.6 Identify, classify, and describe certain features and the movements at the following joints:

- Costovertebral
  - (i) articular surface
  - (ii) ligaments
    - radiate
    - intraarticular
- Costotransverse
  - (i) articular surfaces
  - (ii) ligaments
    - superior costotransverse
    - costotransverse
    - lateral costotransverse
- Sternocostal
  - (i) articular surfaces
  - (ii) ligaments
    - (radiate) sternocostal
    - intra-articular
    - costoxiphoid
- Costochondral
- Interchondral
- Manubriosternal
- Xiphisternal





Anterior view of the thoracic cage



The thoracic cage from the right

- 5.7 On a radiograph of the thoracic region, find:**
- (i) 24 ribs**
  - (ii) 12 thoracic vertebrae**
  - (iii) C7**
  - (iv) L1**
  - (v) Thoracic spinous processes**
  - (vi) Costovertebral joints**
  - (vii) Shadow of the heart**
  - (viii) Shadow of the aorta**
  - (ix) Shadow of the diaphragm**



5.8 Identify and state the attachments, actions and nerve supply of the muscles of respiration:

|  | <b>Origin</b> | <b>Insertion</b> | <b>Action</b> | <b>Nerve Supply</b> |
|--|---------------|------------------|---------------|---------------------|
| <b>External Intercostals</b><br><b>Internal Intercostals</b> |               |                  |               |                     |
| <b>Subcostales</b>   |               |                  |               |                     |
| <b>psoas minor</b>   |               |                  |               |                     |
| <b>Transversus Thoracis</b>                                  |               |                  |               |                     |
| <b>Diaphragm</b>   |               |                  |               |                     |
| <b>Levatores Costarum</b>                                    |               |                  |               |                     |
| <b>Scalenes Anterior</b>                                     |               |                  |               |                     |
| <b>Scalenes Medius</b>                                       |               |                  |               |                     |
| <b>Scalenes Posterior</b>                                    |               |                  |               |                     |

5.8 Identify and/or describe the basic arrangement, nerve supply and actions of the muscles of the upper back:

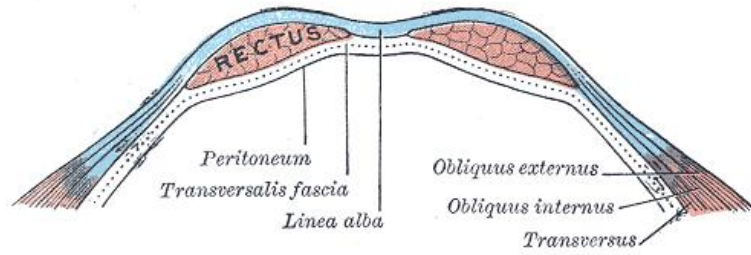
|                                    | <b>Origin</b> | <b>Insertion</b> | <b>Action</b> | <b>Nerve Supply</b> |
|------------------------------------|---------------|------------------|---------------|---------------------|
| Intermediate Layer                 |               |                  |               |                     |
| <b>Serratus Posterior Superior</b> |               |                  |               |                     |
| <b>Serratus Posterior Superior</b> |               |                  |               |                     |
| Deep Layer<br>Erectores Spinae     |               |                  |               |                     |

|                                  |  |  |  |  |
|----------------------------------|--|--|--|--|
| (Sacrospinalis)                  |  |  |  |  |
| <b>Spinalis Thoracis</b>         |  |  |  |  |
| <b>Longissimus Thoracis</b>      |  |  |  |  |
| <b>Iliocostalis Thoracis</b>     |  |  |  |  |
| <b>Iliocostalis Lumborum</b>     |  |  |  |  |
| Transversospinalis               |  |  |  |  |
| <b>Semispinalis Thoracis</b>     |  |  |  |  |
| <b>Multifidus</b>                |  |  |  |  |
| <b>Deep Multifidus/Rotatores</b> |  |  |  |  |
| Short Segmental Muscles          |  |  |  |  |
| <b>Interspinales</b>             |  |  |  |  |
| <b>Intertransversarii</b>        |  |  |  |  |

5.10 Distinguish between the roles of the erectores spinae and transversospinalis muscle groups.

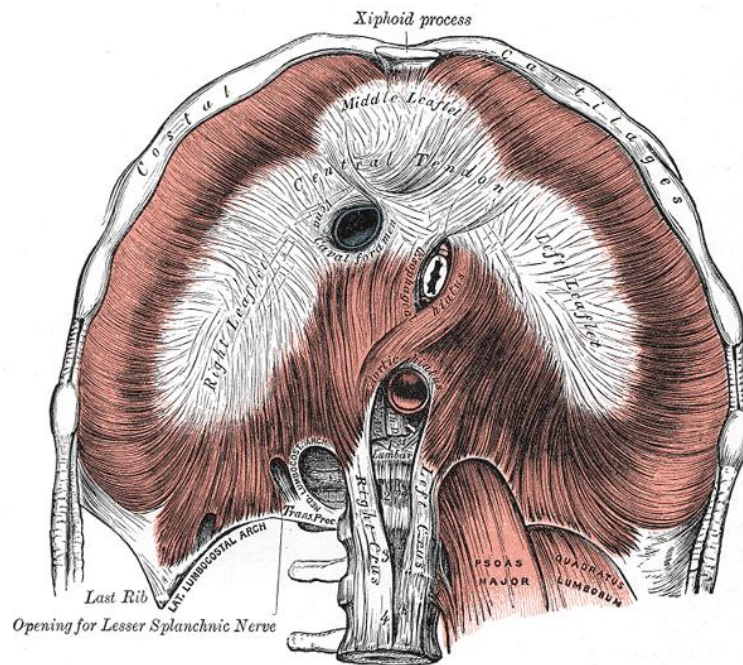
5.11 Identify, describe the attachments and deduce the action(s) of the muscles of the anterolateral abdominal wall:

|                             | Origin | Insertion | Action | Nerve Supply |
|-----------------------------|--------|-----------|--------|--------------|
| <b>Rectus Abdominis</b>     |        |           |        |              |
| <b>External Oblique</b>     |        |           |        |              |
| <b>Internal Oblique</b>     |        |           |        |              |
| <b>Transverse Abdominis</b> |        |           |        |              |
| <b>Pyramidalis</b>          |        |           |        |              |



5.12 Identify and describe the structure and significance of:

- (i) linea alba
- (ii) inguinal ligament
- (iii) umbilicus
- (iv) inguinal canal
- (v) diaphragm



The diaphragm. Under surface

5.13 Identify and describe the attachments and deduce the action(s) of the muscles of the posterior abdominal wall:

| Muscle             | Origin | Insertion | Action | Nerve Supply |
|--------------------|--------|-----------|--------|--------------|
| Quadratus Lumborum |        |           |        |              |

|                    |  |  |  |  |
|--------------------|--|--|--|--|
| <b>Iliacus</b>     |  |  |  |  |
| <b>Psoas Major</b> |  |  |  |  |
| <b>Psoas Minor</b> |  |  |  |  |

5.14 Describe the means by which, and the directions in which, the thoracic diameters are altered during inspiration and expiration.

