Human Anatomy
Lab Manual
Seventh Edition

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Preface

This book is for students in Biology 2325 - Human Anatomy. As you begin your anatomical learning adventure, use this book to prepare for the laboratory. It is designed to help you prepare for and get the most out of each of the laboratory sessions. There is a chapter for each of the labs that has a list of objectives that you should use to prepare for lab. If you follow these objectives you will arrive at lab prepared and you will maximize your learning efforts. All the material you will cover in each laboratory along with what you will need to do to prepare for the lab quizzes each week is covered in this manual.

In this most recent edition, I want to thank Anna Ricci and Aiden Tourek for their assistance in catching errors and things that needed to be updated.
Orientation

Welcome to the human anatomy laboratory that accompanies the lecture in Biology 2325 - Human Anatomy. This lab provides you with a rare opportunity to explore anatomy using dissected human cadavers. Exploring cadavers is the true approach to learning anatomy, that is, experiencing anatomy in its three-dimensional reality. There is no better way to learn this subject. In lecture you will use your sense of hearing to listen and learn and your visual sense to see two-dimensional illustrations throughout the lecture. The lab opens the door to additional senses — those of touch, three-dimensional vision, and even the unique smell of a cadaver lab. This allows you to gain a total exposure to the design of the human body.

You may have asked yourself as you were registering for this class, what can I expect in the anatomy lab? How do I prepare for lab? What is expected of me? The following information will help answer these questions and provide guidelines for a successful learning experience.

1. Each lab will begin with a visual quiz that will require approximately 10 minutes to administer. There will be a total of eleven quizzes during the semester. All will count towards your grade. The quizzes are administered at the beginning of lab, so be on time. Questions will not be repeated for latecomers. You must attend the lab for which you are registered. Only under extenuating circumstances, and with Professor’s written approval, can you take a quiz in another lab, or for that matter attend another lab time.

2. The quizzes are visual tests that you will take at the beginning of the lab session. The quiz will cover the material that you will study in that week’s lab, as well as some review questions from prior labs. The purpose behind quizzing students on material they will be studying in the current lab is to encourage students to come to lab prepared. Years of experience, have demonstrated that this helps students get the most out of their lab experience. The Human Anatomy Interactive Atlas software (see download instructions in the Human Anatomy Lecture Manual) contains numerous cadaver photographs that you will study in preparation for the lab quizzes. These cadaver photographs correspond to lecture material from the previous week and are similar to the cadaver materials you will study in the lab. Each photograph is a professionally prepared dissection to not only help you prepare for the lab, but also to allow you to take the lab home with you. By having access to these excellent photographs, you can study the cadavers from the lab without being in the lab. You should also take advantage of the Real Anatomy, 2nd edition software that is part of WileyPlus. This incredible cadaver dissection software gives you access to thousands of images of tissues, bones, and cadavers that can greatly enhance your study efforts in this course.
3. Attendance is required as the lab is 24% of the course grade. The lab time should be used wisely. Again, history demonstrates that the students who perform best in the course are those who come prepared for lab, work hard, and do not waste time in the laboratory.

4. There can be no food or drinks in the lab.

5. A seating chart will be assigned, so pick the seat you want for the semester. This helps the teaching staff learn your names and allows them to run a more orderly lab.

6. Never touch skeletal material or models with pens and pencils as it mars these expensive, hard-to-replace materials. Use a probe to point to these objects. Handle all skeletal material with extreme care, as this will help us prolong the use of these unique and valuable teaching materials.

7. Guests and visitors are not allowed in the lab. There is simply not enough room for people who are not registered for the course to attend the lab.

8. Anatomical materials cannot be loaned out to students. The materials used in the lab are to remain within the lab. There are no exceptions.

9. It is a privilege to have human body parts to study and use as learning aids. Very few undergraduate courses have access to human body parts. Please respect this privilege.

10. Following the quiz there will be a brief orientation by the teaching assistant in charge of the lab. This will be followed by the general lab work.

11. Students are responsible for identifying the structures listed on the designated pages of this manual for quiz and test purposes. During the lab you will work with teaching assistants who will teach you using the prosected cadavers. They will help you identify the structures listed in the lab manual and will teach you techniques to learn anatomy on the cadaver prossections.

12. Students should prepare for lab by reading the objectives for the pertinent lab each week. This is extremely important. If you are prepared, you will maximize your learning experience.

13. It is important to use the lab time wisely. During the majority of the lab period you will be involved in small, structured learning groups. In these small groups a teaching assistant will work with you to help you see and learn the anatomy on the cadavers. There will be other periods of time during some of the labs where you will have time to review what you are learning by taking practice practical examinations.

14. The lab contains a variety of materials to help you visualize the anatomy being covered in the lectures. There are pictures, models, and human body parts. Be aware of all these materials and use them to your full advantage in learning anatomy.

15. Take advantage of the staff of teaching assistants in the labs. Do not hesitate to ask questions. The only bad questions are those that are not asked! Every effort will be made to answer even the most difficult of questions.

16. The anatomy staff encourages you to fully participate and take complete advantage of the materials and resources available. With proper preparation this lab can be an exciting and unique educational experience. HAVE FUN AND GOOD LUCK!
Tips

The following techniques will be useful in learning anatomical concepts throughout this course. Before each lab, review this list and apply the appropriate concepts to the lecture material.

1. **Hands on!!**: Exploration and touching of cadaver parts is essential. The more you handle and examine cadaver parts the more familiar you will become with orienting, recognizing, and discovering specific anatomical structures.

2. **Palpation**: This is the process of exploring structures with your hands on your own or someone else’s body. Realize that your own body is a human anatomy review sheet (anatomy can be fun with a partner, too). Palpation can be used to study bony landmarks, muscles, tendons, ligaments, vessels, and nervous structures. Whenever you are learning a new anatomical structure, try and palpate it on your own body.

3. **Etymology**: Many anatomical terms are derived from Latin and Greek roots. Often terms that look foreign to you are actually very descriptive. The term might describe the size, shape, action, or location of the anatomical structure being named. By dissecting a term’s Latin or Greek origin you can make memory associations that help with learning the anatomical structures. For examples of this approach, look at the chapters Anatomical Nomenclature and Anatomical Etymology in the *Human Anatomy Lecture Manual*.

4. **Traces**: A trace is a sequential path of chambers, vessels, tubular structures, valves, or nervous structures through which a substance or impulse passes as it travels from one region of the body to another. When learning systems, such as the cardiovascular, respiratory, digestive, urinary, or nervous systems, traces provide an excellent strategy for identifying the structures in an ordered fashion. This is an excellent way to see if you understand the big picture. Learning a trace through a system will help you reinforce the sequential relationship between the structures of that system. **Remember you can trace molecules from one system to another across diffusion or transport barriers, such as an oxygen molecule from the alveolar air spaces in the lungs to the pulmonary capillaries that surround those air spaces**!

5. **Form and function**: Often anatomical structures are not only named for their shape or size, but for functional characteristics as well. The reverse can also be true, the function or structure can be logically deduced from the anatomical name (i.e.; Name: Pronator teres; Function: round muscle that pronates).
6. **Topography:** The human body is like a map. Once you recognize a particular structure, it can then be used to identify other structures in the same area. As you learn the topographical relationships between muscles, organs, bones, nerves, and vessels, you can begin to make associations with known key structures. Understanding how structures are related to easily identifiable, obvious structures, makes identifying the various parts of the body an easier task.

7. **Logic and simplification:** Look for common themes, such as, compartments, innervation, action, location, tissue type, etc. Think logically! Learn structures according to common groups and characteristics. This is always superior to sheer memorization.

8. **Mnemonics:** Mnemonics can be a useful memory device. They are most useful in learning structures that can be grouped or categorized (i.e., the rotator cuff muscles the Supraspinatus, Infraspinatus, Teres minor, and Subscapularis are the SITS muscle group).

There is a wealth of material that you can use as a reference to help you prepare for the laboratory, as well as study for the course. These materials are visually stimulating and will, if used, enhance your lab preparation, along with your ability to learn anatomy. Anatomy is a visual subject, therefore one of the most effective ways to learn and understand it is to do as much visualization as possible. Gaining a strong visual knowledge of the structure increases one’s ability to think critically, problem solve, and memorize the extensive language of anatomy. The following are some resources to help with your study of anatomy:

1. *Human Anatomy Interactive Atlas* by Shawn Miller and Mark Nielsen. This computer software is available as a download from the web or to run on the web (see second page of your *Human Anatomy Lecture Manual* for download instructions). Weekly study of this software will be required preparation for the laboratory quizzes. You will also find this to be an extremely useful resource as you study anatomy. This software, along with the *Real Anatomy* software on WileyPlus, in essence, allows you to take the lab home with you.

2. *Real Anatomy 2.0* by Mark Nielsen and Shawn Miller. This is software available on WileyPlus and it allows you to dissect and explore real cadaver anatomy like no other software on the market. It is packaged with WileyPlus.

3. *AnatomyLab* by Mark Nielsen and Shawn Miller. This is an App that can be purchased on the Apple iTunes Store for your iPhone or iPad (the Apple version is presently out of date and needs to be updated to work with their new operating system), or on the Android store, Amazon store, or Barnes and Noble store for non-Apple mobile devices. It allows you to study and dissect a full cadaver anywhere you have your mobile device. This is a spin-off of *Real Anatomy 2.0*. 

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*Human Anatomy Lab Manual*
Labs

The next chapters in this manual are outlines of the weekly laboratories. They are designed to help you accomplish three important tasks: 1) to prepare for the lab; 2) to benefit maximally from the time you spend in the lab; and 3) to summarize what you should learn during lab. These chapters are concise and to the point. Use them to learn what is expected. Doing so will help you get the most out of the laboratory. Each chapter follows a consistent layout that has the following topics or headings:

Collaborative learning stations

In the lab the students are divided into groups of seven to nine people and each group is assigned a teaching assistant for that lab. The lab consists of five of these groups. Within the lab there are five collaborative learning stations. Each group will start at one of the collaborative learning stations, where they will explore and learn anatomy under the tutelage of a teaching assistant. After approximately 20 minutes, the groups will rotate to a different station. By the end of the laboratory session each group will have visited each of the five learning stations. The learning stations are interactive, hands-on explorations of bones and human cadavers. The cadavers are professionally dissected to illustrate the relevant anatomy for the lab. This is a wonderful opportunity to explore anatomy in the third dimension. Learning anatomy on the cadavers will broaden the perspective you gain from the two dimensional approach of lecture. During these sessions do not sit back passively, instead, actively become involved in the lab so you can maximize your learning experience. In each of the lab chapters that follows, the learning stations for that lab will be listed in this collaborative learning section.
How to prepare for the lab
This section in each lab chapter presents a clear summary of the necessary information you need to be aware of in order to prepare for the laboratory. There are two main areas of preparation for each laboratory period. First, you must prepare for a quiz at the beginning of each lab. Second, you must prepare for the lab itself. By accomplishing the first task you begin to accomplish the second. In this section, throughout the chapters that follow, you will find helpful hints to guide you as you prepare for the lab. Included in this section will be a list of the modules on the Human Anatomy Interactive Atlas software that you should study to prepare for the quiz. The quiz is a visual test that includes projected photographs identical to the photographs present on the Human Anatomy Interactive Atlas software. These photographs show anatomical structures that you will study on dissections in the laboratory. By studying these pictures for the quiz, you will begin to familiarize yourself with the anatomy you need to identify on the cadavers. In addition to the quiz guide, other study tips, suggestions, and questions are presented in this section. This will help you maximize your preparation so you can get the most from your lab experience.

