The Muscular System

CHAPTER 11

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Principles of
Human Anatomy
13th Edition
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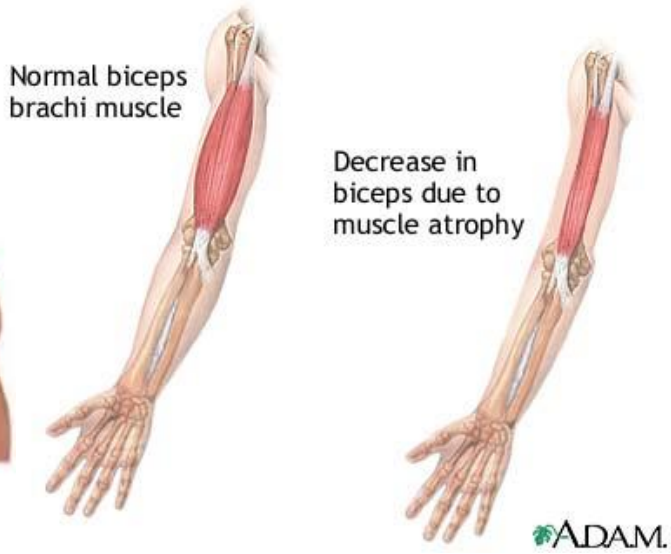
The Muscular System

Movement is produced by action of bones, muscles & joints

Atrophy: reduced muscle mass

Hypertrophy: increased muscle mass



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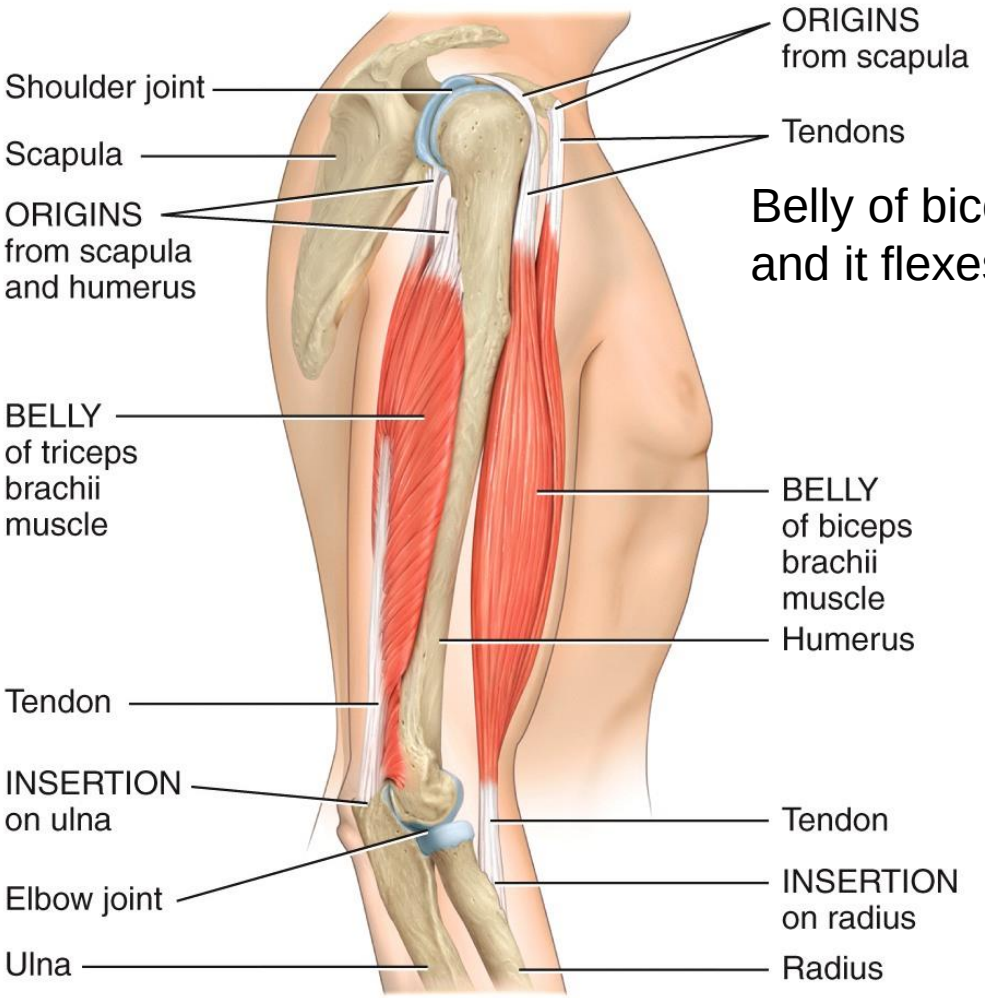
Muscle Attachment Sites: Origin and Insertion

- Contraction of muscle fibers(cells) produce movements
- Skeletal muscles cause movements by exerting force on tendons, which pull on bones or other structures.
- Articulating bones usually do not move equally in response to contraction.
  - Origin: stationary bone/ proximal
  - Insertion: movable
  - Action(s)

Relationship of Skeletal Muscles to Bones



Belly of biceps is on the arm, and it flexes the forearm

Origin and insertion of a skeletal muscle

Effects of Fascicle Arrangement

- All muscle fibers are parallel to one another within a single fascicle.
- Fascicle arrangement is related to power & rang of motion: Long fibers gives greater range of motion
- Strength is related to total number of fibers(more fibers…… stronger muscle)

Effects of Fascicle Arrangement

- Fascicles form patterns with respect to the tendons:
  - Parallel
  - Fusiform
  - Circular
  - Triangular
  - Pennate: unipennate, bipennate, and multipennate

Arrangement of Fascicles

TABLE 11.1

Arrangement of Fascicles

PARALLEL

Fascicles parallel to longitudinal axis of muscle; terminate at either end in flat tendons.

Example: Sternohyoid muscle (see Figure 11.8a)

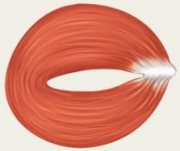
FUSIFORM

Fascicles nearly parallel to longitudinal axis of muscle; terminate in flat tendons; muscle tapers toward tendons, where diameter is less than at belly.

Example: Digastric muscle (see Figure 11.8a)

CIRCULAR

Fascicles in concentric circular arrangements form sphincter muscles that enclose an orifice (opening).



Example: Orbicularis oculi muscle (see Figure 11.4a)

TRIANGULAR

Fascicles spread over broad area converge at thick central tendon; gives muscle a triangular appearance.

Example: Pectoralis major muscle (see Figure 11.3a)

PENNATE

Short fascicles in relation to total muscle length; tendon extends nearly entire length of muscle.

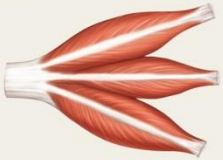
Unipennate
Fascicles are arranged on only one side of tendon.

Example: Extensor digitorum longus muscle (see Figure 11.24b)

Bipennate
Fascicles are arranged on both sides of centrally positioned tendons.

Example: Rectus femoris muscle (see Figure 11.3a)

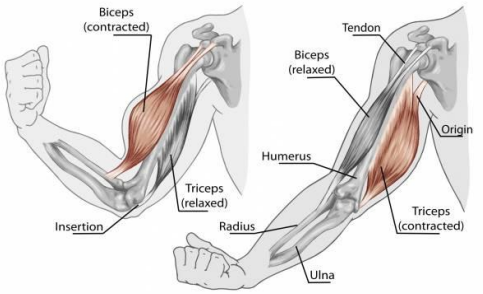
Multipennate
Fascicles attach obliquely from many directions to several tendons.



Example: Deltoid muscle (see Figure 11.17d)

Coordination Among Muscles

- It is common to attribute a specific action at a joint to a single muscle bundle, but remember that muscles do not work in isolation.
- Movements usually result from several skeletal muscles acting as a group:
  - Prime mover or agonist (ex: biceps)
  - Antagonist(triceps)
  - Synergist
  - Fixator: stabilize origin of primary mover



