MUSCLES OF THE BACK

Complex but divisible into 3 groups (in layers) with different functions:

A. SUPERFICIAL LAYER - move upper extremity (arm)

B. INTERMEDIATE LAYER - Respiratory muscles (insert to ribs)

C. DEEP LAYER - move trunk and back; support body weight

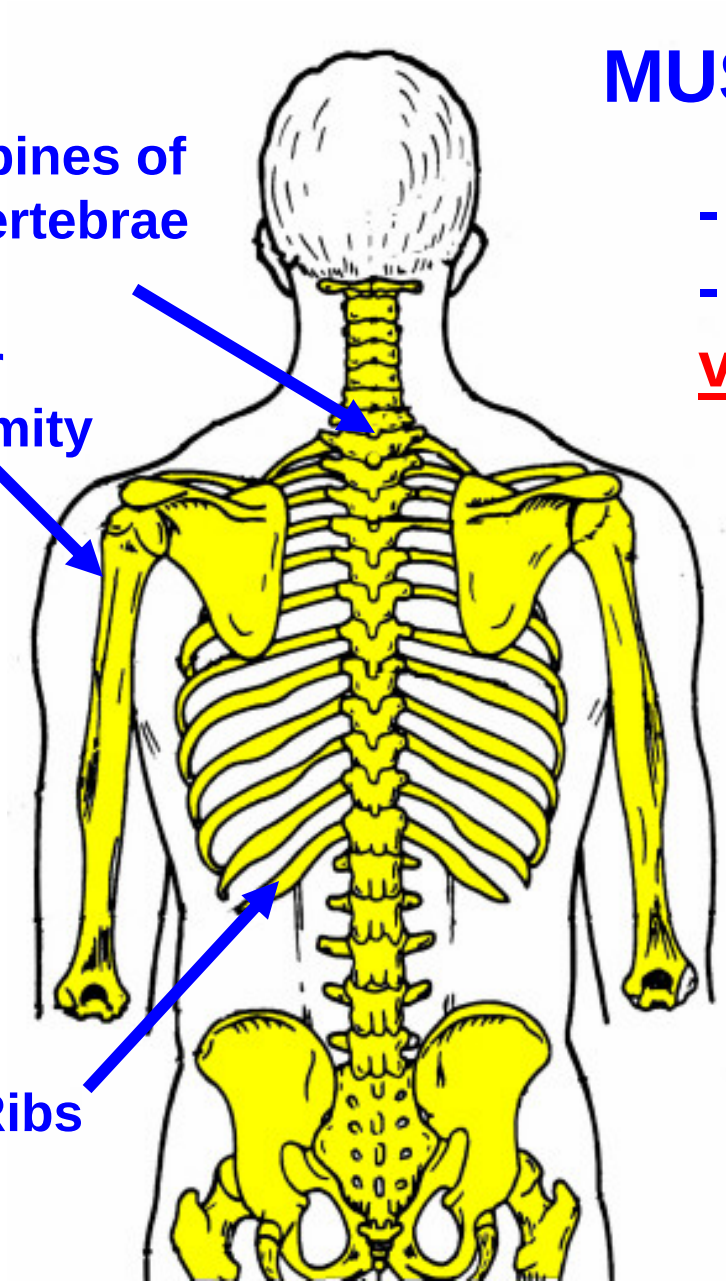
BACK MUSCLES ARE MULTIFUNCTIONAL: SUPPORT UPPER BODY, WEIGHT CARRIED BY UPPER EXTREMITIES

1. Kamper, et al. Best Pract Res Clin Rheum 30:1021-1036, 2016
1. Skaggs, et al.
J Pediatric Ortho 26(3):358-363, 2006
2. Talbott et al., Work. 34(4):481-94, 2009

- ~30-35% of children experience back pain
- contributing factors: backpack type, child overweight, etc.
- backpack variables:

1) Use of both shoulder straps - load distributed symmetrically
2) Weight of backpack
3) Design: transfer of load to lumbar vertebrae, innominate bone

MUSCLES OF THE BACK



- layered and multifunctional
- almost all take origin from vertebrae

IN LAB: ORIENT TO SKELETON

1) Spines of Vertebrae in midline (PALPATE SPINES)

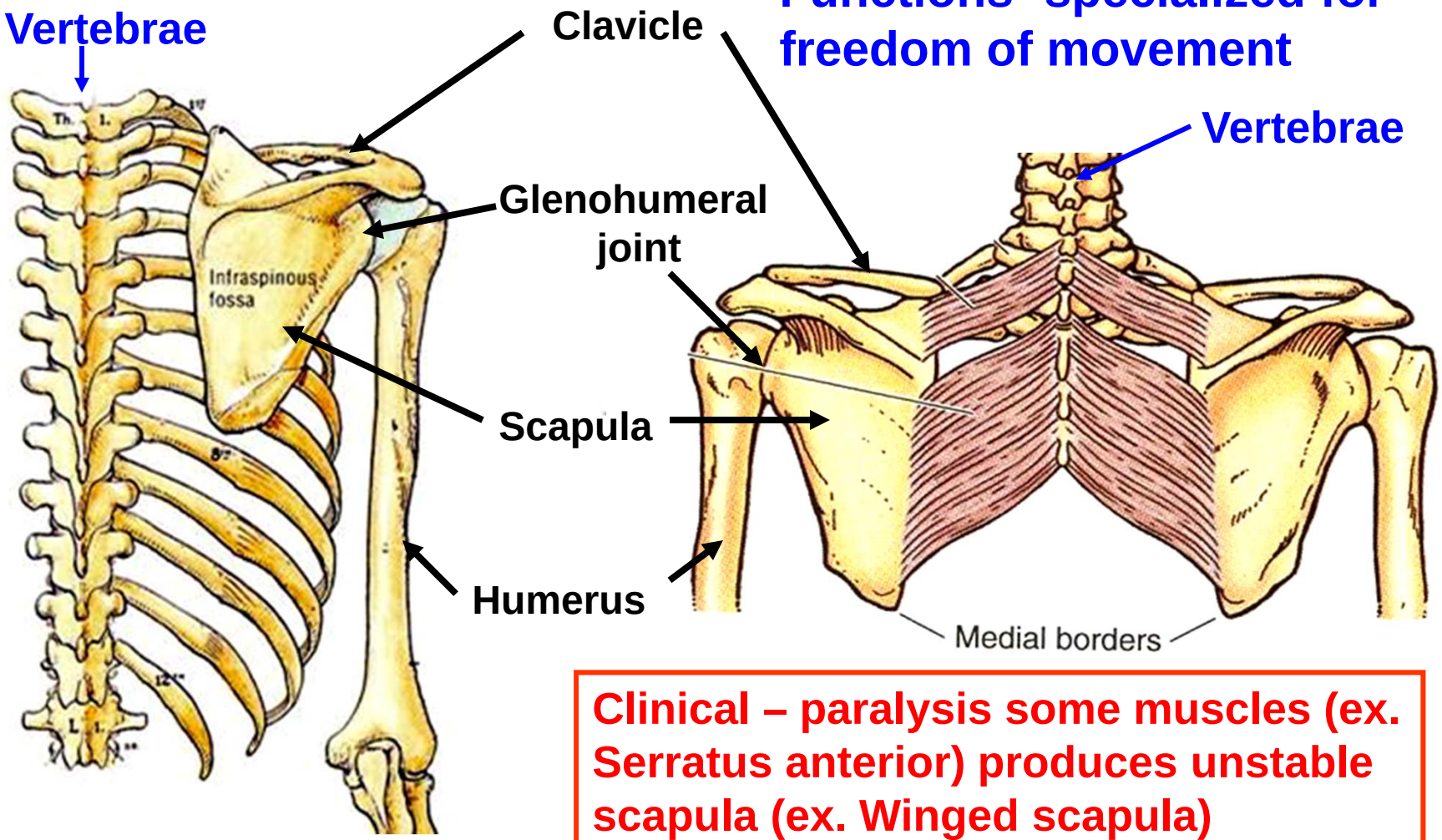
2) Ribs attach to vertebra (thorax) - ribs move in respiration

3) Upper extremity (arm) - mostly free to move; attach to vertebrae by muscles

SUPERFICIAL GROUP- insert to bones of upper extremity

- **scapula is FREE FLOATING AND is stabilized by muscles; attached to vertebrae by muscles (NO DIRECT JOINTS)**
- **only bony link of scapula to skeleton is by clavicle**
- **scapula articulates with humerus at glenohumeral joint (ball and socket)**
- **allowing other muscles to act on arm**

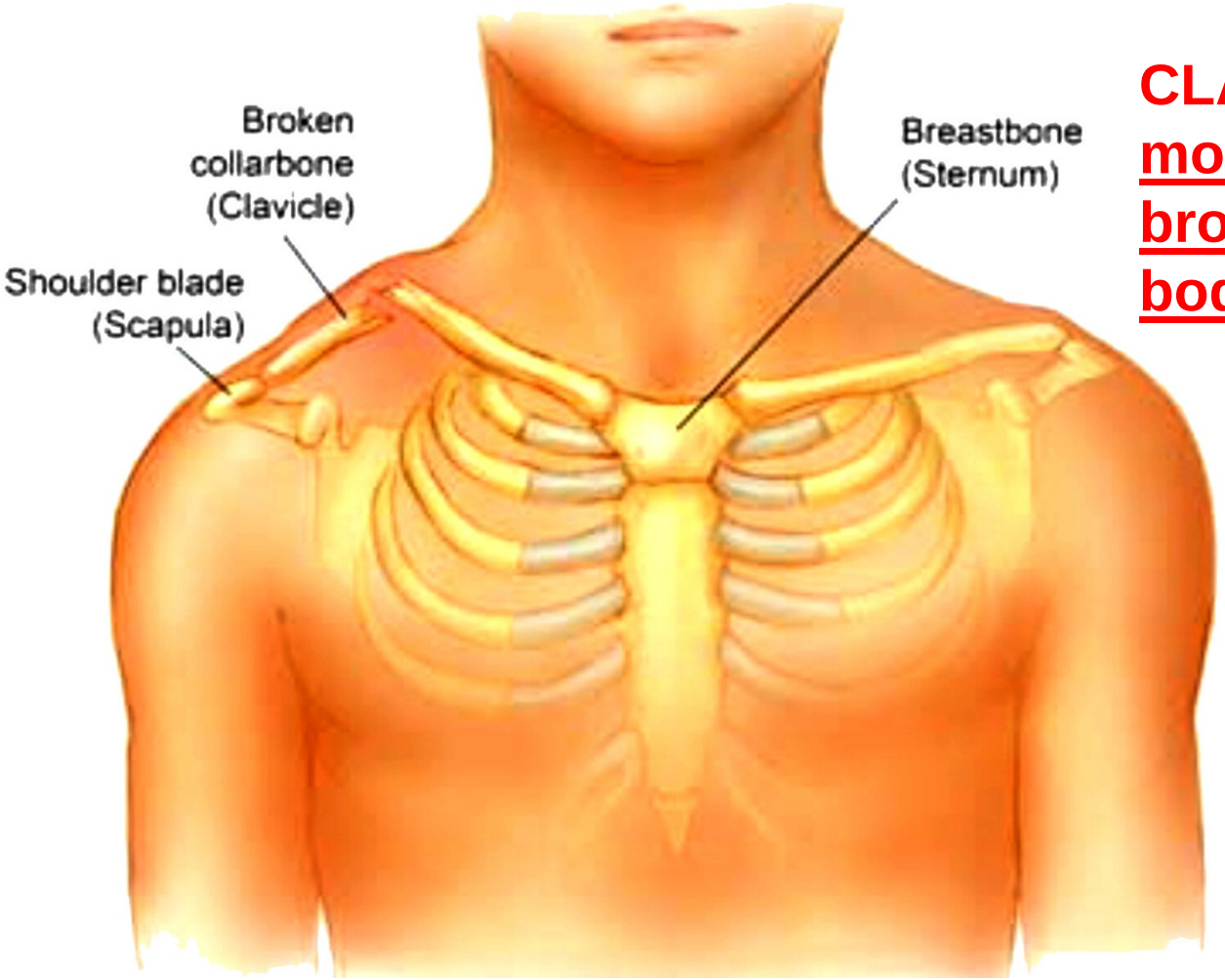
Functions- specialized for freedom of movement



