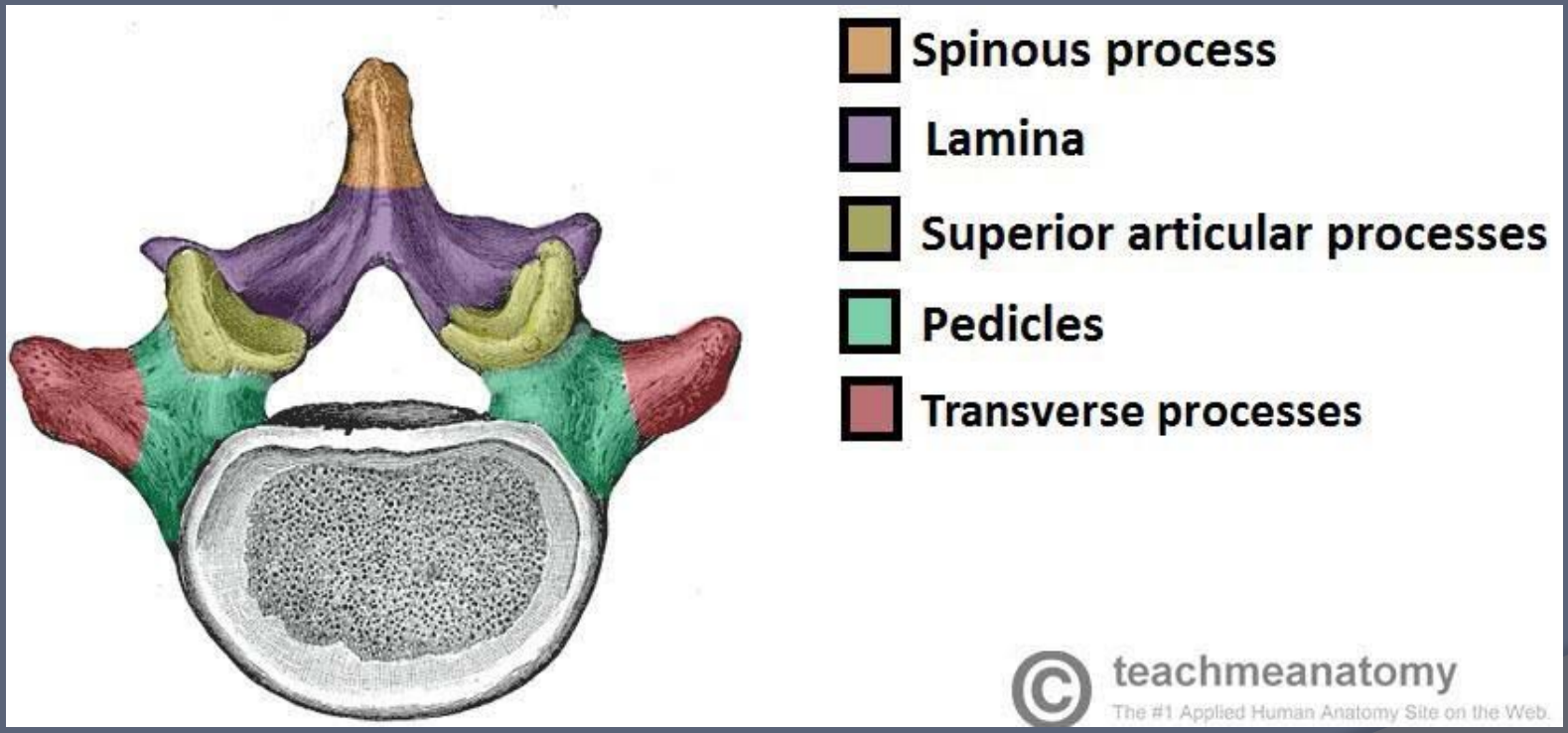
Lumbar Spine

ANATOMY OF THE BACK

Vertebrae Review

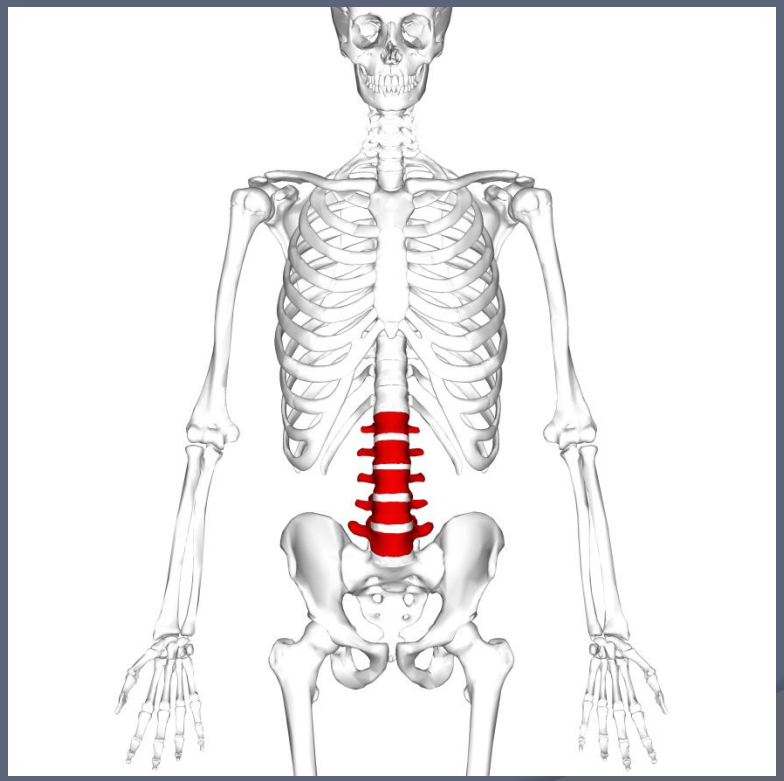
- All vertebrae share a basic common structure. They each consist of
  - vertebral body
  - posterior vertebral arch - refers to the lateral and posterior parts of the vertebrae
  - Vertebral foramen – forms vertebral canal
  - Pedicle
  - Lamina
  - Superior and inferior articular facets
  - Spinous process

Typical Vertebra



Lumbar Vertebrae

- 5 Lumbar Vertebrae
- Largest of the all the vertebrae
- Support the weight of the upper body



Characteristics of Lumbar Vertebrae

- Vertebral bodies are large and kidney bean shaped
- Vertebral foramen is triangle shaped
- Transverse processes are long and slender.
- Articular processes have nearly vertical facets.
- Spinous processes are short and broad.
- Accessory processes can be found on the posterior aspect of the base of each transverse process. They act as sites of attachment for deep back muscles.
- Mammillary processes can be found on the posterior surface of each superior articular process. They act as sites of attachment for deep back muscle
  - The fifth lumbar vertebrae, L5, has some distinctive characteristics of its own. It has a notably large vertebral body and transverse processes as it carries the weight of the entire upper body

