

COMMUNITY COLLEGE OF BALTIMORE COUNTY  
CATONSVILLE CAMPUS



**BIOLOGY 220**  
**ANATOMY & PHYSIOLOGY I**  
**LABORATORY SUPPLEMENT**

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Revised Spring 2012



## BIOLOGY 220

### ANATOMY & PHYSIOLOGY I

#### INTRODUCTION

Welcome to Biology 220 – Human Anatomy and Physiology I - laboratory. These exercises are designed to give you experience in:

- following directions accurately;
- using microscopes properly and observing histological specimens using prepared slides;
- identifying anatomical structures based on diagrams, models, and preserved specimens; and
- understanding various physiological processes through experiments including virtual experiments (PhysioEx).

Please come to each laboratory prepared to learn, and for each lab please bring the following:

- *Seeley's Anatomy & Physiology and PhysioEx CD*;
- 3-ring binder with laboratory supplement, which provides the objectives for the day's lab activities;
- extra paper and pencils (preferred) or pens to take notes.

You may also want to bring pencils or pens of different colors.

You are expected to have successfully completed Biology 110 - Biology I: Molecular and Cells - or the equivalent. **You are responsible for material covered in that course such as using the microscope and prepared slides, structures and functions of an animal cell and other material related to the systems you will study in A&P I.** We will not review the material covered in that course. If you had difficulty with any of these subjects in BIOL 110, you should review the relevant exercises in the laboratory supplement.

You should plan to come with all definitions, locations and functions filled out so that you can maximize your time in lab looking at slides, models and other materials. Information can be found in the textbook.

## LAB EXPECTATIONS

The laboratory is a place of serious observation and study. Toward that end, please observe the following:

1. Cell phones and pagers are disruptive – especially during tests. **Please turn them to a silent mode; or, better yet, turn them off.** In an emergency, you can reach the Department Administrative Assistant (443-840-4212) or Public Safety (443-840-4455).
2. Read through the upcoming laboratory exercise **before** coming to lab (see tentative course lab schedule) and write out definitions of terms, descriptions, locations and functions of structures to be observed. You may need to refer to your textbook to completely answer some objectives.
3. Models, slides, atlases, books, diagrams, model keys, etc. may **not** be taken out of the laboratory. Do not count on open lab time. Use your time in lab wisely.
4. After completing each lab, you should be able to identify any structure or organ viewed as part of the objectives from models, slides, micrographs, diagrams, and dissected material, as appropriate; discuss the functions, locations and properties of these structures or organs; and discuss physiological principles studied.
  - a. **You** are responsible for making sure you cover and understand all of the objectives not labeled “optional”. Please check with your lab instructor regarding “optional” objectives because he or she may require you to complete those, too.
  - b. **You** are responsible for knowing the importance and/or function of every structure or term listed regardless of whether it is stated explicitly in the objective.
  - c. **You** are responsible for making sure you have viewed all available materials that may be used on exams.
  - d. **Your instructors** are here to help you learn. It is **your** responsibility to seek help when needed in and out of lab.
5. A limited number of models are available for study in the library. Many excellent web sites exist that provide images of materials similar to those we use in lab. See your instructor for more information.
6. Please treat all materials with care; many students need to use them. **Please do NOT use pens, pencils or markers on the models.** *Pipe cleaners* (chenille sticks) are available for pointing at structures on models. Report any problems with equipment or models to the instructor as soon as possible.
7. Please **clean** all equipment used and **return** it to its place of storage before you leave the lab.

8. Please **clean** up any chemicals that may have spilled during physiological experiments.
9. **Dissection** is a vital part of understanding anatomical relationships and tissues. Students are expected to participate in dissection of selected materials or view dissections during lab. Dissected materials will appear on most laboratory practical exams. **Students who object** to the use of animal material for dissection **must** submit a written explanation of their objections **by the end of the FIRST full week** of classes. Students with valid reasons ("I just don't want to." is not a valid reason) will meet with the course coordinator during the first two weeks of class to discuss their objections.
10. You may wish to bring a smock or lab coat to lab when doing dissections.
11. **Attendance is required.** If you are going to miss a lab, please contact the instructor as soon as possible, preferably before the missed lab, to schedule a make-up. It is **YOUR** responsibility to contact the instructor and to make up the material. If your regular instructor does not teach the lab section you want to attend to make up the lab, you must contact that instructor as well to make sure there is room in her/his lab section.
12. **Group study**, both, during and after lab is highly beneficial. Taking turns teaching each other about the material will help the learners better understand and remember the material.