5.15 Define and demonstrate "bucket handle" movements of the thoracic cage and their respective roles in the mechanics of respiration.

5.16 List the muscles responsible for:

| <b>Function</b>    | <b>Muscles</b> |
|--------------------|----------------|
| Quiet Inspiration  |                |
| Deep Inspiration   |                |
| Forced Inspiration |                |
| Quiet Expiration   |                |

5.17 Describe the course and distribution of the medial and lateral branches of the dorsal rami of the spinal nerves.

**5.18 Indicate the following surface markings on a living subject:**

- (i) **sternum**  
- **manubrium**  
- **jugular notch**

- clavicular notch
- body
- angle
- xiphoid
- (ii) costal cartilages
- (iii) ribs 1->12
- (iv) T1->12

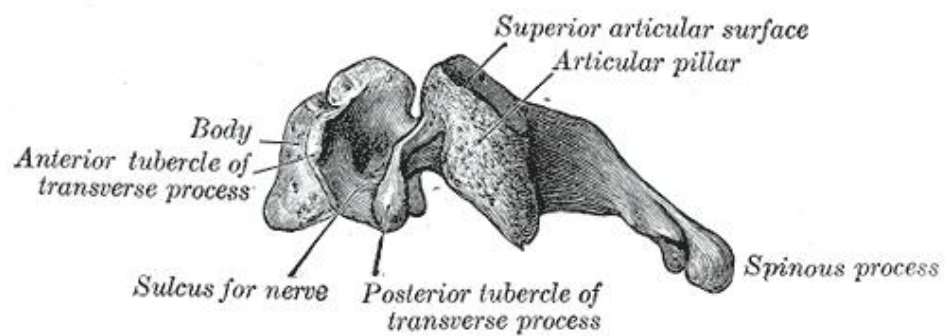
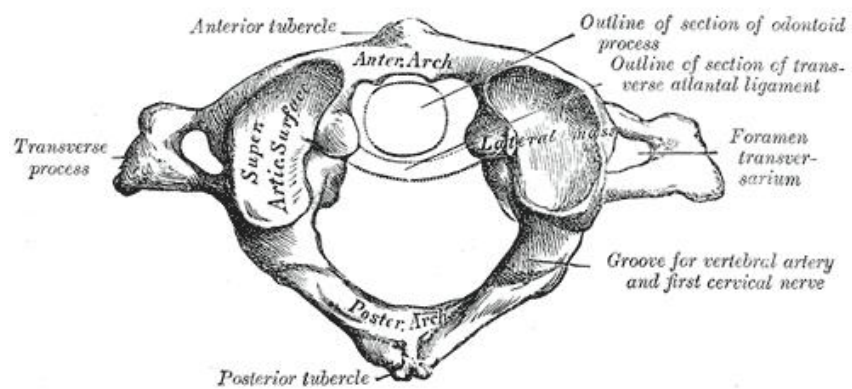
## ACTIVITIES

- List those muscles involved in each movement of the vertebral column:
  - flexion
  - extension
  - lateral flexion - ipsilateral
  - rotation - ipsilateral and contralateral
- Relate the orientation of the zygapophyseal joints to their function and to mobilisation techniques used in the treatment of the thoracic spine.
- Determine the direction of combined movements that take place in the thoracic spine with flexion and extension.
- Review features from a subjective examination that would assist in the differential diagnosis of acute chest pain

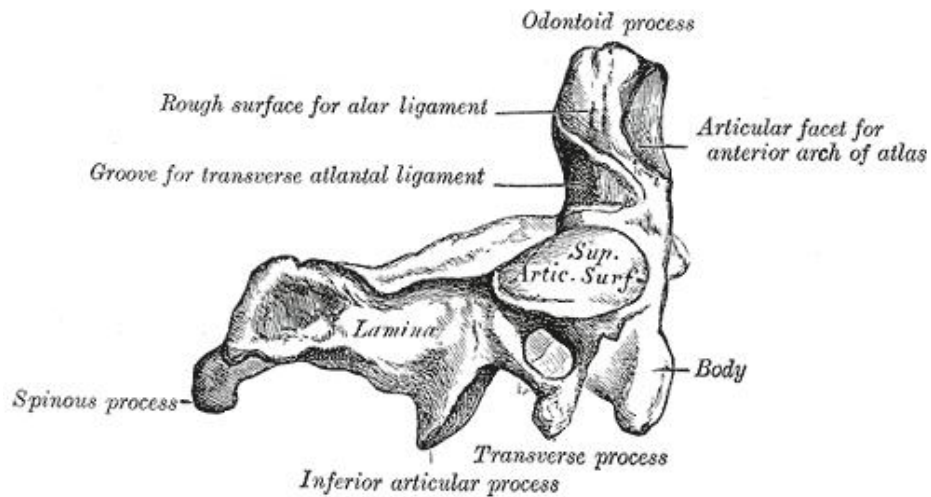
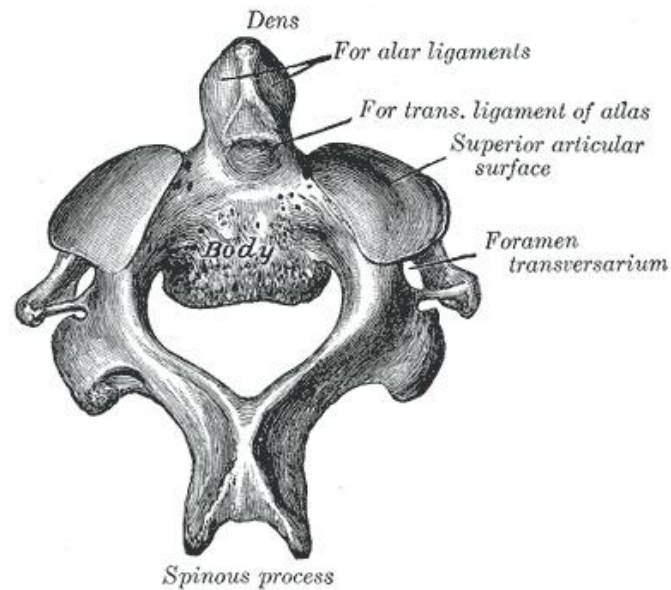
6. **BONES, MUSCLES, JOINTS & NERVES OF THE CERVICAL SPINE**  
 6.1 Identify the main features of the upper cervical vertebrae.

