Fall 2019

UGA Laboratory Manual for Functional Human Anatomy

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Functional Human Anatomy Laboratory Manual CBIO 3010L

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Laboratory Safety Rules

Safety in any laboratory must be of primary importance. At times, your work in the laboratory may involve chemicals and equipment that can cause injuries if handled improperly. Accidents are usually the result of (1) lack of preparation and/or (2) carelessness. To avoid both, you should carefully read through the laboratory and its activities in advance of coming to the lab. To further avoid accidents, the following general rules should be followed during all laboratory exercises:

1. Know the location of the eye-wash station(s). Their proper use will be demonstrated by your instructor. Proper and timely use will be critical in the event an accident happens.
2. Eating and drinking in the lab are prohibited at all times.
3. Dress appropriately and professionally: sandals, open-toed shoes, and bare feet are prohibited at all times in the lab. If you are dressed inappropriately, you will not be permitted to enter the lab, and will be counted absent for that day.
4. Long hair should be tied back, and any hanging jewelry should be removed or secured.
5. Be aware of specific exercises that warrant the use of protective lab wear (goggles, lab apron, and gloves). Follow your instructor's recommendations on their use.
6. Handle any glassware and solutions carefully to avoid spills and breakage. Close all containers immediately after use. Inform your instructor immediately of any spills or breakage.
7. Anything that comes in contact with bodily fluids should be disposed of in a biohazard bag or sharps container.
8. Never work alone and never perform any unauthorized experiments.
9. Wash your hands any time you get any chemicals on your skin and at the end of each lab day.
10. Any medical condition that might prevent full participation in the exercises in the lab should be discussed with your instructor in advance.

Acknowledgement of Laboratory Safety Rules

I have carefully read and understood the Laboratory Safety Rules on the previous page. I will follow the policies in all laboratory exercises, and help my classmates do likewise.

Date: _____

Printed Name: _____

Lab Day: _____ Lab Time: _____

Student Signature: _____

Please print and submit this acknowledgement form to your instructor or TA during the first laboratory session of the semester.

Before You Start: An Introduction to the CBIO 3010 Lab

Lab Participation

As you begin your study of anatomy, you will often feel as though you are learning to speak another language. In a way, you are: you are learning the common language of anatomists worldwide; a language that has developed over millennia, reaching back over 3000 years! Learning a new language has few (if any) real short-cuts. The major keys to success in mastering this language is repeated exposure to lab structures and studying in groups with others. For this reason, we believe that your regular participation in labs is worth some effort, and worth rewarding. At the end of each practical unit, you will take a practical exam (see below), but you will also be given a participation score worth up to 5 points. These points will be awarded by your TA based on their observation of your attendance and work in the lab with other students.

Lab Information

Your teaching assistants set laboratory policy with final approval by the laboratory coordinator and course instructor. Your laboratory instructors will discuss these policies, in detail, during your first lab meeting. All laboratory conflicts or questions should be directed to your teaching assistants. If your laboratory instructor cannot resolve your conflict, then please feel free to contact either your laboratory coordinator or course instructor.

You are expected to attend the laboratory section for which you are scheduled. Under certain extraordinary circumstances, the laboratory coordinator may approve a change in laboratory assignment of provide permission to attend an alternate laboratory section.

Lab Practicals

Laboratory practicals are designed to test your ability to visually identify "pinned" structures. Each laboratory practical is worth up to 50 points and consists exclusively of fill-in-the blank items. They will be set up in the form of station-type questions that will include questions regarding particular structures, individual organ (partial or whole), model or bone situated at that station.

There will be four laboratory practicals, scheduled on 4 Thursday evenings during the semester. The dates of these practicals will be on the eLC calendar. Please make careful note of these dates, since a missed practical cannot be rescheduled or made up.

On the practicals, you are expected to answer the specific question asked at each station with a specific and clear handwritten answer. This may include side identification (right or left) and structure identification (artery, nerve, vein, etc.) in addition to the specific structure’s anatomical name.

Lab Practical Grading

Laboratory practicals are graded according to the following criteria:

Points per Question	Grading Criteria
Full Credit	Completely correct; answer is legible and identical to the answer key.
Half Credit	a. Answer is correct but handwriting is unclear and must be deciphered. b. Minor misspelling Example: Keyed answer: **Ileum** Student answer: **Illeum**
No Credit	a. Other than keyed answer or answer is left blank. Example: Keyed answer: **Femoral artery** Student answer: **Radial artery** b. Handwriting is illegible and cannot be deciphered. c. More than one answer is in the answer space, even if one is correct. Example: Keyed answer: **Femoral artery** Student answer: **Femoral artery Radial artery** (both written in the answer space) d. Side identification is incorrect. Example: Keyed answer: **Left gonadal artery** Student answer: **Right gonadal artery** e. General structure type is incorrect. Example: Keyed answer: **Ulnar vein** Student answer: **Ulnar artery** f. Answer is significantly misspelled or misspelling refers to another anatomical structure. Example: Keyed answer: **Ileum** Student answer: **Ilium**

Decisions about grading as outlined above are at the discretion of your TA. Final decisions about grading these answers will be arbitrated by the course instructor.

An Introduction to Anatomical Terminology

Introduction: The Study of Anatomy and Anatomical Position

As you begin your study of anatomy, you will often feel as though you are learning to speak a foreign language. In a way, you are: you are learning the common language of health professionals worldwide. For centuries scientists have used Latin as the common language of communication across borders, boundaries, and even time. And this remains true to this day. Although Latin is no longer the standard language of publication in science, much of our terminology comes from Latin and, by extension, the language of Greek before it. In previous centuries, students who were new to anatomy would have had years of prior Latin and Greek language study. While this is no longer the case for most students today, it remains true that the common language of the health sciences is based in Latin and Greek roots (there's a nice article on Wikipedia that collects together some of the most common prefixes, suffixes, and word roots: https://en.wikipedia.org/wiki/List_of_medical_roots,_suffixes_and_prefixes). So in this way, Latin and Greek remain our standard "starting point" for communication in anatomy.

Since the practice of medicine is frequently a "matter of life and death," even the student new to the professions would understand the importance of accuracy. You must be precise in your knowledge about the body, but also precise in how you communicate your knowledge, both written and spoken. You should be able to spell and speak anatomy terminology correctly to be sure you are getting your point across accurately, for the sake of the listener, but mostly for the sake of your patients.

