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1 The Trunk and Spinal Column

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The Trunk and Spinal Column

Vertebral column – complex

24 intricate and complex articulating vertebrae

31 pairs of spinal nerves

most complex part of body other than CNS

Abdominal muscles

some sections linked by fascia and tendinous bands

do not attach from bone to bone

Many small intrinsic muscles act on head, vertebral column, and thorax

assist in spinal stabilization or respiration

too deep to palpate

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Bones

24 articulating and 9 fused vertebrae

- 7 cervical (neck) vertebrae
- 12 thoracic (chest) vertebrae
- 5 lumbar (lower back) vertebrae
- 5 sacrum (posterior pelvic girdle) vertebrae
- 4 coccyx (tail bone) vertebrae

First 2 cervical vertebrae - shapes allow for extensive rotary movements of head to side, as well as forward and backward movement

3 normal curves within spine

- Thoracic spine curves anteriorly
- Cervical and lumbar spine curve posteriorly
- Spinal curves enable it to absorb blows and shocks

Vertebrae increase in size from cervical to lumbar region due to lower back having to support more weight

First 2 cervical vertebrae - atlas and axis

Vertebrae C2 through L5 - similar architecture

- body - anterior bony block
- central vertebral foramen for spinal cord
- transverse process projecting out laterally
- spinous process projecting posteriorly

Bones

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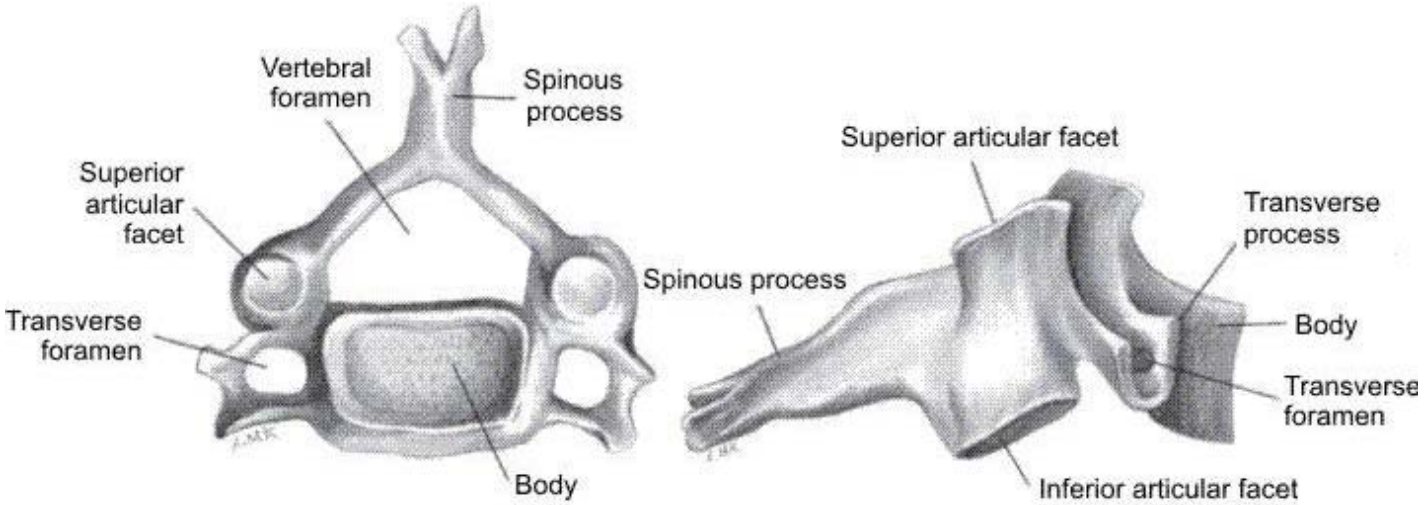
Bones



Bones

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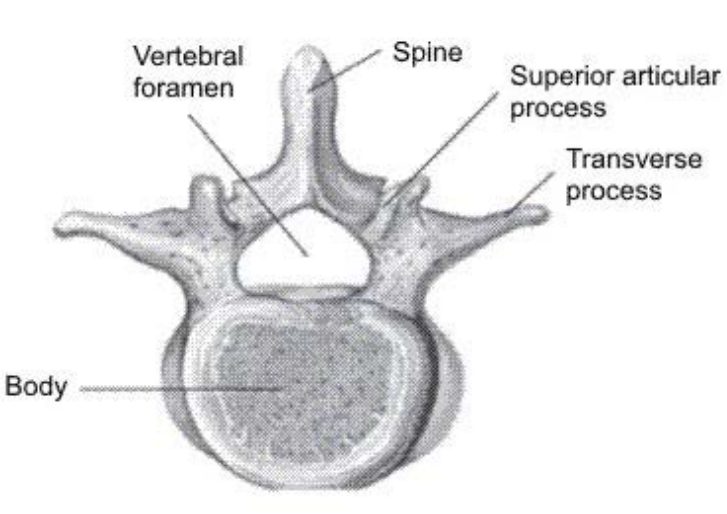
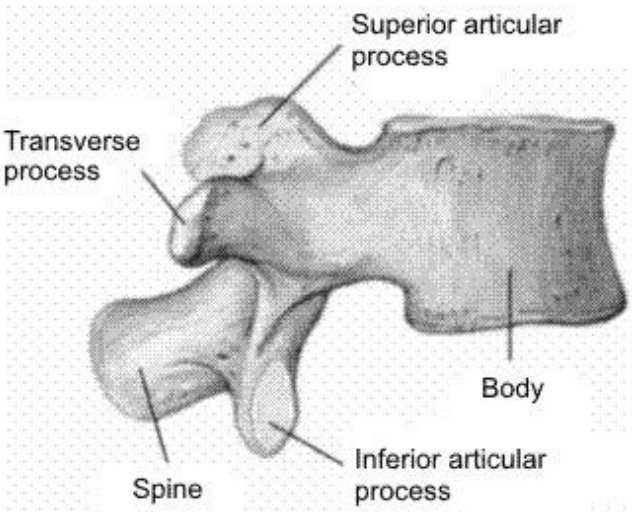
Bones





Bones

Lordosis - increased posterior concavity of lumbar and cervical curves

Kyphosis - increased anterior concavity of thoracic curve

Lumbar kyphosis - reduction of normal lordotic curve, resulting in a flat-back appearance

Scoliosis - lateral curvatures or sideward deviations of spine

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Bones

12 pairs of ribs

7 pairs of true ribs attach directly to sternum

5 pairs of false ribs : 3 pairs attach indirectly to sternum ; 2 pairs of floating ribs - ends are free

All ribs attached posteriorly to thoracic vertebrae

Sternum

Manubrium, body of sternum, and xiphoid process

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Bones

Back Next

Joints

Atlantooccipital joint

first joint

formed by occipital condyles of skull sitting on articular fossa of the 1st vertebra

allows flexion and extension

Atlantoaxial joint

Atlas (C1) sits on axis (C2)

Most cervical rotation occurs here

Trochoid or pivot-type joint

Most mobile joint of any two vertebrae

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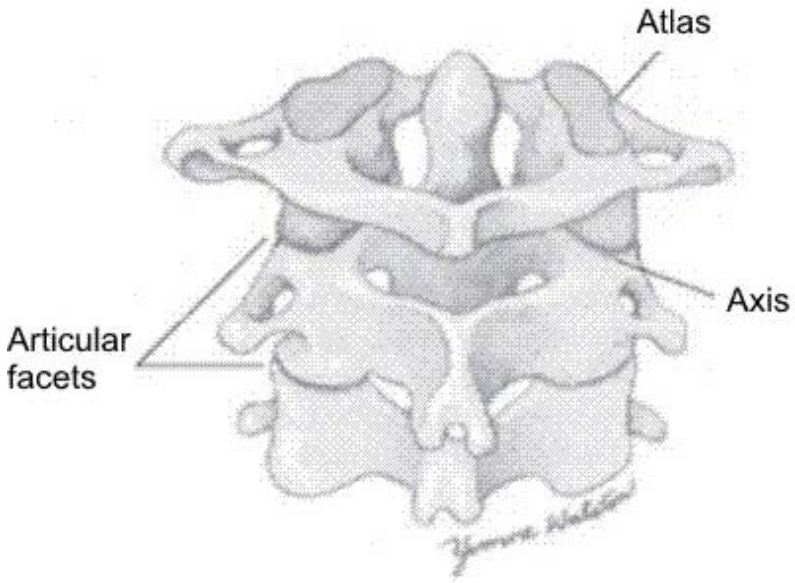
Joints



Joints

Minimal movement between any 2 vertebrae (except atlantoaxial joint)

Cumulative effect of combined movement from several vertebrae allows for substantial movements

Vertebral articulations classified as arthrodial

Gliding-type joints due to limited gliding movements

Gliding movement between superior & inferior articular processes of facets joints

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Joints

Back Next

Joints

Intervertebral disks

between and adhering to articular cartilage of vertebral bodies

annulus fibrosus - outer rim of dense fibrocartilage

nucleus pulposus - central gelatinous, pulpy substance

compressed elastic material allows compression in all directions along with torsion

become less resilient with age, injury, or improper use, resulting in a weakened annulus fibrosus

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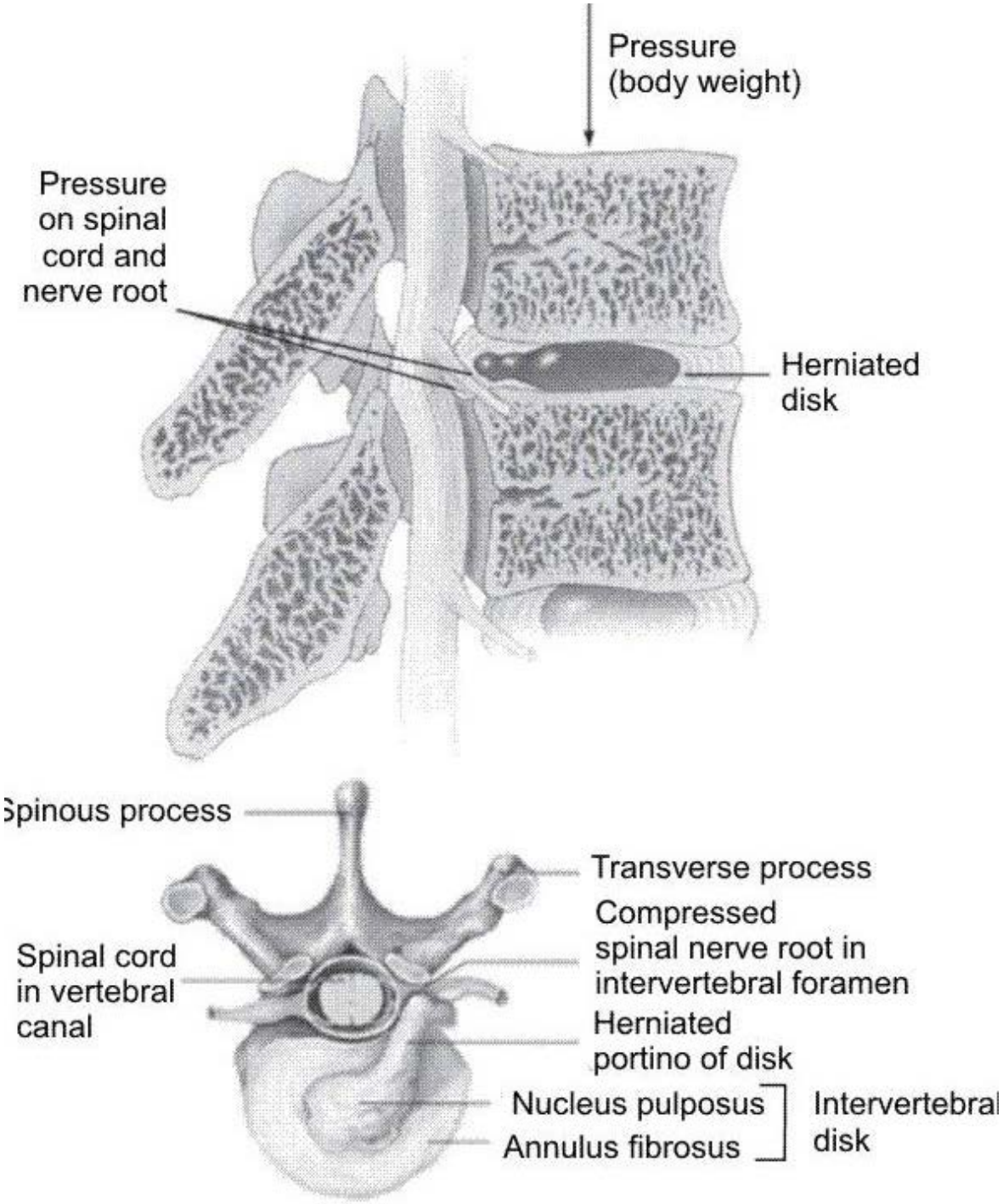
Joints



Joints

Intervertebral disks

herniated nucleus pulposus (herniated or “slipped” disk) – nucleus protruding through annulus resulting from substantial weakening combined with compression

protrusion puts pressure on spinal nerve root, causing radiating pain, tingling, numbness, and/or weakness in lower extremity

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Joints

Back Next

Joints

Most movement occurs in cervical and lumbar

Some slight thoracic movement

Movements of head

- Movement between cranium and 1st cervical and within other cervical vertebrae
- Referred as cervical movements