**GOOD LUCK and HAVE A GREAT SEMESTER!**

## LAB SAFETY

1. Students should maintain appropriate classroom behavior (see the College Catalogue under Student Code of Conduct); disruptive students will be asked to leave the laboratory.
2. **Smoking, eating and drinking** are **NOT** permitted in the laboratory **at any time**. Do not bring open food or beverage containers of any kind into the lab.
3. Do not put anything in your mouth while in lab; this includes pens, pencils and pipettes. If you do not know what something is, treat it as if it were dangerous until you know otherwise.
4. For your safety, **close-toed shoes** are required in lab. **If you are wearing sandals, your instructor cannot permit you to enter the lab.** It is your responsibility to dress appropriately and wear proper footwear.

### **SANDALS ARE NOT PERMITTED IN THE LABS**

5. When anyone is performing dissections or working with hazardous chemicals, we recommend that students in the lab wear safety glasses or goggles (available from the bookstore for a moderate price).
6. Please wear gloves when you are dissecting and when handling hazardous materials. If you are not the one in your group actually doing the dissection, you do not need to wear gloves.
7. Please clean and dry all equipment used to dissect. Dispose of animal parts in appropriate disposal containers that will be provided. **DO NOT** throw animal parts in the regular trash.
8. Do not dispose of non-hazardous materials in the hazardous waste or sharps containers. For "wet" laboratory exercises your instructor will tell you the proper disposal method.
9. Handle glass carefully. Be sure to use proper protection when handling hot glass (hot pads, *etc*). Broken glassware, used pipettes, sharps (i.e. scalpel blades) and broken slides must be disposed of in the properly labeled receptacles. The instructor should be notified of any broke glassware or slides.
10. Keep your work area clear. To prevent damage to your personal effects store book bags and clothes elsewhere.
11. Clean your lab bench before leaving and wash your hands thoroughly with soap and water. Your instructor may provide you with disinfectant at the end of labs during which you performed dissections or viewed dissected materials.

12. You may want to wear cotton or wool clothes (old clothes are best) during lab. Natural fibers are more flame resistant and less likely to melt and stick to your skin should they catch fire. The probability of flame is limited but caution is generally advisable.
13. Keep water and other conducting materials away from electrical outlets.
14. Unless you have explicit prior permission from an instructor, do not work in the lab unless the instructor is present.
15. Please read the lab exercises carefully. Do not perform "unauthorized" experiments or try out a new idea unless the instructor approves it.
16. Persons (especially children) not enrolled in the course are not permitted in the lab except with the permission of the instructor.

***Biology Department***  
***Safety Procedures Agreement***

After you have read the **Introduction** and **Lab Safety** pages, please read the following, sign in the appropriate space, and give this page to your lab instructor by the end of the second lab.

I have read the lab supplement **Introduction** and **Lab Safety** pages.

I realize that I am responsible for my own learning. I acknowledge that I am expected to follow guidelines outlined in the CCBC "Student Code of Conduct". I acknowledge that I need to display appropriate behavior and treat my fellow students and instructors with respect.

I acknowledge that there will be animal dissections. I acknowledge that I must notify my lab instructor and the course coordinator by the end of the first week of the term if I object to animal use on moral, ethical or religious grounds. We will then discuss alternatives.