Objectives during the lab
This section outlines the main learning objectives for each lab period. Preview these objectives prior to the lab to help guide your study at the collaborative learning stations. After the lab, these objectives will serve as a checklist for what you should have accomplished. Review them and ask, “Did I accomplish the objectives?”

Structures to identify for the quiz
This section provides you with the necessary information to prepare for the weekly laboratory quiz. To prepare for the quiz use the information provided here in conjunction with the Human Anatomy Interactive Atlas software. The quiz will consist of a number of projected photographs from the software. Each photo will be projected onto a large screen at the front of the lab, where a teaching assistant will point to an anatomical structure on the picture and ask you to identify it. This section of the lab manual will list the software module and the specific photos within that module that will be on the weekly quiz. Each anatomy module in the software has two labeling buttons — a “Basic Labels” button and an “All Labels” button. To prepare for the quiz each week, refer to the software module and the specific photos listed in this section. Then simply select the “Basic Labels” button (button on the bottom right of the screen) and study the labeled structures. The software has been designed to allow you to easily prepare for the quiz. By selecting the “Basic Labels” button on the software, all the structures you need to know for the quiz will be marked with flashing circular markers. You can then quiz yourself by pointing and clicking on the markers to view the label. The “Basic Labels” button on the software covers the material that you will study in each lab. Notice that there is an “All Labels” button (button at the bottom left of the image screen) that you can use to quiz yourself later in the semester, as you
begin to learn more and more anatomy. The “All Labels” button labels all structures on the cadaver photo, many of which you are not required to learn. For the weekly quiz, you need only to worry about identifying the “Basic Labels” associated with the photos listed in this section.

**Structures to Identify in the lab**

This section contains a complete list of structures that should be identified and learned during the lab. This is a reference list of all the structures that you will observe in the laboratory each week. This will also serve as a summary list of all the structures that you will be responsible for on the final practical examination. This can serve as a valuable checklist to use during the lab reviews as you prepare for the practical examination. In essence, this is a list of all the “Basic Labels” from all the photos within the modules on the *Human Anatomy Interactive Atlas* software.

**After the lab is over**

At mid-semester and towards the end of the semester, you will have the opportunity to attend review labs on weekends. This provides you with an opportunity to study the cadavers and reinforce the material that you are learning as you prepare for the midterm and final practical examination. This section of the lab manual will help you prepare for these reviews. After you have completed the lab, use this section to jot down notes on the structures and cadaver parts that you feel you would like to review in more detail. Being able to refer back to these notes will help you maximize your time during the weekend review labs. One of the major objectives you should keep in mind throughout the labs is to be constantly preparing for the lab practical examination. This review section can help you focus your efforts toward this end. Review labs allow you to study the body parts on your own, emphasizing your own specific needs. You determine where you need to spend your time and you then spend it most effectively. If you will look back over this section before coming to the special review labs, you will find that you can maximize your learning efforts.
Laboratory One

Collaborative Learning Stations

1. Appendicular skeleton– study of bones and landmarks of the hands and feet
2. Appendicular skeleton– study of bones and landmarks of the shoulder girdle
3. Appendicular skeleton– study of bones and landmarks of the upper limb
4. Appendicular skeleton– study of bones and landmarks of the pelvic girdle
5. Appendicular skeleton– study of bones and landmarks of the lower limb
How to Prepare for the Lab
By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:

1. Study the Appendicular Skeleton module on the Human Anatomy Interactive Atlas software and read the section in the Human Anatomy Study Guide and Workbook (pages 3 - 20) that introduces you to the skeletal system and the appendicular skeleton.

2. Be able to identify each bone of the appendicular skeleton by name. This includes all the bones of the hands and feet.

3. Be able to identify the different views of each bone pictured on the software and in the Human Anatomy Study Guide and Workbook. For example, recognize the difference between an anterior view of the femur and a posterior view of the femur. Try to notice key landmarks on the bones that allow you to identify the anterior aspect of the bone from the posterior aspect of the bone.

4. Be able to relate the appendicular bones to the terms of position covered in the Anatomical Nomenclature chapter of the Human Anatomy Lecture Manual. It is important to become familiar with the basic terminology used to describe relationships between anatomical structures and the various parts of the body. For example, the radius is the lateral bone in the antebrachium and the head of the radius is at the proximal end of the bone.

5. Learn the names of all the bones (including all the bones of the wrist, hand, ankle, and foot) and the landmarks marked with an "**" on the bone illustrations in the Study Guide. Be able to identify these landmarks on the photos of the bones on the Human Anatomy Interactive Atlas software. These are key landmarks that will help you orient the appendicular bones.

6. As you are studying the bones and their landmarks, try to palpate them on your own body. Gaining an understanding of where these landmarks are on your own body can help you with the learning process.

Objectives During the Lab
During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

1. Describe the basic design of the skeletal system and understand its role in the human body.

2. Be able to differentiate between the axial and appendicular portions of the skeleton.

3. Recognize the differences between compact and spongy bone and be able to identify these different types of bone tissue.

4. Be able to identify the parts of a typical long bone.
5. Be able to orient the bones as they would appear in the fully articulated skeleton.

6. Understand the relationships between neighboring bones, i.e., learn the names of the articular surfaces of the bones. These landmarks are easily identified by their smooth, bearing-like surfaces. Surfaces which in life are covered with articular cartilage.

7. Identify all the landmarks indicated for each bone in the *Human Anatomy Study Guide and Workbook* and on the “Basic Labels” button on the *Human Anatomy Interactive Atlas* software. Realize that these landmarks are either surfaces of articulation with other bones or points of soft tissue attachment for muscles and ligaments. Learning these landmarks now will prove to be very beneficial when you study muscle anatomy later in the semester.

If by the end of the lab session you have not learned all the information outlined in these objectives, do not worry. The lab will introduce you to the required knowledge base and help you begin the learning process. For this reason, the more you prepare for the lab, the more you will benefit. Realize that to fully learn the information covered in this lab, you will need to do additional homework after you leave the lab. Use the *Human Anatomy Interactive Atlas* software, *Real Anatomy 2.0*, and the *Human Anatomy Study Guide and Workbook* to further pursue your lab studies after the lab is over.

**Structures to Identify for the Quiz**

To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should do the following:

1. Be able to identify all the bones of the appendicular skeleton on the photographs in Appendicular Skeleton Module of the *Human Anatomy Interactive Atlas* software. You should be able to identify each of the following bones:

   - Clavicle
   - Scapula
   - Humerus
   - Radius
   - Ulna
   - Scaphoid
   - Lunate
   - Triquetrum
   - Trapezoid
   - Trapezium
   - Capitate
   - Pisiform
   - Hamate
   - Metacarpals
   - Phalanges of hand
   - Os coxae
   - Ilium
   - Ischium
   - Pubis
   - Femur
   - Patella
   - Tibia
   - Fibula
   - Talus
   - Calcaneus
   - Navicular
   - Cuboid
   - Lateral cuneiform
   - Middle or intermediate cuneiform
   - Medial cuneiform
   - Metatarsals
   - Phalanges of foot

2. Be able to identify whether you are looking at the anterior aspect of each bone or the posterior aspect of the bone.
3. Using the illustrations of the appendicular skeleton in the *Human Anatomy Study Guide and Workbook*, be able to identify the bony landmarks marked with an asterisk on the bone photos on the software. We are breaking you in gradually and not trying to overwhelm you. By the end of the lab you should know all the bony landmarks listed on the following pages, but for the quiz you should be able to identify the following bony landmarks:

**On Clavicle:**
- Acromial end
- Sternal end
- Conoid tubercle

**On Scapula:**
- Acromion
- Spine of scapula

**On Humerus:**
- Head
- Olecranon fossa

**On Radius:**
- Head
- Styloid process

**On Ulna:**
- Radial notch
- Olecranon process

**On Os Coxae:**
- Iliac crest
- Acetabulum

**On Femur:**
- Head
- Linea aspera

**On Tibia:**
- Tibial tuberosity
- Medial malleolus

4. Be able to use the terminology covered in the Anatomical Nomenclature chapter of the lecture manual with the photos of the bones on the software.
Structures to Identify in the Lab

Clavicle
- Acromial end
- Sternal end
- Conoid tubercle
- Impression for costoclavicular ligament

Scapula
- Spine
- Acromion
- Glenoid cavity
- Coracoid process
- Infraspinous fossa
- Subscapular fossa
- Inferior angle
- Superior angle
- Infraglenoid tubercle
- Supraglenoid tubercle
- Lateral border
- Medial border

Humerus
- Head of humerus
- Greater tubercle
- Lesser tubercle
- Intertubercular groove
- Deltoid tuberosity
- Trochlea
- Capitulum
- Medial epicondyle
- Lateral epicondyle
- Olecranon fossa

Ulna
- Olecranon
- Trochlear notch
- Coronoid process
- Ulnar tuberosity
- Radial notch
- Head of ulna
- Styloid process of ulna

Radius
- Head of radius
- Radial tuberosity
- Styloid process of radius

Carpal Bones
- Scaphoid bone
- Lunate bone
- Triquetrum bone
- Pisiform bone
- Trapezium bone
- Trapezoid bone
- Capitate bone
- Hamate bone