So building on these two points of the importance of a standard language and the urgency of accurate communication, we introduce your first official anatomy term: **anatomical position** (figure 1 on the next page, and figure 1.1 in your textbook). Anatomical position is our standard starting point for all of the medical terminology that follows. When one is in anatomical position, they are **standing, arms at your side, legs straight, face forward, palms forward, toes forward**.

All of the directional terms you will learn in the next section will be based on this position. As an example, the eyes are said to be "superior" to the mouth. Even if a patient is lying down (or even a gymnast hanging upside down!), in anatomical terms, the eyes are always superior to the mouth.

Body Planes (Planes of Sectioning)

Look again at figure 1. Consider that the body is a 3-dimensional object, and as such can be sub-divided along 3 imaginary planes (that are like glass plates). These lines are known as **planes of sectioning**. These three planes can serve as a way of better understanding the directional terms that will follow.

1. The plane that divides the body into left and right is known as the **sagittal** plane. The sagittal plane is really the only plane that could divide the body into "mirrored" or equal left and right halves, so the sagittal plane that is exactly down the middle is designated as a **midsagittal** plane (also known as the **median** plane, which means "down the middle"). If the plane of reference is not right down the middle, it is usually referred to only as a sagittal section (or sometimes the term "**parasagittal**" is used, but this term is being used less). It is important that you know anatomical terms as well as alternate terms for each.
    - Label the **sagittal** plane on the figure below.
2. The plane that divides the body into front and back sections is known as the **frontal** (or **coronal**) plane.
    - Label the **frontal** plane on the figure below.
3. The plane that divides the body into upper and lower sections is known as the **transverse** plane (this section may also be referred to as a **cross section**).
    - Label the **transverse** plane on the figure below.

Figure 1: Anatomical Position and The Body Planes

Directional Terms

Now, with a better understanding of *anatomical position*, and how the body can be divided along the 3 *planes*, we can now begin to describe specific areas and structures of the body that are relative to each other. On the body, directional terms are much like directions on a compass. As east is the opposite direction from west, and north from south, so the anatomical terms are best learned as pairs of opposites. (see table 1.1 at the end of this lab section).

1. **Superior | Inferior**

- Superior means "above" or "toward the head." Another term for superior is **cephalic**. Inferior means "below" or "toward the feet." Another term for inferior is **caudal**. The relationship between superior and inferior is established by the transverse plane. In other words, body parts that are superior and inferior to one another could be separated by a transverse plane.
- Practice the relationships between superior and inferior by completing the following sentences with either "superior" or "inferior":

  The nose is _____ to the chin.

  The eyes are _____ to the eyebrows.

  The chin is _____ to the heart.

  The mouth is _____ to the nose.
- Write two additional sentences of your own using the superior/inferior relationship. Reverse both sentences and use the opposite term.

  _____

  _____

  _____

  _____

2. **Anterior | Posterior**

- Anterior means "front" or " in the direction of movement." Another term for anterior is **ventral**. Posterior means "back" or "behind." Another term for posterior is **dorsal**. The relationship between anterior and posterior is established by the frontal (coronal) plane. In other words, body parts that are anterior and posterior to one another could be separated by a frontal plane.
- Practice the relationships between anterior and posterior by completing the following sentences with either "anterior" or "posterior":

  The nose is _____ to the ears.

  The mouth is _____ to the ears.

  The spine is _____ to the heart.

  The heart is _____ to the breastbone (sternum).

- Write two additional sentences of your own using the anterior/posterior relationship. Reverse both sentences and use the opposite term.

_____

_____

_____

_____

3. **Medial | Lateral**

- Medial means "middle" or "toward the midline of the body." Lateral means "side" or "away from the midline." The relationship between superior and inferior is established by the sagittal plane. In other words, body parts that are medial and lateral to one another could be separated by a sagittal plane.
- Practice the relationships between medial and lateral by completing the following sentences with either "medial" or "lateral":

  The sternum is _____ to the armpits.

  The armpits are _____ to the nipples.

  The heart is _____ to the lungs.

  The hips are _____ to the navel (or umbilicus, informally, "belly button").

  The pinky fingers are _____ to the thumbs.

- Write two additional sentences of your own using the medial/lateral relationship. Reverse both sentences and use the opposite term.

_____

_____

_____

_____

4. **Superficial | Deep**

- Superficial means "toward or at the body surface." Another term for superficial is **external**. Deep means "away from the body surface." Another term for deep is **internal**.
- Practice the relationships between superficial and deep by completing the following sentences with either "superficial" or "deep":

  The sternum is _____ to the skin.

  The humerus (upper arm bone) is _____ to the arm muscles.

  The skin is _____ to the muscles.

  The heart is _____ to the ribs.

- Write two additional sentences of your own using the superficial/deep relationship. Reverse both sentences and use the opposite term.

_____

_____

_____

_____

5. **Proximal | Distal**

- Proximal means "close to" and distal means "far from." In gross anatomy, we use these terms in relation to a point of origin or attachment of the whole body part. Take the arm for example. The point of origin/attachment is the shoulder joint. Which of the following is "closer to" the shoulder? The wrist or the elbow?

_____

So, we would say the elbow is "closer to" the shoulder than the wrist is. Right? And the way we would write the sentence comparing the elbow and wrist is like this…

[Circle one] The elbow is (**proximal** / **distal**) to the wrist.

Now, what this *sounds like* is not what it actually *means*. It sounds like we're saying the elbow is close to the wrist. What we're actually saying is…

"The elbow is closer to the shoulder than the wrist is."

In anatomical terminology, this sentence becomes:

"The elbow is proximal to the wrist."

- Practice the relationships between proximal and distal by completing the following sentences with either "proximal" or "distal":

The knee is _____ to the ankle.

The toes are _____ to the ankle.

The humerus is _____ to the fingers.

The wrist is _____ to the radius (forearm bone).

- Write two additional sentences of your own using the proximal/distal relationship. Reverse both sentences and use the opposite term.

_____

_____

_____

_____

★ **Important Point!** Make sure you always use proximal and distal when answering questions about the arms and legs. For example, while it may be true that, in anatomical position, the humerus is "superior" to the radius, it is preferred by your instructor that you use proximal.