Lumbar vertebra

Thoracic and lumbar vertebra

https://www.youtube.com/watch?v=PM8-C6Lzpso

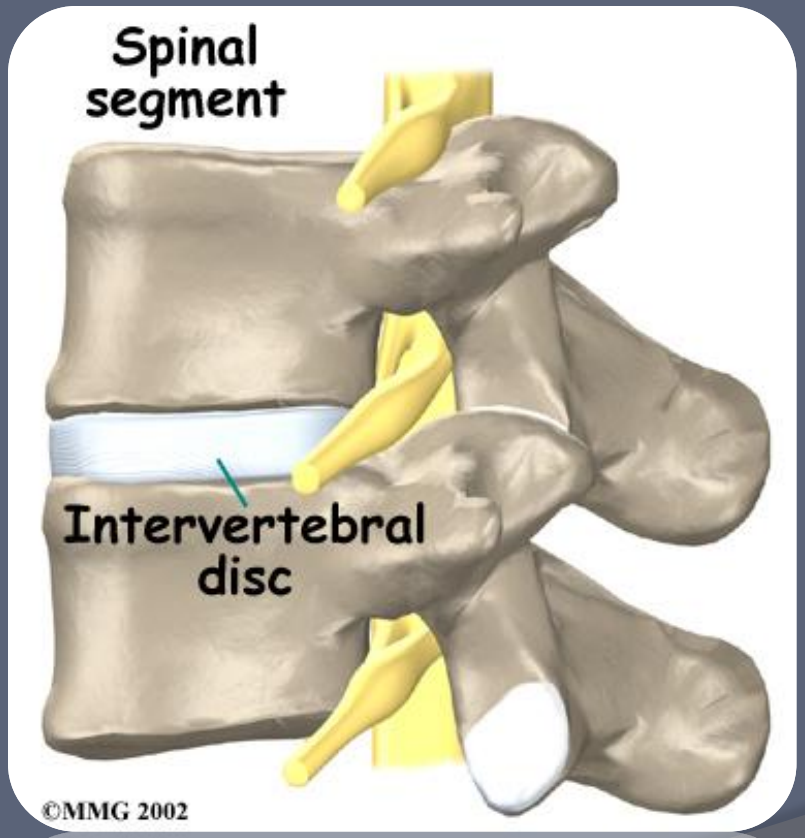
Joints

- There are two types of joint in the lumbar spine. Both of these articulations are not unique to the lumbar vertebrae, and are present throughout the vertebral column.

- Between vertebral bodies – adjacent vertebral bodies are joined by intervertebral discs, made of fibrocartilage. This is a type of cartilaginous joint.

articulation of superior and inferior articular processes from adjacent vertebrae. It is a synovial plane type joint.

Joints



Spinal Nerves/Spinal Column in the Lumbar spine

- The spinal cord starts at the base of the brain, runs throughout the cervical and thoracic spine, and typically ends at the lower part of the thoracic spine.

- The spinal cord does not run through the lumbar spine (lower back). After the spinal cord stops in the lower thoracic spine, the nerve roots from the lumbar and sacral levels come off the bottom of the cord like a "horse's tail" (named the cauda equina) and exit the spine.

- Because the lumbar spine has no spinal cord and has a large amount of space for the nerve roots, even serious conditions—such as a large disc herniation—do not typically cause paraplegia (loss of motor function in the legs).

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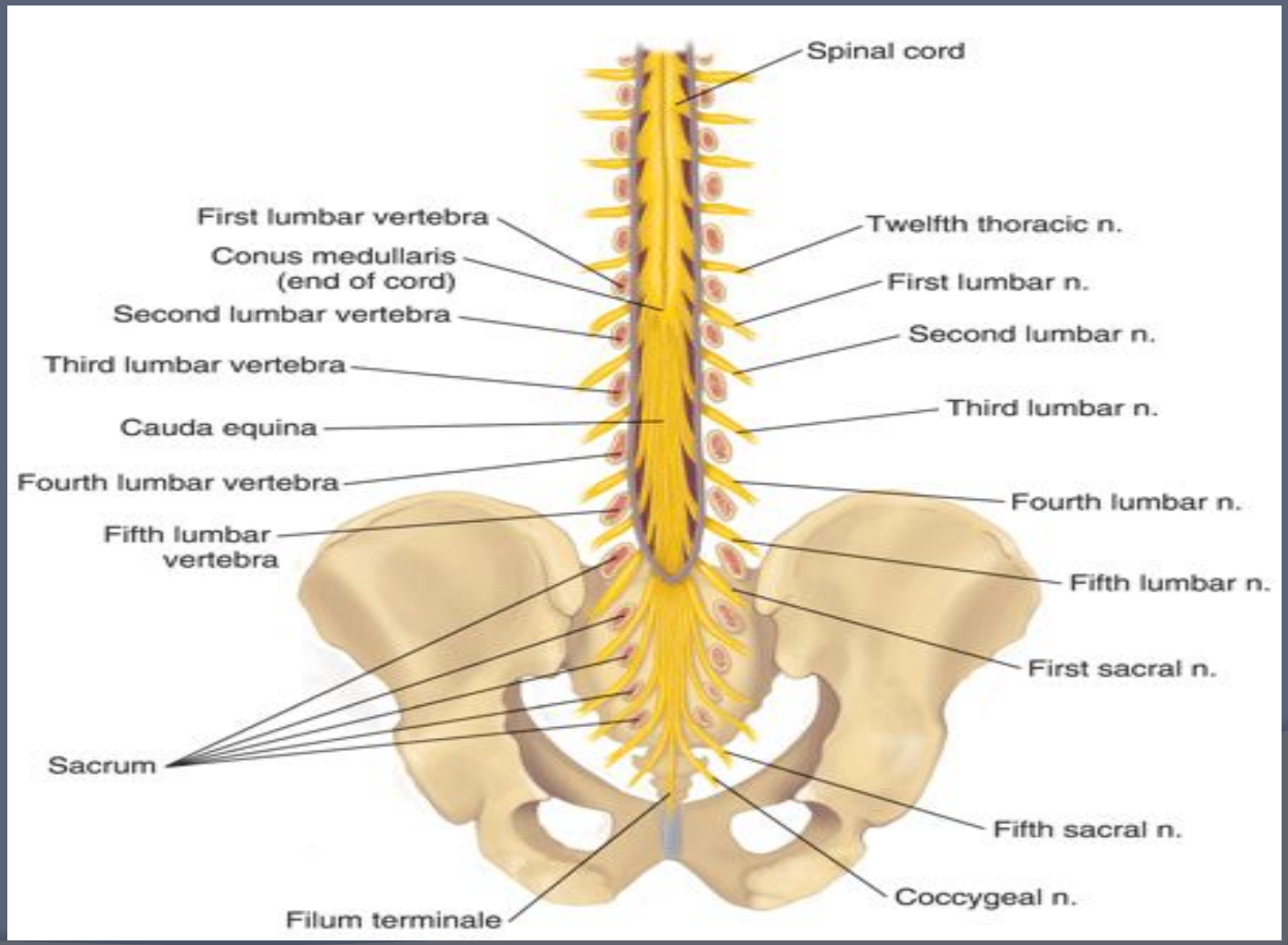

Spinal cord
First lumbar vertebra
Conus medullaris (end of cord)
Second lumbar vertebra
Third lumbar vertebra
Cauda equina
Fourth lumbar vertebra
Fifth lumbar vertebra
Sacrum
Filum terminale
Twelfth thoracic n.
First lumbar n.
Second lumbar n.
Third lumbar n.
Fourth lumbar n.
Fifth lumbar n.
First sacral n.
Fifth sacral n.
Coccygeal n.

Plexuses

- Review lumbar and sacral plexus from anatomy 2

Lumbar Plexus

- The roots (anterior rami) of spinal nerves L1 – L4 from the lumbar plexus
- There is not as much intermingling of fibres in the lumbar (compared to brachial plexus)
- The plexus is formed anterior to the TVP's of lumbar vertebrae
- It is within the proximal attachment of psoas major (ant,lat bodies of t12-L5 and IVD, ant on tps of L1-L5)
- The lumbar plexus supplies the anterolateral abdominal wall the external genitals and part of the lower limbs
- Major branches of the lumbar plexus include:
  - Femoral nerve
  - Obturator nerve
  - Lumbosacral trunk

Femoral Nerve

- L2,3,4 = “Fem-or-al”
- Emerges from lateral border of psoas major and innervates iliacus
- Passes deep to inguinal ligament to the anterior thigh – here it divides into many smaller branches
- Supplies flexors of hip and extensors of knee
- Also supplies skin over anterior and medial thigh and medial leg and foot

Obturator Nerve

- L2,3,4 = SAME AS FEMORAL
- Emerges from medial border of psoas major and passes into lesser pelvis
- Passes through the obturator foramen to supply adductor muscles and skin over medial thigh
- No pelvic structures are supplied by the obturator nerve

