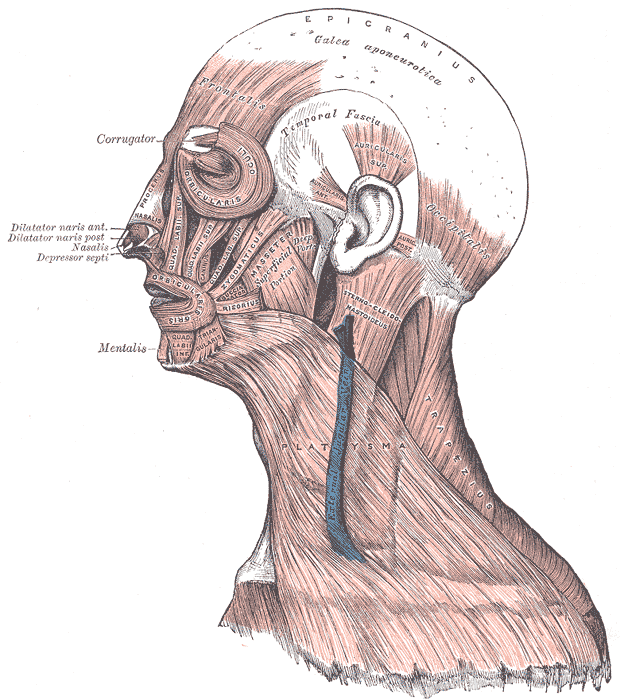
**Exercise 7: Axial Muscular System**



**Figure 7.1**. Muscles of the head and neck drawn to show their relative positions and muscle fiber orientation.

**Exercise 7 Learning Goals**

**After completing this lab, students should be able to:**

* Describe and define the origin, insertion, and action of select muscles:
  + Involved in facial expression
  + Muscles that move the eye
  + Muscles of mastication
  + Muscles that move the head
  + Muscles of the abdomen
  + Muscles involved in breathing

**Pre-Lab Activities for Exercise 7**

**Pre-Lab Activity 7.1:** **Muscle names their & Origin, Insertion and Action (O.I.A.**)

Before lab begins, please make sure you research and write down the **origins**, **insertions and actions** for the muscles listed in the table below. Use the required textbook as a guide.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Muscles of the Face** |  | **Origin** | **Insertion** | **Action** |
| **Frontalis** | Aponeurosis | |  |  |
| **Occipitalis** |  | | Aponeurosis |  |
| **Temporalis** |  | |  | Elevation of mandible  Retraction of mandible |
| **Orbicularis oculi** |  | | Around orbit |  |
| **Zygomaticus major** |  | |  | Elevate corners of mouth (smile) |
| **Masseter** |  | | Mandible |  |
| **Buccinator** |  | | Orbicularis oris |  |
| **Orbicularis oris** | Maxilla & Mandible | |  |  |
| **Mentalis** | Mandible | |  |  |
| **Muscles of the Head & Neck** | **Origin** | | **Insertion** | **Action** |
| **Platysma** |  | | Skin over Mandible |  |
| **Lateral pterygoid** | Sphenoid | |  |  |
| **Medial pterygoid** | Palatine & Maxilla | |  |  |
| **Sternocleidomastoid** |  | | Mastoid process |  |
| **Semispinalis capitis** |  | | Occipital |  |
| **Splenius capitis** | Spinous processes of C7-T3 | |  |  |
| **Longissimus capitis** |  | | Mastoid process |  |
| **Muscles of the Eye** | **Origin** | | **Insertion** | **Action** |
| **Superior rectus** | Back of the orbit | | Superior central eye |  |
| **Inferior rectus** | Back of the orbit | | Inferior central eye |  |
| **Lateral rectus** | Back of the orbit | | Lateral eye |  |
| **Medial rectus** | Back of the orbit | | Medial eye |  |
| **Superior oblique** | Back of the orbit | | Superior lateral eye |  |
| **Inferior oblique** | Back of the orbit | | Inferior lateral eye |  |
| **Muscles of the Trunk** | **Origin** | | **Insertion** | **Action** |
| **Rectus abdominis** | Pubic bone | |  |  |
| **External oblique** |  | | Iliac crest  Pubic bone  Linea alba |  |
| **Internal oblique** | Iliac crest | |  |  |
| **Transverse abdominis** | Iliac crest  Cartilage of ribs 7-12  Thoracolumbar fascia | |  |  |
| **Muscles of Breathing** | **Origin** | | **Insertion** | **Action** |
| **Diaphragm** |  | |  | Contraction=inhalation  Relaxation=exhalation |
| **External intercostals** |  | | Superior border of rib below |  |
| **Internal intercostals** | Superior border of rib below | |  |  |

**Exercise 7 Activities: The Axial Muscular System**

There are over seven hundred different muscles associated with the human body. As we learned from the previous lab, skeletal muscle contractions cause the muscle to shorten. This shortening leads to movement of the skeleton. Movement of bones can only take place at joints. Therefore, each muscle always crosses a joint and attaches to the bones that form the joint. Each muscle has an origin attachment and an insertion attachment. The **origin** is where a muscle attaches to the stationary bone during an action and the **insertion** is where a muscle attaches to the bone that moves during action. The **action** of a muscle is a particular movement of the skeleton when the muscle has contracted. Therefore, by looking at the origin and insertion of each muscle, we can infer the action of the muscle.