- (i) **Atlas (C1)**
- lateral mass
  - superior & inferior articular facets
  - anterior & posterior arches
  - anterior tubercle
  - facet for dens
  - groove for vertebral artery
  - tubercle for transverse ligament

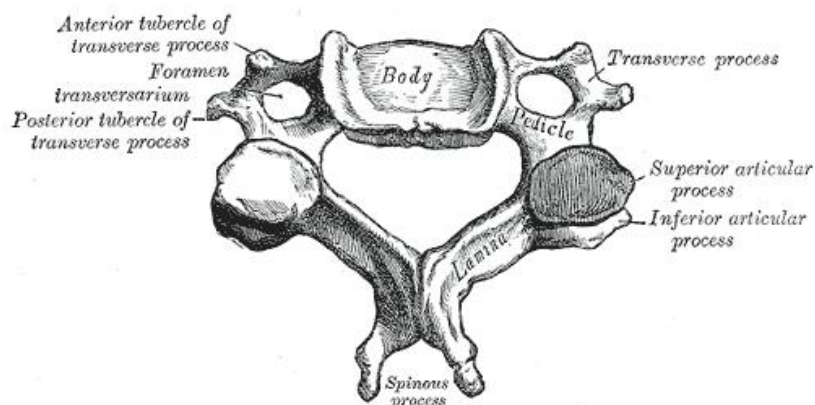
transverse foramen  
 vertebral foramen



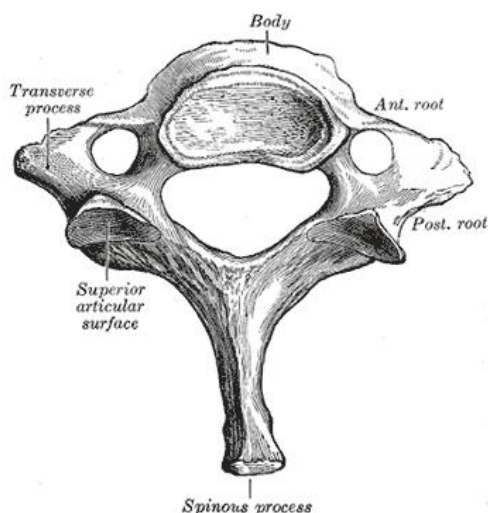
- (ii) **Axis (C2)**  
 - dens (odontoid process)  
 - transverse process  
 - superior & inferior articular facet



- (iii) **C3-C7**  
 superior & inferior articular facets  
 vertebral foramen  
 uncinate process



What level are these vertebrae (above and below)



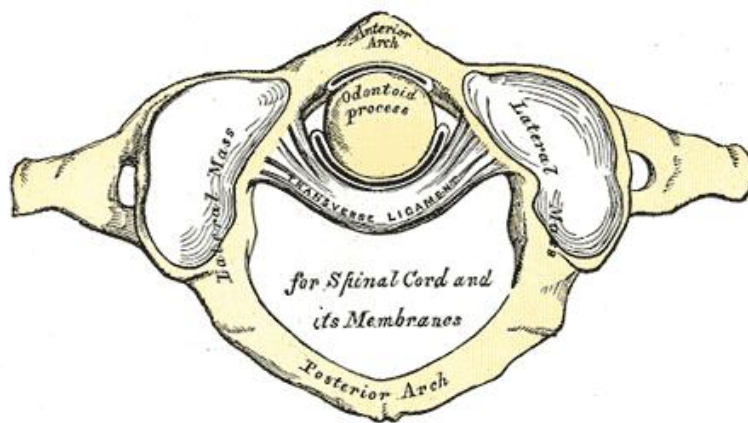
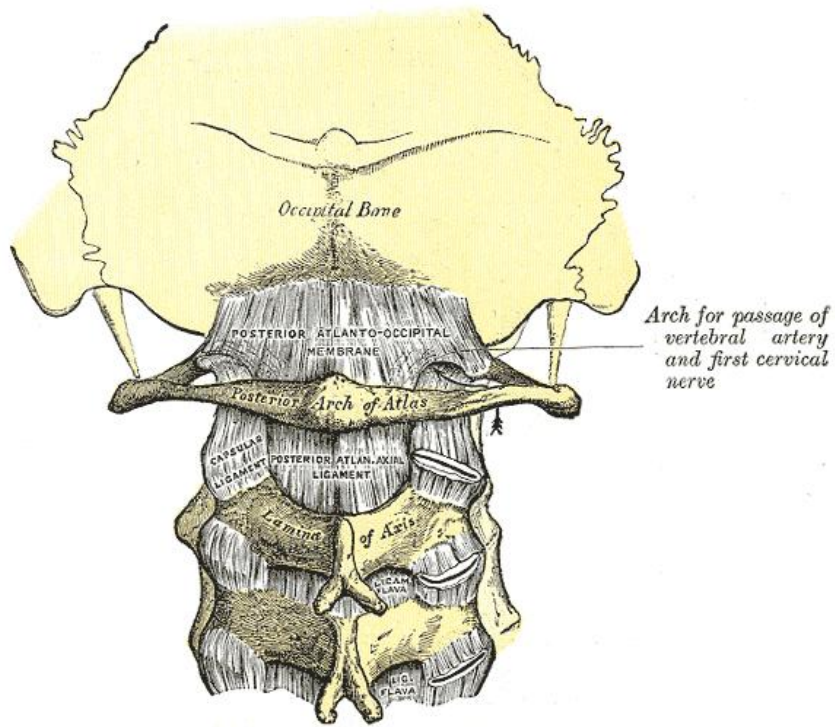
**6.2 Identify, classify and describe the movements at the following joints:**

