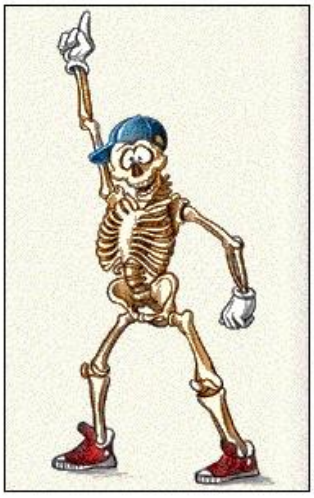
COUNTY COLLEGE OF MORRIS

BIOLOGY 101 ANATOMY & PHYSIOLOGY I

Laboratory Guide



The purpose of this laboratory guide is to emphasize the major points of each laboratory exercise for which you will be responsible on the laboratory exams. This will also help you clarify the goals and objectives for each laboratory exercise when used in conjunction with Marieb's Laboratory Manual, Fetal Pig edition (by Marieb/Mitchell, 13^{th} ed.). **PLEASE NOTE: All the references to Laboratory Manual Exercises are based on the 13th edition. The chapter numbers may be different for previous editions, so be sure to check the table of contents for the correct chapter if you're using a pre-13^{th} edition version.**

As you identify and understand each of the structures/features listed on the pages of the laboratory guide, check that item off on your sheet. Make notes in the space provided and remember to ask questions if there is something you don't understand, or you can't find. Several of the laboratory exercise guides have self-tests or additional questions so you can check your mastery of the items you need to know.

If you would like to review materials for your laboratories outside of the normal lab time, you may do so in the Science Center (of the CCM Tutoring Center, DH-156-158). This room also contains duplicates of the materials from each lab. You should also take advantage of the computer software available in the Science Center.

You might also want to look at a publication called "The Home Lab: A Photo Guide for Anatomy Lab Materials" (available on Amazon.com). It's a great guide for home study of the models you'll be using later in the semester in lab when you are preparing for lab exams.

**** Remember that A&P Laboratory attendance is mandatory. If you accumulate three (3) absences, you will receive a failing grade for Biology 101 (A&P I).**

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The A&P Laboratory is a crucial part of your learning experience. Use your time wisely and you will be rewarded with a much greater understanding of the material than would have been possible otherwise. Have a great semester!

Your Instructor

Study Guide for Bio 101 Laboratory Exam 1

The Laboratory Exam will consist of short, **fill-in-the-blank answers** (number of questions to be determined).

Remember that SPLLEING COUTNS!! ☺ You will lose 1 point for every 2 spelling errors.

Here are the **things you should know** for Laboratory Exam 1:

1. Organization and Body Terminology
   - Use proper anatomical terminology to describe body directions, planes, and surfaces.
   - Name the body cavities and list the organs associated with each cavity.
   - Be able to label/identify parts of the body using anatomical (not common) terminology, e.g., use olecranon/olecranal instead of elbow.

2. The microscope
   - Identify the parts of the microscope and the function of each
   - Describe the proper focusing technique
   - Define: Total magnification, resolution, parfocal, field, depth of field, working distance
   - Discuss the general relationships between magnification, working distance, and field diameter.

3. Scientific Method
   - Outline the general steps of the Scientific Method
   - Define the activities that would be executed in each of the general steps.

4. Be able to identify and name each of the tissues that you looked at under the microscope in lab and that are on your Laboratory Guide checklists, and provide an example of a body location in which you would find each

   You should also be able to identify and correctly spell the following <u>specific</u> cells/structures, when shown a microscope slide or photomicrograph:

   – Erythrocytes, leukocytes, and platelets
   – Haversian (central, osteonic) canal, canaliculi, osteon, lacunae
   – Fibroblasts, FIBERS: collagen and elastic fibers (elastin)
   – Cilia and microvilli
   – Epidermis and dermis of the skin, sebaceous glands, sweat glands, and hair follicles

Study Guide for Bio 101 Laboratory Exam 2

Exam 2 preparation Tips

REMEMBER, SPLLEING COUTNS!! You will lose 1 point for every 2 spelling errors.

To be prepared for Lab Exam 2, it is highly recommended that you follow the preparation guidelines given by your instructor. Additionally, it will benefit you if you:

1. **Work through and understand the material in exercise 9-The Axial Skeleton and exercise 9 review sheet in your Marieb's lab manual (pp. 115-141).**

2. **Work through and understand the material in exercise 10-The Appendicular Skeleton and exercise 10 review sheet in your Marieb's lab manual (pp. 143-156).**

Study Guide for Biology 101 Laboratory Exam 3

The Laboratory Exam will consist of short, fill-in-the-blank answers (~60 questions)

REMEMBER, SPLLEING COUTNS!! You will lose 1 point for every 2 spelling errors.

1. **Muscle Histology**
    a) Identify the type of muscle shown in a photomicrograph or focused under the microscope.
    b) List the characteristics for each type of muscle that enabled you to make the identification in a above; Identify unique structures in the photomicrographs, e.g., striations, intercalated disks, nuclei, etc.
    c) State where each type of muscle is found in the body (see Figure 6.7, a-c, in Marieb's Lab Manual for complete info and photomicrographs).

2. **Human Brain Models and Sheep Brains**
    a) Be able to identify and name the structures listed in this Lab Study Guide using the human brain models or photographs of the human brains (from designated slides in Lab 13).
    b) Be able to identify and state the number and name of four of the twelve cranial nerves: I, II, III, and V on the human brain models/photographs. (See designated slide in Lab 13.)

4. **Spinal Cord Models**
    a) Label parts of a spinal cord given either a silver stained micrograph, an illustration of the spinal cord, or a spinal cord model (use the two slides given here and learn those)
    b) Be able to name the horns (ventral, dorsal, lateral) of the spinal cord and the TYPES of cells found in each horn (motor vs. sensory), given either a model of the spinal cord or a microscope slide. (use the same two slides designated in lab)

5. **Eye**:
    a) Identify the anatomy of the eye and its accessory anatomical structures on a model or appropriate image and list the functions of each structure.
    b) Identify the structural components of the eye that are present in a preserved sheep or cow eye.
    c) Trace the pathway of light through the eye to the retina, describe the events involved in photoreceptors and trace the visual pathway to the visual cortex.
    d) (**Optional)** Pupillary Reflex
    e) (**Optional**) Visual reflexes

6. **Ear**:
    a) Using models, describe the structures and functions of the outer, middle and inner ear.
    b) Explain the pathway of sound conduction and the auditory pathway to the auditory cortex.
    c) Describe the role of the semicircular canals and the vestibule in maintaining balance and equilibrium.
    d) (**Optional**) Sound detection of the human ear

BIOLOGY 101 - Human Anatomy and Physiology I

LABORATORY 1, Part 1

A. Laboratory Safety and Technology Rules
B. The Language of the Body: Organization and Terminology

When this lab is completed, you should be able to do the following:

1. Identify the safety equipment in the A&P Laboratory and describe how to use each item of equipment.

2. Be cognizant of CCM Information Technology usage rules.

3. Describe and list the general safety rules to be followed in the A&P laboratory as reviewed in lab.

4. For the general organization and terminology of the human body:
   a) Describe the anatomical position and explain its importance.
   b) Use proper anatomical terminology to describe body regions, orientation and direction, and body planes.
   c) Name the body cavities and indicate the importance of each.
   d) Name and describe the serous membranes of the ventral body cavities.
   e) Identify the abdominopelvic quadrants and regions on a torso model or image.