Review and Practice

1. Using the appropriate terminology, write descriptive sentences involving the following structures of the head:
   a. eyes and ears _____
   b. nose and cheek _____
   c. eyebrows and chin _____
   d. nose and brain _____
   e. teeth and tongue _____
2. Fill in the blanks with the most accurate directional term.
   a. The fingers are _____ to the elbow.
   b. The chest is on the _____ surface of the body.
   c. The soles of the feet are the most _____ part of the body and the most _____ surface of the legs.
   d. The heart is _____ to the spine.
   e. The sternum is _____ to the umbilicus.

Body Cavities

The head and torso are body regions that are hollow. They enclose numerous internal organs within spaces called **body cavities**. There are 2 such body cavities. The brain and spinal cord are contained within the **dorsal body cavity** which is subdivided into the **cranial cavity** and the **spinal** (or **vertebral**) **cavity**. Label these cavities on figure 2.

The much larger **ventral body cavity** is subdivided into two large regions called the **thoracic cavity** and the **abdominopelvic cavity**. The **diaphragm** is the muscular anatomical structure that separates these two cavities. The thoracic cavity is further subdivided into the central, cylindrical region known as the **mediastinum** (containing the heart in its **pericardial cavity** and several major vessels and glands) and lateral to the mediastinum the paired **pleural cavities** containing the left and right lungs. The abdominopelvic cavity is subdivided into the **abdominal cavity** and the **pelvic cavity**. Label these cavities on figure 2.

Below is an outline showing the organization and subdivision of the two body cavities.

dorsal body cavity
    cranial cavity
    vertebral cavity
ventral body cavity
    thoracic cavity
        mediastinum
            pericardial cavity
        pleural cavities
    abodominopelvic cavity
        abdominal cavity
        pelvic cavity

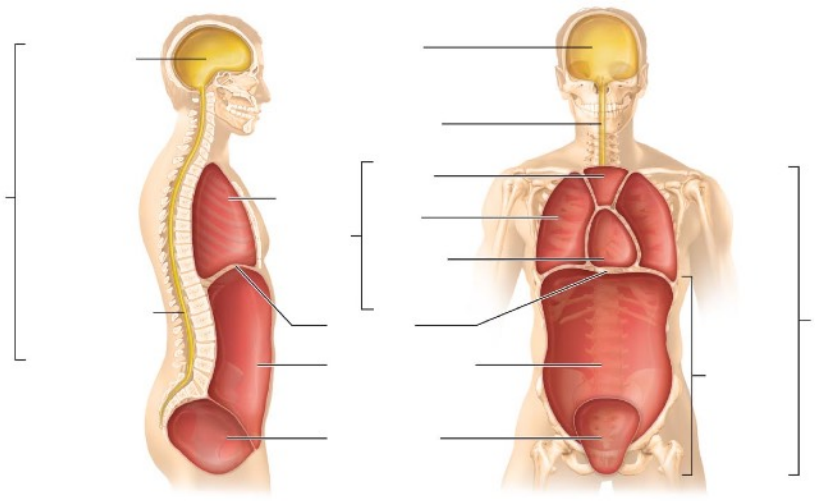


Figure 2: The Body Cavities

The abdominal cavity is further subdivided into smaller regions for ease of communication among health care professionals. Medical clinicians usually prefer the 4 abdominal quadrants shown in figure 3 (below), while anatomists prefer the detail of the 9 regions shown in figure 4.

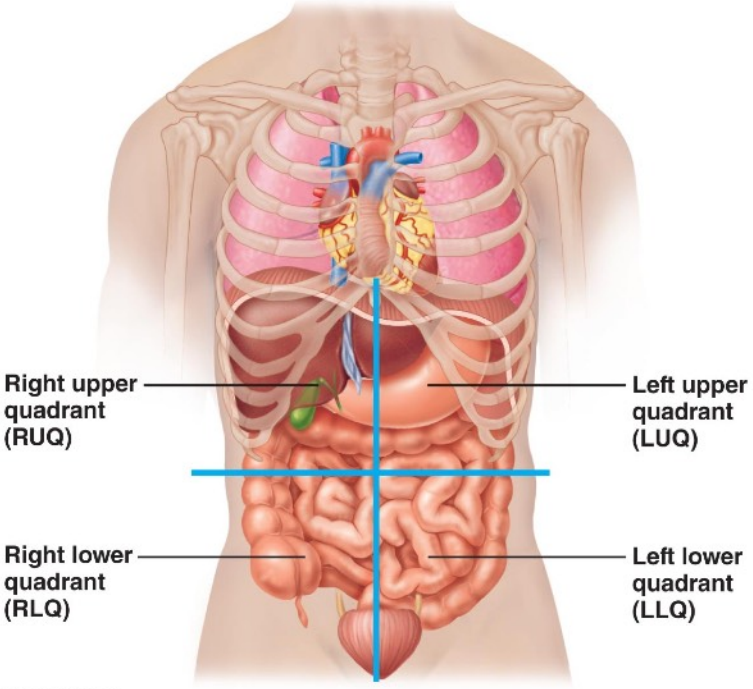


Figure 3: Abdominal Quadrants

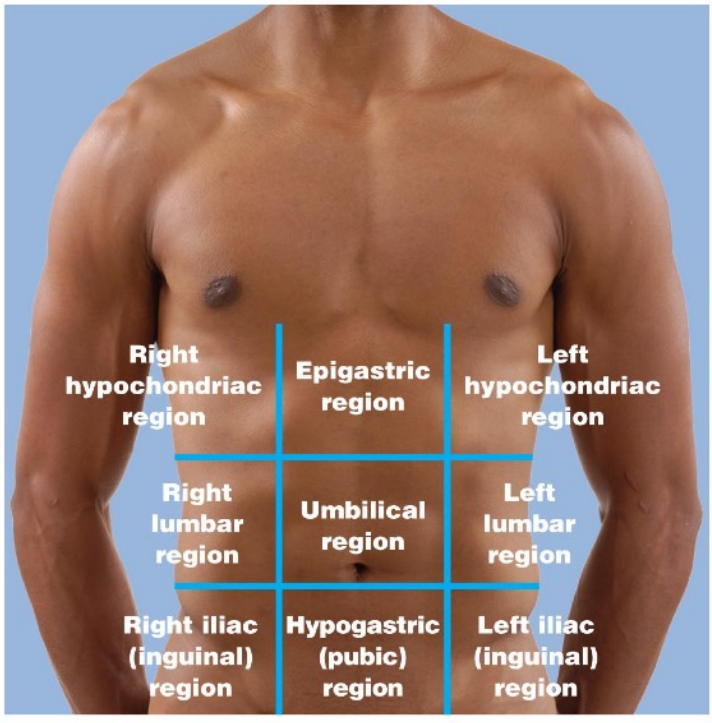
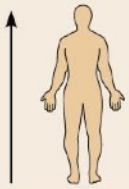
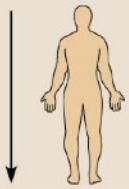
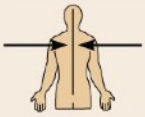
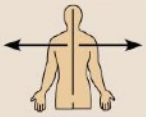
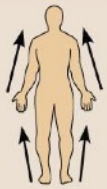
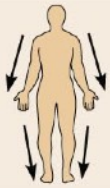
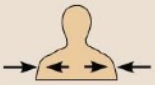


