

LAB 3: DISSECTION: SHOULDER AND PECTORAL REGION

GOALS

PRE-LAB PREPARATION

1. Study the scapula, clavicle, and proximal humerus and identify their named parts.
2. Dissect the breast and identify its features in female cadavers.
3. Reflect the skin and superficial fascia from the anterior and lateral thoracic wall.
4. Clean and reflect the pectoral muscles and clean the serratus anterior muscle.
5. Identify the nerves and vessels supplying the muscles in Goal #4.
6. Bluntly dissect the axilla (armpit region) to identify the axillary vessels.
7. Review the muscles of the posterior shoulder that move the scapula and upper limb.
8. Identify the boundaries and contents of the quadrangular and triangular spaces.
9. Identify the muscles of the rotator cuff and describe their functions.
10. Identify the anatomic features of the glenohumeral (shoulder) joint.

- As will be the case for all lab sessions, **PLEASE COME TO LAB PREPARED!**
- You will have to work quickly and efficiently, as you need to identify the structures in the check-list during this session.
- Please read this Dissector and look at Atlas figures **BEFORE YOU COME TO LAB.**
- Work as a team in the peer teaching and learning mode during lab.
- Unless otherwise instructed, follow the dissection instructions in this Dissector.

OSTEOLOGY OF THE SHOULDER REGION

Scapula

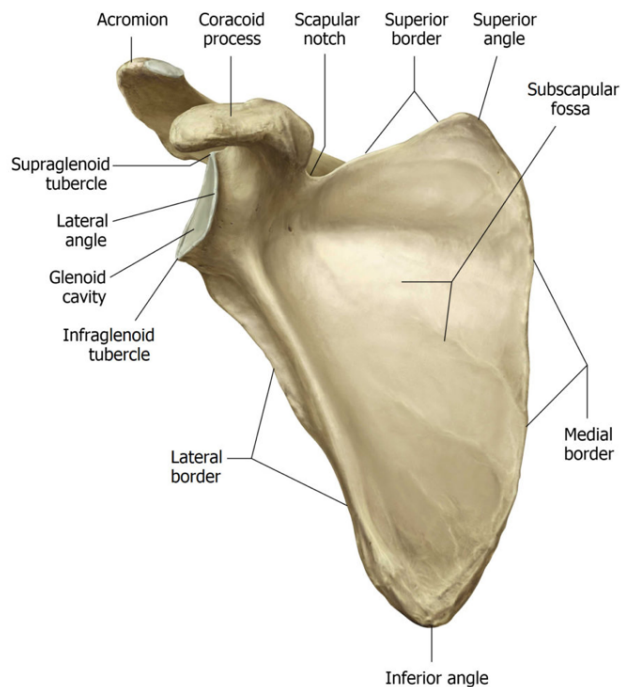


COMPLETE ANATOMY

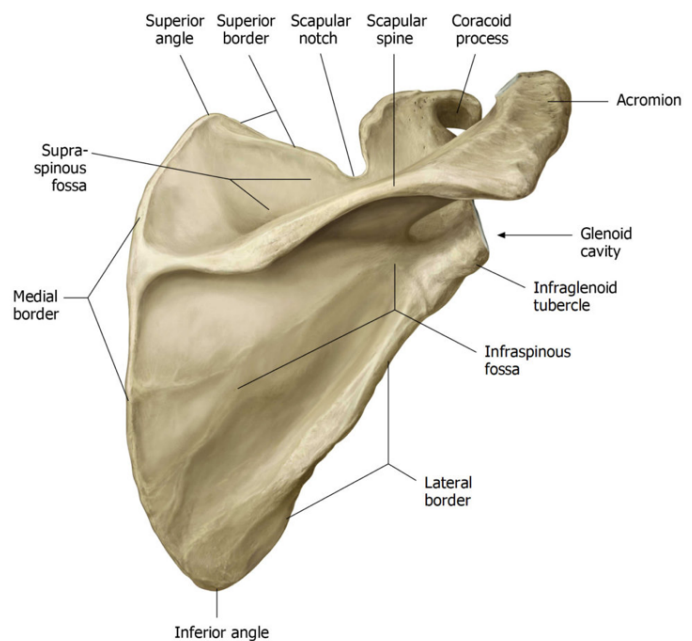
Scapula

On an isolated scapula, locate the following:

- **Borders of Scapula: Superior, Lateral, and Medial**
 - Along the superior border, locate the **scapular notch** (contains the suprascapular nerve and vessels)
- **Inferior Angle**
- **Supraspinous and Infraspinous Fossae**
- **Subscapular fossa**
- **Acromion**
- **Coracoid process**
- **Glenoid cavity**
- **Supraglenoid and infraglenoid tubercles:** for the attachment of the long head of the biceps brachii and the long head of the triceps brachii muscles, respectively.



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Figure 3.1. Anterior view (left) and posterior view (right).

Clavicle



COMPLETE ANATOMY

Clavicle

On an isolated clavicle, locate the following:

- **Sternal end**
- **Acromial end**
- **Shaft of clavicle. Is it straight? No! It has a “double curve”—do you see this?**

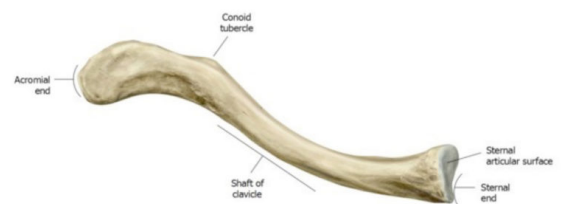


Figure 3.2. Right clavicle.

QUESTION



Divide the clavicle into thirds. In which portion are clavicle fractures most likely to occur? Why?