Lumbosacral Trunk

- L4 &L5
- Passes over the wing of the sacrum and descends into the pelvis
- Here it helps form the sacral plexus with S1-S4

Sacral Plexus

- Roots (anterior rami) of L4, L5 and S1 – S4 form the sacral plexus
- This is found just anterior to the sacrum (anterior to piriformis muscle)
- The sacral plexus supplies the buttocks, perineum and lower limbs
- The sciatic nerve is a branch of the sacral plexus

Sciatic nerve

- Longest nerve in the body
- L4, L5, S1 – S3 nerve roots
- Typically passes through the greater sciatic foramen inferior to piriformis
- Then descends along the posterior thigh to supply the back of the lower limb

Pudendal Nerve

- This is the main nerve of the perineum
- It conveys most of the sensory information from the external genitals
- S2-S4 roots
- Leaves the pelvis through the greater sciatic foramen, hooks around the ischial spine and re-enters the pelvis through the lesser sciatic foramen

Superior Gluteal Nerve

- L4-S1 ROOTS
- Leaves pelvis through greater sciatic foramen (superior to piriformis)
- Supplies gluteus medius, minimus and TFL

Inferior Gluteal Nerve

- L5-S2 ROOTS
- Leaves pelvis through the greater sciatic foramen (inferior to piriformis)
- Lies superficial to sciatic nerve and then supplies gluteus maximus

Videos

Lumbar Plexus

https://www.youtube.com/watch?v=UmIDCHd0Ai4

Sacral Plexus

https://www.youtube.com/watch?v=DZ0IL1tHNxo

Nerves of the thigh

- Femoral nerve, Superior gluteal
- Deep Gluteal Nerves – inferior gluteal & superior gluteal, Sciatic nerve

Nerves of the thigh

- **FEMORAL NERVE**
- The terminal branch of the femoral nerve is the saphenous nerve
- The saphenous nerve travels with the femoral vessels through the adductor canal
- It emerges between sartorius and gracilis at the level of the adductor hiatus
- Supplies the skin on anteromedial knee, leg and foot
-
- **SUPERFICIAL GLUTEAL NERVES**
- Also referred to as the clunial nerves
- These innervate the skin over the gluteal region

Cont..

- **DEEP GLUTEAL NERVES**
- The superior gluteal nerve runs laterally between gluteus medius and minimus
- The inferior gluteal nerve runs on the deep surface of the gluteus maximus
- Sciatic nerve rests on the ischium and then passes posterior to obturator internus, quadrates femoris and adductor magnus
- The sciatic nerve supplies posterior thigh muscles, all leg and foot muscles and skin of most of the leg and foot
- Also supplies joints of the lower limb (Hilton's law)
- The sciatic nerve actually divides into a tibial branch and a como fibular branch
- These usually separate about halfway down the thigh

Nerves of the Leg

- Saphenous, Tibial, Common Fibular, Superficial Fibular, Deep Fibular
- **SAPHENOUS**
- Terminal branch of the femoral nerve
- This is a cutaneous nerve that supplies the anteromedial knee, leg, foot
- **TIBIAL**
- A branch of the sciatic nerve
- The tibial nerve is the medial and larger branch
- It passes through the centre of the popliteal fossa
- Supplies – soleus, gastrocs, plantaris, popliteus (superficial posterior compartment) and tibialis posterior, flexor digitorum longus, flexor hallucis longus (deep posterior compartment)

Nerves of the legs

- **COMMON FIBULAR**
- The lateral smaller branch of the sciatic nerve
- Follows the medial border of biceps femoris
- Winds around the neck of the fibula and divides into its terminal branches:
  - Superficial fibular nerve
  - Deep fibular nerve
-
- **SUPERFICIAL FIBULAR NERVE**
- This branch of the common fibular nerve supplies the lateral compartment muscles
- This nerve then continues as a cutaneous nerve to supply skin on the distal anterior leg and dorsum of the foot

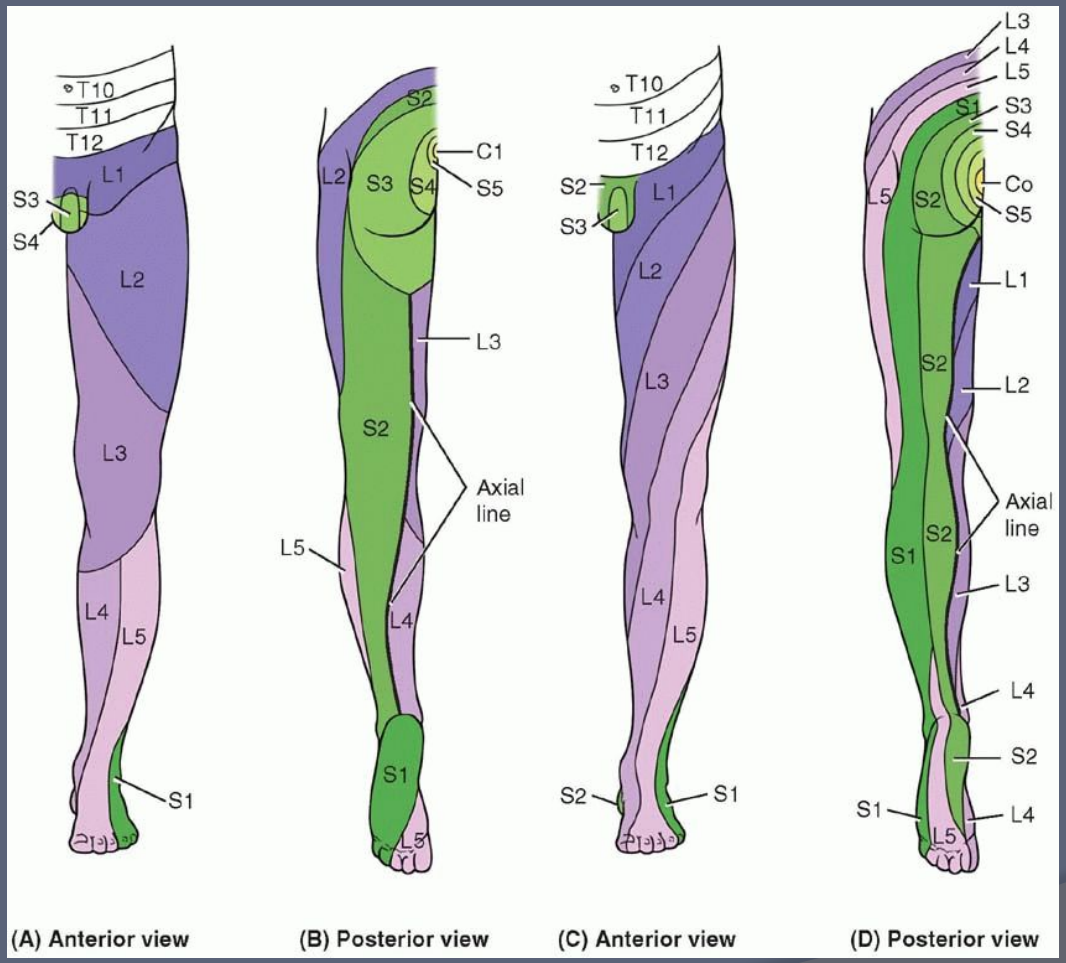
Nerves of the leg

- **DEEP FIBULAR NERVE**
- This branch of the common fibular nerve supplies the anterior compartment muscles
- This branch arises between fibularis longus and the neck of the fibula
- A lesion of this nerve results in “drop foot” (inability to dorsiflex)

Nerves of the foot

- The following nerves all supply skin and muscles of the foot:
  - Saphenous – Medial side of the foot
  - Superficial fibular – Skin on dorsum of foot except for region supplied by deep fibular
  - Deep fibular – Extensor Digitorum Brevis and skin between 1st and 2nd digits
  - Medial plantar – Skin of medial sole of foot, Abductor Hallucis, Flexor Digitorum Brevis and 1st Lumbrical
  - Lateral plantar – Skin on lateral sole, quadratus plantae, abductor digiti minimi pedis, flexor digiti minimi, interossei, lateral 3 lumbricals, adductor hallucis
  - Sural – Lateral aspect of hind foot and mid foot
  - Calcaneal branches – Skin of heel