Figure 4: Abdominal Regions

Table 1.1 Orientation and Directional Terms

TERM	DEFINITION	EXAMPLE	
Superior (cranial)	Toward the head end or upper part of a structure or the body; above		The head is superior to the abdomen.
Inferior (caudal)	Away from the head end or toward the lower part of a structure or the body; below		The navel is inferior to the chin.
Ventral (anterior)*	Toward or at the front of the body; in front of		The breastbone is anterior to the spine.
Dorsal (posterior)*	Toward or at the back of the body; behind		The heart is posterior to the breastbone.
Medial	Toward or at the midline of the body; on the inner side of		The heart is medial to the arm.
Lateral	Away from the midline of the body; on the outer side of		The arms are lateral to the chest.
Intermediate	Between a more medial and a more lateral structure		The collarbone is intermediate between the breastbone and shoulder.
Proximal	Closer to the origin of the body part or the point of attachment of a limb to the body trunk		The elbow is proximal to the wrist.
Distal	Farther from the origin of a body part or the point of attachment of a limb to the body trunk		The knee is distal to the thigh.
Superficial (external)	Toward or at the body surface		The skin is superficial to the skeletal muscles.
Deep (internal)	Away from the body surface; more internal		The lungs are deep to the skin.

*The terms *ventral* and *anterior* are synonymous in humans, but this is not the case in four-legged animals. *Anterior* refers to the leading portion of the body (abdominal surface in humans, head in a cat), but *ventral* specifically refers to the "belly" of a vertebrate animal, so it is the inferior surface of four-legged animals. Likewise, although the dorsal and posterior surfaces are the same in humans, the term *dorsal* specifically refers to an animal's back. Thus, the dorsal surface of four-legged animals is their superior surface.

Back: Skeletal Framework

Human: Disarticulated Vertebrae

Select a single vertebra (singular for vertebrae) from the disarticulated set. Use it to identify all bolded structure names on pp. 68-69[1] of your textbook (labeled in fig. 2.19), under the heading "Typical vertebra".

Now, begin reading the descriptions on pp. 69-72, and comparing the vertebra that you randomly selected with the descriptions and figures of the 3 major groups of vertebrae. Which of the three groups does your vertebra belong to?

Return to the bone box and select one each of the other two types of vertebrae. Identify all of the same features on each of the vertebrae from the other groups. For example, if you first selected and identified the structures on a thoracic vertebra, identify all the same structures on a cervical and a lumbar vertebra, noting the differences that are described in your text.

In addition to all the structures the vertebrae have in common, be sure you identify the **foramen transversarium** (or transverse foramen) found only on the cervical vertebrae and the **facets** and **demifacets** unique to the thoracic vertebrae.

Atlas and Axis

The atlas (CI) and axis (CII) display several features that distinguish them from the other cervical vertebrae. Find one of each, CI and CII, and identify the following, with the help of figures and descriptions on pp. 70-71: **lateral masses**, **superior** and **inferior articular surfaces**, and the **dens** (only on CII).

Sacrum and Coccyx

Simply be able to identify these two sets of fused vertebrae both disarticulated and the fully articulated skeletons.

Articulated Skeletons

On the fully articulated skeletons, be able to identify which vertebrae are cervical (the superior 7), which are thoracic (next 12) and which are lumbar (lower 5 before sacrum). Identify as many of the above structures on the articulated skeleton as possible (some structures will not be visible with bones assembled).

Identify the **intervertebral foramina** (this is plural for foramen) and identify the boundaries that form these openings (description on pp. 72-73). Also notice the **posterior spaces between vertebrae** that are prominent only in the lumbar region (p. 73).

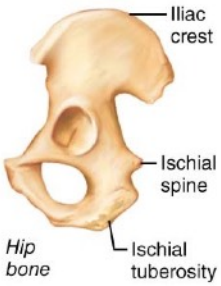
[1] Page numbers and figure numbers refer to the 3rd edition of Gray's Anatomy for Students.

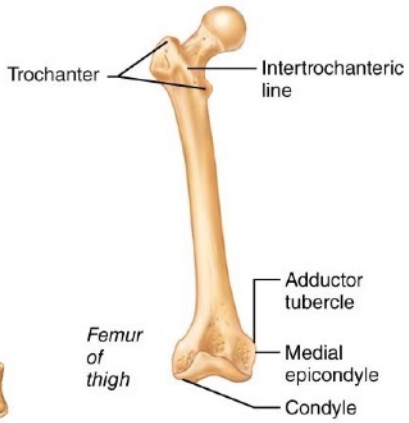
Bone Markings Table

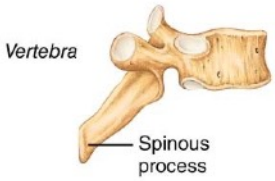
Below I've added a table that illustrates and defines the major types of bone markings that you'll encounter throughout the semester. Feel free to keep it as a reference.