Clinical – paralysis some muscles (ex. Serratus anterior) produces unstable scapula (ex. Winged scapula)

SCAPULA: LINKED TO SKELTON ANTERIORLY BY CLAVICLE

Only bony link of scapula and arm to skeleton is by clavicle

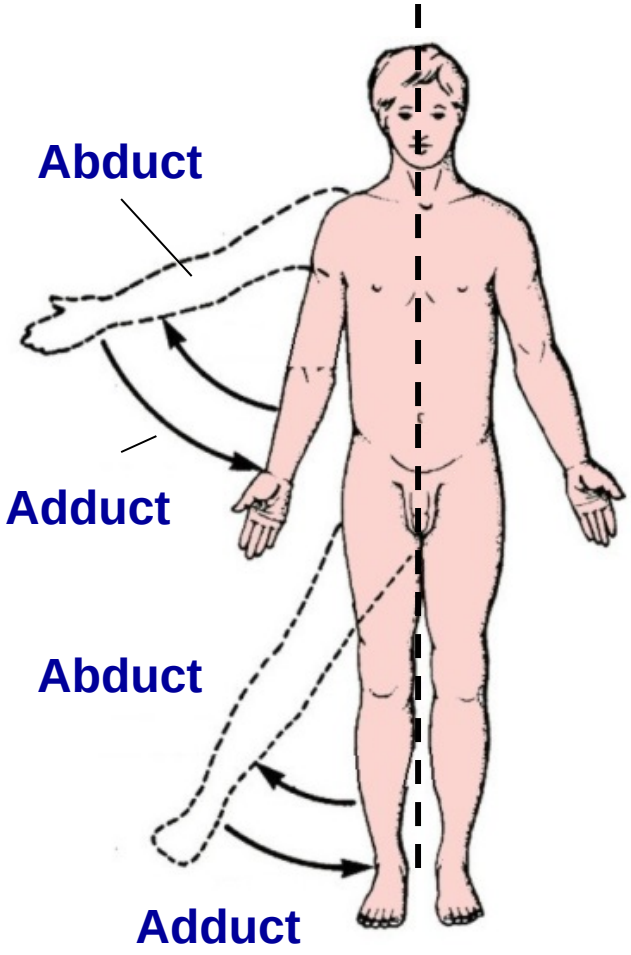


CLAVICLE- most frequently broken bone in body

MOVEMENTS

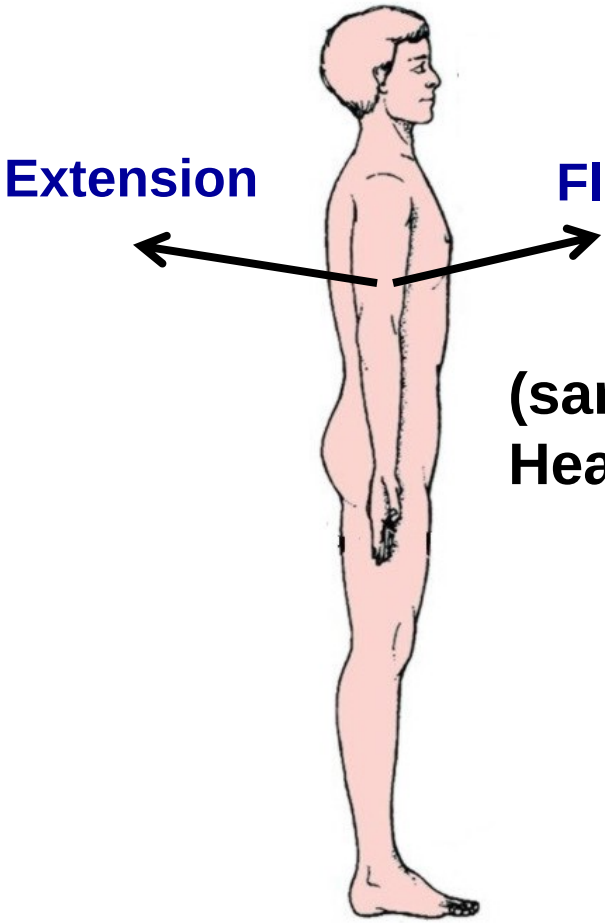
ABDUCTION/ADDUCTION

ABduct - away from midline
ADduct - toward midline



FLEXION/EXTENSION

FLEXION - decrease joint angle
EXTENSION - increase joint angle



(same for Head, Neck)

Note: Different frame of reference for hand (thumb), foot

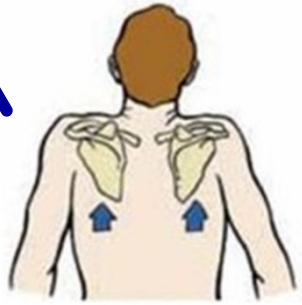
MOVEMENTS

Elevate/Depress Shoulder

Elevate - Raise (Shrug) shoulder

Depress - Lower shoulder

Elevate - Raise



Depress - Lower

CLINICAL TEST - RESIST 'SHRUG' SHOULDER

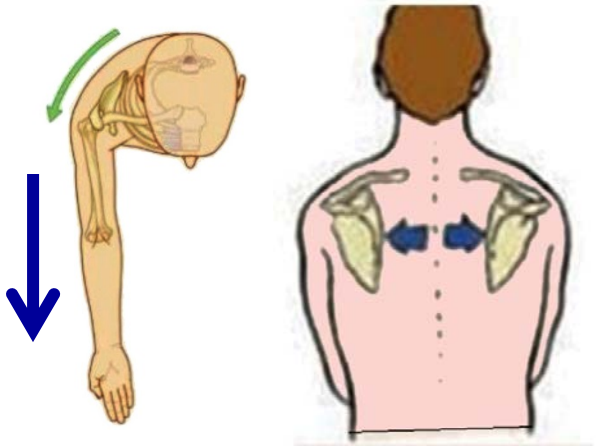
Clinical Test Accessory Nerve - Cranial Nerve X - Medical student 'volunteer'

Protract/Retract Shoulder

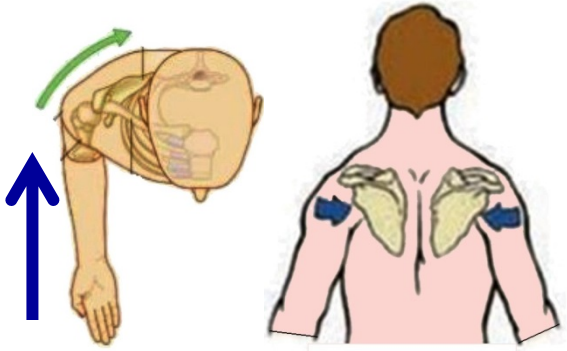
Protract - Pull shoulder forward

Retract - Pull shoulder back

Protract



Retract



Adduct Scapula in Retraction

Elevate/Depress Arm (Humerus)

Elevate - raise past 120 degrees by rotating scapula

Elevate Arm - Raise humerus

Rotate Scapula when raise arm past 120 degrees

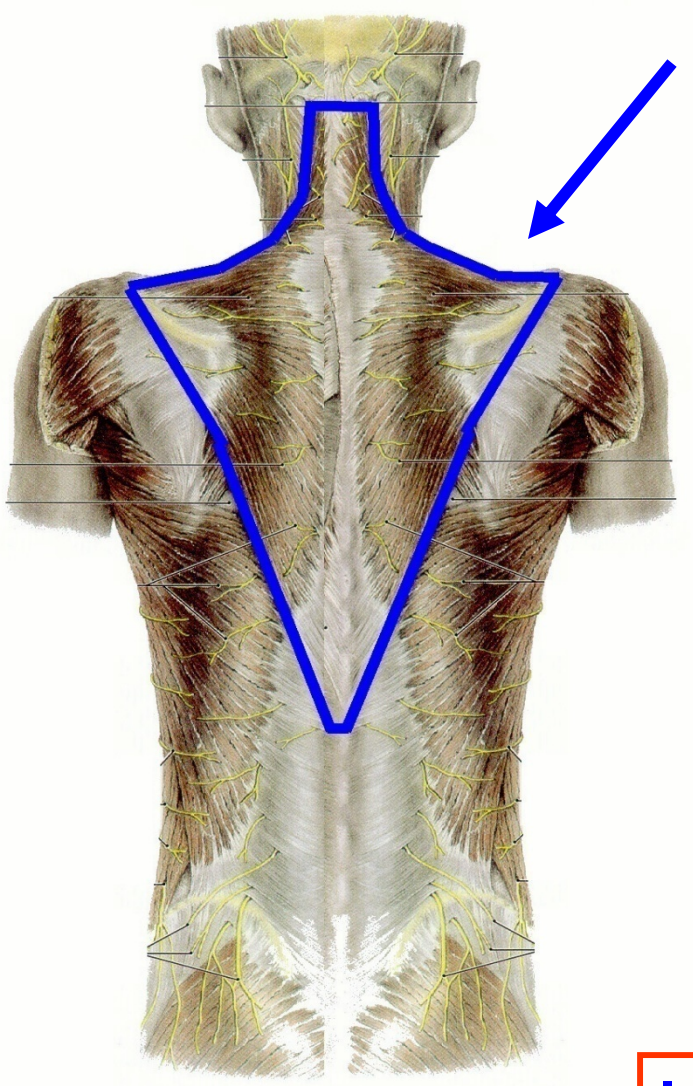
SUPERFICIAL GROUP - origin VERTEBRAE; insert scapula, clavicle, humerus

SUPERFICIAL MUSCLES OF THE BACK - Lab ID - these muscles insert to Scapula or Humerus

MUSCLE	ACTION	NERVE
Trapezius	Both elevates (upper fibers, shrug shoulders) and depresses (lower fibers) shoulder; retracts scapula; also extends head	Accessory n. (Cranial nerve XI)
Latissimus dorsi	Adducts, extends, and medially rotates arm	Thoracodorsal n.
Levator scapulae	Elevates and adducts scapula	Dorsal scapular n.
Rhomboid minor	Elevates and adducts scapula	Dorsal scapular n.
Rhomboid major	Elevates and adducts scapula	Dorsal scapular n.