The instructor has reviewed the Safety Procedures with me and has provided the opportunity to ask questions during the review. I read and understand the safety rules and policies of CCBC; I agree to follow the Safety Policies. **I understand that failure to comply with the safety and lab guidelines may result in a reduction of my final grade and/or I may be asked to leave the class.**

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Course & Section

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date





## REVIEW SECTION

### 1. Using the Microscope Successfully

- a. Keep both eyes open.
- b. Move the lowest power (4x) objective into position.
- c. Place the slide on the stage, with the specimen under the objective.
- d. Reduce the amount of light to decrease eyestrain.
- e. Use coarse adjustment (the large knob) to roughly focus the specimen.
- f. Use the fine adjustment (the small knob) to fine-tune the focus of the specimen.
- g. Move the slide, if necessary, to see the appropriate area.
- h. Move the desired cells or structures into the center of the field.
- i. Switch to low power (make sure it clicks into position).
- j. Adjust the light intensity if necessary.
- k. Use the FINE adjustment to focus. The specimen should be nearly in focus when you change objective lenses.
- l. Switch to high power.
- m. Use only the FINE adjustment to focus. Under NO circumstances should you use the coarse adjustment knob when using the high power objective.
- n. Adjust light if necessary.

### 2. Review the structural components of an animal cell and name the function of each.

### 3. Compare and contrast the steps of meiosis and mitosis; indicate the location of each process.

### 4. Explain the resulting chromosome number of each process: diploid and haploid (a.k.a. monoploid)

### 5. Compare and contrast the structures of DNA and RNA.

### 6. Define the roles of DNA and RNA in protein synthesis.

### 7. Define the following terms:

- a. lyse
- b. osmotic equilibrium
- c. hemolysis
- d. crenation
- e. hypotonic
- f. diffusion
- g. osmosis
- h. filtration

### 8. Metric System Review

#### *Volume*

\* 1 liter (l)

1 milliliter (ml) = 1 cubic centimeter (cc) = 1/1000 l =  $10^{-3}$  l

1 microliter ( $\mu$ l) = 1 millionth l. =  $10^{-6}$  l. = 1/1000 ml

*Weight (mass)*

1 kilogram (Kg) = 1000 g =  $10^3$  g

\* 1 gram (g)

1 milligram (mg) =  $1/1000$  g =  $10^{-3}$  g

1 microgram ( $\mu$ g) = 1 millionth g =  $10^{-6}$  g

*Length*

1 kilometer = 1000 M =  $10^3$  M

\* 1 meter

1 centimeter (cm) =  $1/100$  M =  $10^{-2}$  M

1 millimeter (mm) =  $1/1000$  M =  $10^{-3}$  M

1 micron ( $\mu$ ) = 1 millionth M =  $1/1000$  mm =  $10^{-6}$  M

\* **basic unit**

Common conversions between metric and English measurements

1 inch = about 2.54 cm

1 pound = about 453.59 g

1 liter = 1.057 quarts

$^{\circ}$  F =  $9/5$  ( $^{\circ}$  C + 32)

$^{\circ}$  C =  $5/9$  ( $^{\circ}$  F - 32)

**Show how you arrive at your answers to the following problems:**

A patient is to receive 250 mg of a particular medication. How many grams does this represent?

Convert the following:

a. 100 ml = \_\_\_\_\_ l

b. 2.25 l = \_\_\_\_\_ ml

c. 0.08 g = \_\_\_\_\_ mg

d. 0.030 l = \_\_\_\_\_  $\mu$ l

e. 5.0 m = \_\_\_\_\_ km

Convert these temperatures. Show your work.

a. 88 $^{\circ}$ F = \_\_\_\_\_  $^{\circ}$ C

b. 78 $^{\circ}$ C = \_\_\_\_\_  $^{\circ}$ F

c. A patient's weight is 63 kg. What is it in pounds? \_\_\_\_\_

Write the following in scientific notation.

a. 0.057 g

b. 10,000 m

c. 1257 lbs

d. 740 l

e.  $1/1000$  ml

f. What is specific gravity?

g. What does 10 mg % mean?

h. How would you prepare a solution of physiologic saline?