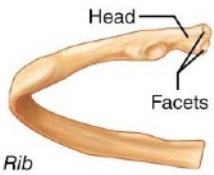
Table 6.1 Bone Markings

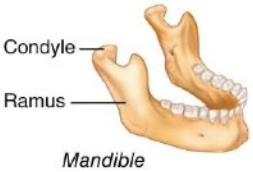
NAME OF BONE MARKING	DESCRIPTION	ILLUSTRATIONS
Projections That Are Sites of Muscle and Ligament Attachment		
Tuberosity (too″bĕ-ros′ĭ-te)	Large rounded projection; may be roughened	
Crest	Narrow ridge of bone; usually prominent	
Trochanter (tro-kan′ter)	Very large, blunt, irregularly shaped process (the only examples are on the femur)	
Line	Narrow ridge of bone; less prominent than a crest	
Tubercle (too′ber-kl)	Small rounded projection or process	
Epicondyle (ep″ĭ-kon′dīl)	Raised area on or above a condyle	
Spine	Sharp, slender, often pointed projection	
Process	Any bony prominence	
Projections That Help to Form Joints		
Head	Bony expansion carried on a narrow neck	
Facet	Smooth, nearly flat articular surface	
Condyle (kon′dīl)	Rounded articular projection	
Ramus (ra′mus)	Armlike bar of bone	
Depressions and Openings		
For Passage of Blood Vessels and Nerves		
Groove	Furrow	
Fissure	Narrow, slitlike opening	
Foramen (fo-ra′men)	Round or oval opening through a bone	
Notch	Indentation at the edge of a structure	
Others		
Meatus (me-a′tus)	Canal-like passageway	
Sinus	Cavity within a bone, filled with air and lined with mucous membrane	
Fossa (fos′ah)	Shallow, basinlike depression in a bone, often serving as an articular surface	

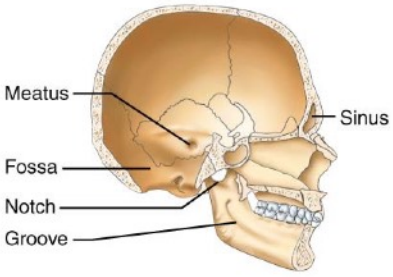


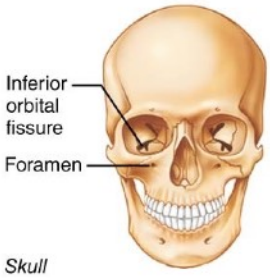












Back Muscles (Cat Dissection)

Clavicle and Scapula

Consult the master list for muscles to know. Also use the PDF file on eLC called “Cat Muscles Pract 1” starting on p. 47.

Space for Notes

Skeletal Framework of the Upper Limb

Clavicle and Scapula

On p. 702 of your text, read the brief introduction to the shoulder region. You should be familiar with the anatomical description of the clavicle and scapula together forming what's known as the **pectoral girdle**.

On both a disarticulated clavicle and on the articulated skeleton, identify the lateral and medial ends (also known, respectively as the **acromial end** and the **sternal end**).

Unlike the clavicle, the scapula is a bone with many projections ("processes"), depressions ("fossae"), and muscle attachment points ("tubercles"). It is a bone that is critical to multiple movements of the upper appendage and is also located in a critical region both for major nerves and blood vessels passing through the region. As such, it is an important bone for anatomy students to know completely. On both a disarticulated scapula and on the articulated skeleton, identify all structures, angles and borders labeled on figure 7.21 (p. 703 of text).

Proximal Humerus

On both a disarticulated humerus and on the articulated skeleton, identify the following structures that are illustrated on Fig. 7.22:

- head
- anatomical neck
- surgical neck
- greater tubercle
- lesser tubercle
- intertubercular sulcus
- deltoid tuberosity

Distal Humerus

On both a disarticulated humerus and on the articulated skeleton, identify the following structures that are illustrated on Fig. 7.61:

- lateral epicondyle
- medial epicondyle
- radial fossa
- coronoid fossa
- capitulum
- trochlea
- olecranon fossa

Forearm (Antebrachium)

On both disarticulated radius and ulna and on the articulated skeleton, identify the following structures that are illustrated on Figs. 7.62, 7.63, 7.78A, and 7.79:

- head
- neck
- radial tuberosity
- oblique line
- radial styloid process
- ulnar notch
- olecranon
- trochlear notch
- coronoid process
- radial notch
- ulnar styloid process

Hand (Manus)

On the articulated skeleton and articulated hand models, identify all bones labeled on Fig. 7.92.

Muscles of the Upper Limb

Human Model of Upper Limb

On eLC, I've uploaded a photo of the model key. On the key, I have checked the structures that are parallel to the muscles, vessels, and nerves that we are covering in lecture. For the muscles, use your textbook to identify the bony landmarks that are the origins and insertions of each muscle and be able to give a brief description of the muscle action (e.g., "flexion of the elbow").

Cat Upper Limb Muscles

Using the PDF file on eLC called "Cat Muscles Pract 1" on p. 58, identify the following muscles that are analogous on a cat and human. Some of these muscles may already have been dissected and identified during your dissection of the back, but particularly with the muscles of the shoulder they should be reviewed.

- supraspinatus
- infraspinatus
- teres major
- teres minor
- subscapularis
- biceps brachii
- coracobrachialis
- triceps brachii
- brachialis
- brachioradialis
- extensor carpi radialis (no need to distinguish between longus and brevis)
- extensor digitorum (no need to distinguish between communis and lateralis)
- extensor carpi ulnaris
- extensor retinaculum
- pronator teres
- flexor carpi radialis
- flexor digitorum superficialis (no need to distinguish between superficial and deep heads)
- flexor carpi ulnaris
- flexor retinaculum

Skeletal Framework of the Lower Limb

Femur

On both a disarticulated femur and on the articulated skeleton, identify the following structures that are illustrated on Figs. 6.26 and 6.52:

- head
- fovea (aka, fovea capitis)
- neck
- greater trochanter
- lesser trochanter
- linea aspera
- adductor tubercle
- medial epicondyle
- lateral epicondyle
- medial condyle
- lateral condyle
- intercondylar fossa

Tibia and Fibula

On both disarticulated tibia and fibula, and on the articulated skeleton, identify the following structures that are illustrated on Figs. 6.54, 6.55, and 6.81:

- lateral condyle
- medial condyle
- intercondylar eminence
- tibial tuberosity
- anterior border
- medial malleolus (tibia)
- head of fibula
- neck of fibula
- lateral malleolus (fibula)

Foot

On only the articulated skeleton and articulated foot models, identify the following labeled on Fig. 6.92:

- talus
- calcaneus
- navicular
- cuboid
- medial cuneiform
- intermediate cuneiform
- lateral cuneiform
- metatarsals (I to V)
- phalanges (identified same as hand)

Pelvic Bones

The Human Pelvis

Named for the Latin word for a "basin," the pelvis consists of 2 pelvic bones (also known as *os coxae*, or "hip bones"), the sacrum, and the coccyx.

