Chicken Wing Dissection Guide

Objectives

By the end of this lab, you will be able to:

1. Safely demonstrate how to load and unload a **scalpel**.
2. Show proper use of scissors as a cutting and a blunt tool (latter: "**spreading technique**").
3. Identify skin, fat, blood vessels, muscle, tendon, ligaments, cartilage, and bone in a chicken wing (and transfer this skill to human tissue, although type of muscle fiber will visibly differ).
4. Perform tasks outlined in your main laboratory guide (Grant's Dissector), such as:
    a. **Incision**: to cut apart (through skin with a scalpel ←often only role of scalpel)
    b. **Clean and define:** carefully clear connective tissue (skin, fat, fascia…) to better visualize a muscle, nerve, vessel, or structure.
    c. **Retract**: pull a structure aside (temporarily).
    d. **Transect**: cut in the transverse plane.
    e. **Reflect**: fold back tissue.

The Upper Limb

Vertebrates like humans and birds share a long evolutionary history, explaining similarities between their limb structures. Over time, the upper limbs of birds developed as specialized structures for flight, whereas in primates, it remained relatively generalized for clinging, climbing, and other forms of locomotion requiring a greater range of mobility (not all of these being characteristic of "human"). You will find many similarities in anatomical structures between human and bird bodies, beyond just osteological patterning in the limbs. The focus of today's lab will be on the gross dissection of a chicken wing which can later be compared to the human upper limb dissection you will complete in this course.

In flapping flight, wing flapping movements through air must produce an air speed sufficient for both lift and propulsion of the animal. ***Pectoralis*** (chest) and ***supracoracoid*** (scapula region) **muscles** of birds are the main **depressor** and **elevator** of the wing, respectively. These muscles will not be present on a standard chicken wing unless you have an entire/half bird. In general, small birds will make short flights, with steep ascents and descents. When a wing is in forward stroke, it is fully **extended (*triceps brachii* muscle)**; while, in backstroke (recovery stroke), the wing is partially **flexed (*biceps brachii* muscle)**, reducing surface area and drag. Larger birds ascend and descend at less steep angles and cannot afford to have a passive backstroke. Instead, their backstroke has been described by 3 characteristics: (1) a flexed wing with the tip close to the trunk, (2) the outer wing is turned over (aka, "flick"), and (3) the primary feathers individually rotate so each might act as a strong airfoil while still allowing some air to pass between them. This backstroke may provide both more lift and propulsion than the forward stroke (Refer to Ch. 28: Flying and Gliding from Hildebrand and Goslow 2001).

Unfortunately for chickens and other birds bred for consumption, characteristics beneficial to flight, like a light body, have not been prioritized. Chickens are artificially bred to grow fast with a high body weight. Because of this heavier mass, domestic chickens can barely fly compared to their wild counterparts.