Humerus



COMPLETE ANATOMY

Humerus

On an isolated humerus, locate the following at the proximal end:

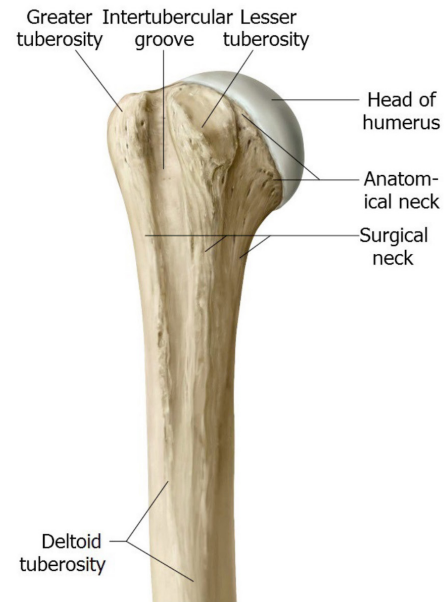
- **Head of humerus**
- **Anatomical neck**
- **Greater and lesser tubercles**
- **Intertubercular (bicipital) groove**

QUESTION



Why is it called “bicipital”? [Hint: it contains a muscle tendon—which one?]

- **Surgical neck**
- **Deltoid tuberosity**
- **Groove for radial nerve**



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Figure 3.3. Proximal humerus.

Joints of the Shoulder Region

Identify these on the skeleton:

- **Sternoclavicular joint**
- **Acromioclavicular joint**
- **Glenohumeral joint**
- **Scapulothoracic joint** (is this a “true” joint?)

In your group, demonstrate and discuss the movements of the **scapula**:

- **Elevation**
- **Depression**
- **Protraction**
- **Retraction**
- **Upward rotation**
- **Downward rotation**

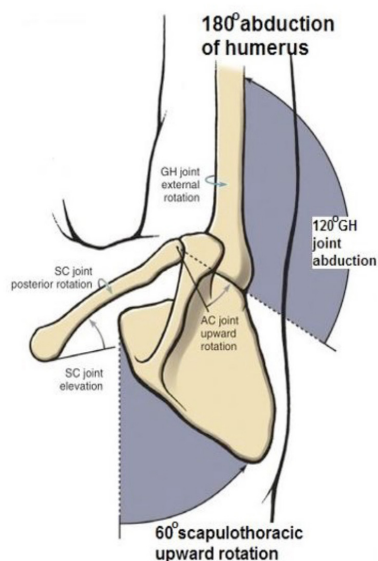


Figure 3.4. Scapulohumeral rhythm for full abduction.

QUESTION



To achieve full 180-degree upper limb abduction at the glenohumeral joint, the scapula must rotate upward. Why?

Demonstrate and discuss the movements of the humerus at the **glenohumeral (shoulder) joint**:

- **Abduction**
- **Adduction**
- **Flexion**
- **Extension**
- **Circumduction**
- **Medial (Internal) rotation**
- **Lateral (External) rotation**

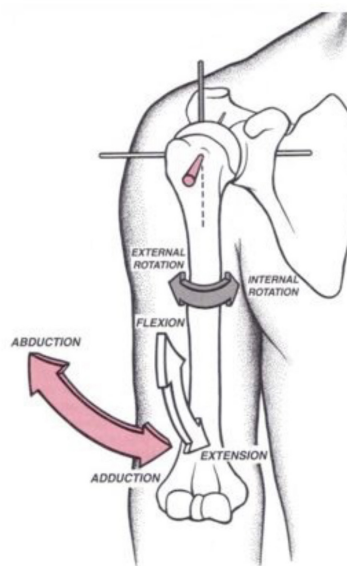


Figure 3.5. Movements at glenohumeral joint.

SURFACE ANATOMY: INSPECTION AND PALPATION

Your donor should be supine. Palpate and attempt to locate the following on your donor. Consult a skeleton for reference.

- Clavicle
- Costal cartilages and costal margin
- Sternum:
 - Suprasternal (jugular) notch
 - Manubrium
 - Sternal angle
 - Body
 - Xiphoid process
- Acromion and coracoid process of scapula

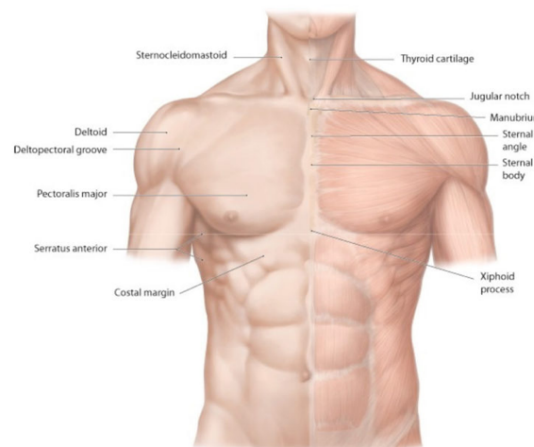


Figure 3.6.

Female donors: Inspect the breasts and note the **nipple** and **areola**.

- Bumps on the areola in the living body are due to underlying sebaceous glands called **areolar glands** (Montgomery's glands). They will be difficult to see in the donor.
- Determine the extent of the **base of the breast** = Which ribs (numbers) and muscles does it overlie?
- The breast has an **axillary tail** that extends into the armpit.

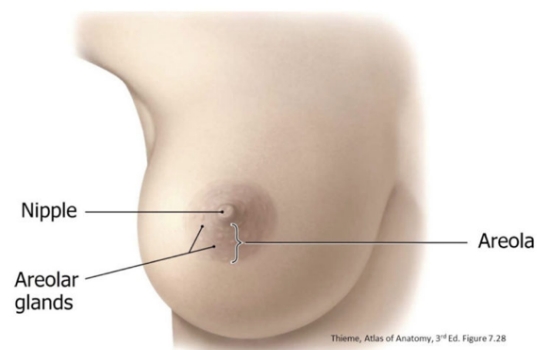


Figure 3.7.



COMPLETE ANATOMY

Breast



Dissect the breast in female donors

If you have a male, observe this dissection at another table. **Do the breast** dissection before removing the skin of the thorax.