Match the following:

- |                        |                     |
|------------------------|---------------------|
| a. ____liters          | a. length           |
| b. ____milliliters     | b. temperature      |
| c. ____millimeters     | c. energy           |
| d. ____degrees Celsius | d. mass             |
| e. ____kilograms       | e. volume           |
| f. ____centimeters     | f. density          |
|                        | g. specific gravity |
|                        | h. specific heat    |

**9. Draw a graph from the following data:**

A patient was admitted to the hospital with a fever of undetermined origin. The patient's temperature was taken at 2-hour intervals and was noted as follows:

2 hrs	101.0	no medication
4 hrs	102.0	no medication
6 hrs	103.0	no medication
8 hrs	104.0	two gr. aspirin given
10 hrs	100.0	no medication

**10. Osmosis Review**

A membrane between two different solutions, which allows some molecules to pass through it, but is impermeable to others, is said to be differentially permeable. The diffusion of solvent (usually water) through such a membrane is osmosis. Use the space below to illustrate the effects of osmosis on a closed system such as a bacterial cell. If the cell contains more non-transmissible molecules than the solution around it, the direction of water movement will be into the cell. Such a solution, which has a lower concentration of solute than the cell, is said to be HYPOTONIC. Surrounded by such a solution the cell swells due to the osmotic pressure built up in the cell by incoming water molecules. In the case of erythrocytes (red blood cells), this condition is termed *hemolysis* because the cells swell and burst and release hemoglobin.

If the surrounding solution has a higher solute content (low water content) it is said to be HYPERTONIC. In this case the solution has a high osmotic pressure. The resultant movement of water is from the cell causing plasmolysis, or shrinking of the protoplast. In the case of erythrocytes this condition is termed *crenation*. Osmotic pressure is a means of expressing the concentration of water in a solution -- the lower the water concentration of a solution, the higher its osmotic pressure.

A solution that has the same water concentration as the cell is ISOTONIC. In an isotonic solution osmotic equilibrium exists.

## 11. Pronunciation of Medical Terms

Most Latin and Greek terms used in medicine are pronounced as in English. However, notice these sounds:

*C* and *G* are softened (pronounced as *S* and *J*) before *e* and *i* sounds. Ex: center, circle, cecum, coelom, cycle, gentle, giant, gyrate. Before other sounds, and on words of Germanic origin, *c* and *g* remain hard as in call, cold, cup, gave, get, give, goat.

*Ch* is almost always pronounced as *K*: Ex: chondroplast, archenteron.

*Ae* and *Oe* are pronounced as *ee*... *I* is usually pronounced *eye*.

Final *e* and *es* are pronounced as separate syllables. E.g., rete (ree tee), nares (nayreez).

## 12. Anatomical Terms

The following words are nouns with which parts of the body are compared, usually because of their shape. These words often appear in the diminutive form ending in either "-oid" or "-form".

<u>Element</u>	<u>Meaning</u>	<u>Element</u>	<u>Meaning</u>
acron	point	glans	acorn
aden	gland	lacuna	hole
ala	wing	lumen	light, lantern
ampulla	jug	macule	spot
arachni	spider web	nodus	knot
atrium	entrance court	oon	egg
bursa	purse	pelvis	basin
corpus	body	pons	bridge
cuneus	wedge	rete	net
cytos	container, cell	ruga	wrinkle
falx	sickle	septum	partition
fascia	bandage	soma	body
fenestra	window	squamous	scale
fistula	pipe	strata	layer
flagellum	whip	stria	striped
foramen	hole	style	peg, post
fossa	ditch	sulcus	furrow, groove
		suture	seam
		tunica	jacket
		vas	vessel, pipe
		xiphos	sword

## 13. Physiology and Pathology Terms

<u>Element</u>	<u>Meaning</u>	<u>Element</u>	<u>Meaning</u>
embolus	plug	oncos	mass
eme	vomit	seda	quiet, calm
etia	cause	narci	numbness, stupor
morbus	disease	spasmos	cramp, convulsions
mors, mort	death	thrombus	clot
naevus	mole, wart	trauma	wound