Required: 1) ID muscle, 2) action, 3) innervation

- However, discuss origins and insertions to aid identification; no questions about origins insertions on written or practical exams.



1. **TRAPEZIUS –**

Origin: Midline

1) Skull

2) Fascia - Ligamentum nuchae

3) Vertebrae - spines of C7, T1-T12

Insert: Lateral

1) Clavicle

2) Scapula

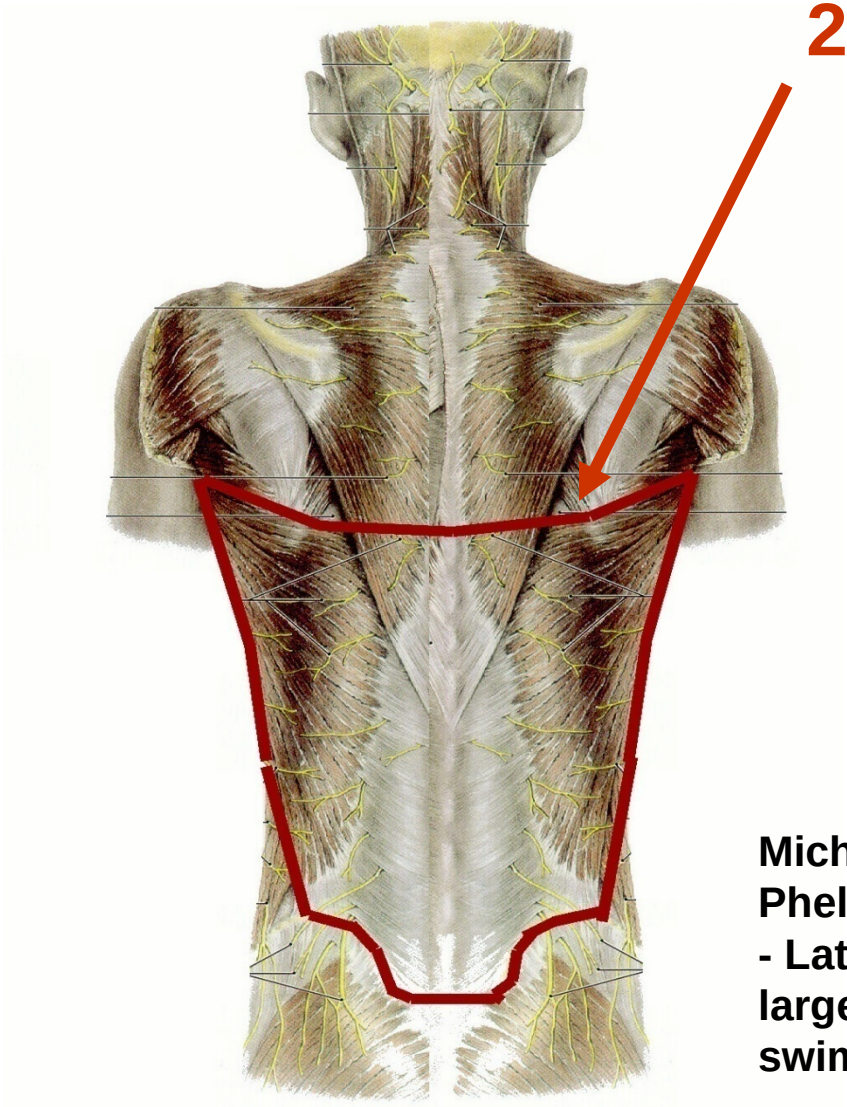
Actions:

1) Upper fibers Elevate shoulder; and Lower fibers Depress shoulder

2) Retracts scapula

3) Extends head

Innervation: Accessory nerve (Cranial nerve XI) - test shrug shoulders **



2. LATISSIMUS DORSI

Origin: Vertebrae T6-T12 (spines)
Fascia- Thoracolumbar fascia, Pelvic Bone
Insertion: Humerus
Actions: Adducts, extends, and medially rotates arm
Innervation: Thoracodorsal nerve

Michael Phelps - Lats large in swimmers

Note: Large trapezius makes head look small

Latissimus = broad, wide in Latin

MUSCLES DEEP TO TRAPEZIUS

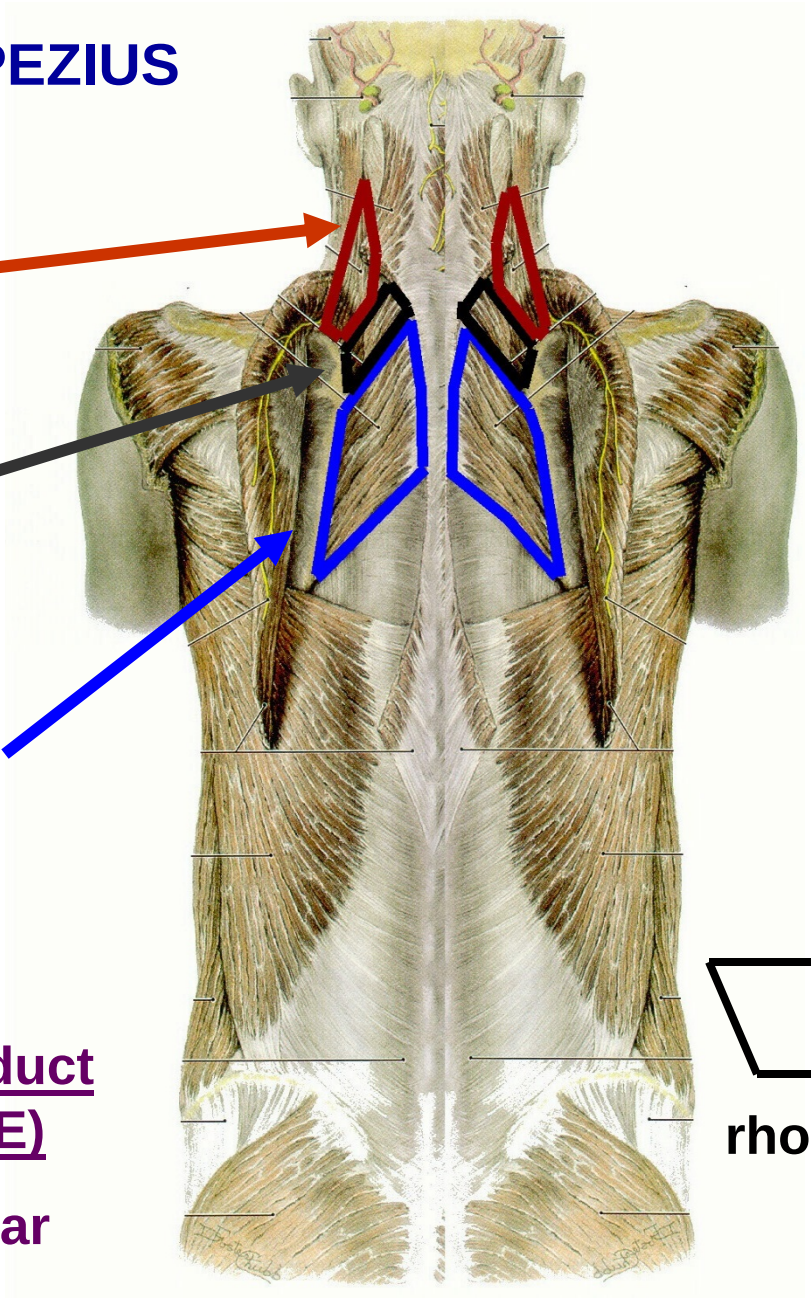
3. LEVATOR SCAPULAE Origin: Vertebrae Insertion: Scapula

4. RHOMBOID MINOR
Origin: Vertebrae
Insert: Scapula

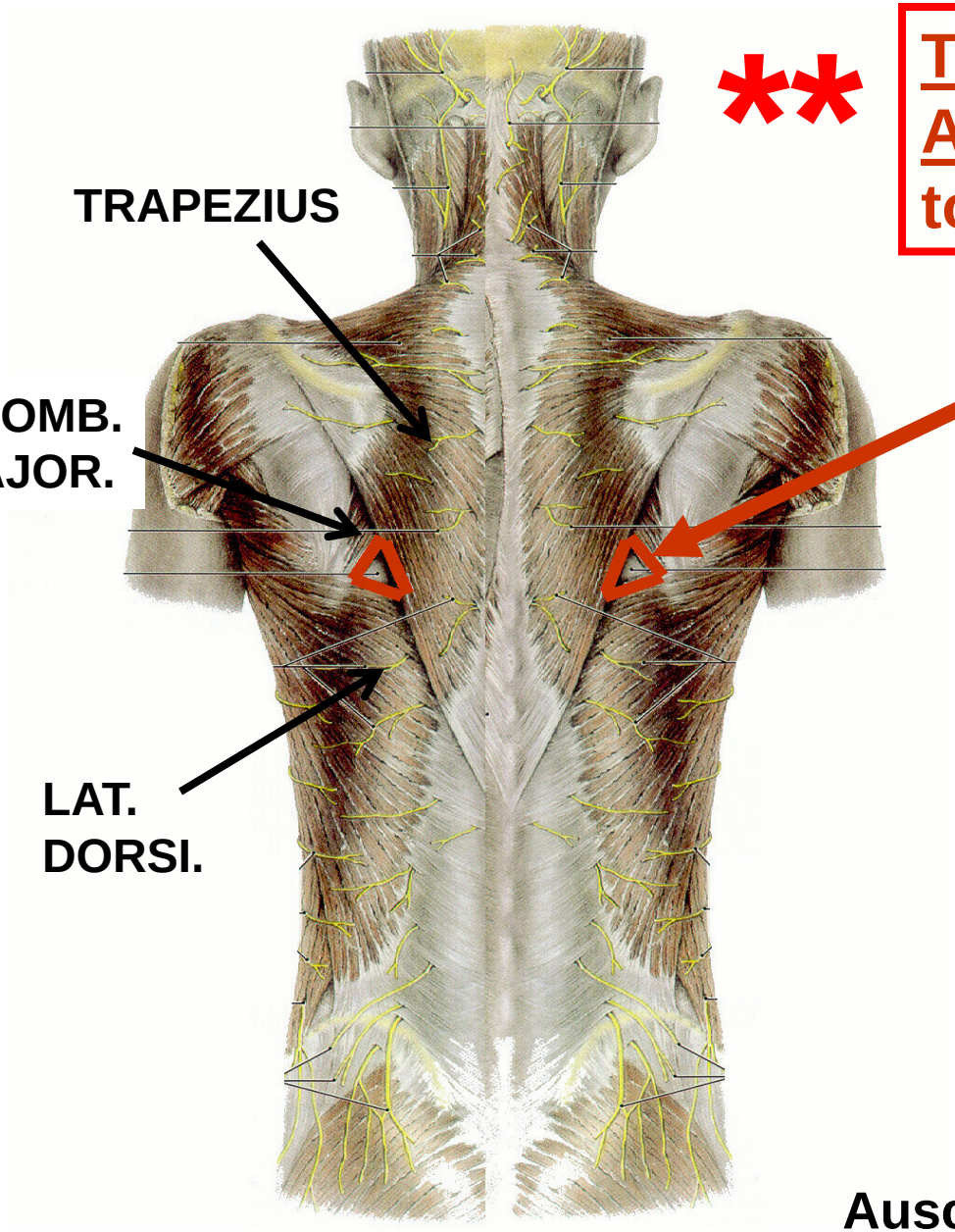
5. RHOMBOID MAJOR
Origin: Vertebrae
Insert: Scapula