- 1 Make a shallow incision in the skin around the **areola**, then make shallow sagittal and transverse incisions, dividing the skin over the breast into **four quadrants**.
- 2 Reflect only the skin away from the areola, producing four skin flaps. Tug on the upper flaps in order to locate the fibrous **suspensory ligaments (Cooper's ligaments)**. These course between the fibroglandular tissue in the core of the breast and the overlying dermis. What is their function?
- 3 Divide the breast into two equal halves with a deep sagittal incision through the center of the breast, down to the muscle.
- 4 Look at the cut surfaces and identify the **fibroglandular tissue** in the center of the breast. See Figure 3.9.
- 5 Probe below the nipple to find **lactiferous ducts**.
- 6 Place your finger under one of the hemi-breasts and create a plane between the pectoralis major muscle and breast itself = your finger is in the **retromammary space**. What is its functional and clinical significance?
- 7 The dense fascia at the base of the breast superficial to your finger is **retromammary fascia** = this is part of the body wall's superficial fascia.
- 8 The fascia deep to your finger on the pectoralis major muscle is **pectoral fascia**. This is deep fascia—also called “investing” fascia.
- 9 Clinicians divide the breast into **quadrants** (using vertical and horizontal lines through the nipple). These are called Upper Medial, Upper Lateral, Lower Medial, and Lower Lateral.

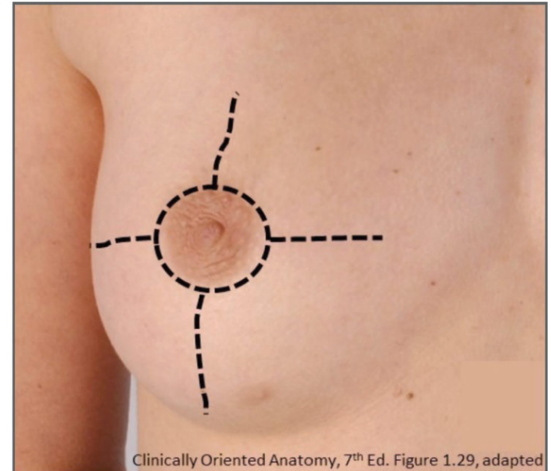


Figure 3.8.

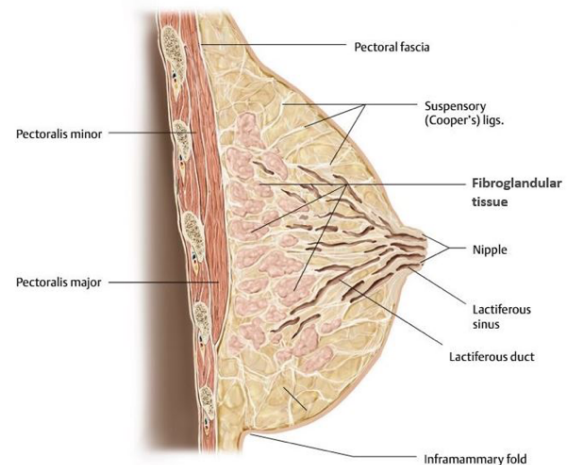


Figure 3.9.

QUESTION



Recalling that the breast has an axillary tail: which of the breast quadrants is largest and therefore has the most fibroglandular tissue? What bearing might this have on breast tumors?

CHALK TALK



The breast dissection may not be particularly satisfying. Be sure to do a chalk talk with your team concerning the female breast anatomy. The clinical significance of the breast warrants this.

QUESTION

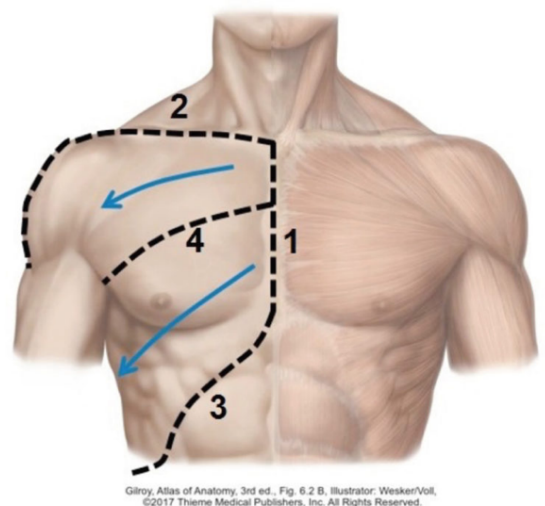


When discussing breast anatomy, consider its lymphatic drainage. Which lymph nodes receive most of the breast's lymphatic drainage? What is the definition of the term "sentinel nodes"?



Reflect the skin (and breast) from the anterior and lateral thoracic wall

- 1 Make skin incisions as shown in the diagram, **on both sides of the body**. Cut into the superficial fascia, but not into the muscles.
- 2 Carry incision 2 along the clavicle and over the shoulder into the upper arm.
- 3 Carry incisions 3 and 4 to the **mid-axillary line** (as close to the table top as possible). Incision 3 runs along the **costal margin**.
- 4 Reflect the skin, superficial fascia, and breast together as flaps laterally. Leave the flaps attached to the body so they can be closed at the end of lab to keep the body moist.
- 5 Clean fat and fascia from the **pectoralis major muscles**. Don't worry if they aren't squeaky clean.



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Figure 3.10.

NOTE



If your donor has a pacemaker implanted in the chest wall, notify an instructor so it can be removed properly. **DO NOT cut the leads (wires) of the pacemaker.**

You may see these while dissecting:

- **Anterior cutaneous branches of intercostal nerves** and **perforating branches of internal thoracic arteries** poking out through the intercostal spaces just lateral to the sternum.
- **Lateral cutaneous branches of intercostal nerves** and **lateral cutaneous branches of posterior intercostal arteries** poking out between the “serrations” of the serratus anterior muscle in the lateral chest wall.

