



An Overview of The Skeletal Muscles

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The Shoulder

The shoulder is a complex area in the sheer number of muscles in the region.

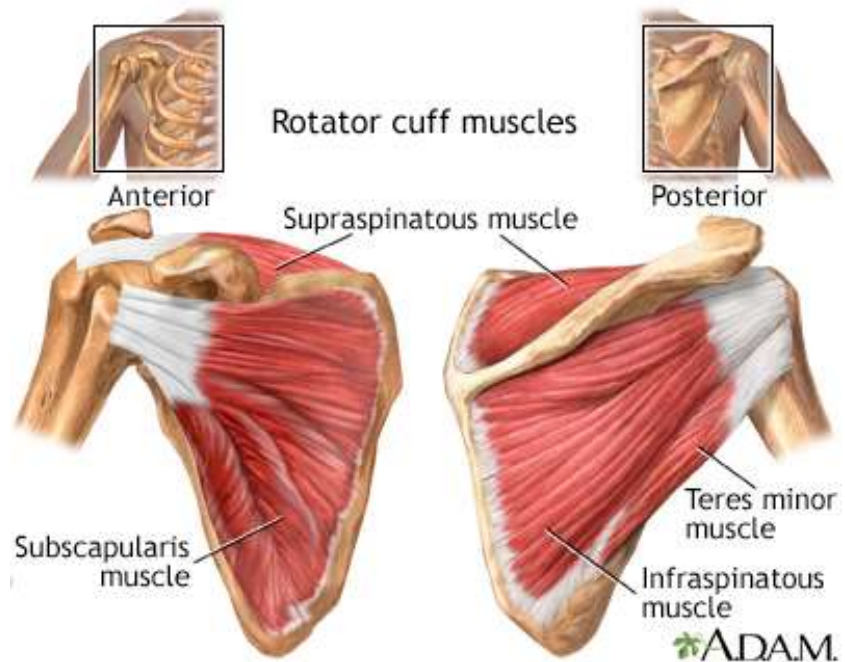
These can be seen from two aspects: anatomical and functional

Anatomical groups

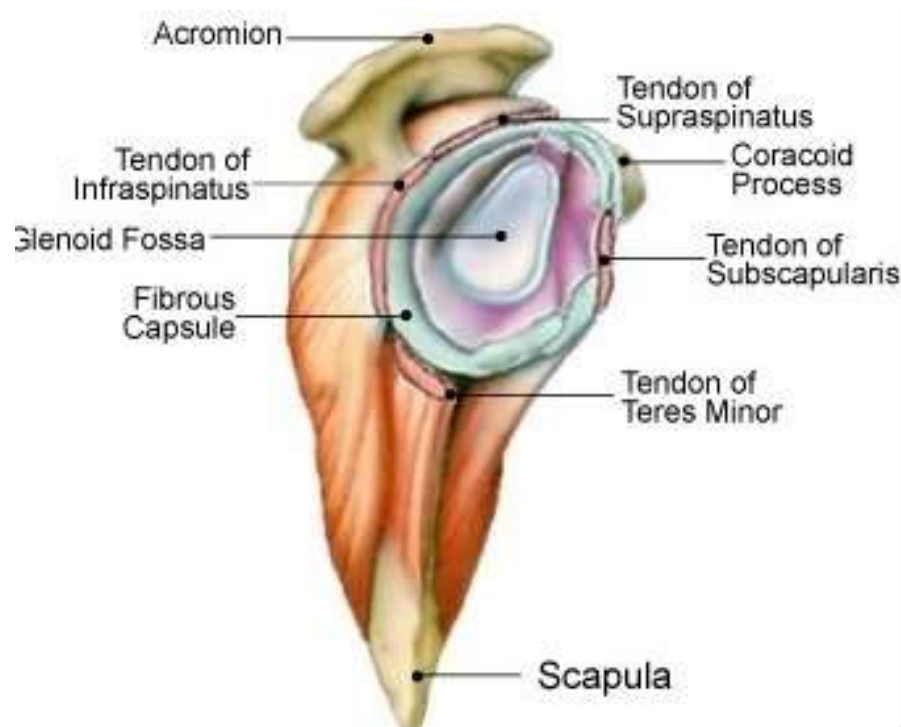
- Rotator cuff muscles - collectively, hold arm onto scapula
- Muscles from the scapula to the trunk
- Muscles from the scapula to the arm
- Long muscles

Rotator cuff muscles

- Supraspinatus
 - Abductor
- Infraspinatus
 - Lateral rotator
- Teres minor
 - Lateral rotator
- Subscapularis
 - Medial rotator



Rotator cuff muscles seen from the lateral side (with arm removed)



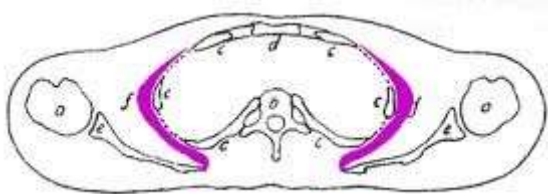
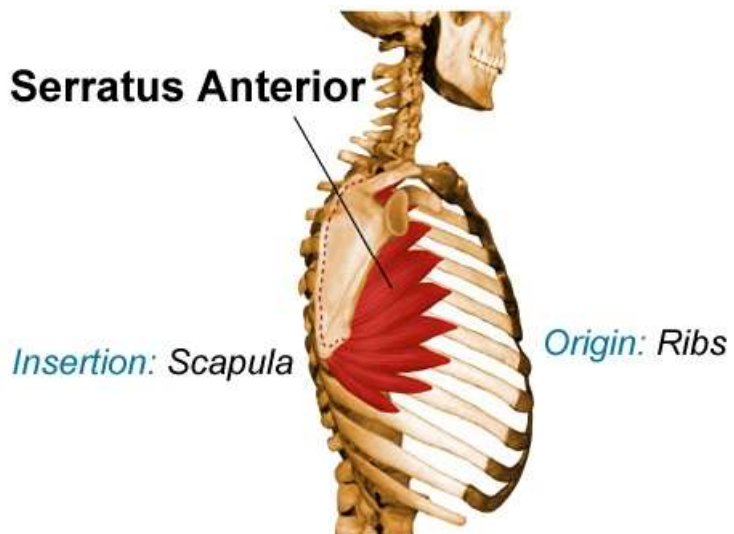
Muscles from the scapula to the trunk

- Pectoralis minor - depressor
- Serratus anterior - protractor
- Levator scapulae - elevator
- Rhomboids - retractor
- Trapezius - elevate, depress, retracts

Pectoralis minor - depresses scapula



Serratus Anterior



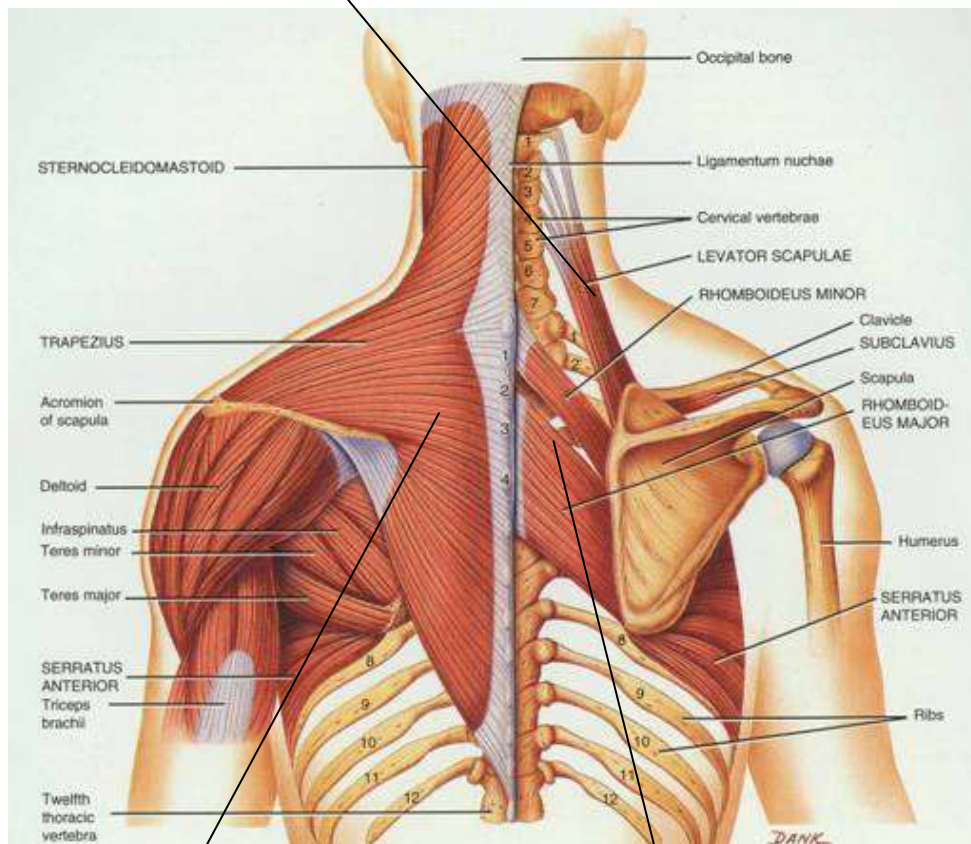
Serratus anterior - (seen from above) protracts scapula



Serratus anterior. Seen here from the front, in relation to Subscapularis

Levator scapulae

Elevates scapula

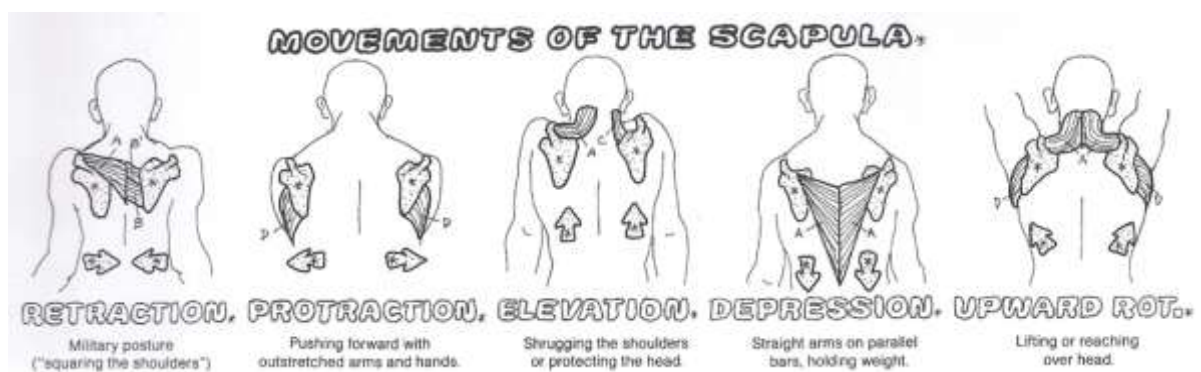


Trapezius

Elevates, retracts, depresses, rotates

Rhomboids

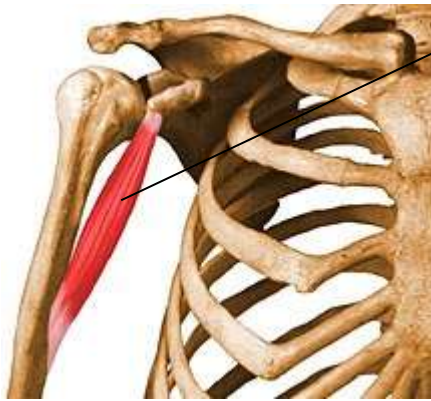
Retract and elevate



Muscles from the scapula to the arm

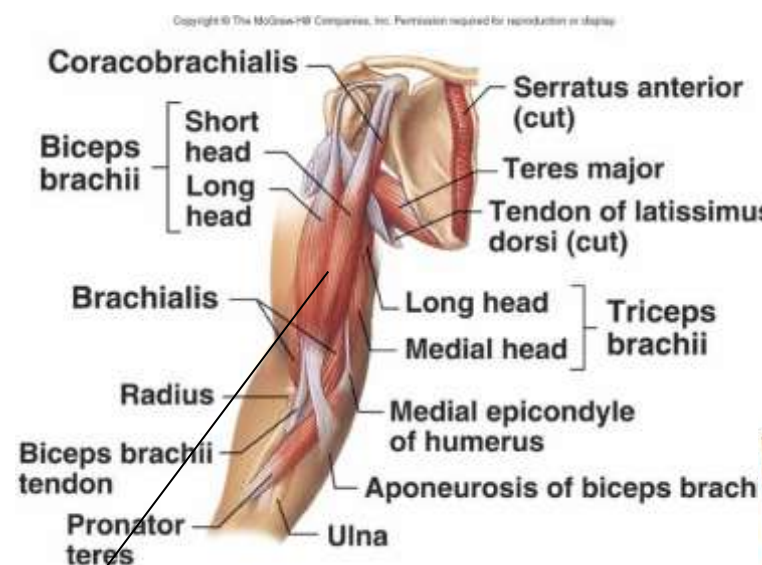
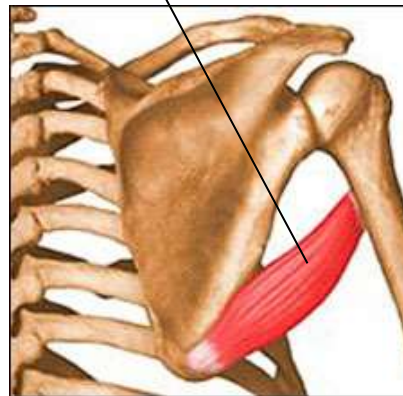
These move the arm in relation to the scapula

- Coracobrachialis
- Teres major
- Biceps brachii - not officially classified as a shoulder muscle
- Triceps - not officially classified as a shoulder muscle



Coracobrachialis - flexes shoulder

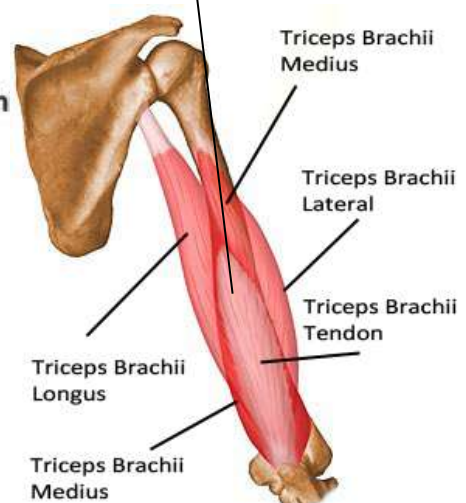
Teres major - adducts, extends, medially rotates