Cutaneous nerve supply



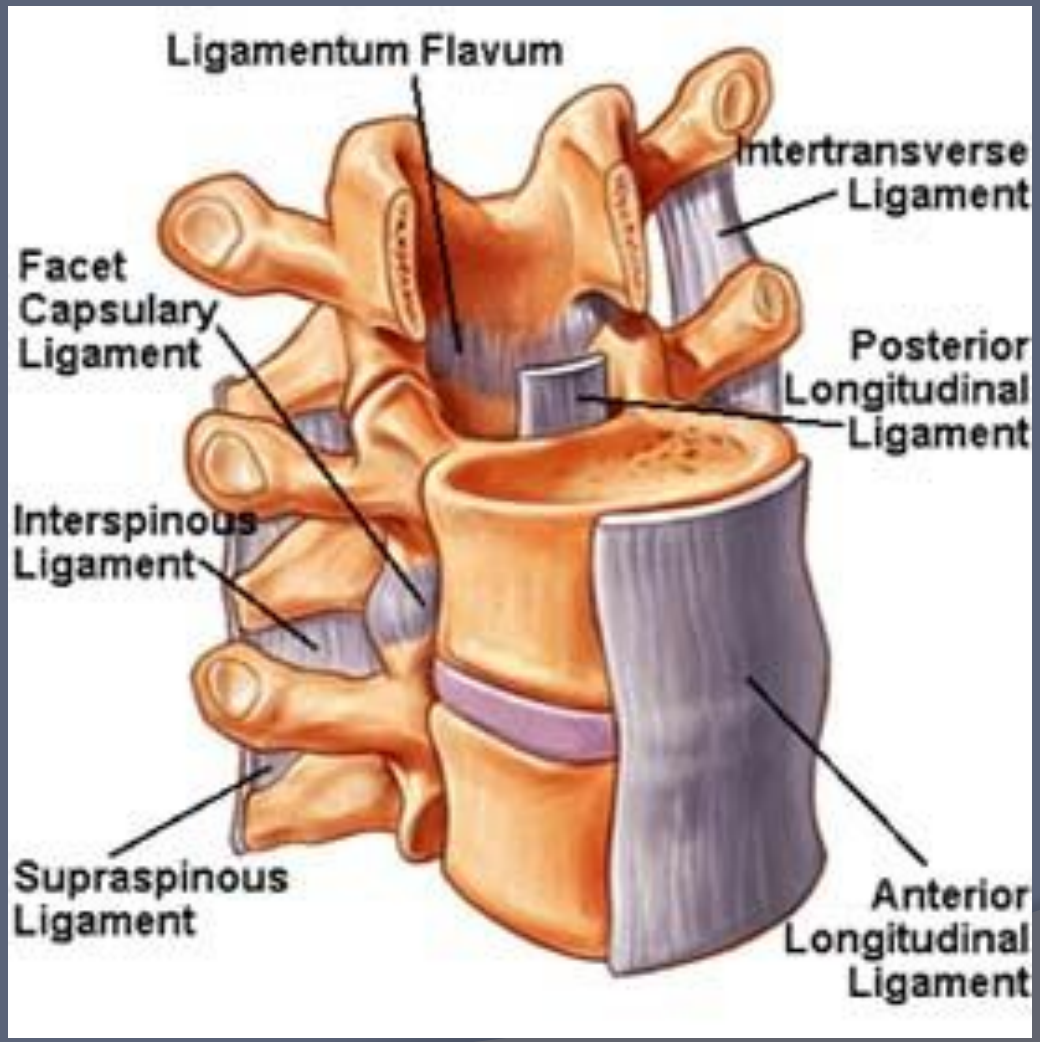
Ligament Review

- Supraspinaous Ligament
  - Starts at SP of C7 and follows SP to the sacrum, Slightly limits Spinal Flexion
- Anterior longitudinal ligament
  - Begins at the Occipit bone or Anterior tubercle of the Atlas (C1) and travels to the Sacrum, located on the anterior surface of vertebral bodies but does not attach to the intervertebral discs, limits spinal extension
- Posterior longitudinal ligament
  - Begins at the occipit bone and runs Posterior surface of vertebral bodies, travels to sacrum. Attaches to intervertbral discs and upper and lower margins of vertebral bodies, limits flexion of the spine and protects the disc

Ligaments Continued

- Capsular ligaments (zygoapophyseal ligament)
  - Covers joint capsule of each facet, limits gliding motion (opening and closing) of the facets
- Ligamentum Flavum
  - NON CONTINUOUS ligament that extends from posterior vertebral arch to posterior vertebral arch. Always under tension – even at rest, stretched more during flexion. Plays a role in returning the spinal column to an erect position

Spinal Ligaments



Pelvic Ligaments

- Sacrotuberous Ligament - attached by its broad base to the posterior superior iliac spine, the posterior sacroiliac ligaments (with which it is partly blended), to the lower transverse sacral tubercles and the lateral margins of the lower sacrum and upper coccyx
- Sacrospinous Ligament - is a thin ligament attached to the ischial spine (a bone prominence in the lower pelvis) and the lateral (side) regions of the sacrum (at the bottom of the spine) and coccyx, or tailbone

Continued

- Posterior Sacroiliac Ligament - is situated in a deep depression between the sacrum and ilium behind; it is strong and forms the chief bond of union between the bones
- The upper part (short posterior sacroiliac ligament) is nearly horizontal in direction, and pass from the first and second transverse tubercles on the back of the sacrum to the tuberosity of the ilium.
- The lower part (long posterior sacroiliac ligament) is oblique in direction; it is attached by one extremity to the third transverse tubercle of the back of the sacrum, and by the other to the posterior superior spine of the ilium.
- Illiolumbar Ligament - is a strong ligament passing from the tip of the transverse process of the fifth lumbar vertebra to the posterior part of the inner lip of the iliac crest

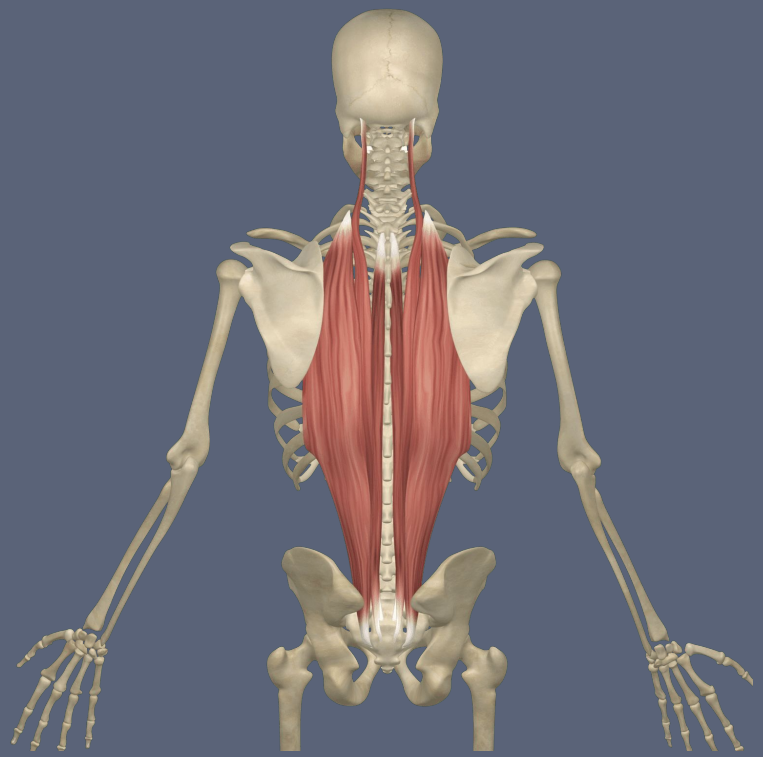
Review hip and thigh muscles

Back muscles

https://youtu.be/-oxY2Duc-0c

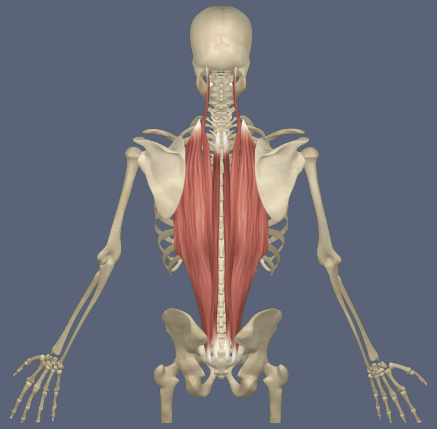
Muscles

Erector Spinae Muscles



- aka: paraspinal muscles
  - most superficial of the paraspinal muscles
- erector spinae:
  - three main muscles:
    - Iliocostalis
    - Longissimus
    - Spinalis