Metacarpal bones

Phalanges of the hand
- Proximal phalanx
- Middle phalanx
- Distal phalanx

Os Coxa
- Acetabulum
- Obturator foramen
- Greater sciatic notch
- Ilium
- Iliac crest
- Anterior superior iliac spine
- Anterior inferior iliac spine
- Iliac fossa
- Auricular surface for sacrum
- Iliac tuberosity
- Anterior gluteal line
- Posterior gluteal line
- Inferior gluteal line
- Ischium
- Ischial spine
- Ischial ramus
- Lesser sciatic notch
- Ischial tuberosity
- Pubis
- Pubic crest
- Pubic tubercle
- Pectineal line
- Pubic symphysis
- Superior pubic ramus
- Superior pubic ramus
Femur
- Head of femur
- Neck of femur
- Greater trochanter
- Lesser trochanter
- Intertrochanteric crest
- Pectineal line
- Gluteal tuberosity
- Linea aspera
- Lateral condyle
- Medial condyle
- Adductor tubercle
- Patellar surface

Patella

Fibula
- Head
- Neck
- Lateral malleolus
- Malleolar fossa

Tibia
- Lateral condyle
- Medial condyle
- Tibial tuberosity
- Medial malleolus

Tarsal bones
- Talus bone
- Calcaneus bone
- Navicular bone
- Medial cuneiform bone
- Intermediate cuneiform bone
- Lateral cuneiform bone
- Cuboid bone

Metatarsal bones

Phalanges of the foot
- Proximal phalanx
- Middle phalanx
- Distal phalanx

Parts of a typical bone
- Epiphysis
- Diaphysis
- Medullary cavity
- Nutrient foramen
- Compact bone
- Spongy bone
After the Lab is Over

The Marriott Library has bone boxes that you can check out to study the bones. You can check the bones out from the general reserve desk and use them within the library.

Tips for reviewing bone material

Bone orientation

Be able to orient any bone and determine whether it is a right or a left bone. Try to do it with your eyes closed by feeling for prominent surface landmarks that you learned during the lab.

Landmarks

Every osteological landmark has a descriptive name and the Latin and Greek origins of these words can be very helpful learning aids. For example, in Latin the greater tubercle means the ‘bigger bump’. Knowing the etymology of these words can help you use association techniques when learning the terminology to improve long term memory.

Take advantage of the opportunity to use the bone boxes at the library and during anatomy office hours and review the bony landmarks. Pair up with a partner and quiz each other. Take turns pointing to the bony landmarks and asking each other their names. This will help you prepare for the bone practical exams that you will take in some of the later labs in the semester.

Landmarks I need to review this week

In the space to the right, compile a list of the osteological landmarks from Lab 1 that you feel you need to focus on during your review opportunities.

The Human Anatomy Study Guide and Workbook contains additional unlabeled illustrations of the bones. These are provided for you to use as study aids to test your knowledge of the landmarks. During the first laboratory session you covered these landmarks with a teaching assistant. Now test yourself and make sure that you can identify them on your own. If you desire to spend additional time handling the actual bones, you can look at the bones at the library or in the laboratory during office hours.
Laboratory Two

Collaborative Learning Stations

1. Blood vessels - Major pathways
2. Arthrology
3. Heart 1
4. Heart 2
5. Integument, soft tissues, and myology
**How to Prepare for the Lab**

By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:

1. Study the Soft Tissues and Cardiovascular modules on the *Human Anatomy Interactive Atlas* software.

2. Know the material covered in the histology, integument, arthrology, myology, and cardiovascular lectures in the *Human Anatomy Lecture Manual*.

3. Be especially familiar with the major joint categories and the specific subcategories within each major joint category.

4. Be able to trace a drop of blood through the heart.

5. Using the major “highway system” of blood vessels, be able to trace a drop of blood from the heart to major regions of the body and then back again to the heart. Practicing blood traces will help you solidify the “big picture” relationships of the blood vessels.

**Objectives During the Lab**

During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

**Integument and soft tissues**

1. Be able to recognize the gross appearance of different tissue types and their locations on the cadaver parts.

2. Understand the concept of a tissue versus a layer or structure. When learning structures always ask the question: What tissue or tissues is this structure made of? Realize that tissues are merely building materials. All anatomical layers and structures are made of tissues. For example, the epidermis is a layer or structure made up of stratified squamous epithelial tissue.

3. Learn to recognize and identify the different fiber orientations of dense regular connective tissue and dense irregular connective tissue. Identify specific examples of structures comprised of each of these dense connective tissues.

4. Be able to identify the layers of the integument, as well as the deeper fascial layers and connective tissue wrappings around and within a skeletal muscle.

**Arthrology**

1. Be able to recognize the different types of joints identified in the arthrology section of the lecture manual.

2. Be able to identify the structures of a synovial joint. Understand the role of a meniscus and the extracapsular ligaments around the synovial joints.
Cardiovascular system
1. Be able to identify all the structures of the heart including the chambers, vessels, and valves.
2. Be able to correctly orient a heart.
3. Understand how the valves function to create a unidirectional flow through the heart and be able to trace the flow of blood through the heart.
4. Understand how the atria and ventricles are different, in both appearance and function.
5. Acquire the skill to distinguish an artery from a vein on a cadaver.
6. Be able to identify the major arteries and veins on a cadaver and be able to trace blood through the vessels from one part of the body to another part.

Structures to Identify for the Quiz
To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Soft Tissues Module and Cardiovascular Module of the Human Anatomy Interactive Atlas software. There will be five questions on the quiz on this material. In addition, there will be five questions on the quiz from the material you studied in Lab #1. These five questions can be anything in the Lab 1 Section titled “Structures To Identify In The Lab”.

Soft tissue photos
1. Step dissection
2. Thigh cross section
3. Hand
4. Cranium
5. Knee joint 2

Cardiovascular photos
1. Heart, external anatomy
2. Ventricles of the heart 1
3. Valves of the heart
4. Proximal superior limb 1
5. Antebrachial arteries
6. Branches of aorta 2
Structures to Identify in the Lab

Integument and soft tissues

Integument
- Epidermis
- Dermis
- Hypodermis (tela subcutanea)

Miscellaneous soft structures
- Fascia
- Body of skeletal muscle
- Tendon of skeletal muscle
- Epimysium
- Perimysium
- Retinaculum
- Periosteum

Arthrology

Fibrous joints
- Gomphosis
- Interosseous membrane
- Plane suture
- Squamous suture
- Serrate suture
- Denticulate suture

Cartilaginous joints
- Intervertebral symphysis (disc)
- Epiphyseal growth plate

Synovial joints
- Articular cartilage
- Fibrous membrane (capsular ligament)
- Synovial membrane
- Meniscus
- Ligament

Synovial structures
- Synovial bursa
- Tendon sheath

Cardiovascular system

Heart
- Right atrium
- Left atrium
- Auricle

- Pectinate muscle
- Tricuspid valve
- Mitral or bicuspid valve
- Right ventricle
- Left ventricle
- Trabeculae carneae
- Papillary muscle
- Chordae Tendineae
- Pulmonary valve
- Aortic valve

Major vessels
- Pulmonary trunk
- Pulmonary arteries
- Pulmonary veins
- Aorta
- Coronary arteries
- Cardiac veins
- Coronary sinus
- Superior vena cava
- Inferior vena cava
- Brachiocephalic artery and veins
- Common carotid arteries
- Internal jugular veins
- Subclavian arteries and veins
- Axillary arteries and veins
- Brachial arteries and veins
- Radial arteries and veins
- Ulnar arteries and veins
- Common iliac arteries and veins
- Internal iliac arteries and veins
- External iliac arteries and veins
- Femoral arteries and veins
- Popliteal arteries and veins
- Anterior tibial arteries and veins
- Posterior tibial arteries and veins

Lymphatics
- Lymph node
- Lymph vessels
After the Lab is Over

Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during those review labs it is beneficial to jot down some notes after attending the lab. Use this section to make notes about areas of the anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information below and the space to the right for this purpose.

Tips for reviewing the integument and soft tissues

Work from superficial to deep whenever identifying the different layers on the step dissections and transverse sections. Always identify a starting point and think through the relationships that you learned in the lecture to guide your way through the structures.

Tips for reviewing arthrology

Use the dissection of the knee joint and find all the synovial joint structures from superficial to deep. Think about the relationships each of the structures form with one another and identify these relationships on the dissection.

Where would you look for a bursa? Try to find a few.

Tips for reviewing hearts

Orient several different hearts using the methods you learned in the lab.

Trace a red blood cell through the heart and identify all the chambers, valves and vessels you pass through.

Where do you look for muscular structures such as pectinate muscle and trabeculae carnae?

Some of the hearts have clearly dissected coronary arteries and cardiac veins. On these hearts, identify all the vessels that vascularize the cardiac muscle of the heart.

Structures I need to review

In the space to the right, compile a list of the anatomical structures from Lab 2 that you feel you need to focus on during the review labs.
Laboratory Three

Collaborative Learning Stations
1. Digestive system
2. Organs in situ
3. Urinary system
4. Respiratory system
5. Practice practical exam/Review
**How to Prepare for the Lab**

By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:

1. Study the Systems module on the *Human Anatomy Interactive Atlas* software.

2. Know the material covered in the urinary, respiratory, and digestive lectures in the *Human Anatomy Lecture Manual*.

3. Be able to trace molecules through the urinary, respiratory, and digestive systems and be prepared to follow these traces on the body parts in the lab. This will require that you know the different structures of each system and how they are related.

4. Understand the concept of diffusional exchange and the structural relations the urinary, respiratory, and digestive systems form with the cardiovascular system to promote these exchange sites.

**Objectives During the Lab**

During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

**Urinary system**

1. Using the dissections and models in the lab, learn how to identify all the urinary structures listed in the section – Structures to identify in the lab.

2. Be able to orient a kidney as it would appear in situ (in the body). Distinguish a right from left kidney.

3. Understand the significance of the relationships between urinary tubes and circulatory vessels. Understand where molecular exchanges between these systems occur and the nature of the exchange barriers.

4. Understand the functional significance of increased surface area and identify the structures that contribute to this.

**Respiratory system**

1. Using the dissections in the lab, learn how to identify all the respiratory structures listed in the section – Structures to identify in the lab.

2. Be able to identify the anatomy of the larynx that is responsible for sound production.

3. Understand the relationship of the pulmonary air spaces of the lung to the capillaries of the cardiovascular system.

4. Understand where diffusion between the cardiovascular and respiratory systems occurs and the nature of the diffusional barriers.

5. Understand the functional significance of increased surface area and identify the structures that contribute to this.
Digestive system
1. Using the dissections in the lab, learn how to identify all the digestive structures listed in the section – Structures to identify in the lab.