Biceps Brachii - flexes elbow, flexes shoulder

Triceps -

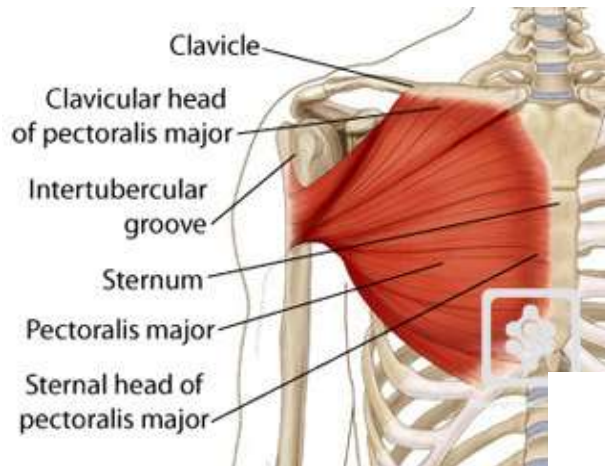
Extends elbow, extends shoulder



Long muscles of the shoulder

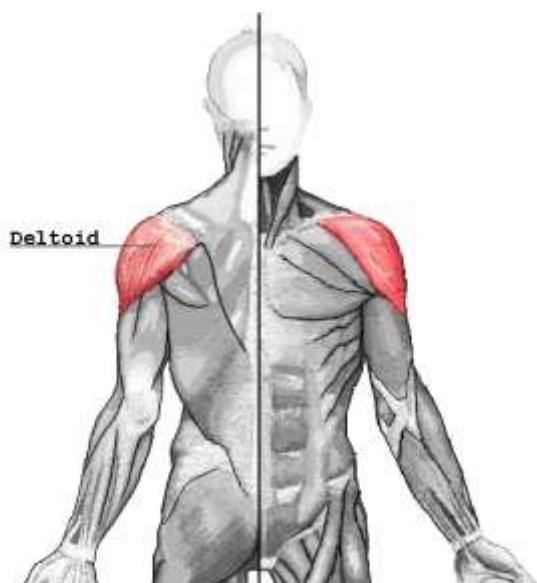
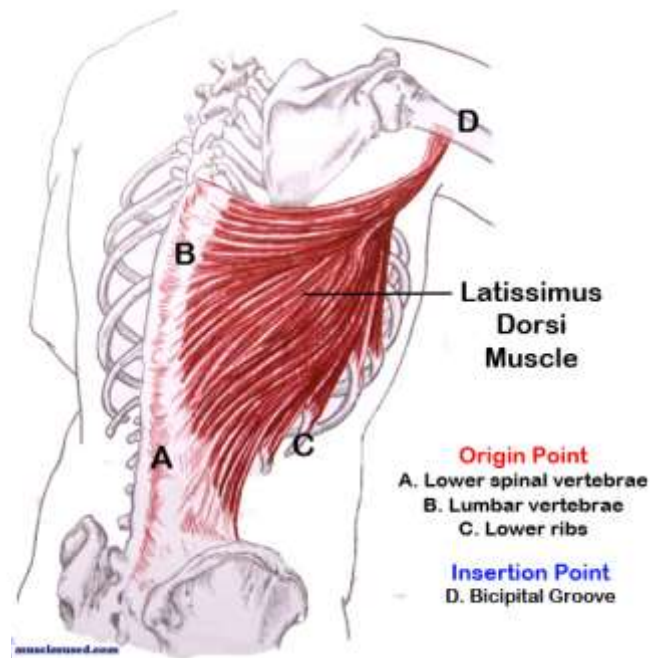
These tend to be bigger, more powerful and cover over the other shoulder muscles

- Pectoralis major
- Deltoid
- Latissimus dorsi



Pectoralis Major - flexes, adducts, medially rotates shoulder

Latissimus dorsi - adducts, extends and medially rotates



Deltoid - abducts, flexes, extends shoulder

Anatomical Groups

Muscle Group	Name	Actions
Rotator cuff muscles: All act on glenohumeral joint	Supraspinatus	Abducts glenohumeral
	Infraspinatus	Lateral rotation
	Teres minor	Lateral rotation
	Subscapularis	Medial rotation
From Scapula to Trunk All move scapula on trunk	Levator scapulae	Elevates scapula and rotates it laterally
	Rhomboids (major and minor)	Retracts and elevates scapula
	Pectoralis minor	Depresses scapula Elevates ribs 3-5
	Serratus anterior	Protracts scapula
	Trapezius	Elevates, retracts, depresses, medially rotates
From scapula to humerus All move glenohumeral joint	Coracobrachialis	Flexes
	Teres major	Adducts, extends, medially rotates
	Biceps - Short and long head	Flexes
	Triceps	Extends
Long muscles All act on glenohumeral	Pectoralis major	Flexes and adducts
	Latissimus dorsi	Adducts, extends, medially rotates
	Deltoid	Abducts, flexes extends

Functional Muscle Groups of The Shoulder

Flexors	Extensors
Coracobrachialis	Deltoid, posterior
Deltoid , anterior	Teres major
Biceps, short and long heads	Latissimus dorsi
	Triceps
Abduction	Adduction
Supraspinatus	Teres major
Deltoid	Latissimus dorsi
	Pectoralis major
Medial rotation	Lateral rotation
Subscapularis	Infraspinatus
Teres major	Teres minor
Latissimus dorsi	
Protractors	Retractors
Serratus anterior	Trapezius (medial fibres)
Pectoralis major	Rhomboids
Elevators	Depressors
Trapezius (upper fibres)	Trapezius (lower fibres)
Levator scapulae	Pectoralis major (lower fibres)
Rhomboids	Latissimus dorsi

Nerve root values

Nerves					
Dorsal scapular Rhomboids	C5				
Axillary Teres minor Deltoid	C5	C6			
Musculocutaneous Coracobrachialis, Biceps, Brachialis	C5	C6			
Subscapular Subscapularis, teres major	C5	C6			
Suprascapular Supraspinatus, Infraspinatus	C5	C6	C7		
Long thoracic Serratus anterior	C5	C6	C7		
Lateral pectoral Pectoralis major	C5	C6	C7		
Medial pectoral Pectoralis major/minor				C8	T1
Thoracodorsal Latissimus dorsi	C5	C6	C7	C8	
Median Wrist and fingers - flexors	C5	C6	C7	C8	T1
Radial Triceps; wrist/fingers extensors	C5	C6	C7	C8	T1

Muscles									
Trapezius	C1	C2	C3						
Levator scapulae			C3	C4	C5				
Rhomboids				C4	C5				
Supraspinatus				C4	C5				
Deltoid					C5				
Teres minor				C4	C5	C6			
Biceps					C5	C6			
Brachioradialis					C5	C6			
Brachialis					C5	C6			
Infraspinatus					C5	C6			
Subscapularis					C5	C6			
Serratus anterior					C5	C6	C7		
Teres major					C5	C6	C7		
Triceps						C6	C7		
Pectoralis Minor						C6	C7	C8	T1
Pectoralis Major					C5	C6	C7	C8	T1

Muscles of the arm

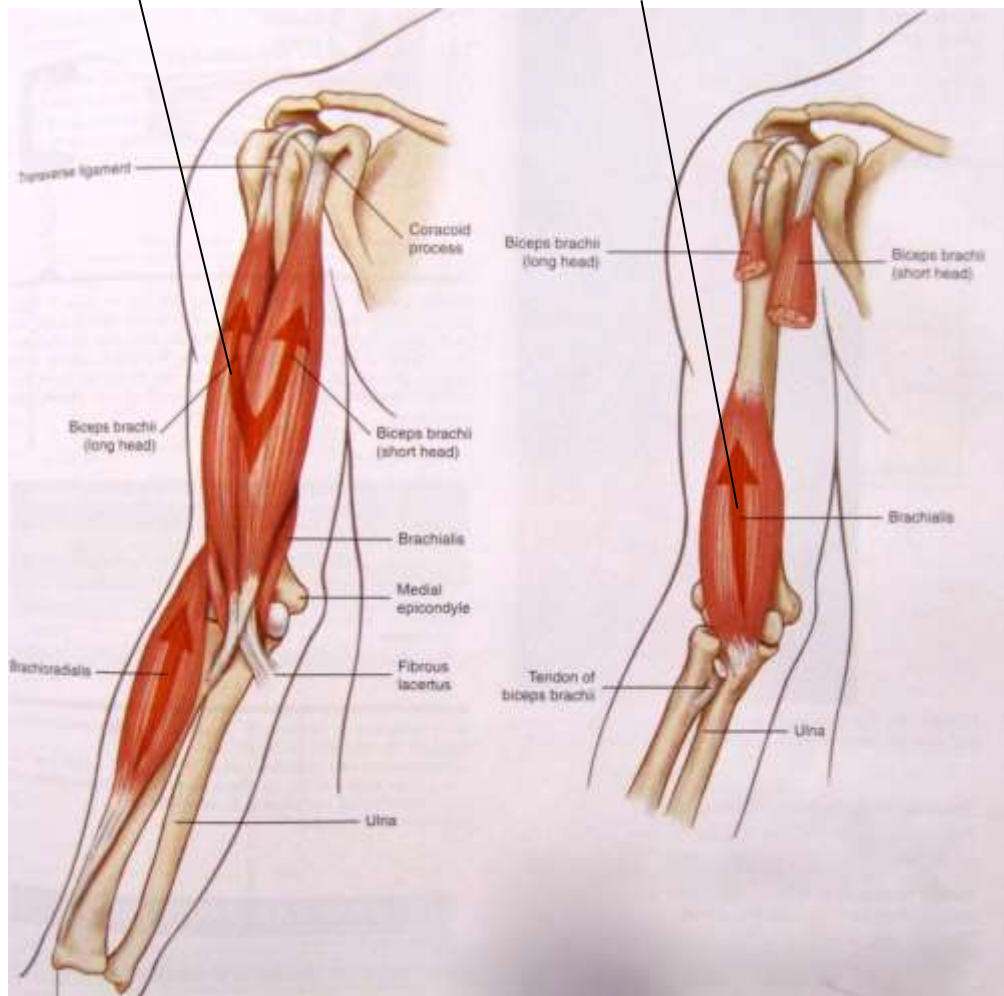
These are generally classified as muscles that move the forearm on the humerus.

Flexors	Biceps brachii, Brachialis, Brachioradialis, pronator teres
Extensors	Triceps, anconeus
Supinators	Biceps brachii, supinator
Pronators	Pronator teres, pronator quadratus

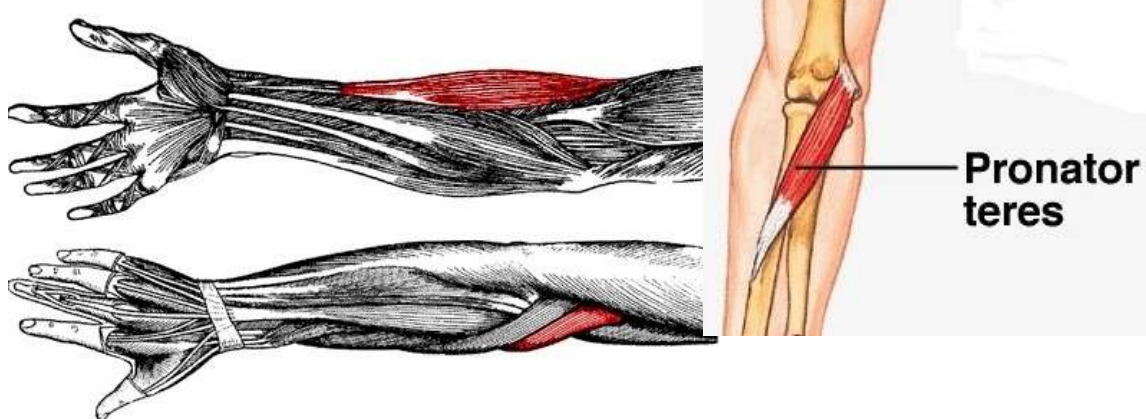
Flexors

Biceps Brachii

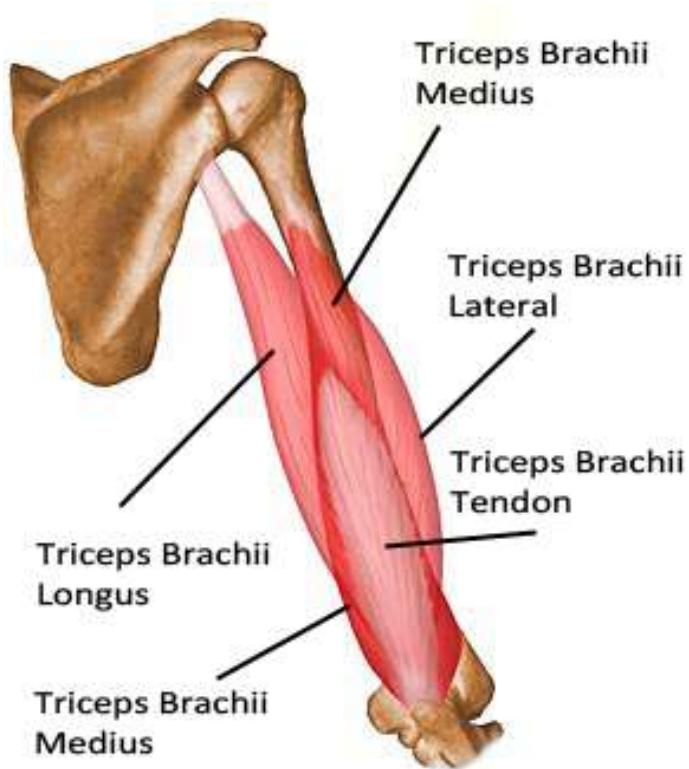
Brachialis



Brachioradialis



**Extensors
Triceps**



**Ancon
eus**

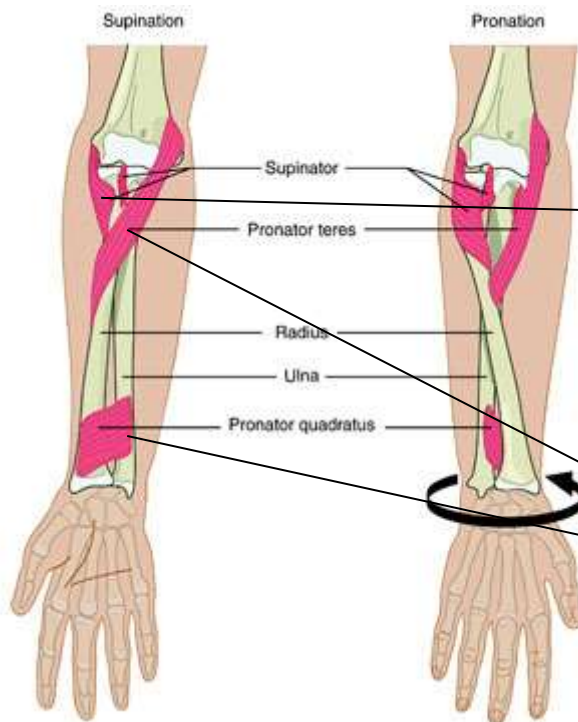


Muscles of the Forearm

These are numerous but are essentials arranged into the two groups of the anterior and posterior compartments:

Anterior compartment muscles are flexors of the elbow, wrist and fingers. Their origin is mainly the **common flexor origin** - the medial epicondyle of the humerus

Posterior compartment muscles are extensors of the elbow, wrist and fingers. Their origin is mainly the **common extensor origin** - the lateral epicondyle of the humerus



Supination is turning the hand, palm facing up

Muscles:

Supinator

Biceps brachii

Pronation is turning the hand, palm facing down

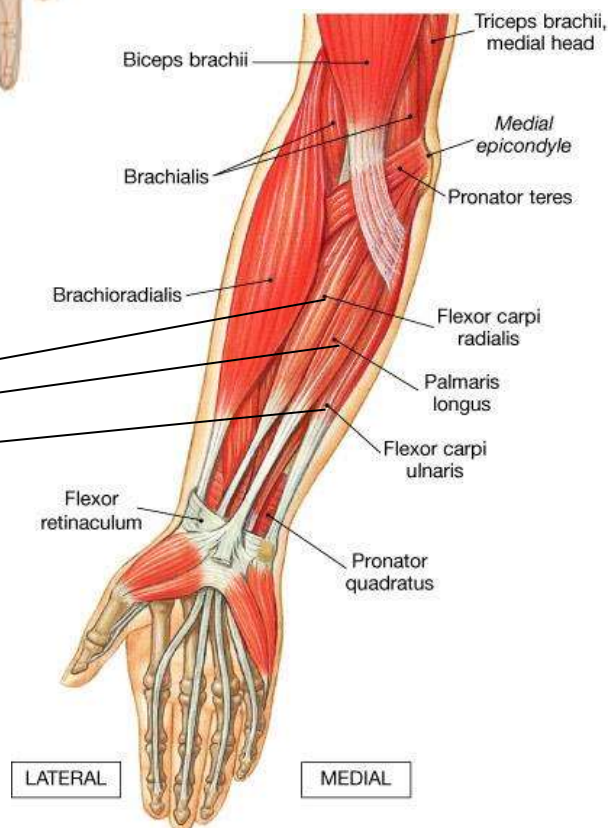
Muscles:

Pronator teres

Pronator quadratus

The remainder of the anterior forearm muscles lie in three layers:

- **Superficial**
 - Flexor carpi radialis
 - Palmaris longus
 - Flexor carpi ulnaris
- **Intermediate**
 - Flexor digitorum superficialis
- **Deep**
 - Flexor digitorum profundus
 - Flexor pollicis longus



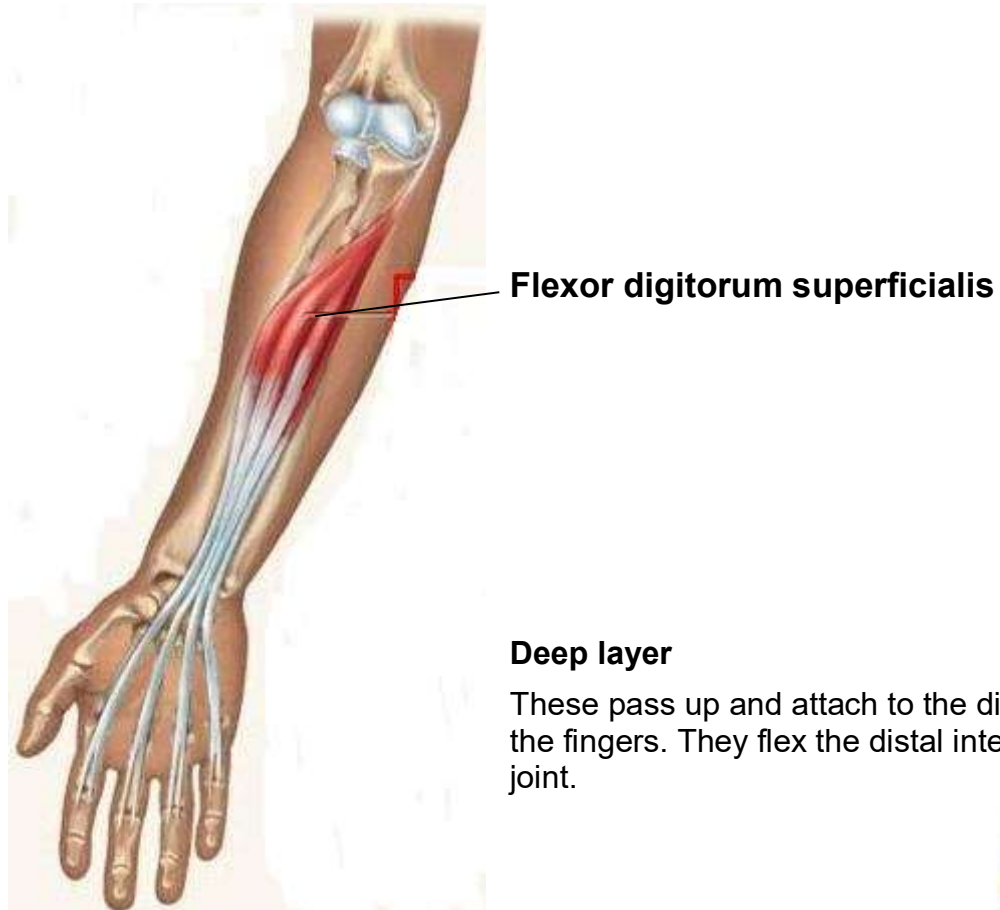
(a) Anterior view, superficial

Superficial muscles

Intermediate Layer

These lie deep the wrist flexors. They originate at the common flexor origin, pass up the fingers and attach to the middle bone of the fingers. The tendon splits just before it inserts to allow passage of the flexor profundus tendon.

They flex the finger at the proximal interphalangeal joint

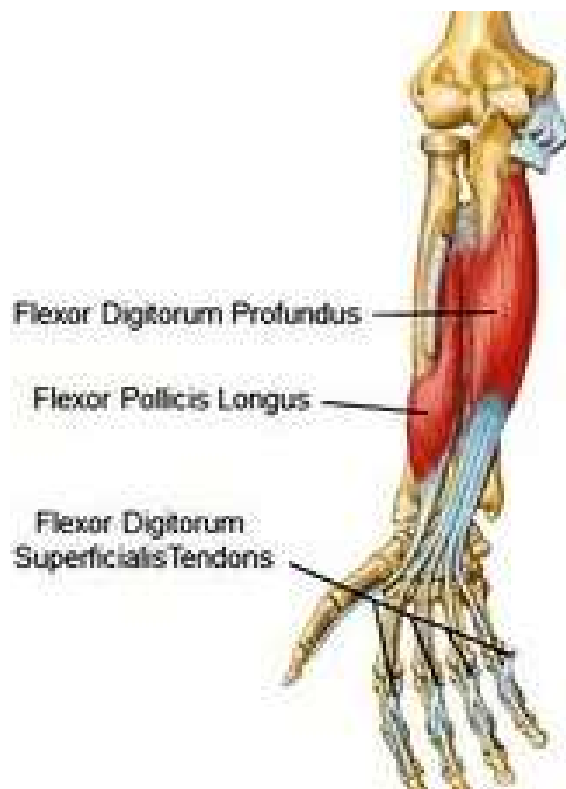


Deep layer

These pass up and attach to the distal bone of the fingers. They flex the distal interphalangeal joint.



This shows a pair of forceps placed between the tendons of flexor digitorum profundus and superficialis showing how the profundus tendon passes through the superficialis tendon

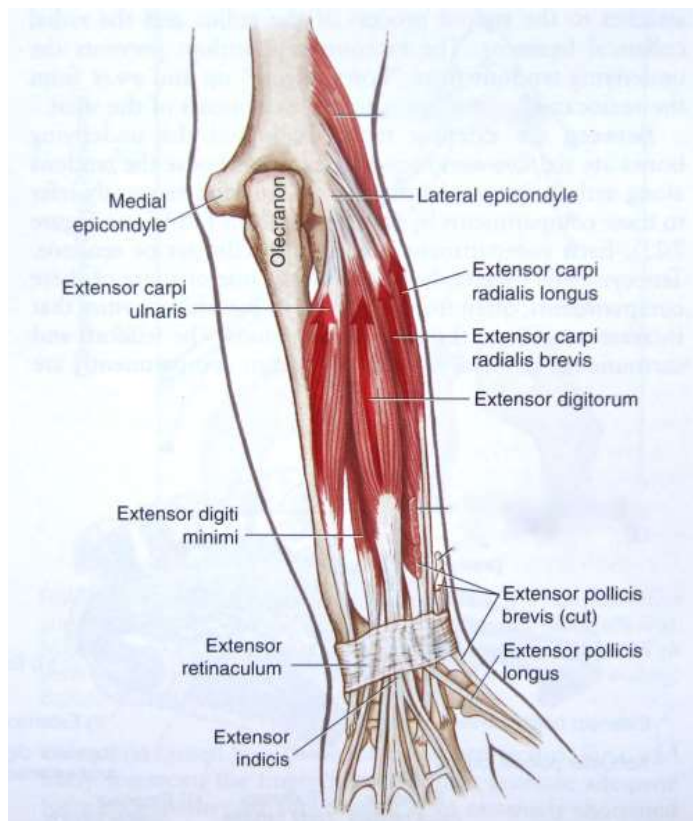


Extensor compartment of muscles

These have their origin from the common extensor origin. They attach on the back of the wrist bones and extend the wrist, and fingers.

There are two layers

- **Superficial**
 - Extensor carpi ulnaris
 - Extensor digiti minimi
 - Extensor digitorum
 - Extensor carpi radialis longus
 - Extensor carpi radialis brevis
- **Deep**
 - Extensor indicis
 - Extensor pollicis longus
 - Extensor pollicis brevis
 - Abductor pollicis longus



Superficial layer

Abductor pollicis longus

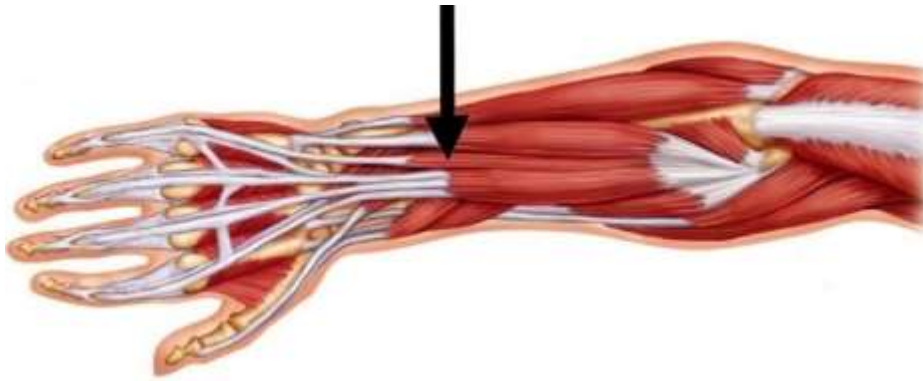


Note:

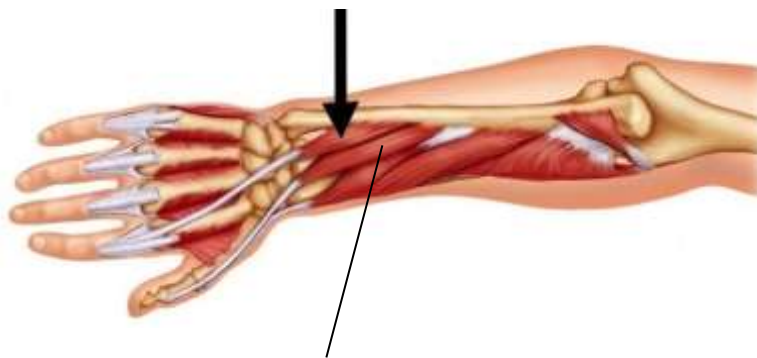
- There is only one group of finger extensor muscles
- The webbing of the tendons on the back of the hand. This limits fine function in extension.
- The index and little fingers both have their own extensor muscle (so you can point and have a 'pinkie' drinking tea)

Deep layer

Extensor digiti minimi - extends little finger



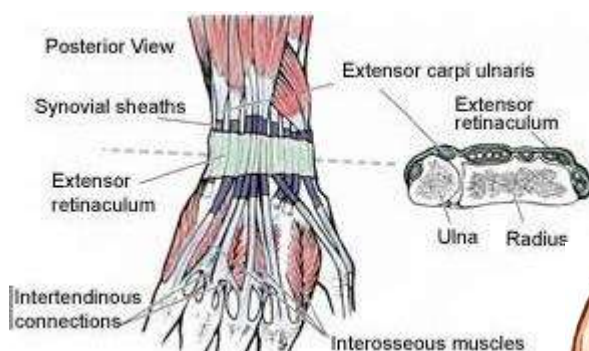
Extensor indicis - extends index finger



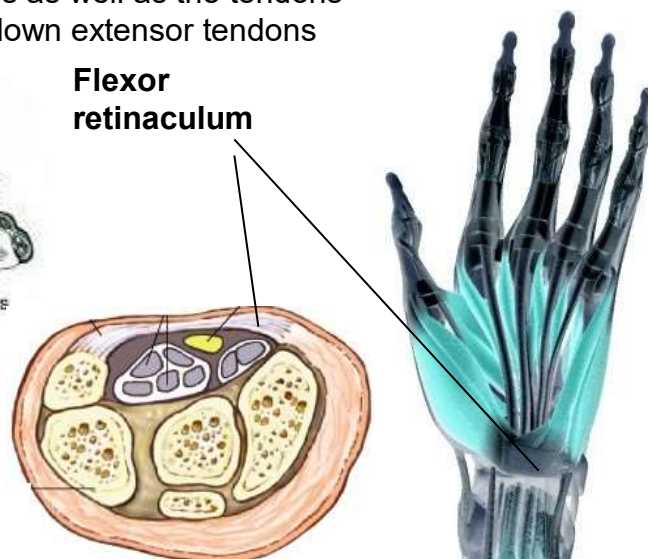
Extensor pollicis longus - extends thumb

As the muscles pass down into the fingers, they pass under a sheath of tissue called a retinaculum. They hold down the tendons, such that they do not stand out like a bowstring.