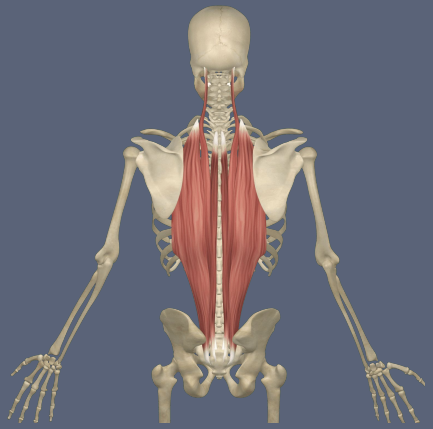
Erector Spinae Muscles



- each individual muscle is divided into three different sections
  - named based on where they attach along the spinal column
    - thoracis → thoracic spine
    - cervicis → cervical spine
    - Capitis → head

- "I LIKE SPAGHETTI"
  - spinalis is the most medial along the spinal column

Erector Spinae Muscles



- muscle actions:
  - bilaterally:
    - all contribute to spinal extension & lateral flexion
  - unilaterally
    - some muscle segments function on their own to create other actions based on their attachment site
  - move larger segments of the vertebral column vs. deeper muscles of the back that may only target individual segments

Iliocostalis

Origin

lumborum: medial iliac crest & sacrum
thoracis: angle of ribs 7 -12
cervicis: angle of ribs 3-6

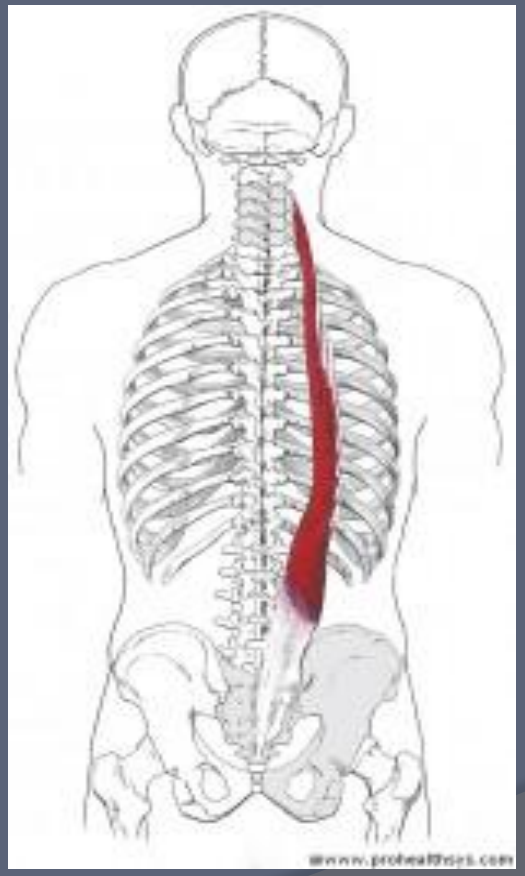
Insertion

lumborum: angle of ribs 7 -12
thoracis: angle of ribs 1-7
cervicis: TPs of C4 - C6

Actions

Extension of the trunk & neck
lateral flexion trunk & neck

Nerve – Spinal Nerve (Dorsal Rami)
Blood - Muscular branches of Aorta



Longissimus

Origin

Thoracis: Medial Iliac crest, posterior sacrum, TPs L1-L5

Cervicis: TPs of T1-T5

Capitis: TPs C5 – T5

Insertions –

Thoracis: TPs of T1-12 & lower 9 Ribs

Cervicis: TPs C2-C6

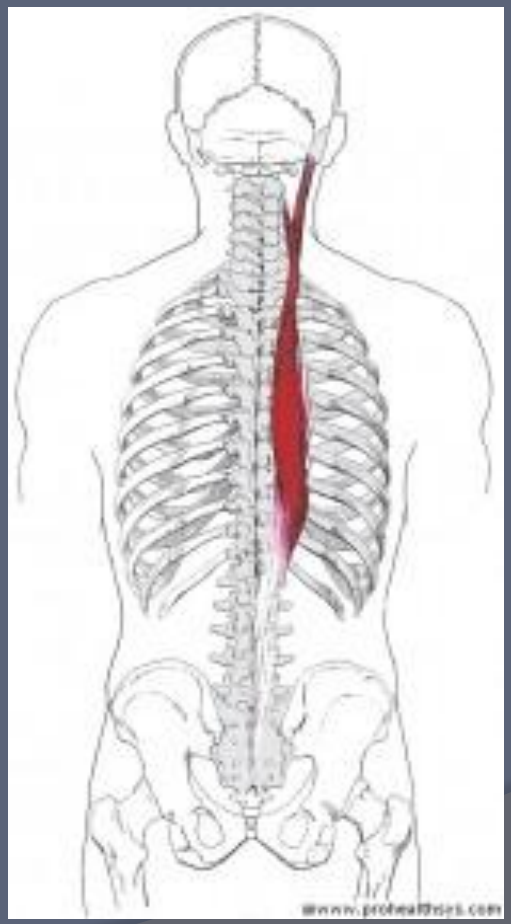
Capitis: mastoid process

Actions

extension and lateral flexion of trunk, neck & head

Nerve- Spinal Nerves Dorsal Rami

Blood- muscular branches of Aorta



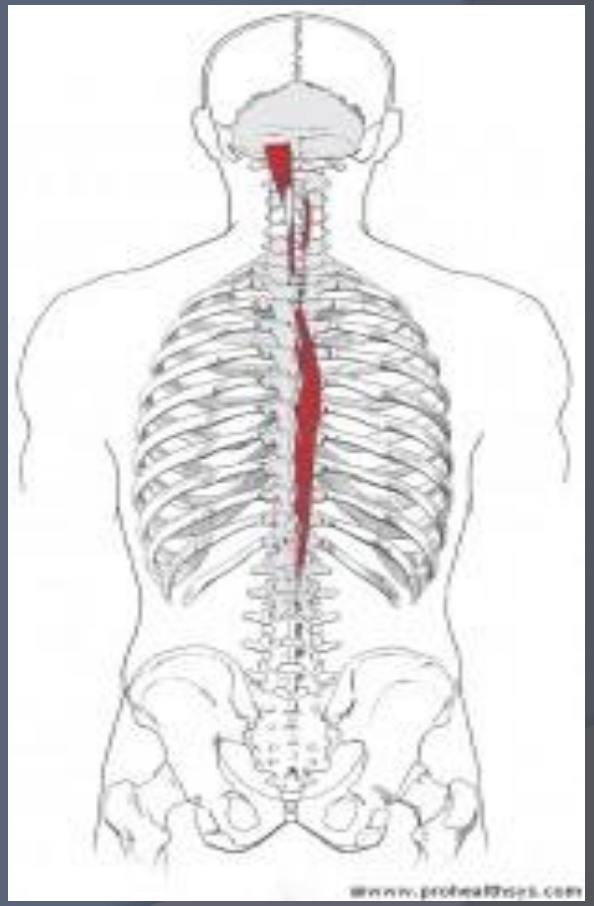
Spinalis

Origins
Thoracis: SPs T11-L2
Cervicis: Inferior Nuchal ligament & SP C7
Capitis: Medial portion of semispinalis

