

6 AXIAL MUSCLES

Due to the numerous muscles and actions, studying them can seem overwhelming, but by using some basic vocabulary it becomes manageable. It is invaluable to refer to the skeletal system when learning the muscles names as terms will be repeated. In the muscular system, there are many terms used to name muscles. While this includes the shape focusing on the origin, insertion, and action can be a great starting point. The origin is where a muscle is attached and does not usually produce movement. The insertion is where muscles attach to cause movement. The action is how a muscle moves when contracting. It is important to note that due to the microstructure, muscles can only actively pull. The muscles innervations will be covered in neuroanatomy is the nerve that tells the muscle to contract.

1. Abduct= to take away (alien abduct you)
2. Adduct= to bring back
3. Depressor= to bring down
4. Levator= to bring up
5. Extend= to draw apart
6. Flex= to bring in
7. Pronate= to put face down
8. Supinate= to put face forward
9. Brachi= relating to the humerus
10. Erector= straighten spine
11. Origin= connection with muscle that is not affected by that muscles contraction
12. Insertion= connection with muscle that moves with contraction.
13. Orbicularis= circular or sphincter
14. Pennate= pen shaped
15. Labii= Lips
16. Oculi= pertaining to eye
17. Cilia= hair
18. Oris= mouth
19. Mentalis= pertaining to the mental process of the mandible
20. Gloss= tongue
21. Omo= shoulder
22. Genio= chin
23. Capit= head

Hint: for the Muscles of the head use a skull to determine the origin and insertion of the following muscles

Muscles of the head:

Muscles found on the head and sometimes neck, are functionally broken down into two groups. There are the muscles of facial expression and the muscles of mastication. While at times these can have overlapping actions, their main action is usually used to determine the classification. There are many nerves that will innervate these muscles but usually we talk about two main ones for the head. Most muscles of facial expression are innervated by the Facial nerve, known as Cranial nerve seven. Most muscles of mastication are innervated by the Trigeminal nerve, or cranial nerve five. The nerves will be addressed in more detail in the neuroanatomy section.

Muscles of facial expression:

Muscles of facial expression are, for the most part, innervated by the seventh cranial nerve. These muscles are unique as they usually have origin on bone, but the insertion is on soft tissues such as skin or other muscles. For organization, we can look at muscles of facial expression based on the Anatomical locations.

Muscles around the mouth:

Muscle	Origin	Insertion	Action
Orbicularis Oris	Mandible and maxilla	Lips	Close and purse lips
Buccinator	Alveolar process of mandible and maxilla	Orbicularis oris	Compress cheeks
Risorius	Fascia of parotid gland	Angle of mouth	Raises corner of mouth
Levator labii superioris	Maxilla and zygomatic bone	Orbicularis oris	Elevates and everts lips
Levator anguli oris	Maxilla inferior to infra orbital foramen	Skin below angle of mouth	Elevates corner of mouth
Zygomaticus major	Zygomatic bone	Levator anguli oris and orbicularis oris	Elevates corner of mouth and pulls laterally
Zygomaticus minor	Zygomatic bone	Upper lip	Elevates upper lip
Depressor Labii inferioris	Midline of mental process	Lower skin on lips	Depress lip
Mentalis	Above and medial of the mental process of mandible	Skin of chin	Protrudes lower lip
Depressor anguli oris	Mandibular body	Skin of angle of mouth	Pulls down the corner of the mouth

Muscles of the eye and scalp

Muscle	Origin	Insertion	Action
Orbicularis Oculi	Orbit of the eye	Skin around eyelid	Close eyes
Occipitalis	Superior nuchal line	Epicranial aponeurosis	Tenses and retracts scalp
Frontalis	Epicranial aponeurosis	Skin of brow	Raises eyebrow wrinkles forehead
Temporoparietalis	Fascia around ear	Epicranial aponeurosis	Tenses scalp, moves ears
Corrugator Supercillia	Medial end of superciliary ridge	Skin of eyebrow	Wrinkles brow
Levator palpebrae superioris	Inferior part of lesser wing of sphenoid	Eye lid	Opens eye

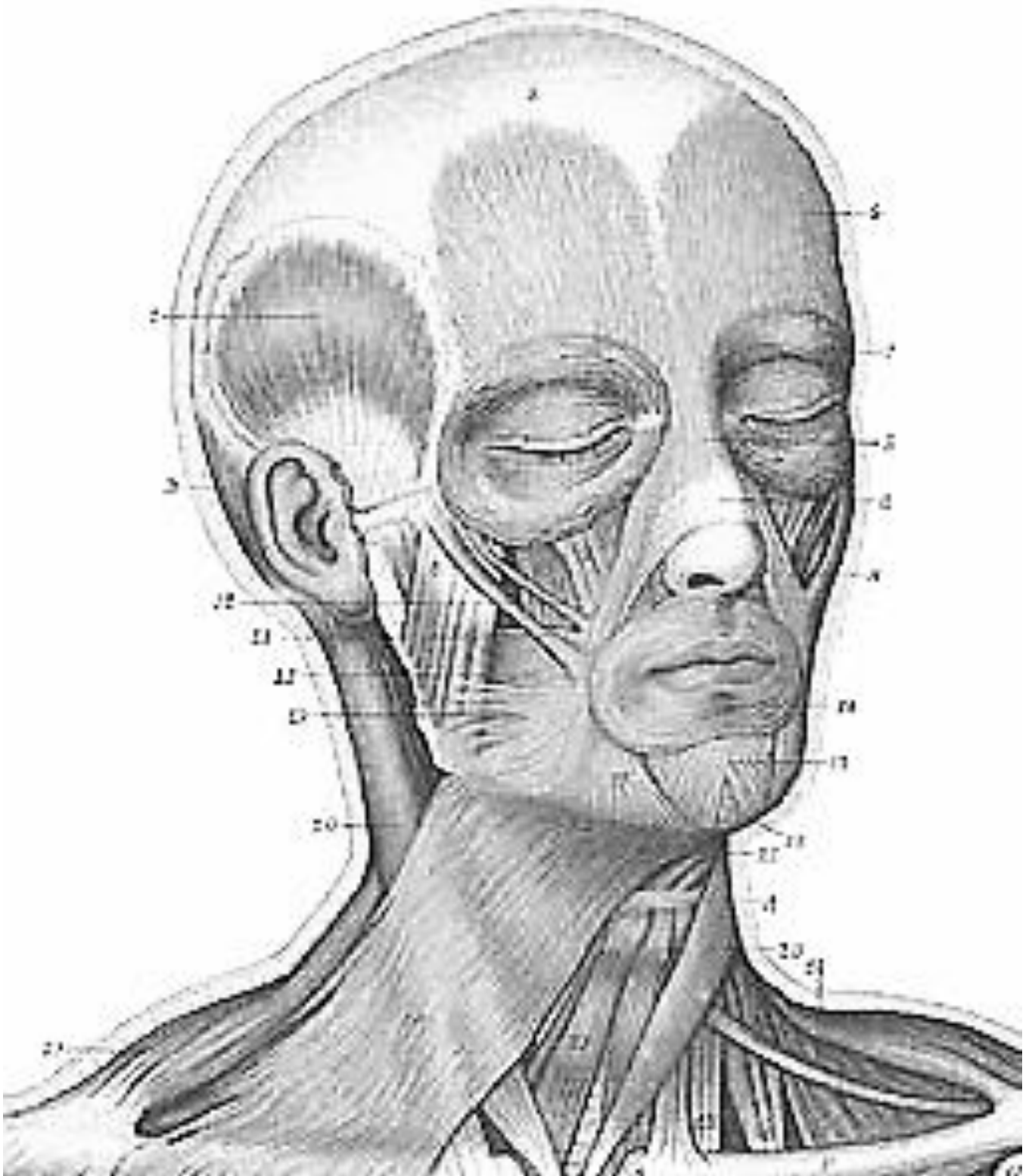
Muscles around the Nose:

Muscle	Origin	Insertion	Action
Nasalis	Maxilla and cartilage of nose	Bridge of nose	Flares nostrils
Procerus	Lateral nasal cartilage	Aponeurosis near nose	Moves nose and changes shape of nostrils

Muscle of neck:

Muscle	Origin	Insertion	Action
Platysma	Fascia over pectoralis major	Mandible and Skin over mandible	Tenses skin of neck and depresses mandible

1. Using the tables above find the corresponding muscle and label it on the picture on the next page. If the muscles are not present, draw it in based on its origin and where it's insertion would be. To find the muscles easier later consider color coding the muscle.



Muscles of Mastication:

When looking at the muscles of mastication, consider the names to determine the locations and actions. There are always words that will refer to specific structures which will be addressed. Cranial Nerve seven will innervate most muscles of mastication five which is called the Trigeminal nerve.

Muscles of Mastication:

Muscle	Origin	Insertion	Action
Masseter	Zygomatic arch	Angle of mandible	Close mouth
Temporalis	Temporal fossa	Coronoid process of mandible	Closes mouth
Medial Pterygoid	Medial surface of lateral pterygoid plate	Mandibular ramus	Moves mandible side to side and closes mouth
Lateral Pterygoid	Lateral surface of Lateral pteroid plate	Anterior section of mandibular condyle	Opens jaw. Protrudes and moves mandible to sides

2. On the previous picture label, the Masseter and Temporalis. Color it in to make it easier to find later.

Take the skull and feel the lateral aspect over the temporal bone then go superior until you feel a rising on the Parietal bone and follow this ridge from one end to the other. You can see that this depression is over the Parietal, Temporal, and Sphenoid bone. That depression is the temporal fossa. Covering the temporal fossa in a human is the temporalis muscle which pulls on the Coronoid process of the mandible. Feel this area on your own head and open and close your mouth to see when it becomes tense.

If you place your fingers onto the temporal process of the zygomatic bone, then follow it to the angle of the mandible, you are tracing the path of the masseter. The masseter will help elevate the mandible. It can be palpated on your own face to check when it is used.

3. What bones are within the temporal fossa?
4. What is the muscle of mastication which is located in the temporal fossa's origin and insertion?
5. What is the muscle that attaches from the zygomatic arch to the mandibular angle?

Look at the inferior view of your skull with the mandible in place and place your fingers so they go from the medial aspect of the lateral plate of the pterygoid process of the sphenoid bone to the inferior medial aspect of the mandible's angle. This is the path of the Medial Pterygoid muscle. Due to its position, it will help close the jaw as well as move it side to side.

Next, place your fingers on the lateral aspect of the lateral plate of the pterygoid process of the sphenoid bone and trace it to the mandibular condyle. This is the course of the lateral Pterygoid muscle. From its position, you can see how it can help slide the jaw forward which is needed to open it. It can also function to pull the mandible to its side.

6. When does the Lateral Pterygoid muscle contract?
7. What originates at the medial portion of the lateral pterygoid plate and inserts at the ramus of the mandible?
8. What would the above muscle do when it contracts?

Muscles of the tongue:

The muscles of the tongue have a few things in common, most will have the root -glossus in the name. Besides the Palatoglossal, which is innervated by the Vagus nerve (Cranial nerve X) most muscles of the tongue are innervated by the Hypoglossal nerve (Cranial Nerve XII) which came from the brain through the hypoglossal canal besides eating, these muscles are needed for speaking. The naming of tongue muscles tends to be easy as they have the root Gloss and the root for the projection they originate from. For instance, there is a muscle that originates at the soft palate and goes to the tongue called the Palatoglossus. Palato for palate and gloss for the tongue.

Muscles of tongue movement:

Muscle	Origin	Insertion	Action
Styloglossus	Styloid process of temporal bone	The sides and tip of tongue	Retracts tongue, moves tongue side to side
Genioglossus	Posteromedial chin	Tongue and hyoid bone	Protracts and depresses tongue
Hyoglossus	Hyoid bone	Sides of tongue	Depressed, retracts and moves tongue side to side
Palatoglossus	Soft palate	Sides of tongue	Elevates tongue draws down the soft palate

On a skull, find the styloid processes of the temporal bone and place a finger from the incisors of the maxilla to each of the styloid processes.

9. If the fingers above represent a muscle what would happen to the tongue if both muscles contracted?
10. What would occur if only one of the two muscles above contracted?
11. Which muscle from the table is described above?

Next place a finger from the posterior aspect of the back of the Maxilla to the incisors of the maxilla.

12. What would contraction of the muscle that follows your finger do to the tongue?
13. What is the name of the muscle described above?

Look at an articulated skeleton and place two fingers from the horns of hyoid bone to the incisors.

14. If the above muscle were to contract, what action would it have on the tongue?
15. What if only the left side contracted?
16. What is the muscle described above?

Taking the skull again, place your fingers just posterior to the palatine bone and trace it to where the base of the tongue should be.