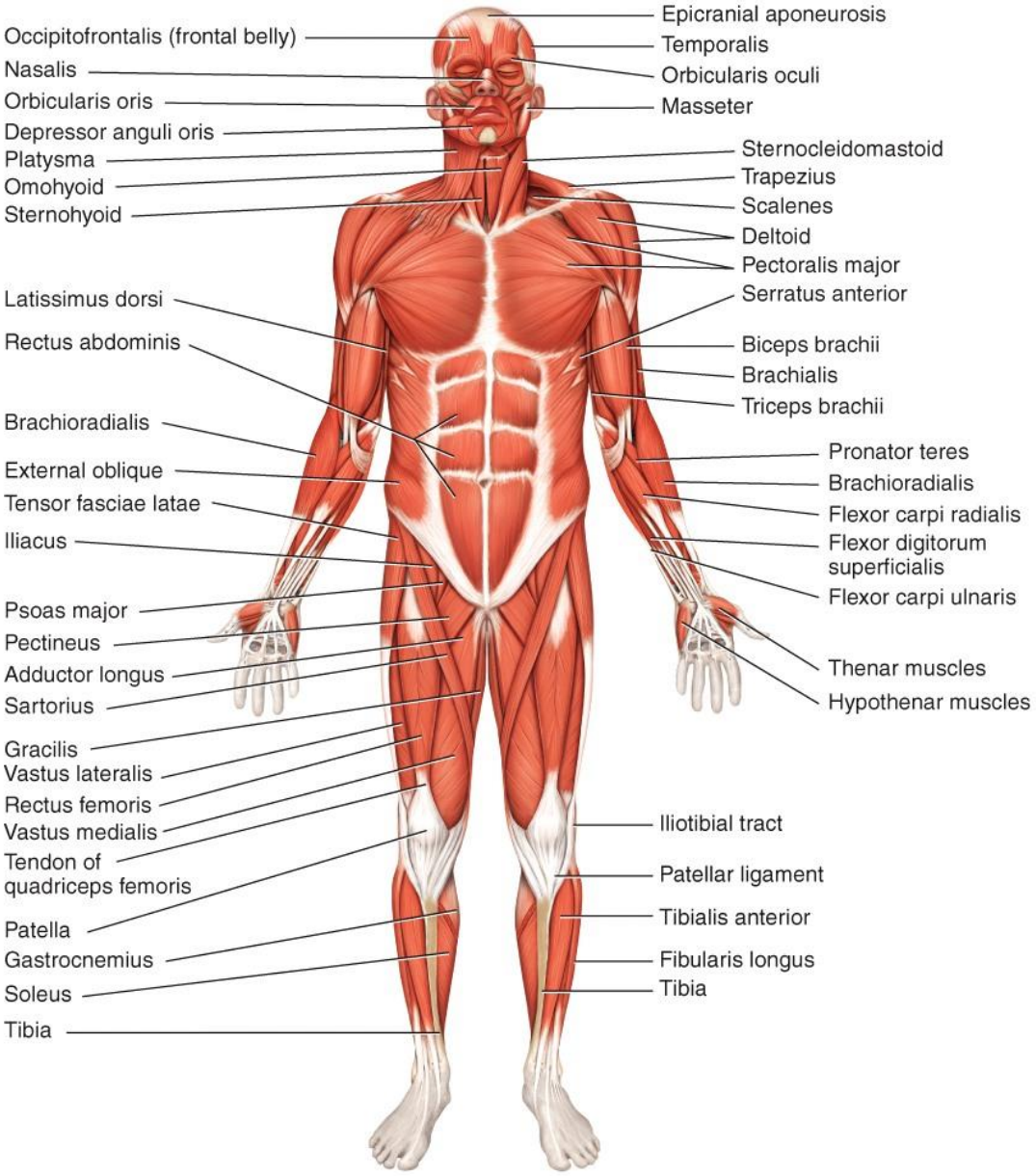
Structure and Function of Muscle Groups

- Muscle bundles arise from common masses of embryonic tissue. The limbs, trunk, and head each have a distinct pattern of muscle development.
- Muscle compartment
- Nerves and blood vessels develop along with muscles in a particular compartment.

How Skeletal Muscles Are Named

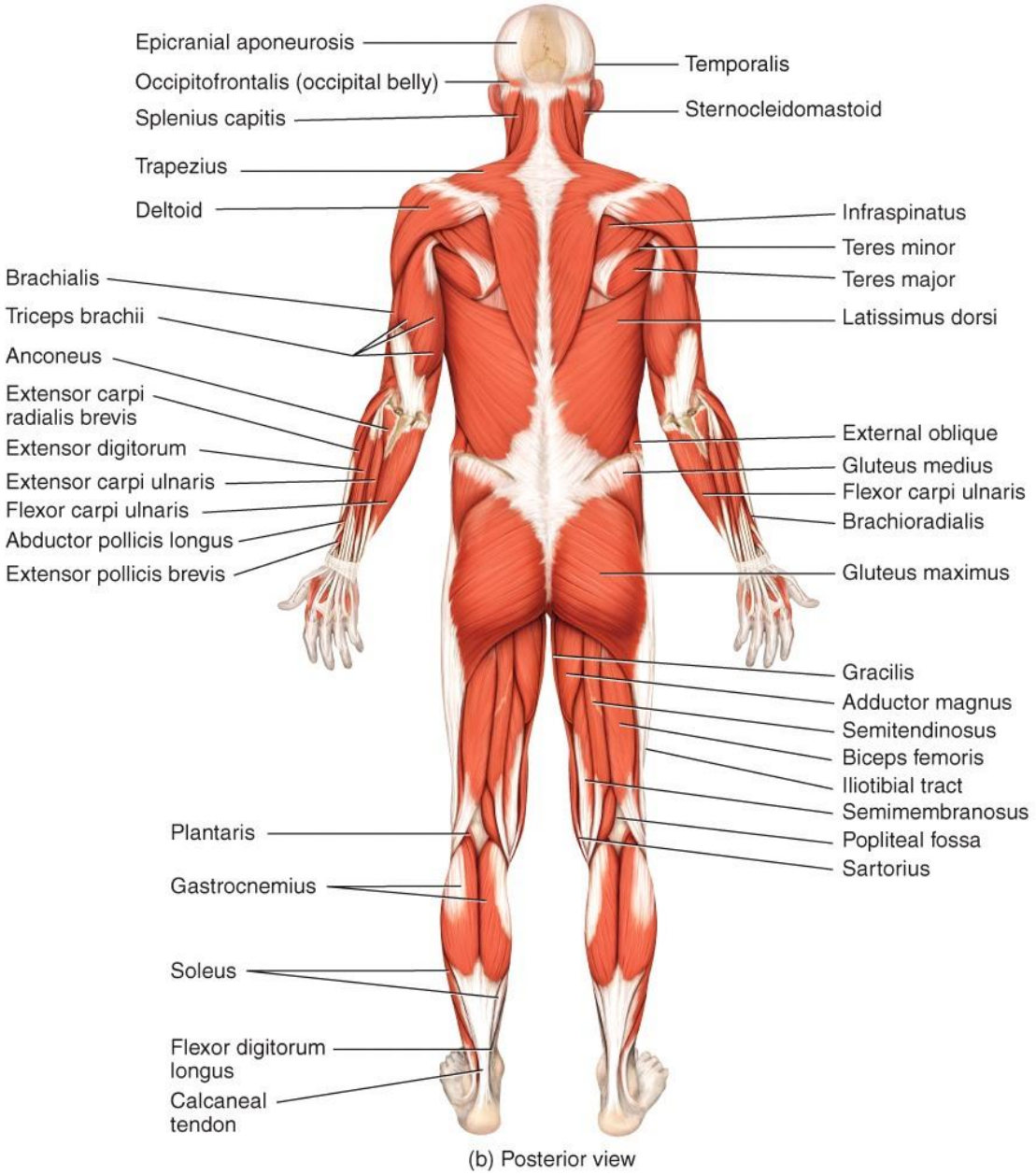
- Orientation of muscle fascicles relative to body's midline
- Size(pectoralis major), shape(trapezius), and action of muscles(flexors)
- Origin and insertion(thyrohyoid)

Principal Superficial Skeletal Muscles



(a) Anterior view

Principal Superficial Skeletal Muscles



(b) Posterior view

Characteristics Used to Name Muscles

NAME	MEANING
DIRECTION: Orientation of muscle fascicles relative to the body's midline	
Rectus	Parallel to midline
Transverse	Perpendicular to midline
Oblique	Diagonal to midline
SIZE: Relative size of the muscle	
Maximus	Largest
Minimus	Smallest
Longus	Long
Brevis	Short
Latissimus	Widest
Longissimus	Longest
Magnus	Large
Major	Larger
Minor	Smaller
Vastus	Huge

ACTION: Principal action of the muscle	
Flexor	Decreases a joint angle
Extensor	Increases a joint angle
Abductor	Moves a bone away from the midline
Adductor	Moves a bone closer to the midline
Levator	Raises or elevates a body part
Depressor	Lowers or depresses a body part
Supinator	Turns palm anteriorly
Pronator	Turns palm posteriorly
Sphincter	Decreases the size of an opening
Tensor	Makes a body part rigid
Rotator	Rotates a bone around its longitudinal axis

NUMBER OF ORIGINS: Number of tendons of origin	
Biceps	Two origins
Triceps	Three origins
Quadriceps	Four origins

LOCATION: Structure near which a muscle is found. Example: temporalis, a muscle near the temporal bone

ORIGIN AND INSERTION: Sites where muscle originates and inserts. Example: sternocleidomastoid, originating on the sternum and clavicle and inserting on mastoid process of temporal bone

TABLE 11.2

Characteristics Used to Name Muscles

NAME	MEANING
SHAPE: Relative shape of the muscle	
Deltoid	Triangular
Trapezius	Trapezoid
Serratus	Saw-toothed
Rhomboid	Diamond-shaped
Orbicularis	Circular
Pectinate	Comblike
Piriformis	Pear-shaped
Platys	Flat
Quadratus	Square, four-sided
Gracilis	Slender

Clinical Connection

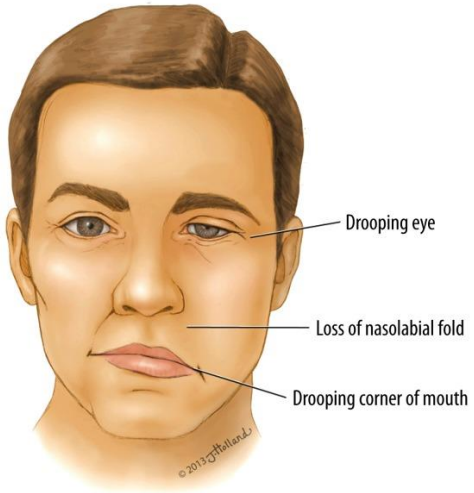
- Bell's palsy

Unilateral paralysis of muscles of facial expression: face droping, pt. cannot wrinkle forehead, difficulty in swallowing