Insertions
Thoracis: SPs of T4 –T8
Cervicis: SP of C2
Capitis: Medial portion of semispinalis

Action
extension and lateral flexion of the trunk & neck

Nerve – Spinal Nerve (dorsal Rami)
Blood – Muscular branches of Aorta



Transversospinalis Group

- Associated with movements of the vertebral column
- This muscle group attaches from the transverse process inferiorly to the spinous process superiorly

Transversospinalis group – Semispinalis

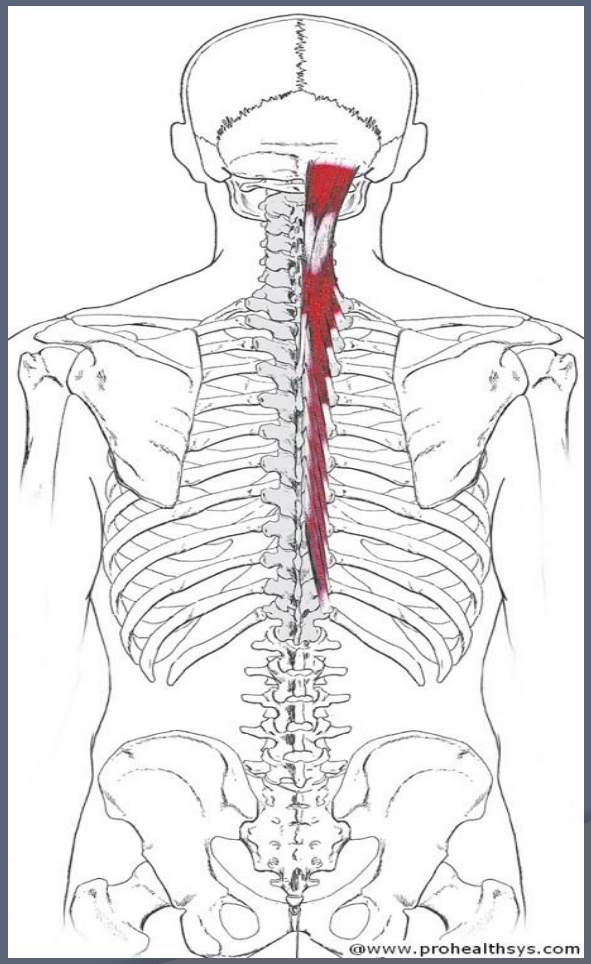
Origin - **Thoracis**: TPs of T6-T10
cervicis: TPs of T1-T5
capitis: TPs of C7-T6 & articular process of C4-C6

Insertion - **Thoracis**: SPs of C6-T4
Cervicis: SPs of C2-C5
Capitis: occipital bone (below superior nuchal line)

Action – extension & lateral flexion of head, neck & trunk; contralateral rotation of trunk and neck

Nerve – Spinal Nerves (Dorsal Rami)

Blood-Occipital & Posterior intercostal Artery



Multifidus

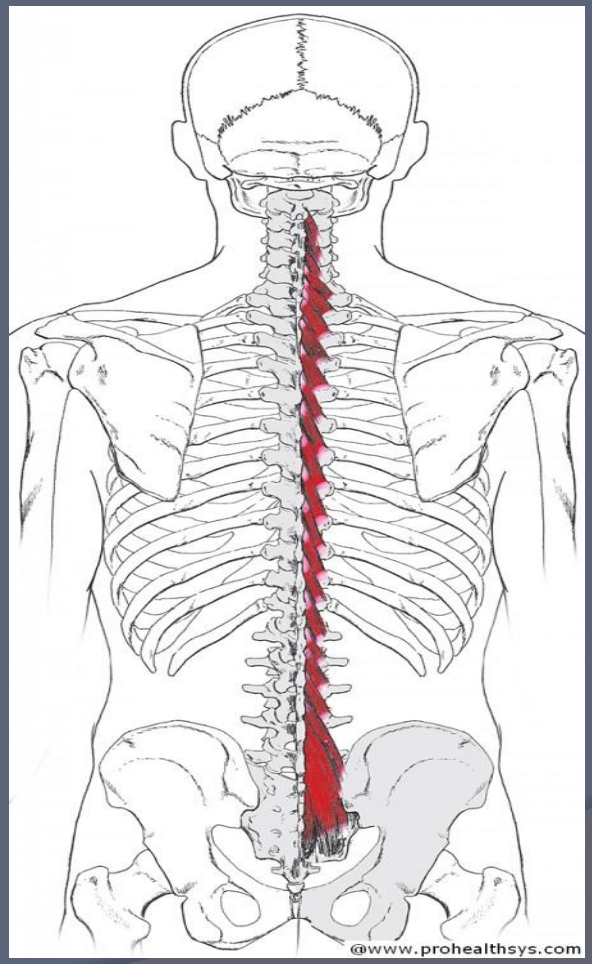
Origin – **lumborum** – Mamillary processes of L1 – L5; **Thoracis** – TP T1 –T12; **Cervicis** – Articular Process C4-C7

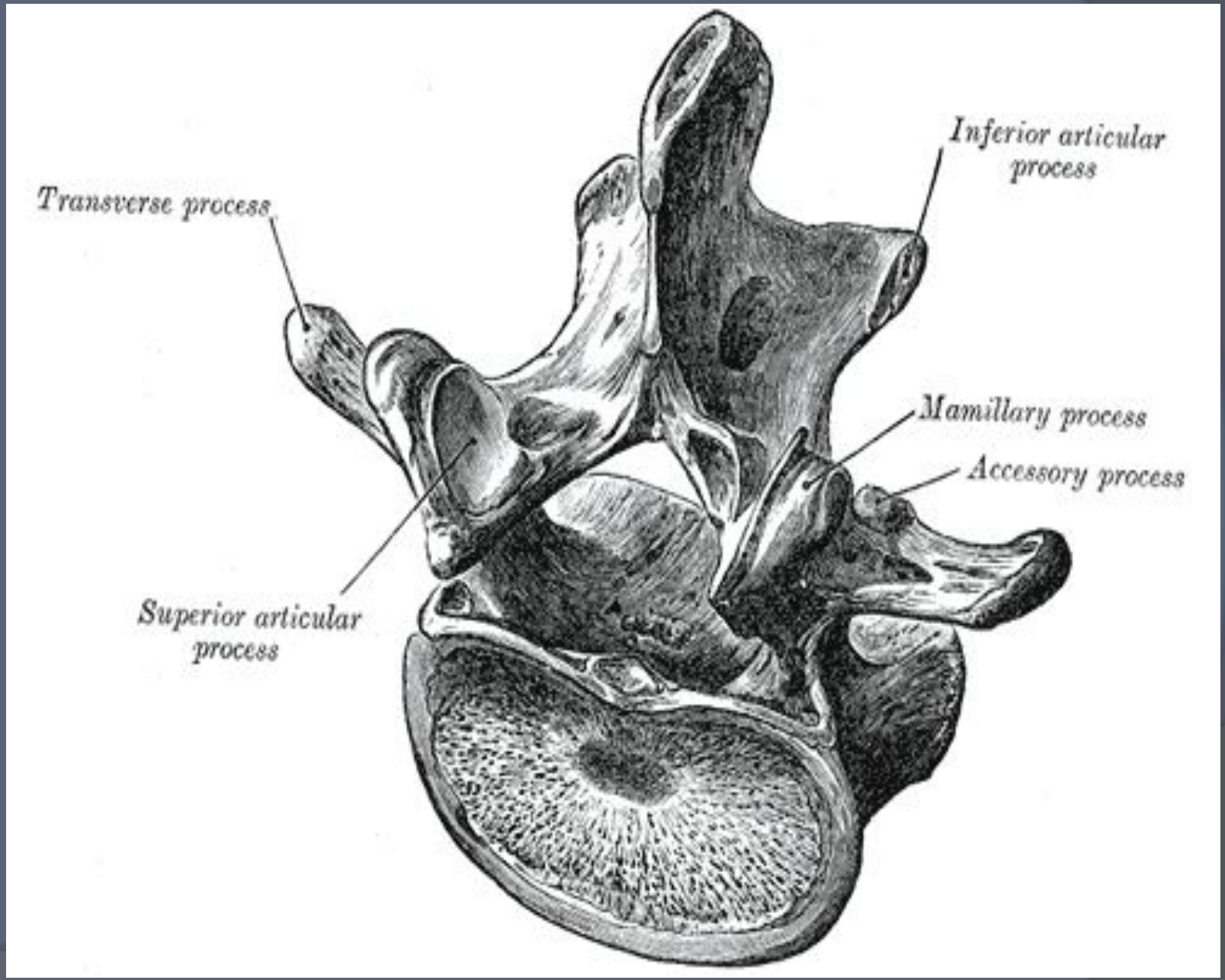
Insertion – **Sp's 3-4 segments above origin**