17. What action would the above muscle perform?
18. What is the name of the muscle above?

Muscles of swallowing:

The area between the nose and mouth that continues and ends near the trachea is referred to as the pharynx. When eating, there are three muscles that constrict the area to propel food to the esophagus. The three muscles are the Superior, Middle and inferior pharyngeal constrictors. It is important to remember that these are striated skeletal muscles so under voluntary control via the Vagus Nerve (CNX).

Pharyngeal constrictors:

Muscle	Origin	Insertion
Superior pharyngeal constrictors	Pterygoid process of sphenoid, Medial surface of mandible, and sides of tongue	Pharyngeal raphe
Middle constrictors	Hyoid bone	Pharyngeal raphe
Inferior constrictors	Cricoid and thyroid cartilage	Pharyngeal raphe

19. What are the three muscles that constrict the pharynx?

Working in concert with the pharyngeal constrictors are both the muscles that elevate the larynx and those that elevate the palate. There are three nerves which innervate these muscles. The main nerve for which acts on these is the Vagus nerve, but the Glossopharyngeal and Trigeminal nerves are also used sometimes.

Palate Elevators:

Muscle	Origin	Insertion	Innervation
Levator Veli Palatini	Petrous portion of temporal bone	Soft palate	CN X
Tensor Veli Palatini	Pterygoid process	Soft palate	CV V

Laryngeal Elevators:

Muscle	Origin	Insertion	Innervation
Palatopharyngeus	Soft and hard palate	Thyroid cartilage	CN X
Salpingopharyngeus	Cartilage inferior to auditory tube	Thyroid cartilage	CN X
Stylopharyngeus	Styloid process of temporal bone	Thyroid cartilage	CN IX

The area made of the hyoid bone to the thyroid cartilage (area with the Adams apple) is called the larynx. Feel your Thyroid Cartilage (Adam's apple) and swallow, what happens?

20. What muscles are responsible for this movement?

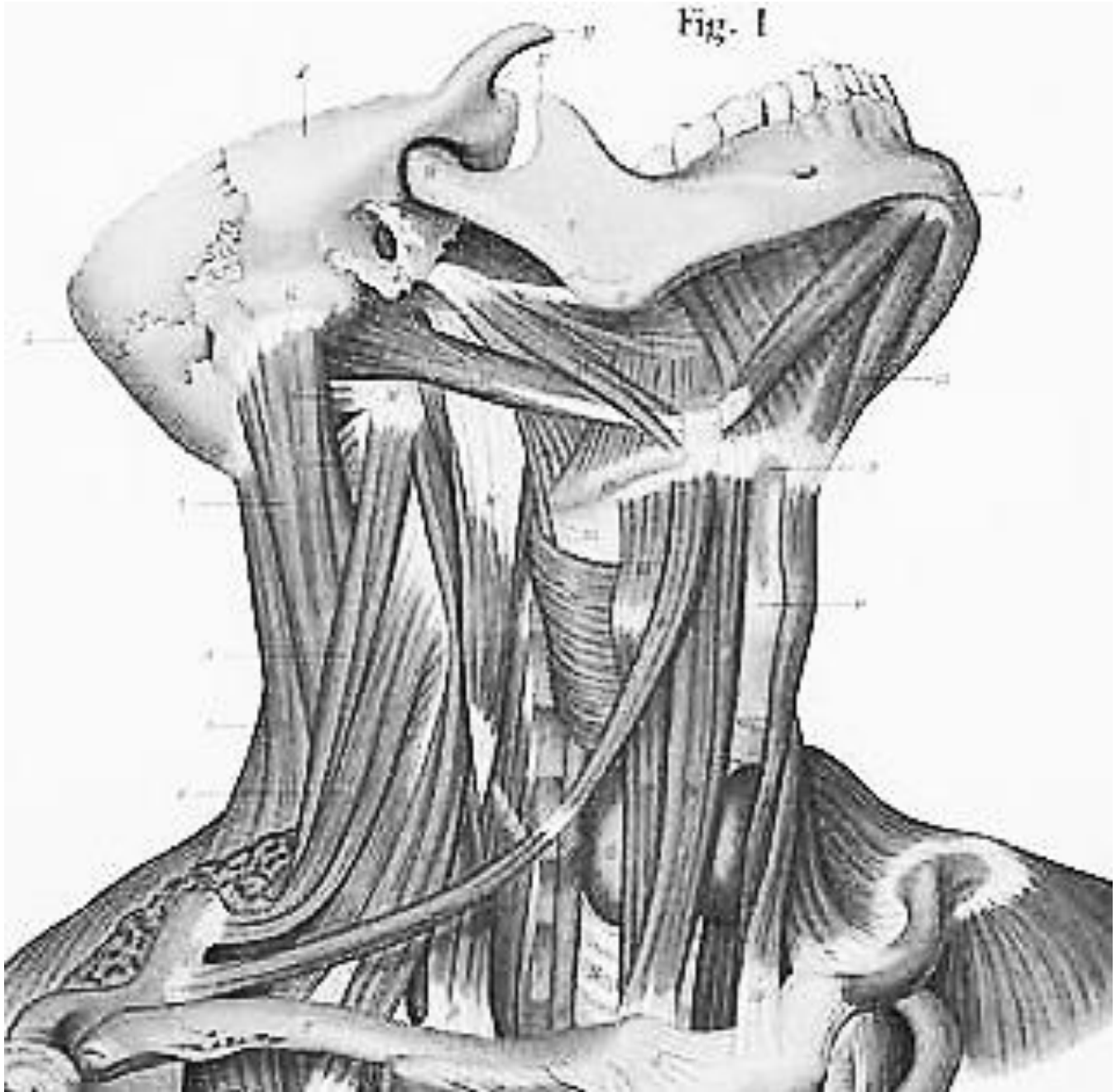
Muscles posterior to the mandible:

Muscle	Origin	Insertion	Action	Innervation
Digastric Anterior:	Inferior surface of mandible	Hyoid	Depresses mandible, elevates larynx	Trigeminal nerve (CN V)
Posterior:	Mastoid process of temporal			Facial nerve (CN VII)
Geniohyoid	Posteromedial surface of mandible	Hyoid	Depresses mandible, elevates larynx, retracts hyoid	Hypoglossal nerve (CN XII)
Mylohyoid	Posterior Mandibular symphysis	Hyoid	Elevates mouth floor, elevates hyoid, depresses mandible	Trigeminal (CNV)
Stylohyoid	Styloid process of temporal	Hyoid	Elevates larynx	Facial nerve

For an easier way to identify the muscles posterior to the mandible, it may be needed use anatomical triangles for orientation. Most of the triangles are covered by the Platysma, a thin sheet muscle discussed in facial expression. At the anterior inferior aspect of the jaw, the first two triangles is the Submandibular Triangles. The lateral border of this triangle is the body of the mandible, the posterior border is the stylohyoid muscle, and the medial border is the anterior belly of the digastric muscle.