Action: All elevate (LIFT) and adduct scapula (PULL TOWARD MIDLINE)

Innervation: All by Dorsal scapular nerve



rhombus



**

TRIANGLE OF AUSCULTATION – Medial to scapula

Boundaries
Inferior - Lat. Dorsi
Superior - Trapezius
Lateral - Rhomboid Major

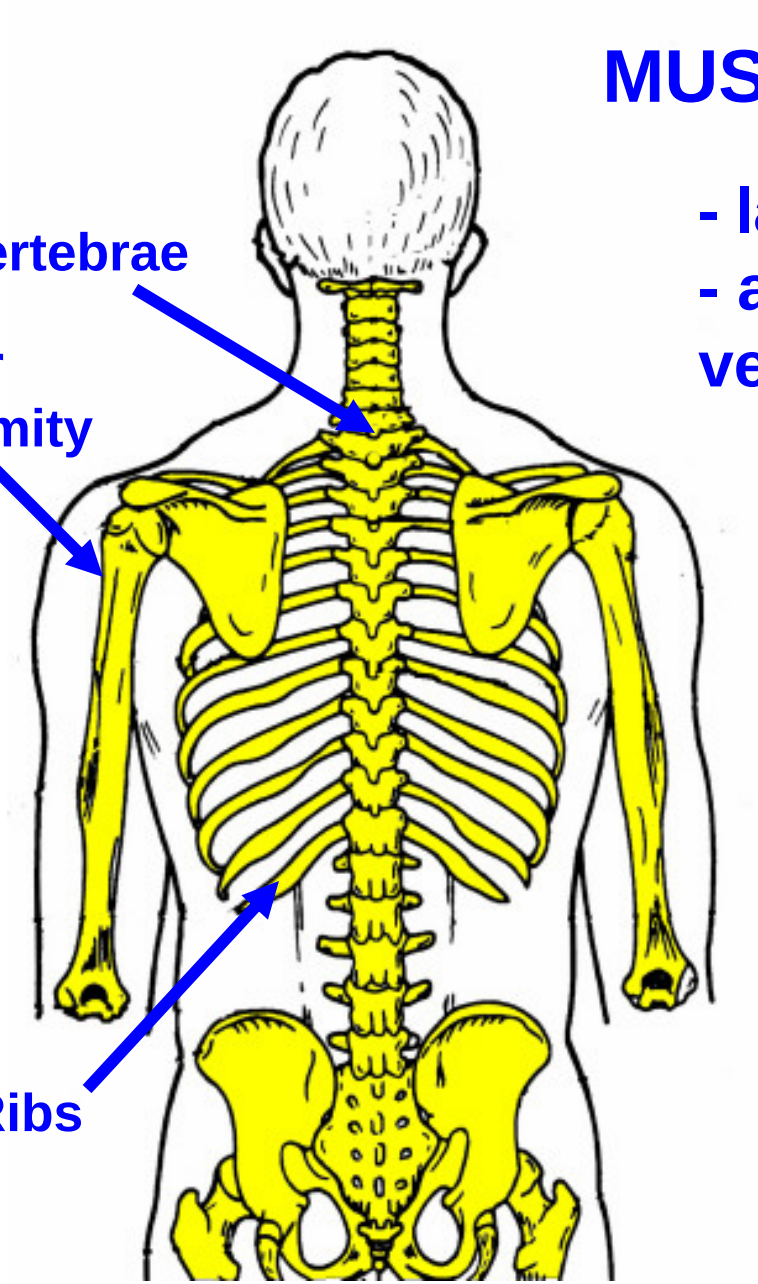
overlies 6th intercostal space; floor has no large muscles- good place for listening with stethoscope

Auscultation = listening

Intermediate Group- associated with Respiration
All Origin - Vertebrae; All Insert - Ribs

INTERMEDIATE MUSCLES OF THE BACK - Lab ID - these muscles insert to Ribs

MUSCLE	ACTION	NERVE
Levatores costarum	Raise ribs in inspiration	Dorsal rami of thoracic spinal nerves
Serratus posterior superior	Raise ribs in inspiration	Intercostal nerves
Serratus posterior inferior	Lower ribs in expiration	Intercostal nerves



MUSCLES OF THE BACK

- layered and multifunctional
- almost all take origin from vertebrae

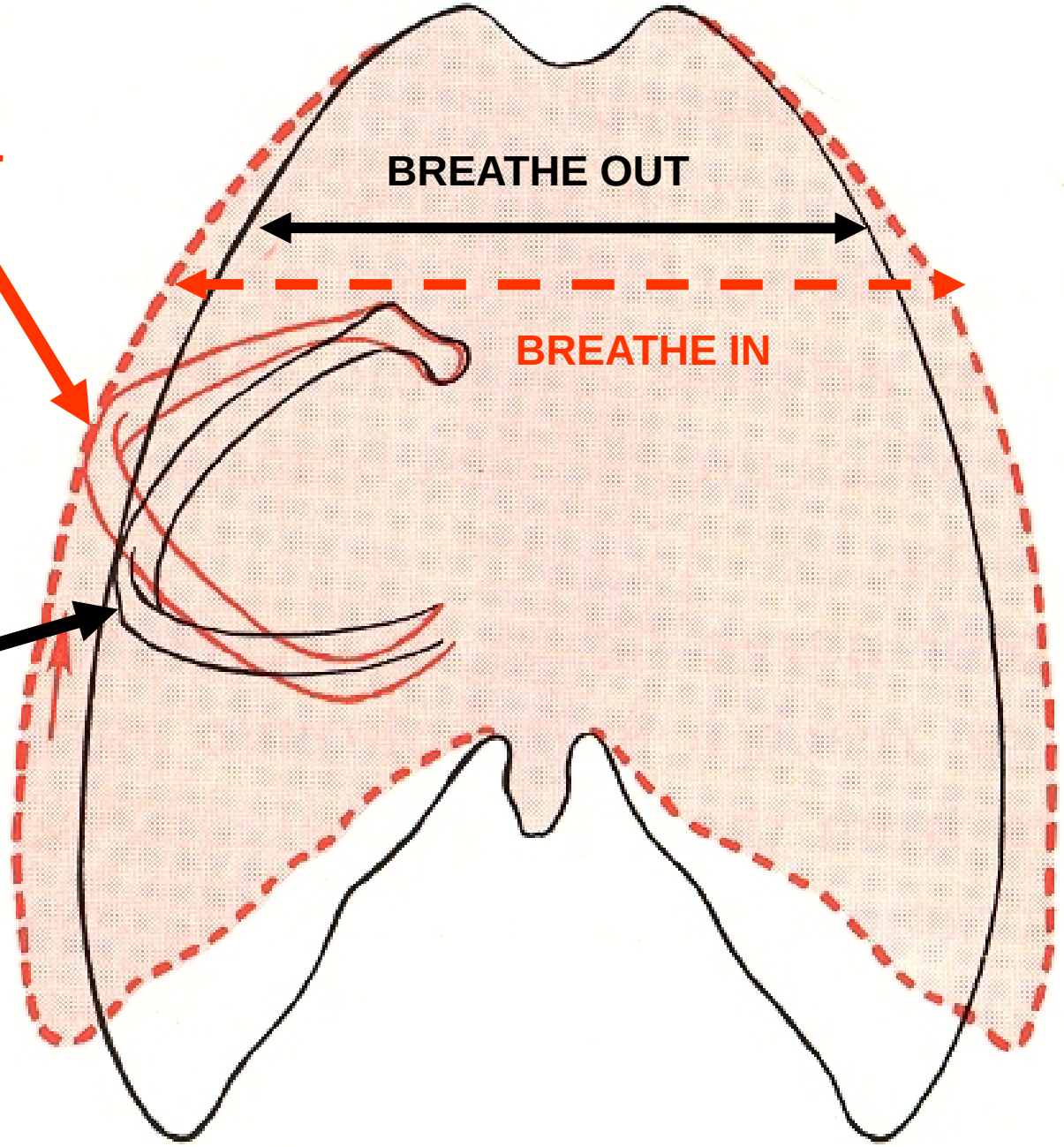
IN LAB: ORIENT TO SKELETON

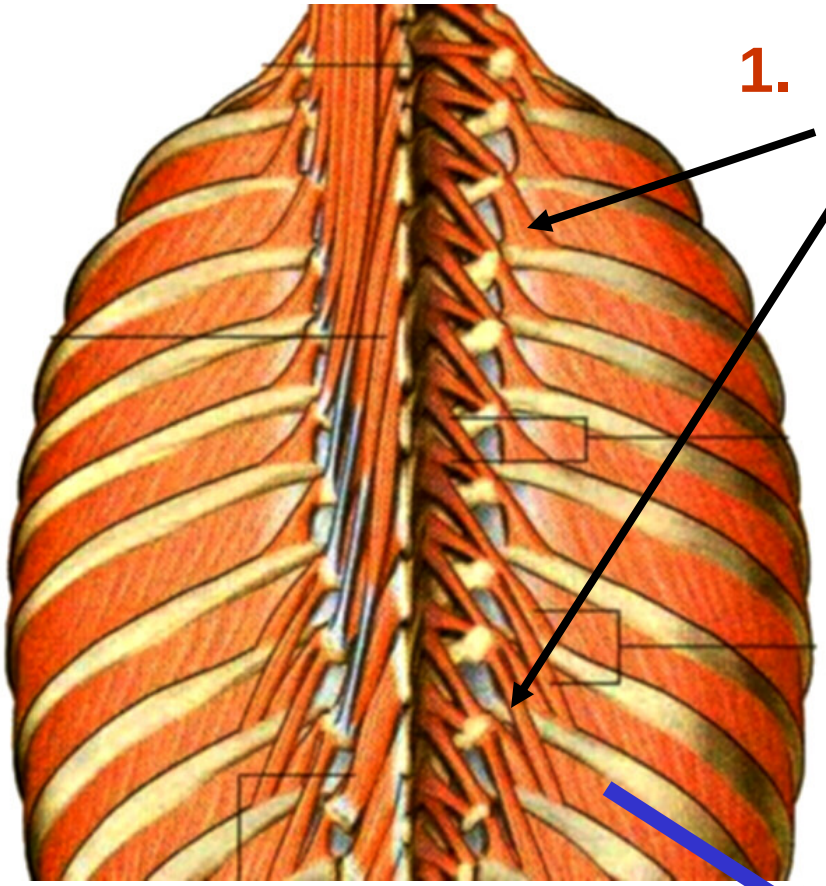
1) Vertebra in midline

2) Ribs attach to vertebrae (thorax) - ribs move in respiration

LIFTING RIBS EXPANDS THORAX (CHEST CAVITY) – BREATHE IN = INSPIRATION

LOWERING RIBS MAKES THORAX (CHEST CAVITY) SMALLER – BREATHE OUT = EXPIRATION





1. LEVATORES COSTARUM

Series of muscles:

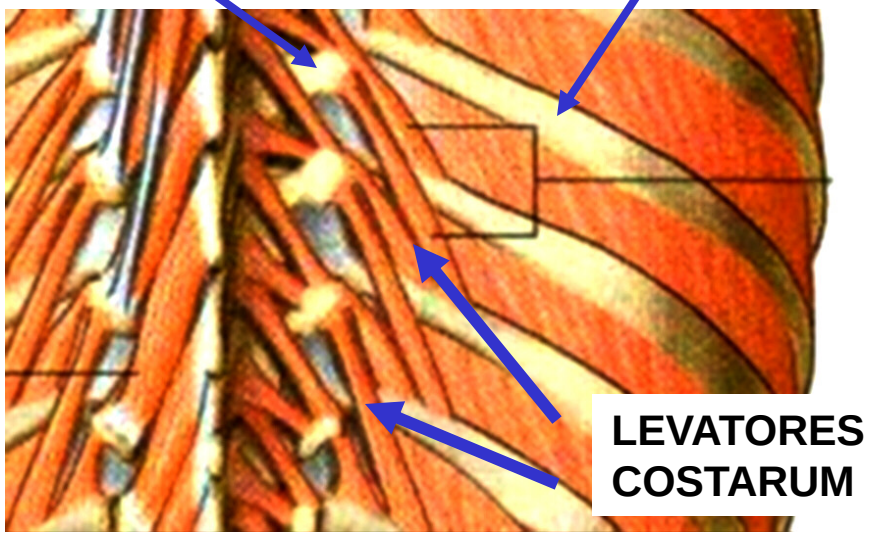
Origin: Vertebrae

Insert: Ribs

Action: Raise ribs in Inspiration

Innervation: Dorsal primary rami of thoracic spinal nerves

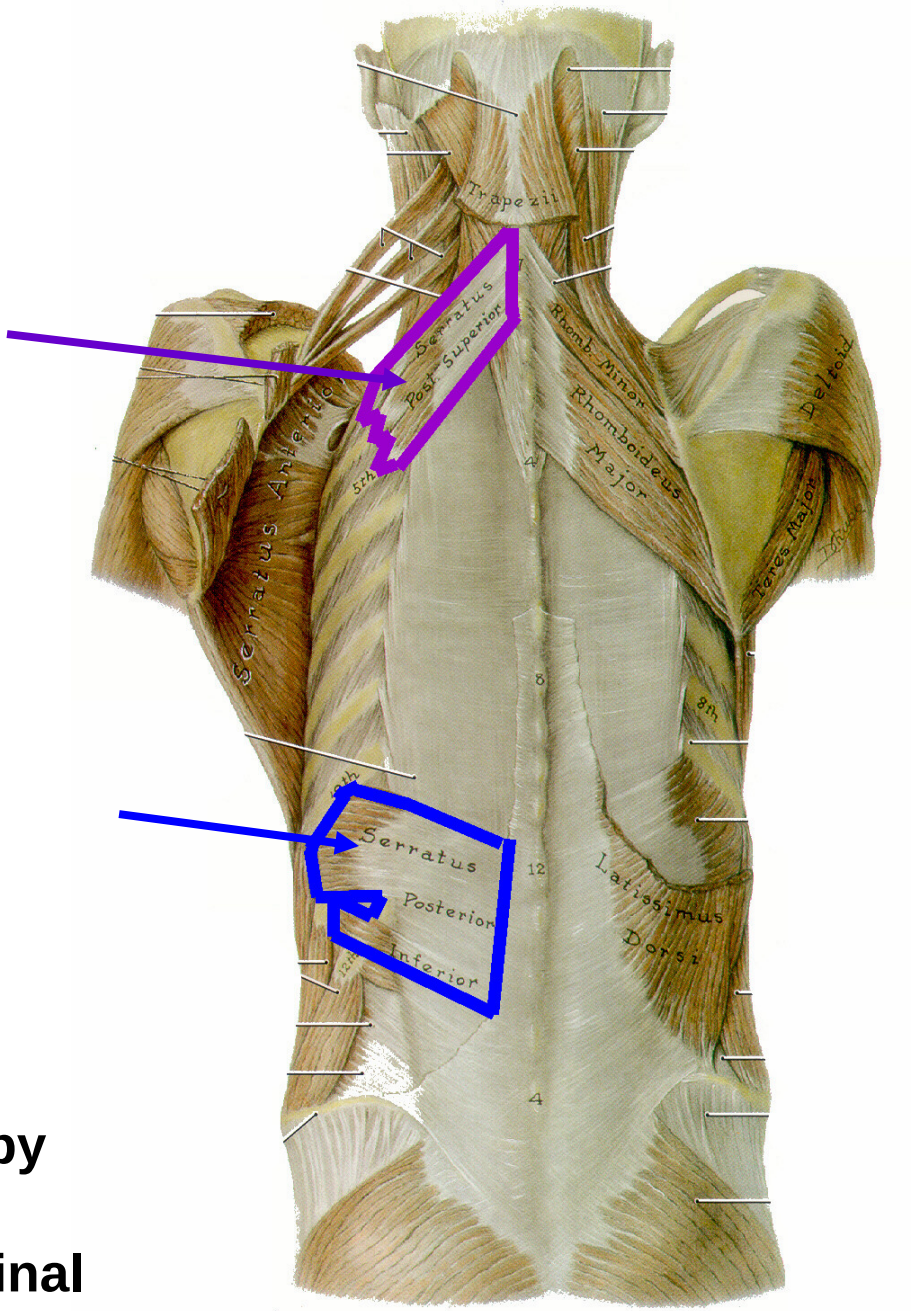
Costa = Rib



2. SERRATUS POSTERIOR SUPERIOR -
Origin: Vertebrae
Insert: Ribs
Action: Raise ribs in inspiration

3. SERRATUS POSTERIOR INFERIOR -
Origin: Vertebrae
Insert: Ribs
Action: Lower ribs in expiration

Innervation: both muscles by Intercostal Nerves (ventral primary rami of thoracic spinal nerves)



DEEP GROUP- divisible into 3 subgroups: Splenius, Erector Spinae, Transversospinalis

DEEP MUSCLES OF THE BACK

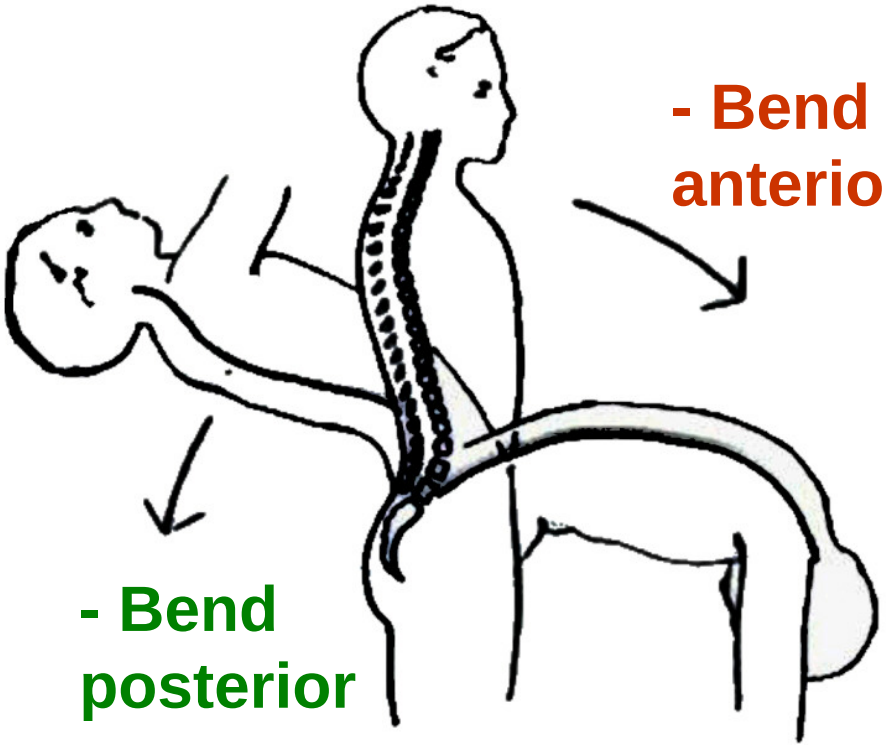
MUSCLE	ACTION	NERVE
Splenius	Extend neck and head (rotate in unilateral action)	Dorsal rami of spinal nerves
Erector Spinae 1) Iliocostalis - Lab ID Ilium and ribs to ribs above 2) Longissimus- Lab ID - Transverse processes to Transverse processes 3) Spinalis -Lab ID spines to Spines	Extend trunk and vertebral column	Dorsal rami of spinal nerves
Transverso-spinalis	All extend trunk in bilateral action and rotate vertebral column in unilateral action	Dorsal rami of spinal nerves

- all extend trunk of neck when act bilaterally
- all located dorsal to vertebral column
- all innervated by dorsal rami of spinal nerves