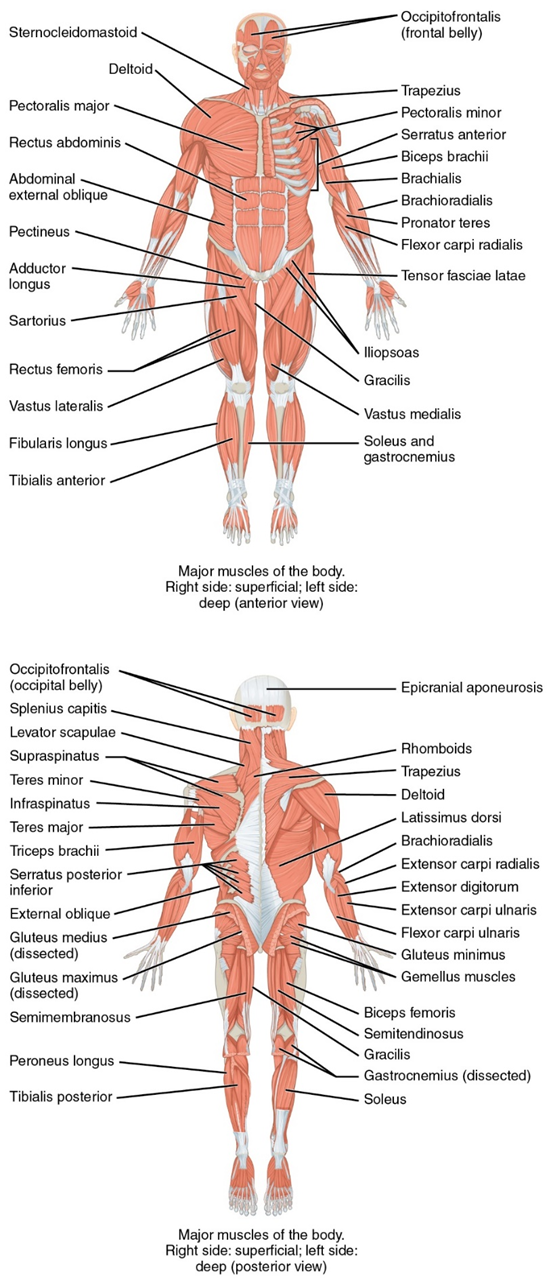
**Lab Activity 7.1: Naming of Skeletal Muscles**

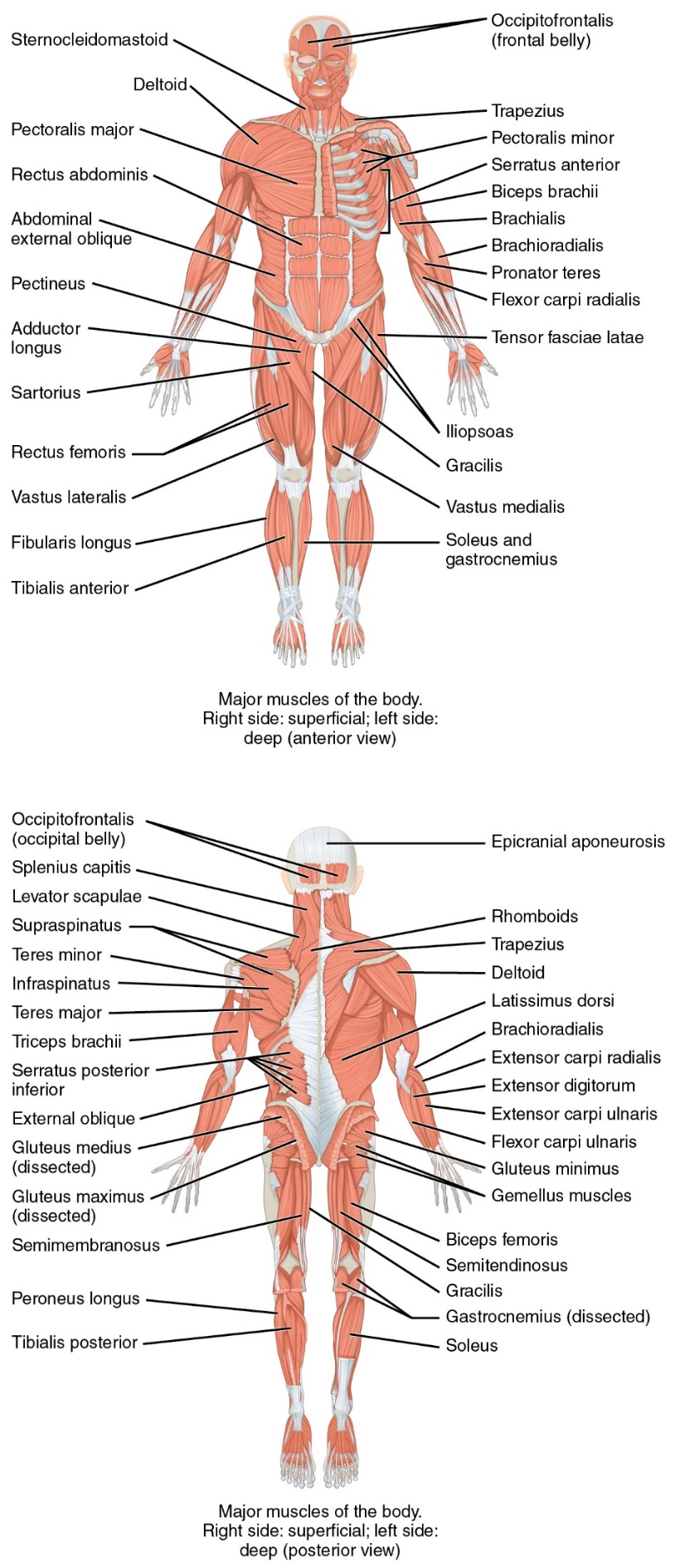
There are several ways to determine names of muscles. In general, muscles are named by one or more of the following criteria:

1. Shape of muscle
2. Size of the muscle compared to other muscles in the area (relative size)
3. Location of muscle in the body
4. Location of muscle’s origins and insertions
5. Number of origins
6. Principal action of the muscle
7. Direction of the fascicles

Using **Figure 7.2**, the anatomical models in lab, and/or your textbook, give an example of **two muscles** named based on the following criteria for each category.