5. For organ systems of the body:
   a) Name the human organ systems and indicate the major function of each.
   b) List several major organs of each system and identify them on a human torso model or image.
   c) Name the correct organ system for each organ when presented with a list of organs.

<u>Materials and References to use for Part 1 of Lab 1:</u>

1. Marieb's Laboratory Manual (13th ed.)

   - Exercise 1: The Language of Anatomy
   - Exercise 2: Organ Systems Overview

2. Human torso models (muscle figurine models can also be used for directional terms and surface anatomy)

What we'll do today in lab...

1. Review the Laboratory Guide for lab 1 (handed out), talk about how we will conduct lab, and how you will be graded in lab.

2. Review safety procedures and locate safety equipment.

3. Slide presentation on the Language of Anatomy to include surface anatomy, body orientation/direction/planes/sections, and body cavities.

4. Make sure to complete review Exercises 1 and 2 in Marieb's before the next lab meeting. Your instructor will decide on whether you should complete this in lab or as homework, but you definitely need to be comfortable completing the exercises.

*Note You will encounter and/or use anatomical terminology throughout A&P I & II and maybe in your future career. Learning as much anatomical terminology as you can and its proper use now will make things better for you in in A & P going forward.

BIOLOGY 101 - Human Anatomy and Physiology I

LABORATORY 1, Part 2
Fetal Pig Dissection and Organ System Overview

When this laboratory exercise is completed, you should be able to do the following:

1. Uses directional anatomical terminology to describe various parts/organs of the fetal pig in relation to other parts/organs.

2. Successfully dissect a fetal pig and provide an overview of the ventral body cavity organs and organ systems.

3. Identify the organs in the ventral body cavity of a dissected fetal pig and identify the organ systems with which each identified organ is associated.

Materials and References to use for Part 2 of Lab 1:

1. Dissecting Kit, Gloves, Safety glasses or goggles

2. Fetal Pig Dissection Guidelines and Fetal Pig Dissection Handout

3. Fetal pigs, dissecting trays, twine

What we'll do today in lab...

1. Practice using directional anatomical terminology to describe various parts/organs of the fetal pig in relation to other parts/organs.

2. Dissect a fetal pig for an overview of ventral body cavity organs and organ systems.

3. Identify the organs in the ventral body cavity of a dissected pig and associate the organs with their correct organ system

4. Complete the worksheet at the back of your fetal pig dissection handout

BIOLOGY 101 Human Anatomy and Physiology I

LABORATORY 2
The Scientific Method
The Microscope; Mitosis in Whitefish Blastula

When this laboratory exercise is completed, you should be able to do the following:

1. Scientific Method

    - Outline the general steps of the Scientific Method
    - Describe what activities would be executed in each step of the Scientific Method
    - Demonstrate the application of the Scientific Method

2. Meet the learning outcomes stated in Exercise 3, The Microscope, of Marieb's Laboratory Manual (see top of page 25).

3. Identify the stages of mitosis and identify a cell as being in interphase of the cell cycle using the microscope and/or photomicrographs (pp.44-45, then #5 on page 49).

What we'll do today in lab...

1. Scientific Method

2. Review the compound microscope, its parts, and how to use it effectively.

    - Get a microscope from the microscope cabinet and set it up at your lab table.
    - Become familiar with the parts of the microscope by reviewing pages 26-36 in Marieb's Laboratory Manual.
    - C**omplete the Review Sheet for Exercise 3**, pp. 33-36 in lab (in case you have any questions you need me to answer). You do NOT have to hand this in, but I highly recommend you use this to study for the lab exam since the questions on the exam will be very similar to the items in Exercise 3.

3. Learn about the cell cycle and mitosis in animal cells using the whitefish blastula. This will help you get used to looking at slides under the microscope.

- Use the Whitefish Blastula slide to observe the stages of the cell cycle and mitosis in animal cells.
- Look at pp. 44-45 of Marieb's Laboratory Manual as a guide for identifying the different stages of the cell cycle.

Laboratory 2 Instructions - Learning to Use the Microscope

Refer to Activities 2 through 5 in Marieb's Laboratory Manual (pp. 27 - 32). These sections contain specific instructions on what to do (except for things I note with ** below).

Notes for Activity 2 - Observing a prepared slide of the typewritten letter 'e'

You will be following the instructions in your lab manual for looking at the letter 'e' under the microscope. Please note the following:

**1. Use coarse adjustment knob only with scanning (4x) objective. When you switch to low power (10x) and high power (40x) objectives, use ONLY fine adjustment knob to avoid breaking the objective lenses against the slide since they come very close.

**2. You will NOT be using OIL IMMERSION (100x objective)- the highest power objective you are to use is the 40x objective.

**3. Do NOT discard letter 'e' slides after use. These are permanent slides that MUST be returned to the slide case.

Notes for Activity 3 - Observing the size of a microscope field

You will be following the instructions in your lab manual for getting a rough idea about the size of the microscope field at different powers of magnification:

**1. For size measurements described in this activity, you will use one of the transparent plastic rulers with mm markings. You will put this directly on the stage of the microscope (you won't be using a slide for this Activity)

2. Follow the instructions in Marieb's Laboratory Manual and answer the questions.

NOTE: You really won't be able to use any objective lens higher than 4x (low power) for this. To figure out field sizes for higher powers, use the equation given in Marieb's Laboratory Manual (page 30).

Notes for Activity 4 - Observing threads, perceiving depth, and adjusting image

The objective here is to use the light control, iris diaphragm and condenser adjustment to get the maximum contrast and best image you can and to get a feel for looking at a thick specimen - like a thread!

1. Obtain a slide of colored threads.

2. Observe this under the microscope beginning, as usual, at lowest power (4x) with the microscope stage as close to the objective lens as you can get it. Initially, focus on the ends of one of the threads. Adjust the light control, iris diaphragm, and condenser so that you have what looks like the 'best' image to you.

3. Move around under lowest power (4x) and try to arrive at the center of the X WHILE YOU'RE LOOKING INTO THE MICROSCOPE. No cheating.

4. Now use the 10x and 40x objectives and move around a bit and each time you change power, readjust the light control, iris diaphragm, and condenser to give you the best image

5. When finished, return the colored thread slides to their case.

Notes for Activity 5 - Observing stained cheek cells (from a buccal swab)

The objective here is to obtain a biological specimen (your cheek cells) and mount it on a microscope slide with a coverslip. You will be using a dye/stain to 'color' the cells so that you can see them more clearly.