E. MOVEMENTS OF VERTEBRAL COLUMN

a. Extension

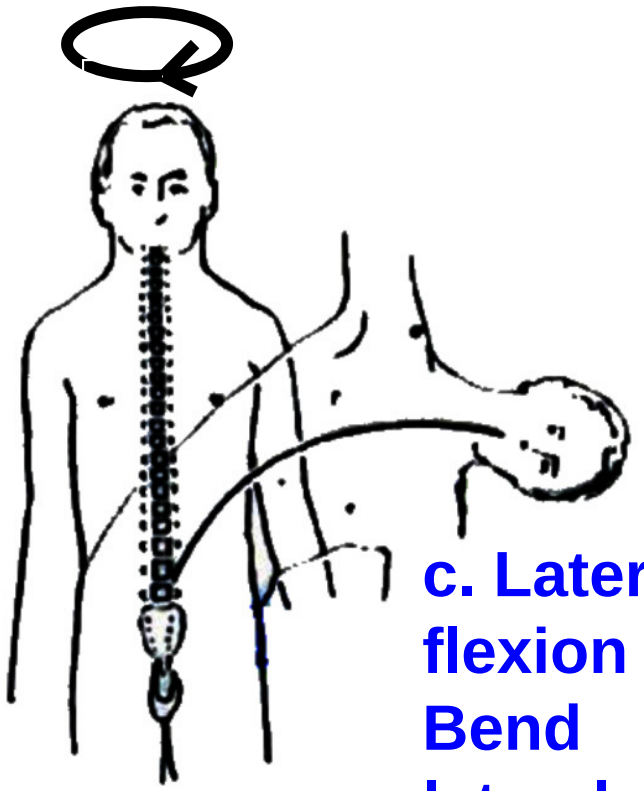
b. Flexion



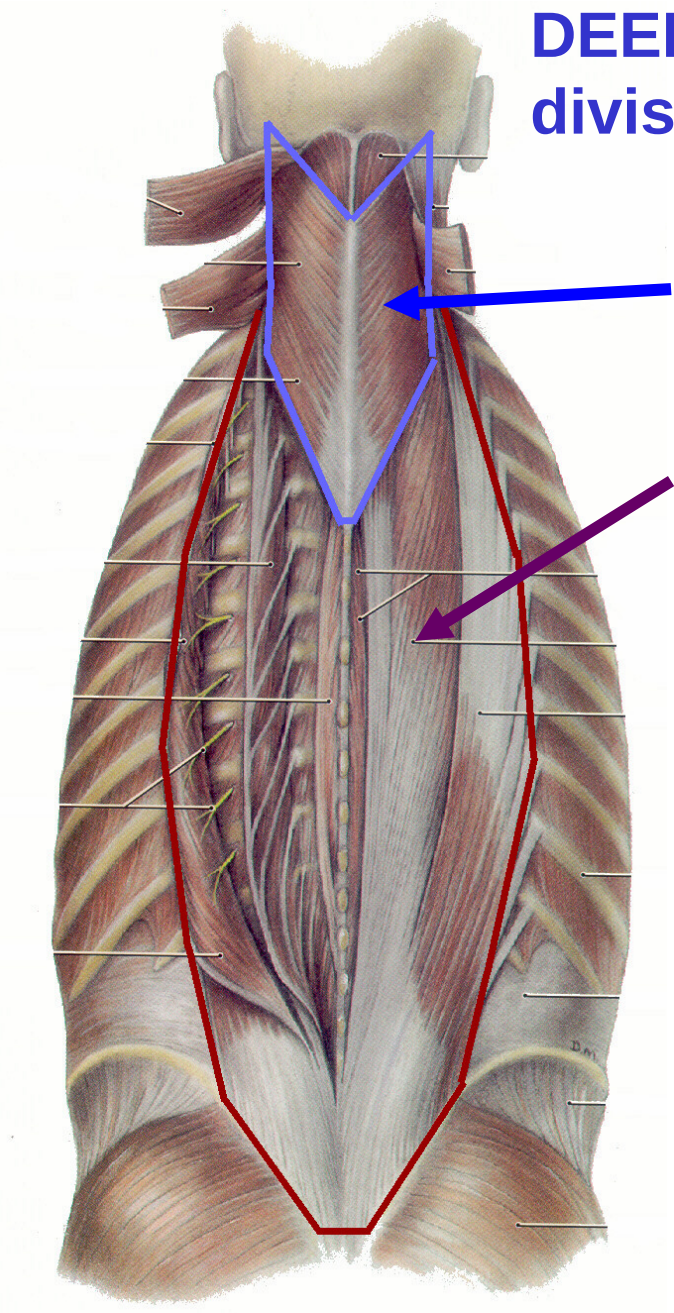
- Bend anterior

- Bend posterior

d. Rotation = rotation about long axis of spinal column



c. Lateral flexion - Bend lateral



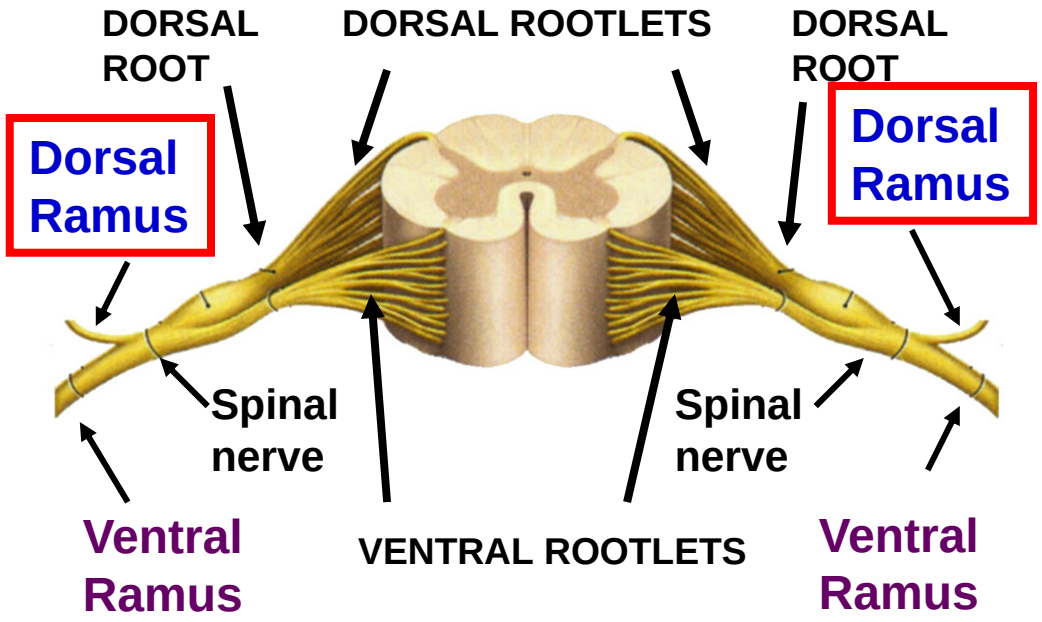
DEEP GROUP OF BACK MUSCLES divisible into three subgroups

1. **SPLENIUS**
2. **ERECTOR SPINAE**
3. **TRANSVERSO-SPINALIS – deep to Erector Spinae**

ALL

1. **Act to Extend trunk when act bilaterally**
2. **Located dorsal to vertebral column**
3. **Innervated by Dorsal primary rami of spinal nerves**

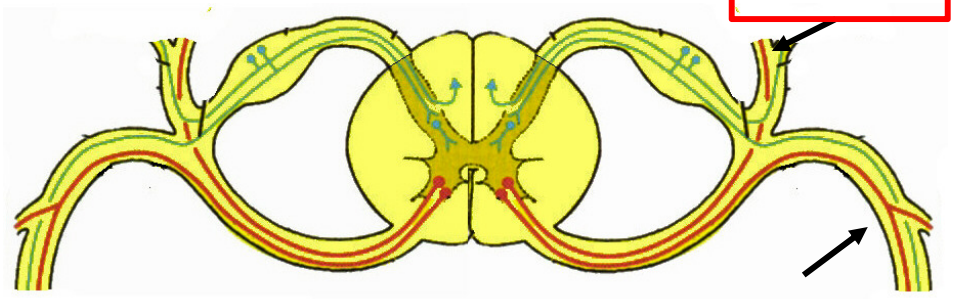
DORSAL AND VENTRAL RAMI OF SPINAL NERVES



Spinal nerves divide into Dorsal and Ventral Rami immediately after they leave the intervertebral foramen Dorsal Rami are much smaller.

1. Dorsal Ramus (also called Dorsal Primary Ramus) - sensory and motor axons to region of back; sensory to skin of back and posterior neck, motor axons to deep muscles of back and neck. **

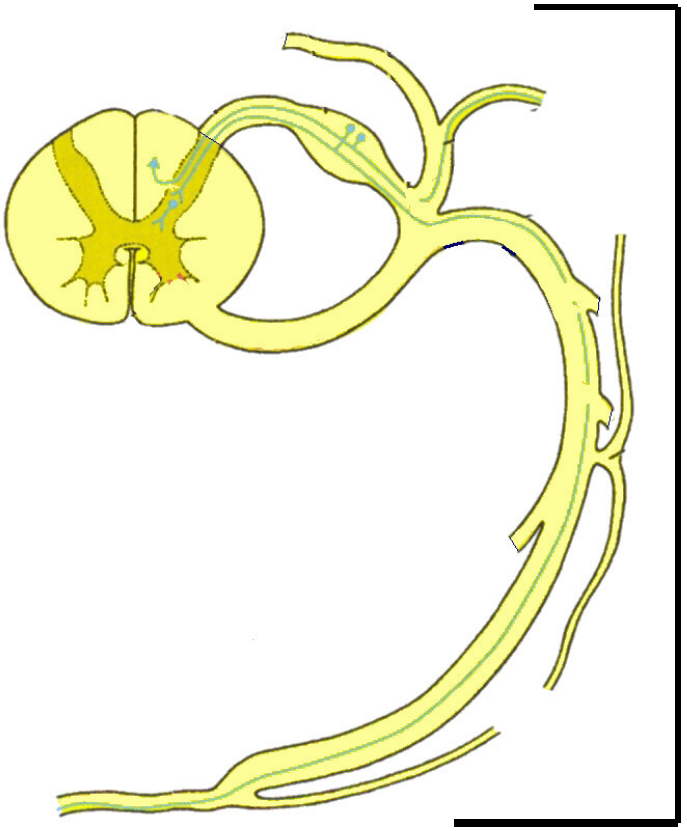
Both Dorsal and Ventral Rami contain sensory and motor axons



2. Ventral Ramus (also called Ventral Primary Ramus) - sensory and motor axons to other parts of body; sensory to skin of extremities (arm, leg) and anterior and lateral regions of trunk; motor to muscles of extremities and anterior and lateral regions of trunk.

