Lab 4: Dissection: Axilla, Brachial Plexus, and Arm

Goals

1. Identify the boundaries and contents of the axilla.
2. Learn the architecture of the brachial plexus.
3. Identify the muscles, nerves, and vessels of the arm.

Axilla

Before you dissect, discuss **the boundaries of the axilla**.

Note that it is pyramid-shaped, with its **base** facing the skin of the **axillary fossa** ("armpit", between the **anterior and posterior axillary folds**), and its apex projecting toward the neck, between the first rib and the clavicle. The walls of the axilla are summarized in Figure 4.1.

Walls of the axilla

Anterior wall	Pectoralis major Pectoralis minor Clavipectoral fascia
Lateral wall	Intertubercular groove of humerus
Posterior wall	Subscapularis Teres major Latissimus dorsi
Medial wall	Lateral thoracic wall Serratus anterior

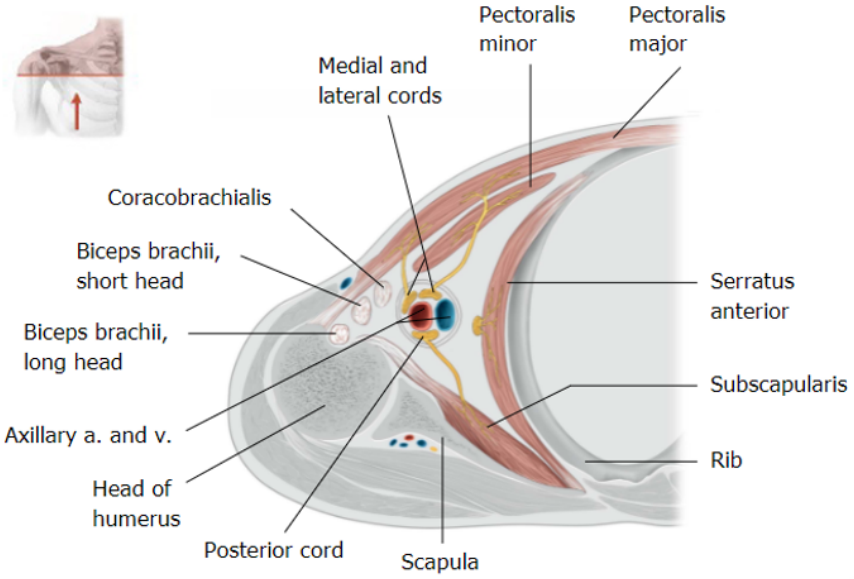


Figure 4.1.

Remove skin from the arm in preparation for dissection of the axilla.

! TAKE CARE not to cut the superficial veins of the arm—review the course of the cephalic and basilic veins BEFORE making the incisions.

1. Make a shallow incision in the midline skin of the arm, from the shoulder superiorly to just distal to the elbow inferiorly. See Figure 4.2.
2. Make a circular incision in the skin of the upper forearm, just below the elbow joint. Carry the incisions as far posterior as you can, both medially and laterally.
3. Reflect the skin as two shallow flaps: Medial and Lateral.

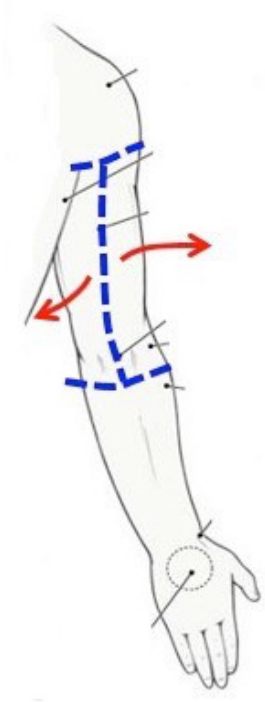


Figure 4.2.

Contents of the Axilla

Dissect the axilla on both sides of the cadaver.

! Keep the veins on one side; remove the veins on the other.

Abduct the arm to about 45° and keep it there throughout the dissection.

Use blunt dissection with fingers and sharp scissors (open-and-close technique) to pry open the axillary fascia.

Cut away fat and connective tissue to expose the **axillary vessels** and the **brachial plexus**.

Axillary Vein

COMPLETE ANATOMY
AXILLARY VEIN

On one side of the cadaver, clean and identify the veins in the axilla.

Identify the **axillary vein**, formed by union of the **basilic vein** (a superficial vein) and the paired **brachial veins** = the venae commitantes (companion veins) of the brachial artery. It changes its name proximally at the **first rib** where it becomes the **subclavian vein**.

As you clean the axillary vein, look for lymph nodes. Sometimes these are small and hard to find, but it is said there are 20 or 30 **axillary lymph nodes**.