Pelvic Bones (*Os Coxae*)

Each of these two bones consists of three regions: the ilium, the ischium, and the pubis. These regions originated as separate bones, but are already beginning to fuse into a single bone by birth. By around 16 - 18 years, they are fully fused at the last place that they come together: the acetabulum.

Begin with the description on 441 of your text and the figures that follow. Start with either a disarticulated pelvic bone or a fully articulated skeleton, and identify the following structures on each region of the bones that make up the pelvis. Whichever you start with (disarticulated or articulated), be sure to spend time studying the other version, as both will be included on the practical.

Ilium

- anterior superior iliac spine
- anterior inferior iliac spine
- iliac crest
- iliac fossa
- gluteal surface
- greater sciatic notch
- iliac tuberosity

Ischium

- lesser sciatic notch
- ischial tuberosity
- ischial spine
- ramus

Pubis

- body

Additionally, identify the following structures that are not specifically part of a single section of the pelvis:

- acetabulum
- obturator foramen

Sacrum

Identify the following both on an articulated model and the disarticulated sacrum.

- ala
- superior articular processes
- sacral canal (probably only visible on disarticulated)
- anterior sacral foramina

• posterior sacral foramina

Coccyx

No need to identify individual structures, simply identify this bone. By the way, it was named for its apparent similarity to the beak of a cuckoo.

The Pelvic Joints

On an articulated skeleton, identify the **sacro-iliac joints** and the **pubic symphysis**. Additionally, on pp. 448 - 449 and figure 5.27 of your text, read about and be able to identify the differences between the male and female pelvis.

Muscles of the Lower Limb

Human Model of Lower Limb

As with the upper limb muscle model, I've uploaded a photo of the model key for the lower limb models. On the key, I have checked the structures that are parallel to the muscles, vessels, and nerves that we are covering in lecture. As with the upper limb muscles, use your textbook to identify the bony landmarks that are the origins and insertions of each muscle and be able to give a brief description of the muscle action (e.g., "extension of the knee").

Cat Lower Limb Muscles

Using the lab manual starting on p. 66, identify the following muscles that are analogous on a cat and human. Some of these muscles may already have been dissected and identified during your dissection of the back and abdomen.

- gluteus maximus
- gluteus medius
- gluteus minimus
- piriformis (pyriformis)
- sartorius
- gracilis
- biceps femoris
- semitindinosus
- semimembranosus
- adductor longus
- adductor femoris
- rectus femoris
- vastus lateralis
- vastus medialis
- vastus intermedius
- tensor fasciae latae
- tibialis cranialis
- extensor digitorum longus
- peroneus longus/brevis
- gastrocnemius
- soleus
- flexor digitorum longus

Thorax: Skeletal Framework

Thoracic Vertebrae

Start by selecting a disarticulated thoracic vertebra. Using the description and figures on p. 144 of your text, review all of the structures on the vertebrae that you looked at in lab 2. Find the **demifacets** and and the **transverse costal facets** on the vertebra you have selected. On the molded plastic models that will be used on practicals, these facets can be a little difficult to identify, so be sure you can locate them.

Next, find a TI, TX, and either a TXI or TXII vertebra. Notice the differences described in the middle of p. 144 of the textbook. Notice the lack of a superior demifacet on TI (that the superior costal facet is a "complete" facet, rather than a demifacet). Notice that the TX veterbra has only a single, complete costal facet on each side of the body. On either TXI or TXII, notice the lack of a transverse costal facet. TXI and TXII are unique in this way as they are the origins of the floating ribs that do not articulate with transverse processes of the vertebrae they attach to. Be sure you look at TXI, TXII, and their pairs of floating ribs on the fully articulated skeleton as well.

Ribs

Using the text on pp. 144 - 146, distinguish what differentiates **true ribs** and **false ribs** (and why the last two pairs of false ribs are also known as **floating ribs**). Using several disarticulated ribs, identify all structures labeled in figure 3.21 on p. 145 of your text.

Find disarticulated ribs I, XI and XII. Be able to identify these unique ribs.

Sternum

Identify all structures labeled in figure 3.23 of the text. On the models you won't be able to directly identify the articular facets and demifacets for the ribs. Just know that they are there under the costal cartilages. You should be able to see everything else.

Clavicle and Scapula

Although you've already studied the major features of these two bones, their importance to the muscles of the thoracic region means it can't hurt to review them. While not directly part of the thoracic cavity, the clavicle and scapula are important bones in this region. It would be difficult to move forward and identify the muscles, their attachments and actions without learning the important features of these two bones.

On p. 702 of your text, read the brief introduction to the shoulder region. You should be familiar with the anatomical description of the clavicle and scapula together forming what's known as the **pectoral girdle**.

On both a disarticulated clavicle and on the articulated skeleton, identify the lateral and medial ends (also known, respectively as the **acromial end** and the **sternal end**).

Unlike the clavicle, the scapula is a bone with many projections ("processes"), depressions ("fossae"), and muscle attachment points ("tubercles"). It is a bone that is critical to multiple movements of the upper appendage and is also located in a critical region both for major nerves and blood vessels passing through the region. As such, it is an important bone for anatomy students to know completely. On both a disarticulated scapula and on the articulated skeleton, identify all structures, angles and borders labeled on figure 7.21 (p. 703 of text).

Bone Markings Table

Refer to the bone markings table on page 10 as needed.

Body Cavities and Mesenteries

Opening the Cat

Begin by reading and following the procedure described on pp. 79-80 of the lab manual. Pay close attention to the last paragraph on p. 80, being careful not to disturb any tissues initially so that you can identify as many of the body cavity membranes as possible.

Body Cavities

Using figures 3-2 and 3-3B, identify the body cavities on your cat. Distinguish between **parietal** and **visceral** serosa in these cavities. For example, lining the ribs of the thoracic cavity will be parietal pleura, but on the surface of the lungs is visceral pleura (see fig. 3-4). Lining the muscular wall of the abdomen is parietal peritoneum, but on the surface of the intestines is visceral peritoneum. The intestines may not be immediately visible on first opening the abdomen due to the overlying greater omentum.

On your cat, you will need to be able to identify all cavities and structures labeled on figure 3-3B.