DERMATOME = area of skin innervated by a single spinal nerve

Sensory neurons in a single spinal nerve innervate a discrete area of the body



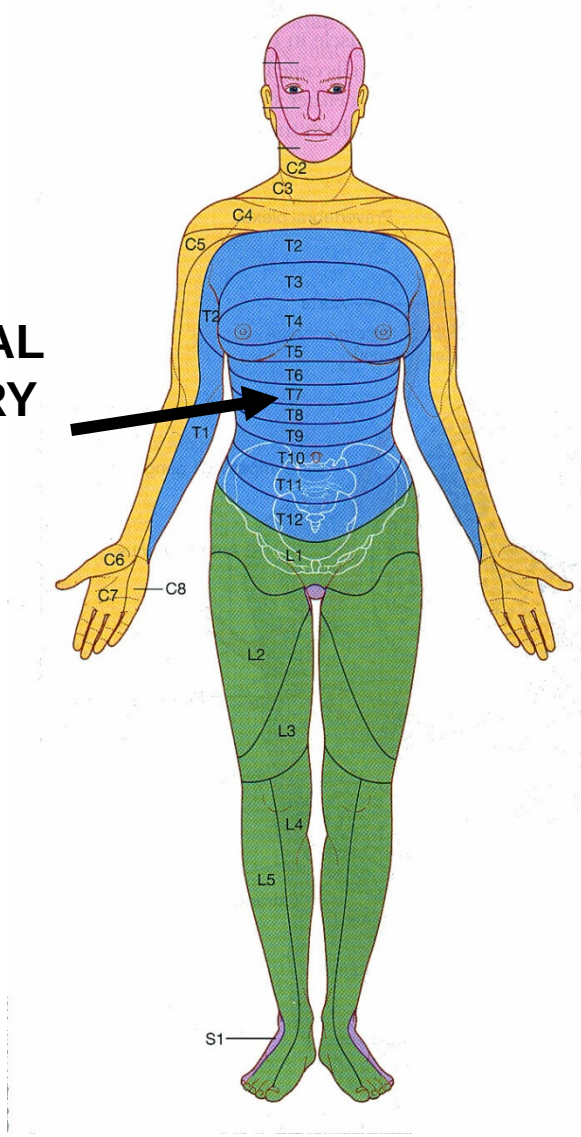
Dermatome - is area of skin innervated by a single spinal nerve

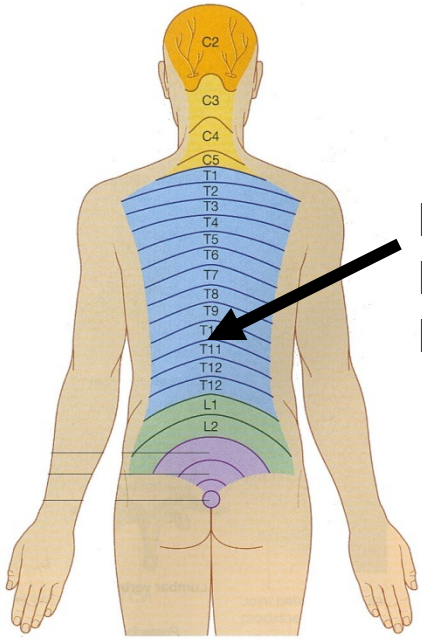
1. Structure - sensory axons from each spinal nerve end up innervating strips of skin on body called dermatomes; regions from different spinal nerves form a continuous series;

MOST OF INNERVATION OF BODY IS FROM VENTRAL PRIMARY RAMI

SENSORY INNERVATION OF SKIN

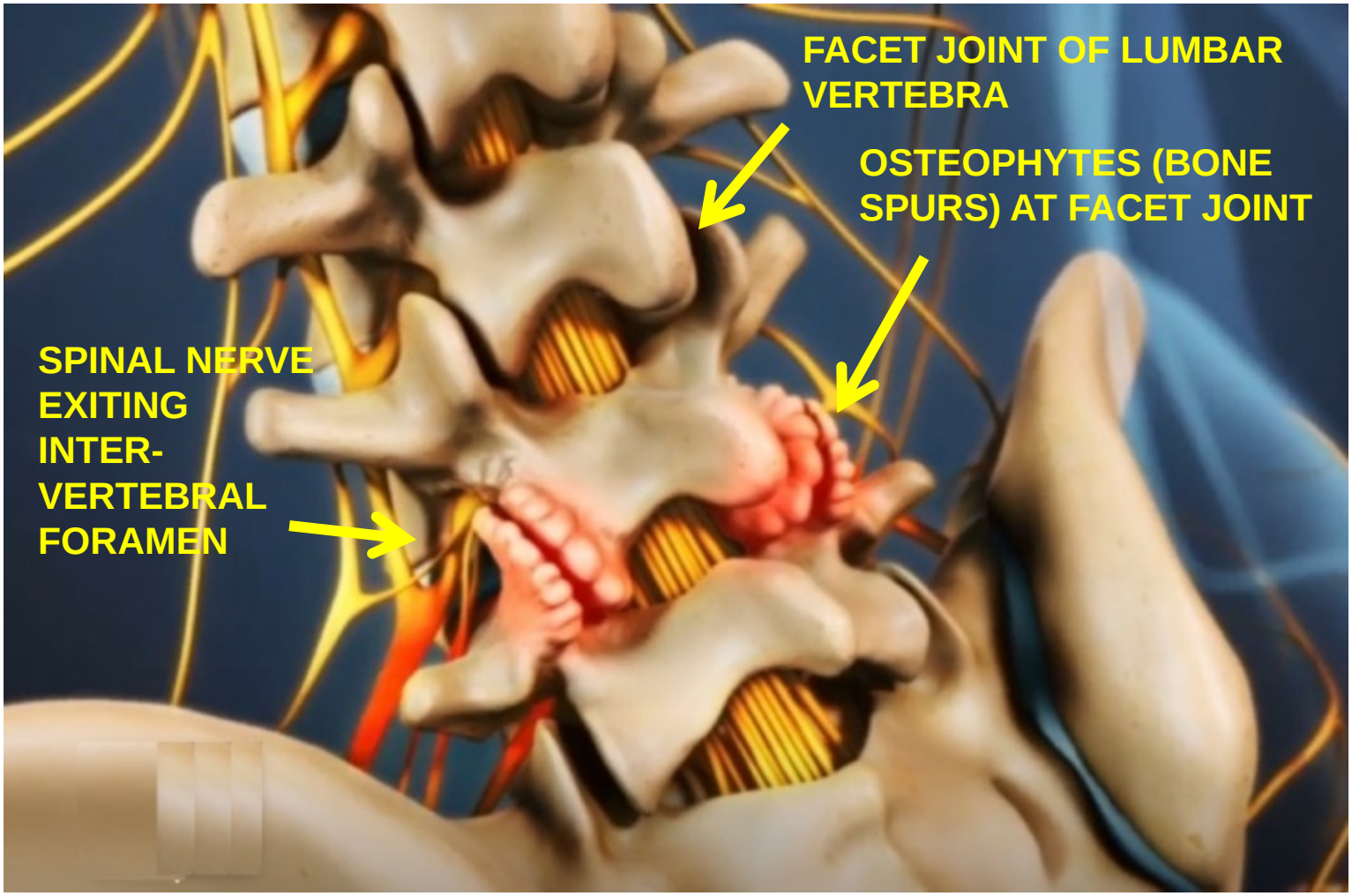
VENTRAL PRIMARY RAMI



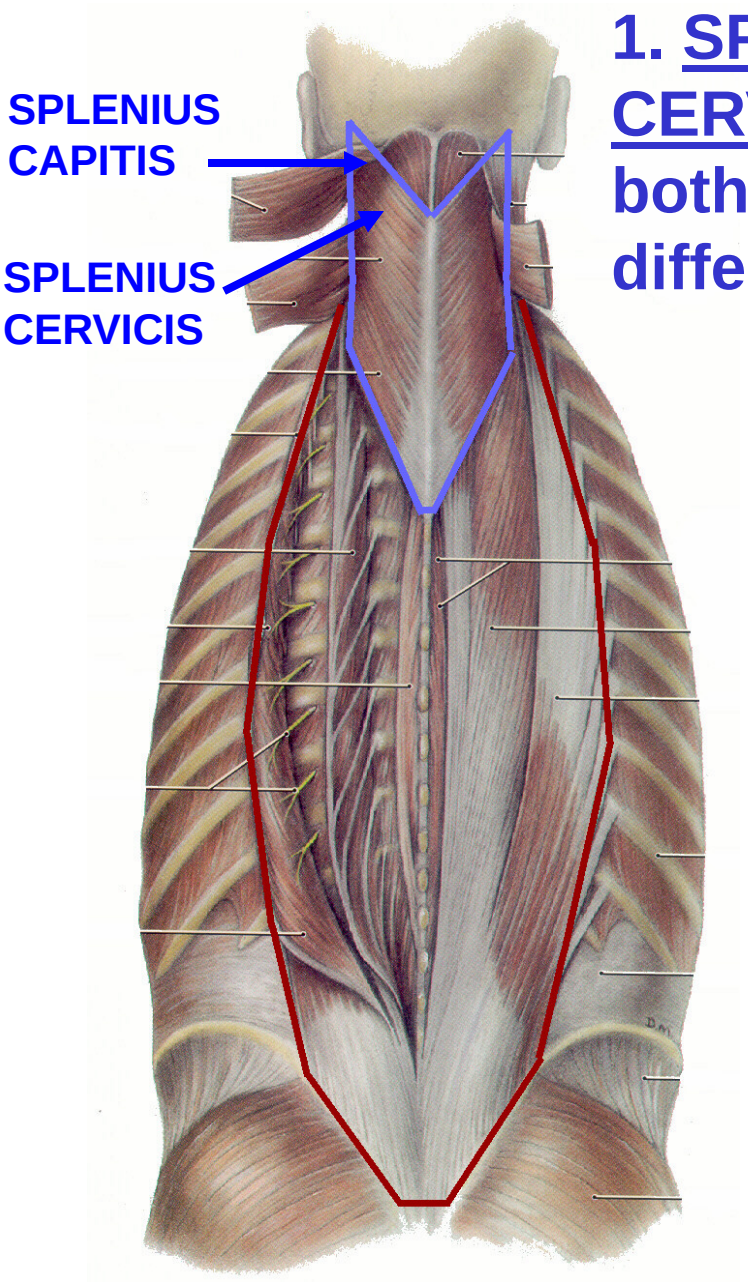


DORSAL PRIMARY RAMI

DEGENERATIVE ARTHRITIS OF FACET JOINTS (SPONDYLOSIS) CAN COMPRESS SPINAL NERVES, INCLUDING DORSAL PRIMARY RAMI



Nerve compression can caused back pain, spasm of back muscles

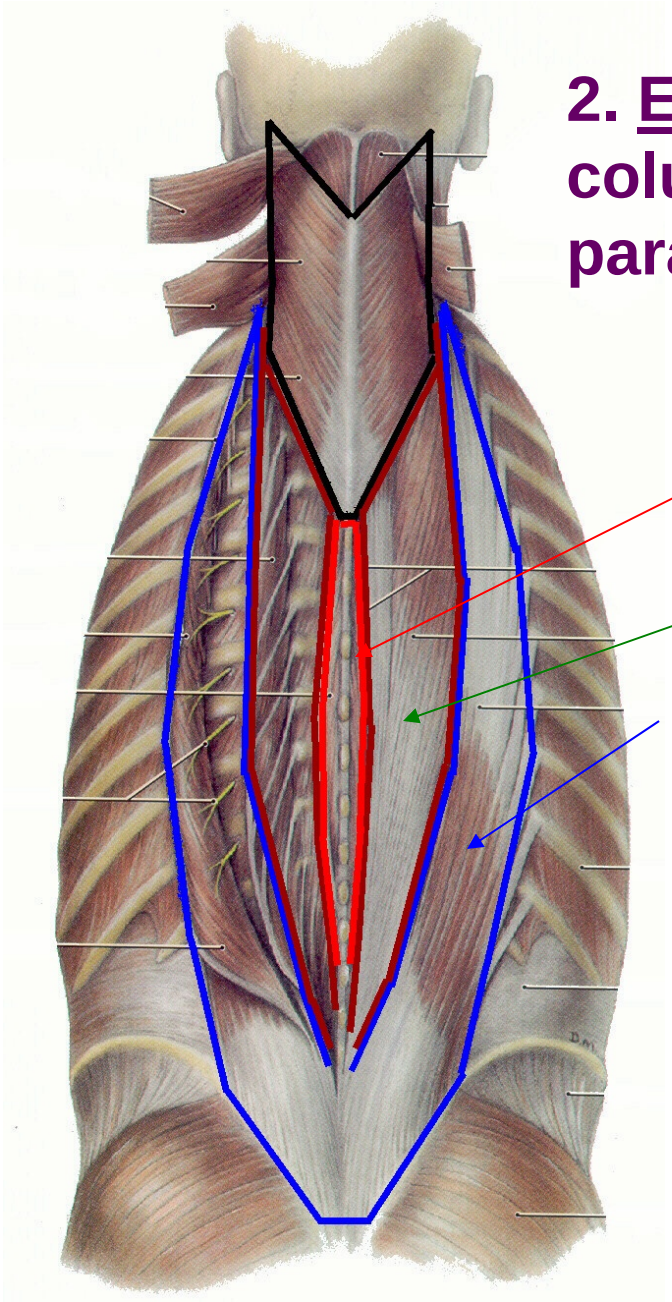


1. SPLENIUS CAPITIS AND SPLENIUS CERVICIS- located deep to trapezius; both muscles have same origin, different insertions