Trunk movements

- Lumbar motion terminology describes combined motion in thoracic and lumbar

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Joints

Cervical region

Flexes 45 degrees

Extends 45 degrees

Laterally flexes 45 degrees

Rotate approximately 60 degrees

Back Next

Joints

Lumbar spine including trunk movement

Flexes approximately 80 degrees

Extends 20 to 30 degrees

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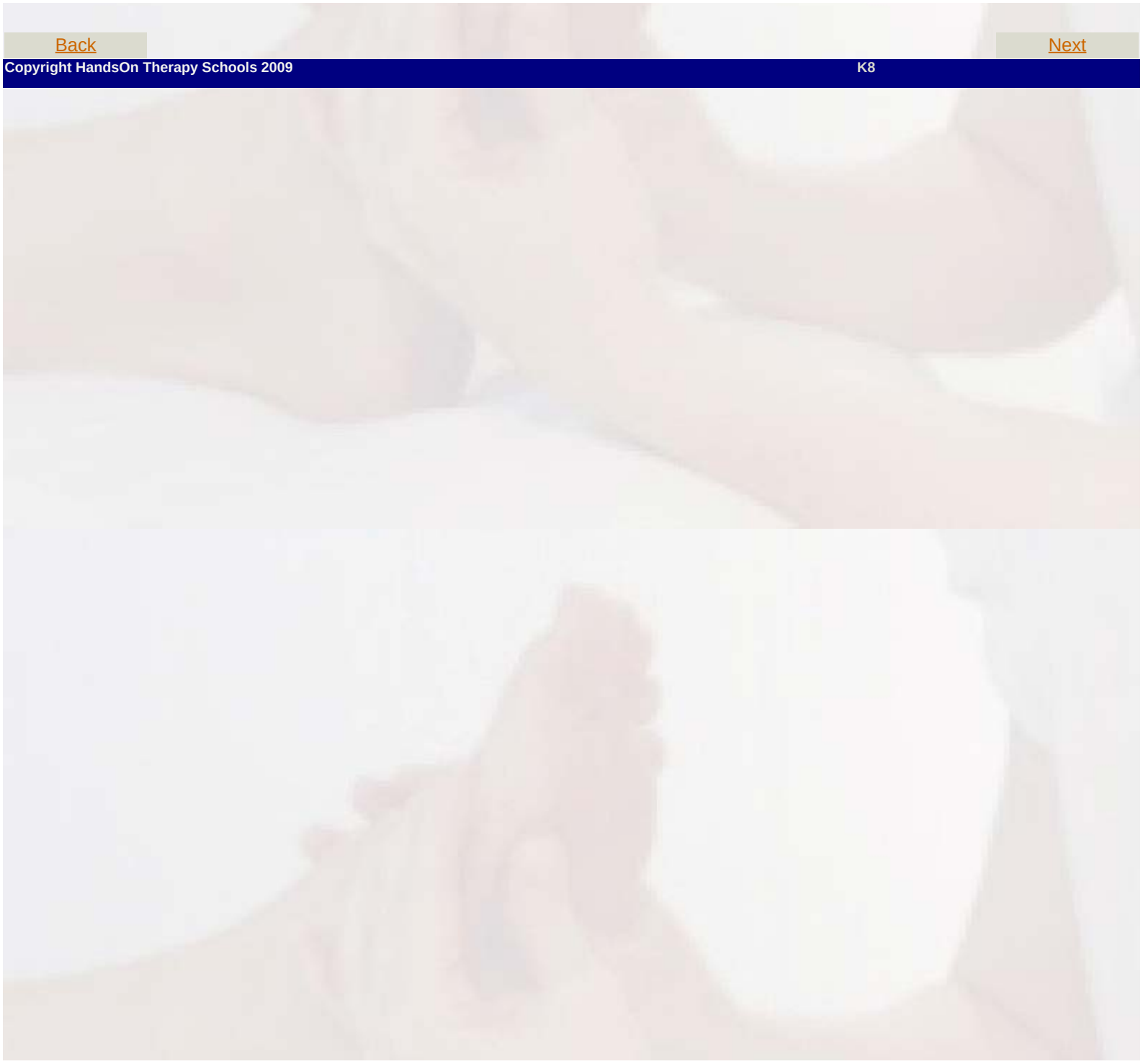
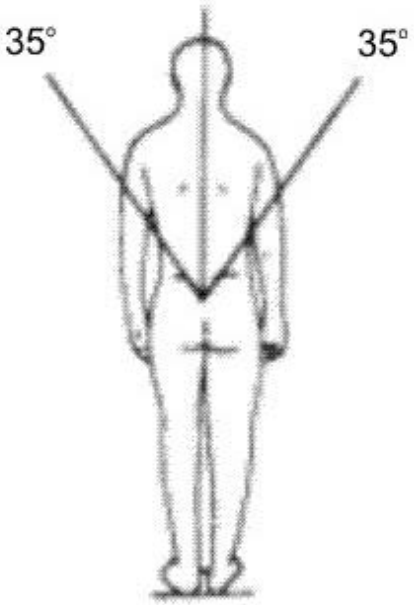


Joints

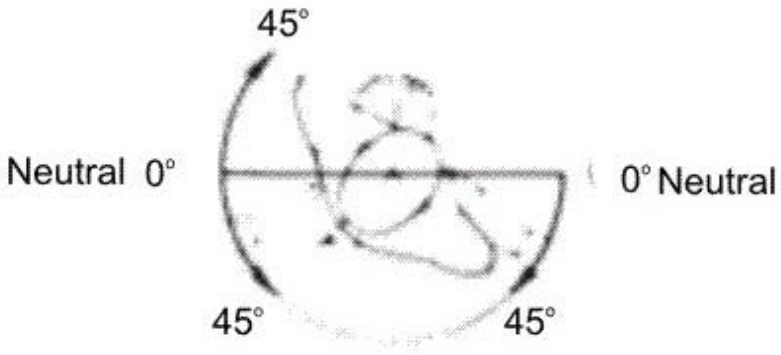
Lumbar spine including trunk movement

Lumbar lateral flexion to 35 degrees

Rotation approximately 45 degrees



Lateral bending



Movements

Spinal movements are often preceded by the name given to the region of movement

Ex. flexion of trunk at lumbar spine is known as lumbar flexion, and extension of neck is cervical extension

Pelvic girdle rotates as a unit due to movement occurring in hip and lumbar spine

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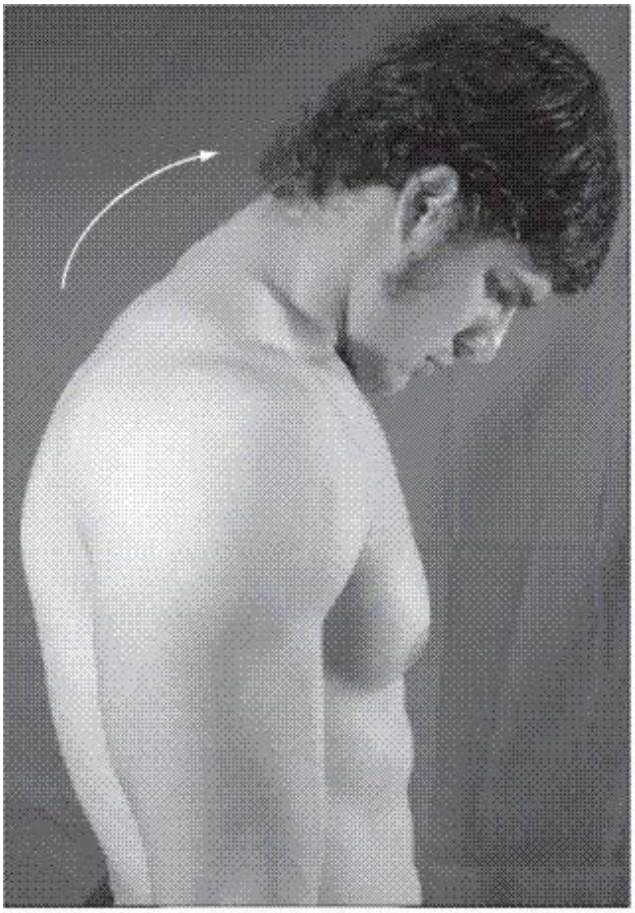
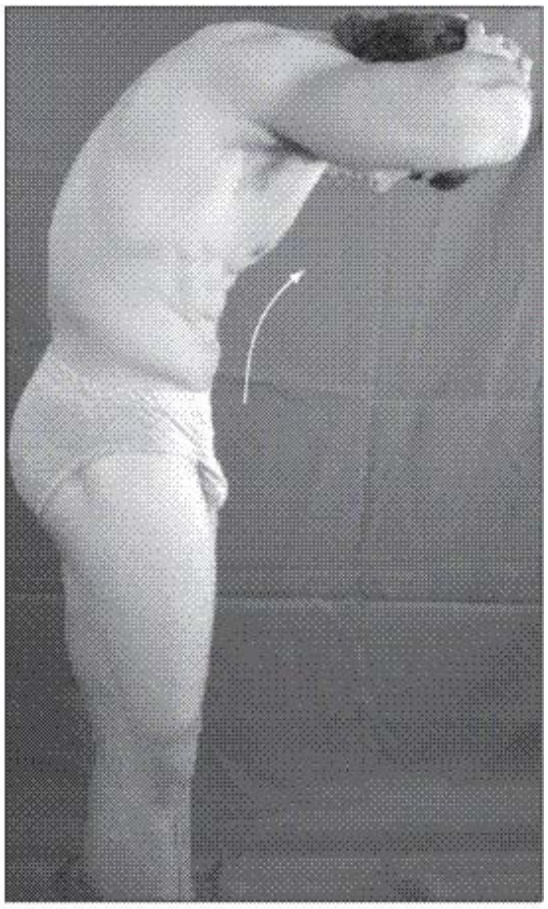
Movements

Spinal flexion

anterior movement of spine; in cervical region the head moves toward chest; in lumbar region the thorax moves toward pelvis



Cervical flexion

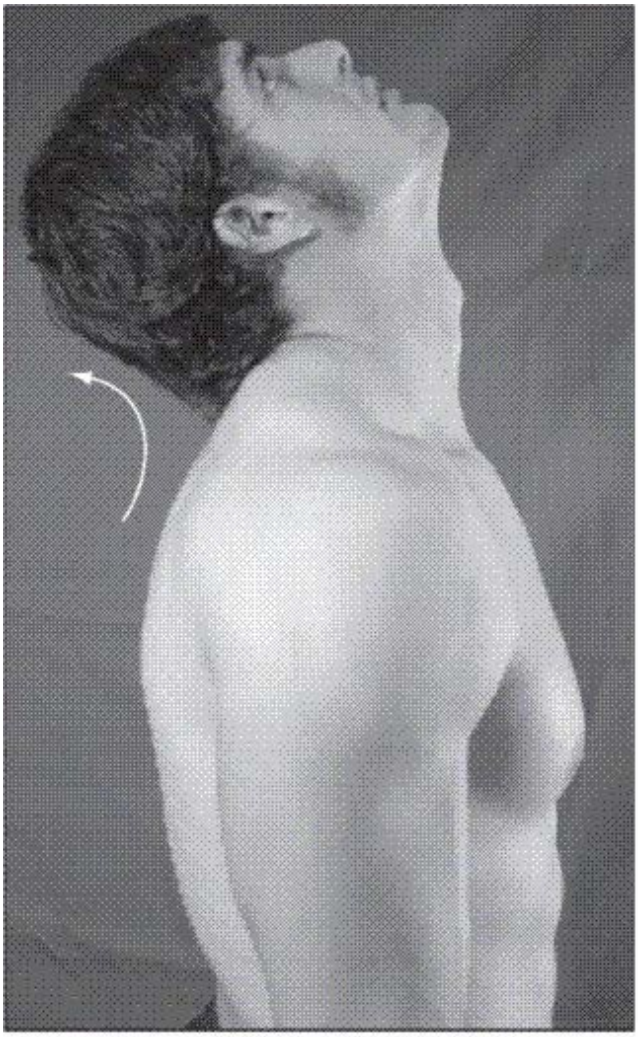


Lumbar flexion

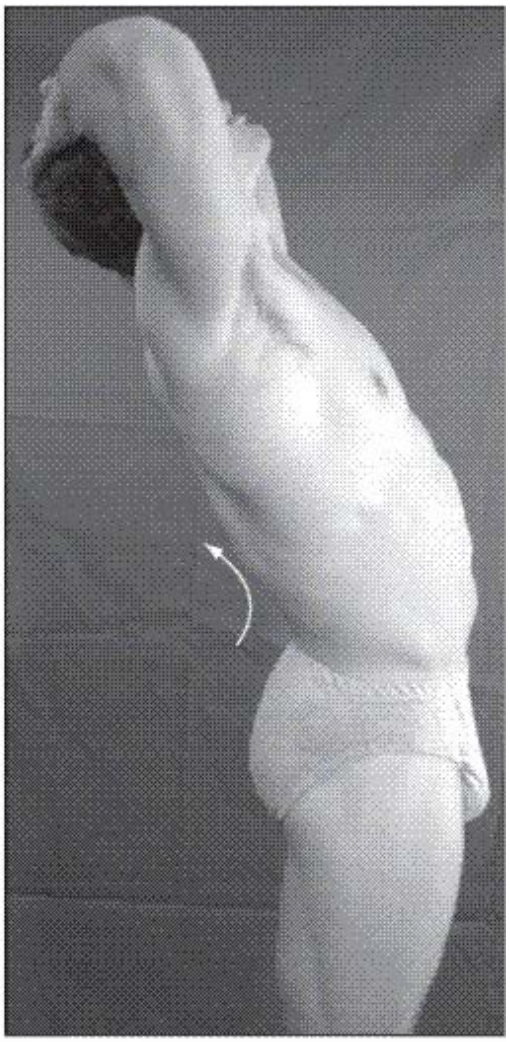
Movements

Spinal extension

return from flexion or posterior movement of spine; in cervical spine, head moves away from the chest & thorax moves away from pelvis