Surface Anatomy

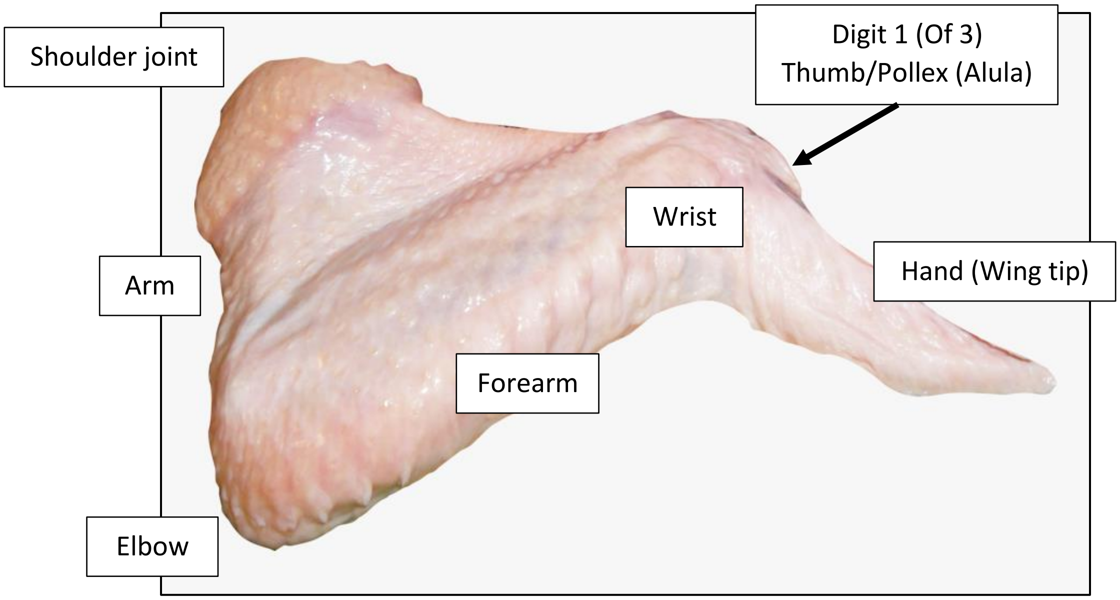

Figure 1. *Surface anatomy of a (right) chicken wing. Chicken wings are homologous to the upper limbs of humans, although their digits are reduced in number (humans express standard tetrapod vertebrate "pentadactyl" of 5-digit pattern).*

Musculature

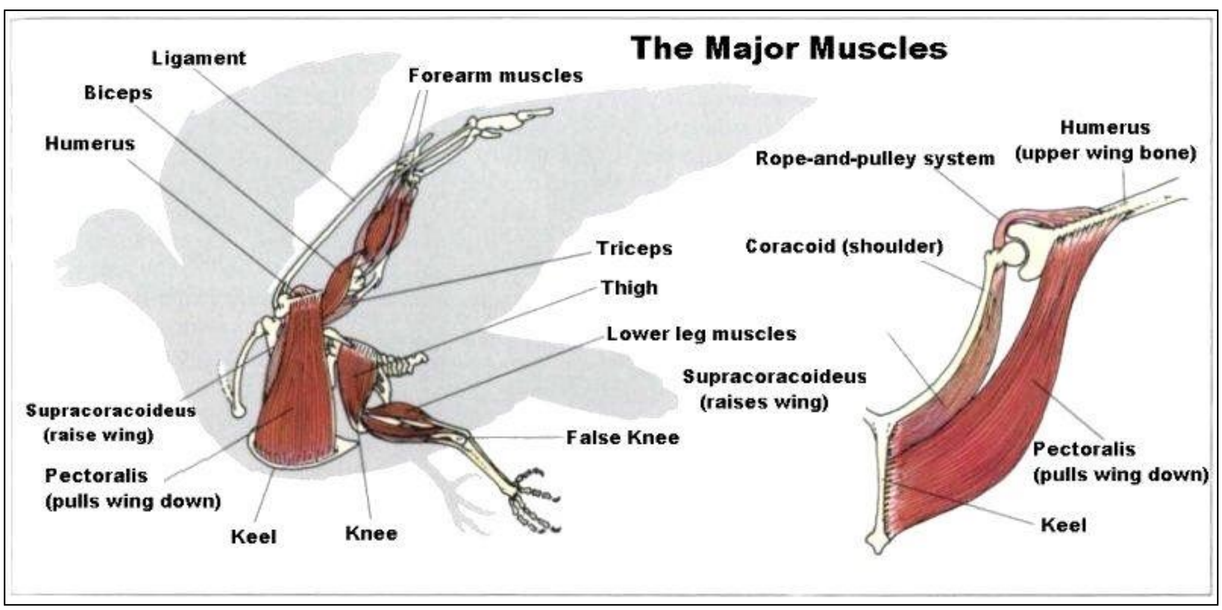

Figure 2. *General muscles labeled in a chicken wing. From: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjkuOW91afrAhXDKs0KHVgzAQkQFjAhegQIBRAB&url=https%3A%2F%2Fwww.woboe.org%2Fcms%2Flib%2FNJ01912995%2FCentricity%2FDomain%2F905%2FChicken%252*