21. On the image label and highlight in the muscle that make the submandibular triangle. Next, label the rest of the muscles from the table of muscles found under the mandible.
22. What are the actions of the two muscles that form the border of the Submandibular Triangle?
23. What are the origins and insertions those muscles?

24. What two muscles are superior to the triangle?

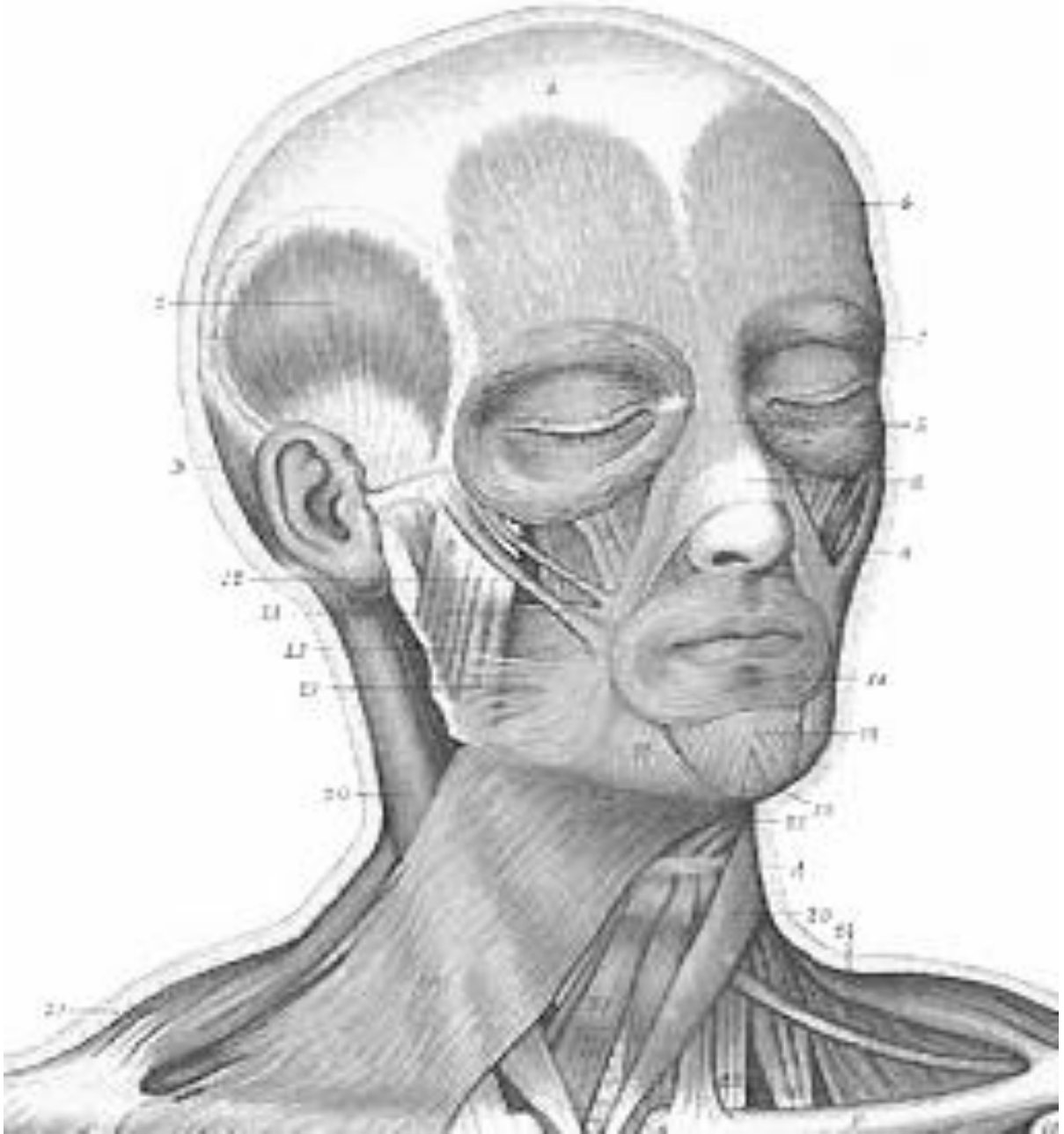


Muscles of the Anterior aspect of the neck:

Omohyoid	Superior border of scapula	Hyoid	Depresses hyoid and larynx	Cervical nerves C _{2,3}
Sternohyoid	Manubrium and clavicle	Hyoid	Depresses hyoid and larynx	Cervical nerves C ₁₋₃
Sternothyroid	Manubrium and 1 st rib	Thyroid cart.	Depresses hyoid and larynx	Cervical nerves C ₁₋₃
Thyrohyoid	Thyroid cart.	Hyoid	Elevates larynx depresses hyoid	Hypoglossal nerve
Sternocleidomastoid	Sternum and clavicle	Mastoid	Flex neck and turn head	Accessory nerve

At the anterior part of the neck, there are three more triangles. The muscular triangle is formed by both Sternocleidomastoids laterally and the posterior bellies of the two digastric superiorly.