1. On your clean microscope slide, place a drop of SALINE - NOT DISTILLED/DEIONIZED WATER!

2. Carefully rub the end of a plastic toothpick against the inside of your cheek. Remove it carefully from your mouth, and place the end of it you rubbed against your cheek into the drop of saline on the slide. Mix it around well. Don't discard your toothpick yet; lay it down so that the end with the cells on it is not touching anything (use a rolled up piece of paper towel or tissue to prop it up).

3. Put one drop of methylene blue stain into the saline on the slide, and mix with your toothpick. Lay the toothpick on the paper towel or tissue you had it on before

4. **Gently** lay a coverslip over it using forceps to lower it slowly so as to avoid any air bubbles. Remember to place one edge of the coverslip into one side of the drop, then lower it slowly until it's flat. If there is a lot of excess stain around the coverslip edges, blot gently with filter paper or paper towel.

5. Discard the toothpick and paper towels/tissue into the red autoclave bag.

6. Examine the cheek cells under the microscope at 4x, 10x, and 40x objective powers.

7. When you are finished, dispose of the slide and coverslip by placing them in the white bucket labeled “Glass Only”.

BIOLOGY 101 Human Anatomy and Physiology I

LABORATORIES 3 & 4
Histology of Epithelial and Connective Tissues
Histology of the Integument

1. When these two laboratory exercises are completed, you should be able to identify the following tissues and give examples of the location of each type in the body.
2. Be able to identify/name the layers of the Integument as well as the accessory structures listed below: hair follicles, sebaceous glands, sweat glands.

EPITHELIAL TISSUE

_____ Simple squamous epithelium (membranes, lungs)

_____ Simple cuboidal epithelium (kidney tubules, ovaries)

_____ Simple columnar epithelium (digestive system, e.g., intestines; uterus)

_____ Pseudostratified ciliated columnar epithelium (trachea)

_____ Transitional epithelium (ureters, bladder, urethra)

_____ Stratified squamous epithelium (scalp, thick/thin, dark/light skin, keratinized vs. non-keratinized)

INTEGUMENT

_____ Parts of the Integument
- _____ Epidermis and its layers (stratified squamous epithelium)
- _____ Dermis (connective tissue)
- _____ Subcutaneous layer (also called: hypodermis, superficial fascia)

Accessory structures of the integument
_____ Hair follicles
_____ Sebaceous glands
_____ Sweat glands

CONNECTIVE TISSUE

_____ Areolar connective tissue (membranes around organs)
- _____ Collagen fibers
- _____ Elastic fibers

_____ Adipose connective tissue (fat pads, breasts)

_____ Dense fibrous connective tissue (tendons, ligaments)
- _____ Collagen fibers

_____ Hyaline cartilage (ribs, trachea)
- _____ Chondrocytes in lacunae

_____ Fibrocartilage (intervertebral disks, pubis symphysis)
- _____ Chondrocytes in lacunae
- _____ Collagen fibers

_____ Elastic cartilage (pinna of ear, larynx)
- _____ Chondrocytes in lacunae
- _____ Elastic fibers

_____ Bone
- _____ Osteon (contains all 4 structures below)
- _____ Osteonic (Haversian, Central) canal
- _____ Osteocytes in lacunae
- _____ Canaliculi
- _____ Lamella(e) {circular rings}

_____ Blood
- _____ Erythrocytes (red blood cells)
- _____ Leukocytes (white blood cells)
- _____ Platelets

Some notes about learning to identify tissues...When you first look at a slide/photograph under the microscope, you should go through a routine (algorithm) in your mind to figure out what you are looking at (most of the

times indicated by a pointer). **Try to do the same thing for each and every slide you look at**, and you'll have it down pat by exam time.

1) Does this specimen have characteristics of epithelial, connective, muscle, or nervous tissue? (Remember the epidermis of skin is stratified squamous tissue. The combo of epidermis and dermis of the skin is an organ.)

Recall the **general characteristics** we talked about:

- **Epithelium**: Closely adjoined cells with little intercellular 'stuff', free surface, basement membrane
- **Connective**: Cells far apart, lots of matrix in between (that may or may not contain fibers)

2) Once you know the general type of tissue, then decide what its correct classification is within that major tissue type:

a) **Epithelial** - Here you need to remember the two characteristics needed to identify ANY epithelial tissue

- **Cell shape**
  - flat and plate-like (squamous) [keep in mind that they will look different from the side or from the top]
  - square (cuboidal)
  - tall and rectangular (columnar)
- **Cell layering** (stratification)
  - one layer = simple
  - two or more layers = stratified
  - looks like two or more layers - but we know better = pseudostratified

b) **Connective** - Recall the major types of CT:

- **CT Proper - remember that the cells that make all the stuff you see in this tissue are called 'fibroblasts'**

  - **Loose (areolar);** lots of different kinds of cells but FAR APART with a lot of 'stuff' in between, plus big fibers (collagen) and little fibers (elastin) running in different directions.

NOTE: Adipose tissue is a type of loose (areolar) CT, and it has the same stuff in it, but it has LOTS of adipocytes as well. In fact, you can't usually see anything BUT adipocytes in adipose tissue.

- **Dense;** FIBERS are closely packed together and if they're all running in about the same direction, it's called a 'regular' dense CT. TIP: The fibers, since they are extracellular will NOT have nuclei in them! (This is a great way to differentiate this type tissue from smooth muscle (see later).

- Cartilage - remember that the cells that make the stuff you see in this tissue are 'chondrocytes' (or chrondroblasts - but later for those) within somewhat circular structures called lacunae (singular: lacuna).

- **Hyaline** - Chondrocytes within lacunae, **no fibers** *visible* (they are there, we just can't see them with a light microscope).

- **Elastic** - **Chondrocytes** within lacunae. TIP: The fibers of **elastin** that you see will be VERY small and fragile-looking compared to the size of the chondrocyte nuclei.

- **Fibrocartilage** - **Chondrocytes** within lacunae. TIP: The fibers of **collagen** you see will be LARGE compared to the size of the chondrocyte nuclei.

NOTE: Laboratory # 5 is used for Lab Exam 1

BIOLOGY 101 Human Anatomy and Physiology I

LABORATORY 6
Identification of the Bones of the Axial Skeleton (Part 1)

Refer to Exercise 9 in Marieb's Lab Manual for this laboratory.