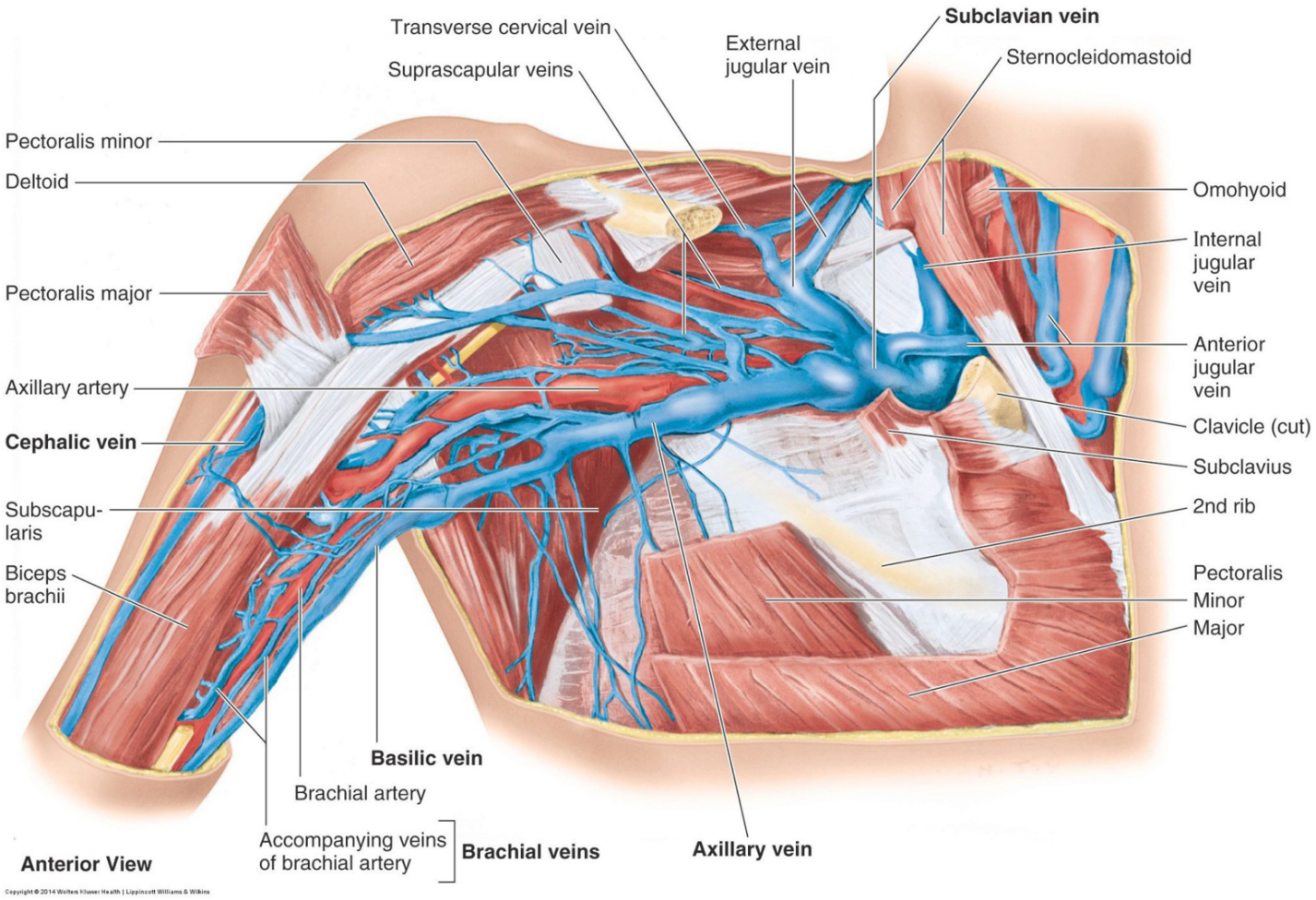


Figure 4.3.

The tributaries of the axillary vein are the **cephalic**, **basilic**, and **brachial veins**.

Axillary Artery

COMPLETE ANATOMY
AXILLARY ARTERY

On one side of the cadaver, remove the axillary vein.

Clean the **axillary artery**. Proximal to the first rib it becomes the subclavian artery. Distally at the teres major muscle it becomes the **brachial artery**.

Return the reflected **pectoralis minor muscle** to its anatomic position and note that it crosses the axillary artery. The pectoralis minor divides the axillary artery into 3 parts:

- Part 1: Proximal to pectoralis minor
- Part 2: Posterior to pectoralis minor
- Part 3: Distal to pectoralis

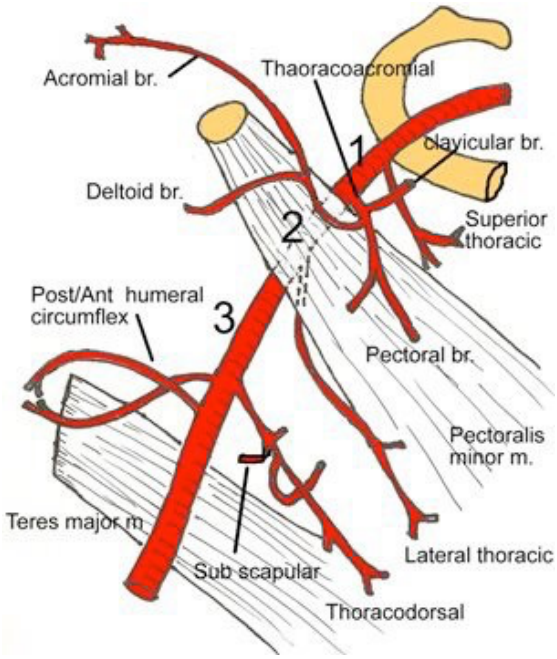


Figure 4.4.

Identify the three parts of the artery and look for these branches from each.

- **Part 1:**
  - **Superior thoracic artery** (not important to find)
- **Part 2:**
  - **Thoraco–acromial trunk** and **lateral thoracic artery** (we examined these in the last lab, remember?)
- **Part 3**:
  - **Subscapular artery** and the **posterior and anterior circumflex humeral arteries** (the posterior is the larger of the two).