Skeletal Anatomy

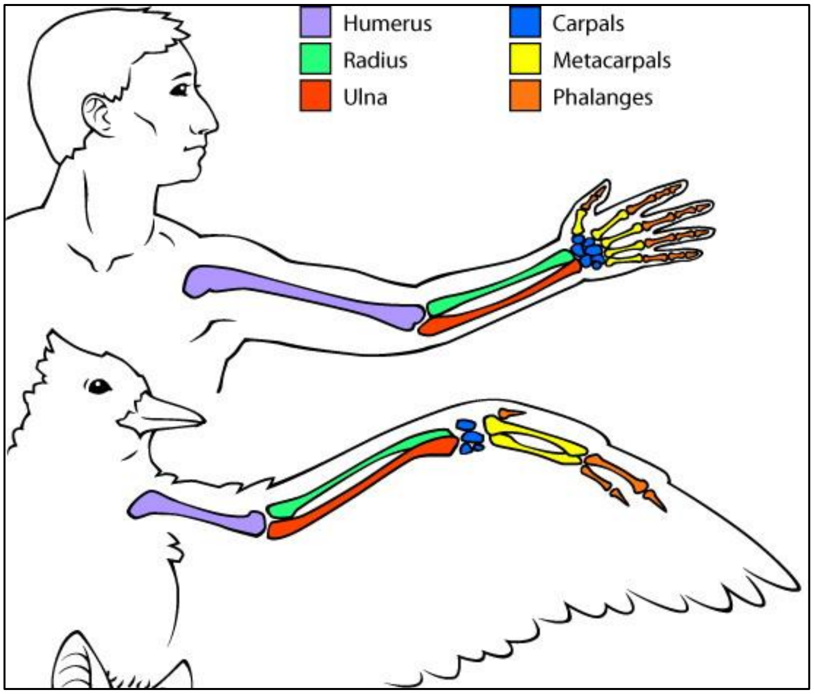

Figure 3. *A comparison of upper limb bones and their relative locations between humans and birds. Image from: https://askabiologist.asu.edu/sites/default/files/resources/coloring_pages/pdf/AAB_bats_coloring_page.pdf*

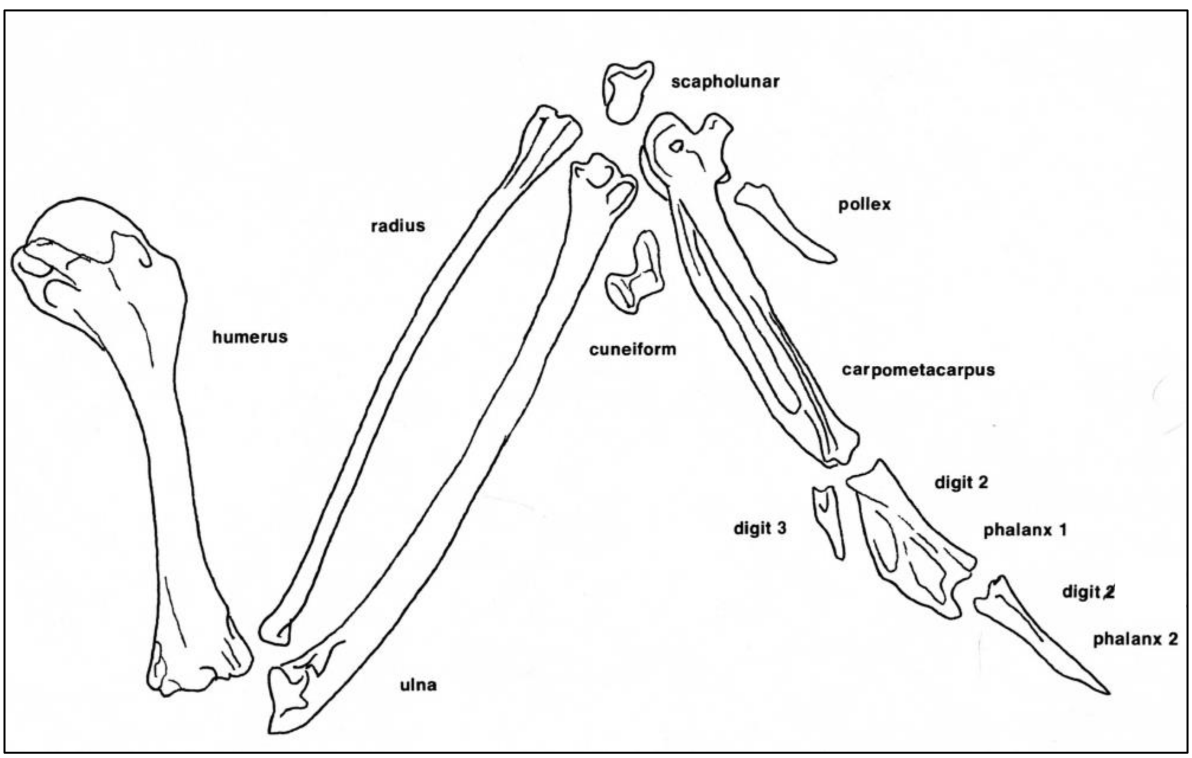

Figure 4. *Upper limb bones in a chicken wing. Image from Gilbert, Martin, and Savage (1981).*