These provide the segmental sensory nerve supply and segmental blood supply to the superficial tissues of the body wall.

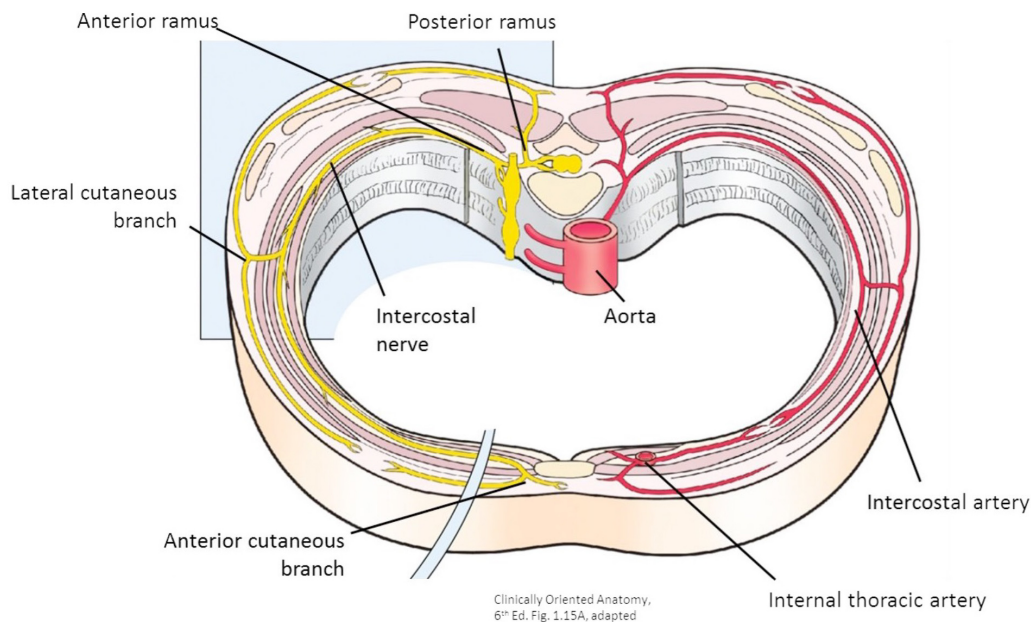


Figure 3.11. Spinal nerve branches, superior view. NOTE THE SEGMENTATION.



Cut and reflect the pectoralis major and minor muscles



COMPLETE ANATOMY

Pectoral region

- 1 Loosen the pectoralis major from the chest wall with **blunt dissection** (create an opening under the muscle with scissors along the inferior edge—then slide your fingers under the muscle through this opening to create a plane). With a scalpel or scissors cut the pectoralis major's proximal attachments to the **clavicle, sternum, and ribs**. Reflect the muscle laterally toward the upper limb (the distal attachment of the muscle).
- 2 Cut the pectoralis minor's proximal attachment to the ribs and reflect the muscle superiorly toward its distal attachment to the **coracoid process** of the scapula.
- 3 Carefully clean the **neurovascular bundles** (nerve, artery, and vein) that enter the deep surfaces of the muscles.

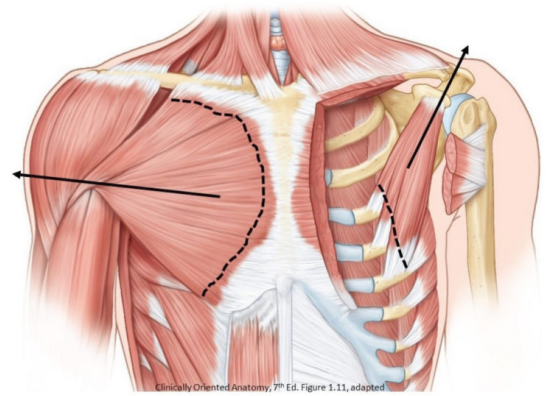


Figure 3.12. Reflecting pectoralis major and pectoralis minor.

NOTE



Nerves and vessels usually enter the deep surfaces of muscles where they are protected.

QUESTION



The “**origin**” of a muscle is defined as the point of attachment that is most stable and less moveable when the muscle contracts. It is usually the proximal attachment. The “**insertion**” is defined as the attachment that moves when the muscle contracts. It is usually the distal attachment of the muscle. Can you describe the origin and insertion of the pectoralis major and minor muscles?

Identify:

- **Lateral pectoral nerve** (with pectoral artery and vein): courses above the superior border of pectoralis minor, then into the deep surface of pectoralis major.
- **Medial pectoral nerve**: penetrates (and innervates) the pectoralis minor first, then passes into pectoralis major. **Therefore, the pec major is innervated by BOTH pectoral nerves.**

QUESTION



What the heck? The medial and lateral pectoral nerves don't seem aptly named. Why are they named this way???

► ANSWER



Clean the axilla with blunt dissection and scissors

In the next lab session we will be studying the axillary region in detail. However, if you have time today you should start working in this area to find some of the structures related to the shoulder.

- 1 The **axilla** (armpit) is the pyramid-shaped space under the shoulder joint, where the upper limb meets the trunk. The nerves and vessels to the upper limb pass through the axilla. Abduct the donor's upper limb as far laterally as possible. Use your fingers to loosen up the axilla. The fascia and fatty tissue here are dense and thick and must be separated with scissors (DON'T CUT—instead use the open-and-close method)!
- 2 Clean the lateral wall of the chest (this is the medial wall of the axilla) and identify the **serratus anterior muscle**. Note its “serrated” attachments to the ribs. This muscle depresses and protracts the scapula, keeping it flush against the body wall.
- 3 Clean and identify the **long thoracic nerve** coursing along the surface of the **serratus anterior**. It passes from superior to inferior. Its origin is in the root of the neck, above the axilla, from the **brachial plexus** (spinal nerves C-5, C-6, and C-7).