The posterior circumflex humeral artery loops around the posterior humerus with the axillary nerve and enters the **quadrangular space**.

A branch of the subscapular artery—the **circumflex scapular artery—**curls around to the posterior surface of the scapula via the **triangular space.**

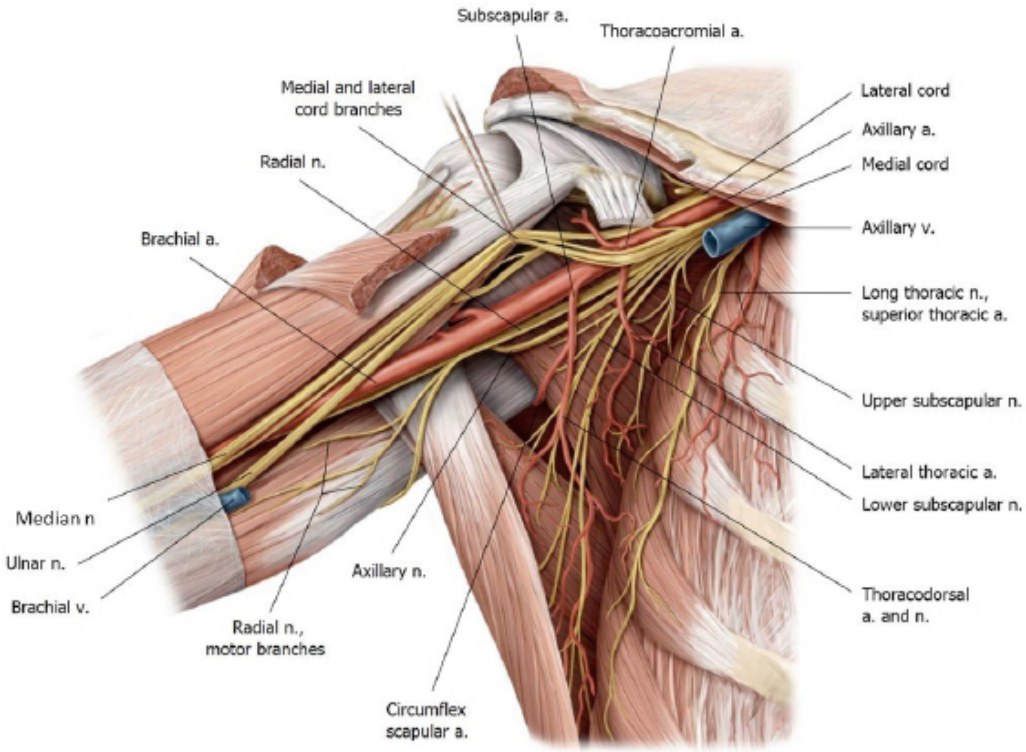


Figure 4.5.

Brachial Plexus

COMPLETE ANATOMY
STRUCTURE OF THE BRACHIAL PLEXUS

Chalk Talk

Draw the Brachial Plexus on the whiteboard as you perform this part of the lab.

Use the "Rule of 3s" as demonstrated in the slides linked here.

To study the architecture of the brachial plexus you will use both dissection and prosection. Because the brachial plexus begins in the neck you will need to use the prosection to study the proximal structures of the brachial plexus. While you should focus on identifying the roots, trunks, and divisions on this specimen, it's also a great time to review the cords and branches.

Prosection: Use the prosection to identify the roots, trunks, and divisions of the brachial plexus.

- Start proximally in the neck and identify the roots (ventral rami of spinal nerves) = **C–5, C–6, C–7, C–8, and T–1**. They emerge between the **anterior and middle scalene muscles**.
- Next identify the **upper**, **middle,** and **lower trunks** and determine which roots form them
- Each trunk splits into an anterior and posterior division

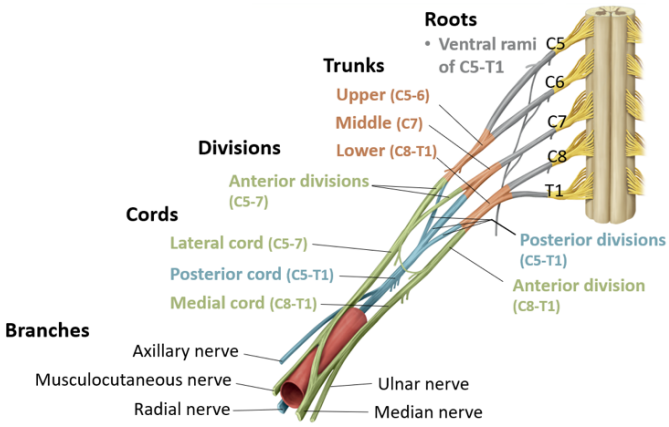


Figure 4.6.

Which cord is formed from the posterior divisions?

Which cord is formed from the anterior divisions of the upper and middle trunks?

Which cord is formed from the anterior division of the lower trunk?

Dissect and identify the cords and branches of the brachial plexus.

COMPLETE ANATOMY
STRUCTURES OF THE AXILLA

You will study the distal parts of the brachial plexus through dissection. The best way to tackle the brachial plexus is by starting with the terminal branches and working back towards the cords.