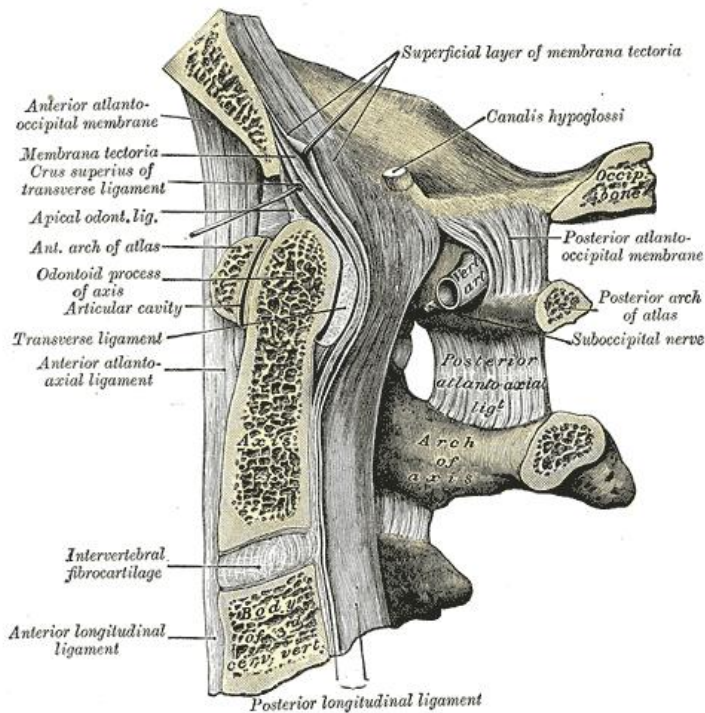
- (i) **atlanto-occipital**
- (ii) **atlanto-axial (median & lateral)**

**6.3 Identify and describe the structure, location and function of the following ligaments/membranes of the cervical spine:**

- (i) **atlanto-occipital membranes**
  - anterior
  - posterior
- (ii) **transverse ligament**
- (iii) **cruciform ligament**
- (iv) **alar ligaments**
- (v) **tectorial membrane**
- (vi) **apical ligament**
- (vii) **anterior longitudinal ligament**
- (viii) **ligamenta flava**
- (ix) **posterior longitudinal ligament**
- (x) **interspinous ligament**
- (xi) **supraspinous ligament (and ligamentum nuchae)**
- (xii) **intertransverse ligament**







- 6.4 Identify, classify and state the functions of the zygapophyseal (facet) joints.
- 6.5 Describe the position and function of the joints of Luschka (uncovertebral joints).
- 6.6 Describe the structure and function of the intervertebral disc and its components:
- (i) anulus fibrosus
  - (ii) nucleus pulposus
- 6.7 Identify the superficial muscles of the back of the neck listing their general attachments and nerve supply:

| Muscle             | Origin | Insertion | Action | Nerve supply |
|--------------------|--------|-----------|--------|--------------|
| trapezius *        |        |           |        |              |
| levator scapulae * |        |           |        |              |
| splenius capitus * |        |           |        |              |
| splenius cervicis  |        |           |        |              |

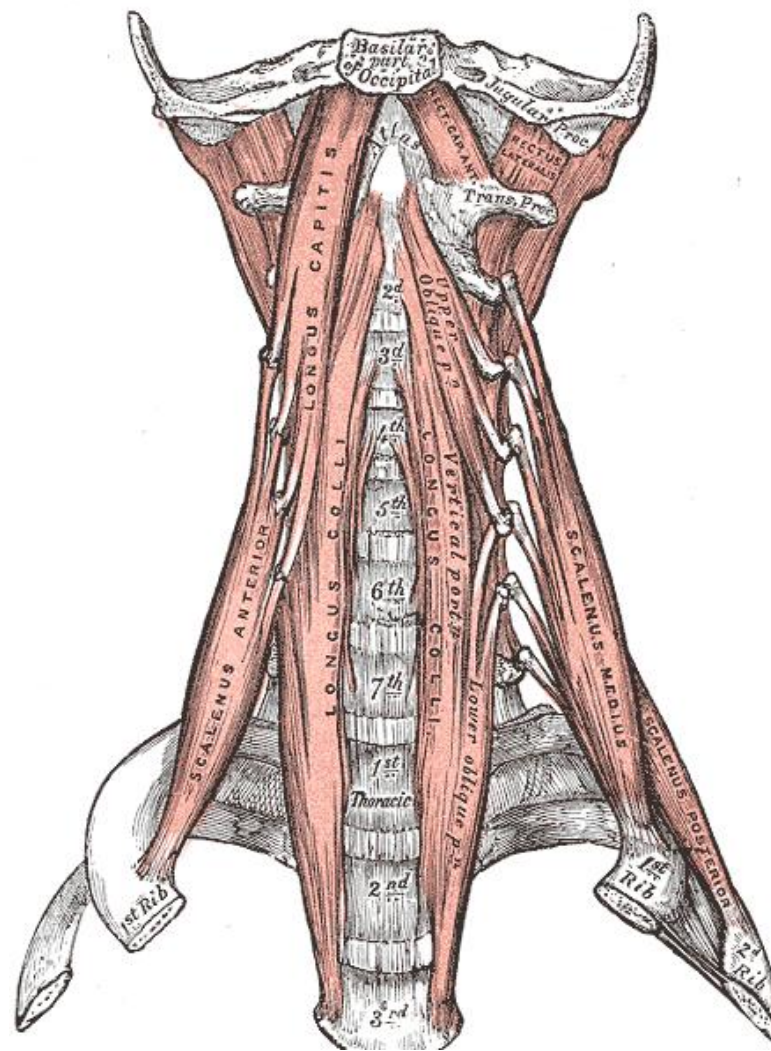
**6.8 Identify and state the actions and nerve supply of the deep muscles of the neck:**

| <b>Muscle</b>   | <b>Origin</b> | <b>Insertion</b> | <b>Action</b> | <b>Nerve supply</b> |
|---|---------------|------------------|---------------|---------------------|
| <b>erector spinae</b> <ul style="list-style-type: none"> <li>▪ iliocostalis cervicis</li> <li>▪ longissimus               <ul style="list-style-type: none"> <li>○ capitus</li> <li>○ cervicis</li> </ul> </li> </ul> <b>spinalis</b> <ul style="list-style-type: none"> <li>▪ capitus<br/>(semispinalis capitus)<br/>*</li> <li>▪ cervicis</li> </ul>            |               |                  |               |                     |
| <b>transversospinalis</b> <ul style="list-style-type: none"> <li>▪ semispinalis               <ul style="list-style-type: none"> <li>○ cervicis</li> <li>○ capitus<br/>*</li> </ul> </li> <li>▪ multifidus</li> <li>▪ rotatores cervicis<br/>(rarely present)</li> </ul>  |               |                  |               |                     |
| <b>intersegmental muscles</b> <ul style="list-style-type: none"> <li>▪ interspinales</li> <li>▪ intertransversarii</li> <li>▪ suboccipital muscles *</li> <li>▪ rectus capitus posterior major</li> <li>▪ rectus capitus posterior minor</li> <li>▪ oblique capitus inferior (inferior oblique)</li> <li>▪ oblique capitus superior (superior oblique)</li> </ul> |               |                  |               |                     |