Facial nerve is diseased/ affected

Etiology: infection/ surgery

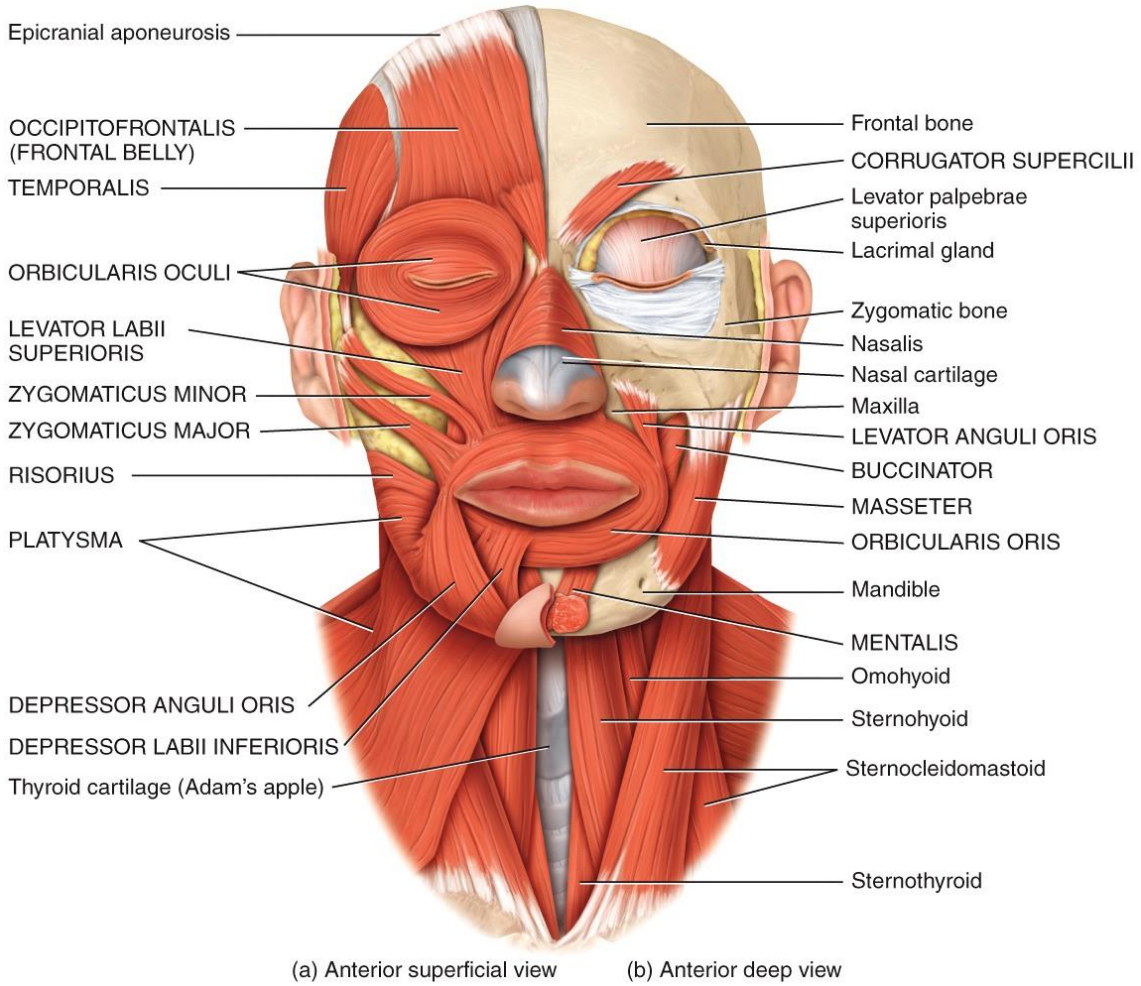
Prognosis: 80% recover completely



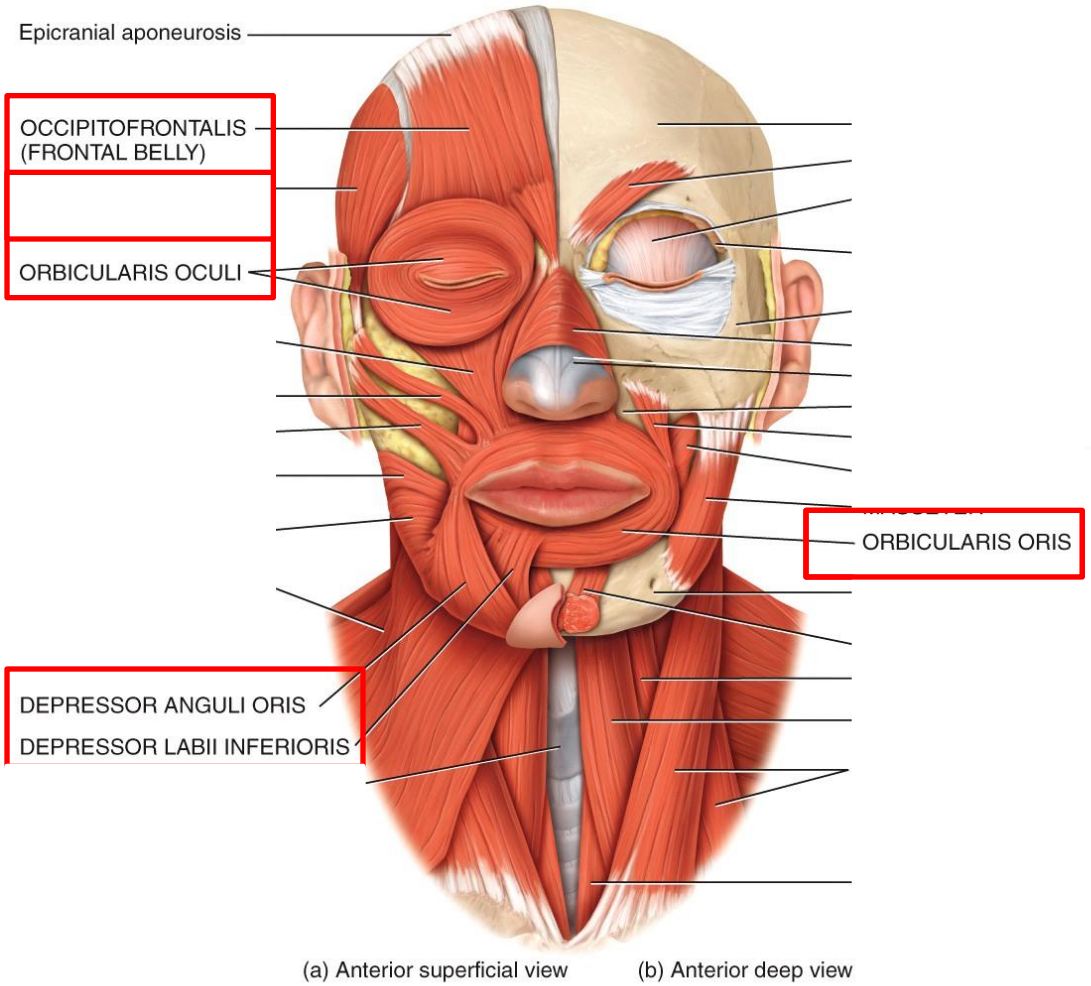
Muscles of the Head That Produce Facial Expressions

- Because of their insertions, the muscles involved in facial expression move the skin rather than a joint when they contract.
- Origin: fascia/ skull bones
- Insertion: skin
- Move skin not a joint
- Act on eye/ mouth
- Nerve supply: Facial VII

Muscles of the Head That Produce Facial Expressions



Muscles of the Head That Produce Facial Expressions



MUSCLE	ORIGIN	INSERTION	ACTION	INNERVATION
SCALP MUSCLES				
Occipitofrontalis (ok-sip′-i-tō-frun-TĀ-lis)				
Frontal belly (frontalis)	Epicranial aponeurosis	Skin superior to supraorbital margin	Draws scalp anteriorly, raises eyebrows, and wrinkles skin of forehead horizontally as in a look of surprise	Facial (VII) nerve
Occipital belly (occipitalis) (*occipit-*=back of the head)	Occipital bone and mastoid process of temporal bone	Epicranial aponeurosis	Draws scalp posteriorly	Facial (VII) nerve