! This work can be done on both sides of the cadaver, but it is best to do thoroughly on the side with the veins removed

The **Musculocutaneous Nerve**, a terminal branch, pierces the **coracobrachialis muscle** (verify this). Follow it proximally to find the **Lateral Cord of the brachial plexus** lateral to the axillary artery.

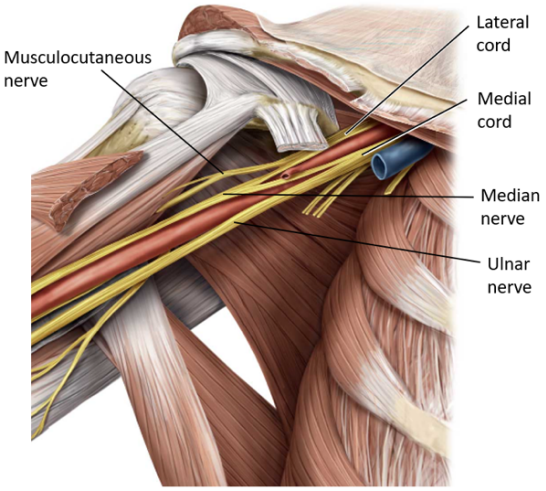


Figure 4.7.

Note

The cords of the brachial plexus are named based on their relationships to the axillary artery.

Once you have identified the lateral cord, clean and trace distally its other terminal branch: the **Lateral Root of the Median Nerve**.

Pick up the **Median nerve** and trace its **Medial Root** proximally to find the **Medial Cord of the brachial plexus,** medial to the axillary artery.

? Can you see that the median nerve is a terminal branch of the brachial plexus made by contributions from the lateral and medial cords?

Finally: trace the **Medial cord** distally, it becomes the **Ulnar Nerve**.

Clinical correlation

The terminal branches discussed above are configured in the shape of the letter "M": the musculocutaneous nerve, the medial and lateral roots of the median nerve, and the ulnar nerve. Lots of "M's": musculocutaneous nerve, median nerve, and medial cord—all contribute to the "M".

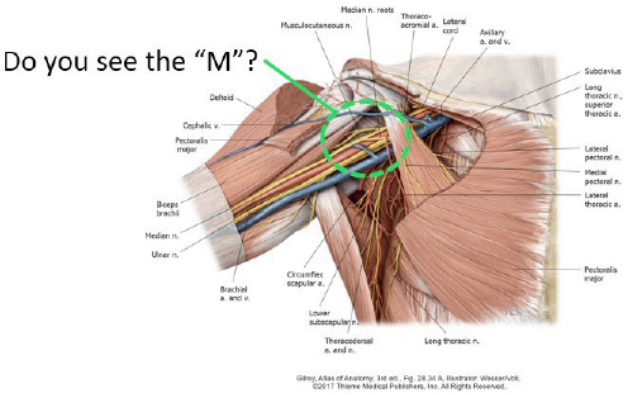


Figure 4.8.

Let's go deeper—find the posterior cord and its terminal branches.

Now grab the medial cord, lateral cord, and the axillary artery and retract them just enough to expose the **posterior cord of the brachial plexus,** posterior to the axillary artery.

Clean the posterior cord and all of its branches. The posterior cord is large and continues distally as the **radial nerve**, a terminal branch. It leaves the posterior wall of the axilla with the **deep brachial artery (profunda brachii)—a branch of the brachial artery—**via a gap in the triceps muscle.

Trace the posterior cord higher and locate the thick **axillary nerve**. The axillary nerve and **posterior circumflex humeral artery** leave the posterior wall of the axilla via the **quadrangular space**.