Cervical extension (hyperextension)



Lumbar extension (hyperextension)

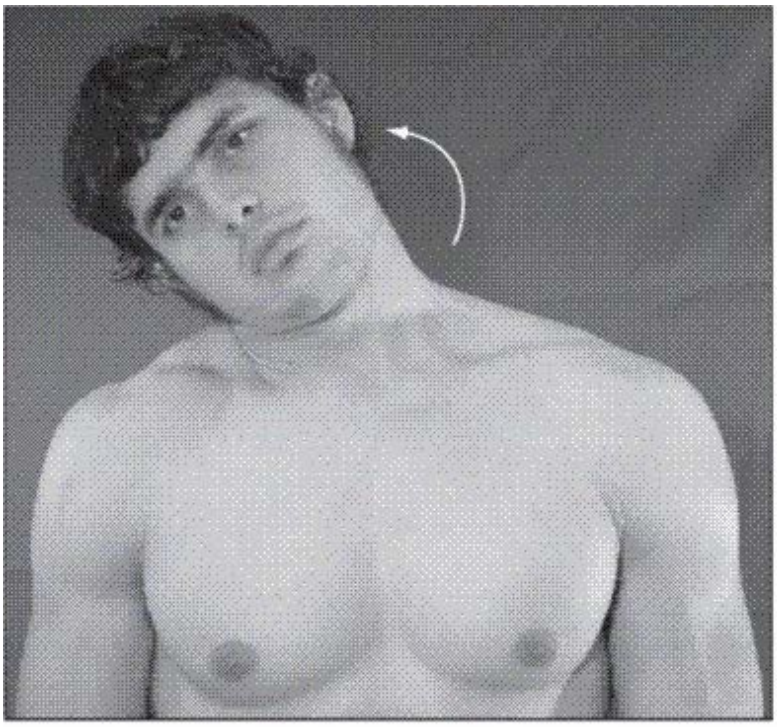
Movements

Lateral flexion (left or right)

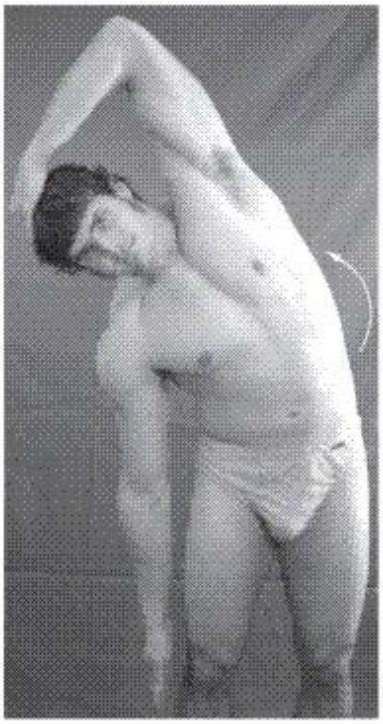
sometimes referred to as side bending; head moves laterally toward the shoulder & thorax moves laterally toward pelvis

Reduction

return movement from lateral flexion to neutral



Cervical lateral flexion to the right

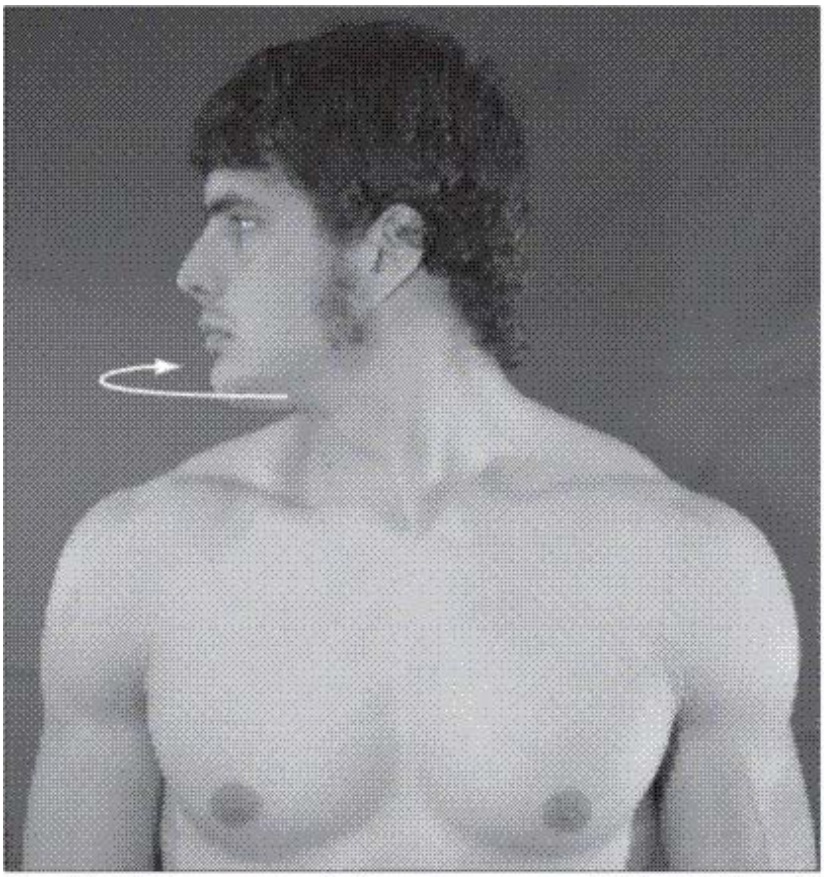


Lumbar lateral flexion to the right

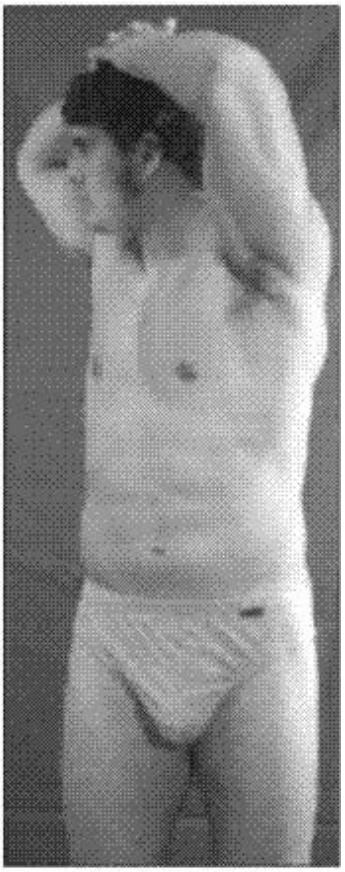
Movements

Spinal rotation (left or right)

rotary movement of spine in horizontal plane; chin rotates from neutral toward shoulder & thorax rotates to one side



Cervical rotation
to the right



Lumbar rotation
to the right

Muscles

A few large muscles and many small muscles

Erector spinae (sacrospinalis)

- largest muscle
- extends on each side of spinal column from pelvic region to cranium
- divided into 3 muscles : Spinalis, longissimus, and iliocostalis ; From medial to lateral side, has attachments in lumbar, thoracic, and cervical regions ; Actually made up of 9 muscles

Sternocleidomastoid and splenius muscles

- large muscles involved in cervical and head movements

Large abdominal muscles - lumbar movements

- Rectus abdominis, external oblique abdominal, internal oblique abdominal, and quadratus lumborum

Numerous small muscles

- Many originate on one vertebra and insert on next vertebra
- Important in functioning of spine

Grouped according to location and function

Some muscles have multiple segments

- one segment of a muscle may be located and perform movement in one region while another segment of same muscle may be located in another region to perform movements in that region

Many muscles of trunk and spinal column function in moving spine and aiding respiration

- All thoracic muscles are primarily involved in respiration

Abdominal wall muscles do not go from bone to bone but attach into an aponeurosis (fascia) around rectus abdominis area

- external oblique abdominal, internal oblique abdominal, and transversus abdominis

Muscles

Muscles that move the head

Anterior

- Rectus capitis anterior
- Longus capitis

Posterior

- Longissimus capitis
- Obliquus capitis superior
- Obliquus capitis inferior
- Rectus capitis posterior - major & minor
- Trapezius, superior fibers
- Splenius capitis
- Semispinalis capitis

Lateral

- Rectus capitis lateralis
- Sternocleidomastoid

Muscles of the vertebral column

Superficial

- Erector spinae (sacrospinalis) : Spinalis - cervicis, thoracis ; Longissimus - capitis, cervicis, thoracis ; Iliocostalis - cervicis, thoracis, lumborum
- Splenius cervicis

Deep

- Longus colli - superior oblique, inferior oblique, vertical
- Interspinales - entire spinal column

Intertransversales - entire spinal column

Multifidus - entire spinal column

Psoas minor

Rotatores - entire spinal column

Semispinalis - cervicis, thoracis

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Muscles

Muscles of the thorax

- Diaphragm
- Intercostalis - external, internal
- Levator costarum
- Subcostales
- Scalenus - anterior, medius, posterior
- Serratus posterior - superior, inferior
- Transversus thoracis

Muscles of the abdominal wall

- Rectus abdominis
- External oblique abdominal (obliquus externus abdominis)
- Internal oblique abdominal (obliquus internus abdominis)
- Transverse abdominis (transversus abdominis)
- Quadratus lumborum

Muscles

Muscles that move the head

All originate on cervical vertebrae and insert on occipital bone of skull (capitis name)

3 anterior vertebral muscles – longus capitis, rectus capitis anterior, and rectus capitis lateralis

- All are flexors of head and upper cervical spine
- Rectus capitis lateralis
- laterally flexes head
- assists rectus capitis anterior in stabilizing atlantooccipital joint

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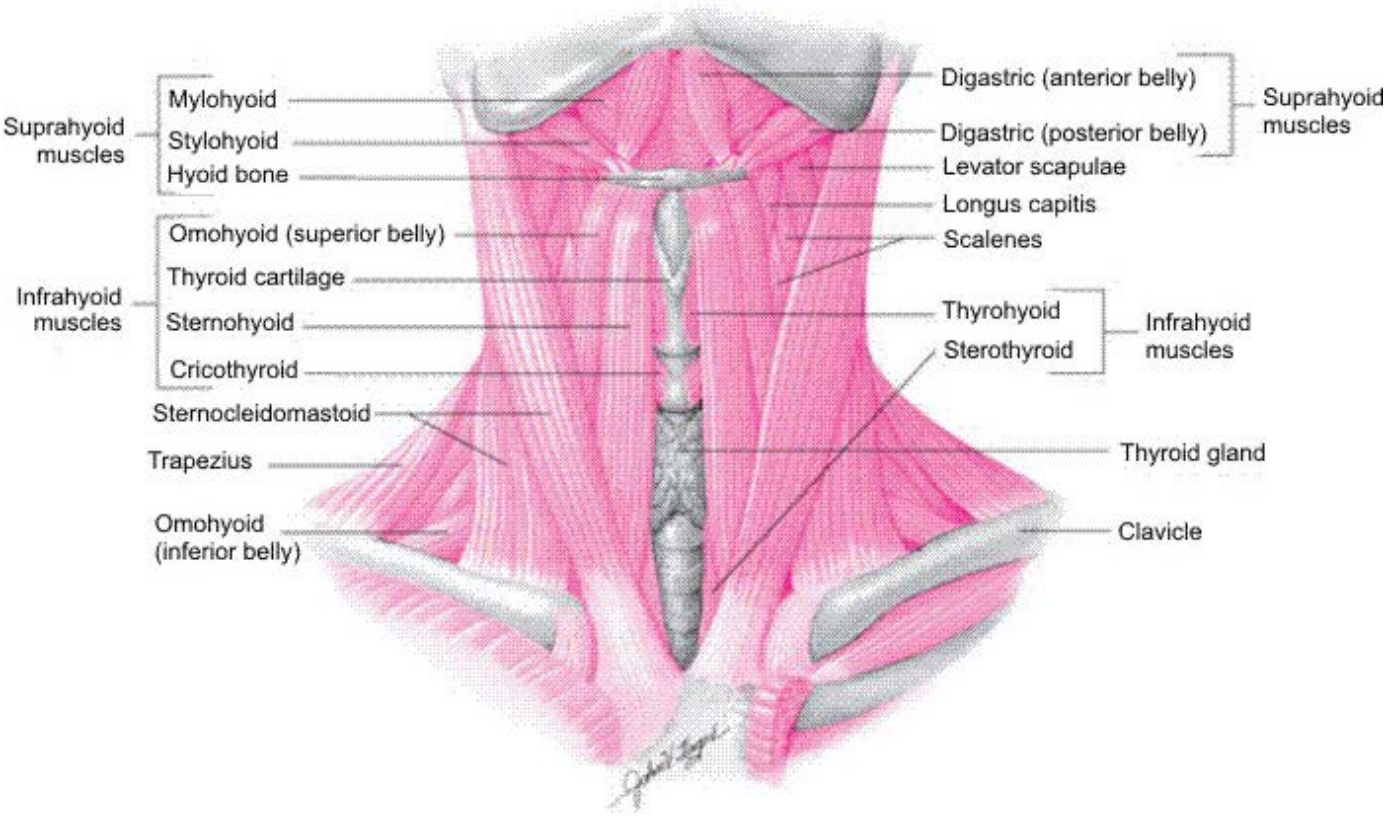
Movements