1. **Shape of muscle:**
2. **Size of the muscle compared to other muscles in the area (relative size):**
3. **Location of muscle in the body:**
4. **Location of muscle’s origin and insertion:**
5. **Number of muscle origins:**
6. **Principal action of the muscle:**
7. **Direction of the muscle’s fibers:**

****



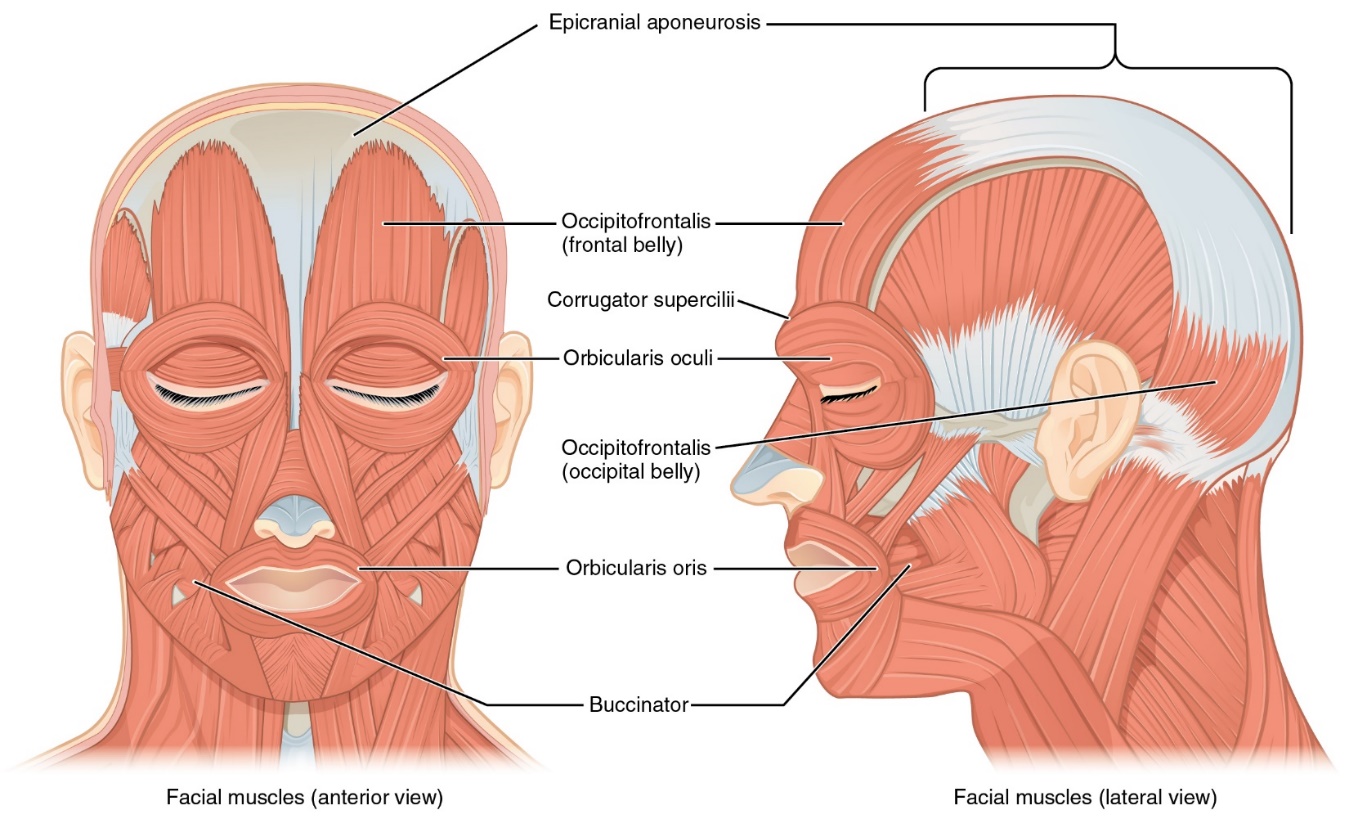
**Figure 7.2** Overview of anterior and posterior muscles.

**Activity 7.2: Origins, Insertions, Actions and Fascicular arrangements of axial muscles**

For each of the following groups of muscles, use the anatomical models in the lab and the figures in this chapter to exam the individual muscle’s origins, insertions, and fascicle arrangement. Fill out the table after completing your examination of the anatomical models and figures.

# **Muscles of facial expression**

The origins of the muscles of facial expression are on the surface of the skull (remember, the origin of a muscle does not move). The insertions of these muscles are connected to the dermis of the skin. Because the muscles insert in skin rather than bone, when they contract, the skin moves to create facial expression.



**Figure 7.3** Muscles of Facial Expression

# **Complete the table for Facial Muscles**

|  |  |  |  |
| --- | --- | --- | --- |
| Muscle Name | Origin | Insertion | Action |
| Frontalis |  |  |  |
| Occipitalis |  |  |  |
| Orbicularis oris |  |  |  |
| Zygomaticus major |  |  |  |
| Buccinator |  |  |  |
| Mentalis |  |  |  |
| Platysma |  |  |  |
| Orbicularis oculi |  |  |  |

# **Anatomy in Clay® Instructions**

To demonstrate your understanding of origins, insertions, and fascicle arrangement of the muscles, you will use an oil-based clay to form select muscles on the Manikin®. Please follow the instructions below. If you are unsure of what to do, ask your instructor.

* Keep your space clean and organized.
* Keep track of your tools and supplies.
* Feel free to stand or sit when working on your model.
* Move your model around so it is easy to build on but be careful!
* Use dry paper towels to remove clay from hands and tools (DO NOT USE SOAP OR WATER).
* Use red/ terra cotta clay to build muscles.
* Always keep the clay on the green mats.