2. Be able to recognize the structural differences and modifications that occur along the length of the gut tube.

3. Understand the relationship between the absorptive surface of the gut and the cardiovascular system.

4. Understand where absorption occurs between the digestive and cardiovascular systems and the nature of the barriers to this molecular movement.

5. Understand the functional significance of increased surface area and identify the structures that contribute to this.

Structures to Identify for the Quiz
To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Exchange Systems Module of the Human Anatomy Interactive Atlas software. There will be five questions on the quiz from this material. In addition, there will be five questions on the quiz from the material you studied in Lab 1 and Lab 2. These five questions can be anything in the Lab 1 or 2 from the Section titled “Structures To Identify In The Lab”. These review questions will help you keep on top of past material and not forget it. This will help you prepare for comprehensive tests later in the semester.

Urinary system photos
1. Urinary organs
2. Kidneys
3. Bladder and urethra

Respiratory system photos
1. Sagittal head and neck
2. Thorax
3. Cartilages of the larynx 1

Digestive system photos
1. Sagittal head and neck
2. Esophagus
3. Stomach
4. Small intestine 3
5. Large intestine
Structures to Identify in the Lab

Urinary system
Principal organ
- Kidney

Regions of the Kidney
- Cortex
- Medulla
- Renal pyramid
- Renal column

Urinary tubes
- Minor calyces
- Major calyces
- Renal pelvis
- Ureter
- Urinary bladder
- Urethra

The following urinary tubes are microscopic and must be identified on the models in the lab.
- Glomerular capsule
- Proximal convoluted tubule
- Nephron ansa
- Distal convoluted tubule
- Collecting tubule

Urinary vessels
- Renal artery
- Renal vein
- Segmental artery
- Segmental vein
- Interlobar artery
- Interlobar vein

The following urinary vessels are microscopic and must be identified on the models in the lab.
- Arcuate artery
- Arcuate vein
- Interlobular artery
- Interlobular vein
- Afferent glomerular arteriole
- Glomerulus
- Efferent glomerular arteriole
- Peritubular capillaries

Respiratory system
Nasal cavity and pharynx
- Nasal cavity
- Nasopharynx
- Oropharynx
- Laryngopharynx

Larynx
- Epiglottis
- Thyroid cartilage
- Cricoid cartilage
- Arytenoid cartilages
- Vocal fold
- Vocal ligament

Bronchial tree
- Trachea
- Tracheal cartilages
- Fibromuscular membrane
- Principal or main bronchi
- Lobar bronchi
- Segmental bronchi

Principal organ
- Right lung
- Left lung

Digestive system
Oral cavity and pharynx
- Oral cavity
- Hard palate
- Soft palate
- Uvula
- Tongue
- Oropharynx
- Laryngopharynx

Gut tube proper
- Esophagus
- Stomach
- Greater curvature
- Lesser curvature
- Fundus of stomach
- Body of stomach
- Pylorus of stomach
- Gastric rugae
- Pyloric sphincter
- Duodenum
- Jejunum
- Ileum
- Circular folds
- Cecum
- Vermiform appendix
- Ascending colon
- Transverse colon
- Descending colon
- Sigmoid colon
- Semilunar folds
- Taenia coli
- Omental or fatty appendices
- Rectum
Structures to Identify in the Lab (cont.)

Glandular organs
- Liver
- Gall bladder
- Pancreas

After the Lab is Over
Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during those review labs, it is beneficial to jot down some notes after attending the lab. Use this section to make notes about the areas of anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information and space below for this purpose.

Tips for reviewing the material

Respiratory
Identify all of the respiratory passageways on the sagittal head.

On the dissections look at the relationships of the heart and lungs. Find the trachea and bronchi. Are there other structures you recognize from previous labs?

Digestive
Visualize the thoracic and abdominal organs you have seen in the lab. Try and get a sense of where the different organs sit in the abdominal cavity. Understand the topography of the viscera in your own body.

Structures I need to review
Compile a list of the anatomical structures from Lab 3 that you feel you need to focus on when you get a chance to review.
Laboratory Four

Collaborative Learning Stations

1. Axial skeleton - Ribs, Sternum, Hyoid
2. Nervous System - Somatic
3. Nervous System - Autonomic
4. Axial Skeleton - Cranium
5. Axial Skeleton - Vertebral Column
How to Prepare for the Lab
By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:

2. Know the material covered in the nervous system lecture in the Human Anatomy Lecture Manual.
3. Read the section in the Human Anatomy Study Guide and Workbook (pages 47 - 73) about the axial skeleton. Be prepared to identify the different types of vertebrae and the characteristic features shared by all vertebrae.

Objectives During the Lab
During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

Axial skeleton - vertebral column and ribs
1. Understand the structural design and functional significance of the vertebral column and rib cage in the human body.
2. Be able to identify the bony landmarks of a typical vertebra.
3. Be able to distinguish the bones in the five different regions of the vertebral column. For each vertebral region, know the number of bones and the diagnostic feature for the bones of that region.
4. Understand how the ribs articulate with the vertebral column.
5. Understand the difference between true ribs, false ribs, and floating ribs and recognize the relationships each of these rib types has with the sternum.

Axial skeleton - cranium
1. Be able to identify the individual bones of the cranium listed in the section - Structures to identify in the lab. (The Human Anatomy Interactive Atlas software and the Human Anatomy Study Guide and Workbook can help you study the individual bones.)
2. Be able to identify the names of the main sutures and recognize the different types of sutures.

Nervous system
1. Using the dissections in the lab, learn to identify all the nervous structures listed in the section - Structures to identify in the lab.
2. Be able to distinguish between the structures of the peripheral nervous system and the central nervous system.

3. Identify the somatic branches of the spinal nerves and the splanchnic branches of the spinal nerves. Understand the functional differences between these two nerve pathways.

**Structures to Identify for the Quiz**

To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Axial Skeleton and Control Systems Modules of the *Human Anatomy Interactive Atlas* software. There will be five questions on the quiz from this material. In addition, there will be five questions on the quiz from the material you studied in Lab 1, 2, and 3. These five questions can be anything in those labs from the Section titled “Structures To Identify In The Lab”. These review questions will help you keep on top of past material and not forget it. This will help you prepare for comprehensive tests later in the semester. Also, this quiz will have 1 or 2 questions from the illustration of the nervous system on page 148 of the *Human Anatomy Study Guide and Workbook*. You should be able to label all structures on this illustration.

**Axial skeleton photos**
1. Cranium, anterior view
2. Cranium, lateral view
3. Cranium, inferior view
4. Cranial vault
5. Thoracic vertebrae

**Nervous system photos**
1. Autonomic system 1
2. Spinal nerves 1
3. Spinal nerves 2
Structures to Identify in the Lab

**Axial skeleton**

**Vertebral Column**
- Body of vertebrae
- Pedicle
- Transverse process
- Superior articular process
- Inferior articular process
- Lamina
- Spinous process
- Vertebral foramen
- Intervertebral foramen
- Atlas (first cervical vertebra)
- Axis (second cervical vertebra)
- Dens (odontoid process)
- Cervical vertebrae
- Transverse foramen
- Thoracic vertebrae
- Costal facets
- Lumbar vertebrae
- Sacrum
- Coccyx

**Rib cage**
- Rib
- Head of rib
- Tubercle of rib
- Sternum
- Manubrium
- Body of sternum
- Xiphoid process

**Cranium bones**
- Frontal bone
- Parietal bone
- Occipital bone
- Temporal bone

**Nervous system**

**Central nervous system**
- Brain
- Spinal cord
- Gray matter
- White matter

**Peripheral nervous system**
- Ventral rootlets
- Dorsal rootlets
- Ventral root
- Dorsal root
- Dorsal root ganglion or spinal ganglion
- Spinal trunk nerve
- Anterior or ventral ramus
- Posterior or dorsal ramus
- White communicating ramus
- Gray communicating ramus
- Intercostal nerve
- Sympathetic trunk
- Sympathetic trunk ganglion
- Parasympathetic splanchnic nerve
- Sympathetic splanchnic nerve
After the Lab is Over

Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during those review labs, it is beneficial to jot down some notes after attending the lab. Use this section to make notes about the areas of anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information and space below for this purpose.

Tips for reviewing the material

The Marriott Library has bone boxes that you can check out to study the bones. You can check the bones out from the general reserve desk and use them within the library.

Take advantage of the opportunity to use the bone boxes at the library and during anatomy office hours to review the bones of the axial skeleton. Pair up with a partner and quiz each other. Take turns pointing to the bones and asking each other their names. This will help you prepare for the final practical exam that you will take at the end of the semester.

Structures I need to review

Compile a list of the anatomical structures from Lab 4 that you feel you need to focus on when you get a chance to review.

| Vertebral column | Rib cage | Cranium |
Laboratory Five

Collaborative Learning Stations

1. Abdominal body wall muscles
2. Thoracic body wall muscles and anterior body wall blood vessels
3. Posterior body wall blood vessels
4. Peritoneal organs, retroperitoneal organs, and mesenteries
5. Coeloms and cross-sections
How to Prepare for the Lab

By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:

1. Study the Thorax and Abdomen modules on the Human Anatomy Interactive Atlas software.

2. Know the material covered in the patterns of trunk design, thorax, and abdomen lectures in the Human Anatomy Lecture Manual.

3. Know the pattern of organization for the body wall muscles. Be able to relate the pattern to the named muscles of the thoracic and abdominal walls.

4. Know the basic pattern of body wall vessels and their names in the two regions. Be able to recognize the continuity of the vessels between the thorax and abdomen.

5. Understand the fist in the balloon concept of a visceral organ in a coelomic cavity.

6. Understand and be able to differentiate between the following terms: parietal, visceral, mesentery, omentum, peritoneal, retroperitoneal, and secondary retroperitoneal.

Objectives During the Lab

During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

Thoracic anatomy

1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.

2. Understand the concept of segmental somatic veins, arteries, and nerves and their relationship to the body wall. Be able to identify these structures. Note the possible collateral circuits that exist between vessels.

3. Understand and identify the regions of the thoracic cavity (pleural cavity, pericardial cavity, mediastinum) and the mesothelial membranes that define them. Identify the structures within each of these thoracic regions.

4. Learn how to identify any vessel by asking, “From where does it arise, and more importantly, where is it going?”

Abdominal anatomy

1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.

2. Note the similarities between the abdominal body wall muscles and the thoracic body wall muscles and recognize how they fit the body wall pattern of design.
3. Identify the arteries, veins, and nerves of the abdominal body wall. Understand their relationships with vessels in the thoracic body wall.