- **Flexor retinaculum** - hold down flexor tendons
 - It forms the roof of a tunnel, **the carpal tunnel**, through which pass nerves and blood vessels as well as the tendons
- **Extensor retinaculum** - hold down extensor tendons



Flexor retinaculum

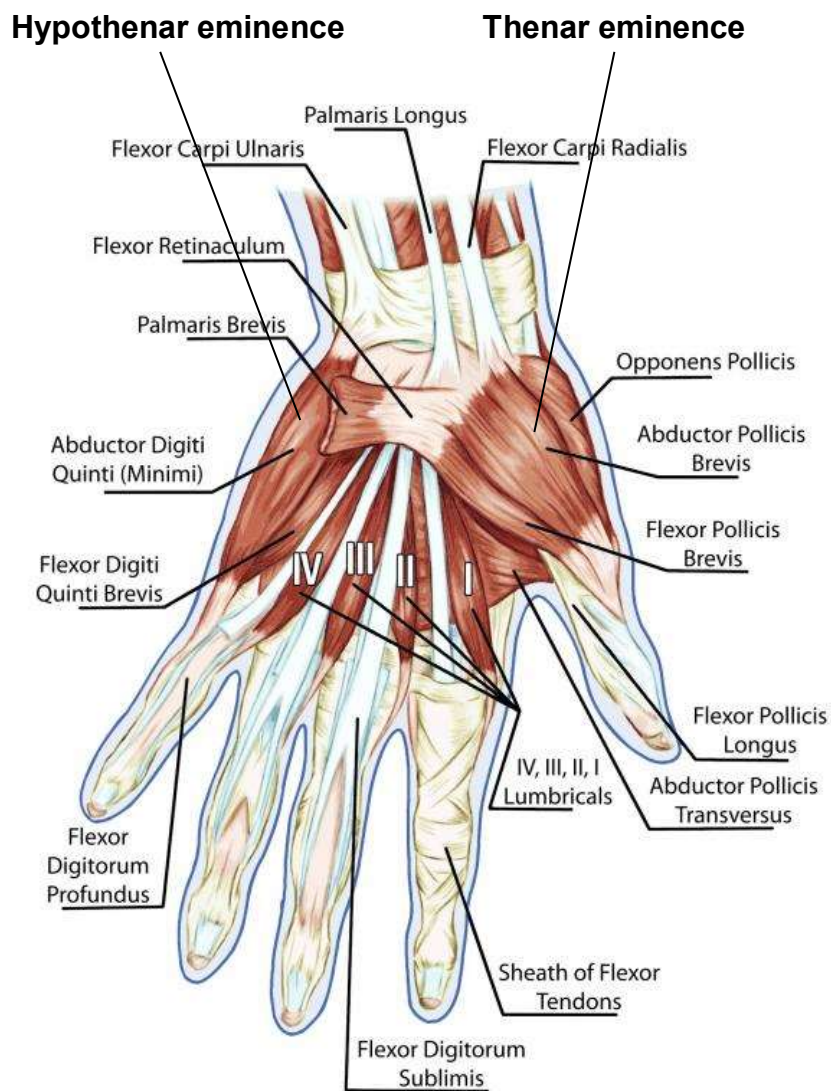


Intrinsic muscles of the hand

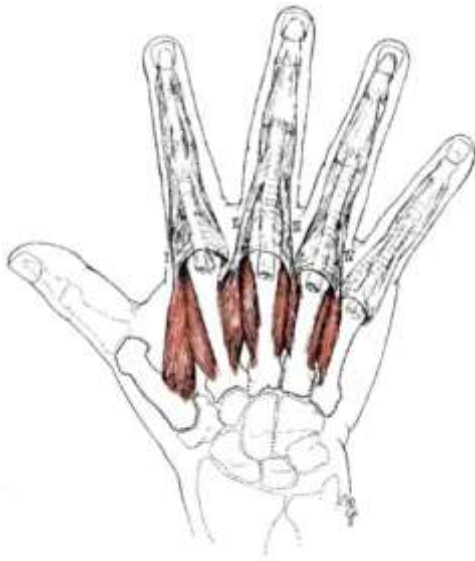
The intrinsic muscles of the hand assist in movement of the fingers

These are in three groups

- **Thenar eminence**
 - Opponens pollicis - across palm to little finger
 - Abductor pollicis brevis - away from thumb
 - Flexor pollicis brevis - flexes thumb
- **Hypothenar eminence**
 - Opponens digiti minimi - across palm to thumb
 - Abductor digiti minimi - away from hand mid-line
 - Flexor digiti minimi brevis - flexes little finger
- **Deep muscles**
 - Adductor pollicis - towards plane of hand
 - Dorsal interossei - opens fingers apart
 - Palmar interossei - closes fingers together
 - Lumbricals - flexes fingers at base

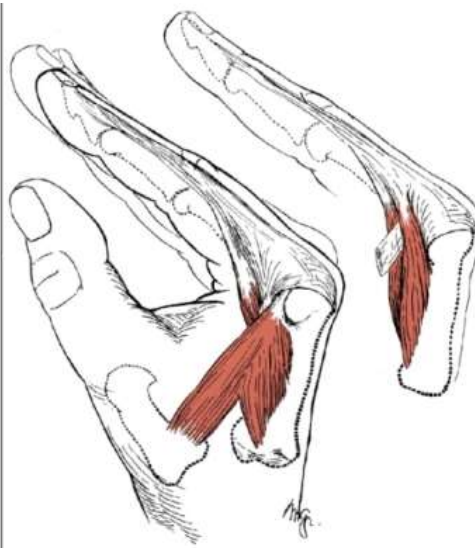
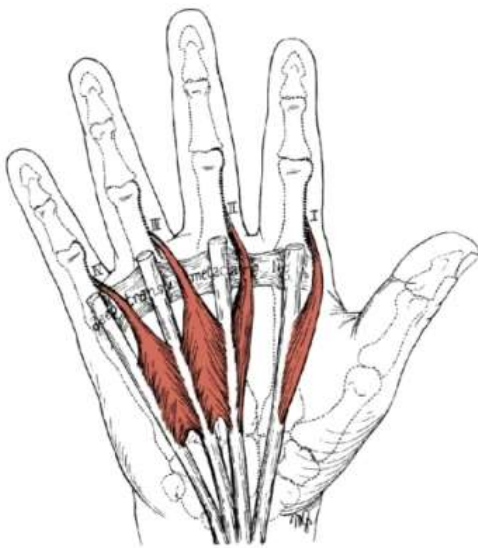


Deep Muscles



Dorsal interossei - abducts fingers

Palmar interossei - adducts fingers



Lumbricals - flex fingers at metacarpal/phalangeal joints (at their base)

Posterior muscles of the spine

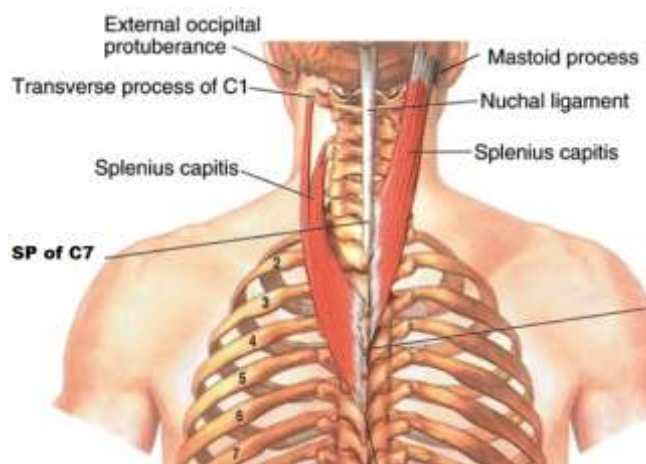
These muscles are essentially arranged in three groups, with a covering layer

- Covering layer
- Vertical muscles
- Oblique muscles
- Deepest muscles

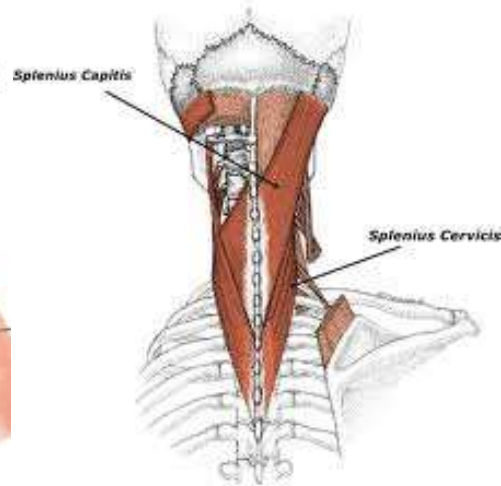
Groups	Cervical	Thoracic	Lumbar
Flexors	Sternocleidomastoid Longus Colli Longus Capitis Suboccipitals	Rectus Abdominis	Psoas Rectus Abdominis
Extensors	Splenius Capitis Splenius Cervicis Spinalis Capitis Suboccipitals	Iliocostalis Longissimus Spinalis	Iliocostalis Longissimus Spinalis
Sidebend	Sternocleidomastoid Iliocostalis Longissimus Spinalis	Iliocostalis Longissimus Spinalis	Iliocostalis Longissimus Spinalis
Rotator Ipsilateral	Splenius Suboccipitals	Semispinalis	Semispinalis
Rotator Contralateral	Sternocleidomastoid Semispinalis	Multifidus Rotatores	Multifidus Rotatores

Covering muscles

Splenius Capitis



Splenius Cervicis



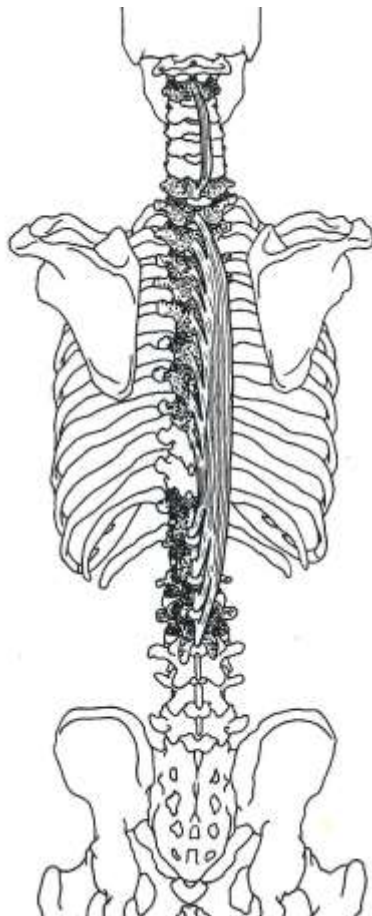
Vertical Muscles

Their function to hold the spine vertical, extend and side bend the spine to the side
Here there are three groups.

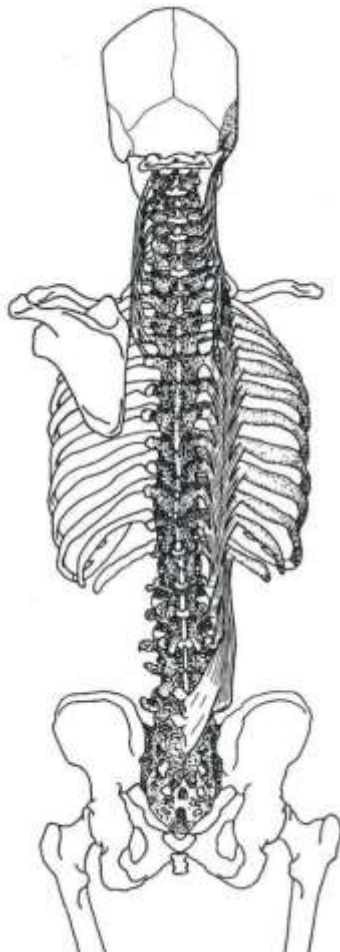
From medial to lateral:

- Spinalis
- Longissimus
- Iliocostalis

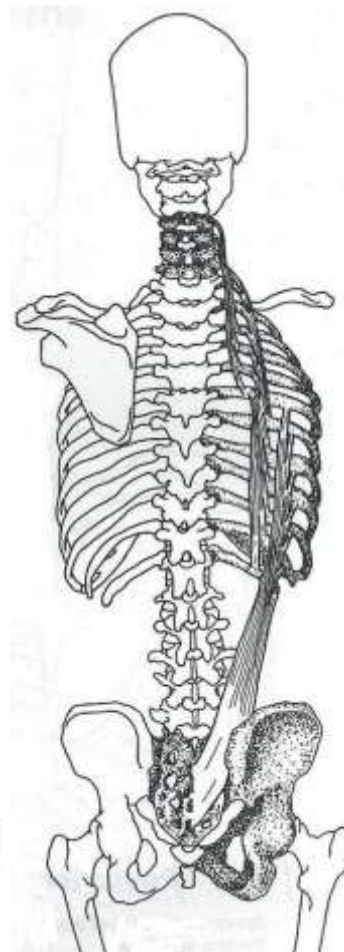
Spinalis



Longissimus



Iliocostalis



Obliques

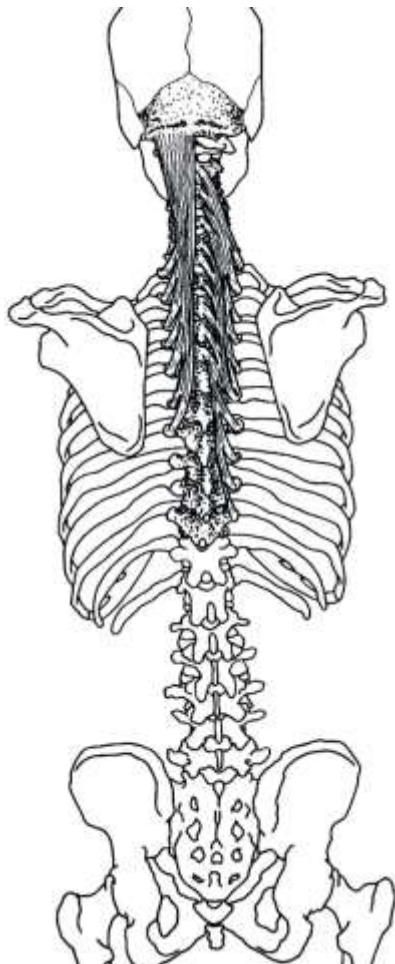
These are deeper to the vertical muscles. They are fairly short, mainly passing up only one or two vertebrae from the transverse process to the spinous process.

These rotate the spine, usually to the opposite (contralateral) side

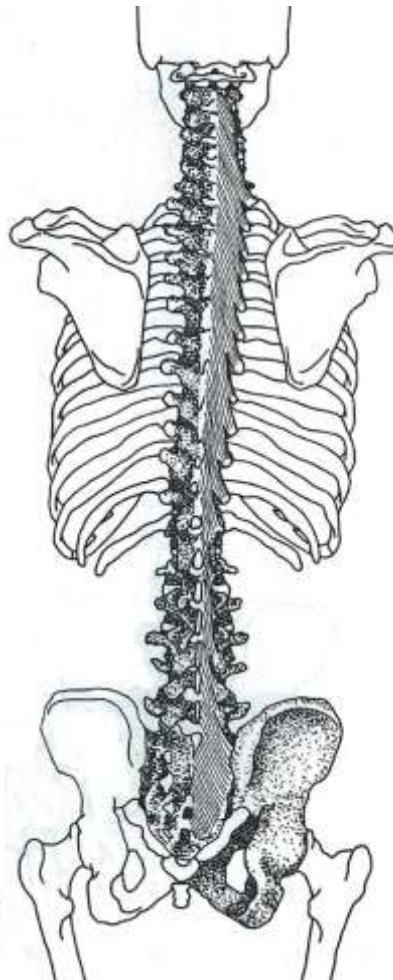
There are three groups

- **Semispinalis**
- **Multifidus**
- **Rotatores**

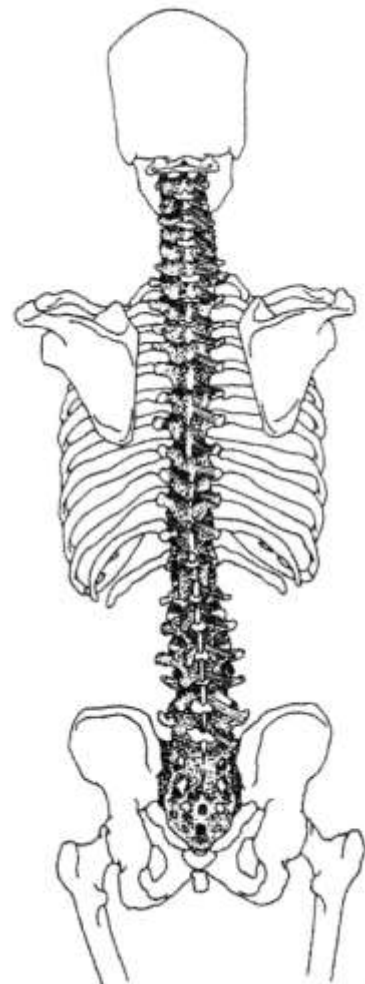
Semispinalis



Multifidus



Rotatores



Deepest Muscles

These are deep beneath all the other muscles. They are tiny muscles, passing just from one bone to the next bone. They are only found in the cervical and lumbar spines, (with a little overlap). Their main function is to extend and side bend the spine. If they are all tight, though, it creates a compression along the axis of the spine and certainly contributes to 'wear and tear' through compression of the disc.