Origin: Vertebrae

Insert: Splenius Capitis- **Skull**
Splenius Cervicis- Vertebrae

Action: Extend neck and head; rotate head and neck in unilateral action



2. ERECTOR SPINAE- three columns of muscle lying in parallel

SPINALIS- most medial

LONGISSIMUS- intermediate

ILIOCOSTALIS- lateral

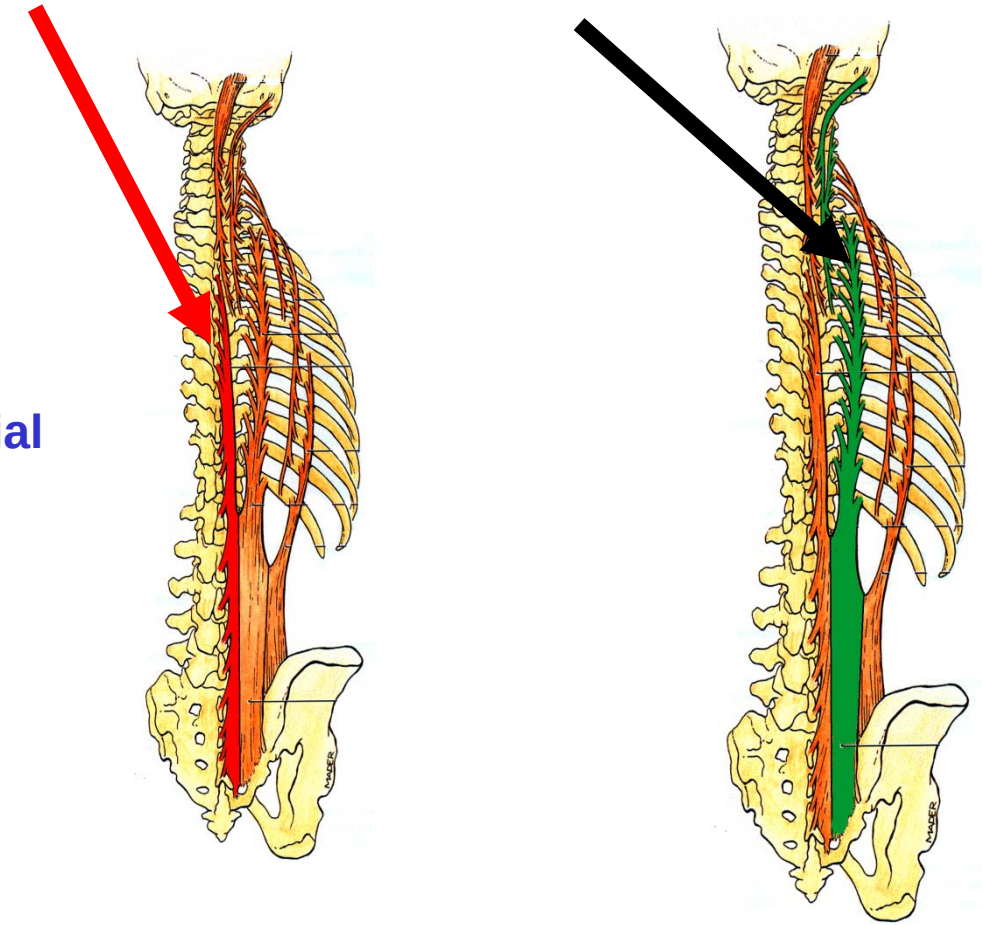
ERECTOR SPINAE- actually itself 3 subgroups in parallel

c. SPINALIS
Origin: Spinous processes
Insertion: Spinous processes

b. LONGISSIMUS
Origin: Transverse Processes
Insertion: Transverse Processes

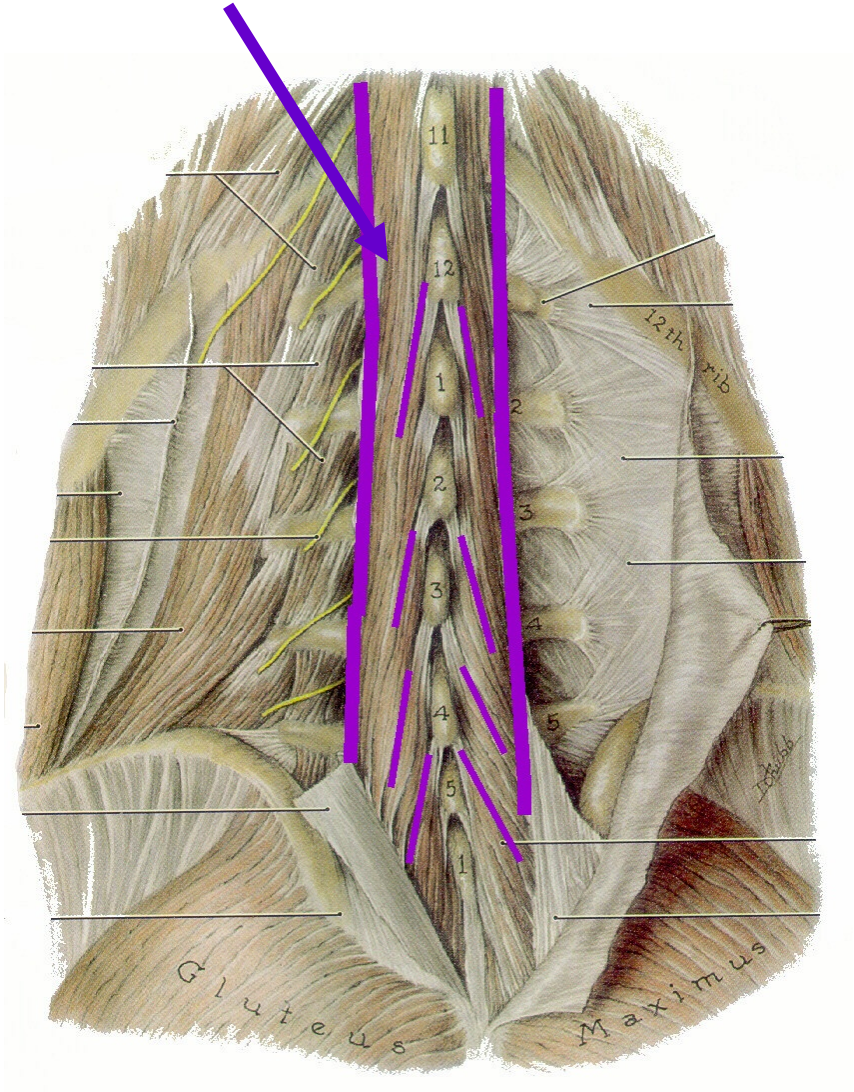
a. ILIOCOSTALIS
Origin: Ilium and ribs
Insertion: Ribs or Transverse Processes Above

Medial



Lateral

3. TRANSVERSOSPINALIS

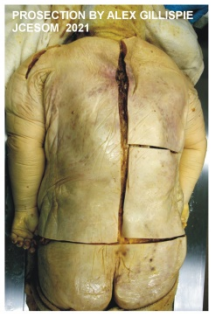


- ALL: Origin: transverse processes
Insert: spines of vertebrae above

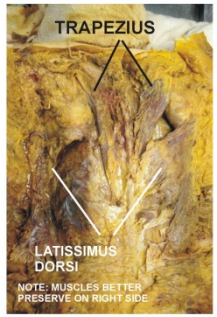
Note: Orientation of muscle fibers: transversospinalis are angled up and in toward spines; erector spinae are parallel to vertebral column

PROSECTION OF BACK – DO-IT-YOURSELF DISSECTION – REFLECT SUCCESSIVE LAYERS

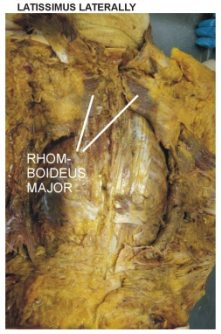
MUSCLES OF BACK: FIRST LAYER - MUSCLES OF SCAPULA AND UPPER EXTREMITY BACK 1

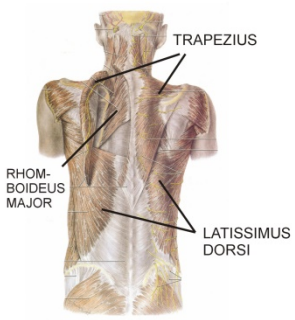


REFLECT SKIN LATERALLY



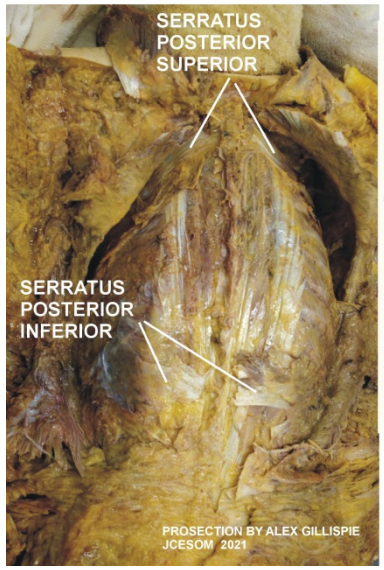
REFLECT TRAPEZIUS AND LATISSIMUS LATERALLY

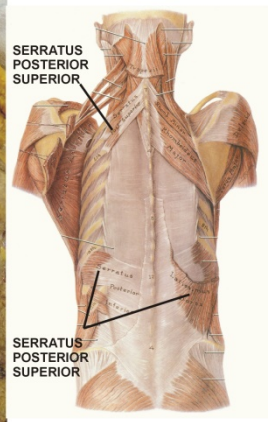




MUSCLES OF BACK: SECOND LAYER - ACCESSORY MUSCLES OF RESPIRATION BACK 2

RHOMBOIDS, TRAPEZIUS, LATISSIMUS DORSI REFLECTED





MUSCLES OF BACK: THIRD LAYER - ERECTOR SPINAE BACK 3

ALL LAYER 1 AND 2 MUSCLES REFLECTED