4. Identify the extent of the peritoneal cavity and the visceral and parietal peritoneal layers. Recognize the difference between a mesentery and an omentum and be able to identify the mesenteries and omenta in the peritoneal cavity.

5. Recognize the relationships the various abdominal organs have with one another and within the peritoneal cavity.

6. Identify the retroperitoneal viscera. Understand the significance of peritoneal versus retroperitoneal organs.

**Structures to Identify for the Quiz**
To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Thorax and Abdomen Modules of the Human Anatomy Interactive Atlas software. There will be five questions on the quiz from this material. In addition, there will be five questions on the quiz from the material you studied in Lab 1, 2, 3, and 4. These five questions can be anything in those labs from the Section titled “Structures To Identify In The Lab”. These review questions will help you keep on top of past material and not forget it. This will help you prepare for comprehensive tests later in the semester.

**Thorax photos**
1. Thoracic cavity 3
2. Thoracic cavity 4
3. Heart in situ
4. Posterior thoracic wall 1
5. Posterior thoracic wall 2
6. Posterior thoracic wall 3

**Abdomen photos**
1. Abdominal muscles 1
2. Abdominal muscles 2
3. Abdominal wall 1
4. Abdominal cavity 1
5. Abdominal cavity 3
Structures to Identify in the Lab

**Thorax**

**Thoracic muscles**
- Sternalis
- External intercostals
- Internal intercostals
- Innermost intercostals
- Transversus thoracis
- Subcostals
- Diaphragm
- Longus colli

**Thoracic vessels and nerves**
- Aorta
- Posterior intercostal artery and vein
- Superior phrenic artery and vein
- Internal thoracic artery and vein
- Pericardiacophrenic artery and vein
- Anterior intercostal artery and vein
- Musculophrenic artery and vein
- Bronchial artery and vein
- Esophageal artery and vein
- Superior vena cava
- Azygos vein
- Hemiazygos vein
- Accessory hemiazygos vein
- Thoracic lymphatic duct
- Intercostal nerve
- Phrenic nerve
- Sympathetic trunk
- Communicating rami
- Sympathetic splanchnic nerve
- Vagus nerve

**Abdomen**

**Abdominal muscles**
- Rectus abdominis muscle
- Rectus sheath
- Linea alba
- External oblique
- Internal oblique
- Transversus abdominis
- Quadratus lumborum
- Psoas major
- Psoas minor

**Abdominal vessels and nerves**
- Aorta
- Inferior vena cava
- Inferior phrenic artery & vein
- Lumbar artery & vein
- Superior epigastric artery & vein
- Inferior epigastric artery & vein
- Ascending lumbar vein
- Sympathetic splanchnic nerves

**Coeloms and mesenteries**
- Parietal peritoneum
- Visceral peritoneum
- Peritoneal cavity
- Greater omentum
- Lesser omentum
- Mesentery
- Peritoneal organs
- Retroperitoneal organs
After the Lab is Over

Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during the review labs, it is beneficial to jot down some notes after attending the lab. Use this section to make notes about the areas of anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information and space on the following page for this purpose.

Tips for reviewing material

One of the keys to learning the anatomy of the thorax and abdomen is to understand the body wall patterns of design taught in lecture. If you comprehend this basic underlying pattern of design it will make it much less formidable to learn the detail of this anatomy. Understanding the patterns will simplify the learning process.

Thoracic anatomy

Identify each of the muscles in the thoracic wall pattern.

Recognize which layer of the lateral wall musculature is the most complex?

Try to identify the fist in the balloon analogy in the thoracic cavity?

Abdominal anatomy

Again, use the muscle wall pattern to help you simplify the muscles of the abdominal wall.

Make sure you understand the concept of retroperitoneal. How does this relate to the organs of the abdominal cavity?

Recognize how the fist in the balloon exists in the abdominal cavity also.

Coeloms


On any visceral dissection you see in lab try to name the coelomic membranes that are associated with the different organs.

Body wall vessels

Find the main posterior supply – the aorta. Now find all the branches of the aorta in the thorax. Do the same in the abdomen.

Look on the internal surface of the sternum to find the anterior supply of the thorax – the internal thoracic artery. Now look for and identify the small branches of this artery. Look on the internal surface of rectus abdominis, beneath the rectus sheath, to find the epigastric arteries. Look for the connection between the internal thoracic and the superior epigastric arteries.

Trace the veins of the posterior abdominal body wall up towards the thorax. The ascending lumbar veins in the abdomen become the azygos and hemiazygos veins of the thorax.
**Structures I need to review**

Compile a list of the anatomical structures from Lab 5 that you feel you need to focus on when you get a chance to review.

<table>
<thead>
<tr>
<th>Body wall muscles</th>
<th>Body wall vessels</th>
<th>Coelomic anatomy</th>
</tr>
</thead>
</table>

**Handy Mnemonic Memory Tricks**

Here is a mnemonic device to help you learn the retroperitoneal organs of the abdominal cavity:

Rocker Kids Party Down with AC/DC Records
Retroperitoneal
Kidneys
Pancreas
Duodenum
Ascending Colon
Descending Colon
Rectum
Laboratory Six

Collaborative Learning Stations

1. Mediastinum
2. Male genital anatomy
3. Female genital anatomy
4. Abdominal vasculature
5. Review
How to Prepare for the Lab
By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:

1. Study the Abdomen and Reproductive/Pelvis modules on the Human Anatomy Interactive Atlas software.
2. Know the material covered in the abdomen and reproductive lectures in the Human Anatomy Lecture Manual.
3. Study the vessels, both arteries and veins, that carry blood to and form the digestive organs. Understand the basic pattern of design covered in the lecture that governs the basic structure of these vessels.
4. Understand the functional significance of the hepatic portal system.
5. Be able to trace male and female gametes from their sites of production to the point where they meet.
6. Understand the similarities and differences between male and female erectile tissues.

Objectives During the Lab
During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

Abdominal visceral vessels
1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.
2. Be able to identify the visceral vessel that supplies and drains each abdominal organ.
3. Recognize the difference between the abdominal visceral arteries and veins, that is, the hepatic portal system. Understand the significance of the hepatic portal system.
4. Recognize the topographical relationships that exist among the blood vessels and the abdominal organs.

Reproductive system
1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.
2. Be able to demonstrate on the cadavers the gametic pathways in the male and female reproductive systems.
3. Be able to recognize and identify the homologies between male and female reproductive structures.
Structures to Identify for the Quiz

To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Abdomen and Pelvis Modules of the Human Anatomy Interactive Atlas software. There will be five questions on the quiz from this material. In addition, there will be five questions on the quiz from the material you studied in Lab 1, 2, 3, 4, and 5. These five questions can be anything in those labs from the Section titled “Structures To Identify In The Lab”. These review questions will help you keep on top of past material and not forget it. This will help you prepare for comprehensive tests later in the semester.

Abdomen photos
1. Abdominal vessels 1
2. Abdominal vessels 2
3. Abdominal vessels 3
4. Abdominal vessels 4

Genital system photos
1. Male pelvis, anterior view – just the genital system structures
2. Male accessory glands – just the genital system structures
3. Male sagittal pelvis – just the genital system structures
4. Female sagittal pelvis – just the genital system structures
Structures to Identify in the Lab

Abdominal visceral vessels

Visceral arteries
- Celiac artery
- Left gastric artery
- Esophageal artery
- Splenic artery
- Left gastro-omental artery
- Short gastric artery
- Common hepatic artery
- Right gastric artery
- Proper hepatic artery
- Gastroduodenal artery
- Right gastro-omental artery
- Pancreaticoduodenal artery
- Superior mesenteric artery
- Inferior mesenteric artery
- Renal artery
- Testicular/ovarian artery

Visceral veins
- Inferior vena cava
- Hepatic vein
- Hepatic portal vein
- Right gastric vein
- Left gastric vein
- Superior mesenteric vein
- Left gastro-omental vein
- Splenic vein
- Inferior mesenteric vein
- Right gastro-omental vein
- Renal veins
- Testicular/ovarian veins

Reproductive system

Male
- Scrotum
- Testis
- Seminiferous tubules
- Spermatic cord
- Ductus deferens
- Epididymis
- Seminal vesicle
- Ejaculatory duct
- Prostate gland
- Bulbourethral gland
- Prostatic urethra
- Intermediate or membranous urethra
- Spongy urethra

Female
- Ovary
- Uterine tubes
- Fimbriae
- Uterus
- Cervix of uterus
- Vagina
- Vaginal fornix
- Labia majora
- Labia minora
- Clitoris
- Bulb of the vestibule
- Greater vestibular gland
After the Lab is Over

Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during those review labs, it is beneficial to jot down some notes after attending the lab. Use this section to make notes about the areas of anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information below and the space to the right for this purpose.

Tips for reviewing the material

Abdominal visceral vessels
To most effectively identify the arteries of the abdominal viscera, begin big. That is, start by finding the three major branches coming off the aorta, the celiac, superior mesenteric, and inferior mesenteric arteries. Once you have identified the larger vessels, it is easier to progress from these to the smaller vessels.

Off the celiac trunk follow each individual branch and name it according to what it supplies or where it travels. Keep in mind the adoral/aboral branching concept.

To locate all of the veins, try beginning with the hepatic portal vein. Find it, then follow out all the veins that drain into it, naming them as you did the arteries. Also, note that the veins run with arteries of the same name.

Genital anatomy
As long as you orient yourself on the dissections in the lab and clearly recognize what you are looking at, you should be able to easily identify the genital structures.

Structures I need to review
Compile a list of the anatomical structures from Lab 6 that you feel you need to focus on when you get a chance to review.
Laboratory Seven

Collaborative Learning Stations

1. Pelvis muscles/Model (5 points)
2. Perineal anatomy
3. Pelvic blood vessels
4. Epaxial back muscles
5. Midterm practical exam (10 points)
How to Prepare for the Lab

By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:

1. Study the Reproductive/Pelvis and Back modules on the Human Anatomy Interactive Atlas software.

2. Know the material covered in the Pelvis and Back lectures in the Human Anatomy Lecture Manual.

3. Review the bony landmarks of the os coxa. This is important! If you can understand the skeletal anatomy of the pelvis, it will be easier to understand the muscular anatomy associated with this region of anatomy.