CLINICAL CORRELATION



The course of the long thoracic nerve on the external surface of the serratus anterior muscle is an exception. This makes the nerve vulnerable to injury. Paralysis of the muscle (damage to the long thoracic nerve) could cause the medial border of the scapula to protrude posteriorly—a condition called “winged scapula.”

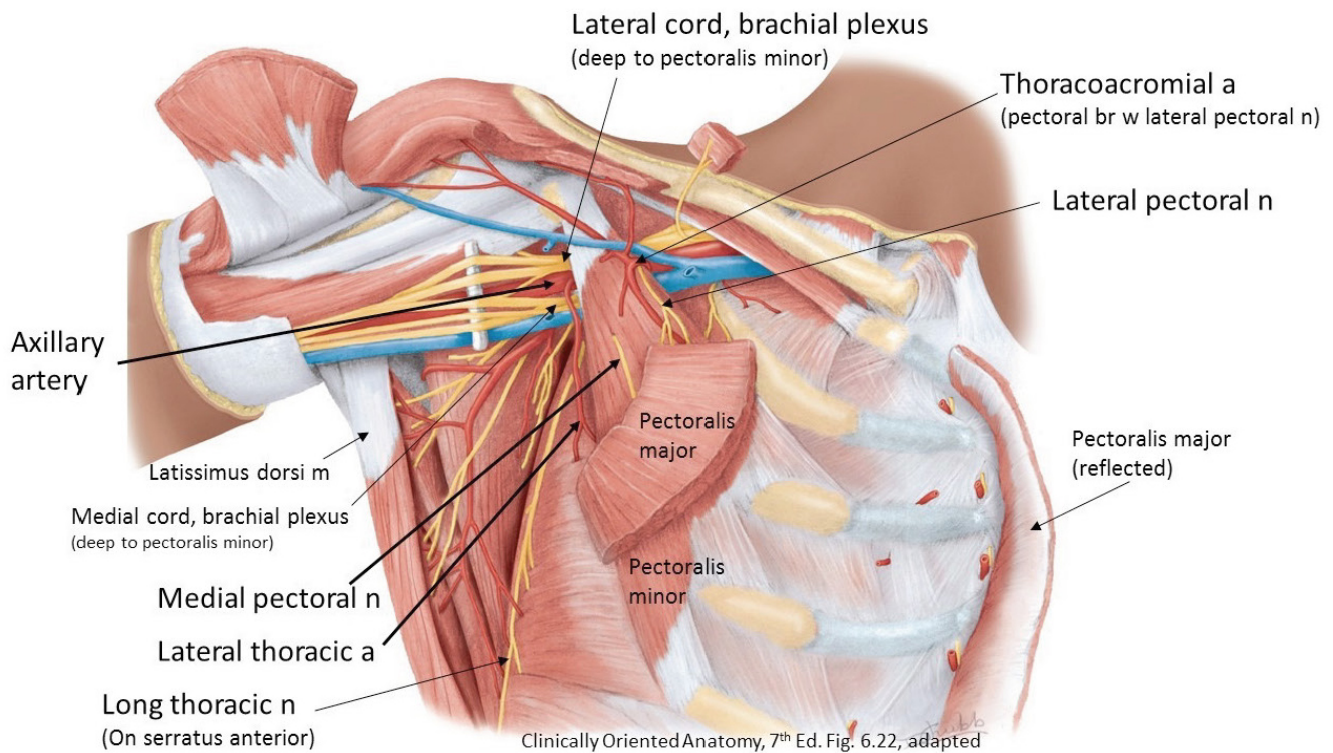


Figure 3.13.

- 4 Clean the **axillary artery and vein**. What is their relationship to the pectoralis minor muscle? Carefully clean the artery in order to identify two of its branches that supply muscles in the pectoral region:
 - o the **thoraco-acromial trunk** = this short vessel gives off pectoral arteries that supply the pec major and minor muscles
 - o the **lateral thoracic artery** = it travels in tandem with the long thoracic nerve to supply the serratus anterior muscle. Don't get the lateral thoracic artery and long thoracic nerve confused!
- 5 Look for **axillary lymph nodes** in the fascia surrounding the axillary vein. If your donor has prominent or enlarged nodes, notify other groups in the lab to come and have a look. Axillary nodes are important, as they receive lymph from the entire upper limb, the breast, and all the superficial tissues of the trunk wall above the umbilicus ("belly button"). That's a lot of territory!

PROSECTIONS: ROTATOR CUFF AND GLENOHUMERAL JOINT

There are three prosections you should review to study the anatomy of the posterior shoulder, rotator cuff, and glenohumeral joint. An instructor will demonstrate these to groups of students.

Muscles of the Posterior Shoulder



COMPLETE ANATOMY

Muscles of the shoulder

These muscles move the scapula and upper limb. You saw many of these muscles in the previous lab session, but now is a good time to review these in detail, particularly their role in movement of the shoulder. You will see these on a dissection of the back (donor in prone position).

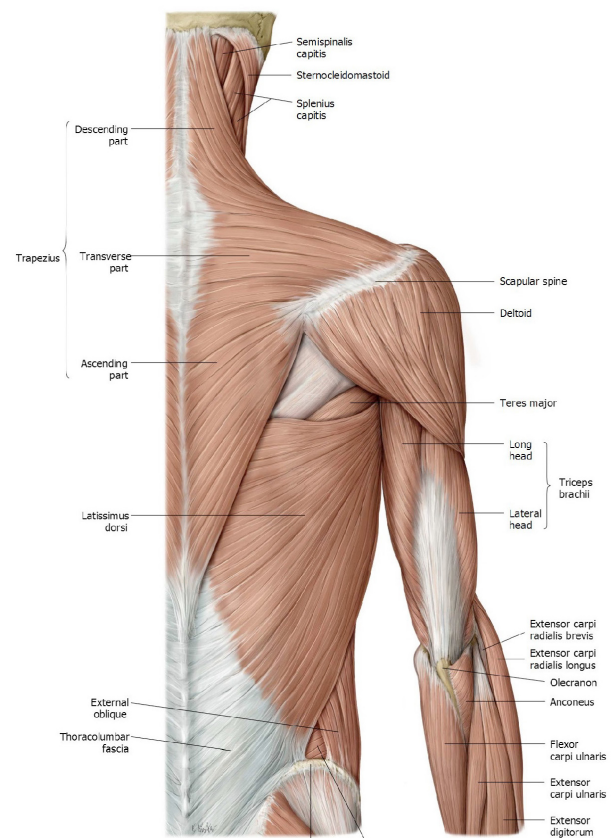
On the superficial side of the dissection, identify the following muscles:

- **Trapezius**
 - Trace out its **upper portion (descending fibers)**, **middle portion (transverse fibers)**, and **inferior portion (ascending fibers)**.

QUESTION



What are the functions of these parts of the muscle?



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Figure 3.14.

- **Latissimus dorsi**
- **Posterior part of the deltoid muscle**
- **Triceps brachii**—this muscle is in the posterior arm.
 - The **lateral head** and **long head of the triceps** should be visible.



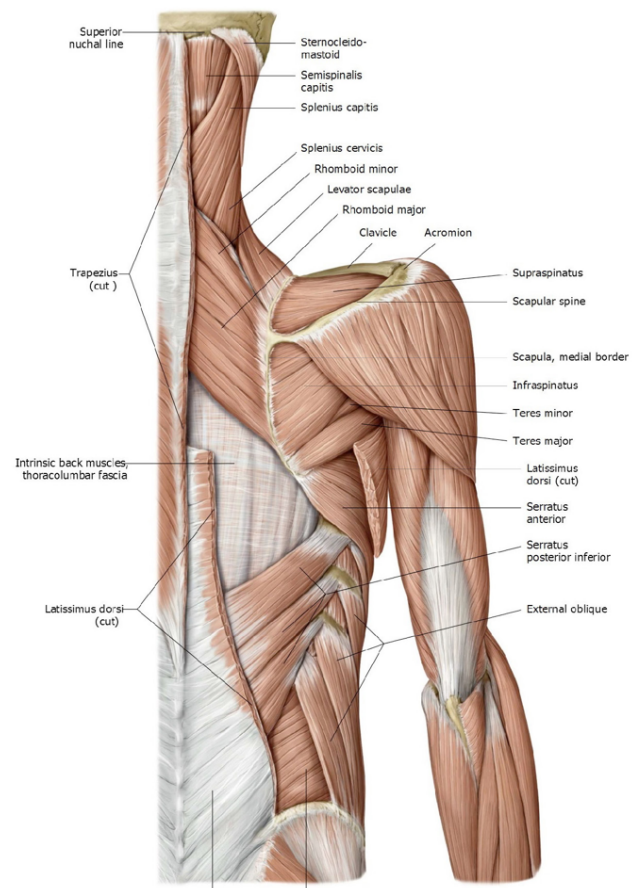
KNOW THE ATTACHMENTS, ACTIONS, AND INNERVATIONS OF THE MUSCLES LISTED ABOVE.

On the deep side of the dissection, identify the following muscles:

- **Rhomboid muscles** (major and minor)
- **Levator scapulae**
- **Supraspinatus**
- **Infraspinatus**
- **Teres minor**
- **Teres major**



KNOW THE ATTACHMENTS, ACTIONS, AND INNERVATIONS OF THE MUSCLES LISTED ABOVE.



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Figure 3.15.



COMPLETE ANATOMY

Neurovasculature tracts of the scapula

Geometry fans! Identify these spaces in the prosection—they transmit nerves and vessels from the axilla to the posterior shoulder. These spaces can only be identified when the posterior part of the deltoid is detached and elevated.

Quadrangular space:

- **Superior border** = teres minor muscle
- **Lateral border** = humerus
- **Medial border** = long head of triceps brachii
- **Inferior border** = teres major muscle
- The **axillary nerve** and **posterior circumflex humeral artery** traverse the quadrangular space.

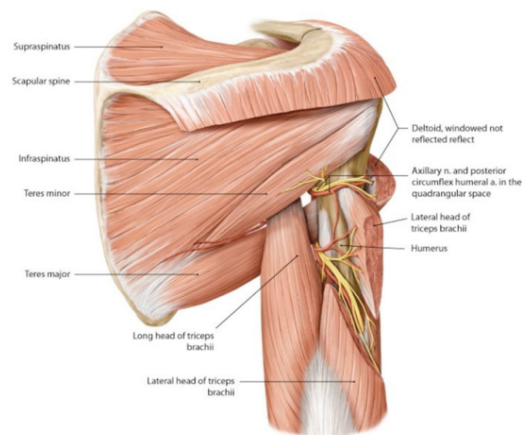


Figure 3.16.

Triangular space:

- **Superior border** = teres minor muscle
- **Lateral border** = long head of triceps brachii
- **Inferior border** = teres major muscle
- The **circumflex scapular artery** traverses the triangular space.

Table 28.10 Neurovascular tracts of the scapula			
Passageway		Boundaries	Transmitted structures
①	Scapular notch	Superior transverse lig. of scapula, scapula	Suprascapular a. and n.
②	Medial border	Scapula	Dorsal scapular a. and n.
③	Triangular space	Teres major and minor	Circumflex scapular a.
④	Triceps hiatus	Triceps brachii, humerus, teres major	Deep a. of arm and radial n.
⑤	Quadrangular space	Teres major and minor, triceps brachii, humerus	Posterior circumflex humeral a. and axillary n.