Muscles

Posterior muscles

Rectus capitis posterior major and minor, obliquus capitis superior and inferior, and semispinalis capitis

All are extensors of head except obliquus capitis inferior which rotates atlas

Obliquus capitis superior assists rectus capitis lateralis in lateral flexion of head

Rectus capitis posterior major rotates head to ipsilateral side

Semispinalis capitis rotates head to contralateral side

Upper Trapezius extend head and rotate its to ipsilateral side

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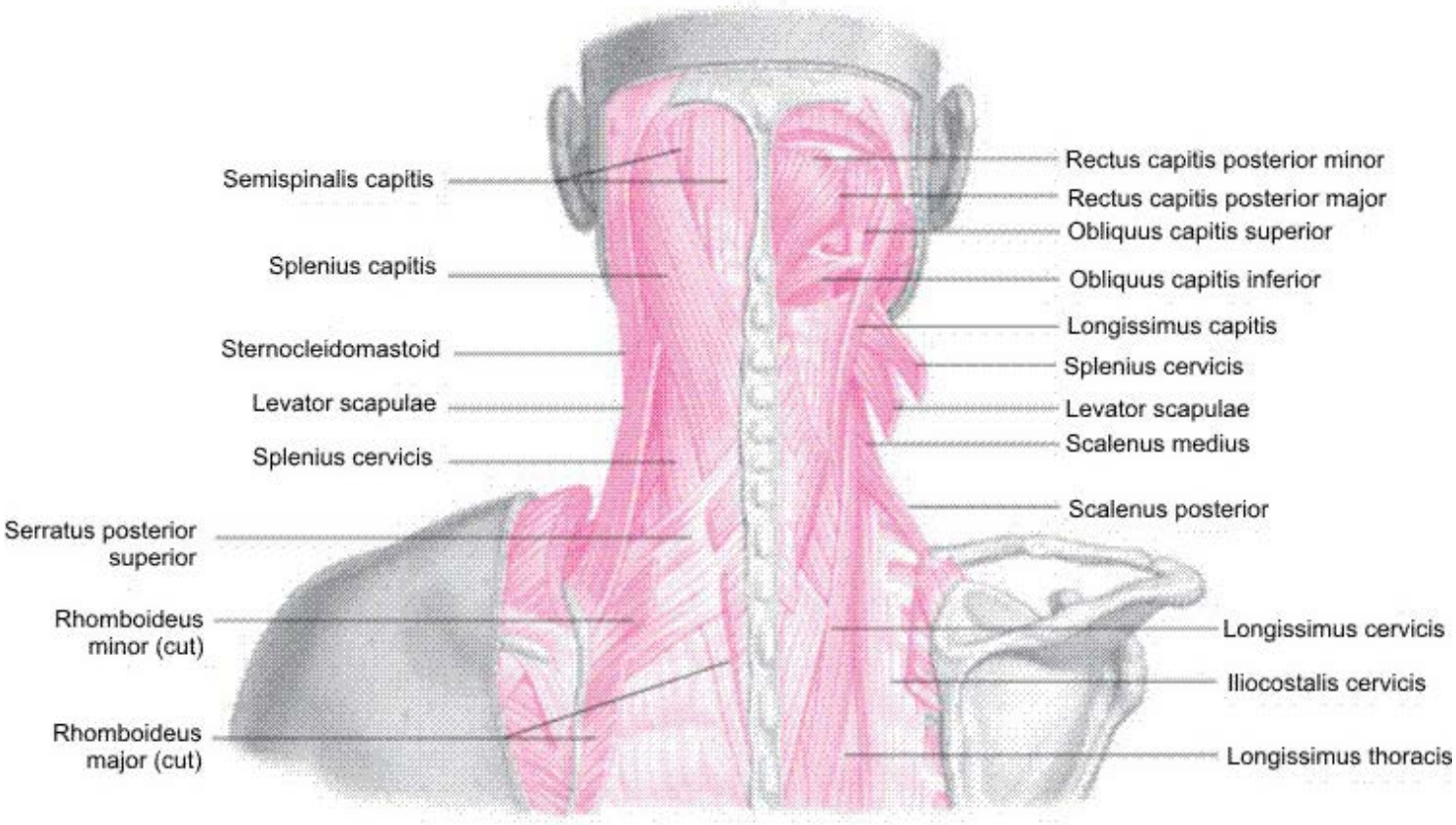
Movements



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Muscles

Splenius capitis and sternocleidomastoid

Much larger and more powerful in moving head and cervical spine

Remaining cervical spine muscles are grouped with muscles of vertebral column

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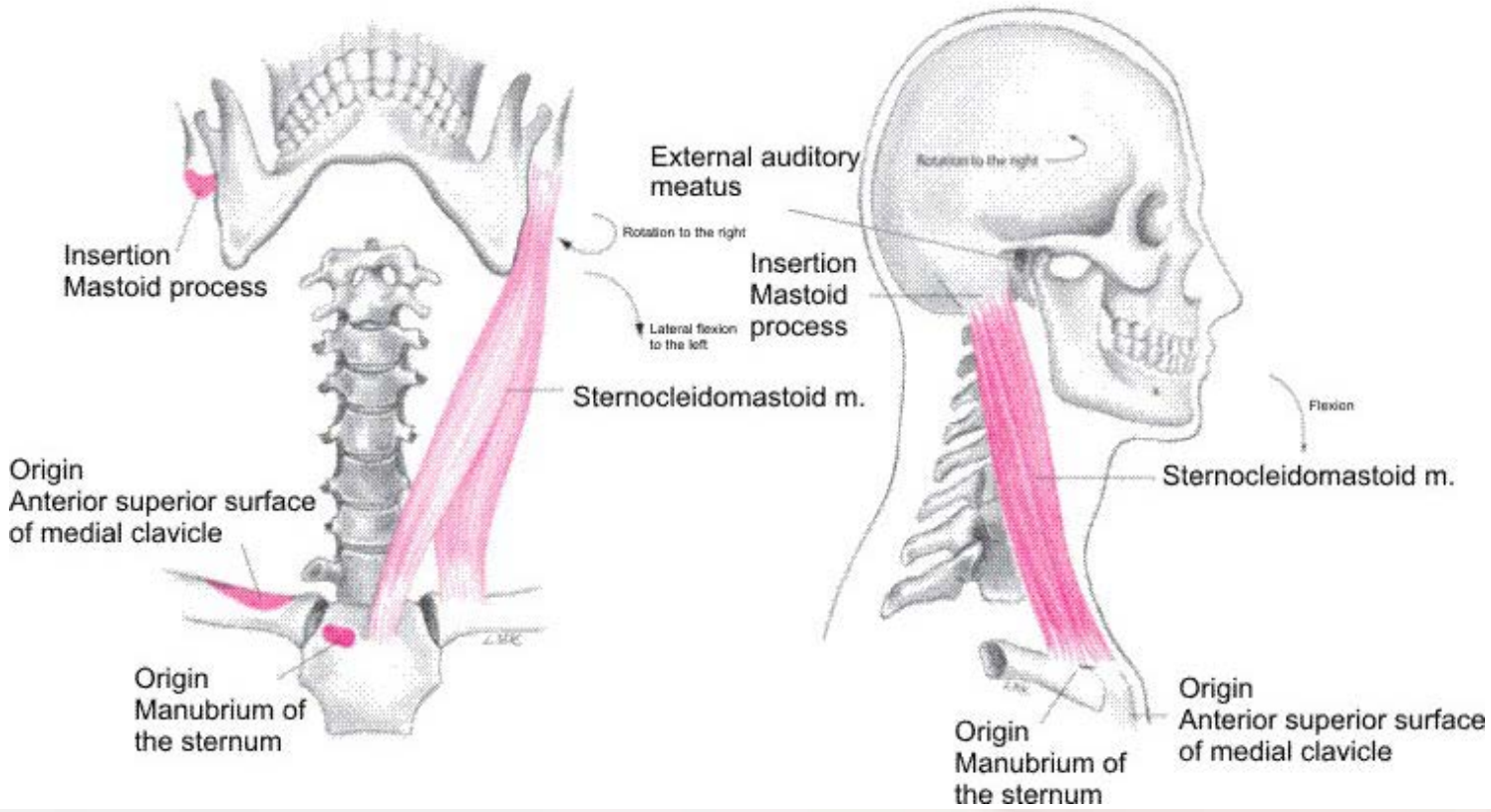
Sternocleidomastoid Muscles

Both sides: extension of head at atlantooccipital joint and flexion of neck

Right side: rotation to left and lateral flexion to right

Left side: rotation to right and lateral flexion to left

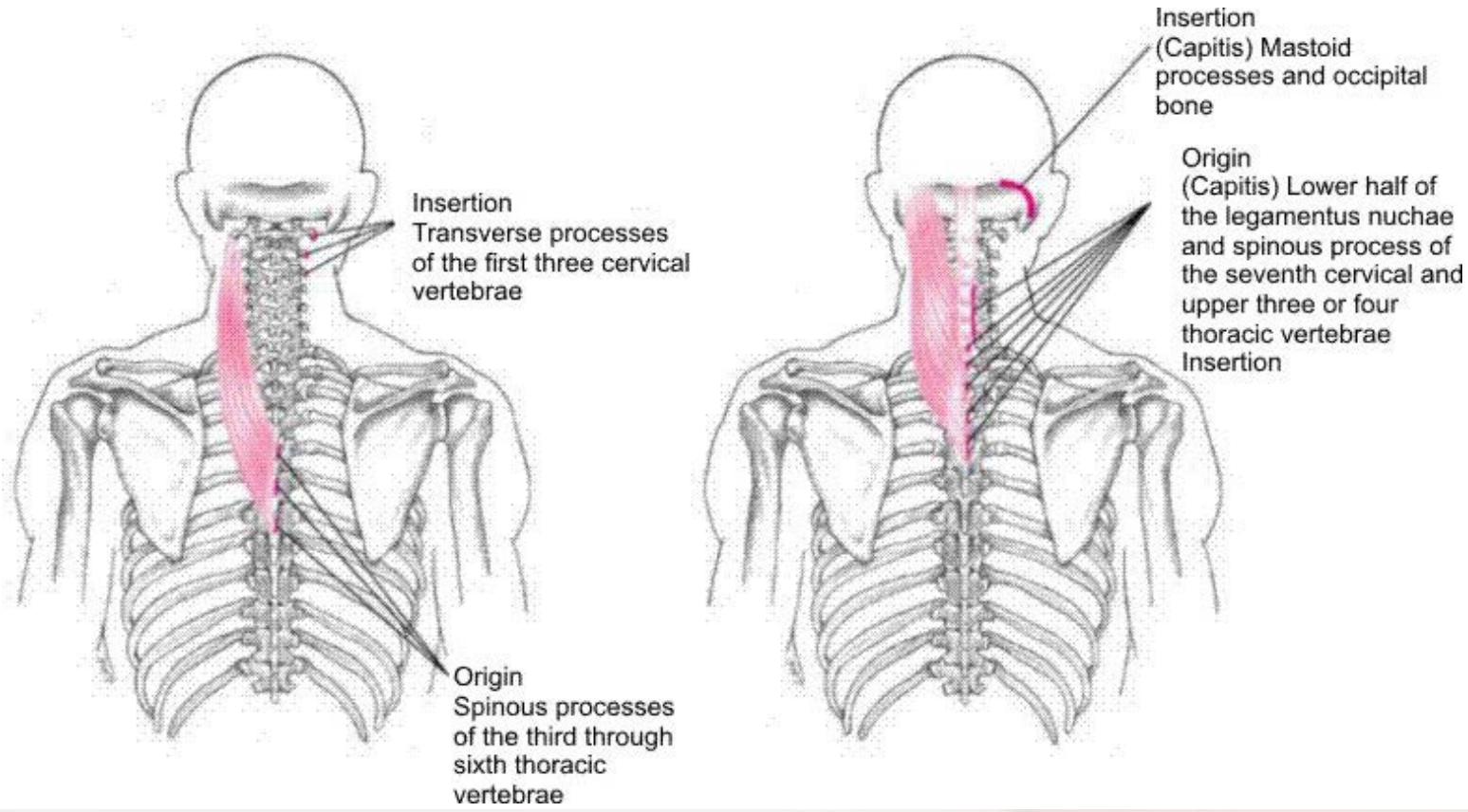


Splenius Muscles

Both sides: extension of head (splenius capitis) and neck (splenius capitis and capitis)