## 14. Prefixes

**a** - absent, deficient

**ab** - away from

**ad** - to, toward

**adeno** - glandular

**amphi** - on both sides

**an** - absent, deficient

**ante** - before, forward

**anti** - against

**ana** - of each

**arthro** - pertaining to one or more joints

**bi** - two, double, twice

**circum** - around, about

**contra** - opposite, against

**de** - away from, from

**dia** - through, between, across, apart

**dys** - difficult

**e** - two, double, twice

**ecto** - outside

**endo** - in, within

**ento** - inside, within

**entero** - pertaining to the intestines

**epi** - on, upon

**infra** - underneath, below

**inter** - between, among

**intra** - within, on the side

**mal** - disordered

**meno** - pertaining to menstruation

**meta** - after, changing

**myo** - pertaining to muscle

**neuro** - pertaining to nerves

**osteo** - pertaining to one or more bones

**para** - beside, beyond

**peri** - around

**phlebo** - venous; eg. pertaining to veins

**pneo** - pertaining to breathing, breath

**pneuma** - **pneumato** - pertaining to: air or gas, breathing, lung tissue or the lungs

**pneumo** - pertaining to: air or gas, lung tissue or the lungs breathing

**post** - after, behind

**pre** - before, in front of

**pro** - before, in front of

**psycho** - mental

**pyo** - pertaining to pus

**retro** - backward, back

**semi** - half

**stomato** - pertaining to the mouth

**sub** - under, beneath  
**super** - above, over  
**supra** - above, on upper side  
**syn** - with, together  
**thoraco** - pertaining to the chest  
**trans** - across, beyond

### 15. Suffixes

<b>-algia</b>	pain	<b>-pathy</b>	abnormality
<b>-dynia</b>	pain	<b>-phobia</b>	morbid fear
<b>-ectomy</b>	surgical removal	<b>-ptosis</b>	falling
<b>-iatrist</b>	specialist	<b>-rrhea</b>	flow, discharge
<b>-iatry</b>	field of medicine	<b>-stomy</b>	surgical opening
<b>-itis</b>	inflammation	<b>-tomy</b>	surgical cutting
<b>-logist</b>	scholar, specialist	<b>-uria</b>	presence in the urine
<b>-logy</b>	study, field of medicine		
<b>-oma</b>	tumor		
<b>-osis</b>	condition or process, especially one that is abnormal		

### 16. Exercise

**Etymology** is the study of the history or derivation of words. In this exercise, pick out the Latin or Greek root word(s) that make up the following terms and attempt to ascertain the meaning of the word. As an example, "thrombophlebitis" has two root words ("thromb" and "phleb") and one suffix ("itis").

*thrombo* - clot

*phleb* - vein

*itis* - inflammation

Term	Prefix/Root/Suffix	Meaning
<i>Hypermenorrhea</i>		
<i>Sedative</i>		
<i>Oncology</i>		
<i>Emesis</i>		
<i>Dysphagia</i>		
<i>Adduct</i>		
<i>Abduct</i>		
<i>Heterosexual</i>		
<i>Adenoid</i>		
<i>Postmortem</i>		





# Lab #1

## Anatomical Terms

Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.

### Materials

- Torso and muscle man models
- Plane Jane model
- Cell models

### Objectives

#### Anatomical Terms

1. Describe and define the ***anatomical position*** verbally and by demonstration.

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2. Define each of the following *terms to describe their anatomical relationships*.

Term	Definition/Notes
<i>Superior/Crania</i>	
<i>Inferior/Caudal</i>	
<i>Anterior/Ventral</i>	
<i>Posterior/Dorsal</i>	
<i>Proximal</i>	
<i>Distal</i>	
<i>Medial</i>	
<i>Lateral</i>	
<i>Superficial</i>	
<i>Deep</i>	

3. Describe the ***anterior*** body ***regions*** and locate them on models and figures.

Term (noun)	Definition/Notes	Adjective
<i>Cephalon*</i>		Cephalic
<i>Cranium</i>		Cranial
<i>Facies</i>		Facial
<i>Frons</i>		Frontal
<i>Oculus</i>		Ocular
<i>Auris</i>		Aural <i>or</i> Otic
<i>Bucca</i>		Buccal