After this lab you should be able to identify the following skeletal structures:

CRANIAL BONES

_____ FRONTAL
- _____ Supraorbital foramen

_____ PARIETAL (2)
- _____ Sagittal suture
- _____ Coronal suture

_____ TEMPORAL (2)
- _____ Squamous portion
- _____ Petrous portion
- _____ Squamous suture
- _____ External auditory meatus
- _____ Styloid process
- _____ Zygomatic process
- _____ Mastoid process
- _____ Mandibular fossa
- _____ Jugular foramen
- _____ Carotid canal
- _____ Stylomastoid foramen
- _____ Internal acoustic meatus

_____ OCCIPITAL
- _____ Lambdoidal suture
- _____ Foramen magnum
- _____ Occipital condyles
- _____ Hypoglossal canal

_____ SPHENOID
- _____ Greater wings
- _____ Lesser wings
- _____ Superior orbital fissure
- _____ Sella turcica
- _____ Optic canal

_____ ETHMOID
- _____ Crista galli
- _____ Cribriform plates
- _____ Nasal conchae (middle and superior) (pronounced kong′-key)

FACIAL BONES

_____ MAXILLA (2)
- _____ Palatine process
- _____ Infraorbital foramen
- _____ Incisive foramen

_____ MANDIBLE
- _____ Body
- _____ Ramus
- _____ Mandibular condyle
- _____ Coronoid process
- _____ Angle
- _____ Mental foramen
- _____ Mandibular foramen

_____ PALATINE
_____ ZYGOMATIC
_____ LACRIMAL
_____ NASAL

_____ VOMER

_____ INFERIOR NASAL CONCHA (pronounced kong′-kah)
Note: The inferior nasal concha is not part of the ethmoid bone. The Ethmoid contains the middle and superior nasal conchae.

_____ MIDDLE/SUPERIOR NASAL CONCHAE (of the ethmoid bone)

Note: Only the middle nasal concha is visible in the nasal cavity of the intact skull. The superior nasal concha is visible in the isolated ethmoid bone, i.e., the one not in the intact skull.

Notes on 'processes'...A process is a piece of bone that sticks out and may, or may not, join with another bone. **When it does join (articulate) with another bone, the process is named for the *bone it articulates with*.**

For example:
1) the Palatine process of the Maxillary bone is part of the maxillary bone that joins with another bone, the palatine bone.

2) the Zygomatic process of the Temporal bone is a part of the temporal bone that joins with the Zygomatic bone

BIOLOGY 101 Human Anatomy and Physiology I

LABORATORY 7
Identification of the Bones of the Axial Skeleton - Part 2

After this lab you should be able to:

1. Identify by name and number any vertebra on an articulated (jointed) skeleton model, e.g., cervical 4 (C4), thoracic 10 (T10), etc.
2. Identify the type of vertebra, i.e., cervical, thoracic, etc., given a disarticulated (isolated) vertebra.

**** See Table 9.3 from Exercise 9 in Marieb's Laboratory Manual for a comparison of vertebral characteristics.**

You should also be able to identify the following skeletal structures:

_____ VERTEBRAE
- _____ Body
- _____ Vertebral foramen
- _____ Transverse process
- _____ Spinous process
- _____ Superior articular facet
- _____ Inferior articular facet
- _____ Intervertebral foramina
- _____ Dens (axis)
- _____ Atlas
- _____ Transverse foramina (cervical vertebrae only)
- _____ Sacrum
  - _____ Promontory (important later when we study the pelvis)
  - _____ Auricular surface
  - _____ Canal
- _____ Coccyx
- _____ Vertebral canal (The passageway formed by the vertebral foramina when the vertebrae are stacked on top of one another.)

_____ STERNUM
- _____ Manubrium
- _____ Body (gladiolus)
- _____ Xiphoid process
- _____ Angle of sternum

_____ RIBS
- _____ True (1-7)
- _____ False (8, 9, and 10)
- _____ Floating (11 and 12)

Remember, you will have to identify the TYPES of vertebrae, e.g., cervical, thoracic, lumbar, sacrum, or coccyx on the lab exam given a *disarticulated* vertebra or structure. Your instructor may require that you know the number of each type of vertebra.

BIOLOGY 101 Human Anatomy and Physiology I

LABORATORIES 8 & 9
Identification of the Bones of the Appendicular Skeleton

Refer to Exercise 10 in Marieb's Laboratory Manual.

You should be able to identify the following skeletal structures:

_____ SCAPULA
- _____ Glenoid cavity
- _____ Lateral border
- _____ Medial border
- _____ Superior border
- _____ Superior angle
- _____ Inferior angle
- _____ Acromion
- _____ Coracoid process
- _____ Suprascapular notch
- _____ Spine
- _____ Supraspinous fossa
- _____ Infraspinous fossa
- _____ Subscapular fossa

_____ CLAVICLE

_____ HUMERUS
- _____ Head
- _____ Greater tubercle
- _____ Lesser tubercle
- _____ Deltoid tuberosity
- _____ Capitulum
- _____ Trochlea
- _____ Lateral epicondyle
- _____ Medial epicondyle
- _____ Coronoid fossa
- _____ Radial fossa
- _____ Olecranon fossa

_____ RADIUS
- _____ Head
- _____ Radial tuberosity
- _____ Styloid process

_____ ULNA
- _____ Coronoid process
- _____ Olecranon process
- _____ Radial notch
- _____ Trochlear notch
- _____ Styloid process

Continued on next page…

_____ CARPALS (hand)
- _____ Scaphoid
- _____ Lunate
- _____ Triquetrum
- _____ Pisiform
- _____ Trapezium
- _____ Trapezoid
- _____ Capitate
- _____ Hamate

_____ METACARPALS (1-5)

_____ PHALANGES (proximal,middle,distal)

_____ ILIUM
- _____ Sacroiliac joint
- _____ Iliac crest
- _____ Iliac fossa
- _____ Pelvic brim
- _____ Ant. sup. iliac spine
- _____ Post. sup. iliac spine
- _____ Ant. inf. iliac spine
- _____ Post. inf. iliac spine

_____ ISCHIUM
- _____ Ischial tuberosity
- _____ Ischial spine
- _____ Ischial ramus
- _____ Greater sciatic notch
- _____ Lesser sciatic notch

_____ PUBIS
- _____ Superior/Inferior Rami
  - _____ Obturator foramen
- _____ Pubic crest
- _____ Pubic symphysis
- _____ Acetabulum (**what 3 bones make up this structure?**)
  {pronounced: as-sah-tab′-you-lum}

_____ Five differences between male and female pelvis

_____ FEMUR
- _____ Greater trochanter
- _____ Lesser trochanter
- _____ Lateral condyle
- _____ Medial condyle
- _____ Patellar surface
- _____ Intercondylar notch
- _____ Lateral epicondyle
- _____ Medial epicondyle
- _____ Gluteal tuberosity

_____ PATELLA

_____ LEG
- _____ TIBIA
  - _____ Medial condyle
  - _____ Lateral condyle
  - _____ Tibial tuberosity
  - _____ Medial malleolus
- _____ FIBULA
  - _____ Lateral malleolus
    {pronounced: ma-lay'-o-lus or mal-e-o'-lus}

_____ TARSALS (foot)
- _____ Calcaneus
- _____ Talus
- _____ Navicular
- _____ Cuneiforms
- _____ Cuboid

_____ METATARSALS (1-5)

_____ PHALANGES (proximal,middle,distal)

NOTE: Laboratory # 10 is used for Lab Exam 2.