**6.9 Identify and briefly list the attachments and state the actions and nerve supply of the muscles of the front of the neck:**

|   | <b>Origin</b> | <b>Insertion</b> | <b>Action</b> | <b>Nerve supply</b> |
|---|---------------|------------------|---------------|---------------------|
| <b>(i) sternocleidomastoid *</b>              |               |                  |               |                     |
| <b>(ii) scalene muscles</b>                   |               |                  |               |                     |
| ▪ <b>anterior</b>                             |               |                  |               |                     |
| ▪ <b>medius</b>                               |               |                  |               |                     |
| ▪ <b>posterior</b>                            |               |                  |               |                     |
| <b>(iii) infrahyoid muscles</b>               |               |                  |               |                     |
| ▪ <b>thyrohyoid</b>                           |               |                  |               |                     |
| ▪ <b>sternohyoid</b>                          |               |                  |               |                     |
| ▪ <b>sternothyroid</b>                        |               |                  |               |                     |
| ▪ <b>omohyoid</b>                             |               |                  |               |                     |
|   |               |                  |               |                     |
| <b>(iv) suprahyoid muscles</b>                |               |                  |               |                     |
| ▪ <b>digastric (anterior &amp; posterior)</b> |               |                  |               |                     |
| ▪ <b>mylohyoid</b>                            |               |                  |               |                     |
| ▪ <b>stylohyoid</b>                           |               |                  |               |                     |

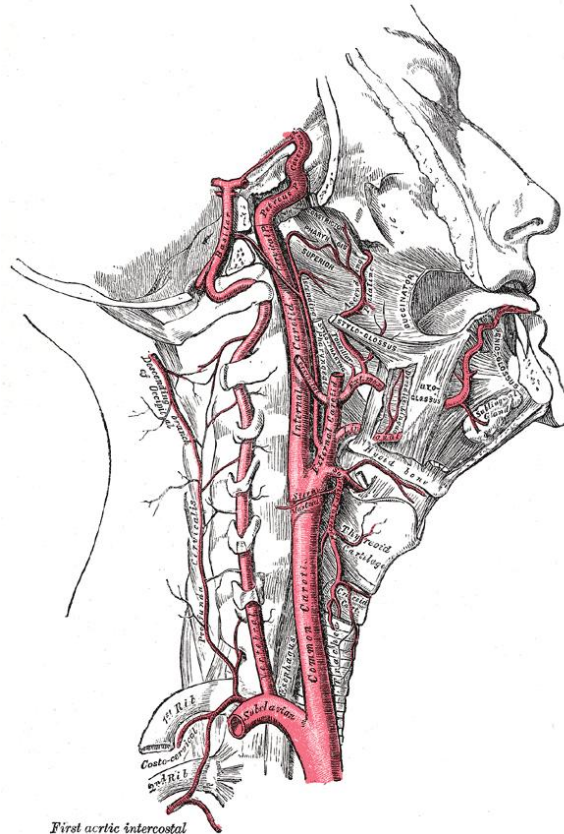




The anterior vertebral muscles.



- 6.14** List the distinguishing features of a typical vertebra from cervical, thoracic and lumbar regions of the vertebral column. (see Table 1).
- 6.15** Describe the pattern of:
- (i) degenerative pathology
  - (ii) joint injury following motor vehicle accidents in the cervical spine.
- 6.16** Identify and describe the course of the vertebral artery.



- 6.17** On an x-ray of the cervical spine find:
- (i) spinous processes C1 – C7
  - (ii) vertebral bodies C1 – C7
  - (iii) Discs are present at which levels?
  - (iv) The dens
  - (v) The mandible
  - (vi) the hyoid bone
  - (vii) facet joints
  - (viii) disc spaces are what shape?
  - (ix) Uncovertebral joints (joints of Luschka)
  - (x) transverse processes
  - (xi) 1<sup>st</sup> rib





Name these views.



## ACTIVITIES

- Deduce a method of assessing the integrity of the ligaments of the upper cervical spine.
- Relate the orientation of the zygapophyseal joints to mobilisation techniques used in the treatment of the cervical spine.
- What structures should be assessed prior to a manipulation of the cervical spine?
- Review tests available to assess the integrity of the vertebral artery.

## REFERENCES

Bogduk, N (1982): *The clinical Anatomy of the Cervical Dorsal Rami Spine*. 7(4): 319-330.

Twomey, L.T. and Taylor, J.R (1989): *Joints of the Middle & Lower Cervical Spine: Age Changes and Pathology*. Proc. 6th biennial conf. MTAA; 215-220.

Mercer, S and Bogduk, N (1999): *The ligaments and annulus fibrosis of human adult cervical intervertebral discs*. Spine, 24 (7):619-628

## 7. SURFACE ANATOMY OF THE HEAD AND NECK

### 7.1 Palpate on the head of a living subject the following bony prominences:

- (i) external occipital protuberance & nuchal lines of occipital bone
- (ii) frontal bone including its orbital plates
- (iii) parietal bone
- (iv) mastoid, styloid and zygomatic processes and squamous part of the temporal bone
- (v) nasal bone
- (vi) zygomatic bone
- (vii) maxilla and its alveolar process
- (viii) all parts of the mandible

### 7.2 Demonstrate on a living subject:

- Principal bony features of the vertebral column:

- (i) spinous processes of the cervical vertebrae

*NOTE: C1 spinous process can be palpated just below the tip of the mastoid process. C3 spinous process is just above the hyoid bone. C4 spinous is level with the upper part of the thyroid cartilage. C6 spinous process can be palpated when neck is flexed but becomes less prominent as the neck is extended. It is level with the transition of larynx to trachea and pharynx to oesophagus. C7 spinous process is usually the most prominent.*

- (ii) transverse processes of the cervical vertebrae

*NOTE: C2 transverse processes (lateral mass) is found just behind the angle of the mandible.*

- Some joints of the vertebral column:

- (i) zygapophyseal joints at all cervical levels
- (ii) intervertebral discs (anteriorly)

- Palpate the following:

- (i) suboccipital muscle group
- (ii) deep anterior vertebral muscles
- (iv) suprahyoid muscles
- (v) thyroid cartilage
- (vii) scalenes
- (viii) levator scapulae
- (ix) erector spinae

## 8. THE MASTICATORY PROCESS

8.1 Identify and describe the articular surfaces and joint cavity of the temporomandibular joint.

8.2 Delineate the attachments of:

- (i) joint capsule
- (ii) lateral ligament
- (iii) sphenomandibular ligament
- (iv) articular disc

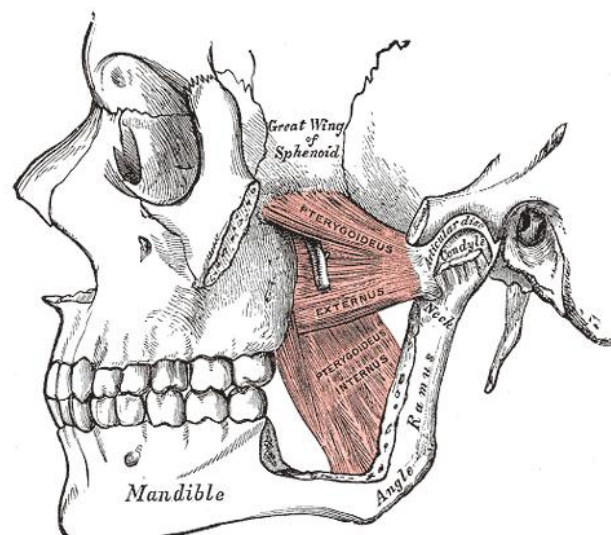
8.3 List and describe the movements at the temporomandibular joint.