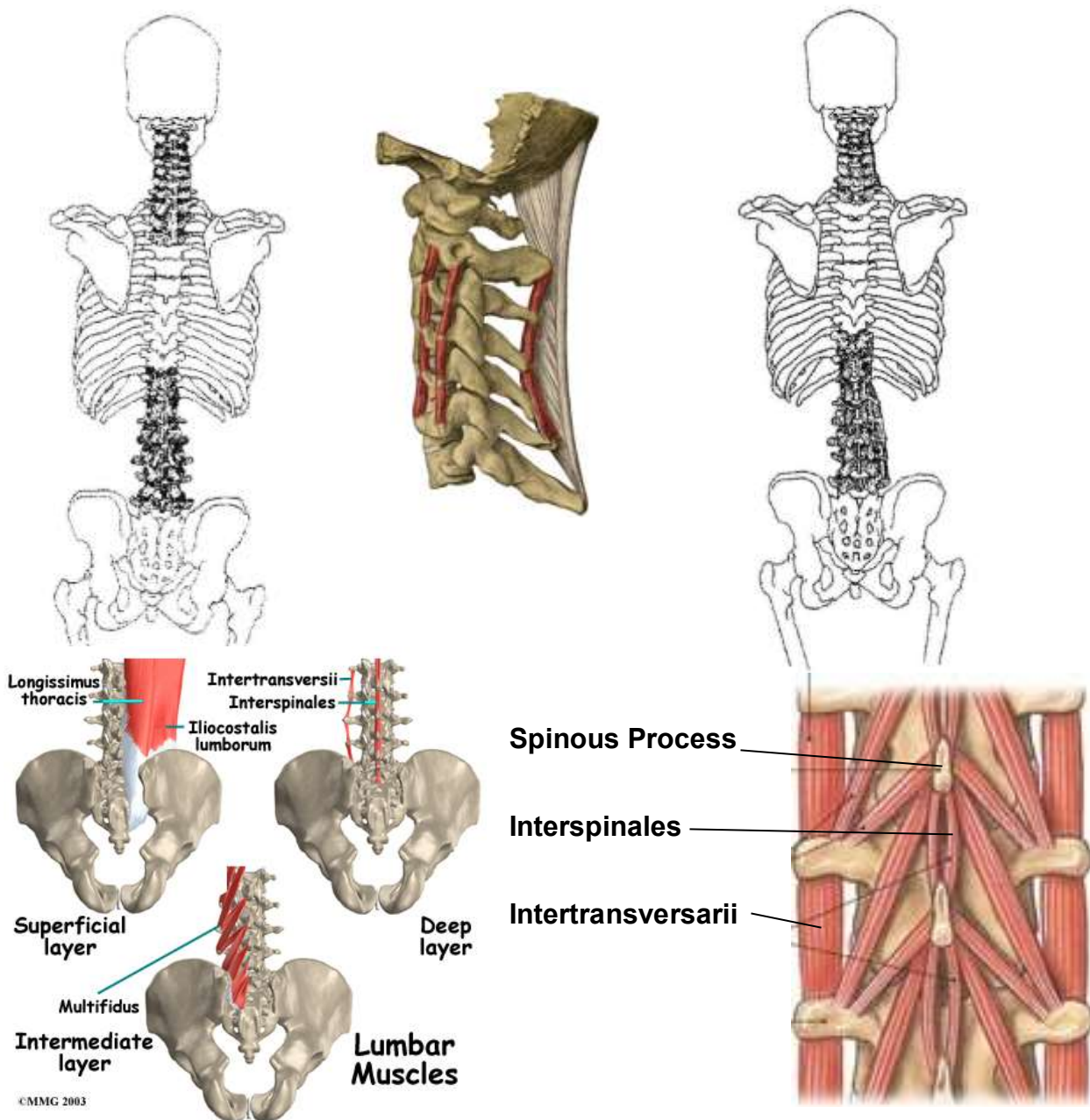
There are two basic groups:

- **Interspinales** - pass between the spinous processes
- **Intertransversarii** - pass between the transverse processes

Interspinales

Close up of neck

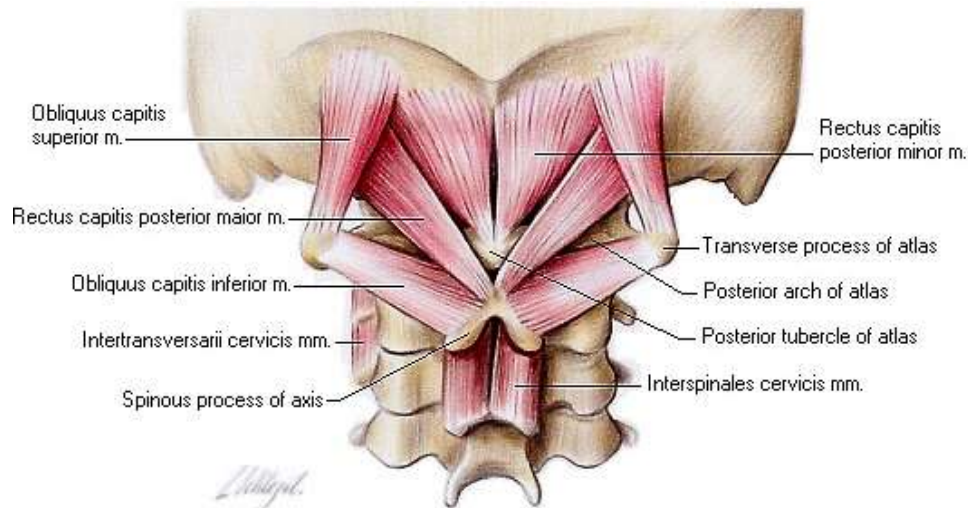
Intertransversarii



Neck Muscles

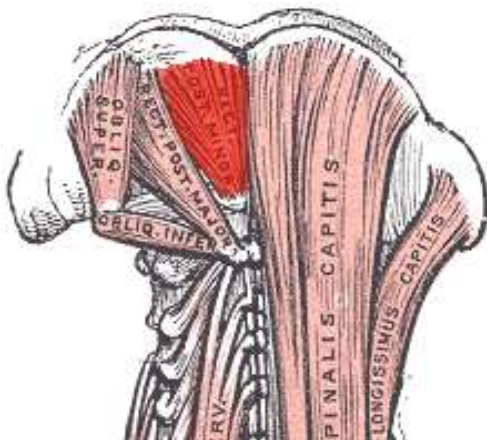
There are generally two groups of muscles:

- Those at the back and side - move the neck
- Those at the front - involved in speech and eating/swallowing

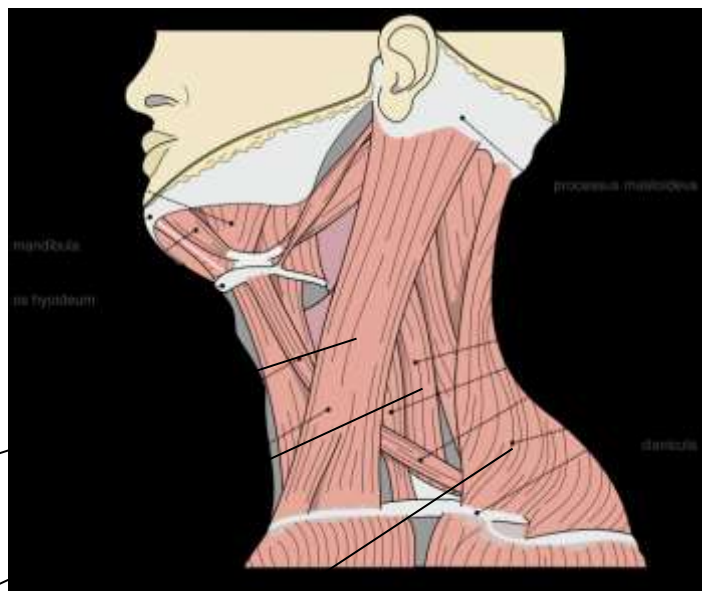


Deep muscles at back of head. These are all small muscles from the occiput down to C1 and C2.

- Extend and rotate (ipsilateral- to the same side)



The same muscles shown in relation to the vertical muscles of the spine

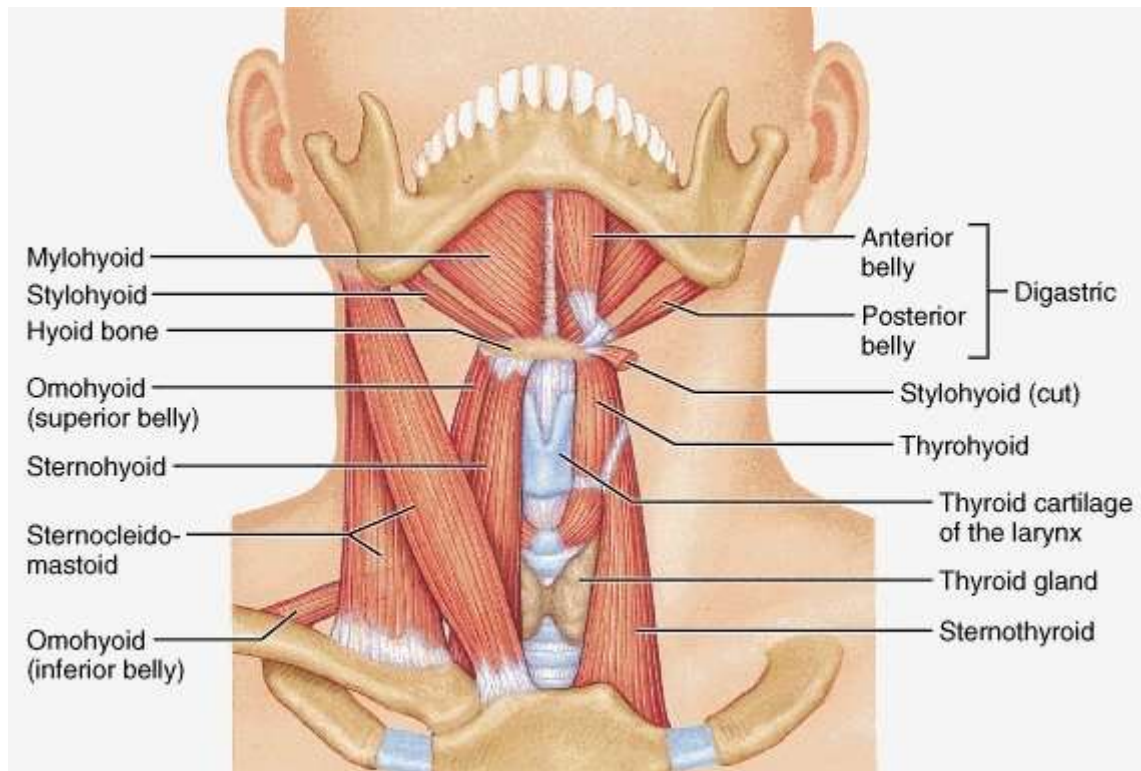


Muscles at the side of the neck

Showing:

- **Sternocleidomastoid**
 - Rotates contralaterally
 - Side-bends ipsilaterally
 - Flexes
- **Scalenes**
 - Side-bends
 - Raises top 2 ribs
- **Trapezius** - upper fibres

Anterior neck muscles



As you can see, they all attach via the hyoid bone. They assist opening of the jaw, speech, eating and swallowing.

Abdominal Muscles

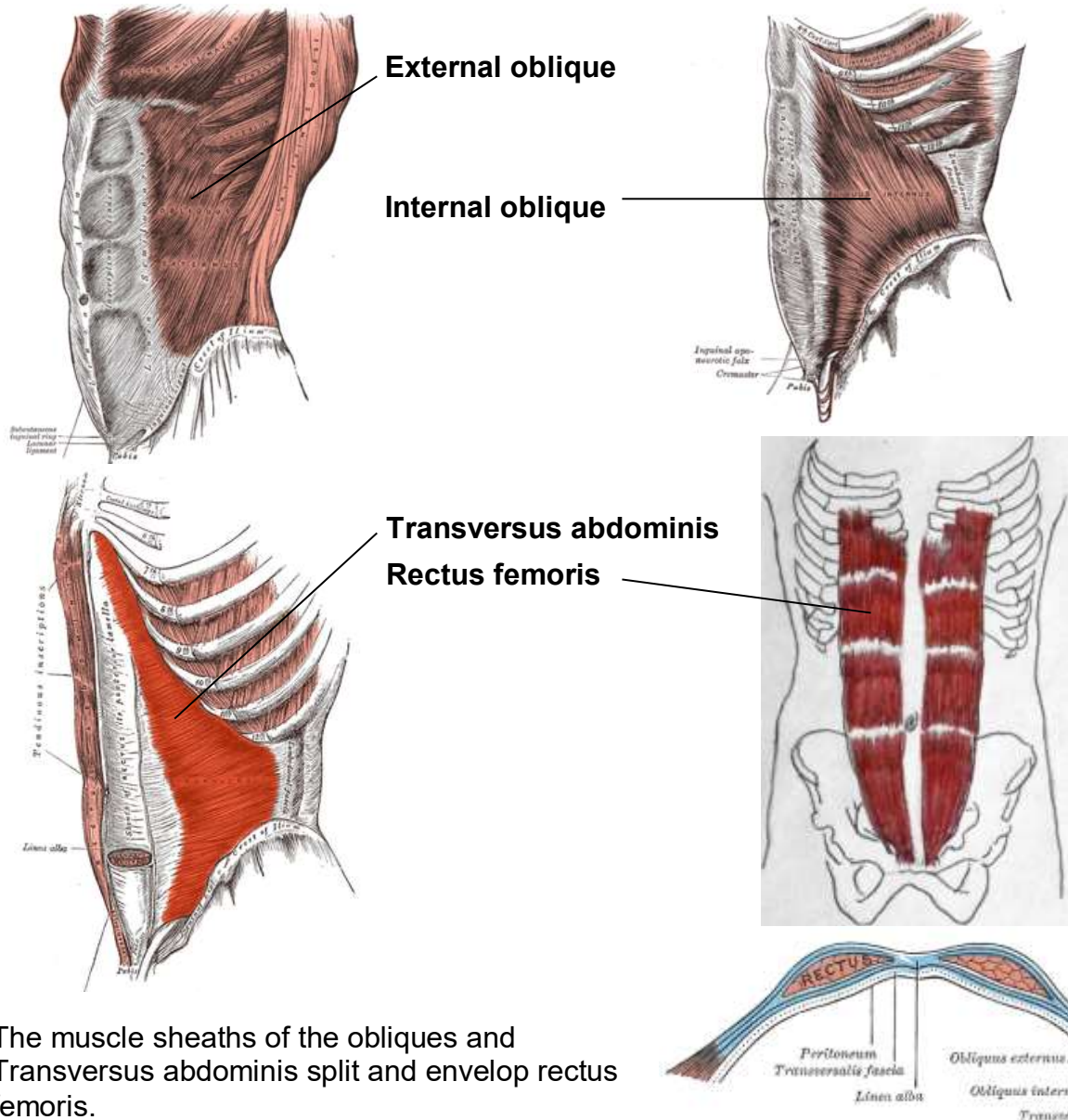
The abdominal wall consists of three layers of muscle. From the outside in, they are:

- **External obliques** - passes down and medially
- **Internal obliques** - passes down and laterally
- **Transversus Abdominis** - passes across abdomen

These attach to the lower edge of the thorax above to the pelvis below.