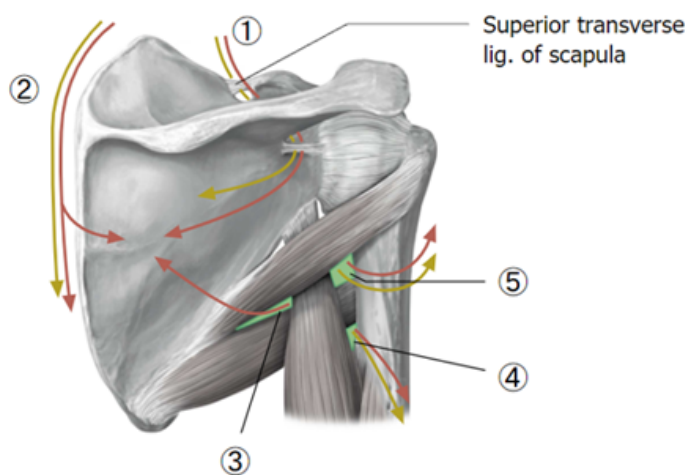


Figure 3.17.

Rotator Cuff



COMPLETE ANATOMY

Rotator cuff

On the disarticulated upper limb specimen, identify the four muscles that make up the rotator cuff:

- **Supraspinatus**
- **Infraspinatus**
- **Teres minor**
- **Subscapularis**



KNOW THE ATTACHMENTS, ACTIONS, AND INNER-VATIONS OF THESE MUSCLES.



QUESTION

Why is this group of muscles referred to as the “rotator cuff”?



QUESTION

Besides external and internal rotation, what is the important function of this muscle group with regards to the glenohumeral joint?

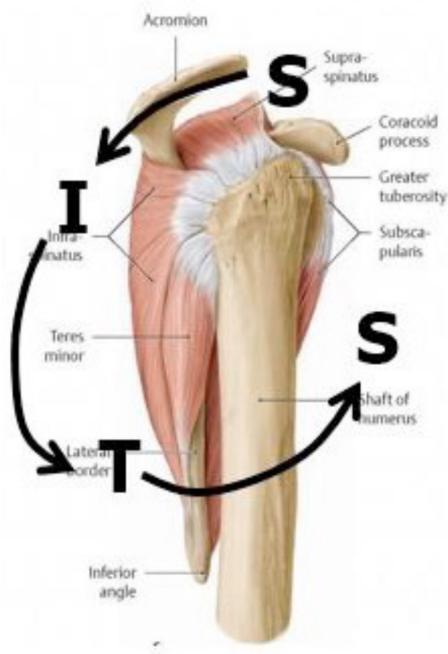


Figure 3.18.

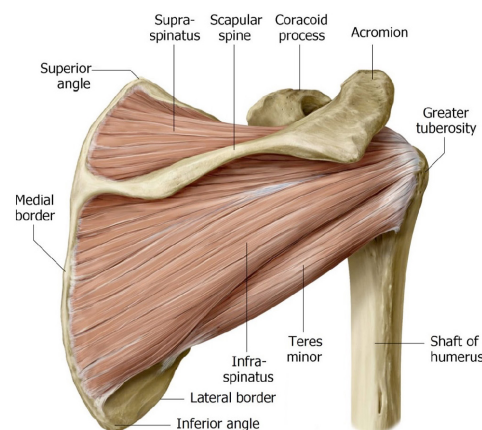


Figure 3.19.

The **posterior compartment of the arm** (containing the triceps brachii) will be visible on this specimen as well. See if you can identify the three heads of the triceps: long, lateral, and medial (some anatomists argue that the medial head should be called the “deep” head).

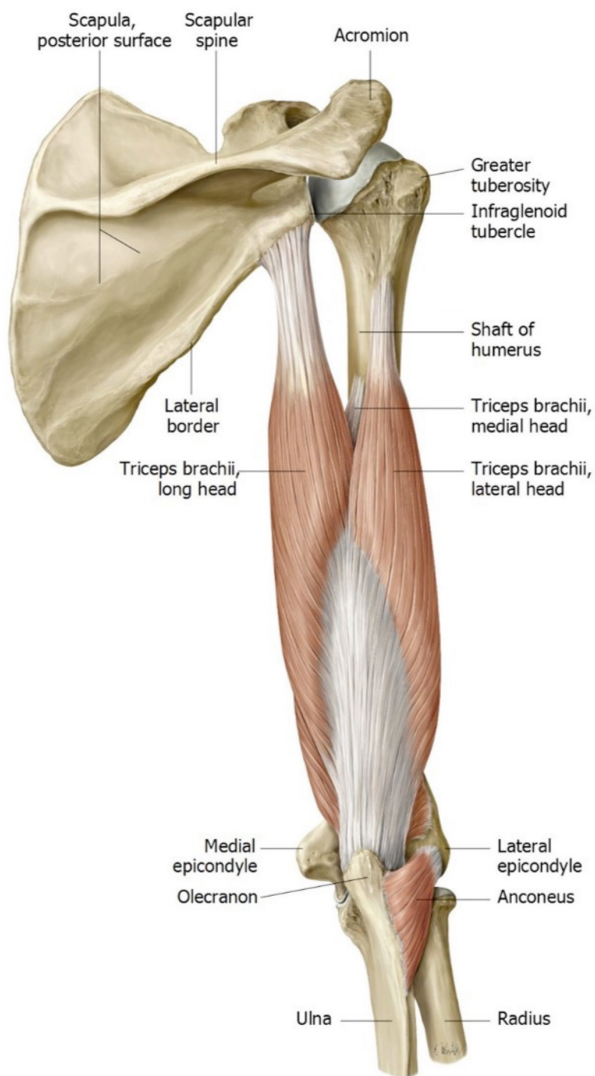


Figure 3.20.