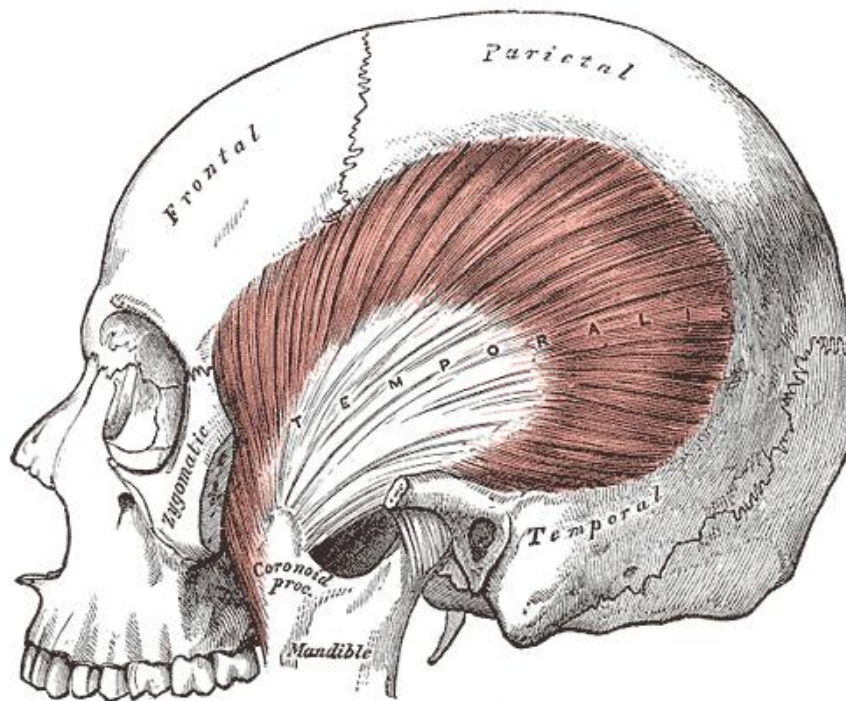
8.4 Describe the arthrokinematic steps that take place during opening and closing of the temporomandibular joint.

8.5 Identify, list the attachments of, and state the nerve supply to the main muscles of mastication:

|   | Origin | Insertion | Nerve supply |
|---|--------|-----------|--------------|
| (i) temporalis<br>(posterior fibres;<br>oblique fibres) |        |           |              |
| (ii) masseter   |        |           |              |
| (iii) medial<br>pterygoid                               |        |           |              |
| lateral pterygoid                                       |        |           |              |

The Pterygoidei; the zygomatic arch and a portion of the ramus of the mandible have been removed





8.6 State the actions of temporalis, masseter, medial pterygoid, and lateral pterygoid and group them with respect to the temporomandibular joint movements.

|                          | Action | Works together with | Function |
|--------------------------|--------|---------------------|----------|
| <b>Temporalis</b>        |        |                     |          |
| <b>Masseter</b>          |        |                     |          |
| <b>medial pterygoid</b>  |        |                     |          |
| <b>lateral pterygoid</b> |        |                     |          |

8.7 State the function of the above muscles (ie. deduce this from recent cadaver findings regarding muscles attachments).

8.8 List the factors conferring stability at this joint.

8.9 Describe the pattern of pathology occurring at the temporomandibular joint (extracapsular/intracapsular).

**8.10 Identify and list the attachments, actions and nerve supply of the extrinsic muscles of the tongue:**

|                           | <b>Origin</b> | <b>Insertion</b> | <b>Action</b> | <b>Nerve Supply</b> |
|---------------------------|---------------|------------------|---------------|---------------------|
| <b>(i) genioglossus</b>   |               |                  |               |                     |
| <b>(ii) hyoglossus</b>    |               |                  |               |                     |
| <b>(iii) styloglossus</b> |               |                  |               |                     |
| <b>(iv) palatoglossus</b> |               |                  |               |                     |

**8.11 Identify and describe the course in the head and or neck and state the specific functions of the following cranial nerves and their branches:**

- (i) trigeminal**
  - **ophthalmic**
  - **maxillary**
  - **mandibular (muscular, inferior alveolar, lingual)**
- (2) hypoglossal**

**ACTIVITIES**

•Deduce a regime of stabilisation exercises for the temporomandibular joint.

•What structures should be considered when assessing a patient who presents with temporomandibular joint dysfunction ?