They wrap around and meet at the front where they form a sheath that envelops:

- **Rectus Abdominis**



The muscle sheaths of the obliques and Transversus abdominis split and envelop rectus femoris.

At the lower end of the abdomen is a specially formed canal, **the inguinal canal**, which allows the passage of **the ductus deferens**, the tube coming from the testes.

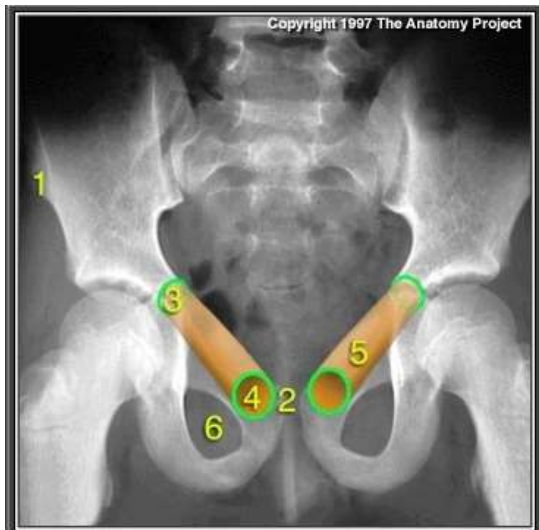
It is formed by a space through and in between the abdominal muscle layers

The X-ray below shows where these hole are situated

3 - The deep inguinal ring, the hole in the deep abdominal wall

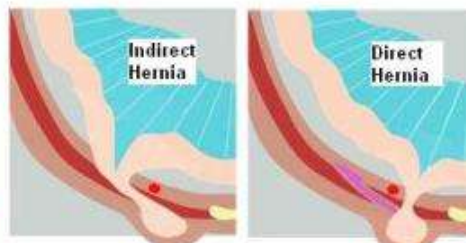
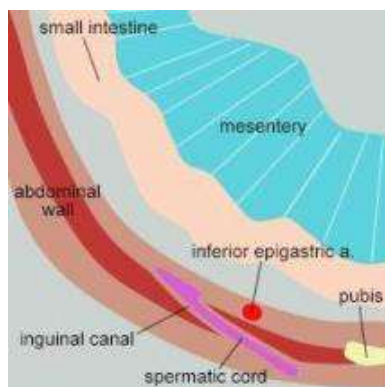
The canal then passes down and medially between the abdominal muscles layers and emerges at

4 - The superficial inguinal ring.



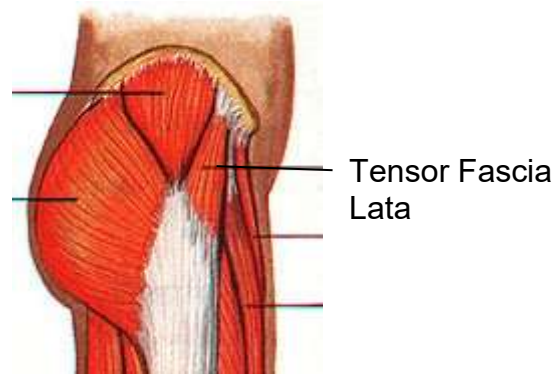
1. Anterior superior iliac spine
2. Pubic symphysis
3. Deep inguinal ring
4. Superficial inguinal ring
5. Inguinal canal
6. Obturator foramen

It is here where a hernia can occur (along with the umbilicus and the oesophageal hiatus, through which the oesophagus passes through the diaphragm)

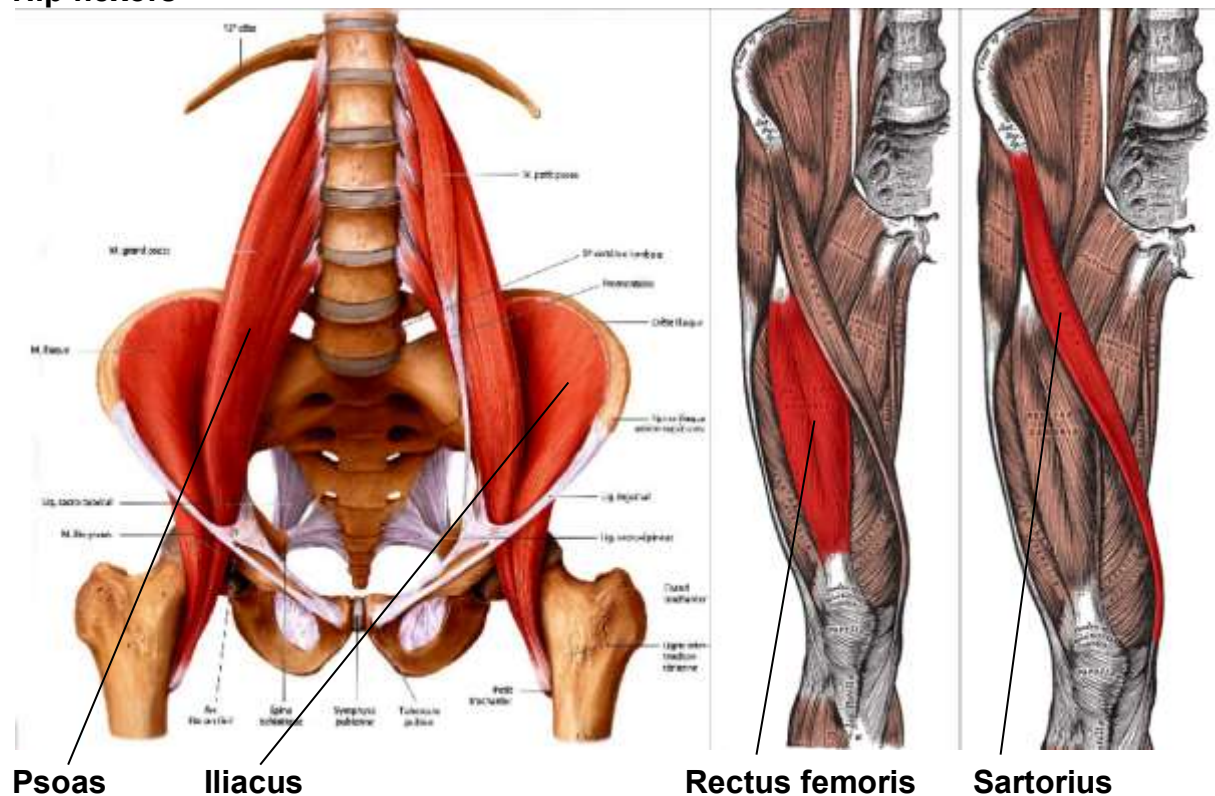


Muscles acting across the hip

Groups	Muscles
Flexors	Sartorius Psoas Iliacus Rectus femoris Tensor fascia lata (TFL)
Extensors	Gluteus maximus Hamstrings Adductor magnus
Adductors	Pectineus Adductor brevis Adductor longus Adductor magnus Gracilis
Abductors	Gluteus medius Gluteus minimus
Rotators:	
Medial	Gluteus medius Gluteus minimus Tensor fascia lata
Lateral	Piriformis (amongst 5 other deep lateral rotators) Sartorius



Hip flexors

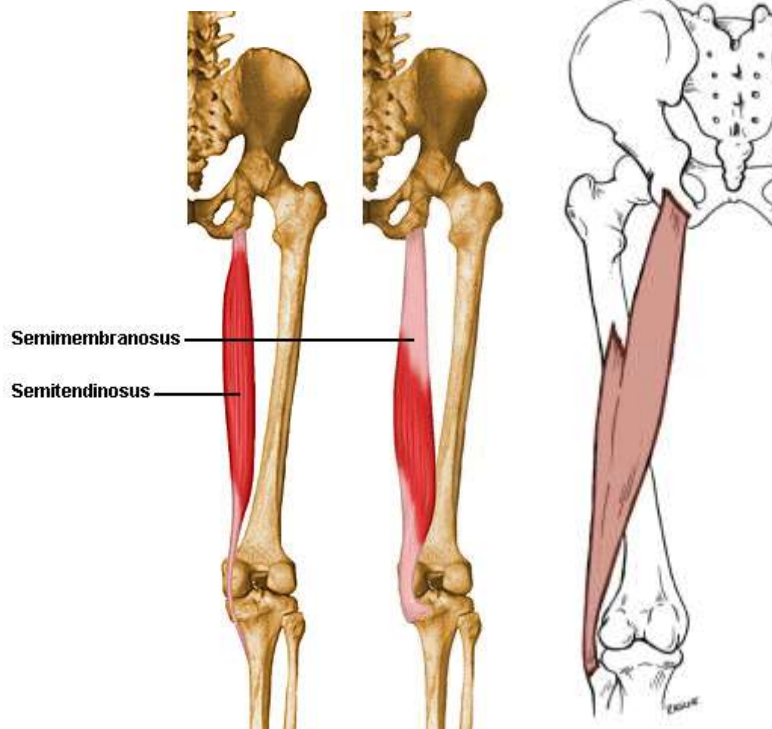
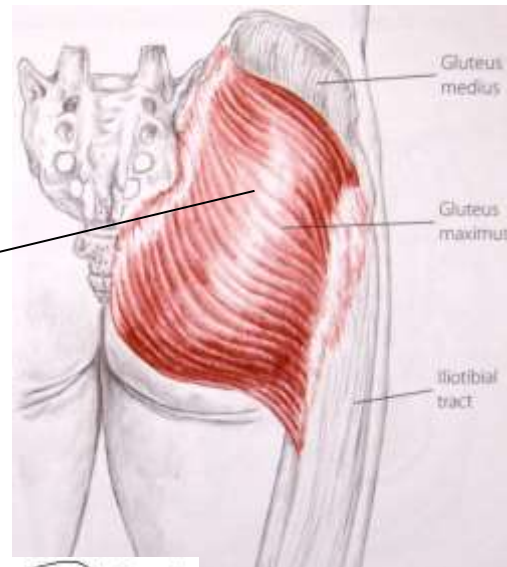


Hip extensors

- **Gluteus Maximus**
- **Hamstrings**
 - Biceps femoris
 - Semimembranosus
 - Semitendinosus
- **Adductor magnus**

Gluteus maximus

Extends and laterally rotates the hip



Hamstrings

These all cross the hip joint and the knee

Extend the hip

Flex the knee

Adductor Magnus

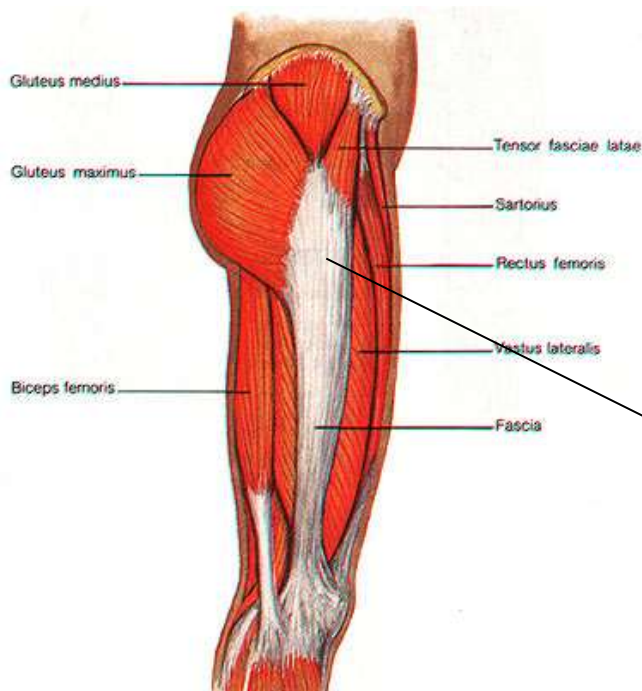
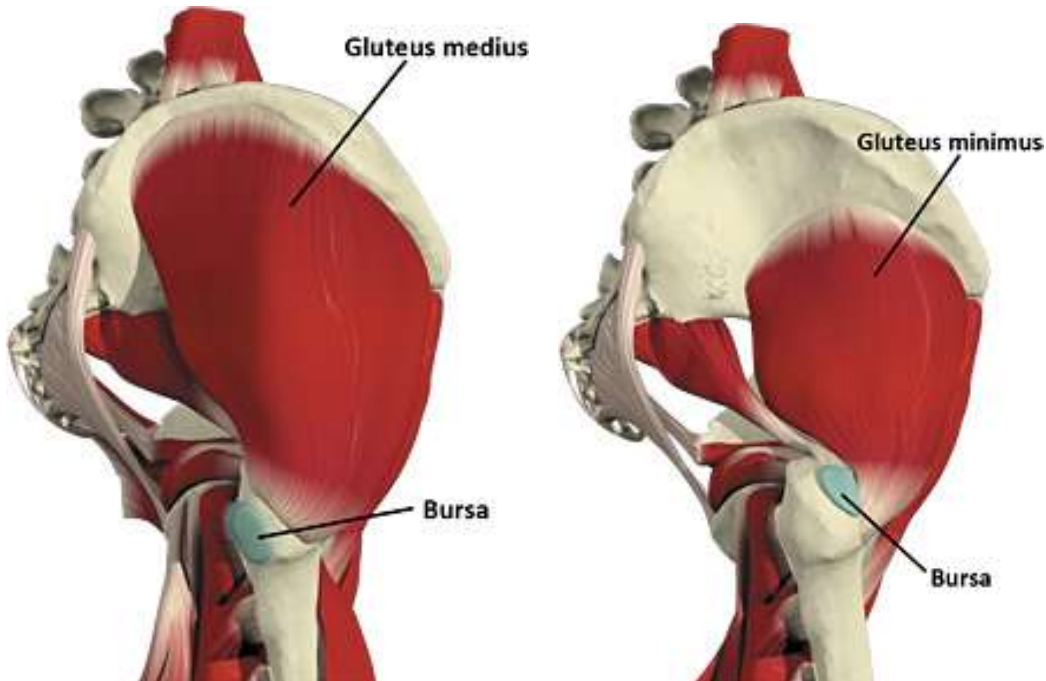
Extends and adducts the hip



Hip abductors

- Gluteus medius - abducts and medially rotates
- Gluteus minimus - abducts and medially rotates