BIOLOGY 101 Human Anatomy and Physiology I

LABORATORIES 11 and 12
Muscle Histology
Human Gross Musculature

After completion of this lab you should be able to do the following for:

1. **Muscle Histology**
   a. Identify the type of muscle shown in a photomicrograph or focused on the microscope.
   b. List the characteristics for each type of muscle that enabled you to make the identification in a above.
   c. State where each type of muscle is found in the body (in parentheses below).
   c. Identify unique structures in the photomicrographs or focused specimen, e.g., striations, intercalated disks, nuclei, etc.

2. **Skeletal Muscle Gross Anatomy** - Be able to identify and name the human skeletal muscles listed in your Laboratory Study Guide when given a photograph/illustration/model of human muscle.

PACE YOURSELF!! Notice that the topic of muscles will cover two labs: 11 and 12. There is quite a lot to look at and to know, which is why we do this in two labs. However, be sure to divide the work up so that you can finish what you need to after the conclusion of your lab 12 work period.

Things to do for this lab...

1. MUSCLE TISSUE HISTOLOGY (in Lab 11)

- See Exercise 6 (pp. 80-82) in Marieb's Laboratory Manual for example photomicrographs and histological features of muscle.

- Be sure to complete Review Sheet 6, item #17 and #22 j, k, and l. You will be expected to know this for the lab exam.

_____ Skeletal muscle (attached to bones and skin)
  _____ Striations
  _____ Multinucleated

_____ Unbranched

_____ Cardiac muscle (heart)
- _____ Striations
- _____ Intercalated disks
- _____ Single nucleus
- _____ Branched

_____ Smooth muscle (digestive system, ureters, blood vessels)
- _____ Single nucleus
- _____ Elongated/spindle shape
- _____ Unbranched

2. HUMAN SKELETAL MUSCLE GROSS ANATOMY

- Use **Figures 13.2 and 13.3** in Exercise 13 in Marieb's Laboratory Manual for an overview of the **human skeletal muscles**. You will NOT need to identify all of the muscles labeled on the figures, only those listed below.

- Note that the figures that follow 13.2 and 13.3 have larger illustrations of each of the muscles you need to know, so you might want to use these to get a better look at them.

- The Review Sheet for Exercise 13 contains very useful activities and figures (that can be used like a 'coloring book'). Good stuff to know for the exam.

- Refer to the **Human Muscle Table** on the following pages for those muscles I expect you to know in the human. It provides the name, location, and action of the muscles.

- For the LECTURE EXAM, you will need to know the same muscles on the table, but you will also need to know the function. You can also use these tables as a guide for the lecture exam on skeletal muscles. If you have a different lecture instructor (other than me), please follow their instructions on what you are expected to know for your lecture exam.

Use **Figures 13.2 and 13.3** in Exercise 13 in Marieb's Laboratory Manual for an overview of the **human skeletal muscles**. You will NOT need to identify all of the muscles labeled on the figures, only those listed below (please see next page).

The list of **human muscles to identify**:

_____ orbicularis oris
_____ orbicularis oculi
_____ temporalis
_____ masseter
_____ trapezius
_____ sternocleidomastoid
{pron: stern′-ō-kly′-dō-mass′-toyed}
_____ deltoid
_____ supraspinatus
_____ rhomboids
_____ biceps brachii
_____ brachialis
_____ brachioradialis
_____ palmaris longus
_____ pronator teres
_____ triceps brachii
_____ external oblique
_____ rectus abdominis
(use the spelling ending in ‘is’, not ‘us’)
_____ linea alba

_____ pectoralis major
_____ latissimus dorsi
_____ gluteus maximus
_____ biceps femoris
_____ semitendinosus
_____ semimembranosus

_____ quadriceps femoris[1]
_____ rectus femoris
_____ vastus lateralis
_____ vastus medialis
_____ sartorius
_____ tensor fasciae latae
_____ gracilis
_____ adductor muscles

_____ gastrocnemius

_____ tibialis anterior

[1]The quadriceps femoris group contains one additional muscle, the vastus intermedius, that is not visible on most models because it is below the other three muscles of this group.

Continued on next page...

Muscle Name, Location, and Action

Muscle Name	Location	Action
Masseter	Cheek in front of ear	Elevates mandible (raises lower jaw)
Temporalis	Side of head (skull)	Elevates mandible
Orbicularis Oculi	Around eye	Closes eye
Orbicularis Oris	Around mouth	Compresses, purses lips
Sternocleidomastoid	Side of neck	Rotates head; Flexes head toward shoulder
Trapezius	Upper shoulder	Elevates clavicle; Extends neck
Deltoid	Shoulder	Abduction at shoulder
Pectoralis major	Front of upper chest	Flexion, adduction, and medial rotation of shoulder
Latissimus dorsi	Upper back	Extension, adduction, and rotation of shoulder
Supraspinatus	Supraspinous fossa	Initiates abduction of humerus
Rhomboids (major/minor)	Between medial border of scapula and vertebrae	Pulls scapula medially; stabilizes scapula
Biceps brachii	Front of upper arm	Flexion at elbow and shoulder
Triceps brachii	Back of upper arm	Extension at elbow
Brachioradialis	Lateral portion of lower arm and upper forearm	Forearm flexion
Brachialis	Lateral portion of upper arm	Flexion of forearm
Pronator Teres	Medial, near elbow crease	Pronates forearm
Palmaris Longus	Medial third of forearm	Flexes wrist; tenses skin of wrist and palm
Abdominal muscles External oblique Internal oblique Rectus abdominis	Front and side of abdomen	Flex trunk (vertebral column); depress ribs (as in forced exhalation)
Gluteus maximus	Buttocks	Extension and lateral rotation at hip
Tensor Fasciae Latae	Lateral side of thigh	Flexes, abducts, and medially rotates thigh
Iliopsoas	Front of upper thigh	Flex trunk on thigh; flex thigh
Adductor longus	Front of upper thigh	Adduct, medially rotate and flex thigh
Sartorius		Flexes, abducts, and medially rotates thigh; flexes knee
Quadriceps group Rectus femoris Vastus lateralis Vastus medialis Vastus intermedius	Front of thigh Middle Lateral Medial Deep	Extends knee (all muscles in group)
Hamstring group Biceps femoris Semitendinosus Semimembranosus	Back of thigh Lateral part of thigh Medial part of thigh Medial part of thigh	Flexes knee/extend thigh (all muscles in group)
Tibialis Anterior	Shin (lower leg)	Flexion at ankle; inversion of foot
Gastrocnemius	Calf (lower leg)	Extension at ankle; inversion of foot; flexion at knee

BIOLOGY 101 Human Anatomy and Physiology I

LABORATORY 13
Nerve Histology
Human Brain and Spinal Cord Models
Sheep Brain Dissection

After completion of this lab you should be able to do the following for:

1. **Nerve Histology**
   a. Identify cells as being neurons or neuroglial cells, given a photomicrograph or focused image of a section of nerve.
   b. Identify the major parts of a nerve cell.
   c. Classify neurons structurally (unipolar, bipolar, multipolar) or functionally (sensory neuron, interneuron, motor neuron) when given a photomicrograph, figure, or description.
   b. Identify the parts of the spinal cord (sc), given a photo-micrographic, silver stained cross section of sc.