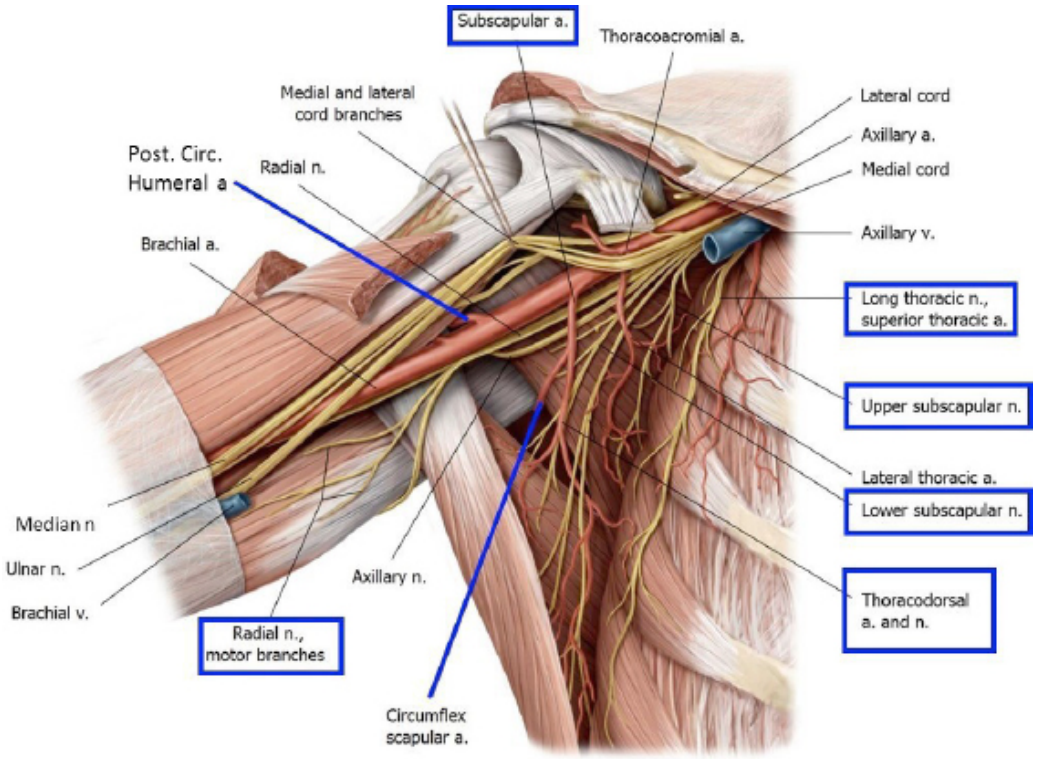


Figure 4.9.

Clinical correlation

Radial nerve + deep brachial (profunda brachii) artery spiral around the shaft of the humerus together.

Fractures of the midshaft of the humerus can damage the radial nerve and/or deep brachial artery. What symptoms might be seen in a patient with damage to the radial nerve because of a midshaft fracture of the humerus? The triceps muscle would be spared . . . but not the muscles on the posterior side of the forearm.

Both sides: Identify side branches of the brachial plexus.

COMPLETE ANATOMY
BRANCHES OF THE BRACHIAL PLEXUS

Hint

Branches from the proximal parts of the brachial plexus (branches from roots and trunks) will need to be identified on the prosection.

- *From the roots of the plexus:*
  - **Dorsal scapular nerve:** from C-5 (hard to find—look for it near the middle scalene muscle, then piercing the levator scapulae muscle, which it innervates).
  - **Long thoracic nerve:** from C-5, C-6, and C-7, to serratus anterior. You identified this nerve on the external surface of the serratus anterior in the last lab session. On the prosection, trace it back proximally to its origin from the brachial plexus.
- *From the upper trunk:*
  - **Suprascapular nerve**
- *From the lateral cord:*
  - **Lateral pectoral nerve**
- *From the medial cord:*
  - **Medial pectoral nerve**
  - **Medial cutaneous nerve of arm**
  - **Medial cutaneous nerve of forearm** (often the two cutaneous nerves travel together as one trunk—one branch given off to arm and one continuing into the forearm). **What does the word "cutaneous" tell you about these nerves?**
- *From the posterior cord:*
  - **Upper subscapular nerve**
  - **Thoracodorsal nerve**
  - **Lower subscapular nerve**

Note

A mnemonic for remembering all the branches of the posterior cord is **ULTRA**:

Upper subscapular

Lower subscapular

Thoracodorsal

Radial

Axillary

(These are not in the correct topographic order however—oh well!)

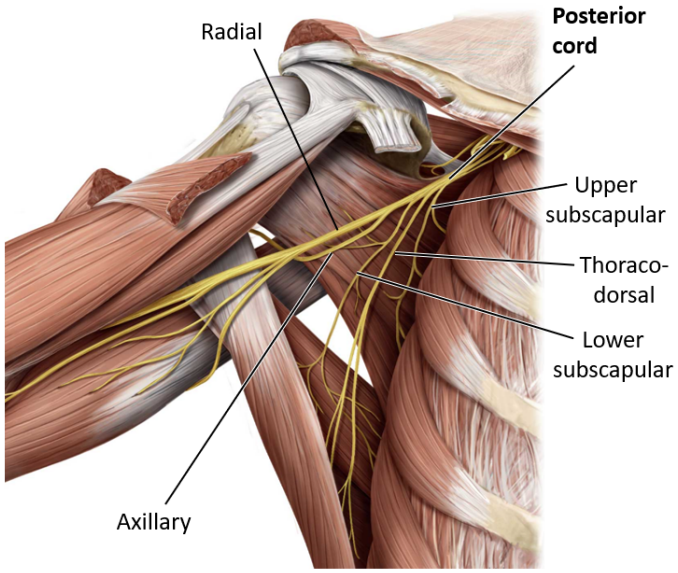


Figure 4.10.

The Arm

COMPLETE ANATOMY
SUPERFICIAL VEINS OF THE ARM

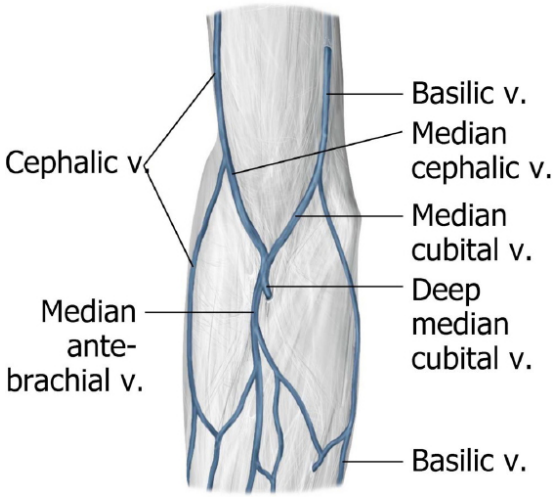
Anterior Compartment of the Arm

The skin was reflected from the anterior compartment earlier in the lab session.

In the superficial fascia, look for the two superficial veins of the arm: **basilic** and **cephalic veins**.