(General) Vasculature

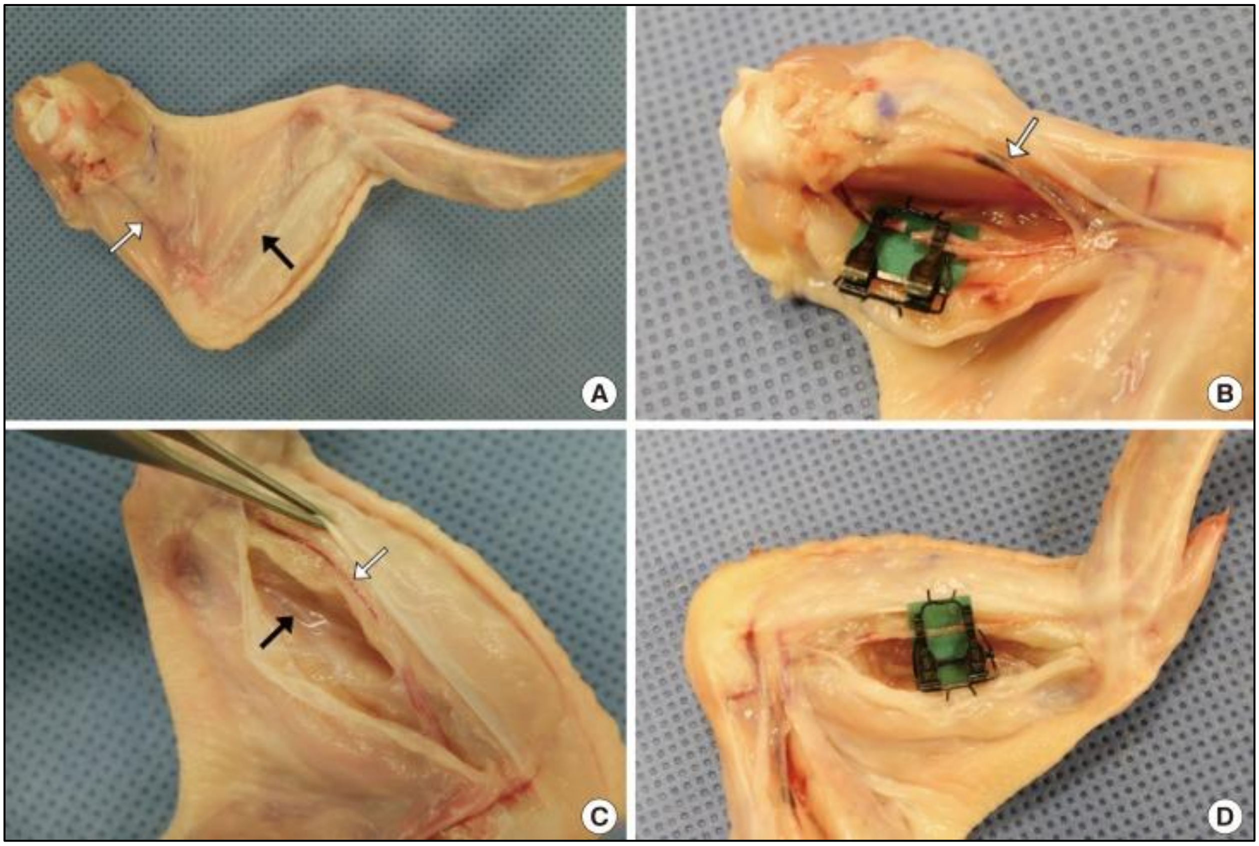

Figure 5. *Vessels of the upper extremity. (A) The* ***basilic vein*** *(white arrow) shows through the skin on the ventral side of the upper wing. The* ***ulnar artery*** *(black arrow) also shows through the skin of the lower wing. (B) The* ***basilic vein*** *(white arrow) lies on the skin flap and the* ***brachial artery*** *lies on the fascia of the* ***biceps brachii muscle****. A microvascular clamp was applied on the* ***brachial artery****. (C) The* ***ulnar artery*** *(white arrow) and* ***radial artery*** *(black arrow). (D) A microvascular clamp was applied to the* ***ulnar artery****. Image and caption from Kang, Jeon, Lee, and Mun (2017).*