**Clean Up at the end of lab period**

1. Take all clay off the model!

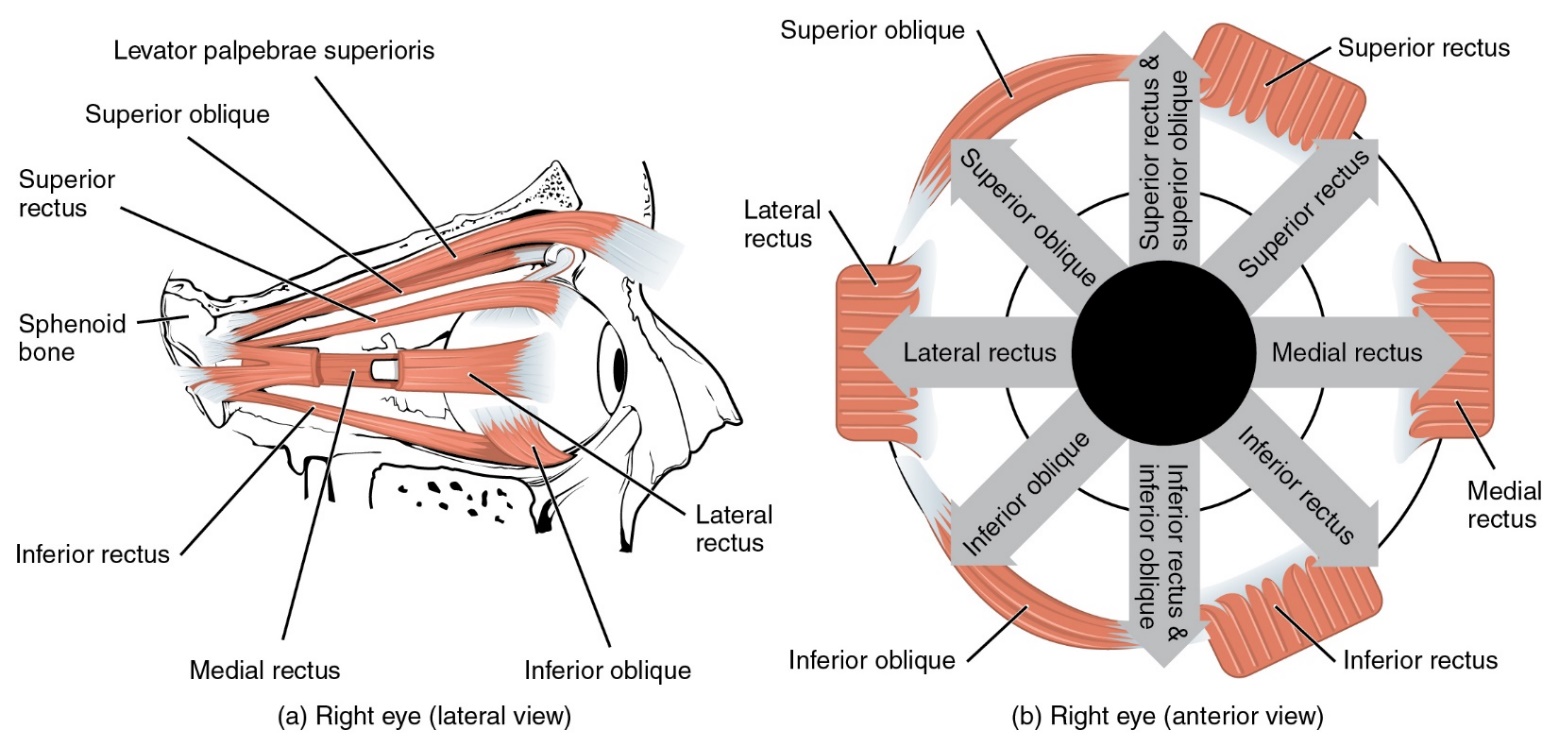
2. Roll into balls **NO BIGGER** than image below and organize into plastic bags.

3. Use dry paper towels to wipe off as much clay as possible from the model and tools used.

4. Return your model to its original place.

# **Muscles that Move the Eye**

It takes six extraocular muscles to create the fine tandem movements of the eyes. These muscles originate behind the eye and insert on the sclera (the white of the eye). Like the muscles of facial expression, the muscles that move the eye are a rare example of skeletal muscle inserting into non-bony attachments.

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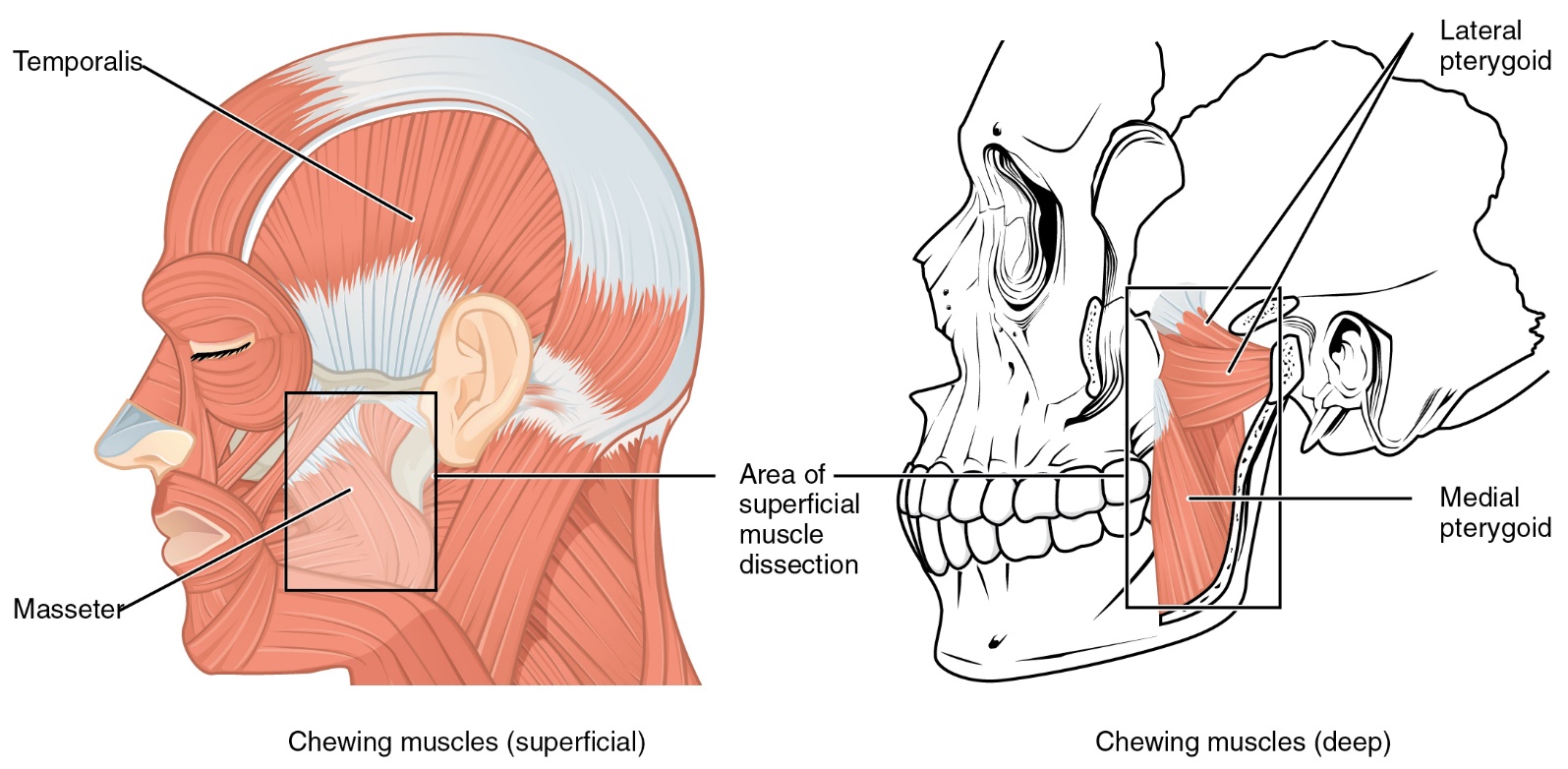
**Figure 7.4:** Muscles that Move the Eye