**REFERENCES**

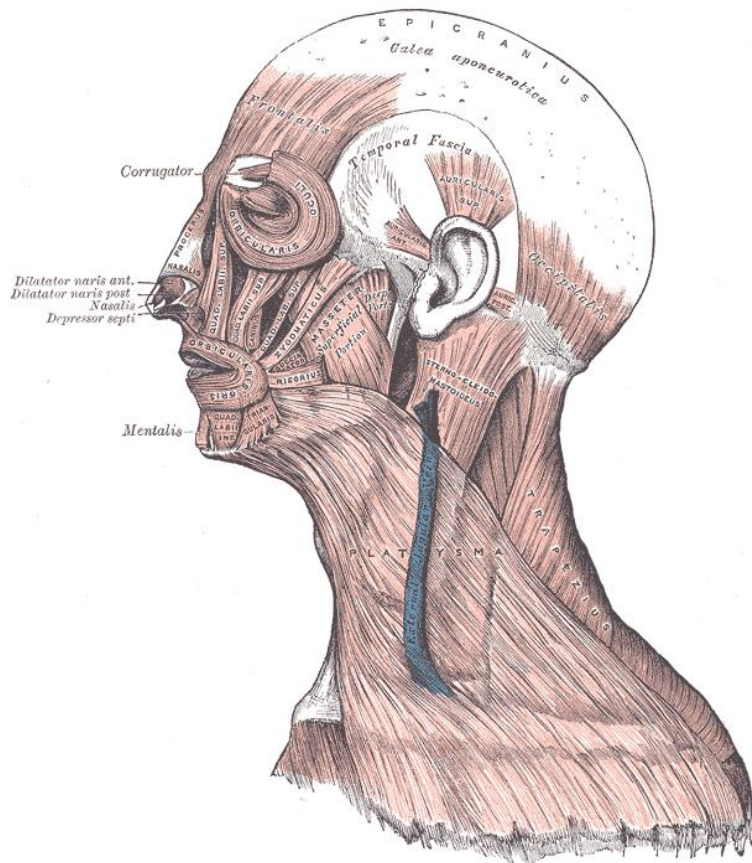
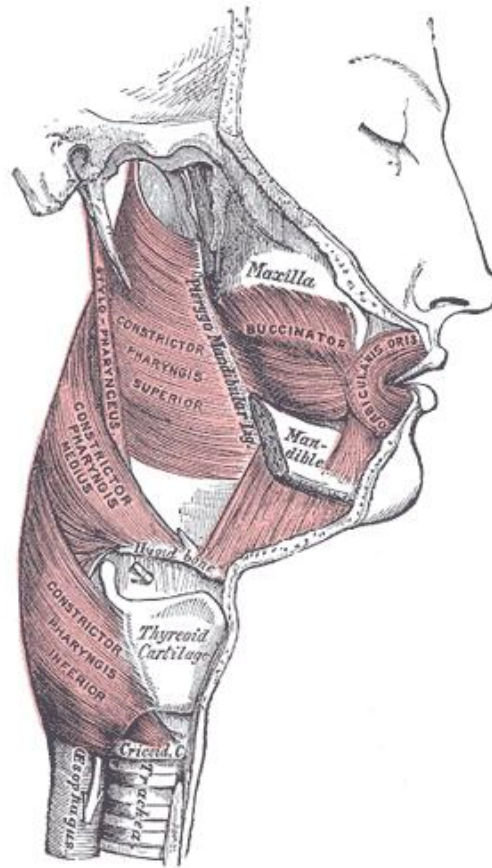
Velasco, J., Vazquez, R., Collado, J. *The Relationship between the Temporomandibular Joint Disc and related Masticatory Muscles in Humans* in Journal of Oral Maxillfac Surgery, v.51: 390-395, 1993.

## **9. FACIAL MUSCLES**

9.1 Understand the general features of the muscles of facial expression and their arrangements into 5 groups.

9.2 Identify the following facial muscles:

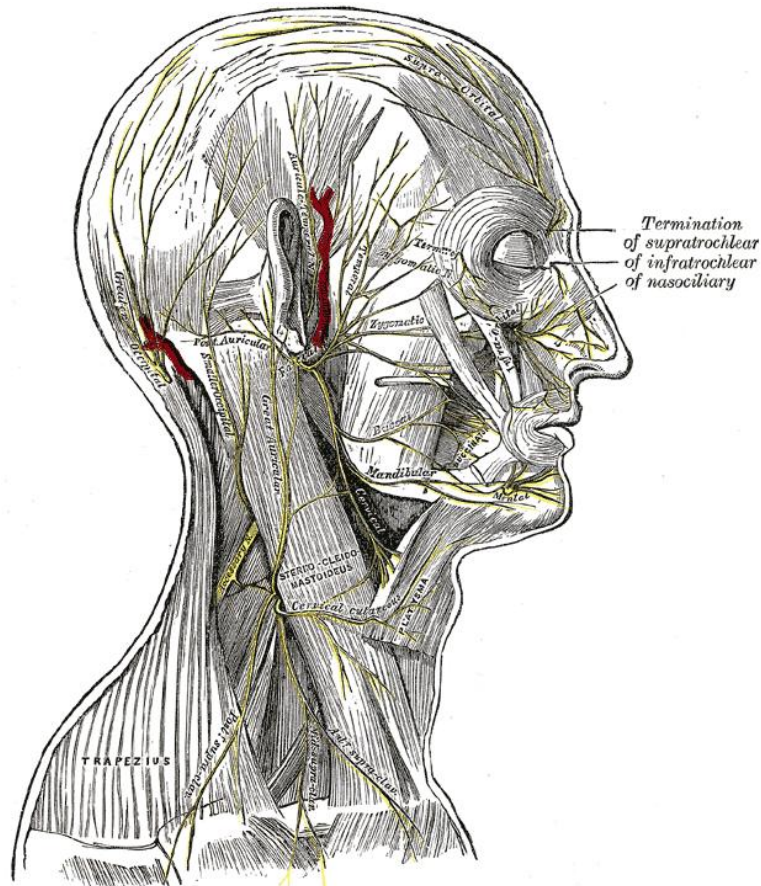
- (i) **muscles around and to the orbit**
  - **corrugator supercilli**
  - **orbicularis oculi**
  
- (ii) **muscles around and to the mouth**
  - a) **orbicularis oris**
  
  - b) **to raise upper lip**
    - **levator labii superioris**
    - **zygomaticus minor**
    - **levator labii superioris alaque nasi**
  
  - c) **to depress lower lip**
    - **depressor labii inferioris**
    - **mentalis**
  
  - d) **to angle of mouth**
    - **zygomaticus major**
    - **levator anguli oris**
    - **risorius**
    - **depressor anguli oris**
  
  - e) **buccinator**
  
- (iii) **muscles around the nose**
  - **procerus**
  - **nasalis**
  - **depressor septi**
  
- (iv) **muscles of the scalp and auricle**
  - **auricularis posterior**
  - **auricularis superior**
  - **auricularis anterior**
  - **frontalis - occipitalis**
  
- (v) **platysma**





9.3 Describe the actions of, and nerve supply to the muscles of facial expression.

9.4 Identify, describe the course in the head and state the specific functions of the facial nerve and its chorda tympani branch.



## ACTIVITIES

- By observing different facial expressions ("live" or using photographs/diagrams) deduce the muscles involved.