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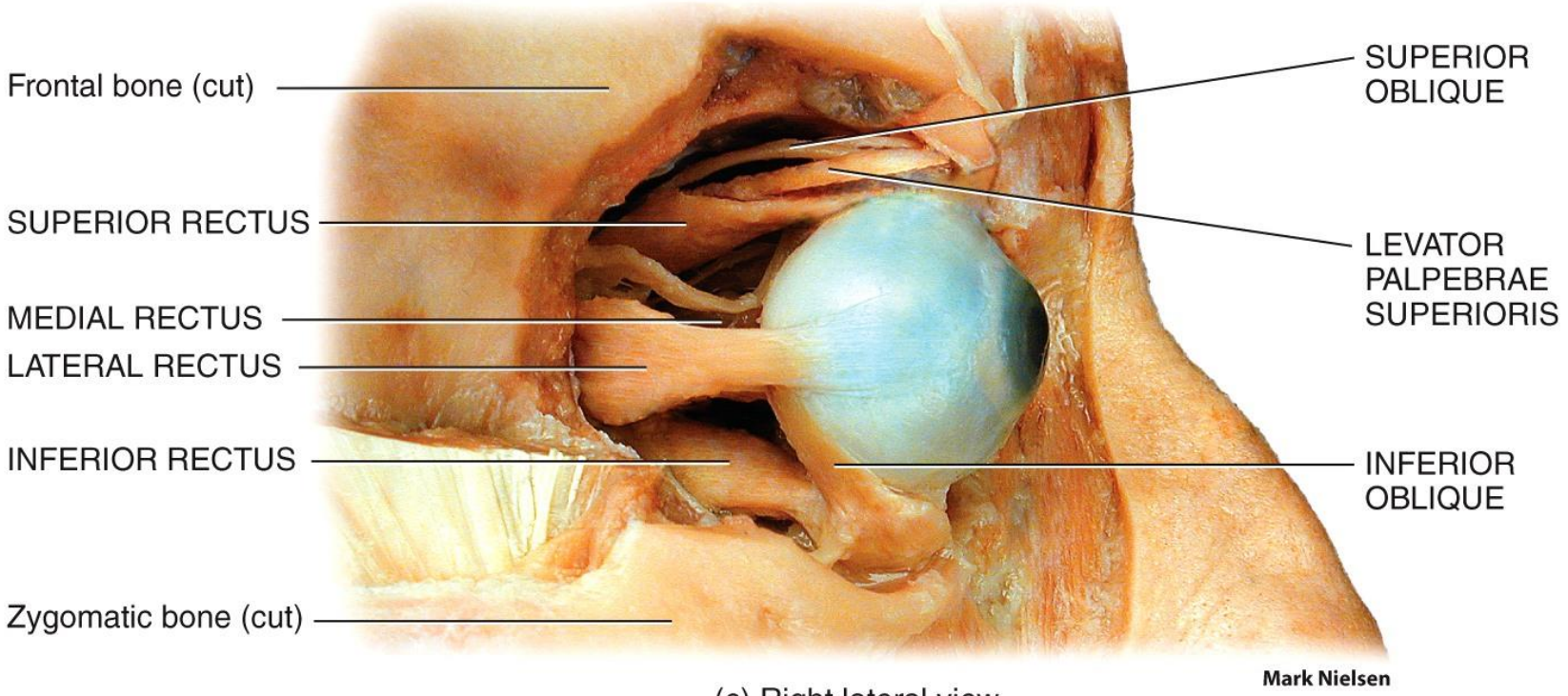
MUSCLE	ORIGIN	INSERTION	ACTION	INNERVATION
MOUTH MUSCLES				
Orbicularis oris (or-bi′-kū-LAR-is OR-is; *orb-*=circular; *oris*=of the mouth)	Muscle fibers surrounding opening of mouth	Skin at corner of mouth	Closes and protrudes lips, as in kissing; compresses lips against teeth; and shapes lips during speech	Facial (VII) nerve
Zygomaticus major (zī-gō-MA-tī-kus; *zygomatic*=cheek bone; *major*=greater)	Zygomatic bone	Skin at angle of mouth and blends with fibers of orbicularis oris	Draws angle of mouth superiorly and laterally, as in smiling	Facial (VII) nerve
Zygomaticus minor (*minor*=lesser)	Zygomatic bone	Upper lip	Raises (elevates) upper lip, exposing maxillary (upper) teeth	Facial (VII) nerve
Levator labii superioris (le-VĀ-tor LĀ-bē-ī soo-per′-ē-OR-is; *levator*=raises or elevates; *labii*=lip; *superioris*=upper)	Maxilla superior to infraorbital foramen	Skin at angle of mouth and blends with fibers of orbicularis oris	Raises upper lip	Facial (VII) nerve
Depressor labii inferioris (de-PRE-sor LĀ-bē-ī; *depressor*=depresses or lowers; *inferioris*=lower)	Mandible	Skin of lower lip	Depresses (lowers) lower lip	Facial (VII) nerve
Depressor anguli oris (ANG-ū-lī; *angul*=angle or corner; *oris*=of the mouth)	Mandible	Angle of mouth	Draws angle of mouth laterally and inferiorly, as in opening mouth	Facial (VII) nerve
Levator anguli oris	Maxilla inferior to infraorbital foramen	Skin of lower lip	Draws angle of mouth laterally and superiorly	Facial (VII) nerve
Buccinator (BUK-si-nā′-tor; *bucc-*=cheek)	Alveolar processes of maxilla and mandible and pterygomandibular raphe	Blends with fibers of orbicularis oris	Presses cheeks against teeth and lips, as in whistling, blowing, and sucking; draws corner of mouth laterally	Facial (VII) nerve
Risorius (ri-ZOR-ē-us; *risor*=laughter)	Fascia over parotid (salivary) gland	Skin at the angle of mouth	Draws angle of mouth laterally, as in grimacing	Facial (VII) nerve
Mentalis (men-TĀ-lis; *ment-*=the chin)	Mandible	Skin of chin	Elevates and protrudes lower lip and pulls skin of chin up as in pouting	Facial (VII) nerve
Platysma (pla-TIZ-ma; *platys*=flat, broad)	Fascia over deltoid and pectoralis major muscles	Mandible, blends with muscles around angle of mouth, and skin of lower face	Draws outer part of lower lip inferiorly and posteriorly as in pouting; depresses mandible	Facial (VII) nerve

Muscles of the Head That Move the Eyeballs and Upper Eyelids

- Superior rectus
- Inferior rectus
- Lateral rectus
- Medial rectus
- Superior oblique
- Inferior oblique
- Levator palpebrae superioris

MUSCLE	ORIGIN	INSERTION	ACTION	INNERVATION
Superior rectus (*rectus*=fascicles parallel to midline)	Common tendinous ring (attached to orbit around optic foramen)	Superior and central part of eyeballs	Moves eyeballs superiorly (elevation) and medially (adduction), and rotates them medially (intorsion)	Oculomotor (III) nerve
Inferior rectus	Same as above	Inferior and central part of eyeballs	Moves eyeballs inferiorly (depression) and medially (adduction), and rotates them laterally (extorsion)	Oculomotor (III) nerve
Lateral rectus	Same as above	Lateral side of eyeballs	Moves eyeballs laterally (abduction)	Abducens (VI) nerve
Medial rectus	Same as above	Medial side of eyeballs	Moves eyeballs medially (adduction)	Oculomotor (III) nerve
Superior oblique (*oblique*=fascicles diagonal to midline)	Sphenoid bone, superior and medial to the common tendinous ring in the orbit	Eyeball between superior and lateral recti. The muscle inserts into the superior and lateral surfaces of the eyeballs via a tendon that passes through the trochlea (a fibrous band on the supero-medial aspect of the orbit)	Moves eyeballs inferiorly (depression) and laterally (abduction), and rotates them medially (intorsion)	Trochlear (IV) nerve
Inferior oblique	Maxilla in floor of orbit	Eyeballs between inferior and lateral recti	Moves eyeballs superiorly (elevation) and laterally (abduction) and rotates them laterally (extorsion)	Oculomotor (III) nerve
Levator palpebrae superioris (le-VĀ-tor PAL-pebrē soo′-per′-ē-OR-is; *palpebrae*=eyelids)	Roof of orbit (lesser wing of sphenoid bone)	Skin and tarsal plate of upper eyelid	Elevates upper eyelids (opens eyes)	Oculomotor (III) nerve

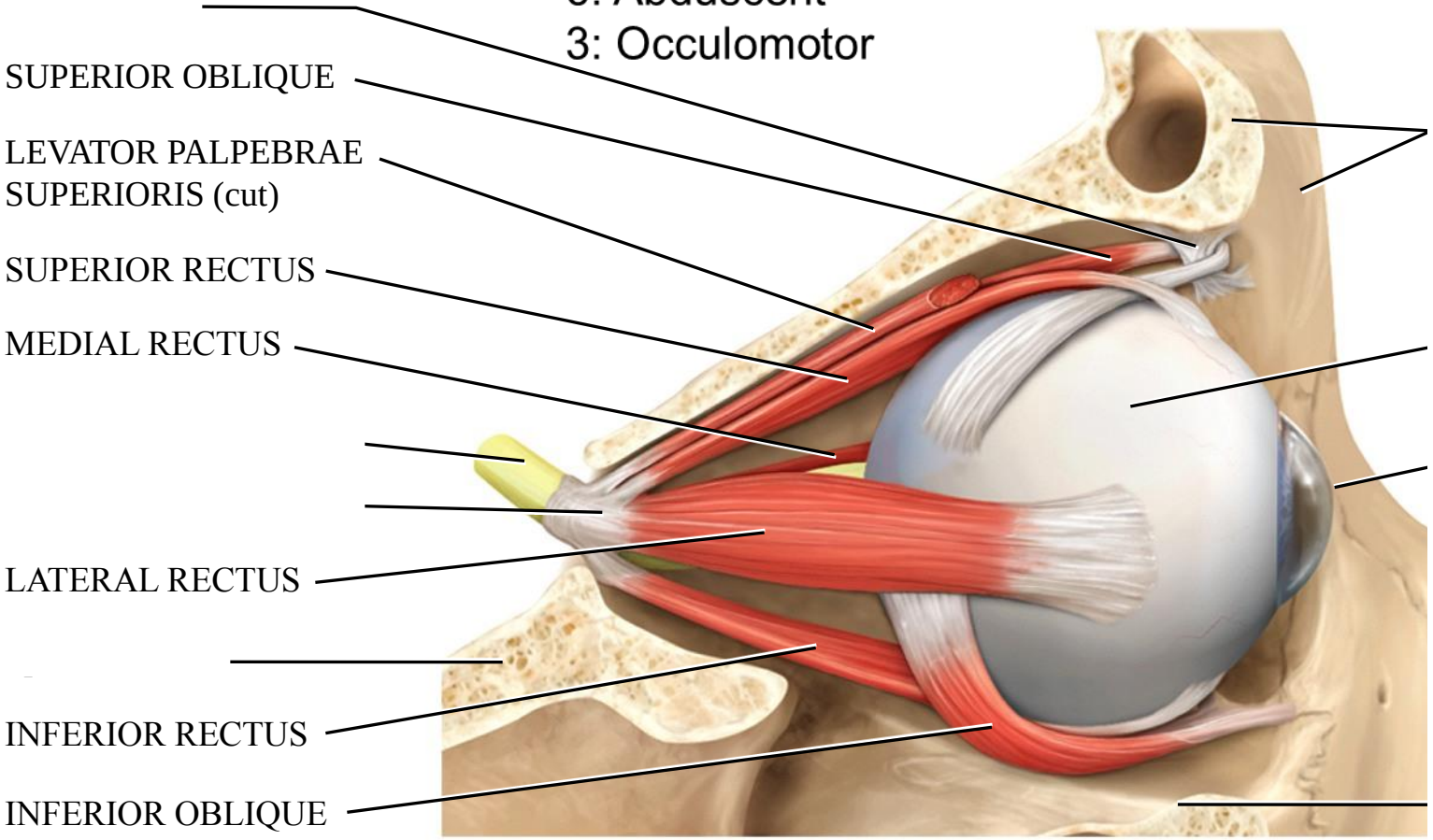
Muscles of the Head That Move the Eyeballs and Upper Eyelids