Mesenteries of Thoracic Cavities

Following the instructions in the lab manual, identify the following:

- parietal pleura
- visceral pleura
- caval fold (identify the posterior vena cava within)
- parietal pericardium
- parietal cavity
- visceral pericardium

Mesenteries of Abdominopelvic Cavity

Following the instructions in the lab manual, identify the following:

- central tendon of diaphragm
- falciform ligament
- round ligament
- greater omentum (try to identify both the ventral and dorsal layer on your cat)
- lesser omentum (two parts: gastrohepatic ligament and hepatoduodenal ligament)
- mesentery

Respiratory System

Following the instructions in your lab manual, identify the following:

- larynx
- trachea
- left and right primary bronchus
- secondary bronchi (if possible)
- anterior, medial, and posterior lobes of left lung
- anterior, medial, posterior, and accessory lobes of right lung
- diaphragm

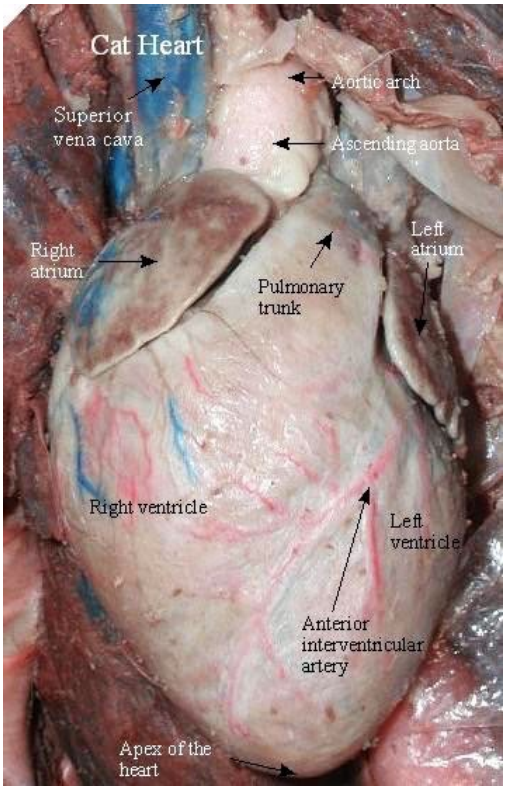
Though not labeled in this part of the lab manual, while you are in this region, notice the relationship between the ribs, intercostal muscles, and the tiny intercostal blood vessels.

Cat Heart and Thoracic Vessels

Heart

The lab manual, on pp. 125 - 131, focuses on the dissection and identification of the anatomy of the sheep heart. We will return to this later, but for now, identify the following structures on the external surface of the cat heart. Note: the lab manual does not identify all of these structures on the cat heart, but you should be able to use your textbook and notes from lecture to identify them.

- parietal pericardium
- apex
- anterior interventricular sulcus
- anterior interventricular artery
- left ventricle
- right ventricle
- left atrium
- right atrium
- pulmonary trunk



For now, leave the heart intact. Internal structures will be studied on the sheep hearts, and you can open the cat's heart for detailed dissection at the end of the semester, time permitting.

Thoracic Vasculature

Identify the following vessels of the thoracic (and dorsal neck) region:

- aorta
- aortic arch
- thoracic (dorsal) aorta
- pulmonary arteries
- brachiocephalic artery
- right subclavian artery
- right and left common carotid arteries
- left subclavian artery
- pulmonary veins
- anterior vena cava
- posterior vena cava
- right and left brachiocephalic veins
- external jugular veins
- azygous vein
- intercostal arteries and veins

Sheep Heart Dissection

Following the instructions in the lab manual, identify the following:

- all structures in **Figure 8-1**
  - Notes on Fig 8-1 and 8-2:
    - The lab manual uses the term "groove" where we use the term **sulcus.** The term I prefer you to use is sulcus.
    - The lab manual also does not distinguish between the ventral interventricular "sulcus" and the dorsal (on humans these are the anterior and posterior, respectively). I do want you to make sure you are able to distinguish these on the sheep heart since it indicates your ability to determine the front of the heart from the back, an important skill.
- all structures in **Figure 8-2**
- all structures in **Figure 8-4**, except you do not need to individually identify the individual cusps of the tricuspid and bicuspid valves
- **moderator band** (Figure 8-5)
- additionally, be able to identify the **left** and **right semilunar valves**, also known as the **aortic** and **pulmonary** semilunar valves, respectively

Be able to identify all structures indicated or listed above both on the sheep heart and the plastic models, as both will be featured on the practical.

Abdomen

Following the instructions in the lab manual, identify the following vessels:

Arteries	Veins
Abdominal aorta	Posterior vena cava
Celiac a.	Renal vv.
Cranial mesenteric a.	Hepatic portal v. (if possible, can be difficult to ID)
Renal aa.	Cranial mesenteric v.
Caudal mesenteric a.	Caudal mesenteric v.
External iliac aa.	Gastrosplenic v.

Abdominal Organs

Using your lab manual, identify the the organs of the digestive, immune, urinary, and reproductive systems that are listed on the Comprehensive Practical Guide posted to eLC.

Kidney Dissection

Following the instruction on the lab table regarding this dissection, the structures to identify and what to know for the practical.

Skull

Anterior View

Beginning with figure 8.18, and following the text descriptions beginning on p. 855 of your text, identify the following structures on the human skull models:

- frontal bone
  - glabella
  - supraorbital notch
- zygomatic bones
- maxilla
  - infraorbital foramen
- mandible
  - angle of mandible
  - mental foramen

Lateral View

Beginning with figure 8.19, and following the text descriptions beginning on p. 857 of your text, identify the following structures on the human skull models. Many of these may be the same bones/structures from a previous list, just from a different view:

- frontal bone
- coronal suture
- nasal bone
- lacrimal bone
- zygomatic bone
  - temporal process
- maxilla
- mandible
  - mental foramen
- mandible (cont)
  - coronoid process
  - ramus
  - angle
  - condylar process
  - mandibular foramen (not labeled, but on medial side of mandibular ramus)
- parietal bone
- squamous suture
- temporal bone
  - zygomatic process
  - mastoid process
  - styloid process
  - external acoustic meatus (not labeled)
- occipital bone
- lambdoid suture

Posterior View

Beginning with figure 8.20, and following the text descriptions beginning on p. 859 of your text, identify the following structures on the human skull models. Many of these may be the same bones/structures from a previous list, just from a different view:

- sagittal suture
- lambdoid suture
- parietal bone
- occipital bone
- external occipital protuberance
- superior nuchal line
- inferior nuchal line

Superior View

From figure 8.21, be able to identify all structures previously identified in other views (i.e., everything in the figure except the bregma and parietal foramen).