The **cephalic vein** ("bodybuilder's vein") is on the preaxial border of the arm. It gets its names since the preaxial border is closer to the head in the embryo.

The superficial vein of the postaxial border is the **basilic vein** (it gets its name because it courses along the "base" of the upper limb = its postaxial border).



COMPLETE ANATOMY
MUSCLES OF THE SHOULDER AND ARM

COMPLETE ANATOMY
BONY LANDMARKS OF THE ARM

Identify the three muscles in the anterior compartment of the arm:

- **Biceps brachii**
- **Coracobrachialis**
- **Brachialis**

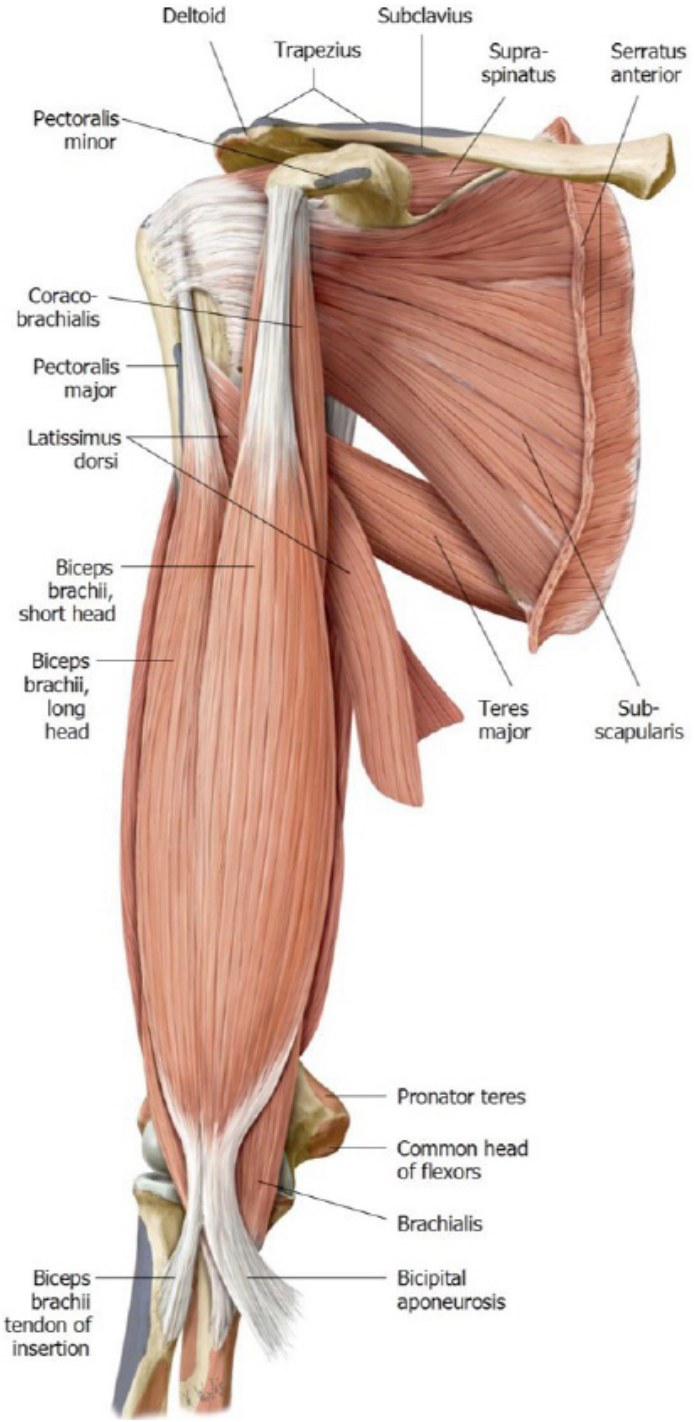


Figure 4.12.