## 10. THE SKULL

10.1 Identify, and distinguish the extent and some of the main features, of the individual skull bones. These bones can be divided into 2 groups:

### (A) bones of the brain case

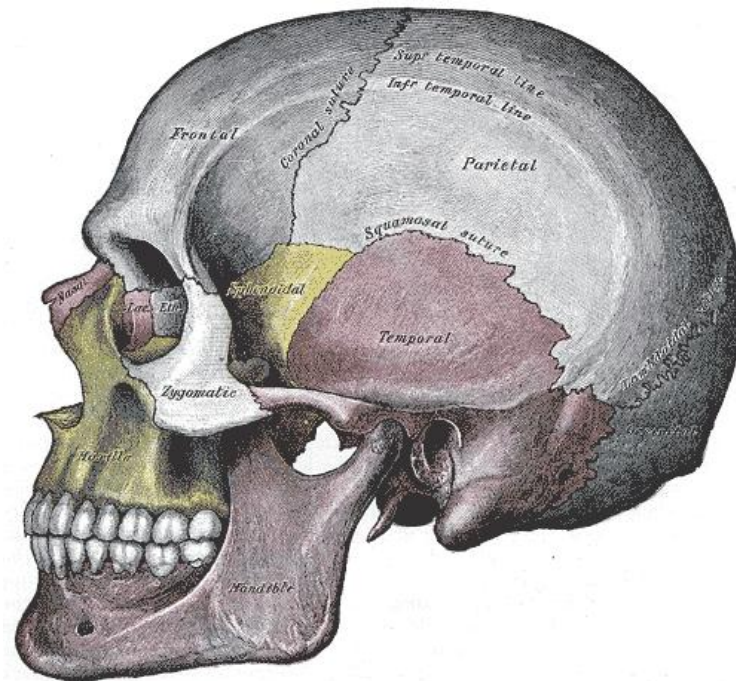
- (i) frontal
  - orbital plates
- (ii) parietal
- (iii) occipital
  - condyles
  - basilar part
  - external occipital protuberance
  - nuchal lines
  
- (iv) temporal
  - petrous part
  - squamous part
  - mastoid process
  - styloid process
  - zygomatic process
  
- (v) sphenoid
  - body
  - wings (greater, lesser)
  - pterygoid plates (medial, lateral)
  - pituitary fossa
  
- (vi) ethmoid
  - cribriform plate
  - perpendicular plate

### (B) facial bones

- (i) nasal
- (ii) lacrimal
- (iii) zygomatic
- (iv) maxilla
  - alveolar process
  - palatine process
  
- (v) mandible
  - body
  - ramus
  - angle
  - coronoid process
  - condyloid process

- alveolar process
- mylohyoid line
- genial (mental spines) tubercles
- mandibular foramen
- mental foramen

- (vi) vomer
- (vii) palatine
- (viii) inferior concha



**10.2** Identify the following sutures of the skull:

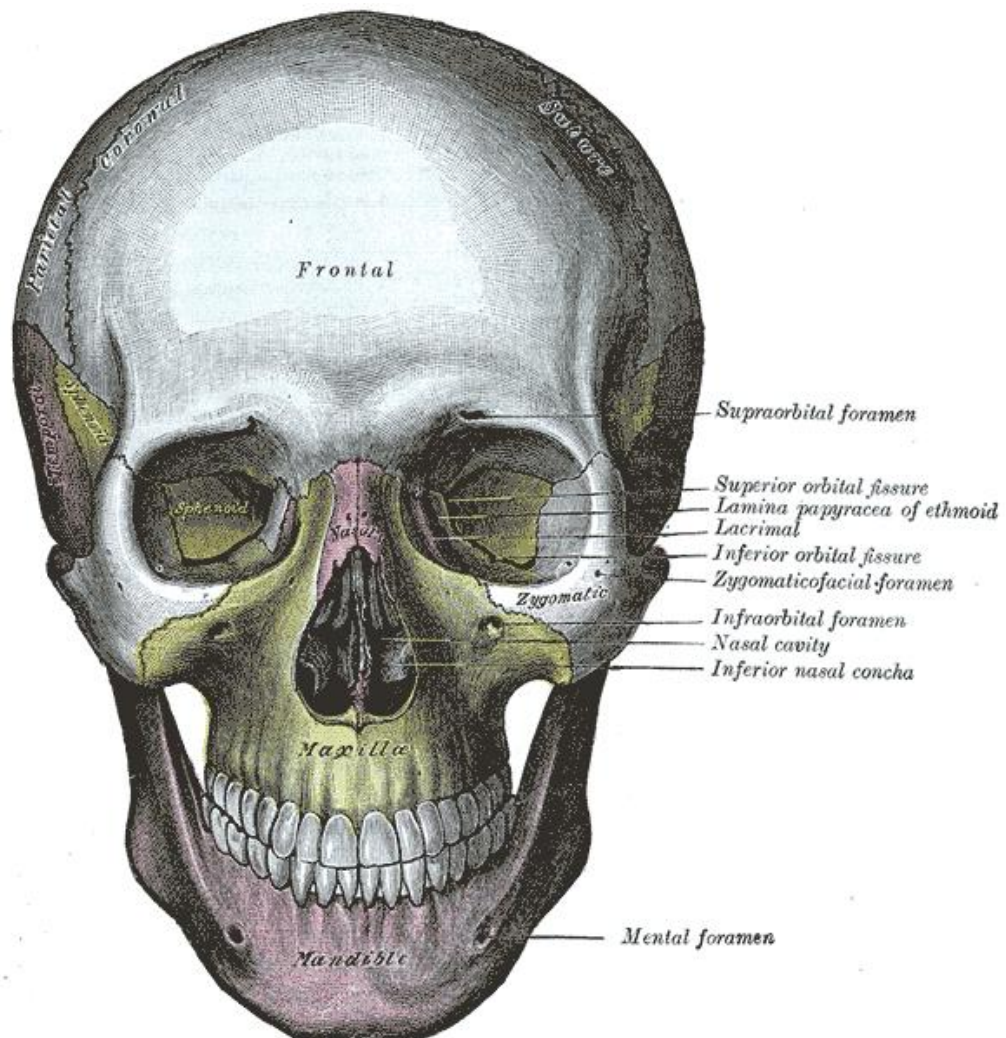
- (i) coronal
- (ii) sagittal
- (iii) lambdoid

**10.3** Identify the hyoid bone; its body, horns and position in relation to cervical vertebrae, mandible and larynx.

**10.4** Identify the following foramina in the brain case:

- (i) cribriform plate
- (ii) superior orbital fissure
- (iii) inferior orbital fissure
- (iv) optic canal
- (v) foramen rotundum
- (vi) foramen ovale
- (vii) foramen spinosum

- (viii) foramen lacerum
- (ix) carotid canal
- (x) internal acoustic meatus
- (xi) external acoustic meatus
- (xii) stylomastoid foramen
- (xiii) jugular foramen
- (xiv) hypoglossal canal
- (xv) foramen magnum



**10.5** List the structures that pass through each foramen in objective 10.4.

**10.6** Understand the location of the four pairs of paranasal air sinuses:

- (i) maxillary
- (ii) frontal
- (iii) ethmoidal
- (iv) sphenoidal

**ACTIVITIES**

- List the structures passing through each foramen mentioned in objective 10.4.

- Deduce tests to assess the integrity of the following cranial nerves:

(v)

(vii)

(ix)

(xi)

**Viva Anatomy!!!**