Right side: rotation and lateral flexion to right

Left side: rotation and lateral flexion to left



Muscles

Muscles of the Vertebral Column

Cervical area

Longus colli muscles

- located anteriorly
- flex cervical and upper thoracic vertebrae

Posterior

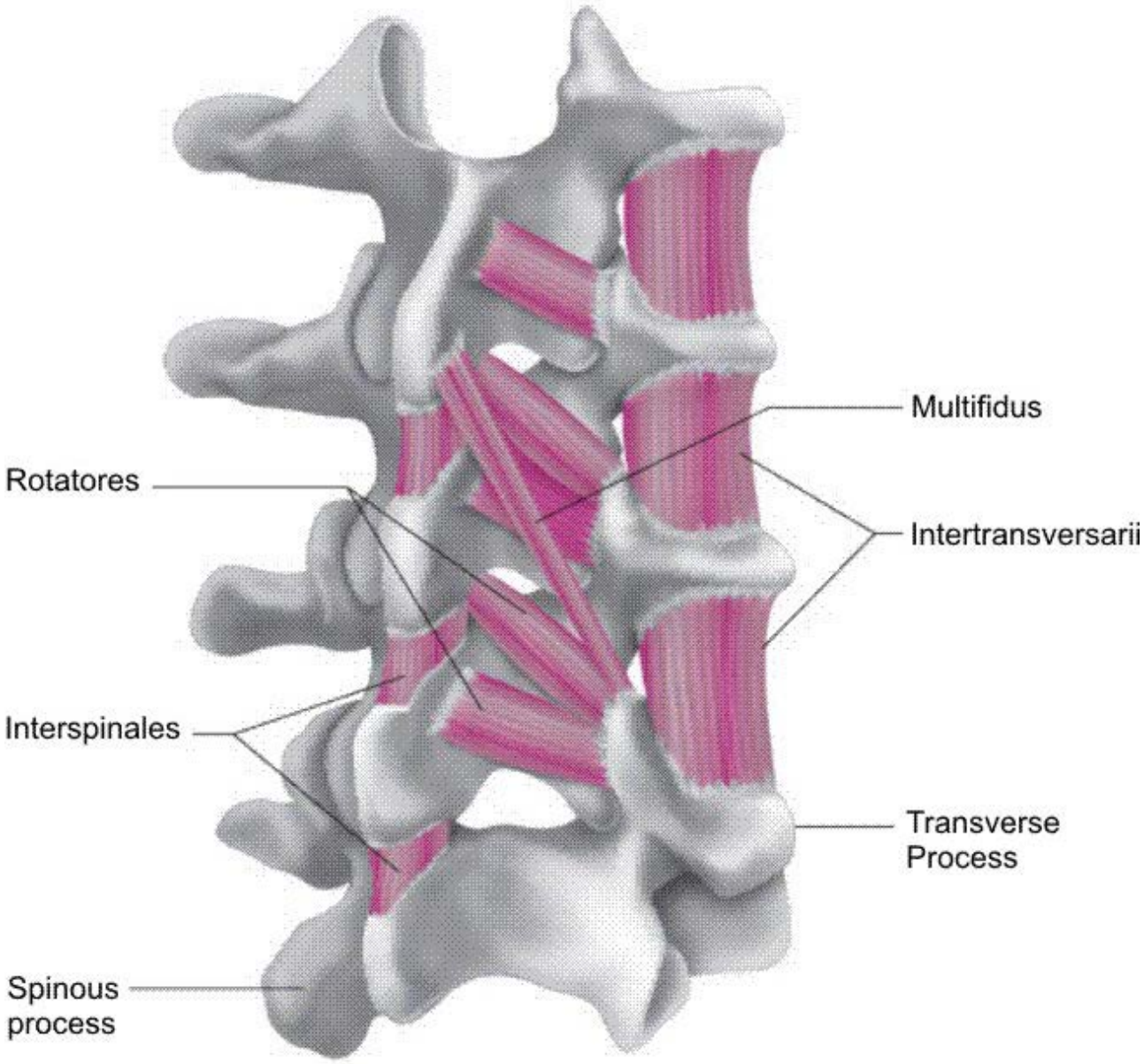
Erector spinae group, transversospinalis group, interspinal-intertransverse group, and splenius

- All run vertically parallel to spinal column
- Location enables them to extend spine and assist in rotation and lateral flexion

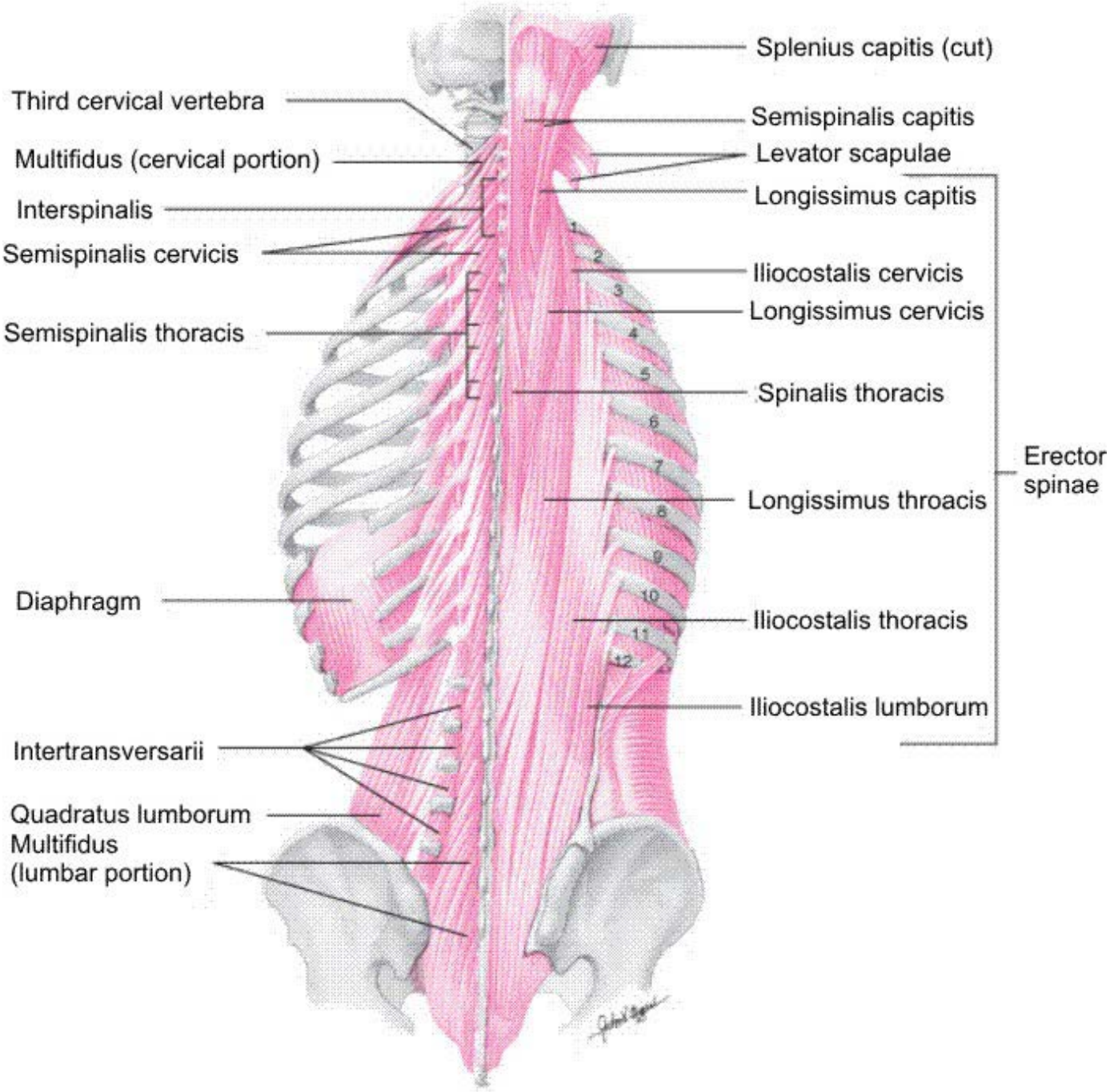
Interspinal-intertransverse group

- lie deep to rotatores
- laterally flex and extend
- do not rotate vertebrae
- Interspinales :
  - extensors
  - connect from spinous process of one vertebra to spinous process of adjacent vertebra
- Intertransversarii muscles
  - flex vertebral column laterally
  - connect to transverse processes of adjacent vertebrae

Muscles of Vertebral Column



Posterolateral view



Muscles

Posterior Muscles of the Thorax

Involved almost entirely in respiration

Diaphragm

- Responsible for breathing during quiet rest
- As it contracts and flattens, thoracic volume is increased and air is inspired to equalize the pressure
- When larger amounts of air are needed, as in exercise, other thoracic muscle have a more significant role in inspiration
- Scalene muscles elevate first 2 ribs to increase thoracic volume
- External intercostals further expand the chest
- Levator costarum and serratus posterior – inspiration
- Internal intercostals, transversus thoracis, and subcostales contract to force expiration

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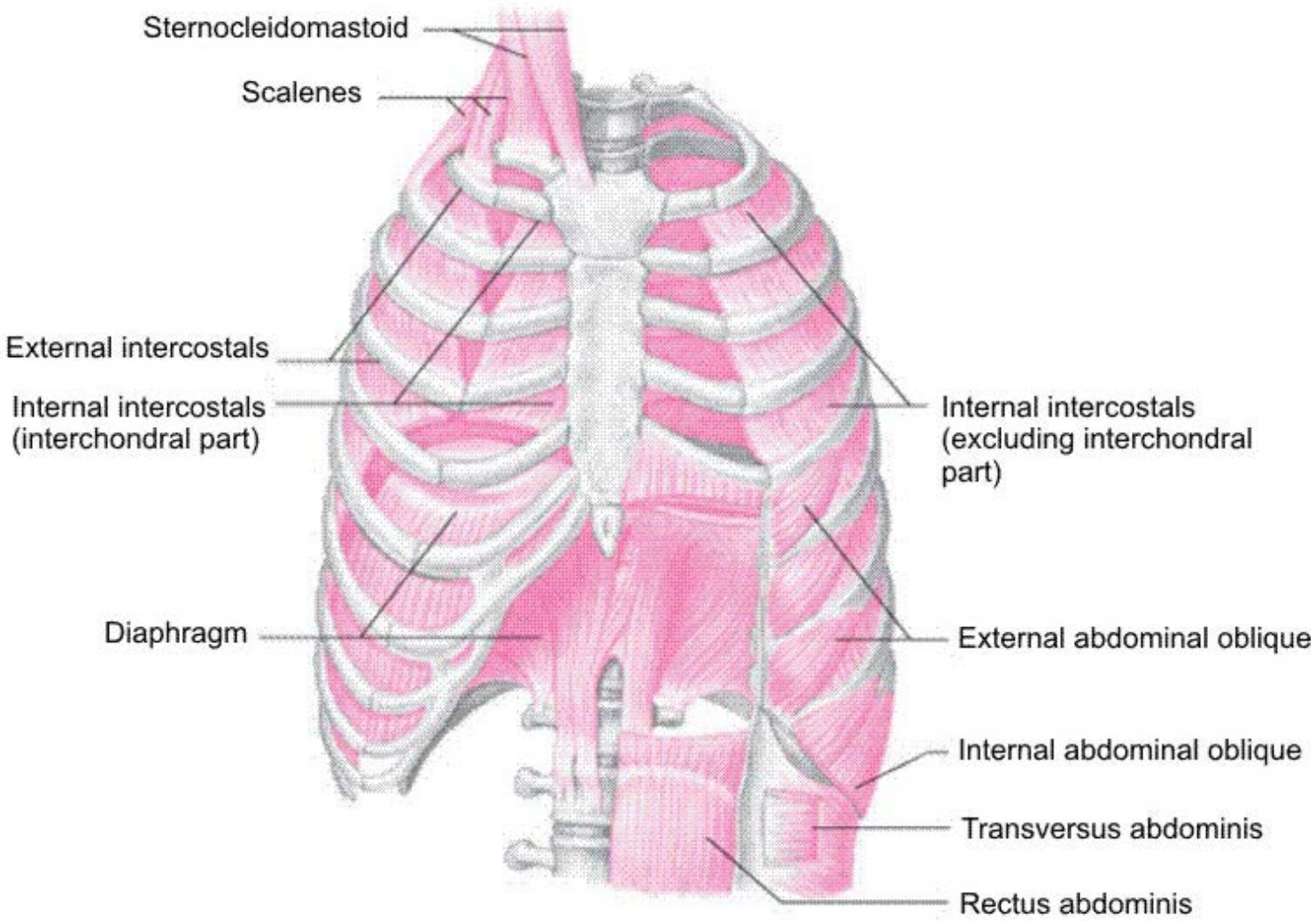
Posterior Muscles of the Thorax



Erector Spinae Muscles

Iliocostalis (lateral layer)