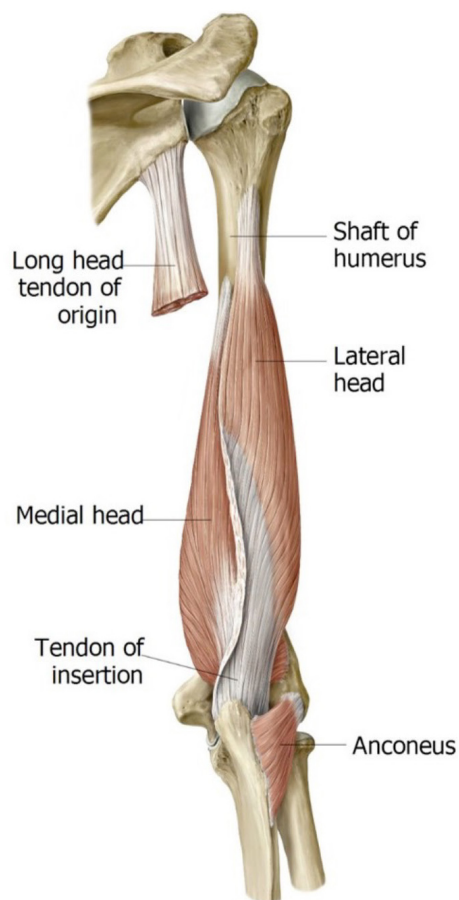


Figure 3.21.

Glenohumeral (Shoulder) Joint



COMPLETE ANATOMY

Glenohumeral joint

Review the bony anatomy of the glenohumeral joint:

- **Head of humerus**
- **Glenoid cavity of scapula**



Figure 3.22.



Figure 3.23.

QUESTION



The bony surfaces of the glenohumeral joint have poor congruence. Is the humeral head (ball) well-covered by the glenoid cavity (socket)? How does this affect joint stability?

If a prosected specimen is available with the glenohumeral joint opened (the **joint capsule** has been opened), identify the following:

- **Articular cartilage** on the humeral head and in the glenoid cavity—is it smooth?
- **Glenoid labrum**—what is its function?
- The **long head of the biceps brachii muscle** passes through the glenohumeral joint cavity. Odd! It inserts onto the supraglenoid tubercle.

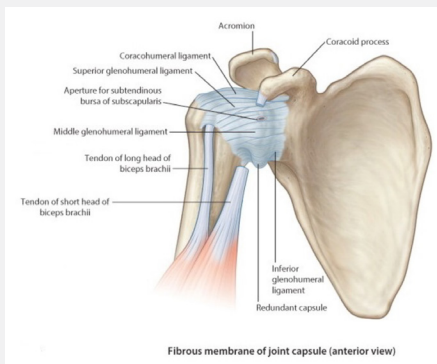


Figure 3.24.

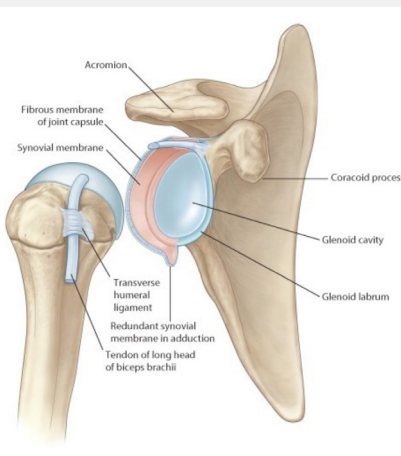


Figure 3.25.

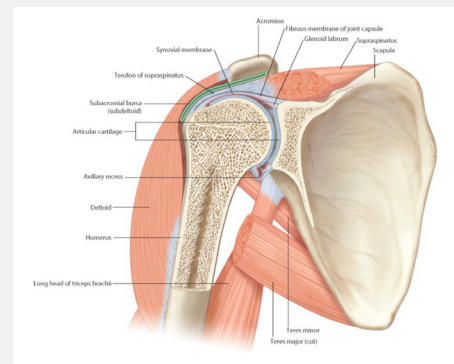


Figure 3.26.

CHECKLIST, LAB #3

REVIEW AND MAKE SURE YOU HAVE IDENTIFIED EACH OF THE STRUCTURES BELOW.

SCAPULA

- ☐ Borders of the scapula: superior, medial, lateral
- ☐ Inferior Angle
- ☐ Supraspinous and Infraspinous Fossae
- ☐ Subscapular fossa
- ☐ Acromion
- ☐ Coracoid process
- ☐ Glenoid cavity
- ☐ Supraglenoid and infraglenoid tubercles

PROXIMAL HUMERUS

- ☐ Head of humerus
- ☐ Anatomical neck
- ☐ Greater and lesser tubercles
- ☐ Intertubercular (bicipital) groove
- ☐ Surgical neck
- ☐ Deltoid tuberosity
- ☐ Groove for radial nerve

SURFACE LANDMARKS

- Clavicle
- Suprasternal notch
- Sternal angle
- Costal cartilages
- Costal margin

BREAST

- Nipple and areola
- Fibroglandular tissue
- Lactiferous ducts
- Suspensory (Cooper's) ligaments
- Retromammary space

PECTORAL REGION AND AXILLA

- Pectoralis major and minor muscles
- Serratus anterior muscle
- Medial and lateral pectoral nerves
- Long thoracic nerve
- Axillary artery and vein
- Thoraco-acromial trunk (artery) with pectoral arteries
- Lateral thoracic artery and vein

- Axillary lymph nodes

POSTERIOR SHOULDER (PRONE PROSECTION)

- Trapezius
- Latissimus dorsi
- Rhomboid muscles (major/minor)
- Levator scapulae
- Deltoid (posterior portion)
- Teres major
- Triceps brachii (long, lateral, and medial head)
- Quadrangular space (w/ axillary n. & posterior circumflex humeral a.)
- Triangular space (w/ circumflex scapular a.)

ROTATOR CUFF (ISOLATED LIMB)

- Supraspinatus
- Infraspinatus
- Teres minor
- Subscapularis

GLENOHUMERAL JOINT PROSECTION (IF AVAILABLE)

- Glenoid labrum
- Long head of biceps brachii