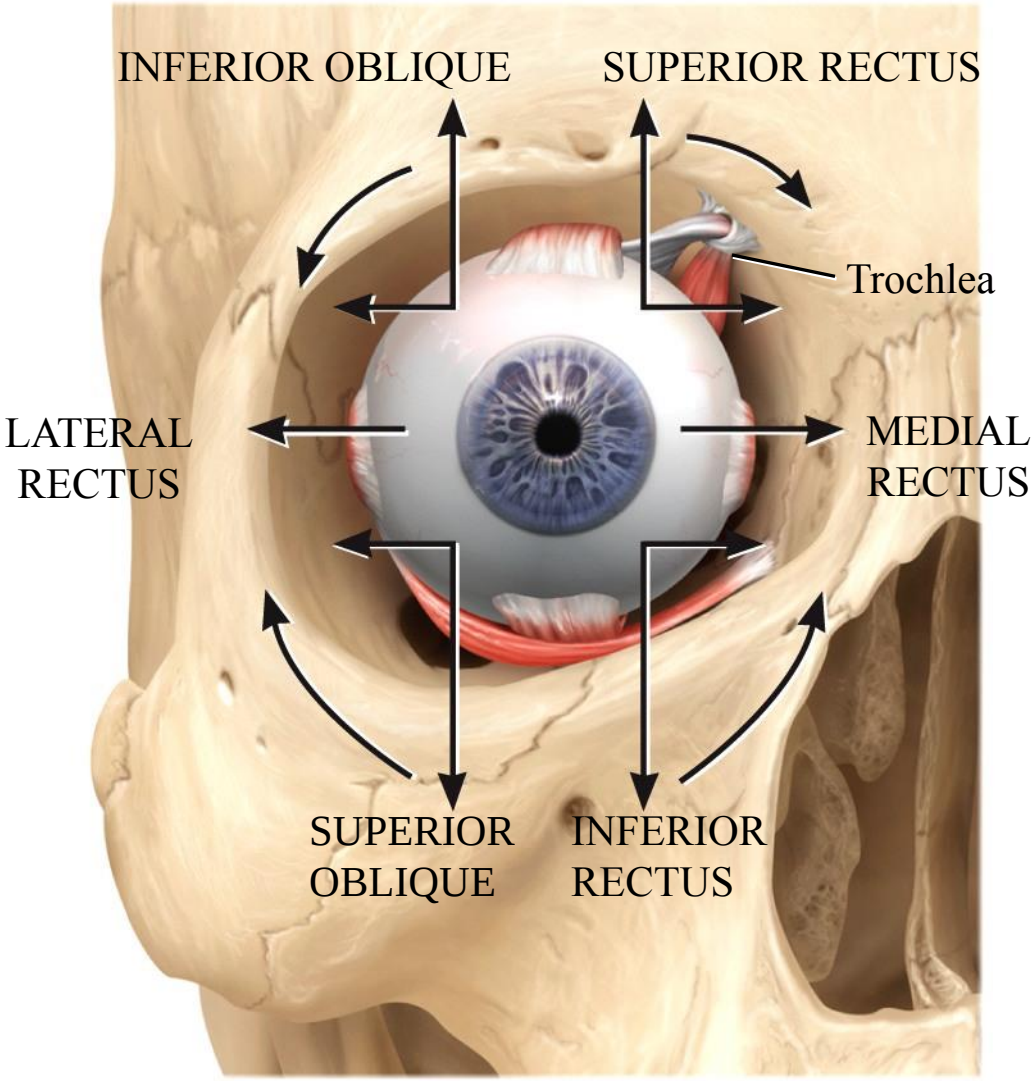
(c) Right lateral view

SO4+LR6/3
4: Trochlear nerve
6: Abduscent
3: Occulomotor

SO4+LR6/3
4: Trochlear nerve
6: Abduscent
3: Occulomotor

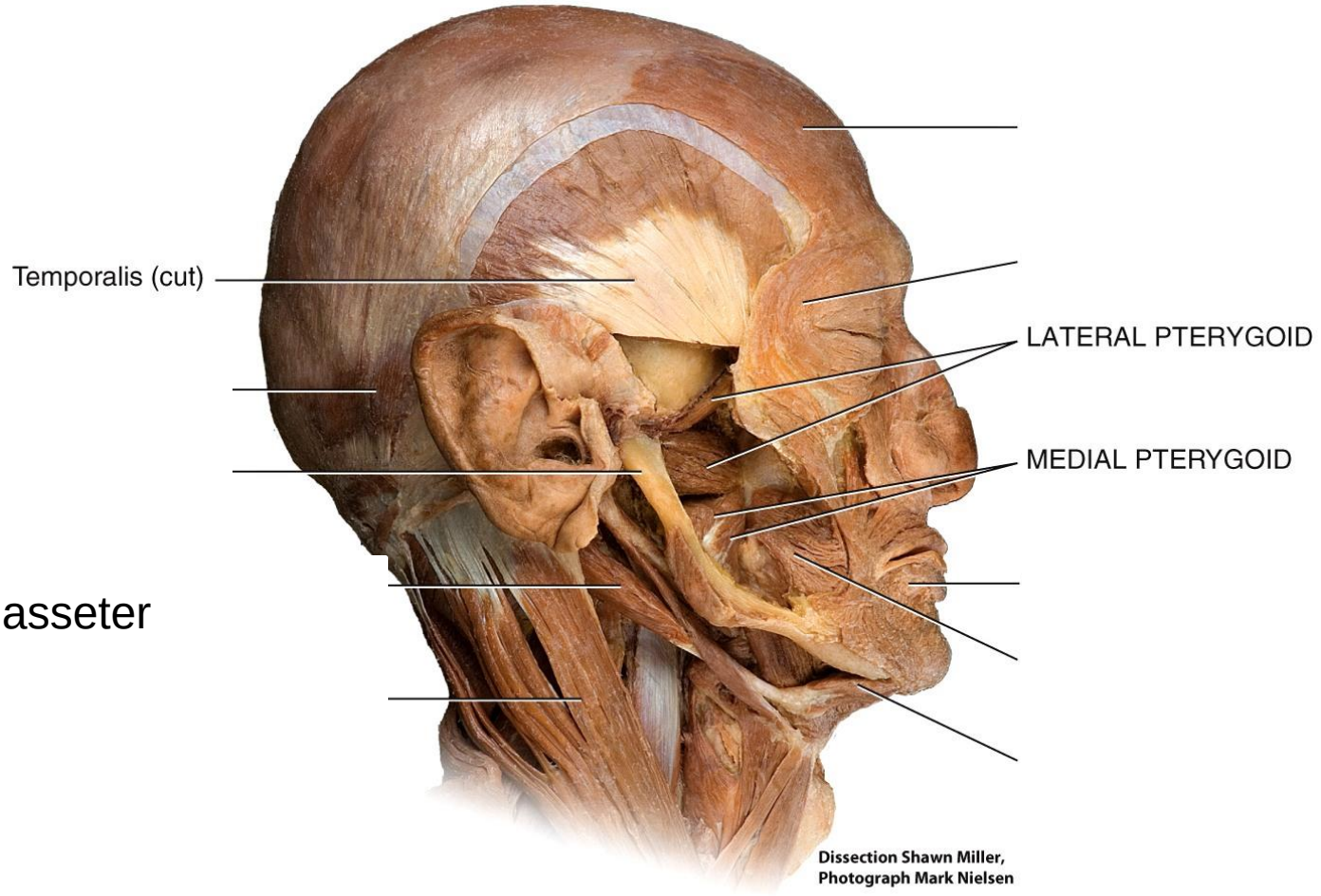


(a) Lateral view of right eyeball



(b) Movements of right eyeball in response to contraction of extrinsic muscles

Muscles That Move the Mandible and Assist in Mastication and Speech



(b) Right lateral deep view

Muscles of Mastication

MUSCLE	ORIGIN	INSERTION	ACTION	INNERVATION
Masseter (MA-se-ter=chewer) (see Figure 11.4b, c)	Maxilla and zygomatic arch	Angle and ramus of mandible	Elevates mandible, as in closing mouth	Mandibular division of trigeminal (V) nerve
Temporalis (tem′-pō-RĀ-lis; *tempor-*=time or temples)	Temporal bone	Coronoid process and ramus of mandible	Elevates and retracts mandible	Mandibular division of trigeminal (V) nerve
Medial pterygoid (TER-i-goyd; *medial*=closer to midline; *pterygoid*=wing-like)	Medial surface of lateral portion of pterygoid process of sphenoid bone; maxilla	Angle and ramus of mandible	Elevates and protracts (protrudes) mandible and moves mandible from side to side	Mandibular division of trigeminal (V) nerve
Lateral pterygoid (TER-i-goyd; *lateral*=farther from midline)	Greater wing and lateral surface of lateral portion of pterygoid process of sphenoid bone	Condyle of mandible; temporomandibular joint (TMJ)	Protracts mandible, depresses mandible as in opening mouth, and moves mandible from side to side	Mandibular division of trigeminal (V) nerve

The Neck
(The Cervical Region)

Divided into 2 portions:

Anterolateral aspect:

ant. & post.