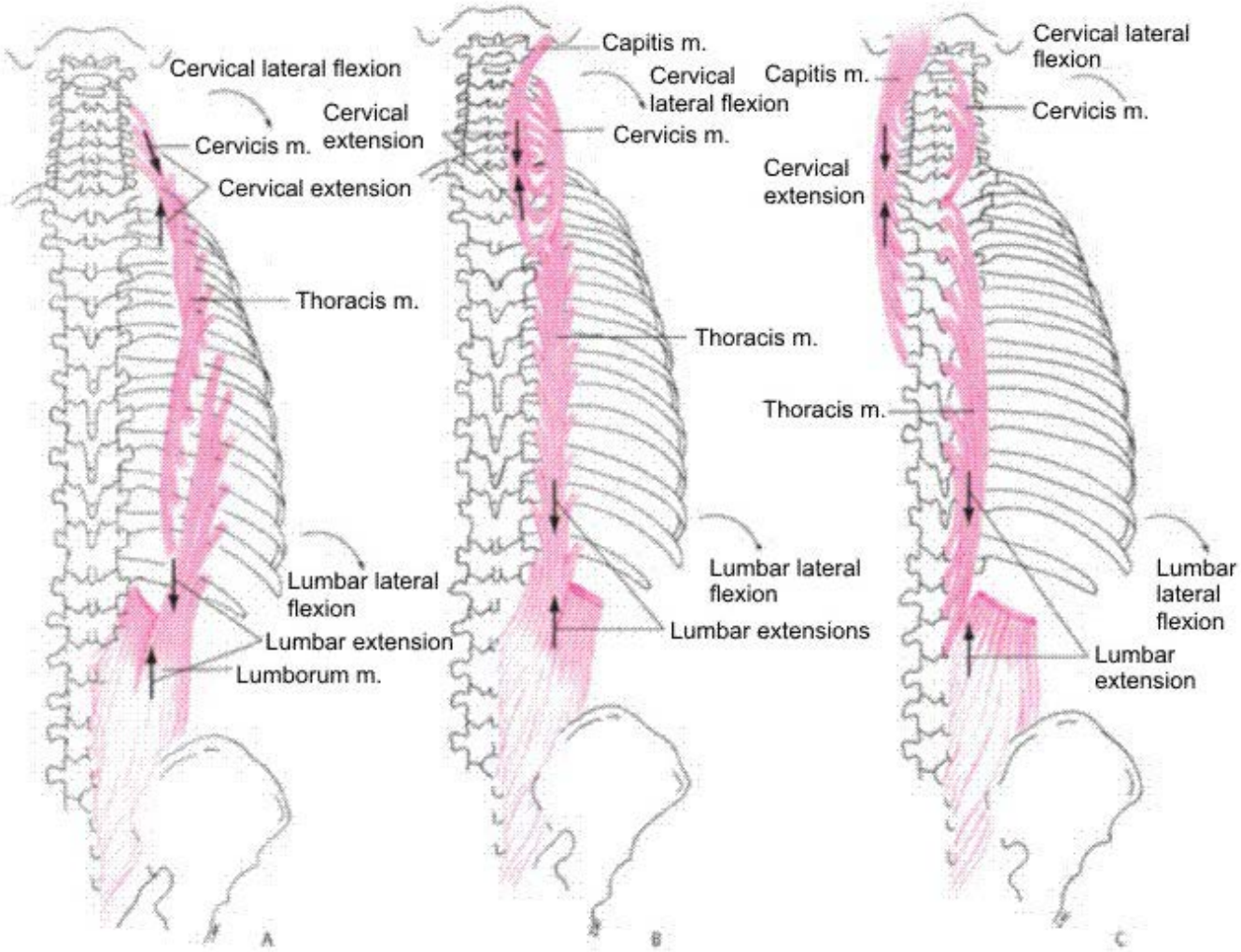
Longissimus (middle layer)

Spinalis (medial layer)