# **Complete the table for Eye Muscles**

|  |  |  |  |
| --- | --- | --- | --- |
| Muscle Name | Origin | Insertion | Action |
| Superior rectus |  |  |  |
| Inferior rectus |  |  |  |
| Lateral rectus |  |  |  |
| Medial rectus |  |  |  |
| Superior oblique |  |  |  |
| Inferior oblique |  |  |  |

# **Muscles of Mastication**

These muscles close the mandible. This movement is especially important when we chew food, hence the name muscles of mastication (chewing).



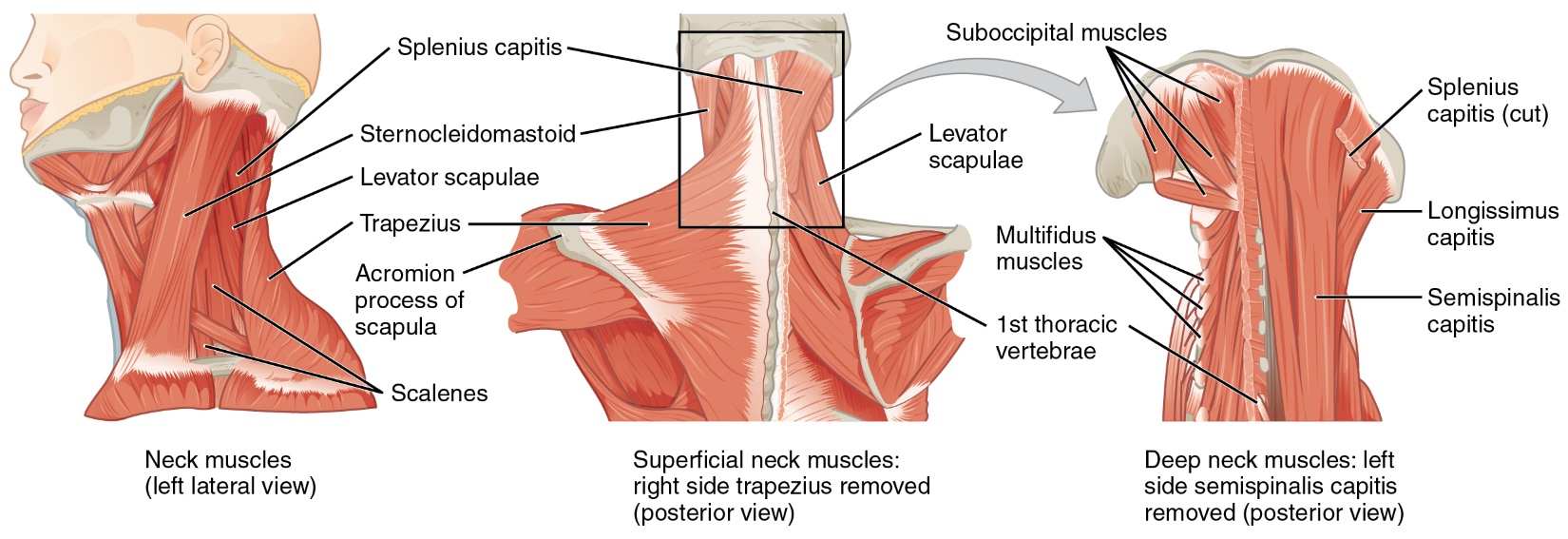
**Figure 7.5** Muscles of Mastication

# **Complete the table for Muscles of Mastication**

|  |  |  |  |
| --- | --- | --- | --- |
| Muscle Name | Origin | Insertion | Action |
| Temporalis |  |  |  |
| Masseter |  |  |  |
| Lateral Pterygoid |  |  |  |
| Medial Pterygoid |  |  |  |

# **Muscles that Move the Head**

The head pivots on the vertebral column and as such can flex, extend, and rotate. The head muscles perform flexion, extension and rotation depending on the contraction coordination. For example, if only one sternocleidomastoid contracts (**unilaterally**), the head will rotate but if both sternocleidomastoids contract (**bilaterally**), the head will flex.