Dissection Procedures

1. Be sure to read through the introductory material of this guide before you proceed through dissection. The following figures are provided for clarity:
    a. Figure 1: Surface anatomy
    b. Figure 2: Musculature
    c. Figure 3: Skeletal anatomy (humans vs. birds)
    d. Figure 4: Skeletal anatomy
    e. Figure 5: Vasculature (blood vessels)
2. Examine the surface anatomy of your chicken wing (**figure 1**). Flex and extend the wing to feel the underlying musculoskeletal system moving beneath your fingertips. Note how what you feel compares to the musculature (and long ligament) illustrated in **figure 2**.
3. Gently squeeze the tissue to locate each of the bones outlined in **figure 4** (noting how this compares to a human limb in **figure 3**).
4. Use scissors to "incise" the skin lengthwise, from shoulder to elbow, then from elbow to wrist. Be sure not to cut the underlying muscle. Leave the skin on the wing tip by cutting around it.
    a. Try not to cut through the long ligament essentially connecting shoulder to thumb.
5. Carefully peel the skin from the wing.
    a. Do you notice any yellowy, greasy tissue? This is fat. Postmortem fat becomes especially yellow in color.
6. Examine the thin, transparent shiny layer coating the musculature. For the chicken, this is its deep fascia or epimysium that surrounds each muscle, separating it from others in the compartment.
7. Insert the tip of the scissors gently through the epimysium, making a small hole. With the scissors closed, insert them through this hole (but on top of the underlying musculature). Once immersed, open the scissors, and note how the epimysium is lifted off the underlying muscle as it tears.
    a. This is the **"spreading technique"** that you will use to help you lift tight fascia safely off muscles without doing too much cutting.
    b. ***This is a form of blunt dissection. Any cutting with scalpels or scissors can cause immediate damage to underlying structures that you might not be able to see yet.
8. Using a probe and your fingers, try to clean and define the muscles from one another.
    a. For this lab, I have only emphasized the ***biceps brachii m.*** and ***triceps brachii m***. There are multiple forearm muscles as well that you can define, but do not worry about knowing their names/functions.

    b. You may find that flexing and extending the wing helps you identify these different muscles and their borders.
    c. See if you can clearly identify the insertion points of these muscles around the elbow joint. Note how their location determines how, when these muscles contract, the joint will move. (You may be able to find their origins, closer to the trunk, depending on how the chicken wing was cut).
9. Do you see any of the blood vessels illustrated in **figure 5**? These are small and difficult to see in a chicken wing. You may need to retract a muscle belly to see them more clearly. Follow their paths with a probe and clear out any surrounding fat or fascia to expose or increase their visibility.
10. Lift (with a probe) and transect the ***biceps brachii m.*** (perpendicular to its long axis, mid-body).
    a. How does this affect the limb? Is it easier to move now?
    b. Try using the weight of a hemostat to hold the muscle back (reflected) as you clean and define underlying structures.
11. Lift up (with a probe) and transect the ***triceps brachii m.*** (perpendicular to its longitudinal axis, mid-muscle body).
    a. How does this affect the limb? Is it easier to move now?
12. Again, do you see any of the blood vessels illustrated in **figure 5**? You may need a probe to separate these vessels out from one another.
13. Examine the elbow joint, flexing and extending the limb.
    a. Thin, shiny connective tissue connecting bone to bone are **ligaments** encasing and stabilizing the joint. You may cut through these to expose the joint surfaces.
    b. The thick, white covering on the joint surface is **hyaline cartilage**, meant to protect and ease movement of the joint. With severe **osteoarthritis**, this cartilage may become eroded or pitted, leaving bone exposed to increased stress and wear from daily activities.
14. **Once you have completed the chicken wing dissection:**
    a. Load and unload a clean scalpel blade in view of the instructor.
    b. Be sure to also locate the sharps containers (red) in the wet lab.
15. Clean up your tools (at the sink) and workstation, throwing away your PPE and chicken wing into the designated trash bin. Wash your hands thoroughly with soap and water before you leave.

References

1. Gilbert BM, Martin LD, Savage HG. 1981 Avian Osteology. Columbia: Missouri Archaeological Society.
2. Hildebrand M, Goslow G. 2001 Analysis of Vertebrate Structure, 5^{th} ed. New York: John Wiley & Sons, Inc.
3. <https://askabiologist.asu.edu/sites/default/files/resources/coloring_pages/pdf/AAB_bats_coloring_page.pdf>.
4. <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjkuOW91afrAhXDKs0KHVgzAQkQFjAhegQIBRAB&url=https%3A%2F%2Fwww.woboe.org%2Fcms%2Flib%2FNJ01912995%2FCentricity%2FDomain%2F905%2FChicken%252.>
5. Kang BY, Jeon BJ, Lee KT, Mun GH. 2017 Comprehensive analysis of chicken vessels as microvascular anastomosis training model. *Archives of Plastic Surgery* 44(1):12-18.