Post. aspect:

covered by trapezius

part of the back

△

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(The Cervical Region)

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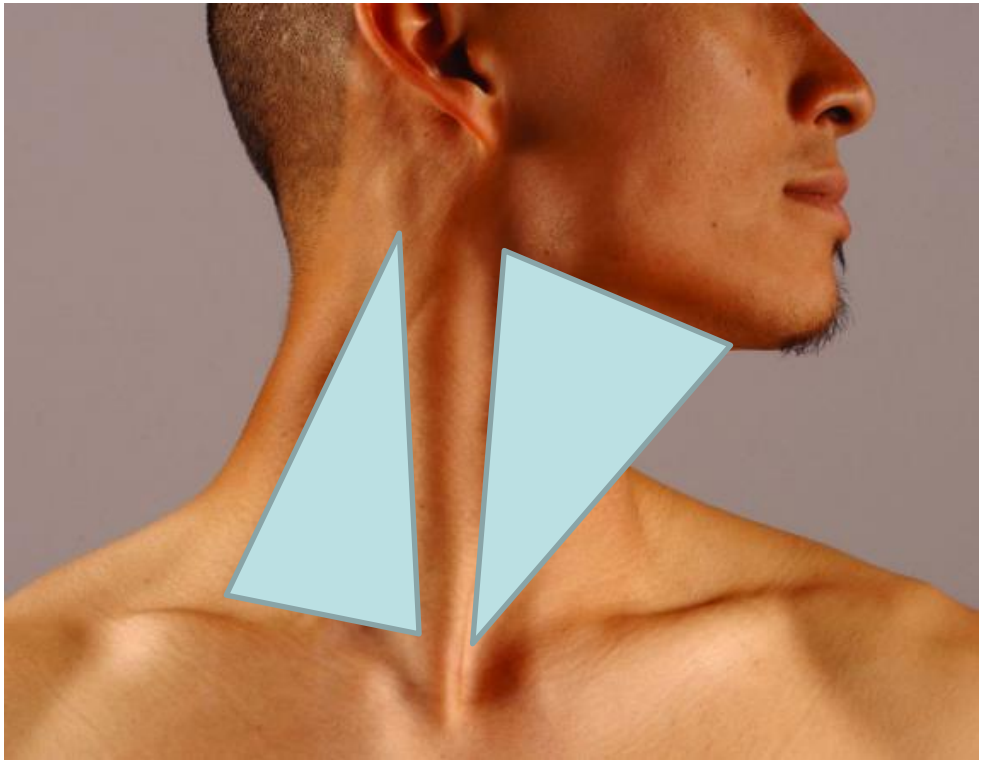
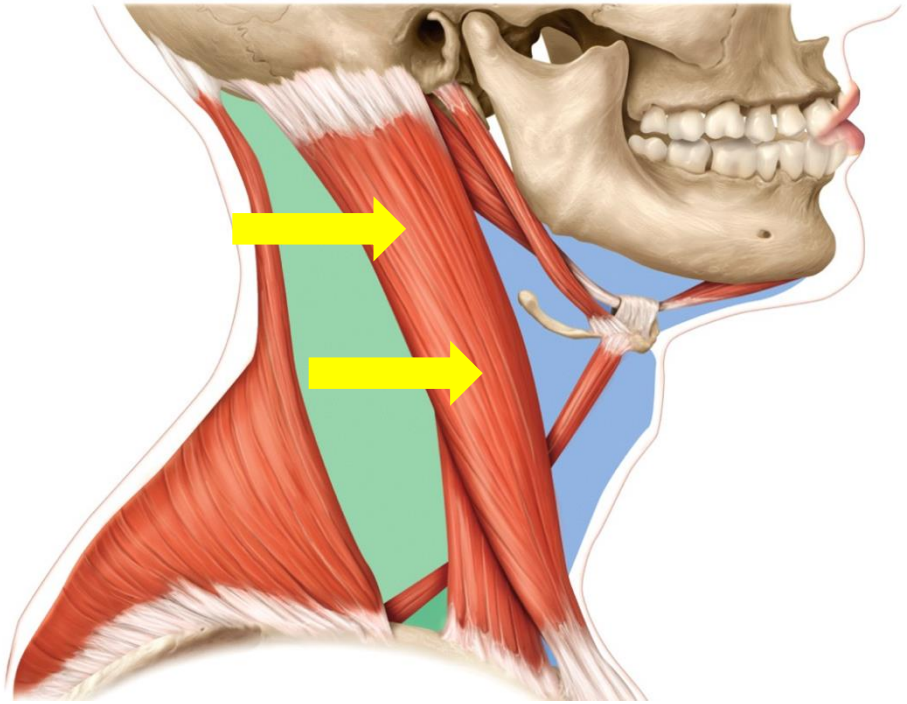


Muscles of the Neck: triangles



sternocleidomastoid

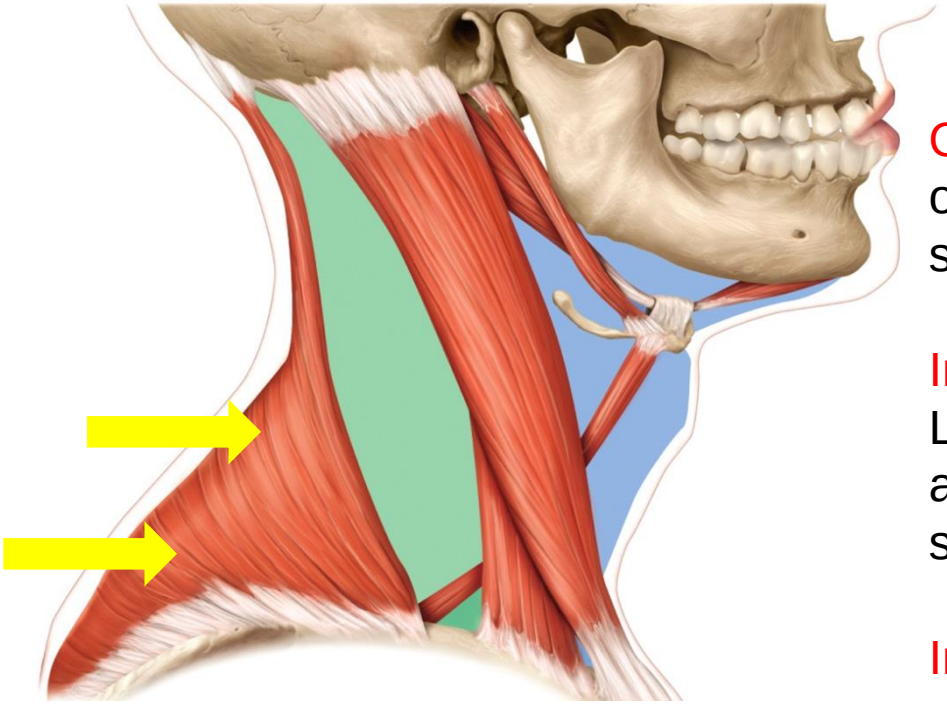
Origin:
Manubrium (sternal head) & clavicle

Insertion:
Mastoid process of temporal

Innervation:
spinal part of XI

Action:
single: tilts head to opposite side
Both: flex the neck

Muscles of the Neck: triangles



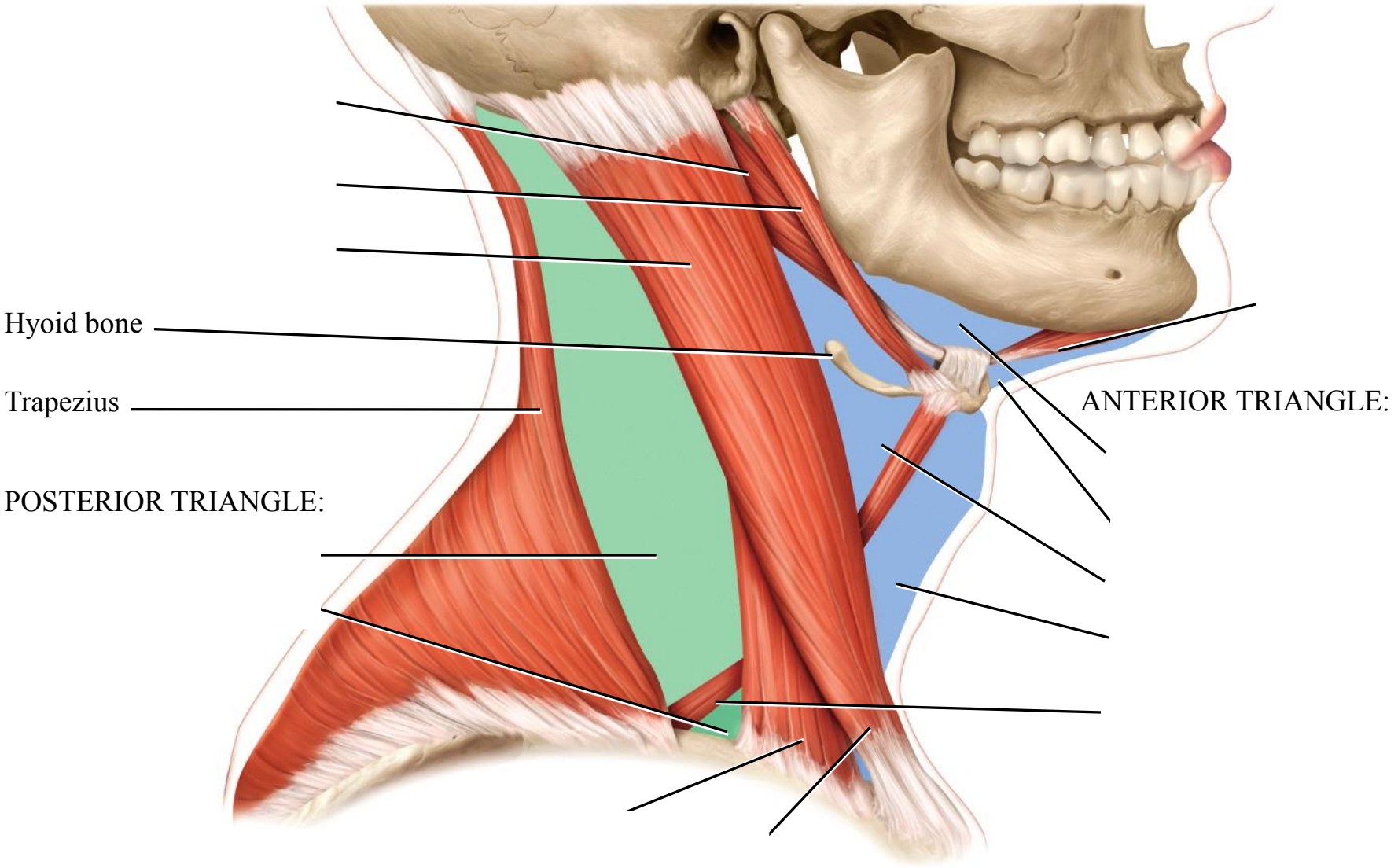
Trapezius Muscle

Origin:
occipital bone
spinous processes (C7-T12)