These are on the outside of the hip, with medius lying over minimus



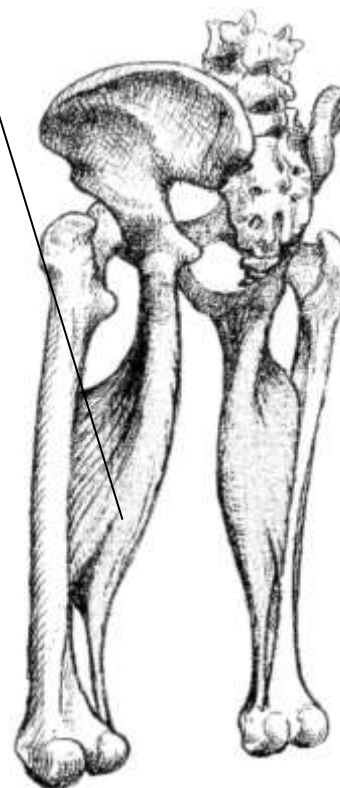
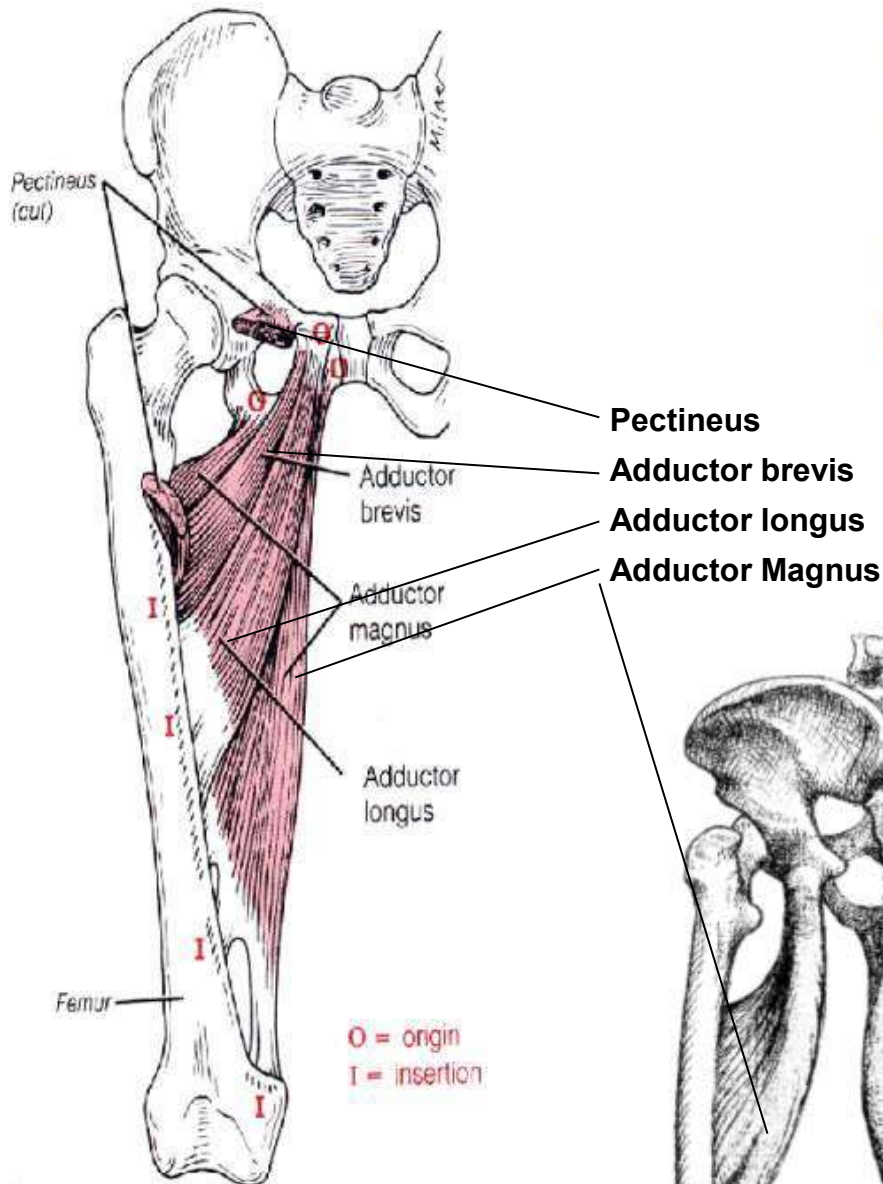
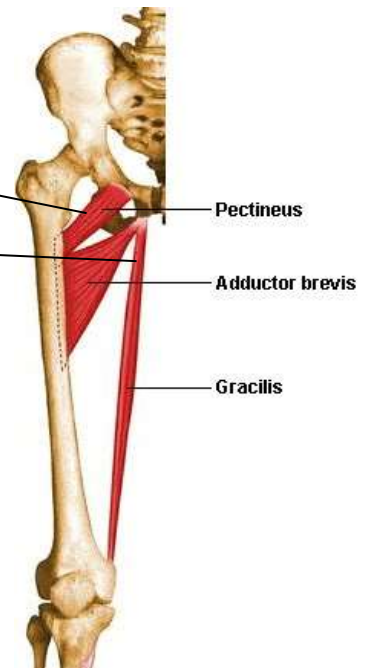
Gluteus maximus, medius, minimus and TFL all attach onto the iliotibial tract (ITT). The ITT passes from the top of the iliac crest down to the top of the tibia. Hence it crosses the hip and the knee and acts to transfer force past both joints down the thigh.

Iliotibial tract

Hip Adductors

- Pectineus
- Adductor brevis
- Adductor longus
- Adductor magnus
- Gracilis

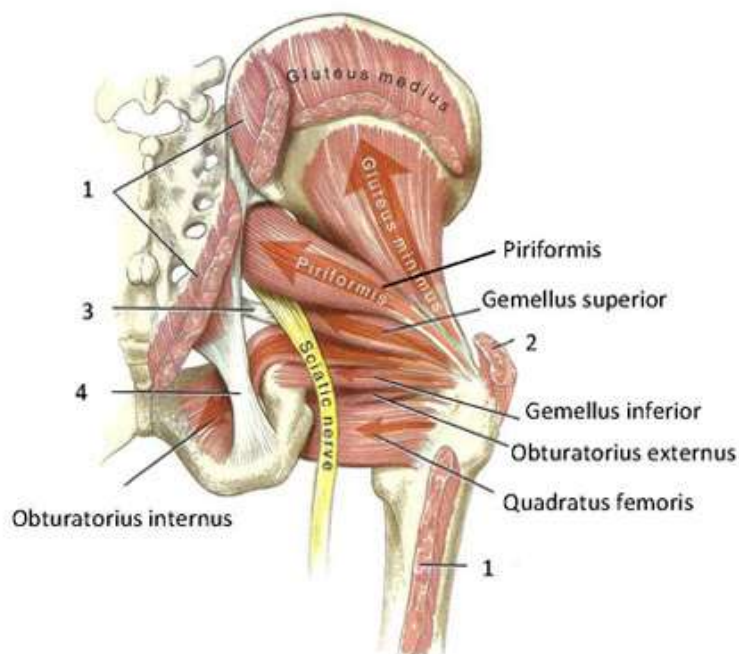
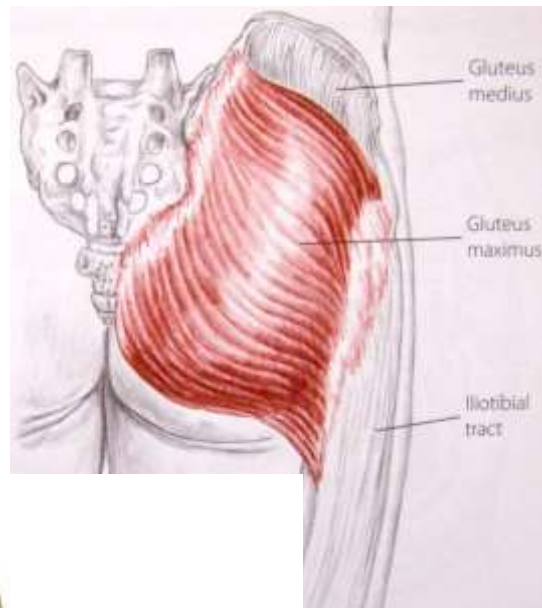
All these originate from the pubic bone adduct the hip



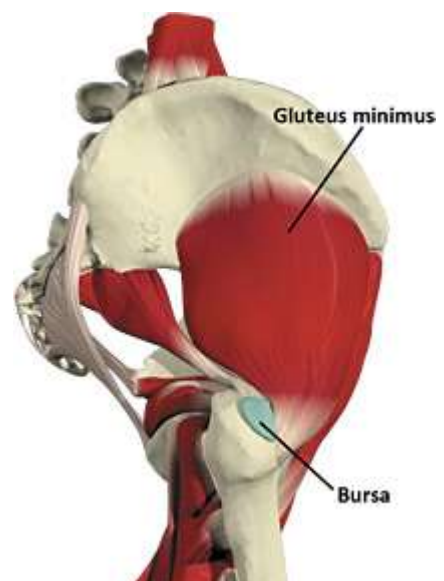
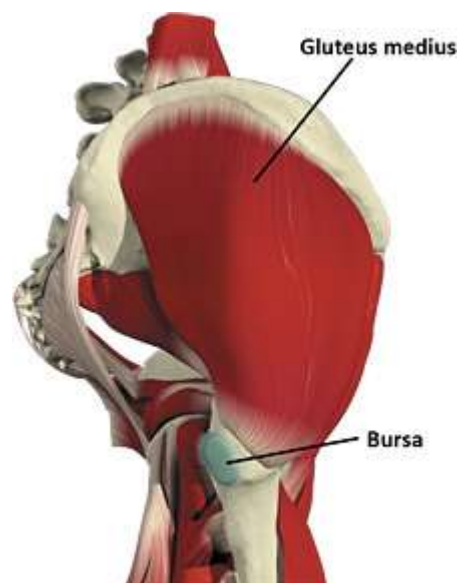
Hip rotators

Lateral rotators

- **Gluteus maximus**
- Deep lateral rotators
 - **Piriformis**
 - Obturator externus
 - Obturator internus
 - Gemellus superior
 - Gemellus inferior
 - Quadratus femoris



Medial rotators



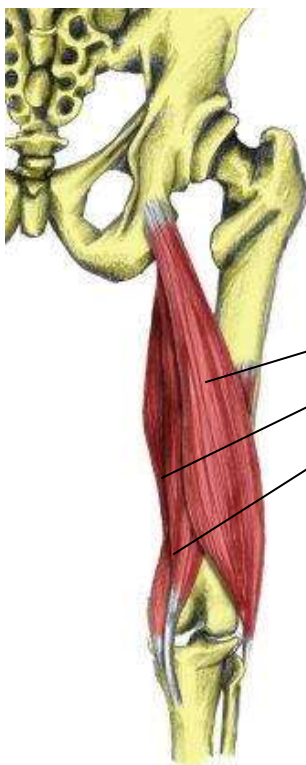
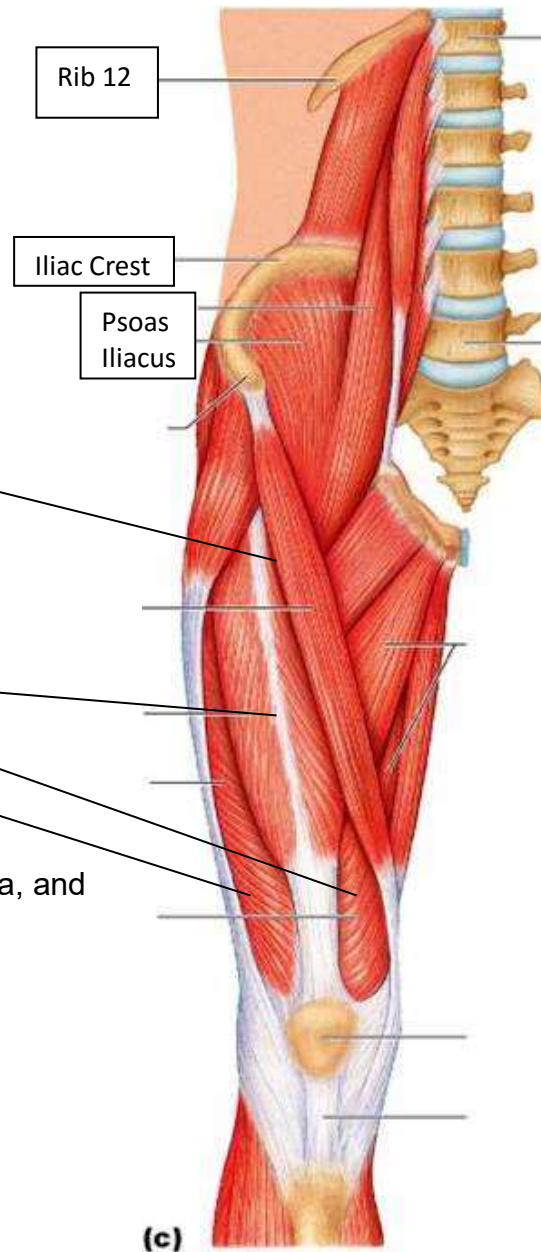
Knee

Knee extensors

- Sartorius
- Quadriceps femoris
 - Rectus femoris
 - Vastus medialis
 - Vastus lateralis
 - Vastus intermedius
 - Under rectus femoris

These pass from the femur on to the patella, and thence to the tibia

- All extend the knee
- Rectus femoris also flexes the hip



Knee flexors

Hamstrings

- Biceps femoris- lateral side
- Semitendinosus - medial side
- Semimembranosus - medial side

Calf and Foot

The calf consists of three distinct compartments:

- Anterior
- Posterior
- Lateral

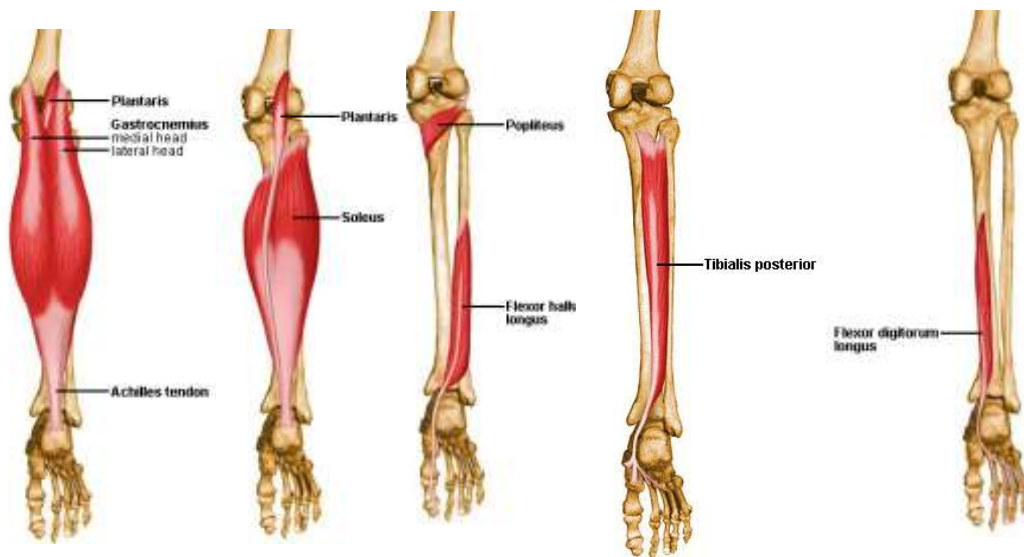
The foot functions at *right angles* to the leg, having a planter surface (the sole of the foot) and a dorsal aspect (the upper side of the foot). The movements are therefore:

Plantar and dorsi flexion (foot down and up, respectively)

Inversion/eversion (foot pulled in and out, respectively)

Muscle groups	Muscles	Compartment
Plantar flexors	Gastrocnemius Soleus Flexor digitorum Flexor hallucis longus Tibialis posterior	Posterior
Dorsiflexors	Tibialis anterior Extensor digitorum Extensor hallucis longus	Anterior
Invertors	Tibialis anterior Tibialis posterior	Anterior and posterior
Evertors	Peroneus longus Peroneus brevis	Lateral