25. On the following picture, label the borders of the muscular triangle of the neck:



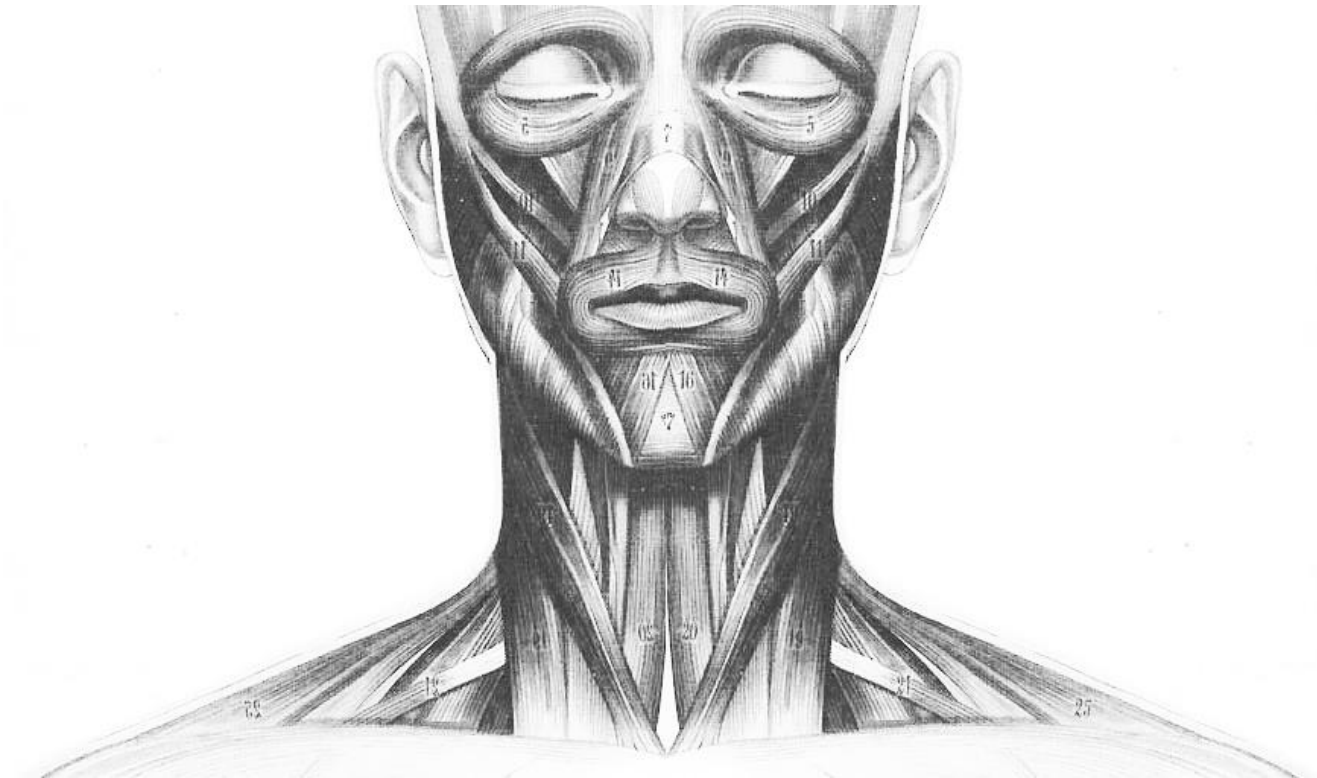
26. What is the action of the posterior belly of the digastric muscle?

27. What is the origin and insertion of the platysma?

28. Label the Platysma on the previous image.

Within the muscular triangle you can find the Carotid triangle, which is formed from the sternocleidomastoid laterally, digastric superior and the superior belly of the omohyoid medially. The Omohyoid muscle, which originates at the scapula and inserts at the hyoid bone is an important muscle that helps pull down the hyoid. This triangle is important as it is where the Common Carotid artery is, and the pulse is palpated.

29. On the image below, color in and label the muscles that make the lateral and medial borders of the carotid triangle.



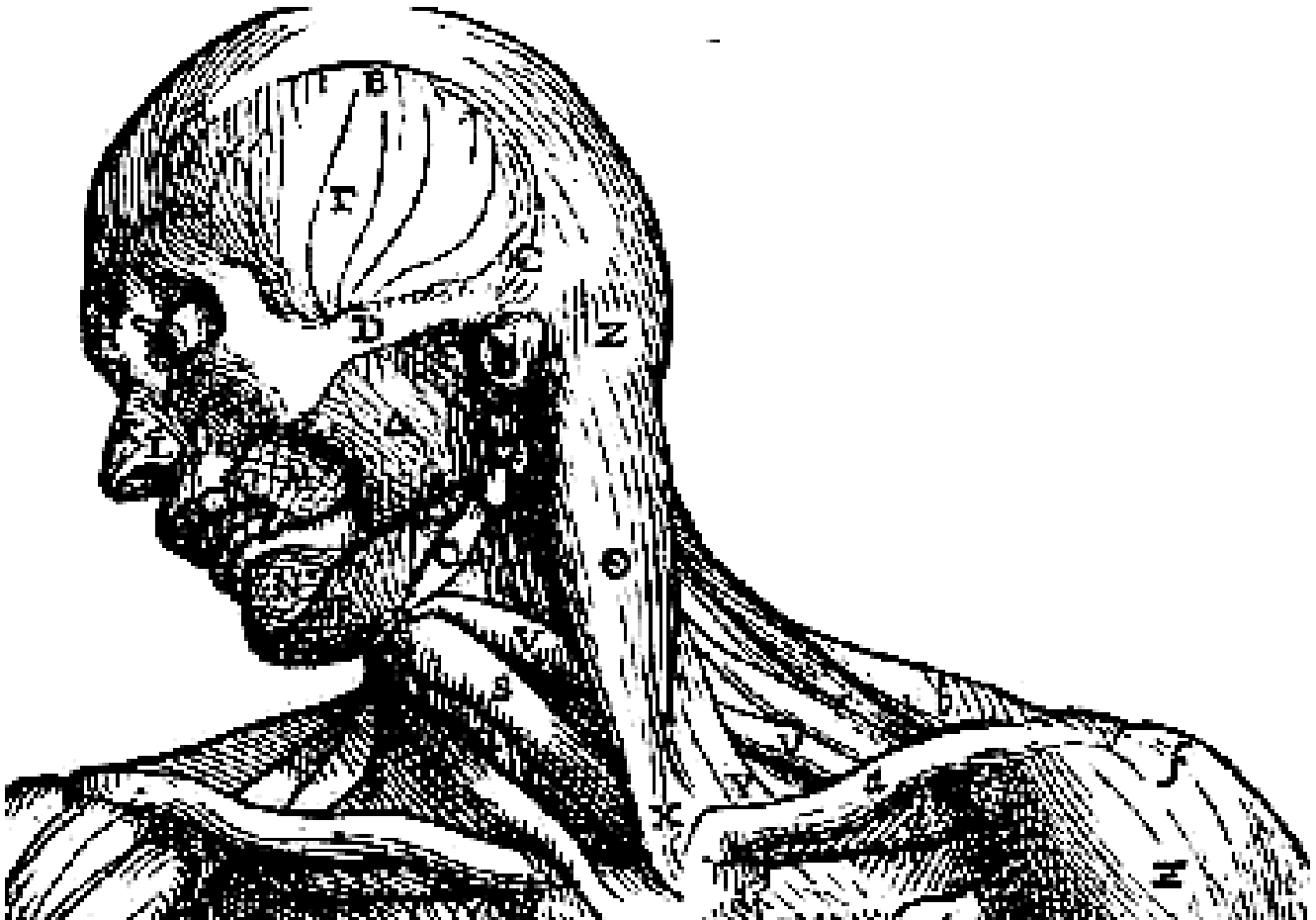
30. What is the origin and insertion of the omohyoid?
31. What is the action of the omohyoid?
32. What muscle is lateral and posterior to the omohyoid (look at picture for question 26) at the carotid triangle?
33. What is its action, origin, and insertion?
34. What muscle is medial to the superior belly of the omohyoid?