Insertion:
Lat. 1/3 of clavicle
acromion/ scapula
spine of scapula

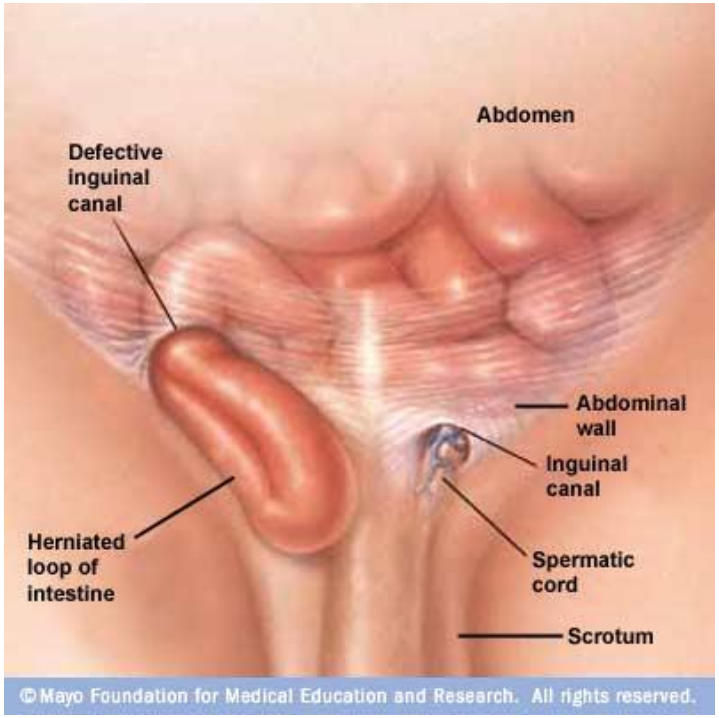
Innervatio:n
spinal part of XI

Actions:
3 actions?



(d) Right lateral view of triangles of neck

Inguinal Hernia



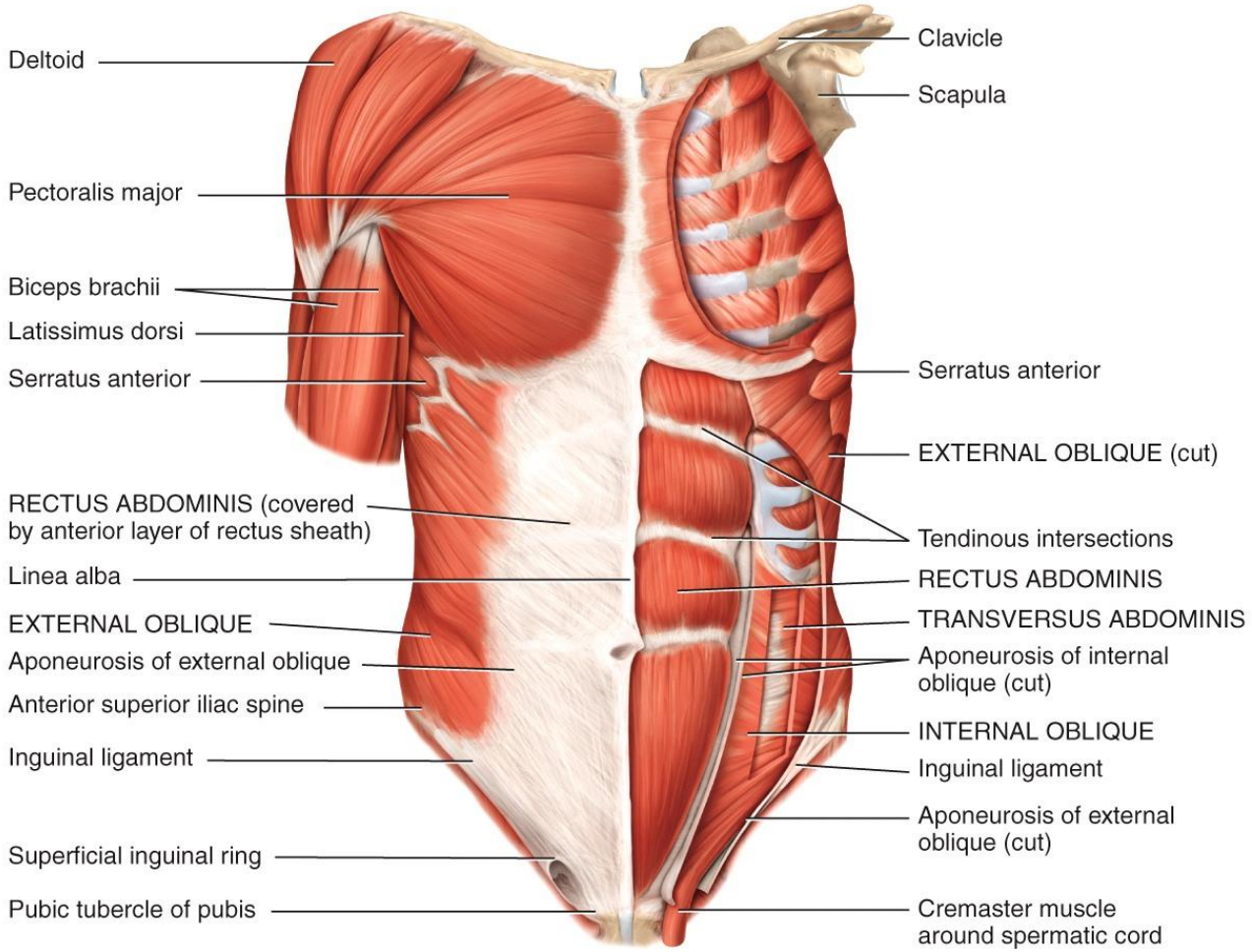
- It is protrusion of part of small intestine due to rupture or separation in the inguinal area
- Common in males as they have larger inguinal canal & it's a week area in the abdominal wall
- Treatment: surgical repair

Muscles of the Abdomen That Protect Abdominal Viscera and Move the Vertebral Column

- Abdominal wall is composed of:
  - Skin
  - fascia
  - 4 pairs of muscles

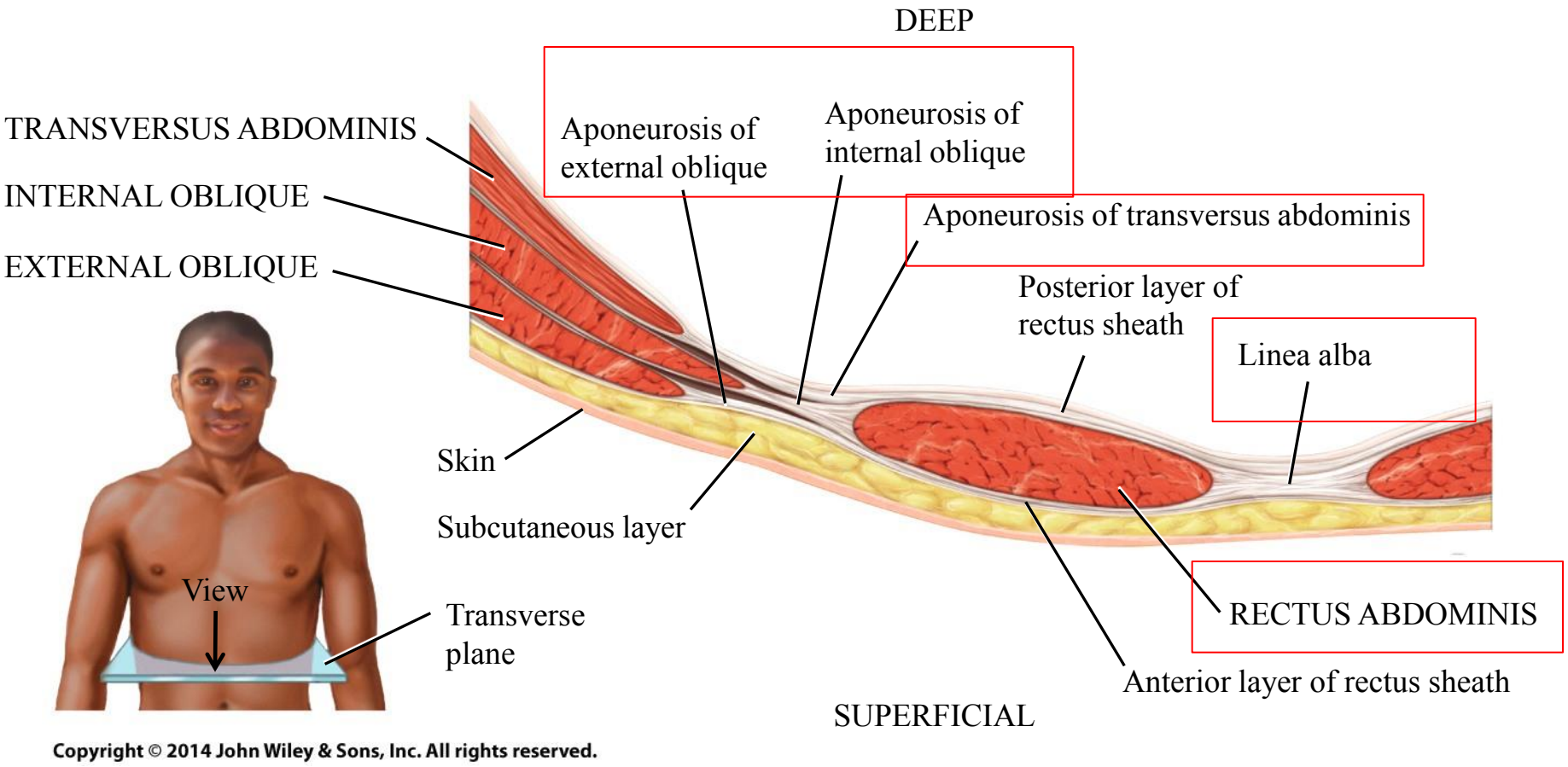
- Function: protection of viscera in the abdomen