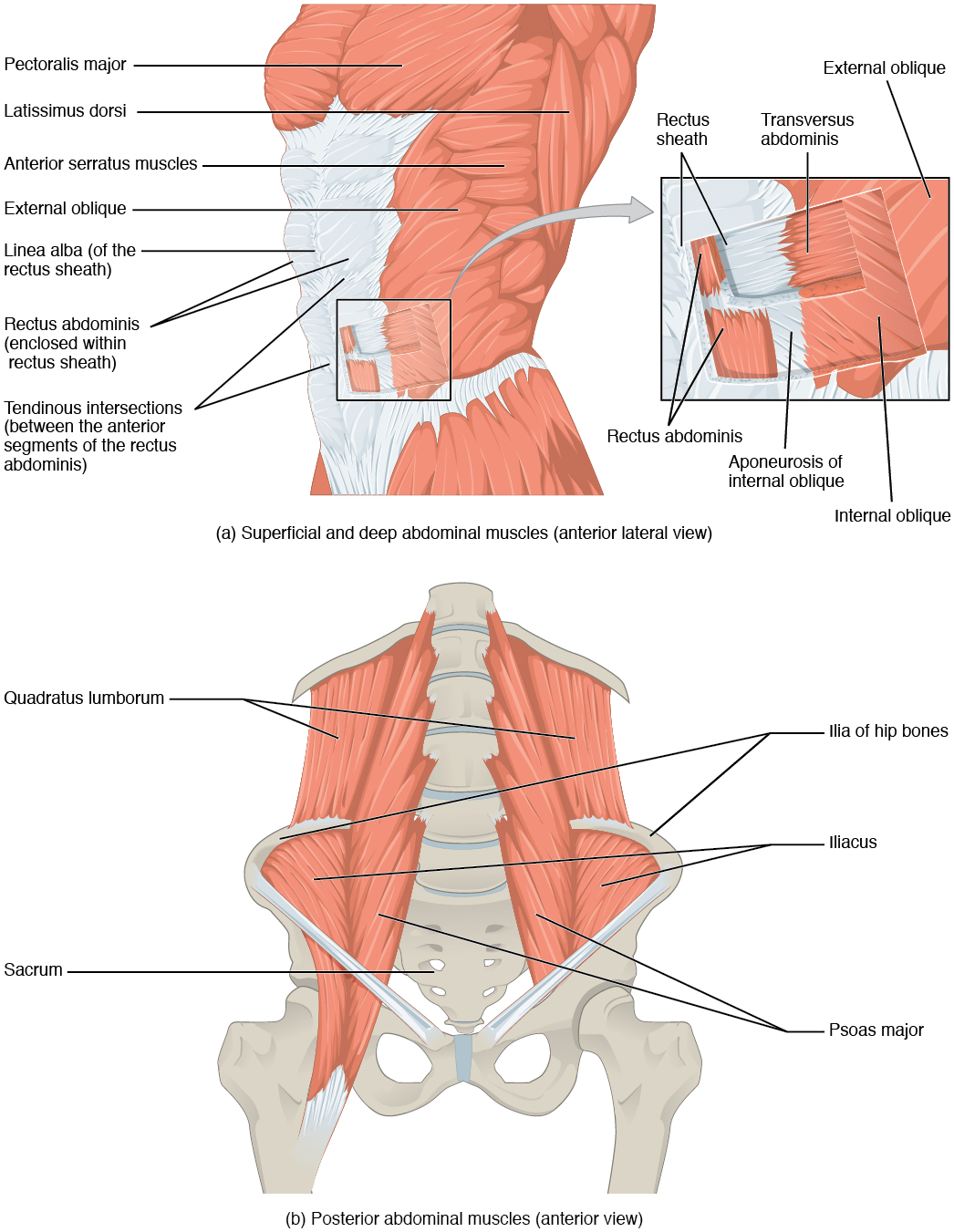
**Figure 7.6** Muscles that Move the Head

|  |  |  |  |
| --- | --- | --- | --- |
| Muscle Name | Origin | Insertion | Action |
| Sternocleidomastoid |  |  |  |
| Semispinalis capitis |  |  |  |
| Splenius capitis |  |  |  |
| Longissimus capitis |  |  |  |

# **Activity 7.3: Anatomy in Clay® - Muscles that move the Head**

On your model, place the **sternocleidomastoid** and **semispinalis capitis** muscles and include the fascicle orientation.

# **Muscles of the Anterior Abdominal Wall**

These muscles are important to human locomotion as they stabilize our core, help with posture, and protect the abdominal organs. There are four pairs of abdominal muscles that cover the anterior and lateral abdominal region and meet at the midline of the body anteriorly. The muscles of the anterolateral abdominal wall can be divided into four groups: the **external obliques**, the **internal obliques**, the **transversus abdominis**, and the **rectus abdominis**.