Actions – extension & lateral flexion of head, neck & spine; contralateral rotation of trunk and neck

Nerve – Spinal Nerves (Dorsal Rami)

Blood- Posterior intercostal & lumbar artery dorsal branches




Transverse process
Inferior articular process
Mamillary process
Accessory process
Superior articular process

Rotatores

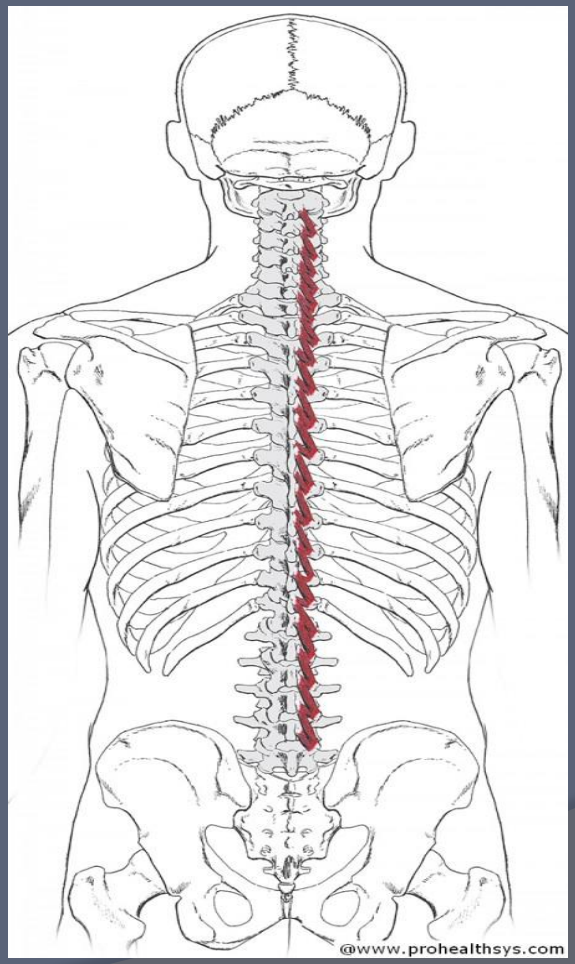
Origin - transverse processes (inferiorly)

Insertion – lamina (superiorly) 1-2 segments above origin

Action – Contralateral rotation, extension and lateral flexion of trunk and neck

Nerve – Spinal Nerves (Dorsal Rami)