Term (noun)	Definition/Notes	Adjective
<i>Nasus</i>		Nasal
<i>Oris</i>		Oral
<i>Mentis</i>		Mental
<i>Cervicis*</i>		Cervical
<i>Thoracis</i>		Thoracic
<i>Mamma</i>		Mammary
<i>Abdomen</i>		Abdominal
<i>Umbilicus</i>		Umbilical
<i>Pelvis</i>		Pelvic
<i>Inguen</i>		Inguinal
<i>Pubis</i>		Pubic
<i>Axilla</i>		Axillary
<i>Brachium*</i>		Brachial
<i>Antecubitis</i>		Antecubital
<i>Antebrachium*</i>		Antebrachial
<i>Carpus*</i>		Carpal
<i>Manus</i>		Manual
<i>Palma</i>		Palmar
<i>Pollex</i>		
<i>Digits*</i>		Digital
<i>Femur*</i>		Femoral
<i>Patella</i>		Patellar
<i>Crus</i>		Crural
<i>Tarsus</i>		Tarsal
<i>Pes</i>		Pedal
<i>Hallux</i>		

4. Describe the *posterior* body *regions* and locate them on models and figures.

Term (noun)	Definition/Notes	Adjective
<i>Cephalon*</i>		Cephalic
<i>Cervicis*</i>		Cervical
<i>Acromion</i>		Acromial
<i>Dorsum</i>		Dorsal
<i>Lumbus</i>		Lumbar
<i>Gluteus</i>		Gluteal
<i>Olecranon</i>		Olecranal
<i>Popliteus</i>		Popliteal
<i>Sura</i>		Sural
<i>Calcaneus</i>		Calcaneal
<i>Planta</i>		Plantar
		Fibular
		Peroneal
*can be seen from both anterior and posterior views		

5. Identify the **dorsal** and **ventral** body cavities and their subdivisions on figures and models, and name the organs contained in each.

<b>Cavity</b>	<b>Subdivision</b>		<b>Definition</b>	<b>Major organs</b>
<i>Dorsal (posterior) body cavity</i>	<b>cranial</b>			
	<b>spinal (vertebral)</b>			
<i>Ventral (anterior) body cavity</i>	<b>thoracic</b>	<i>pleural</i>		
		<i>pericardial</i>		
	<b>Abdominopelvic (peritoneal)</b>	<i>abdominal</i>		
		<i>pelvic</i>		

6. Identify the **abdominopelvic quadrants** on figures and models, and list the **major organs** found in each.

	<b><i>Abdominopelvic Quadrant</i></b>	<b><i>Major organs</i></b>
1.		
2.		
3.		
4.		

7. Identify **regions** of the **abdominopelvic cavity** on figures and models, and list the **major organs** found in each.

	<b><i>Abdominopelvic Region</i></b>	<b><i>Major organs</i></b>
1.		
2.		
3.		
4.		

	<i>Abdominopelvic Region</i>	<i>Major organs</i>
5.		
6.		
7.		
8.		
9.		

8. Define *serous membrane* and state their functions.

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9. Distinguish between the *parietal layer* and *visceral layer* of serous membrane on figures and models, and state the function of each.

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10. Identify the *serous membranes* of the *ventral body cavity* on figures and models, and state the function of each.

<b>Structure</b>	<b>Part of Structure</b>	<b>Definition &amp; Function</b>
<i>Pericardium</i>	<i>parietal pericardium</i>	
	<i>visceral pericardium</i>	
<i>Pleura</i>	<i>parietal pleura</i>	
	<i>visceral pleura</i>	
<i>Peritoneum</i>	<i>parietal peritoneum</i>	
	<i>visceral peritoneum</i>	

11. Define and identify the anatomical *planes* and *sections* on models and figures.

*Longitudinal sections:* *sagittal plane* \_\_\_\_\_  
*frontal (coronal) plane* \_\_\_\_\_

*Transverse (cross) section:* *transverse (horizontal) plane* \_\_\_\_\_

*Oblique section* \_\_\_\_\_

## To be completed by the student

12. Review the *organelles* and *structures* of a eukaryotic cell on figures and models, and state the function of each.

Structure	Physical Features/Notes	Function
<i>Cell membrane</i>		
<i>Nucleus</i>		
<i>Nuclear envelope</i>		
<i>Nucleolus</i>		
<i>Ribosome</i>		
<i>Rough endoplasmic reticulum</i>		
<i>Smooth endoplasmic reticulum</i>		
<i>Mitochondria</i>		
<i>Golgi apparatus</i>		
<i>Cytosol</i>		
<i>Centriole</i>		
<i>Lysosome</i>		
<i>Desmosome</i> (cell junction)		
<i>Hemidesmosome</i> (cell junction)		

## Lab #2 Histology Integumentary System

Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.