2. **Human Brain Models** and **Spinal Cord Models** - Be able to identify the structures and selected cranial nerves in the list below.

3. **Sheep Brain Dissection** - Be able to identify the structures and selected cranial nerves in the list below.

Things to do for this lab...

1. NERVOUS TISSUE HISTOLOGY

- See Exercise 6 (pp. 79-80), Exercise 15 (figures 15.2, 15.3, and 15.7) in Marieb's Laboratory Manual. Look at slides of the entire brain and cross-section of the spinal cord (refer to Figure 19.5 for spinal cord cross-section).

2. HUMAN BRAIN AND SPINAL CORD GROSS ANATOMY

- Use **Figures 17.2 through 17.5** in Exercise 17 in Marieb's Laboratory Manual for an overview of the **human brain structures**.

- Use **Figures 19.2 through 19.4** in Exercise 19 in Marieb's Laboratory Manual for an overview of the **spinal cord structures**.

You will NOT need to identify all of the regions/nerves labeled on the figures for the brain and spinal cord, only those listed below in your checklist.

The Review Sheets for the above Exercises (15.17 and 19) contain useful activities that will help you prepare for the exam.

Continued on next page...

HUMAN BRAIN

_____ cerebral gyri

_____ cerebral sulci

_____ longitudinal fissure

_____ transverse fissure

_____ frontal lobe

_____ parietal lobe

_____ temporal lobe

_____ occipital lobe

_____ olfactory bulbs and tracts(see Note 1 below)

_____ optic nerve (CN II)

_____ oculomotor nerve (CN III)

_____ trigeminal nerve (CN V)

_____ optic chiasma

_____ corpus callosum

_____ Cerebellum
  _____ arbor vitae (white material that looks like a tree/bush)

_____ pons

_____ medulla

_____ spinal cord

_____ thalamus

_____ hypothalamus
  ____ infundibulum
  ____ pituitary gland

_____ cerebral aqueduct

_____ fourth ventricle

_____ Corpora quadrigemina
  _____ Superior colliculi
  _____ Inferior colliculi

_____ Midbrain (mesencephalon)

_____ Pineal body (gland)

SPINAL CORD - MICROSCOPIC/HUMAN MODEL (model, slide of spinal cord)

_____ central canal
_____ ventral (anterior) horns (contains cell bodies of motor neurons)
_____ white matter
_____ gray matter
_____ dorsal (posterior) horns (contains axons of sensory neurons)

_____ neuron/axon locations (See Note 2 below)

Continued on next page...

3. SHEEP BRAIN GROSS ANATOMY

- Use **Exercise 17** in Marieb's Laboratory Manual for an overview of the **sheep brain structures, and the procedure to dissect the sheep brain**.

- Note that the structures/cranial nerves you need to know for the sheep brain are the same ones you need to be able to recognize on the human brain.

You will NOT need to identify all of the regions/nerves labeled on the figures for the brain and spinal cord, only those listed below in your checklist below.

SHEEP BRAIN

_____ cerebral gyri

_____ cerebral sulci

_____ longitudinal fissure

_____ transverse fissure

_____ frontal lobe

_____ parietal lobe

_____ temporal lobe

_____ occipital lobe

_____ olfactory bulbs and tracts(see Note 1 below)

_____ optic nerve (CN II)

_____ oculomotor nerve (CN III)

_____ trigeminal nerve (CN V)

_____ optic chiasma

_____ corpus callosum

_____ Cerebellum

_____ pons

_____ medulla

_____ spinal cord

_____ thalamus

_____ hypothalamus

____ infundibulum

_____ pituitary gland

_____ cerebral aqueduct

_____ fourth ventricle

_____ Corpora quadrigemina

_____ Superior colliculi

_____ Inferior colliculi

_____ Midbrain (mesencephalon)

_____ Pineal body (gland)

_____ arbor vitae (white material that looks like a tree/bush)

Note 1: Cranial nerve I actually consists of the nerve fibers that pass through the cribriform plate of the ethmoid bone. Cranial nerve I fibers then connect to the neurons in the olfactory bulb which, in turn send axons to the brain via the olfactory tracts. (**CN I -> Olfactory bulb -> olfactory tract -> brain**)

Note 2: You should know what TYPES, e.g., motor, sensory, of neurons are present in each of the horns of the spinal cord. As indicated above, ventral/anterior horns contain motor neurons; posterior/dorsal horns contain axons of sensory neurons.

So, WHEN a section of the spinal cord is indicated on a slide/photo on the lab exam, to get full credit your answer should include: 1) where the pointer is pointing, e.g., ventral horn, dorsal horn, etc., and 2) it should also include the types of cells you'd find there, e.g., motor neuron cell bodies, axons of sensory neurons, etc.

BIOLOGY 101 - Human Anatomy and Physiology I
LABORATORY 14 - SPECIAL SENSES

Objectives:

- Distinguish between the quality and quantity of **touch receptors** on differing skin areas. (two-point discrimination test).
- The **Eye**:
    - Identify the anatomy of the eye and its accessory anatomical structures on a model or appropriate image and list the functions of each structure.
    - Identify the structural components of the eye that are present in a preserved sheep or cow eye.
    - Trace the pathway of light through the eye to the retina, describe the events involved in photoreceptors and trace the visual pathway to the visual cortex.
    - (**Optional)** Pupillary Reflex
    - (**Optional**) Visual reflexes
- The **Ear**:
    - Using models, describe the structures and functions of the outer, middle and inner ear.
    - Explain the pathway of sound conduction and the auditory pathway to the auditory cortex.
    - Describe the role of the semicircular canals and the vestibule in maintaining balance and equilibrium.
    - (**Optional**) Sound detection of the human ear

Materials:

- General
    - Dissecting kit, gloves, safety glasses or goggles
    - Marieb & Smith Laboratory Manual, 13th ed., Pearson Education, Inc., 2019
    - Instructor-provided handouts and/or supplements
- Touch Receptor Experiment
    - Lab partner
    - Calipers
    - Alcohol pads
- Eye Anatomy & Physiology
    - Eye models
    - Cow or sheep eye
    - Penlight (for optional pupillary reflexes activity)
    - Meter stick (for optional visual reflexes activity)
- Ear Anatomy & Physiology
    - Ear models
    - 256 Hz and 480 Hz tuning forks (for optional sound detection activity)

Introduction:

All of our information about the outside world, other people, and even about our own bodies comes to us through our special and general **sense organs**. Sense organs contain **sensory receptors** that receive only one type of information. Once received, they respond by firing an impulse to the central nervous system which will then process and make decisions about that incoming information. **General senses** include **touch, pressure, vibration, temperature, pain** and **proprioception** (the body's position in space). **Special senses** include **smell** (olfaction), **taste, vision, hearing and balance.**

Laboratory exercise:

In this laboratory exercise we will:

1. Distinguish between the quality and quantity of touch receptors on differing skin areas.
2. Learn the structures and function of the eye and observe the pupillary reflex.
3. Learn the structures and function of the ear in hearing, balance and gravity.