Inferior View

Beginning with figure 8.23, and following the text descriptions beginning on p. 860 of your text, identify the following structures on the human skull models. Many of these may be the same bones/structures from a previous list, just from a different view:

- incisive fossa
- hard palate
  - maxillary part
  - palatine bone
- vomer
- sphenoid bone
  - pterygoid process
  - greater wing
- sphenoid (cont)
  - foramen ovale
  - foramen spinosum
- temporal bone
  - mandibular fossa
  - styloid process
  - mastoid process
  - jugular foramen
- temporal (cont)
  - carotid canal
- occipital bone
  - foramen magnum
  - occipital condyle
  - external occipital protuberance
  - superior nuchal line
  - inferior nuchal line

Floor of Cranial Cavity

First, using figures 8.25, 8.26, and 8.27, be able to visually identify the anterior, middle, and posterior cranial fossas. Using these figures, in conjunction with figure 8.28, and following the text descriptions beginning on p. 865 of your text, identify the following structures on the human skull models. Many of these may be the same bones/structures from a previous list, just from a different view:

- frontal bone
- ethmoid bone
  - cribriform plate
  - crista galli
- sphenoid bone
  - lesser wing
  - greater wing
- sphenoid (cont)
  - optic canal
  - superior orbital fissure
  - sella turcica
    - hypophyseal fossa
  - foramen lacerum
  - foramen rotundum
- sphenoid (cont)
  - foramen ovale
  - foramen spinosum
- occipital bone
  - jugular foramen (between temp and occ)
  - foramen magnum
  - hypoglossal canal

Head & Neck Muscles

Muscles of the Face

Using the figures beginning on p. 904, identify all the muscles of facial expression listed on Table 8.7 (p. 905) except: depressor septi, anterior auricular, superior auricular, and posterior auricular.

Notice that the innervation for all of these muscles is cranial nerve VII (known as the Facial nerve).

Muscles of the Mastication

Using figures 8.137 and 8.139, identify the masseter and temporalis muscles. The innervation for both is supplied by the mandibular division (V_3) of cranial nerve V (known as the Trigeminal nerve).

Muscles of the Neck

Using the figures beginning on p. 1006, identify the following muscles of the anterior neck region. Other than the SCM muscle, you do not need to know innervations for these muscles.

- sternocleidomastoid (innervated by cranial nerve XI, known as the Accessory nerve)
- stylohyoid
- anterior and posterior belly of digastric
- mylohyoid
- sternohyoid
- omohyoid
- sternothyroid

Brain

For this lab, I've borrowed figures from another source. I've posted the figures in a folder on eLC. It is less convenient, but your textbook lacks some of the detail that I feel you need to know about the neuroanatomy of the brain. Figure numbers in parentheses indicate figures posted to eLC, not from your primary textbook.

Cerebrum (Fig. 12.5, 12.7, 12.11)

left and right cerebral hemispheres
lobes:
- frontal
- parietal
- occipital
- temporal
- insula (central lobe)

sulci (singular "sulcus")
- central sulcus
- lateral sulcus

gyri (singular "gyrus")
- cingulate gyrus
- precentral gyrus
- postcentral gyrus

longitudinal fissure
corpus callosum
fornix

Diencephalon (Fig. 12.11, 12.14)

olfactory bulbs
olfactory tracts
optic nerves
optic chiasma
optic tracts
pituitary gland
mammillary bodies
thalamus
hypothalamus
infundibulum
pineal gland (part of epithalamus)

Midbrain (Fig. 12.11a, b)

corpora quadrigemina
cerebral aqueduct

Brain Stem (Fig. 12.13)

pons
medulla oblongata
pyramids
decussation of pyramids

Cerebellum (Fig. 12.16)

anterior lobe
posterior lobe
vermis
arbor vitae

Cranial Nerves

Using figures 8.50 and 8.51 in your text. Identify the 12 pairs of cranial nerves on the models. Be sure you can accurately identify the cranial nerves on the unlabeled half of each brain model.

Eye & Ear

Extraocular Muscles

Using figure 8.92, identify the following muscles on the models. As you identify them, practice learning the indicated innervations of the muscles as well.

Innervated by CN III (Oculomotor n):
- superior rectus m.
- inferior rectus m.
- medial rectus m.
- inferior oblique m.

Innervated by CN IV (Trochlear n.):
- superior oblique m.

Innervated by CN VI (Abducens n.):
- lateral rectus m.

Anatomy of the Eye

Using figures 8.104 and 8.106, identify the following structures on the eye models. Notice the organization of the structures within the 3 layers of the wall of the eye.

Outer (fibrous) layer
- sclera
- cornea
- scleral venous sinus

Middle (vascular) layer
- choroid
- ciliary body
- iris
- pupil (opening in iris)
- lens

Inner (sensory) layer
- retina
- fovea centralis
- ora serrata
- optic disc
- optic nerve

The eye is also divided into chambers. The **anterior** and **posterior chambers** are filled with a liquid called **aqueous humor**. This fluid is filtered from capillaries in the ciliary body, flows forward through the pupil, into the anterior chamber, and is drained back into the blood by the scleral venous sinuses. **Glaucoma** is a higher than normal pressure of this fluid in these chambers.

Most of the volume of the eye is filled with a gelatinous **vitreous humor** found in the **postremal (vitreous) chamber**. The vitreous humor helps maintain the shape of the eyeball.

Dissection of the Cow Eye

I've posted a guide that will walk you through the steps of dissecting the cow eye.

Anatomy of the Ear

Using figures 8.109, 8.115, 8.118, and 8.125, identify the following structures on the ear models. Notice that the organization of the structures of the ear fall within 3 regions: the external, middle, and internal ear. The boundary between the external and middle ear is the tympanic membrane. The boundary between middle and internal ear is the oval window.

External Ear
- auricle
- external acoustic meatus
- tympanic membrane

Middle Ear
- malleus
- incus
- stapes
- pharyngotympanic tube

Internal Ear
- oval window
- round window
- vestibule
- anterior semicircular canal
- lateral semicircular canal
- posterior semicircular canal
- cochlea
- helicotrema