Extension, lateral flexion, and ipsilateral rotation of spine and head

Anterior pelvic rotation

Lateral pelvic rotation to contralateral side



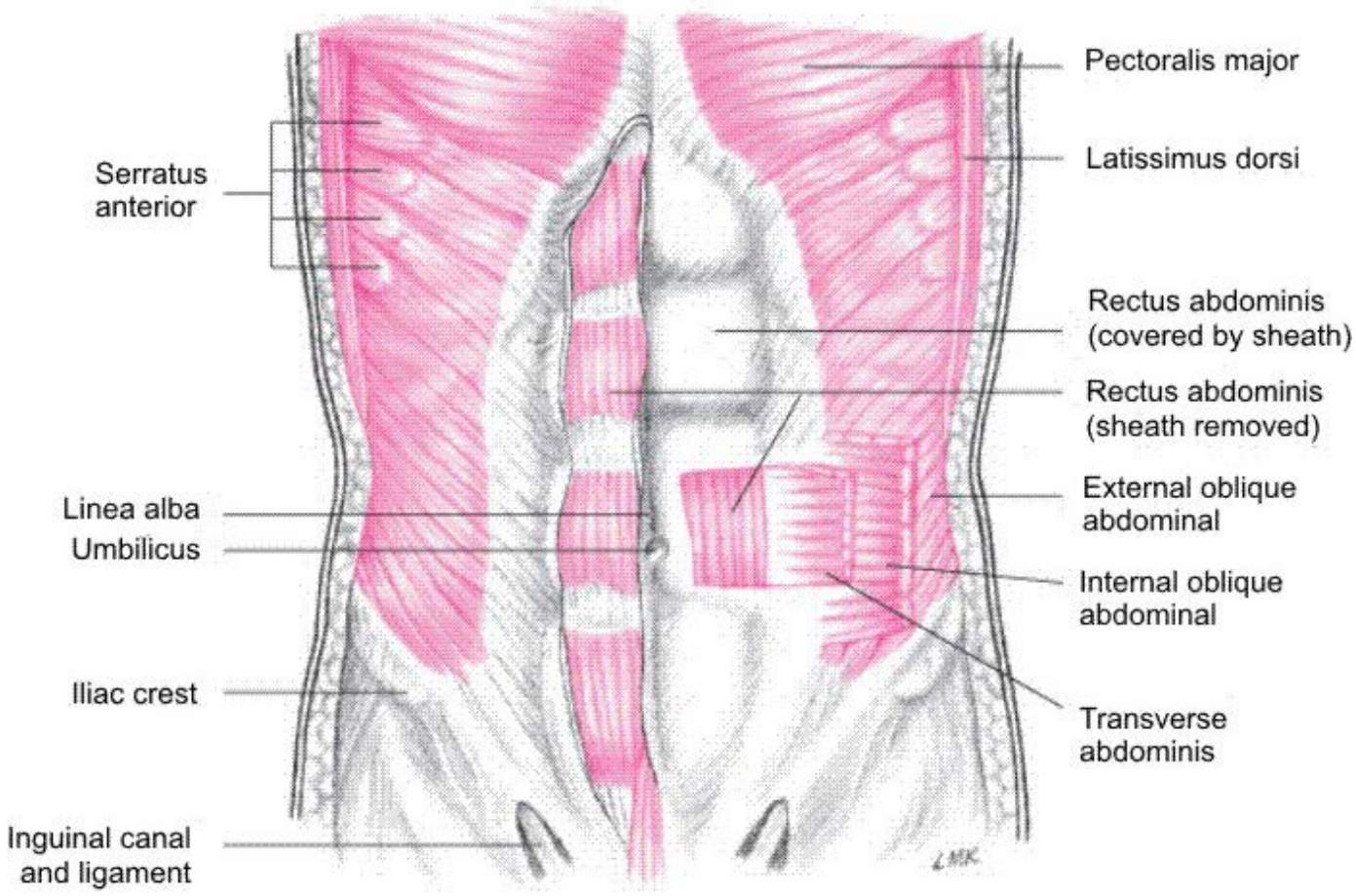
Muscles of the Abdominal Wall

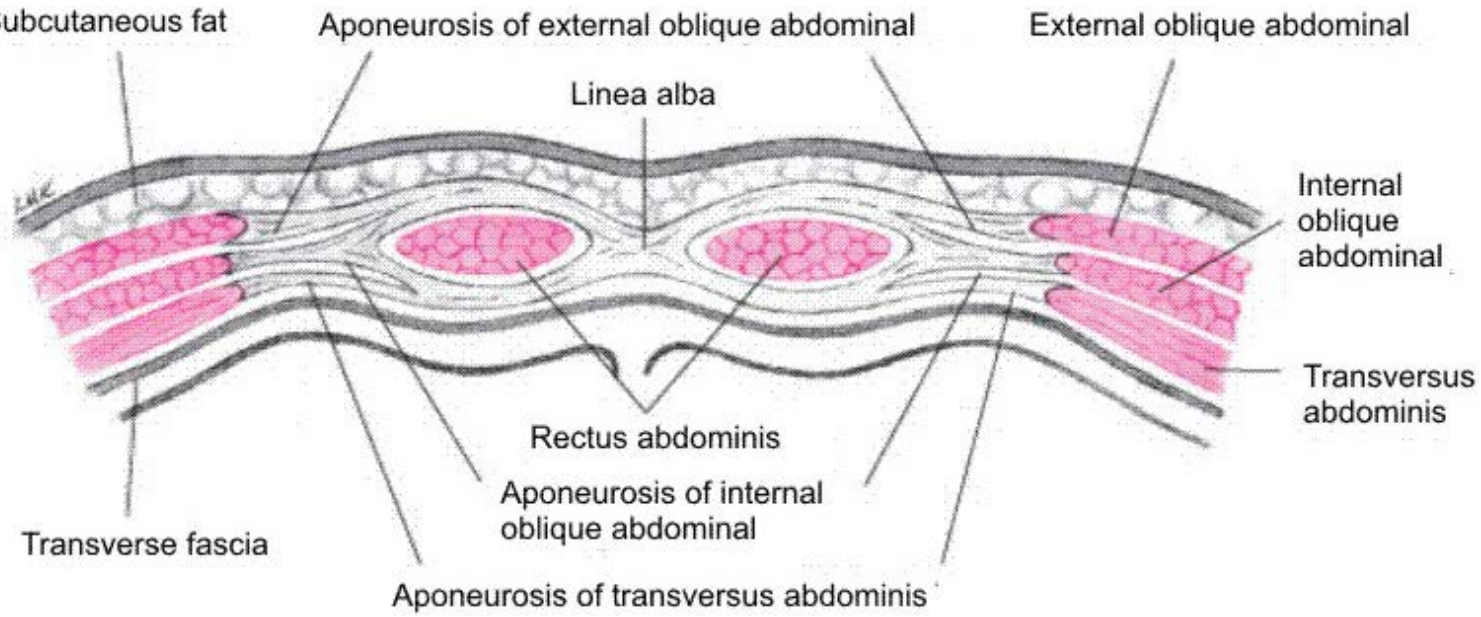
Rectus abdominis

External oblique abdominal

Internal oblique abdominal

Transverse abdominis





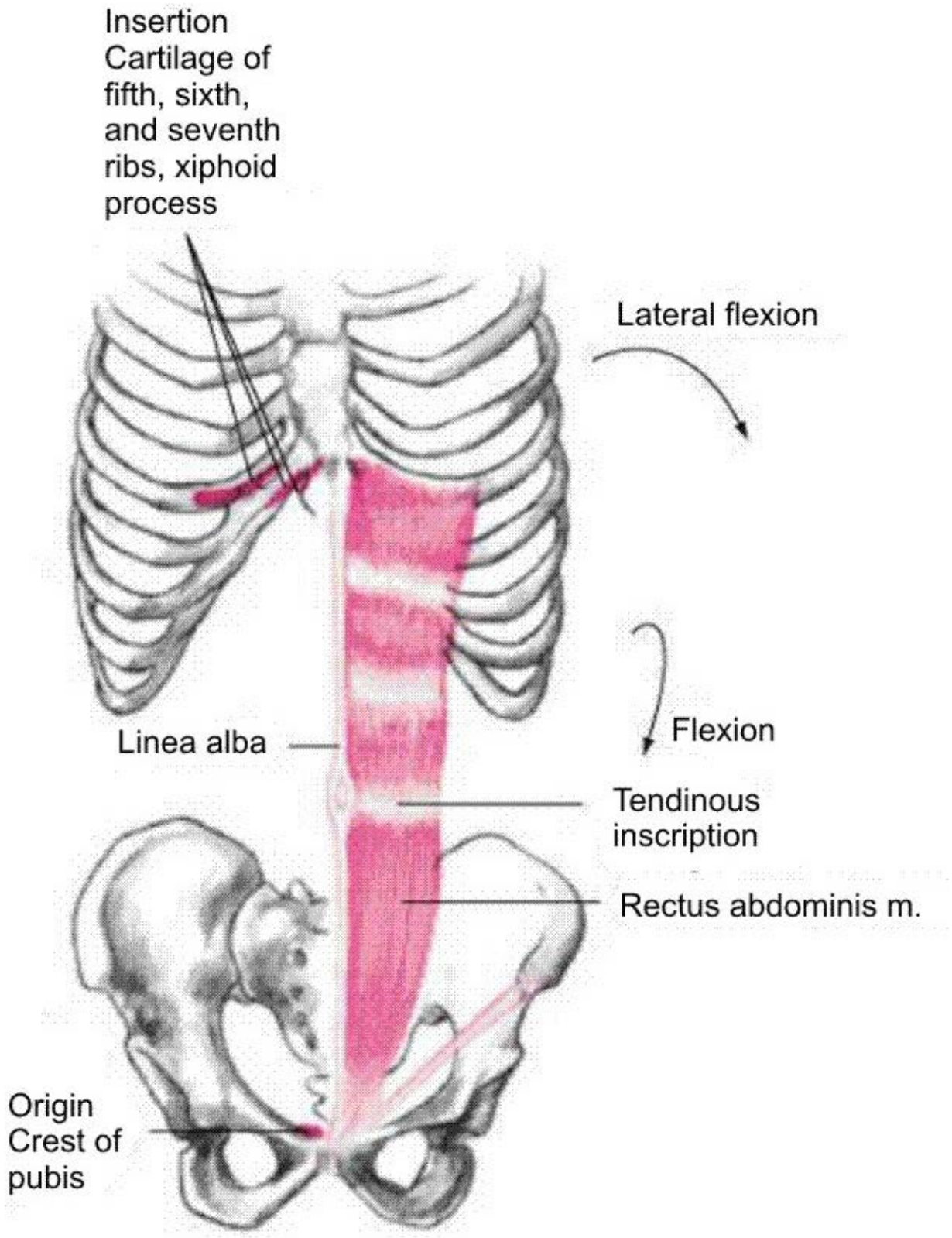
Rectus Abdominis Muscles

Both sides: lumbar flexion

Posterior pelvic rotation

Right side: weak lateral flexion to right

Left side: weak lateral flexion to left



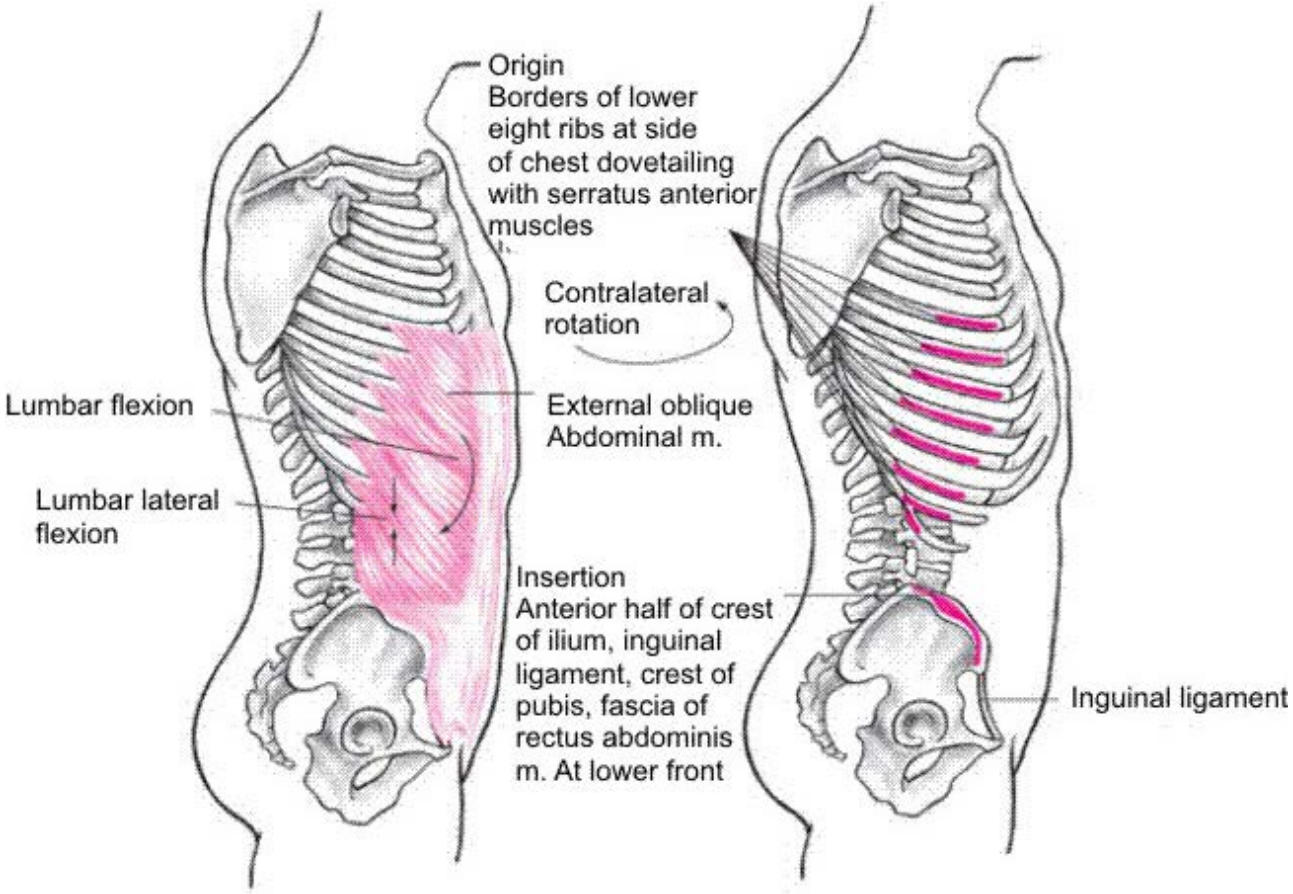
External Oblique Abdominal Muscle

Both sides: lumbar flexion

Posterior pelvic rotation

Right side: lumbar lateral flexion to right, rotation to left, and lateral pelvic rotation to left

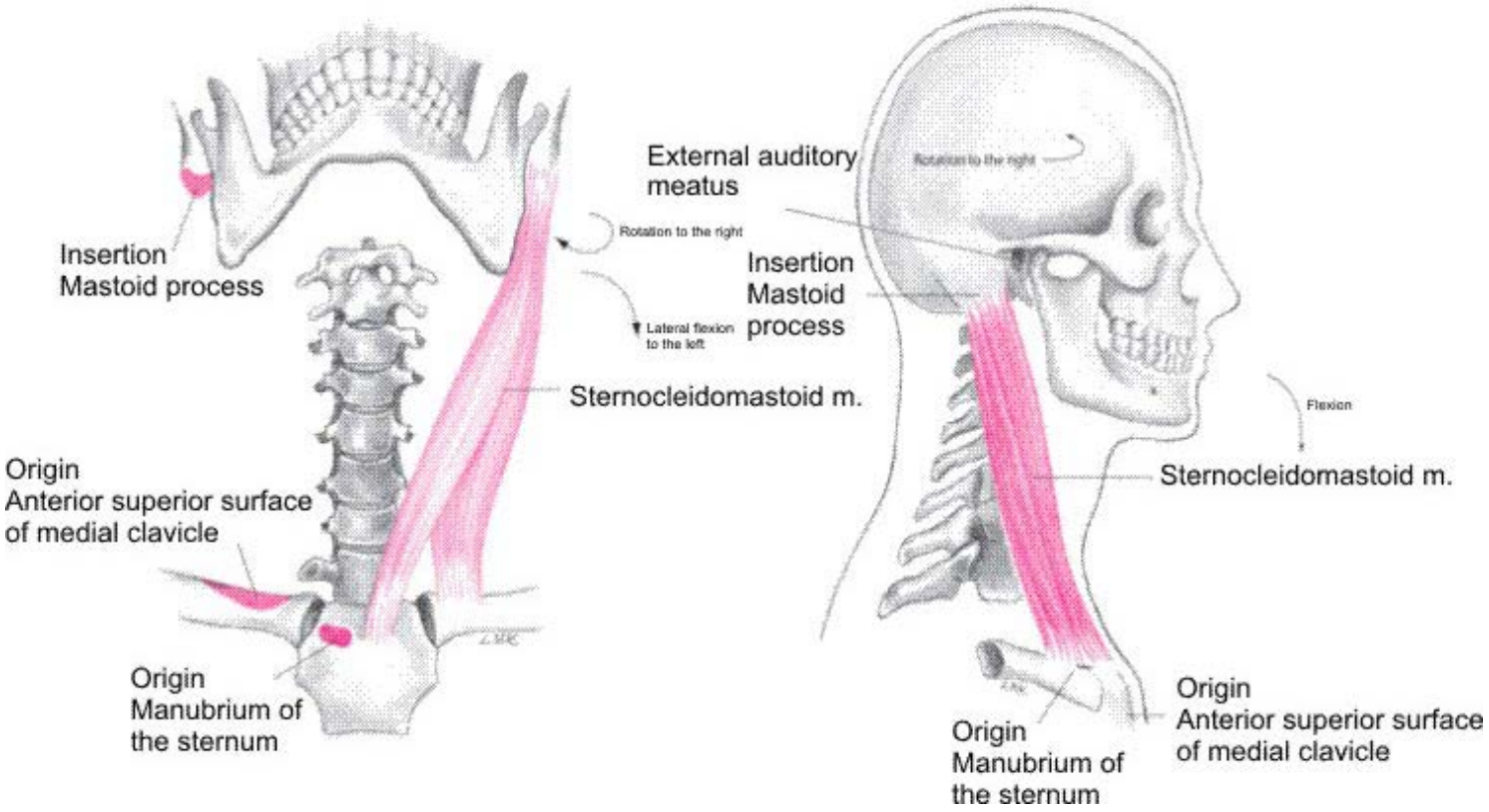
Left side: lumbar lateral flexion to left, rotation to right, and lateral pelvic rotation to right