4. Understand the three layered lateral body wall muscles of the pelvis/perineum.

5. Build the paper pelvis model (it can be found in the back of the Human Anatomy Study Guide and Workbook) and answer the questions that accompany it. Bring the model with you to your lab and you will receive 5 points for it. A rotation in this week’s lab is devoted to helping you understand the muscles of the pelvis and perineum on your pelvic model. The pelvis and perineum is a challenging area of anatomy for most students. The purpose of the model is to help better prepare you for lab where you will study this region of anatomy.

6. Learn the names of the branches of the internal iliac artery. Remember that they are named based on where they go, not how they connect to the internal iliac vessels.

6. Review the “four layers” of back muscles from superficial to deep.

Objectives During the Lab

During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

Pelvis model

1. Be able to identify the three muscle layers of the pelvic/perineal region. Gain a three-dimensional understanding of these muscles on your pelvic model.

2. Analyze the topographical relationships between the pelvic/perineal muscles and the bony pelvis.

3. Identify the different boundaries and regions in the pelvis and perineum (e.g., true versus false pelvis, urogenital triangle versus anal triangle) and understand the difference between the pelvis and perineum.
Pelvis and perineum
1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.

2. Be able to differentiate between the muscles of the pelvic diaphragm (internal layer), the urogenital diaphragm (middle layer), and the external muscle layer. Gain a three-dimensional understanding of these muscles.

3. Be able to identify the different boundaries and regions in the pelvis and perineum (e.g., urogenital triangle and anal triangle).

4. Understand the difference between the pelvis and the perineum.

5. Be able to identify the region called the ischioanal fossa and identify the structures found within this region.

6. Identify the deep perineal pouch and the superficial perineal pouch. Be able to identify the structures and muscles found in these regions.

7. Be able to identify the branches of the internal iliac artery. Note how they are named.

Epaxial back muscles
1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.

2. Understand the relationship between the epaxial muscles and hypaxial muscles of the back.

3. Be able to recognize the difference between epaxial and hypaxial innervation. Identify which muscles of the back are innervated by epaxial nerves and which are innervated by hypaxial nerves.

Midterm practical exam
Be prepared to take the midterm practical exam. It will cover anatomy from Lab 2 through Lab 6 and be worth 10 points. There will be 10 questions and no lab is weighted more than any other. This will help you review the lab material and not fall behind as you prepare for the final practical exam.
Structures to Identify for the Quiz

To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Pelvis and Back Modules of the Human Anatomy Interactive Atlas software. There will be five questions on the quiz from this material. In addition, there will be five questions on the quiz from the material you studied in Lab 1, 2, 3, 4, 5, and 6. These five questions can be anything in those labs from the Section titled “Structures To Identify In The Lab”. These review questions will help you keep on top of past material and not forget it. This will help you prepare for comprehensive tests later in the semester.

Pelvis/perineal photos
1. Pelvic vessels
2. Male sagittal pelvis – just the vessels
3. Female perineum – just the muscles
4. Female pelvic inlet – just the muscles

Back photos
1. Intrinsic back muscles
2. Posterolateral neck 2
3. Semispinalis 1
4. Deep back 1
Structures to Identify in the Lab

Pelvis/perineal body wall muscles
- Levator ani
- Pubococygeus part of the levator ani
- Iliococcygeus part of the levator ani
- Ischiococcygeus or coccygues
- Sacrospinous ligament
- Obturator internus
- Transversus perinei profundus (male)
- External urethral sphincter (male and female)
- Compressor urethrae (male)
- Sphincter urethrovaginalis (female)
- Deep external anal sphincter
- Sacrotuberous ligament
- Obturator externus
- Transverse perinei superficialis
- Ischiocavernosus
- Bulbospongiosus
- Superficial external anal sphincter

Pelvic/perineal regions
- Pelvic cavity
- Ischioanal fossa
- Deep perineal pouch
- Superficial perineal pouch

Pelvic blood vessels and nerves
- Common iliac vessels
- Internal iliac vessels
- Iliolumbar vessels
- Lateral sacral vessels
- Superior gluteal vessels
- Inferior gluteal vessels
- Obturator vessels
- Internal pudendal vessels
- Middle rectal vessels
- Superior vesicle vessels
- Inferior vesicle vessels
- Uterine vessels
- Obliterated umbilical artery
- Pudendal nerve
- Sympathetic splanchnic nerve
- Parasympathetic splanchnic nerve

Hypaxial and epaxial back muscles and nerves
- Serratus posterior superior
- Serratus posterior inferior
- Splenius capitis
- Splenius cervicis
- Spinalis part of erector spinae
- Longissimus part of erector spinae
- Iliocostalis part of erector spinae
- Semispinalis
- Multifidus
- Dorsal ramus
After the Lab is Over

Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during those review labs, it is beneficial to jot down some notes after attending the lab. Use this section to make notes about the areas of anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information and space below for this purpose.

Tips for reviewing the material

Pelvic model

Study the relationships of the muscle layers on the pelvic model that you assemble. The better you understand the relationships on this model, the easier it will be to see the actual muscles on the cadavers.

Identify the different perineal spaces of anatomy on the model and note the body wall muscles that form the boundaries to these spaces.

Pelvic muscles

Remember that there are three layers of musculature in the pelvic wall. Think about the model that you constructed and compare the muscles to the model.

Remember that the inner layer of muscle is the most complete and forms a basin shaped floor to the pelvic cavity.

Remember that the ischioanal fossa is the space between the internal and middle layers, while the deep perineal space and superficial perineal space are correlated to the middle and outer layers of the muscle wall, respectively.

Pelvic blood vessels

Follow the branches of the internal iliac artery and notice where they terminate in the pelvic region. Their names are based on the regions and structures they supply and drain. If you keep this in mind they are easy to learn.

Back muscles

If you remember the layers and fiber orientations associated with the epaxial back muscles, this group of muscles will be much easier to learn and identify.

To help with identification of the epaxial muscles, identify the spinous processes by palpation. The spinous processes are key landmarks for identifying the back muscles.

Focus first in the cervical region of the back. There are two prominent layers of muscle in the head and neck – the splenius muscles and underneath, semispinalis muscle.

Now move down into the thoracic and lumbar regions. Again you will find two prominent layers of muscle – most superficial are the three
erector spinae muscles and underneath the erector spinae you will find the multifidis. You must be able to differentiate the erector spinae muscles. The spinalis muscle is the most medial of the group, sitting against the spinous processes. The longissimus muscle lies just lateral to spinalis muscle and is most prominent in the upper lumbar region and the thorax. The iliocostalis muscle sits lateral to longissimus and projects onto the rib cage.

**Structures I need to review**

Compile a list of the anatomical structures from Lab 7 that you feel you need to focus on when you get a chance to review.

<table>
<thead>
<tr>
<th>Pelvic muscles</th>
<th>Pelvic vessels</th>
<th>Back muscles</th>
</tr>
</thead>
</table>

**Handy Mnemonic Memory Tricks**

Here is a mnemonic device to help you learn the muscles of the male pelvis and perineum.

**Pelvic body wall muscles of the male - PIC DOTS and IBOTS**

- Pubococcygeus
- Iliococcygeus
- Coccygeus
- Deep external anal sphincter
- Obturator internus
- Transversus perinei profundus
- Sphincter urethrae

- Ishiocavernosus
- Bulbospongiosus
- Obturator externus
- Transversus perinei superficialis
- Superficial external anal sphincter
Laboratory Eight

Collaborative Learning Stations

1. Brachial plexus
2. Scapular sling muscles
3. Muscles of the rotator cuff, shoulder cap, and intertubercular groove
4. Brachial muscles, shoulder topography and superficial veins
5. Bone Practical Quiz- Upper limb bones and bony landmarks (5 points)
How to Prepare for the Lab

By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:

1. Study the Superior Limb module on the Human Anatomy Interactive Atlas software.

2. Know the material covered in the patterns of limb design and superior limb lectures in the Human Anatomy Lecture Manual.

3. Review the bony landmarks of the clavicle, scapula, humerus, radius, and ulna. Most of these landmarks will serve as sites of muscle attachment. Familiarity with these landmarks will make it easier to learn muscle anatomy. To encourage you to review your bones, there will be a five point practical exam covering this material from Lab 1. This is in addition to the regular quiz.

4. Understand the concept of limb compartments and recognize how this simplifies learning muscles.

5. Review the components of the brachial plexus and form a strong mental image of its structure.

Objectives During the Lab

During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

Proximal muscles of the superior limb

1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.

2. Gain a topographical understanding of all the muscles of the proximal superior limb.

3. Be able to identify the specific muscle groups and compartments. Recognize each muscle within these muscle groups and understand the features and functions they share in common.

4. Be able to identify each muscle’s attachment sites on the bones.

5. Recognize how the muscles cross the joints, as this will help you understand the joint movements they produce.

6. Do not be afraid to explore the muscles in the lab. Most of the skeletal muscles in the superior limb are large, obvious structures that can be easily observed and studied.
Brachial plexus
1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.

2. Use your visual image of the brachial plexus to help identify it on the cadavers. Note the relationships the nerves of the brachial plexus form with the surrounding muscles and bones.

Structures to Identify for the Quiz
To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Superior Limb Module of the Human Anatomy Interactive Atlas software. There will be five questions on the quiz from this material. In addition, there will be five questions on the quiz from the material you studied in any previous lab. These five questions can be anything in those labs from the Section titled “Structures To Identify In The Lab”. These review questions will help you keep on top of past material and not forget it. This will help you prepare for comprehensive tests later in the semester.

Superior limb photos
1. Brachial plexus
2. Posterior shoulder 1
3. Rotator cuff 1
4. Shoulder, anterior view
5. Proximal limb muscles
Structures to Identify in the Lab

**Scapular sling muscles**
- Rhomboideus major
- Rhomboideus minor
- Levator scapulae
- Trapezius
- Serratus anterior
- Pectoralis minor
- Subclavius

**Rotator cuff muscles**
- Supraspinatus
- Infraspinatus
- Teres minor
- Subscapularis

**Shoulder cap**
- Deltoid

**Intertubercular groove muscles**
- Pectoralis major
- Latissimus dorsi
- Teres major

**Brachial muscles**
- Biceps brachii
- Coracobrachialis
- Brachialis
- Triceps brachii

**Topographic landmarks**
- Triangular space
- Quadrangular space
- Deltopectoral groove

**Superficial veins of the brachium**
- Cephalic vein
- Basilic vein
- Median cubital vein

**Brachial plexus**
- Posterior cord
- Medial cord
- Lateral cord
- Anterior divisions
- Posterior divisions
- Superior trunk
- Middle trunk
- Inferior trunk
- Long thoracic nerve
- Dorsal scapular nerve
- Nerve to subclavius
- Lateral pectoral nerve
- Medial pectoral nerve
- Suprascapular nerve
- Musculocutaneous nerve
- Median nerve
- Ulnar nerve
- Upper subscapular nerve
- Thoracodorsal nerve
- Lower subscapular nerve
- Radial nerve
- Axillary nerve
After the Lab is Over

Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during those review labs, it is beneficial to jot down some notes after attending the lab. Use this section to make notes about the areas of anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information and space below for this purpose.