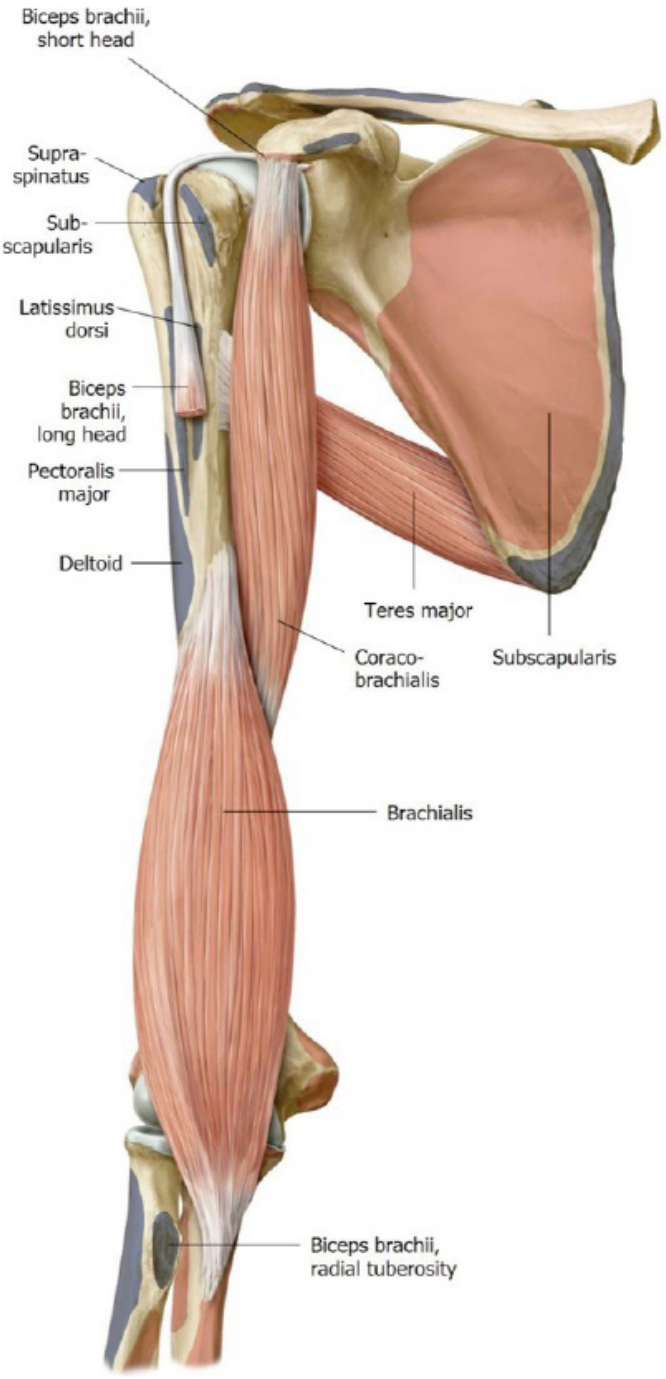


Figure 4.13.

Review the two proximal attachments of the biceps brachii on the scapula:

- **Long head**: courses through the intertubercular (bicipital) groove of the humerus, enters and passes through the glenohumeral joint, and inserts on the **supraglenoid tubercle**. You won't see this attachment in your cadaver unless you open the glenohumeral joint. Find the supraglenoid tubercle on a skeleton.

- **Short head**: attaches to the coracoid process. You will see this attachment in your cadaver; palpate the coracoid process.

The biceps has two distal attachments:

- Via the **bicipital aponeurosis** to the ulna. The bicipital aponeurosis is a thick layer of deep fascia that forms a protective layer over the roof of the cubital fossa.
- Via the **biceps tendon** to the radial tuberosity. Identify this on a skeleton.

Note

The brachialis muscle is the **"workhorse" of elbow flexion**, producing the most power during this movement. The biceps contributes to forearm flexion, but perhaps its most important function is as a **supinator of the forearm**. The biceps is the power supinator—a very useful muscle when using a screwdriver or opening the lid of a jar.

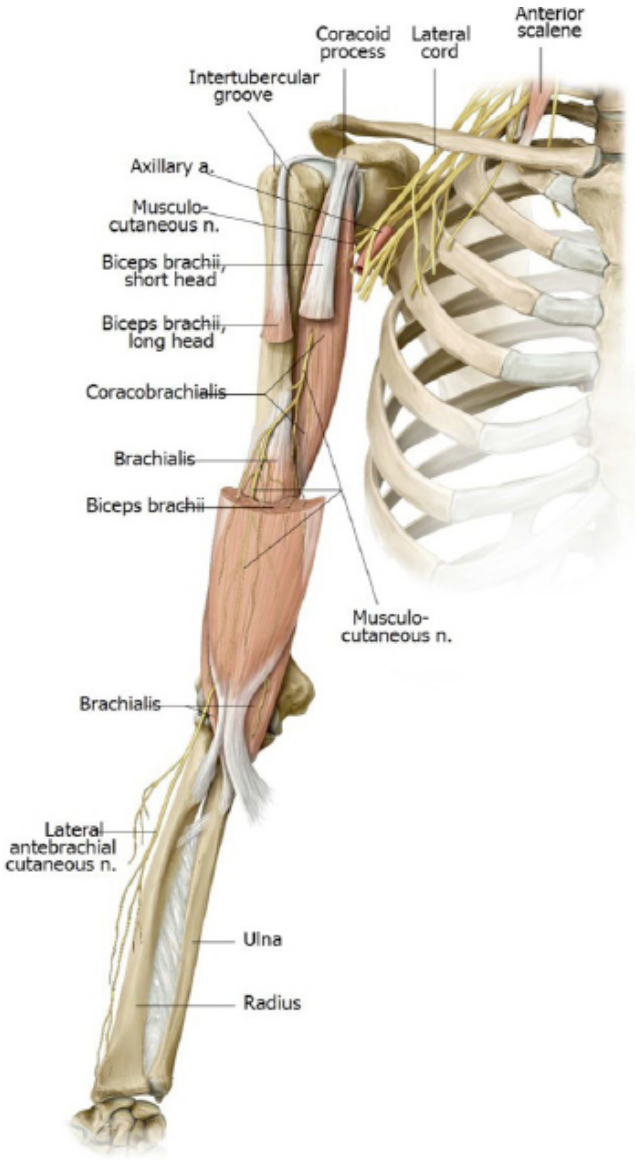


Figure 4.14.

Note that the **musculocutaneous nerve** pierces the **coracobrachialis** muscle, then passes deep to the biceps between it and the brachialis. It innervates all the muscles in the anterior compartment of the arm.

Clean the fascia from the biceps and explore the plane between the biceps and brachialis and follow the musculocutaneous nerve.