Cervical Flexion

Agonists

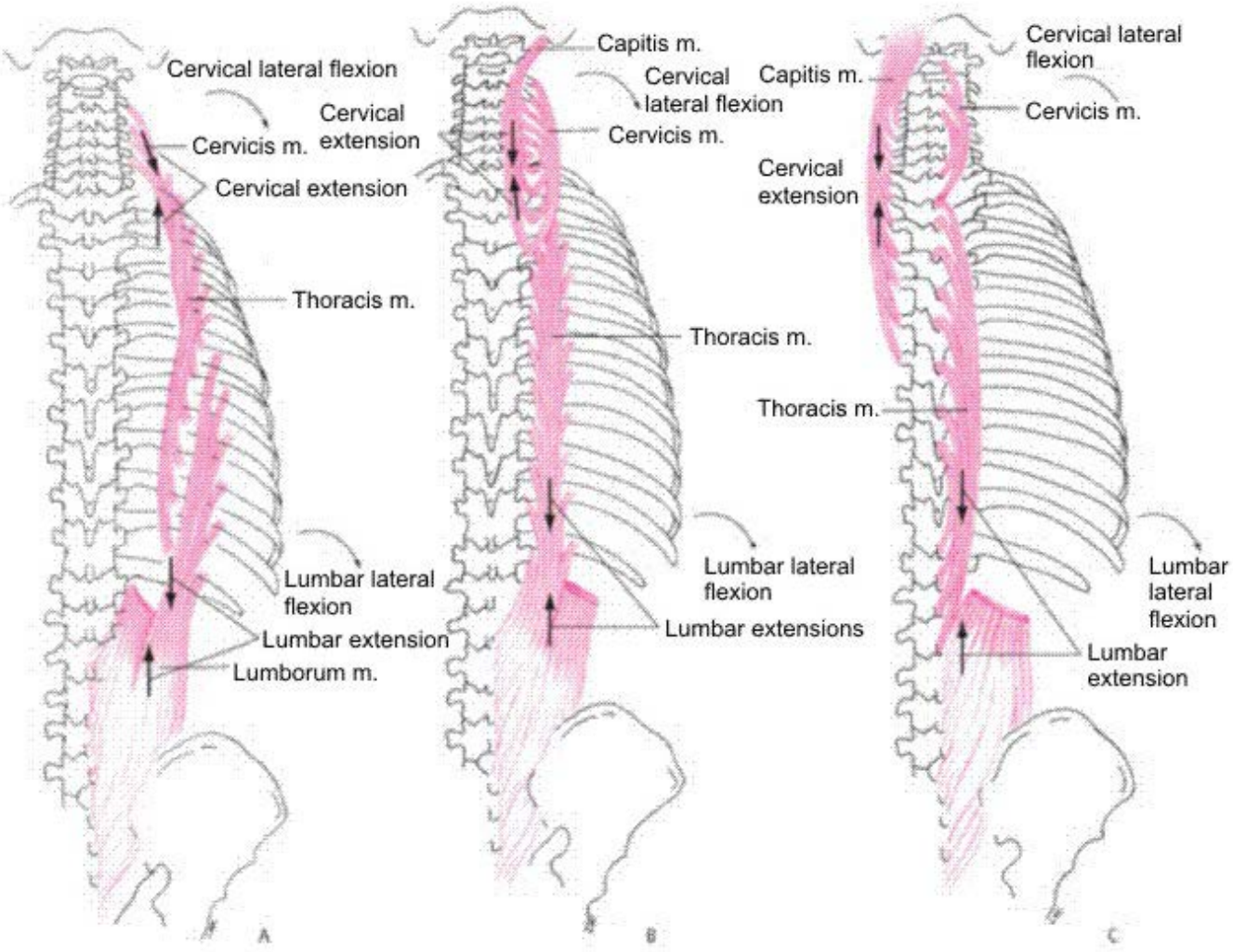
Sternocleidomastoid



Cervical Extension

Agonists

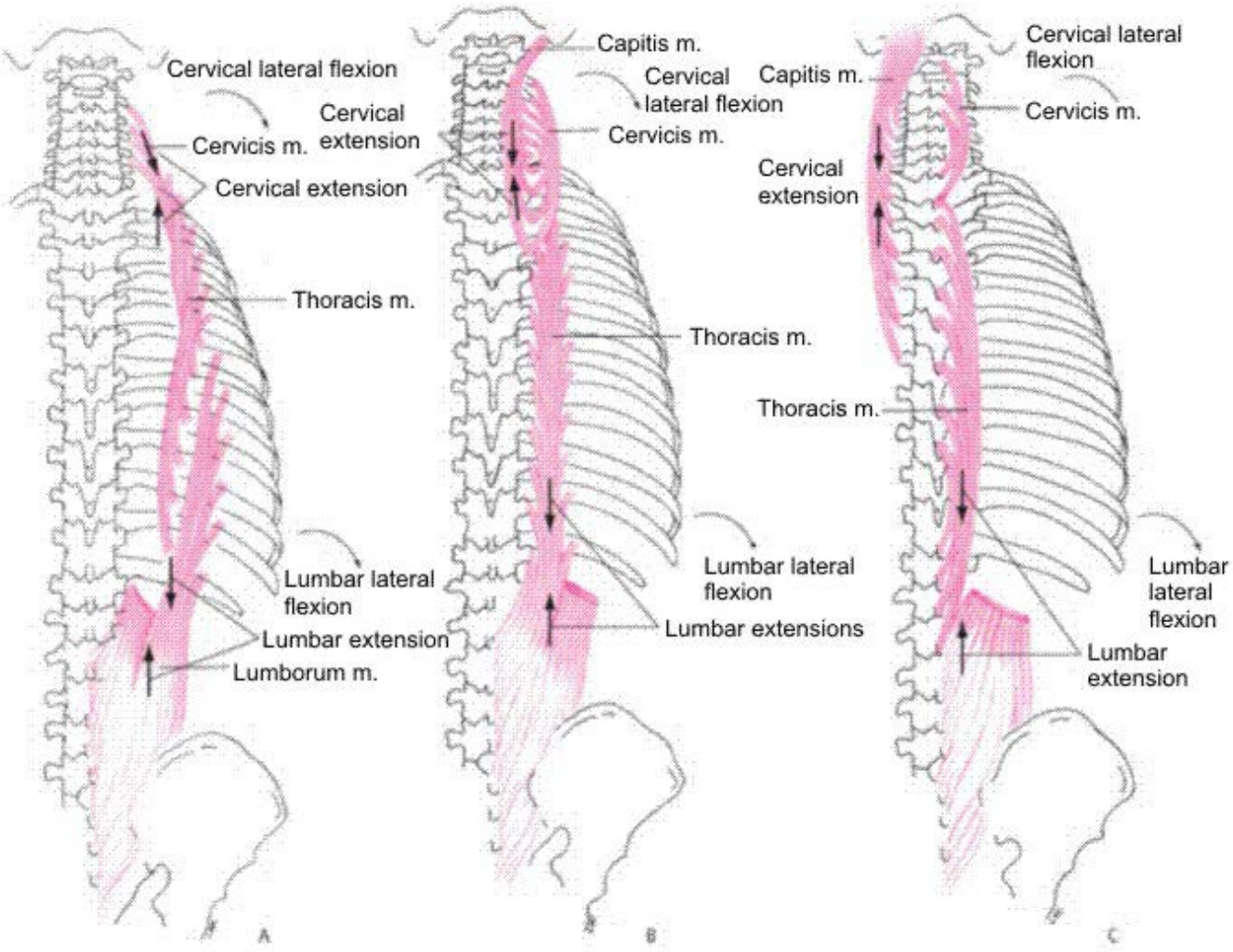
Erector Spinae



Cervical Extension

Agonists

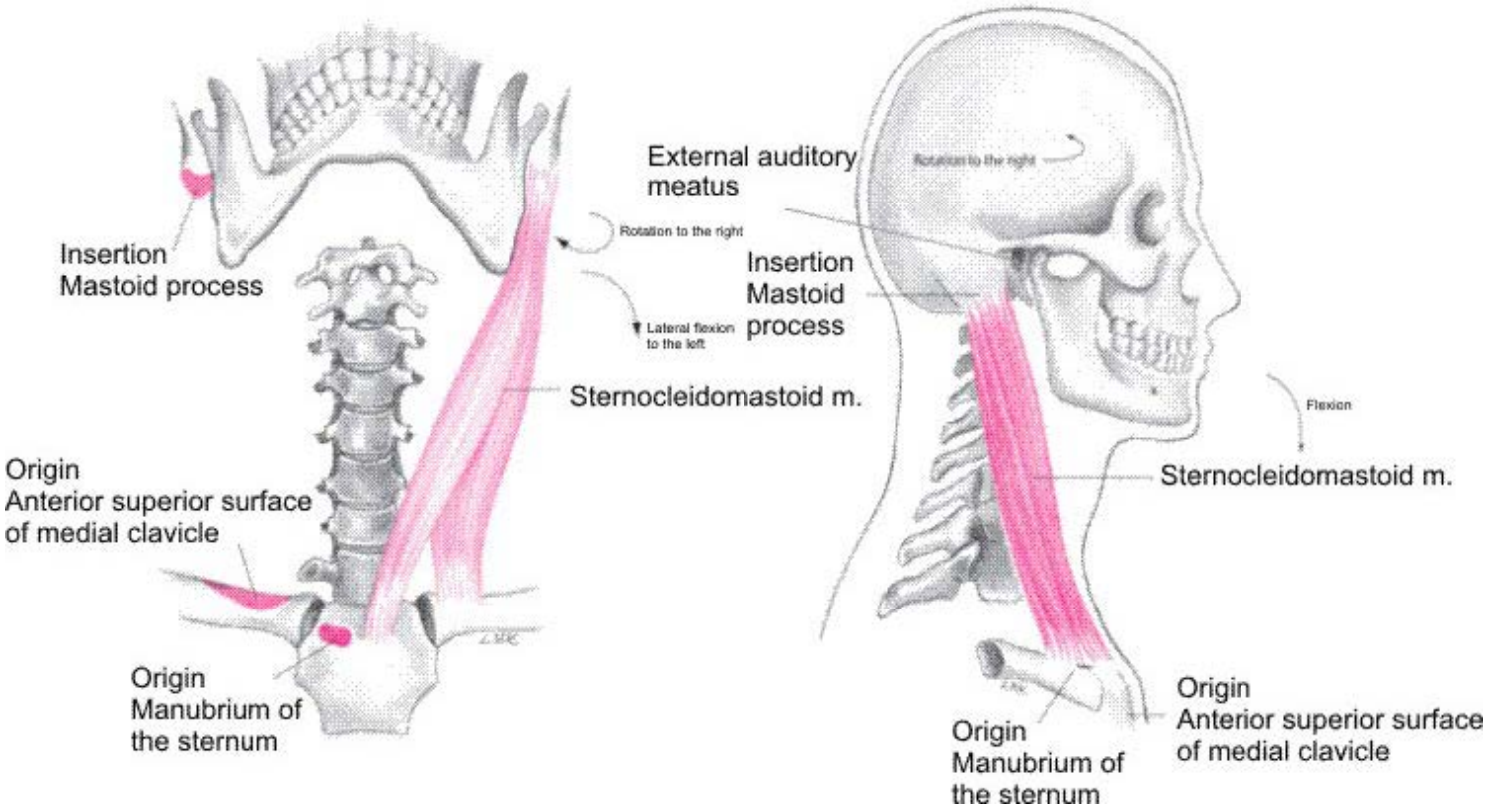
Erector Spinae



Cervical Rotation

Agonists

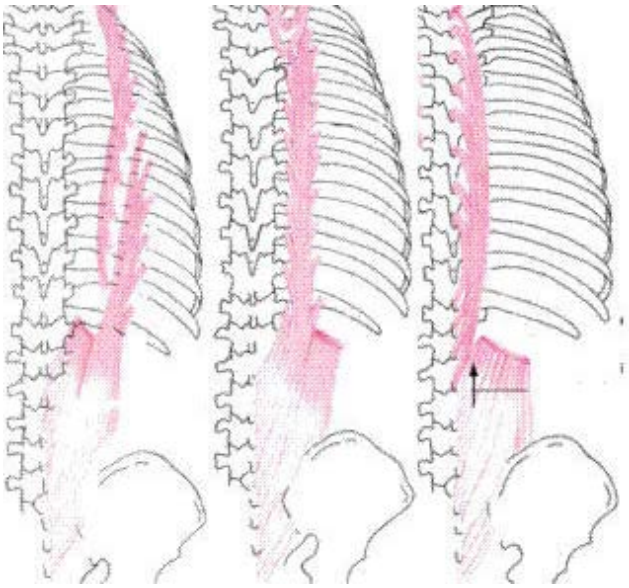
Sternocleidomastoid



Lumbar Extension

Agonists

Erector Spinae



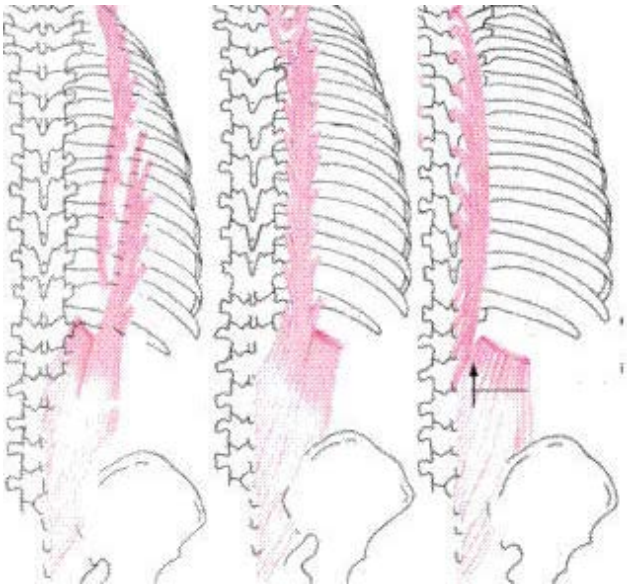
Lumbar Lateral Flexion

Agonists

Erector Spinae

External Oblique Abdominal

Internal Oblique Abdominal



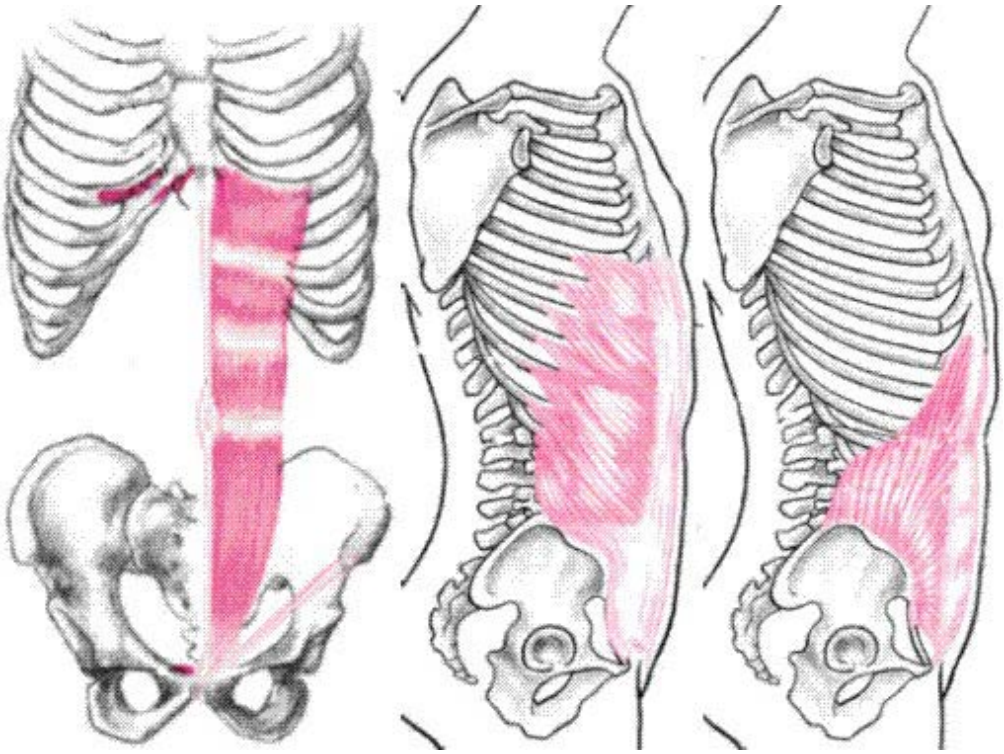
Lumbar Rotation

Agonists

Rectus Abdominus

External Oblique Abdominal

Internal Oblique Abdominal



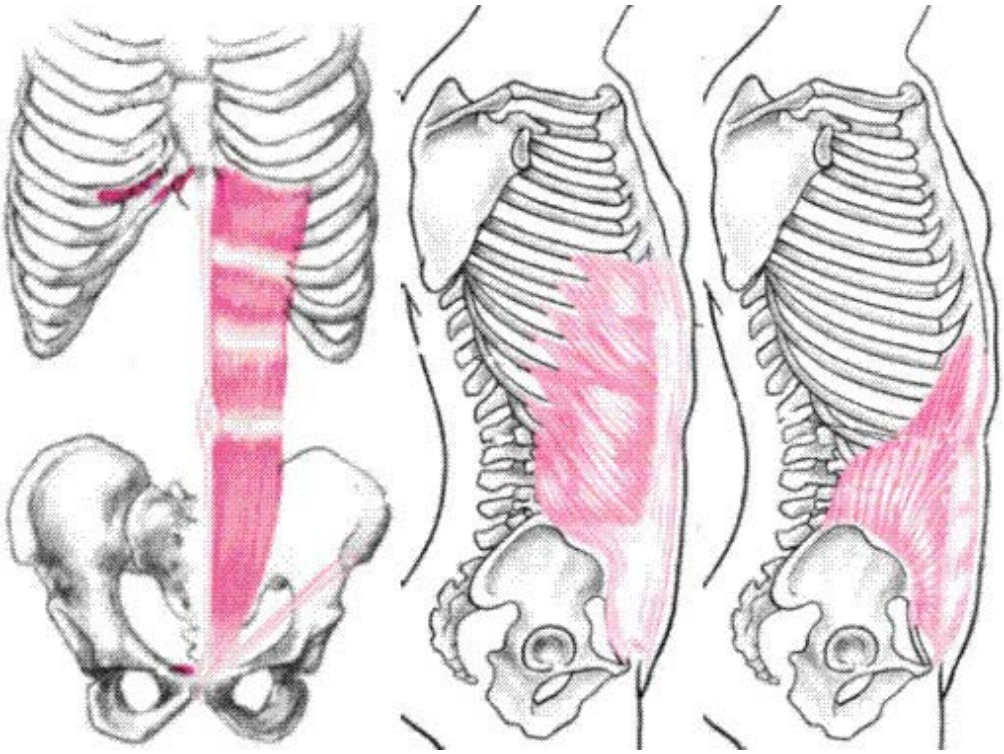
Lumbar Rotation

Agonists

Rectus Abdominus

External Oblique Abdominal

Internal Oblique Abdominal



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