**Figure 7.7** Muscles of the Anterior Abdominal Wall

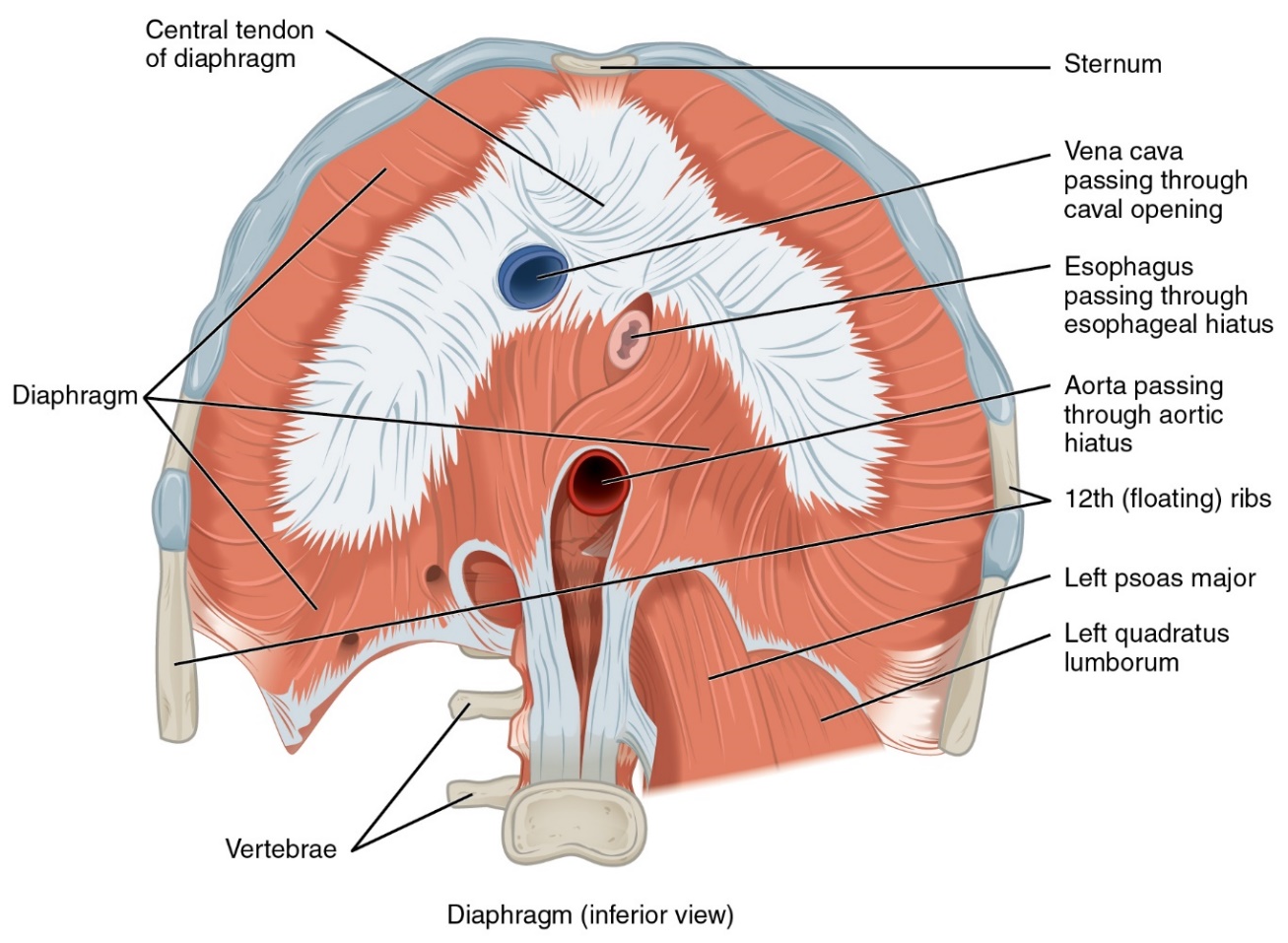
|  |  |  |  |
| --- | --- | --- | --- |
| Muscle | Origin | Insertion | Action |
| Rectus abdominis |  |  |  |
| External oblique |  |  |  |
| Internal oblique |  |  |  |
| Transverse abdominis |  |  |  |

# **Activity 7.4: Anatomy in Clay® - Muscles of the Anterior Abdominal Wall**

On your model, place the **rectus abdominis** and **transverse abdominis** muscles and include the fascicle orientation.

**Diaphragm: the primary muscle of Breathing*.***

The volume and pressure within the thoracic cavity changes during breathing and is due to the alternating contraction and relaxation of the **diaphragm**. Additionally, it serves as a physical barrier between the thoracic and abdominal cavities. The superior surface of the diaphragm is convex, creating the elevated floor of the thoracic cavity. The inferior surface is concave, creating the curved roof of the abdominal cavity.



**Figure 7.8** Muscles used in Breathing

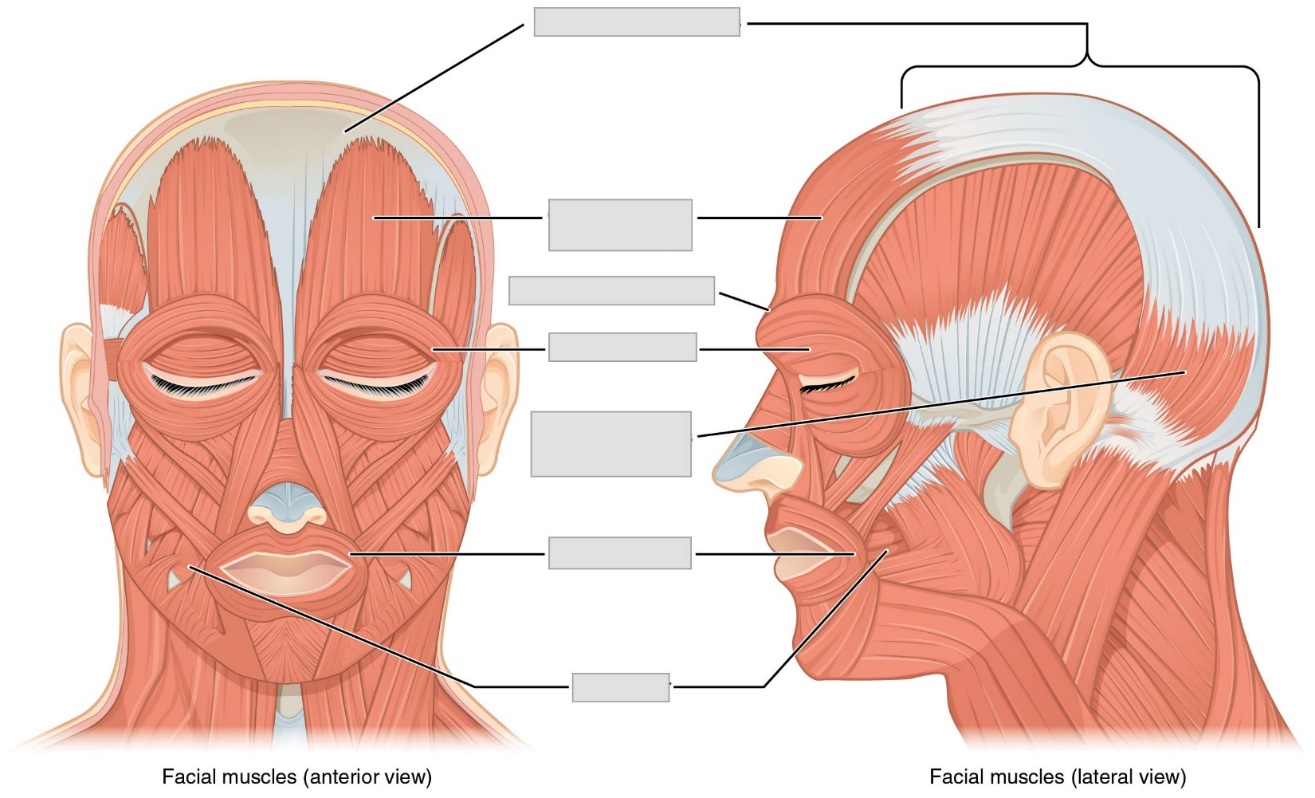
|  |  |  |  |
| --- | --- | --- | --- |
| Muscle | Origin | Insertion | Action |
| Diaphragm |  |  |  |
| External intercostal |  |  |  |
| Internal intercostal |  |  |  |