Tips for reviewing the material

Scapular, shoulder, and brachial muscles

One of the sure fire tricks to identifying muscles on the cadavers in the lab is to know the muscle attachments. If you know their attachments, it becomes easy to follow the muscles to the sites of attachment to check whether or not it is the correct muscle you are identifying.

Brachial plexus

On the brachial plexus dissection use musculoskeletal relationships to find the three large anterior division nerves. Follow them proximally, until you find the “M” of the brachial plexus.

Reflect the anterior division nerves and the axillary artery. Now you have isolated the posterior division nerves (the UTLRA trident).

Find the ‘M’ again, then work proximally up the plexus to find the pre-division nerves.

Find the root of the plexus (C5, C6, C7, C8, and T1). Note that the Long Thoracic and Dorsal Scapular nerves originate at the proximal end of the plexus where they are partially covered by neck muscles. Understanding other topographical relationships formed by these two nerves should help you locate them.
Structures I need to review

Compile a list of the anatomical structures from Lab 8 that you feel you need to focus on when you get a chance to review.

Proximal muscles of the superior limb | Brachial plexus

Handy Mnemonic Memory Tricks

Here are some mnemonic devices to help you learn the muscles of the superior limb.

Scapular sling muscles - Roger Rabbit Loves To Smoke Pot
- Rhomboideus minor
- Rhomboideus major
- Levator scapulae
- Trapezius
- Serratus anterior
- Pectoralis minor

Rotator cuff muscles - SITS
Three muscles SIT on the greater tubercle:
- Supraspinatus
- Infraspinatus
- Teres minor
One muscle inserts on the lesser tubercle:
- Subscapularis

Intertubercular groove muscles
Two MAJORS escorting a MISS
A PLT sandwich
- Pectoralis major
- Latissimus dorsi
- Teres major

Brachial Plexus
You Young Mermaids...
See the lecture manual and movie for full details.
Laboratory Nine

Collaborative Learning Stations
1. Upper Limb Vasculature
2. Anterior antebrachial muscles
3. Posterior antebrachial muscles
4. Hand muscles
5. Review and plexus injuries
**How to Prepare for the Lab**

By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:

1. Study the Superior Limb module on the *Human Anatomy Interactive Atlas* software.
2. Know the material covered in the patterns of limb design and superior limb lectures in the *Human Anatomy Lecture Manual*.
3. Review the osteology of the humerus, radius, ulna, and hand.
4. Understand the concept of limb compartments and recognize how this simplifies learning muscles.
5. Use the name of the antebrachial and hand muscles to help you identify them in the limb.
6. Be able to visualize the branches of the subclavian and axillary arteries and understand the relations they form with the surrounding muscles.

**Objectives During the Lab**

During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

**Antebrachial and hand muscles**

1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.
2. Using the muscle names learn to identify the muscles of the antebrachium and hand on the cadavers.
3. Gain a topographical understanding of all the muscles of the antebrachium and hand.
4. Be able to identify the specific muscle groups and compartments. Recognize each muscle within these muscle groups and understand the features and functions they share in common.
5. Recognize how the muscles cross the joints, as this will help you understand the joint movements they produce.
6. Be able to recognize the common attachment sites of the antebrachial muscles.
7. Do not be afraid to explore the muscles in the lab. Most of the skeletal muscles in the antebrachium and hand are obvious structures that can be easily observed and studied.
Axillary blood vessels
1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.

2. Be able to identify all the branches of the axillary and subclavian arteries. Follow the vessels to their termination points and note the logic in their names.

Brachial plexus
1. Know the innervation of each muscular compartment or group in the shoulder, brachium, antebrachium, and hand.

2. Recognize that nerves and vessels course together in the body in common bundles. Note which vessels and nerves are situated together. In most instances, vessels and nerves that share common pathways have similar names.

Structures to Identify for the Quiz
To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Superior Limb Module of the Human Anatomy Interactive Atlas software. There will be five questions on the quiz from this material. In addition, there will be five questions on the quiz from the material you studied in any previous lab. These five questions can be anything in those labs from the Section titled “Structures To Identify In The Lab”. These review questions will help you keep on top of past material and not forget it. This will help you prepare for comprehensive tests later in the semester.

Superior limb photos
1. Scapular arteries
2. Distal limb muscles
3. Anterior antebrachium
4. Posterior antebrachium
5. Palmar surface of hand
6. Layers of the hand 2
Structures to Identify in the Lab

**Anterior antebrachial muscles**
- Pronator teres
- Flexor carpi radialis
- Palmaris longus
- Flexor carpi ulnaris
- Flexor digitorum superficialis
- Flexor digitorum profundus
- Flexor pollicis longus
- Pronator quadratus

**Posterior antebrachial muscles**
- Brachioradialis
- Extensor carpi radialis longus
- Extensor carpi radialis brevis
- Extensor digitorum
- Extensor digitii minimi
- Extensor carpi ulnaris
- Anconeus
- Supinator
- Abductor pollicis longus
- Extensor pollicis brevis
- Extensor pollicis longus
- Extensor indicis

**Hand muscles**
- Abductor pollicis brevis
- Flexor pollicis brevis
- Opponens pollicis
- Adductor pollicis
- Abductor digitii minimi
- Flexor digitii minimi brevis
- Opponens digitii minimi
- Palmaris brevis
- Lumbricals
- Palmar interossei
- Dorsal interossei

**Subclavian and axillary arteries**
- Subclavian artery
- Vertebral artery
- Thyrocervical trunk
- Suprascapular artery
- Dorsal scapular artery
- Axillary artery
- Superior thoracic artery
- Thoracoacromial artery
- Clavicular artery
- Acromial artery
- Deltoid artery
- Pectoral artery
- Lateral thoracic artery
- Subscapular artery
- Circumflex scapular artery
- Thoracodorsal artery
- Anterior circumflex humeral artery
- Posterior circumflex humeral artery
- Brachial artery
After the Lab is Over

Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during those review labs, it is beneficial to jot down some notes after attending the lab. Use this section to make notes about the areas of anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information and space below for this purpose.

Tips for reviewing material

Antebrachial and hand muscles

Identify the medial epicondyle of the humerus. This is the origin of most of the anterior antebrachial muscles. Recall that there are two groups of antebrachial muscles, a superficial group and a deep group. The superficial group forms two layers, so between the two groups there are three layers of muscle in the anterior compartment.

Identify the lateral epicondyle of the humerus. This is the origin of the majority of the posterior antebrachial muscles. Recall that the lateral muscles of the posterior compartment originate near the lateral epicondyle, while the radial muscles of this compartment are relatively shorter muscles and all converge towards the radial side of the hand.

If you remember your hand compartments (thenar, hypothenar, and intermetacarpal), you should be able to logically think through these muscles. Remember, the opponens muscles do not cross the MP joint. Using this piece of information you can easily identify the opponens muscles.

Axillary blood vessels

Start at the beginning of the subclavian artery and move distally along the artery. As you move along the artery note all the branches. Follow the branches out into the body and notice the region into which they terminate. Use the logic you gained from lecture to apply the correct name to the vessel. Use the same procedure for the axillary artery. It may help to draw a quick sketch of the vessels before starting.

Go back and identify the vessels randomly. If you are having trouble, try identifying other vessels in the vicinity and refer to your sketch.
**Structures I need to review**
Compile a list of the anatomical structures from Lab 9 that you feel you need to focus on when you get a chance to review.

<table>
<thead>
<tr>
<th>Antebrachial muscles</th>
<th>Hand muscles</th>
<th>Upper limb blood vessels</th>
</tr>
</thead>
</table>

**Handy Mnemonic Memory Tricks**
Here are some mnemonic devices to help you learn the muscles of the thenar and hypothenar groups and the brachial plexus.

**Thenar and hypothenar muscles**
All For One And One For All
- Abductor pollicis brevis
- Flexor pollicis brevis
- Opponens pollicis
- Adductor pollicis
- Opponens digiti minimi
- Flexor digiti minimi
- Abductor digiti minimi
Laboratory Ten

Collaborative Learning Stations

1. Anterior thigh muscles and hip flexors
2. Posterior and medial thigh muscles
3. Deep hip rotator and gluteal muscles
4. Thoracic cross-section anatomy
5. Bone Practical Quiz - Lower limb bones and bony landmarks (5 points)
How to Prepare for the Lab

By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:


2. Know the material covered in the patterns of limb design and inferior limb lectures in the Human Anatomy Lecture Manual.

3. Review the bony landmarks of the os coxa, femur, tibia, and fibula. Most of these landmarks will serve as sites of muscle attachment. Familiarity with these landmarks will make it easier to learn muscle anatomy. To encourage you to review your bones, there will be a five point practical quiz covering this material from Lab 1. This is in addition to the regular quiz.

4. Learn the muscles of the hip joint and thigh, with their accompanying muscle attachments and actions.

5. Understand the concept of limb compartments and recognize how this simplifies learning muscles.

6. Know the structure and contents of the femoral triangle, adductor canal, and adductor hiatus.

7. Learn the structures that exit the pelvic cavity above the piriformis muscle and those that exit the pelvic cavity below the piriformis muscle.

Objectives During the Lab

During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

Proximal inferior limb muscles

1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.

2. Gain a topographical understanding of all the muscles of the proximal inferior limb.

3. Be able to identify the specific muscle groups and compartments. Recognize each muscle within these muscle groups and understand the features and functions they share in common.

4. Be able to identify each muscle’s attachment sites on the bones.

5. Recognize how the muscles cross the joints, as this will help you understand the joint movements they produce.
6. Understand the concept of an anatomical pulley. Identify the muscles of the anatomical pulley associated with the medial condyles of femur and tibia.

7. Do not be afraid to explore the muscles in the lab. Most of the skeletal muscles in the inferior limb are large, obvious structures that can be easily observed and studied.

**Topography of the thigh**

1. Be able to identify the following topographical regions and their boundaries: femoral triangle, adductor canal, adductor hiatus, and popliteal fossa.