Muscles of the Posterior Triangle of the Neck:

Muscle	Origin	Insertion	Action
Trapezius	Occipital bone and spinal process of thoracic vertebrae	Clavicle and scapula	Elevates, retracts, depresses scapula
Splenius capitis Splenius cervicis	Spine of C7-T3	Mastoid process and Occipital bone	Extend, rotate, and laterally flex the head
Semispinalis Capitis	C3-T7	Nuchal line	Extend, rotate, and laterally flex the head
Anterior scalenes	C3-C6	First rib	Elevates rib, rotate neck to opposite side
Middle Scalenes	C1, C3-7	First rib	Elevates rib, rotates neck to same side
Posterior Scalenes	C4-C6	First rib	Elevates rib, rotates neck to same side
Sternocleidomastoid	Sternum, clavicle	Mastoid process	
Omohyoid	Scapula	Hyoid bone	

The posterior triangle of the neck is formed from the sternocleidomastoid on the medial anterior border, the clavicle on the inferior border, and the trapezius for the posterior border. While the sternocleidomastoid is responsible for rotation of the head, it is also responsible for forced inspiration. The Trapezius muscle is responsible for extending, elevating, and depressing the scapula (more of this in axial muscles) so is not technically part of the axial muscle. Within this triangle, one can find many other muscles which are responsible for rotation of the neck and supporting the head.

35. In the following picture, Label and highlight the borders of the posterior triangle of the neck.



36. What is the action, origin, and insertion of the trapezius?
37. What muscle is deep to the trapezius that can be seen anterior to it on the triangle near the mastoid process of the temporal bone?
38. What muscle is anterior and inferior to the muscle above?
39. What three muscles can be found on the inferior aspect of the triangle?
40. What are the origin and insertions of the Splenius?

Erector Spinae Postural muscles of the back

Muscle	Origin	Insertion	Action
Spinalis Cervicis	Ligamentum nuchal Spinous process of C7	Spinous process C3-C4	Extends neck
Spinalis Thoracis	Spinous process T11-L2	Spinous process Thoracic	Extend vertebral column
Longissimus capitis	Transverse process C6-T2	Mastoid process	Extend and rotate neck lateral
Longissimus Cervicis	Transverse process T1-T3	Transverse process C1-C7	Extend and rotate neck lateral
Longissimus Thoracis	Transverse process T12-L2	Transverse process T1-T3	Extends and lateral flex spine
Iliocostalis cervicis	Angle ribs 3-6	Posterior tubercle C4-C6	Extend and lateral flex neck
Iliocostalis Thoracis	Angle ribs 7-12	Angle rib 1-6 and transverse process C7	Stabilizes thoracic vertebrae
Iliocostalis lumborum	Iliac, sacral crest and spinous process of lumbar	Angle of ribs 7-12	Extends vertebral column and depressed ribs

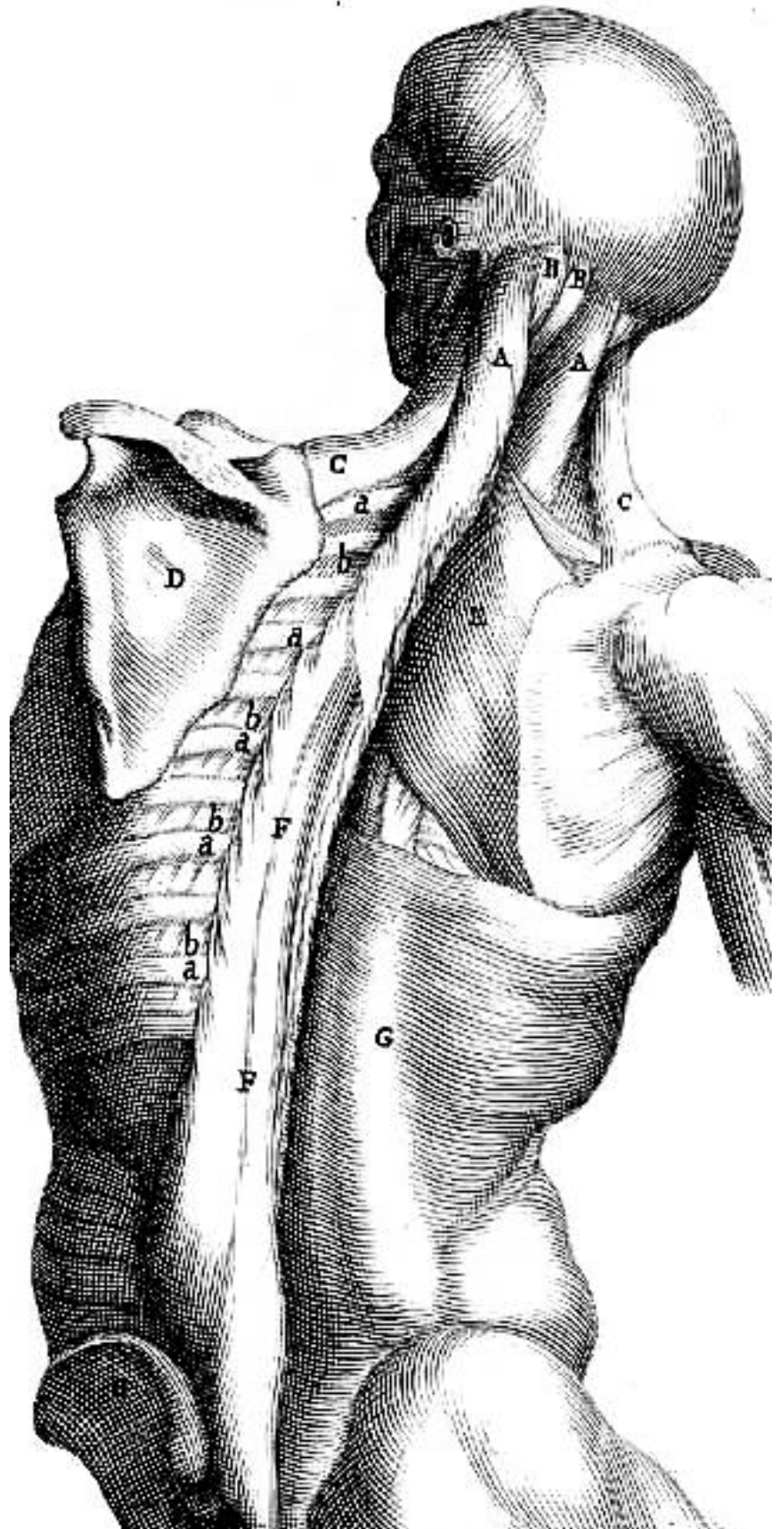
To view the Erector Spinae muscles, the Trapezius and other muscles that work on the shoulder and arm must be removed. Once the Erector Spinae group is visible it is easier to locate them. Before getting to the Erectors, the first muscle of the two Serratus Posteriors is visible. The Superior one of the two will lie superficial to the Splenius muscle this muscle helps extend the neck. Between the ileum and ribs are the Iliocostalis muscle group. This muscle group extends from the ileum to the cervical vertebrae. The Iliocostalis is composed of three muscles, the Iliocostalis cervicis, I. thoracis, and I. Lumbordum.