1. **Touch Receptors**
   How sensitive are you to touch? The answer is it depends upon where on your body you measure. Receptors for touch are everywhere but are closer together in some areas. You will determine where skin has more receptors for touch by performing the two-point discrimination test.

   Procedure:

   1. Lab partner must close eyes tightly.

   2. Wipe the body region (fingertip, Palm, anterior forearm) with an alcohol pad(s). The lab partner/subject can do this themselves before closing eyes if that is more comfortable for them. Using a caliper set to 3 cm, place either one or both ends onto your lab partner's skin in the middle of the region indicated on the table below. Repeat randomly four times,

making sure that two times you use two points and two times you use a single point.

3. Have lab partner report how many ends they can feel. Using Table 14.1, record how many times out of 4 your partner correctly felt the number of points.

4. Repeat step four and five using a caliper set to 2, 1, and 0.5 cm.

5. Complete each of the body regions in Table 14.1.

Table 14.1 Two-Point Discrimination Test

Caliper	**Fingertip**				**Palm**				**Anterior Forearm**			
3 cm												
2 cm												
1 cm												
0.5 cm												

Which areas of the body contain the most touch receptors?

Which have the least?

2. The Eye

A. Eye model

Using models supplied in lab, **identify, label, and state the purpose o**f each the following structures of the eye:

Sclera

Choroid

Retina

Cornea

Iris

Pupil

Lens

Vitreous humor

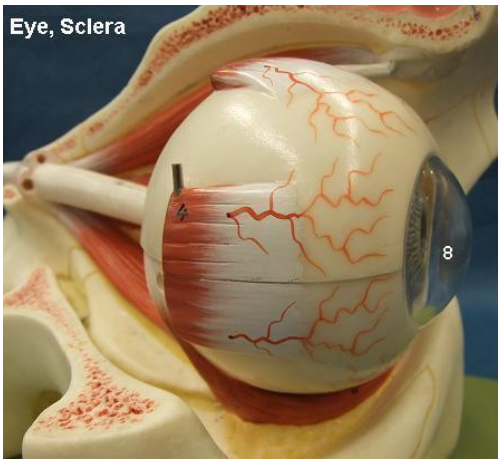
Macula lutea

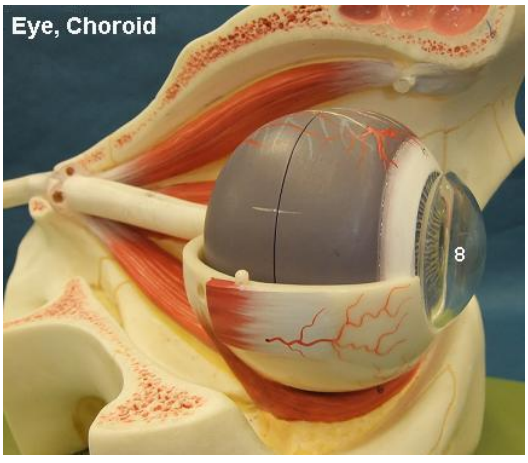
Optic disc

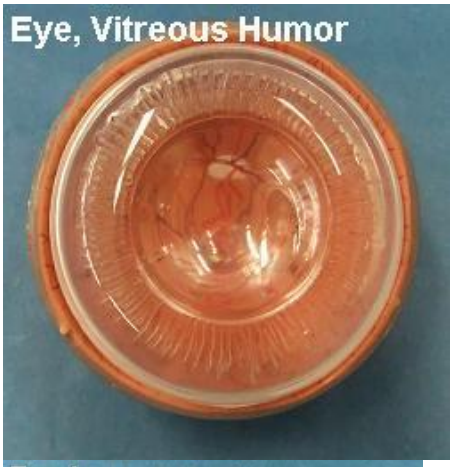
Optic nerve

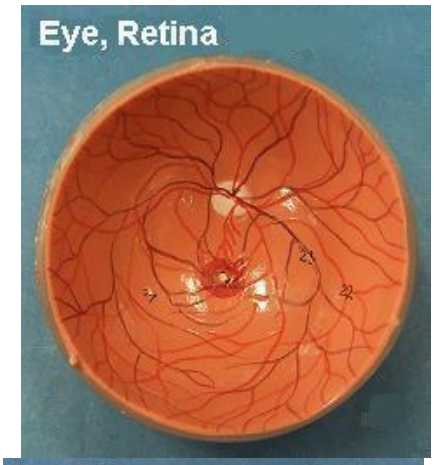
Ciliary body

Aqueous Humor









B. Cow (sheep) eye dissection

1. Wear your safety glasses or goggles and don your disposable gloves
2. Follow eye dissection directions and figure 23.5 (p. 355 - p.357, Marieb & Smith) to dissect a cow or sheep eye provided in the lab
3. Be sure to identify optic nerve, extrinsic eye muscle attachments, conjunctiva, sclera, cornea, lens, ciliary body, iris, aqueous humor, vitreous humor and retina.
4. Relate the structures in the real eye with structures seen in the eye model.

C. Light transduction and visual pathways to the brain.

1. Microscopic anatomy of the retina (p. 354, Marieb & Smith)

2. Visual Pathways to the brain (p. 357, Marieb & Smith)

1. Diagram or list the structures through which light must pass

from the time it enters the eye until it strikes the retina.
2. Using the image of the visual pathway on page 358 of the Marieb & Smith Laboratory Manual, predict the effect of visual pathway lesions:

a. In the right optic *nerve*:

b. Through the optic chiasm:

c. In the left optic *tract*:

d. In the right cerebral cortex:

D. (Optional) Pupillary Reflex

5. Examine your partner's eye and note the colors of the iris, sclera and pupil in Table 14.2 below.

Table 14.2 Eye Color Observations

	Color
Iris	
Sclera	
Pupil	

6. Shine a flashlight on your partner's right eye and note the response of the right pupil:

7. Wait 30 seconds and repeat step two with the left eye. Note the

response of the left pupil:

8. How is this reflex adaptive?

9. Shine a flashlight on your partner's right eye and note the response of the left pupil:

10. Noting that humans have binocular vision (use both eyes), how is this reflex adaptive?

E. (Optional) Visual Reflexes

In order to catch a ball or drive a car, we rely on learned reflex whose input begins with visual information. In this part of the lab, we will try to catch a falling meter stick to demonstrate visual reflexes.