Plantar flexors



Gastrocnemius and soleus both insert via the Achilles tendon onto the calcaneum

Flexor digitorum inserts onto the toes; flexor hallucis onto the big toe

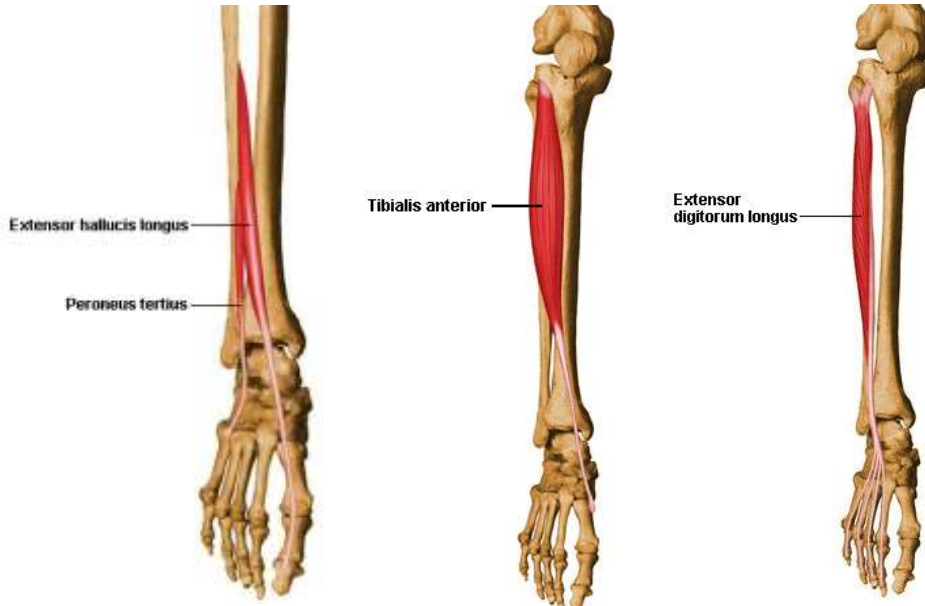
Peroneus posterior inserts onto the plantar aspect of the tarsal bones

Dorsiflexors

Tibialis anterior - crosses across the ankle to the medial side of the tarsal bones

Extensor digitorum - extends the toes

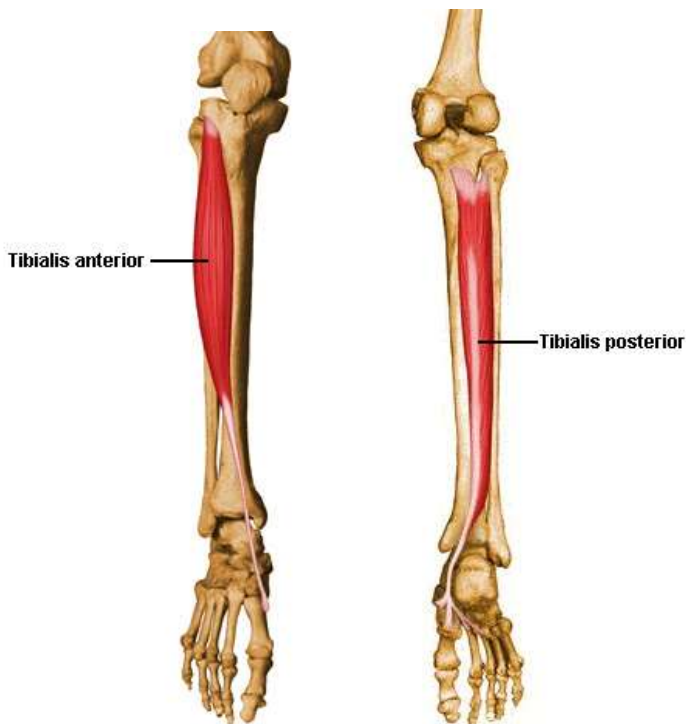
Extensor hallucis longus - extends the big toe



Invertors

Tibialis Anterior

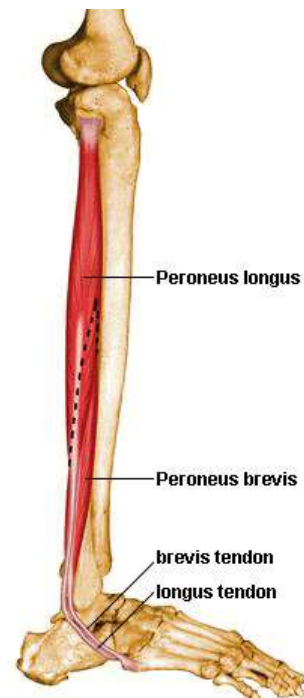
Tibialis posterior



Evertors

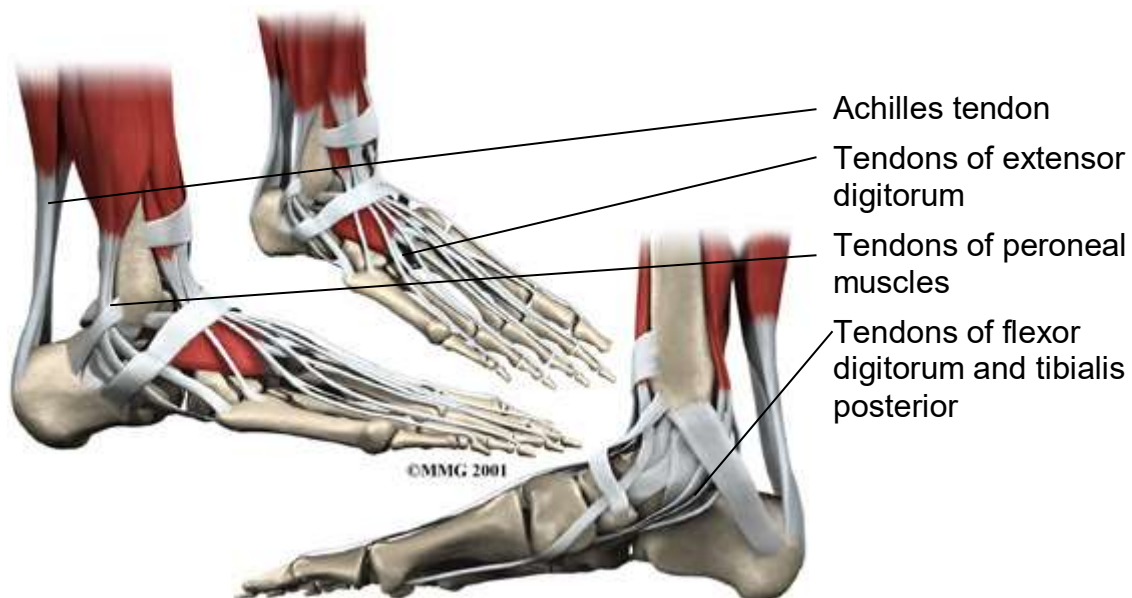
Peroneus brevis

Peroneus longus



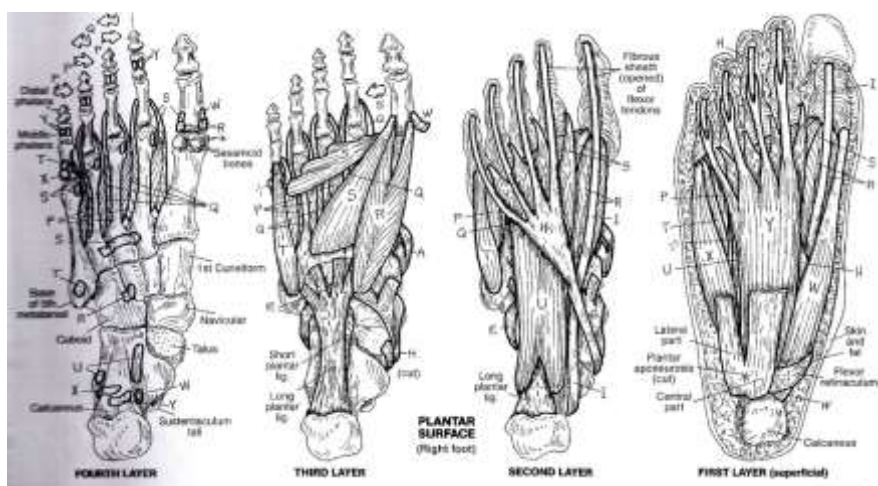
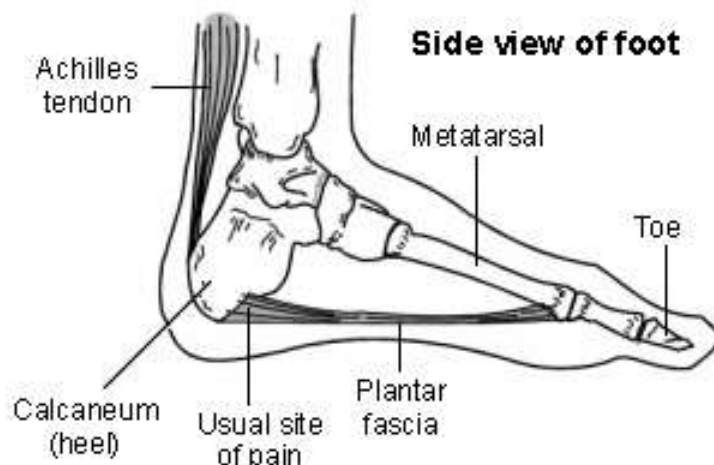
Foot

As the long muscles passing into the foot come from the calf, like in the wrist, they pass under retinacula to 'hold them down', as they go around corners.



The Achilles tendon does not only insert onto the calcaneum, it wraps around the bone, continues as the plantar fascia and attaches at the complex of tissues at the base of the toes.

The intrinsic muscles of the foot have a similar organisation to those in the hand, including the opposition muscles, suggesting the foot was able to grip before we decided to use them for just walking.

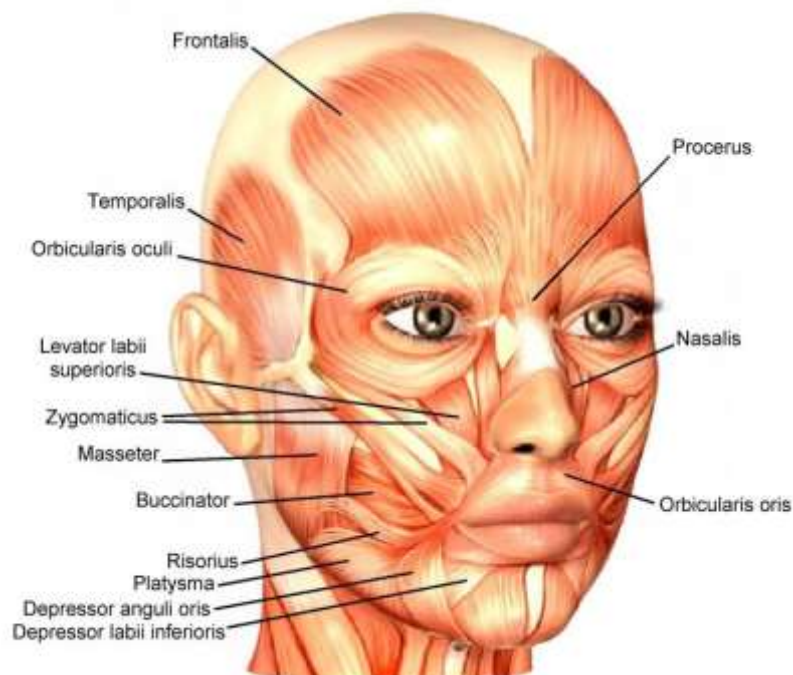


Nerve root values of thigh and leg

Nerve	Area supplied	Root value
Femoral	Front of thigh	L2,3,4
Obturator	Inside of thigh	L2,3,4
Sciatic	Back of thigh Below knee	L4,5,S1,2

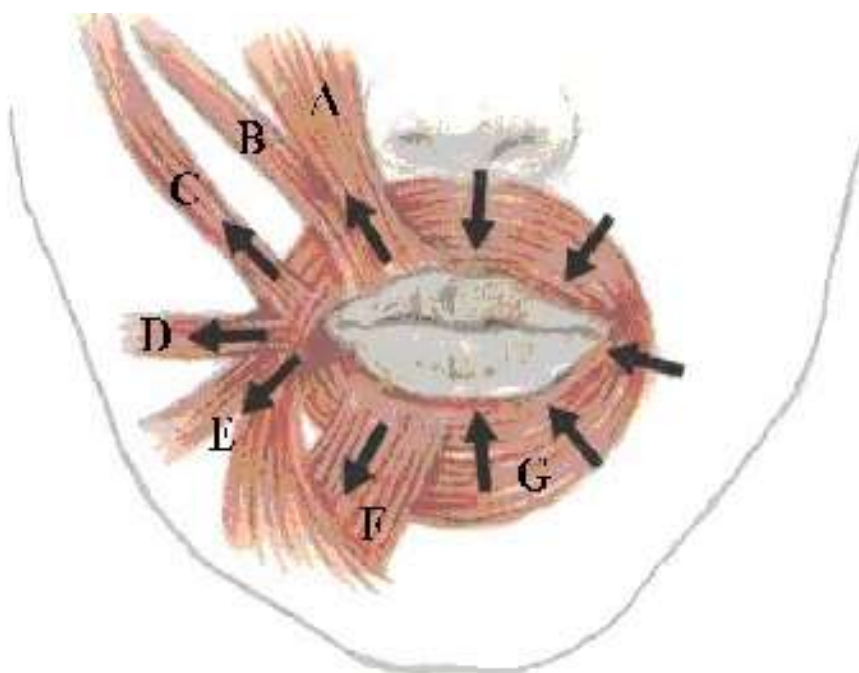
Muscle	Nerve root Values						
Psoas	L1	L2	L3				
Sartorius		L2	L3				
Gracilis		L2	L3				
Iliacus		L2	L3				
Pectineus		L2	L3				
Quadriceps		L2	L3	L4			
Adductor Longus Brevis		L2	L3	L4			
Tensor fascia lata				L4	L5		
Peroneus Longus Brevis				L4	L5	S1	
Extensor digitorum longus				L4	L5	S1	
Tibialis anterior				L4	L5	S1	
Extensor hallucis longus				L4	L5	S1	
Biceps femoris				L4	L5	S1	
Gluteus Medius Minimus				L4	L5	S1	S2
Gluteus maximus					L5	S1	S2
Flexor hallucis longus					L5	S1	S2
Gastrocnemius						S1	S2
Piriformis						S1	S2
Soleus						S1	S2

Muscles of the face



These are the muscles of facial expression. This diagram shows the key groups

Muscle	Situated	Function
Frontalis	Forehead	Pulls hairline down
Orbicularis oculi	Around eyes	Closes eyes tightly shut
Lavator labii (A)	Next to nose, down to lips	Lift lips and wing of nose
Zygomaticus (C)	Lateral, attached to corner of mouth	Pulls corners of mouth laterally (smile/grin)
Orbicularis oris (G)	Around mouth	Closes mouth tightly shut



Muscles of mastication

Muscle	Situated	Action
Temporalis	Temporal bone, down to coronoid process of mandible	Closes mouth Retracts mandible
Masseter	Between zygomatic arch and mandible	Closes mouth
Pterygoids		
Medial	From sphenoid and palatine, back to mandible	Closes mouth
Lateral	From sphenoid, back to mandible, adjacent to TMJ	Protracts mandible