**Post-Lab 7 Review**

# **Post Lab Activity 7.1: Identify the Axial muscle**

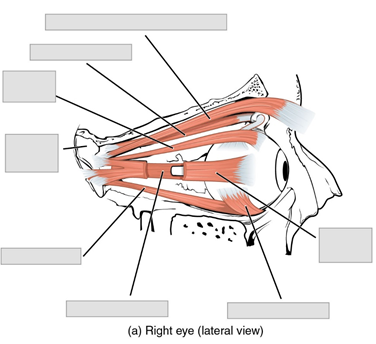
On the diagram below identify the muscle using the appropriate letter.

1. Orbicularis oris
2. Orbicularis oculi
3. Frontalis
4. Occipitalis
5. Buccinator
6. Epicranial aponeurosis



**Figure 7.9**: Unlabeled facial muscles.

# **Post Lab Activity 7.2: Identify the Axial Muscle**

On the diagram below identify the muscle using the appropriate letter. 

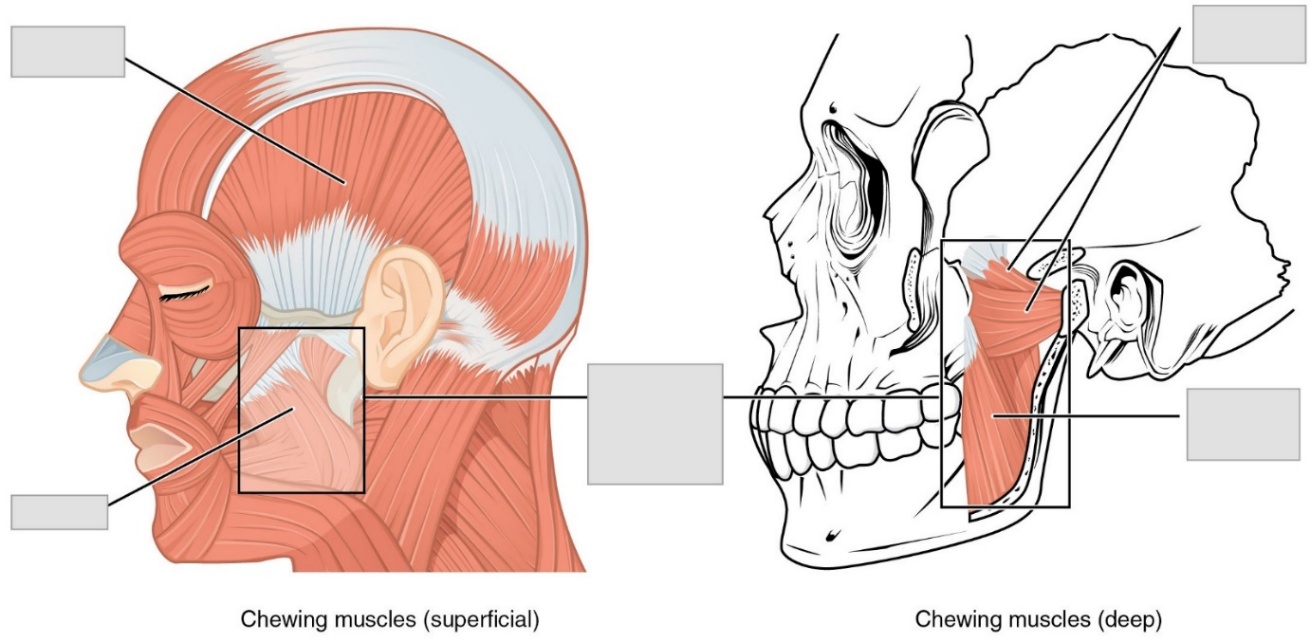
1. Inferior oblique
2. Medial rectus
3. Superior oblique
4. Lateral rectus
5. Superior rectus
6. Inferior rectus

**Figure 7.10**: Unlabeled muscles of the eye.

# **Post Lab Activity 7.3: Identify the Axial Muscle**

On the diagram below identify the muscle using the appropriate letter.

1. Lateral pterygoid
2. Medial pterygoid
3. Temporalis
4. Masseter



**Figure 7.11**: Unlabeled muscles of the jaw.

# **Post Lab Activity 7.4: Axial Muscle OIA**

Match the axial muscle to its origin, insertion, or action

|  |  |  |
| --- | --- | --- |
| Letter | Muscle | OIA |
|  | Mentalis | a. insertion is superior border of rib below |
|  | Temporalis | b. action is elevation and retraction of the mandible |
|  | Lateral pterygoid | c. origin is the pubic bone |
|  | Longissimus capitis | d. action is abducting the eye |
|  | Rectus abdominis | e. origin is the sphenoid |
|  | External oblique | f. action is compressing the abdomen |
|  | External intercostals | g. origin is the mandible |
|  | Lateral rectus | h. action is pressing the cheeks against the lips and teeth and assists in mastication |
|  | Transverse abdominis | i. insertion is iliac crest, pubic bone and linea alba |
|  | Buccinator | j. insertion is the mastoid process |