Procedure:

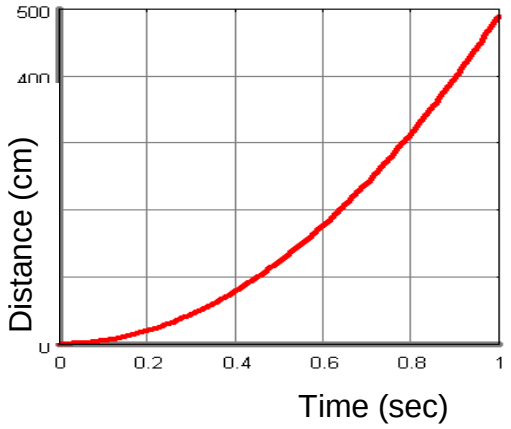
1. Working in pairs, have student # 1 hold their thumb and index finger 3 cm apart. Student # 2 should hold the meter stick so that the zero is positioned between thumb and index finger. Catch the meter stick when your partner drops it. Repeat three times. Record the distance that the meter stick fell (in cm) in Table 14.3 below.

2. Repeat the experiment as in 1 above holding your fingers 15 cm apart. Repeat three times. Record your results in Table 14.3 below.

Table 14.3 Visual Reflex Results

Trial	**3 cm**			**15 cm**		
1						
2						
3						

Gravity pulls the ruler down at an acceleration of 980 cm/sec^2 (cm per second squared). The graph below demonstrates the time it takes for an object to fall a certain distance. Using the following graph, answer the following questions below.



Questions:

1. If you caught the ruler at the 15 cm mark, how many seconds did the visual reflex take? (Show your calculations)

2. If you caught the ruler at the 50 cm mark, how many seconds did the visual reflex take? (Show your calculations)

3. The Ear

A. Ear model

The **outer** ear contains structures to channel and help us locate sound. The **middle ear** contains structures to transmit and control the volume of sound. The inner ear contains structures for hearing, balance and gravity. The **cochlea** contains the **organ of Corti**, which translates pitch into nerve impulses, the **semicircular canals** detect motion, and the **vestibule** detects gravity.

Using the models supplied in lab, **identify and state the purpose of each** of the following structures:

Auricle

External auditory canal

Tympanic membrane

Malleus

Incus

Stapes

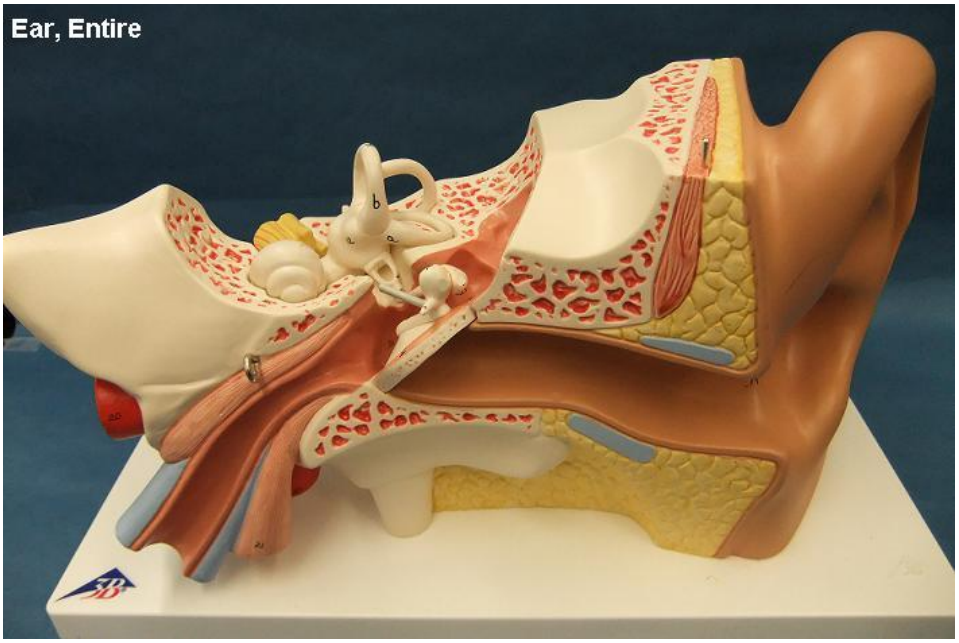
Cochlea

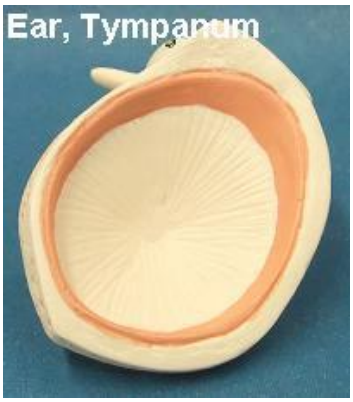
Semicircular canals

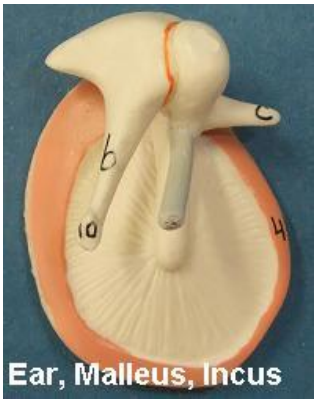
Vestibule

Auditory tube

Vestibulocochlear nerve







Indicate which structures you identified are part of the inner, middle and outer ear:

Inner ear: _

Middle ear:

Outer ear:

B. Pathway of sound conduction and auditory pathway (See Mechanism of Hearing, p. 377, Marieb & Smith Laboratory Manual.)

1. Diagram or list the structures involved in the pathway of sound transduction from the outer ear through the cochlea:

2. List the sequence of structures through which a nerve impulse from a *high-frequency sound* travels from the inner ear to the primary auditory cortex.

C. Explain the role of semicircular canals in maintaining balance (See Microscopic Anatomy of the Equilibrium Apparatus and Mechanisms of Equilibrium, p. 381, Marieb & Smith Laboratory Manual.)

D. Explain the role of vestibular structures in maintaining balance (See Microscopic Anatomy of the Equilibrium Apparatus and Mechanisms of Equilibrium, p. 381, Marieb & Smith Laboratory Manual.)

E. (Optional) Sound Detection The ears of a human (and other animals) are sensitive detectors capable of detecting the vibrations of air pressure that impact the eardrum. Different "notes" or pitches are actually different frequencies of soundwaves. Humans can detect pitches between 20 and 20,000 waves per second in vibration. Other animals can detect ultrasound vibrations beyond 20,000 such as dolphins (200,000).

Procedure:

1. Tap a tuning fork on a hard surface and describe the sensation. Repeat with a second tuning fork and record the difference in pitch (low versus high).

Table 14.4

	Level of Pitch (low or high)
256 Hz	
480 Hz	

2. With your eyes tightly closed, your lab instructor will place the 256 Hz vibrating fork at various locations and distances from your ear. Indicate the position of the fork by pointing in the direction of the sound with your eyes closed. Open your eyes and record if you were able to locate the sound (yes or no) in Table 14.5 below.

Table 14.5 Sound Detection Results

Location	Correctly Located Sound (yes or no)
1	
2	
3	
4	
5	

3. Tap the 256 Hz tuning fork and place the stem on the mastoid process (bump at ear base). When you can't hear it any more, rotate the tuning fork so the tines are close to the external auditory canal.

   Based on your observations, sound conduction is better through: solid or air?

** End of Laboratory 14 **
(Updated: 8/14/18)