Blood- Dorsal branches of Posterior intercostal & lumbar artery



Interspinales

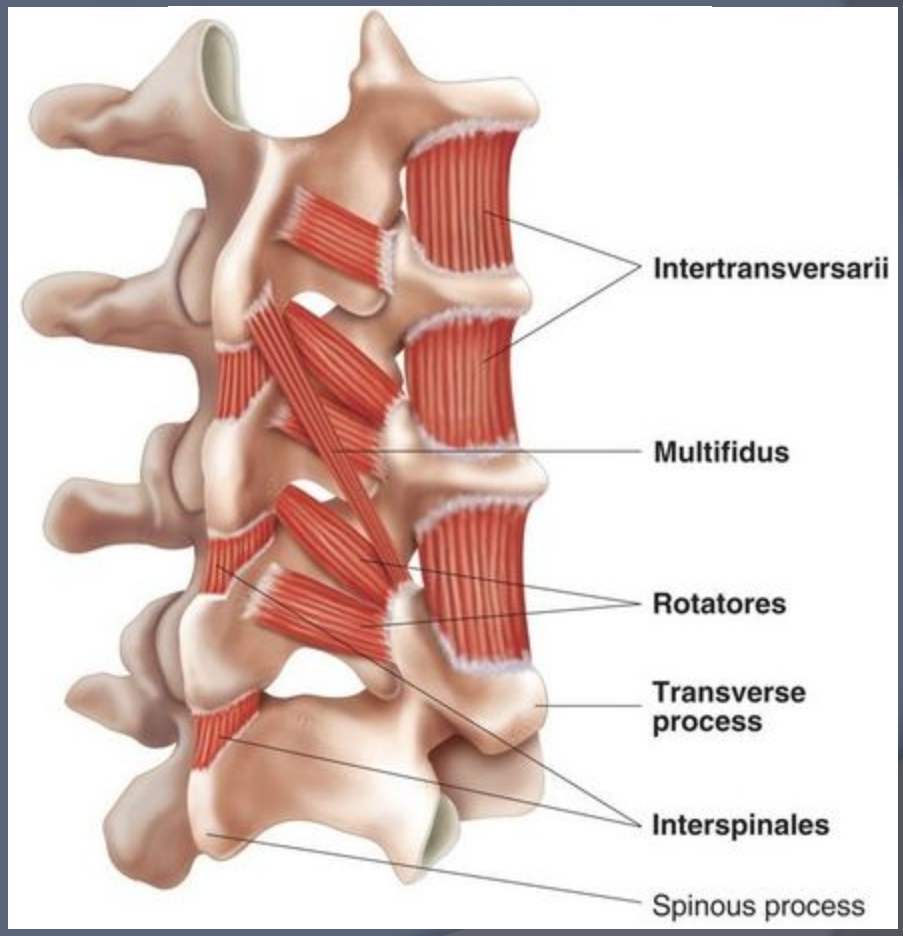
Origin - SP of vertebra below

Insertion - SP of vertebra above

Action - extension of neck & trunk

Nerve – dorsal Rami of Spinal Nerves

Blood- Dorsal Branches of posterior intercostal Arteries



Intertransversarii

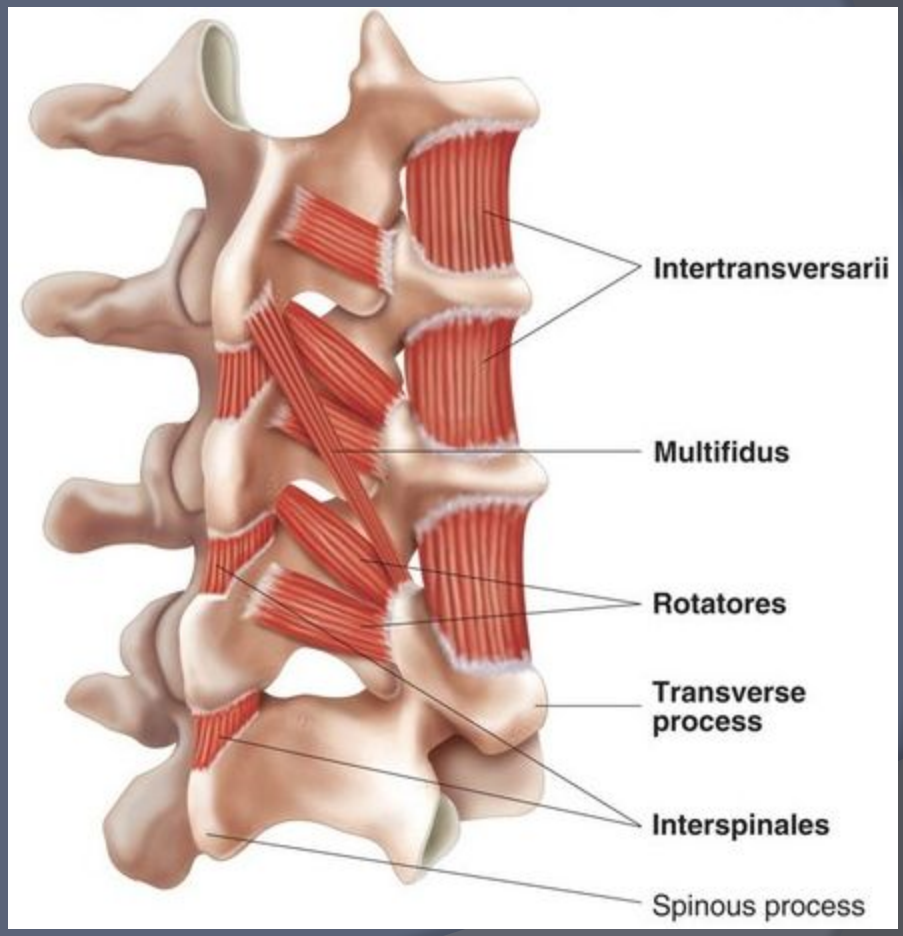
Origin - TP of vertebrae below

Insertion - TP of vertebrae above

Action - lateral flexion of neck. lumbar

Nerve – Dorsal Rami of Spinal Nerves

Blood – Dorsal Branches of posterior intercostal Arteries



Levator Costarum

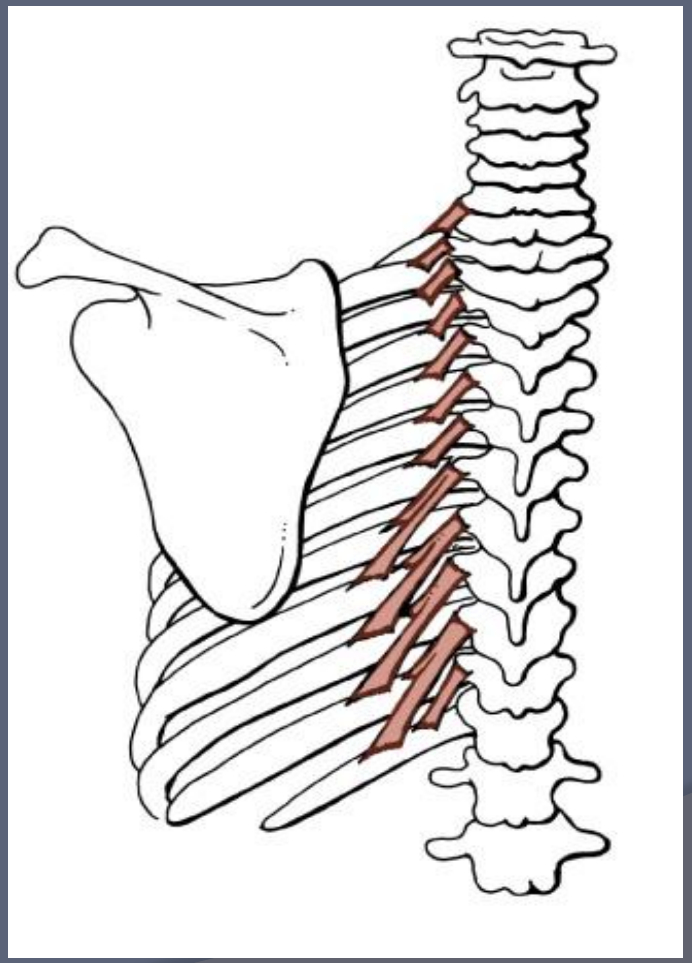
Origin - Tip of Transverse Processes of C7 – T11

Insertion – Ribs 1 – 12 inferiorly

Action – Elevates the ribs

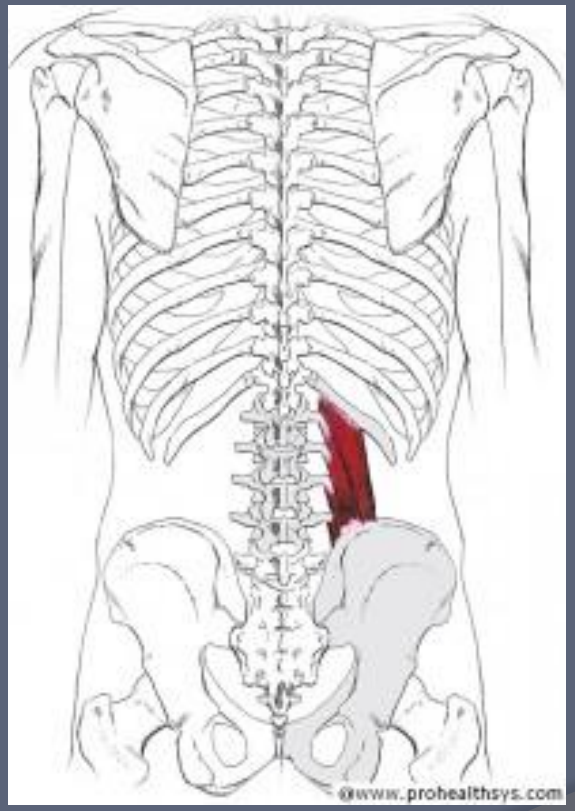
Nerve- Dorsal Rami of Spinal Nerves

Blood – Dorsal Branches Posterior Intercostal Arteries



Quadratus Lumborum

- Origin – 12th rib and the TP's of L1 – L4
- Insertion – Posterior Iliac Crest
- Unilateral – elevates same side pelvis, anterior pelvic tilt
- RMA - lateral flexion of trunk, depression of 12th rib, extend trunk at spinal joints
- Nerve- Lumbar Plexus (T12 – L3)
- Blood – Subcostal, Lumbar, iliolumbar Arteries



Other Information

- Deepest anterior muscle of the lumbar, very little rotation – no flexion or extension as both attachments are in the frontal plane
- Helps cushion and protect kidneys

Other Information

- All thoracic levels have a Levator costarum Brevis - 1 Rib below
- Levator costarum Longus occurs from the TPs of T5-T10 and run to Ribs 7 – 12 (2 ribs below)
- Takes the place of the intertransversarii in thoracic spine

Muscles to review

- These muscles that we have already learned will have an effect on the lumbar spine, pelvis/hip
  - Trapezius (most specifically lower fibers)
  - Latissimus Dorsi
  - Iliacus
  - Psoas

Muscle depth of the Posterior back

- Deepest layer
  - Intertransversarius
  - Interspinalis
  - Levator Costorum
    - In the cervical Region of the back
      - Suboccipital muscles
        - Rectus Capitis Posterior Major
        - Rectus Capitis Posterior Minor
        - Obliquus Capitis Superior
        - Obliquus Capitis Inferior

- Traversospinalis Group
  - Rototares
  - Multifidi
  - Semispinalis (can be considered intermediate muscle)
- Intermediate muscles
  - Erector Spinae Group
    - Spinalis
    - Longissimus
    - Illiocostalis
- Serratus Posterior Inferior and Superior (We will learn during Thoracic spine)

- In the cervical Region superficial to the illiocostalis you will find the
  - Splenius Cervicis
  - Splenius Capitis
- Most superficial in the Posterior Lower back
  - Trapezius
  - Latissimus Dorsi