Muscles of the Abdomen That Protect Abdominal Viscera and Move the Vertebral Column



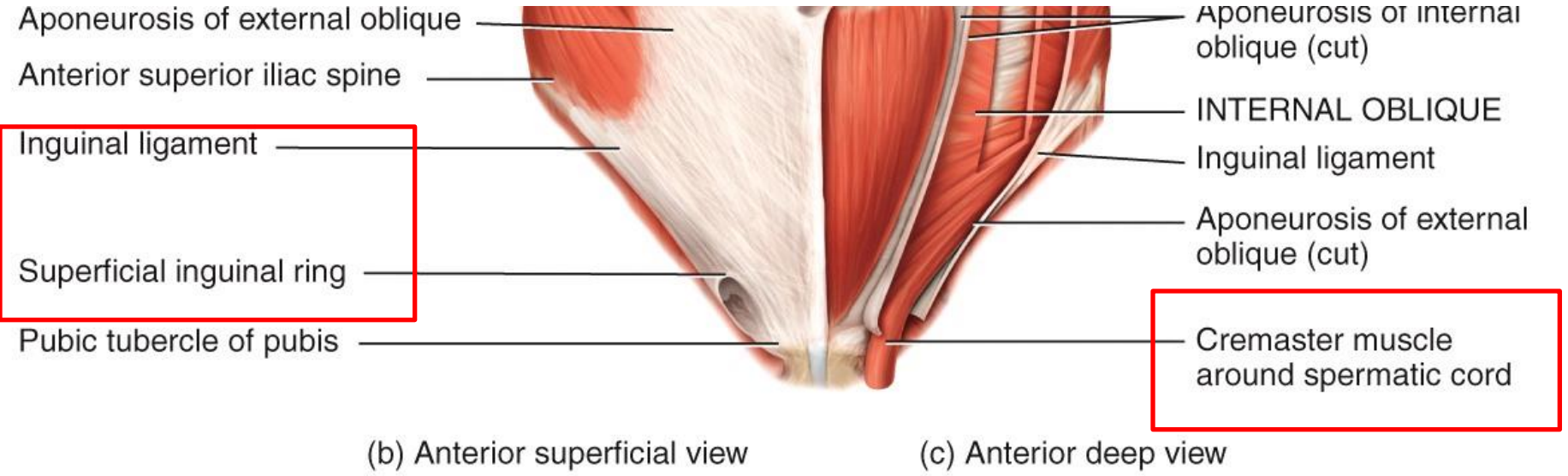
MUSCLE	ORIGIN	INSERTION	ACTION
Rectus abdominis (REK-tus ab-DOM-in-is; *rectus-*=fascicles parallel to midline; *abdomin*=abdomen)	Pubic crest and pubic symphysis	Cartilage of ribs 5–7 and xiphoid process	Flexes vertebral column (especially lumbar portion), and compresses abdomen to aid in defecation, urination, forced exhalation, and childbirth RMA: Flexes pelvis on the vertebral column
External oblique (ō-BLĒK; *external*=closer to surface; *oblique*=fascicles diagonal to midline)	Ribs 5–12	Iliac crest and linea alba	Acting together (bilaterally), compress abdomen and flex vertebral column; acting singly (unilaterally), laterally flex vertebral column, especially lumbar portion, and rotate vertebral column
Internal oblique (*internal*=farther from surface)	Iliac crest, inguinal ligament, and thoracolumbar fascia	Cartilage of ribs 7–10 and linea alba	Acting together, compress abdomen and flex vertebral column; acting singly, laterally flex vertebral column, especially lumbar portion, and rotate vertebral column
Transversus abdominis (tranz-VER-sus; *transverse*=fascicles perpendicular to midline)	Iliac crest, inguinal ligament, lumbar fascia, and cartilages of ribs 5–10	Xiphoid process, linea alba, and pubis	Compresses abdomen
Quadratus lumborum (kwod-RĀ-tus lum-BOR-um; *quad-*=four; *lumbo-*=lumbar region) (see Figure 11.14)	Iliac crest and iliolumbar ligament	Inferior border of rib 12 and L1–L4	Acting together, pull twelfth ribs interiorly during forced exhalation, fix twelfth ribs to prevent their elevation during deep inhalation, and help extend lumbar portion of vertebral column; acting singly, laterally flex vertebral column, especially lumbar portion RMA: Elevates hip bone, commonly on one side

Rectus Sheath

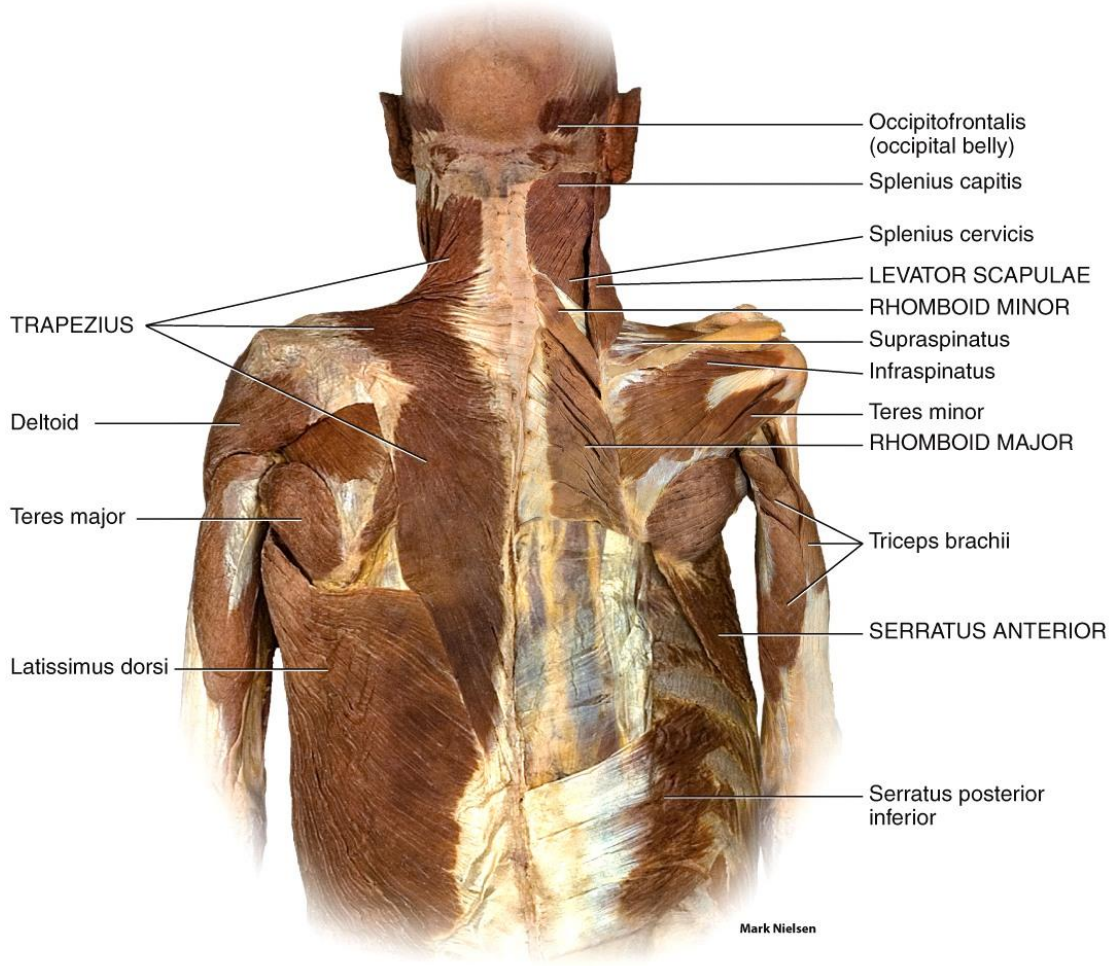


(a) Superior view of transverse section of anterior abdominal wall superior to umbilicus (navel)

Inguinal ligament & Inguinal canal



Muscles of the Thorax That Move the Pectoral Girdle



Posterior superficial view (f) Posterior deep view