COMPLETE ANATOMY
NERVES AND ARTERIES OF THE ARM

The **musculocutaneous nerve** will eventually leave this plane and the anterior compartment of the arm to enter the superficial fascia of the forearm as the **lateral cutaneous nerve of the forearm**.

Use blunt dissection to separate the muscles of the anterior and posterior compartments, on the medial side of the arm.

There is lots of good stuff here, in the groove between the biceps and triceps = the **basilic vein** (a superficial vein), the **brachial artery** (the distal continuation of the axillary artery), the **median nerve**, and the **ulnar nerve**.

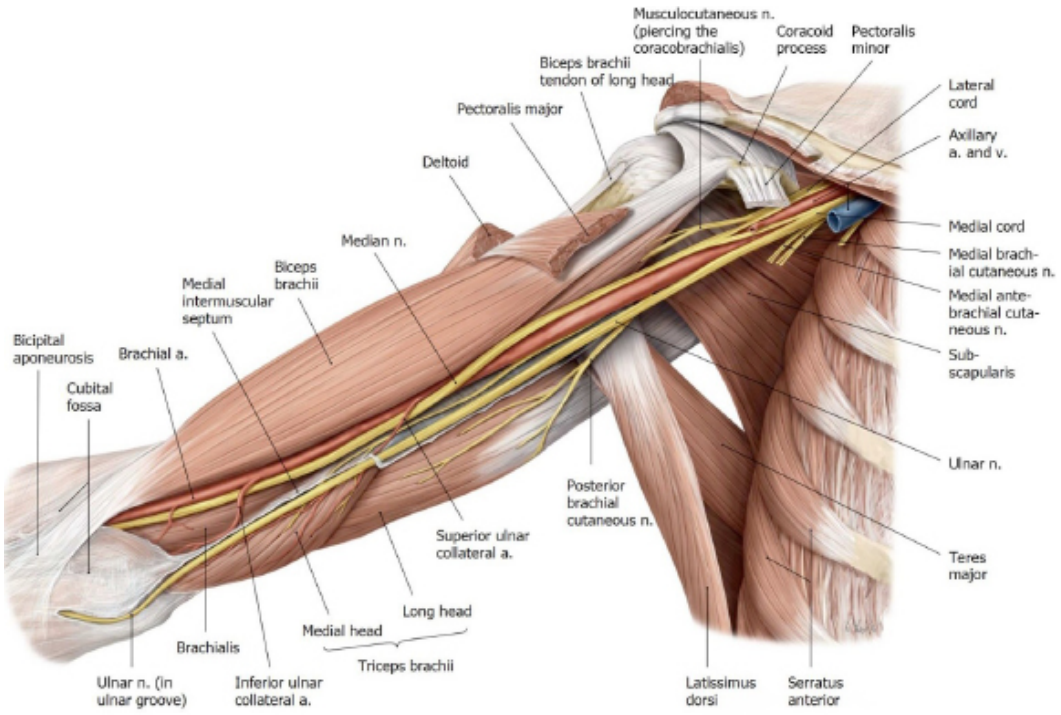


Figure 4.15.

Posterior Compartment of the Arm

We won't dissect the posterior compartment today. It contains the triceps brachii muscle. You saw this in a previous lab session. Study the triceps on the prosected upper limb specimen. Review the three heads. Know their origins and insertion and the innervation of the triceps.

CHECKLIST, LAB #4

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

BONES

Scapula

- [ ] Coracoid process (which muscles attach here?)
- [ ] Supraglenoid and infraglenoid tubercles (which muscle attaches to each?)

Distal humerus

- [ ] Capitulum
- [ ] Trochlea

Proximal radius

- [ ] Head of the radius
- [ ] Radial tuberosity (what muscle attaches here?)

Proximal ulna

- [ ] Olecranon process (what muscle attaches here?)
- [ ] Coronoid process (what muscle attaches here?)
- [ ] Trochlear notch

MUSCLES

- [ ] Pectoralis major
- [ ] Pectoralis minor
- [ ] Serratus anterior
- [ ] Biceps brachii (long and short heads)

- [ ] Triceps brachii (long, lateral, and medial heads)
- [ ] Brachialis
- [ ] Coracobrachialis

NERVES

Parts of brachial plexus

- [ ] Roots (C-5, C-6, C-7, C-8, and T-1)
- [ ] Trunks (upper, middle, and lower)
- [ ] Divisions (anterior and posterior)
- [ ] Cords (medial, lateral, and posterior)

Terminal branches

- [ ] Musculocutaneous nerve
- [ ] Ulnar nerve
- [ ] Median (made from medial and lateral roots)
- [ ] Axillary nerve
- [ ] Radial nerve

Side branches

- [ ] Long thoracic nerve
- [ ] Suprascapular nerve
- [ ] Lateral pectoral nerve
- [ ] Medial pectoral nerve
- [ ] Medial cutaneous nerves of arm and forearm
- [ ] Upper subscapular nerve

- [ ] Thoracodorsal nerve
- [ ] Lower subscapular nerve

VESSELS

- [ ] Axillary vein
  - [ ] Basilic vein
  - [ ] Cephalic vein
  - [ ] Brachial veins
- [ ] Axillary artery
  - [ ] Thoraco-acromial trunk—with pectoral arteries
  - [ ] Lateral thoracic artery
  - [ ] Subscapular artery
  - [ ] Circumflex humeral arteries (anterior and posterior—posterior is the largest)