47. Lateral to Splenius is the Longissimus group, what are the three muscles in this group and where are they found?

48. What are the names of the three muscles that make up the Iliocostalis and where are they found (origin and insertion)?

49. What are the muscles that make up the Semispinalis and what does each do?
50. What do the following roots or terms mean?
 1. Spinalis:
 2. Longissimus:
 3. Ilio:
 4. Costalis:
 5. Cervicis:
 6. Thoracis:
 7. Lumborum:

51. On the image provided label and color in the erector spinae muscles.



Deep posterior muscles of the spine:

Muscle	Origin	Insertion	Action
Semispinalis capitis	C5-8 T1-6	Occipital bone	Extends, laterally flexes, and turns head
Semispinalis cervicis	T1-5	C2-5	Extends and rotates vertebral column
Semispinalis Thoracis	T6-10	C6-T4	Extends and rotates vertebral column
Multifidus	Sacrum and transverse process of vertebrae	Spinous process of superior vertebrae	Extends and rotates vertebral column
Rotatores	Transverse processes	Spinous process of superior vertebrae	Extends and rotates vertebral column
Interspinales	Spinous process	Spinous process superior vert	Extend vertebral column
intertransversarii	Transverse processes	Transverse process of superior vertebrae	Lateral flexion

52. Label the semispinalis muscle group on the image found on the previous page.

Spinal Flexors: Found anterior to the vertebral column.

Muscle	Origin	Insertion	Action
Longus capitis	Transverse process C4-6	Occipital bone	Flex and rotates neck
Longus coli	Anterior cervical thoracic	Transverse process superior vertebrae	Flex and rotate neck
Quadratus Lumborus	Iliac crest and iliolumbar lig	Last rib and transverse process of lumbar	Depress rib, lateral flexion of spine, stabilizes diaphragm

53. Describe the different of flexion of spine and the lateral flexion of spine.

54. Which muscles would cause each type of flexion?

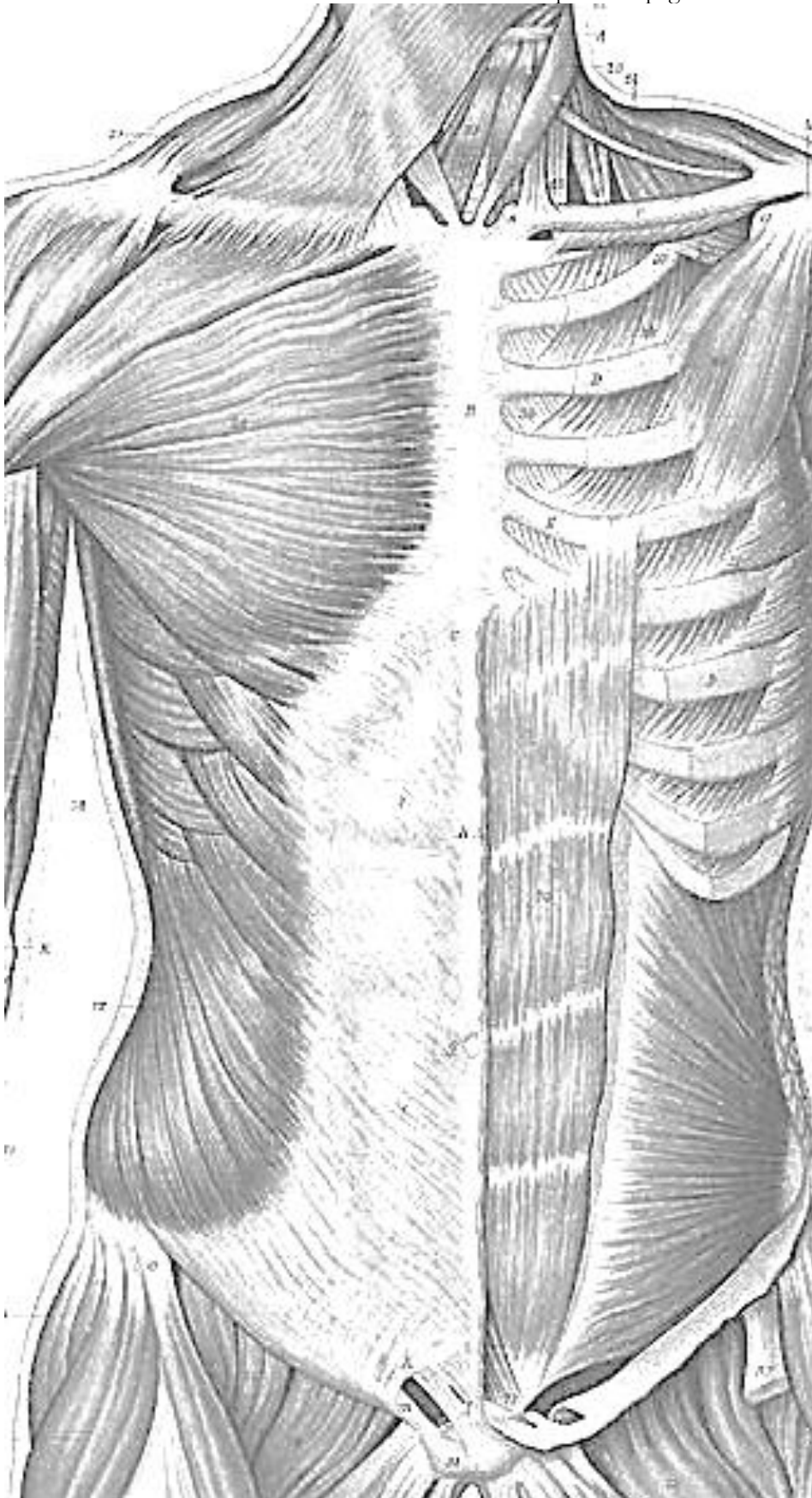
Muscles of the thoracic and Abdominal wall:

Muscle	Origin	Insertion	Action
External intercostals	Inferior border of rib	Superior border of rib	Elevates ribs
Internal intercostals	Superior border of ribs	Inferior border of rib	Depresses ribs
Transverse Thoracis	Posterior of sternum	Cartilage of ribs	Depresses ribs
Diaphragm (border)	Xiphoid process, ribs 7-12, and lumbar verts	Central tendon sheath	Expands thoracic cavity
Rectus Abdominis	Chondral portion of ribcage	Pubic symphysis	Depresses ribs, flexes vertebral column compresses abdomen
External Oblique	Ribs 5-12	Aponeurosis from Linea alba and iliac crest	Compresses abdomen, depresses ribs, flexes, lateral flexion and rotation of vertebral column
Internal Oblique	Thoracolumbar fascia, iliac crest and inguinal ligament	Ribs 8-12, Linea alba, and pubis	Compresses abdomen, depresses ribs, flexes, lateral flexion and rotation of vertebral column
Transverse abdominis	Ribs 7-12, iliac crest, and Thoracolumbar fascia	Linea alba and pubis	Compresses abdomen

Looking at the abdomen and thorax together, we find a muscle that divided this into two areas. This dome-shaped muscle is called the diaphragm. It is a skeletal muscle and is used as a boundary in many cases (will discuss later). Now it is important to look at the abdominal cavity. Looking medially, we see a muscle running straight down from the chondral portion of the ribcage to the pubic symphysis it the rectus abdominis. Between the rectus abdominis is a white line called the Linea Alba which is made up of dense regular connective tissue.

55. What is the white line that divides the rectus abdominis into the right and left?

56. Label the muscles from the table in the previous page:



57. What three muscles make up the lateral parts of the abdomen?

58. What muscles make the boundary between the thoracic and abdominopelvic cavity?

Muscles of Respiration:

With the knowledge you have now we can look at the muscles of respiration. These are divided into two main groups, those of inspiration and expiration and each of these can be further divided into normal (quiet) breathing and forced breathing. The reason which the body needs muscles of both normal breathing and forced has to do with humans being a moving being.

Inspiration is achieved by decreasing the pressure of the thoracic cavity by either raising the chest or pushing down the abdominal contents. Expiration is based on elastic recoil of lungs (later) and on bringing the costals down or pushing the abdominal contents in (increasing intra-abdominal pressure).

Muscles involved in inspiration:

Muscle	Innervation	Type of inspiration
Diaphragm	Phrenic nerve (C3-5)	Normal
External intercostals	Intercostal nerves	Both
Sternocleidomastiod	Accessory nerve	Forced
Scalenes(all)	Cervical spinal nerves	Forced

Breath normally and feel the anterior portion of your neck while standing. Next take a deep breath in and notice if there is any contraction from the muscles of the neck. Sometimes it helps to watch someone breath normally then have them take a deep breath.

59. Does anything happen under normal breathing?

60. Did anything happen during a deep breath?

61. What does this tell you about the muscles of respiration in the neck?

62. What are the muscles of forced inspiration?

63. What are the muscles of normal inspiration?

Muscles involved in expiration:

Muscle	Innervation	Type of expiration
Internal intercostals	Intercostal nerves	Forced
External oblique	Intercostals, iliohypogastic, and ilioinguinal	Forced
Internal oblique	Intercostals, iliohypogastic, and ilioinguinal	Forced
Transverse abdominis	Intercostals, iliohypogastic, and ilioinguinal	Forced

Place your hands on your abdomen and breathe normally. You will noticed that there might be an expansion of the abdominal area when you are breathing. That expansion is occurring as the thoracic cavity is expanding into the abdominopelvic cavity. Next, cough while paying attention to when the muscles contract.

64. When you cough, which muscles are you using?

65. What happens to your abdomen as you contract your diaphragm?

66. What are the four muscles of forced expiration?

The inferior most aspect of the Abdominopelvic region is the pelvic floor. This is best studied by using anatomical triangles. The urogenital triangle is made up of Superficial transverse Perineal muscle posterior, the median raphe medial, and the lateral side from the Ishiocavernosus. The Anal triangle is formed anteriorly by the Superficial Transverse perineal muscle, laterally by a line from the ischial tuberosity to the Coccyx, and medially by the median raphe.

Muscles of the urogenital triangle:

Muscle	Origin	Insertion	Action
Superficial transverse Perineal	Ischial ramus	Central perineal tendon	Stabilizes perineal tendon
ishiocavernosus	Ischial ramus and tuberosity	Corpus cavernosum and ischiopubic ramus	Compresses and stiffens the penis or clitoris
Bulbospongiosum	Perineal body	Corpus cavernosum	Compresses and stiffens the penis or clitoris
Deep transverse perineal	Ischial ramus	Median raphe of urogenital triangle	Stabilizes perineal tendon
External urethral sphincter	Ischial and pubic ramus	Median raphe	Closes urethra

67. What muscle is medial to the Ishiocavernosus?

68. What muscle is deep to the muscle above?

Muscles of the anal triangle:

Muscle	Origin	Insertion	Action
Coccygeus	Ischial spine	Lateral inferior border of sacrum and coccyx	Supports the pelvic floor
Levator ani	Ischial spine, pubis	Coccyx and median raphe	Tenses pelvis floor, elevates anus
Pubococcygeal	Pubis	Coccyx and median raphe	Tenses pelvis floor, elevates anus
External anal sphincter	Coccyx	Anal opening	Closes anal opening

69. Label the muscles found in the two tables above?