2. Identify the vessels and nerves found within the regions mentioned above.

**Structures to Identify for the Quiz**

To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Inferior Limb Module of the Human Anatomy Interactive Atlas software. There will be five questions on the quiz from this material. In addition, there will be five questions on the quiz from the material you studied in any previous lab. These five questions can be anything in those labs from the Section titled “Structures To Identify In The Lab”. These review questions will help you keep on top of past material and not forget it. This will help you prepare for comprehensive tests later in the semester.

**Inferior limb photos**

1. Femoral triangle
2. Thigh 1
3. Thigh 2
4. Gluteal region 1
5. Gluteal region 2
6. Gluteal region 3
Structures to Identify in the Lab

Deep hip rotator muscles
- Piriformis
- Superior gemellus
- Obturator internus
- Inferior gemellus
- Quadratus femoris
- Obturator externus

Gluteal muscles
- Gluteus minimis
- Gluteus medius
- Gluteus maximus
- Tensor fasciae latae

Hip flexor muscles
- Psoas major
- Iliacus

Medial thigh compartment muscles
- Pectineus
- Adductor brevis
- Adductor longus
- Adductor minimus
- Adductor magnus
- Gracilis

Anterior thigh compartment muscles
- Articularis genu
- Vastus intermedius
- Vastus lateralis
- Vastus medialis
- Rectus femoris
- Sartorius

Posterior thigh compartment muscles
- Biceps femoris
- Semitendinosus
- Semimembranosus

Fascia and regions
- Iliotibial tract
- Femoral triangle
- Adductor canal
- Adductor hiatus
- Popliteal fossa

Vessels
- Femoral artery
- Popliteal artery
- Great saphenous vein
- Small saphenous vein
After the Lab is Over

Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during those review labs, it is beneficial to jot down some notes after attending the lab. Use this section to make notes about the areas of anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information and space below for this purpose.

Tips for reviewing the material

Muscles of the gluteal region

Work from superficial to deep, identifying the different muscles in the gluteal region. Note how the gluteal muscles get smaller as you go deeper.

The deep hip rotator muscles, with the exception of the anterior positioned obturator externus, all sit in the same plane of space from superior to inferior. Identify the tendon of the obturator internus and notice the gemelli muscles on either side of the obturator tendon.

Again, use your knowledge of muscle attachments to help you identify the muscles.

Muscles of the thigh

How many muscle compartments should you look for in the thigh?

Note that each compartment contributes a muscle to the anatomical tripod. Identify these muscles as they all converge on the proximal tibia.

Again, use your knowledge of muscle attachments to help you identify the muscles.

Structures I need to review

Compile a list of the anatomical structures from Lab 10 that you feel you need to focus on when you get a chance to review.

<table>
<thead>
<tr>
<th>Muscles of the hip joint</th>
<th>Thigh muscles</th>
<th>Vessels and regions</th>
</tr>
</thead>
</table>
Laboratory Eleven

Collaborative Learning Stations

1. Muscle of the foot
2. Lab evaluations
3. Muscles of the anterior and lateral compartments of the leg
4. Muscles of the posterior compartment of the leg
5. Review of cross-sections
How to Prepare for the Lab
By following the suggestions below you will come to lab better prepared to take advantage of the learning opportunities:


2. Know the material covered in the patterns of limb design and inferior limb lectures in the Human Anatomy Lecture Manual.

3. Review the osteology of the femur, tibia, fibula, and foot.

4. Understand the concept of limb compartments and recognize how this simplifies learning muscles.

5. Use the name of the crural and foot muscles to help you identify them in the limb.

Objectives During the Lab
During the laboratory session, keep the following objectives in mind as you study the lab material. By the end of the laboratory session you should be able to:

Leg and foot
1. Using the cadaver material in the lab, be able to identify all the structures listed in the section – Structures to identify in the lab.

2. Using the muscle names learn to identify the muscles of the crus and foot on the cadavers.

3. Gain a topographical understanding of all the muscles of the crus and foot.

4. Be able to identify the specific muscle groups and compartments. Recognize each muscle within these muscle groups and understand the features and functions they share in common.

5. Recognize how the muscles cross the joints, as this will help you understand the joint movements they produce.

6. Understand the concept of an anatomical pulley. Identify the muscles of the anatomical pulley associated with the medial and lateral malleoli of the crus.

7. Do not be afraid to explore the muscles in the lab. Most of the skeletal muscles in the antebrachium and hand are obvious structures that can be easily observed and studied.
Evaluation rotation

1. During this final laboratory session you will have the opportunity to fill out an evaluation and give us feedback on your lab experience. Think back over the labs this past semester and tell us what we did that worked and how we can improve to better serve students. It is my goal to create the best learning experience possible for students. My lab instructors and I appreciate your constructive feedback.

Structures to Identify for the Quiz

To encourage you to prepare for the lab so that you can get the most out of your laboratory experience, there will be a quiz at the beginning of the lab. To prepare for the quiz in this lab, you should be able to identify all the “Basic Labels” on the following photographs from the Inferior Limb Module of the Human Anatomy Interactive Atlas software. There will be five questions on the quiz from this material. In addition, there will be five questions on the quiz from the material you studied in any previous lab. These five questions can be anything in those labs from the Section titled “Structures To Identify In The Lab”. These review questions will help you keep on top of past material and not forget it. This will help you prepare for comprehensive tests later in the semester.

Inferior limb photos

1. Muscles of the crus
2. Posterior crural vessels
3. Anterior crural vessels
4. Posterior crural muscles
5. Foot muscles 1
6. Foot muscles 2
Structures to Identify in the Lab

Anterior crural compartment
- Tibialis anterior
- Extensor digitorum longus
- Extensor hallucis longus
- Fibularis (Peroneus) tertius

Lateral crural compartment
- Fibularis (Peroneus) longus
- Fibularis (Peroneus) brevis

Posterior crural compartment
- Gastrocnemius
- Soleus
- Plantaris
- Popliteus
- Tibialis posterior
- Flexor hallucis longus
- Flexor digitorum longus

Foot muscles
- Extensor digitorum brevis
- Extensor hallucis brevis
- Abductor hallucis
- Flexor digitorum brevis
- Abductor digiti minimi
- Quadratus plantae
- Lumbricals
- Flexor hallucis brevis
- Adductor hallucis
- Flexor digiti minimi brevis
- Plantar interossei
- Dorsal interossei

Vessels
- Anterior tibial vessels
- Posterior tibial vessels
- Fibular (Peroneal) vessels
After the Lab is Over
Later in the semester you will have the opportunity to attend review labs as you prepare for your practical examination. To maximize your study during those review labs, it is beneficial to jot down some notes after attending the lab. Use this section to make notes about the areas of anatomy that you did not feel you understood or identified very well during the lab session. When you come to a review lab, you can look back at your notes and see where you need to spend your time. Use the information and space below for this purpose.

Tips for reviewing material

Leg muscles
Be able to identify the three muscle compartments in the leg.

Note that the muscles of the anterior compartment pass anterior to the ankle between the two malleoli, the muscles of the lateral compartment pass posterior to the lateral malleolus, and the large posterior compartment muscles attach to the calcaneus or pass posterior to the medial malleolus.

Again, having a general understanding of muscle attachments will help you identify the muscles.

Foot muscles
Remember that there are four layers of foot muscles (3,2,3,2).

Structures I need to review
Compile a list of the anatomical structures from Lab 11 that you feel you need to focus on when you get a chance to review.

Muscles of the leg

Muscles of the foot
Practical Examination Tips

Practical tips

1. Be aware of the different ways that the structures are labeled. Some will have a large “#” positioned directly on the structure to be identified. Some will have a “#” with an arrow pointing to a structure. The tip of the arrow will be on the structure to be identified. Others will have a labeled string or clip around the structure to be identified. Some will have a labeled pin or probe sticking into the structure to be identified. Others will have a pin or probe weaving through the structure or layer to be identified.

2. Always make sure that you are recording your answer on the correct number on the answer sheet. That is, make sure that the numbered part you are looking at is the same as the numbered blank you are recording your answer on the answer sheet. Writing an answer in the wrong blank is a common and easy mistake to make, since you do not necessarily answer the practical exam in an ordered sequence. So be careful! You will be marked wrong if answers are not in their correct place. In grading we can make no assumptions.

3. Like any exam, the goal of the practical examination is to show your knowledge of the anatomy. Therefore, when answering questions do not abbreviate. Be clear so your intentions are understood. Answer the question completely, stating the full name of the labeled structure. For example, do not write internal pudendal as an answer. It is either an internal pudendal vein or an internal pudendal artery. Clearly follow all answers that are arteries, veins, or nerves with the proper designation showing that you know what the structure is. We cannot assume that you know something — you must show us that you know it.
4. Most of the answer spaces will consist of a number followed a blank line. For example:

1. _____________________________________________________

The intention is that you record the specific structure tagged on the body part in the blank space. If something more specific is required, the answer sheet will include a question. For example:

1. What is the tissue of structure 1? ____________________________

Be aware of these differences and answer the more specific question. You will be marked wrong if you just list the structure. The correct answer is to list the tissue of the structure.

5. Do not list multiple answers in an attempt to cover all your bets. For example, if there is a probe in the hypodermis and the answer sheet has a "#" followed by a blank line, then the question is asking for the structure indicated. The answer would be “hypodermis.” Do not write “loose connective tissue - hypodermis.” The structure is not loose connective tissue and you would only record that answer if you were being asked to identify the tissue. You should be able to differentiate between tissues and structures.

**Use your knowledge and ability to reason**

1. The practical questions are very straight forward. Always begin by orienting the body part. If the answer is not quickly obvious to you then analyze the structure by relating it to surrounding structures. Look at the big picture, as this will help you think about the possibilities.

2. If a muscle does not look familiar then analyze it logically. Think of the following: to what limb compartment or to what layer of the body wall does it belong; follow the muscle from its origin to insertion; what other muscles are around it; gently pull on it to see what action it could produce. Gaining this type of insight should allow you to decide which muscle it is.

3. If a vessel or nerve gives you trouble, follow it to its origin and destination. This will allow you to decide where it is going and from where it is coming. With this knowledge you should be able to answer the question based on your knowledge from lecture.

4. Remember to think! **Do not get flustered!** The use of simple logic and reason will take you a long way when you are in a bind.

5. Do not set up camp at a station. If you are having trouble figuring out what a structure is, then move on and come back to the station after you have tried other stations. This will help you clear your mind, while also giving other people an opportunity to view the station.