### Materials

- Histology slides and Histology Atlas
- PhysioEx 9.0 for Human Physiology: Histology Atlas & Review Supplement, Ex. H
- Skin models

### Objectives

1. Define the terms:

*tissues* \_\_\_\_\_

*histology* \_\_\_\_\_

2. List the **four major tissue types** and give examples of functions and locations for each.

Tissue type	Physical Features	Functions	Locations
<i>Epithelial tissue</i>			
<i>Connective tissue:</i>			
Connective tissue proper			
Cartilage			
Bone			
Blood			
<i>Muscle tissue</i>			
<i>Nervous tissue</i>			

3. Identify the following ***epithelial tissues*** on micrographs and **histology slides**. Describe what you see and give examples of functions and locations in the body. (PhysioEx 9.0)

Epithelial Tissue	Physical Features	Functions	Locations
<i>Simple squamous (not teased)</i>			
<i>Simple cuboidal</i>			
<i>Simple columnar</i>			
<i>Stratified squamous</i>			
<i>Stratified squamous, keratinized</i>			
<i>Pseudostratified columnar</i>			
<i>Transitional</i>			

4. Identify the following subclasses of ***connective tissues proper*** on micrographs and **histology slides**. Describe what you see and give examples of functions and locations in the body. (PhysioEx 9.0)

CT Proper	Physical Features	Functions	Locations
<i>Areolar</i>			
<i>Adipose</i>			
<i>Reticular optional</i>			
<i>Dense regular (Fibrous)</i>			
<i>Dense irregular optional</i>			
<i>Elastic CT Optional</i>			

5. Identify the following subclasses of **cartilage tissues** on micrographs and **histology slides**. Describe what you see and give examples of functions and locations in the body. (PhysioEx 9.0)

Cartilage Tissue	Physical Features	Functions	Locations
<i>Hyaline cartilage</i>			
<i>Elastic cartilage</i>			
<i>Fibrocartilage</i>			

6. Identify the major **layers of the skin, their components and accessory structures of the skin** on models, figures, micrographs and **histology slides**, and state the function of each. (PhysioEx 9.0)

	Layer	Structure	Functions	
E P I D E R M I S	<i>Stratum corneum</i>			
	<i>Stratum lucidum</i>			
	<i>Stratum granulosum</i>			
	<i>Stratum spinosum</i>			
	<i>Stratum basale (germinativum)</i>			
D E R M I S	<i>Papillary layer</i>	Dermal papilla		
		Meissner's corpuscle		
	<i>Reticular layer</i>	Arrector pili muscle		
		Hair follicle		
		Hair	<i>shaft</i>	
			<i>root</i>	
			<i>bulb</i>	
		Pacinian corpuscle		
		Sebaceous glands		
		Sudoriferous glands	<i>eccrine</i>	
<i>apocrine</i>				
<b>Hypodermis</b> ( <i>superficial fascia</i> = subcutaneous tissue) – not considered part of the skin.				



7. Define and identify the three *degrees of burn* on figures and models.

Burn	Definition/Notes
<i>1<sup>st</sup> degree</i>	
<i>2<sup>nd</sup> degree</i>	
<i>3<sup>d</sup> degree</i>	

8. Identify the cells of *basal cell carcinoma* on a histology slide.  
*Optional (at the discretion of the instructor)*

## Lab #3 Nervous Tissue General Senses

Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.

### Materials

- Histology slides and Histology Atlas
- Skin models
- Neuron models
- PhysioEx 9.0: Histology Atlas & Review Supplement, Ex. H (Stabler)

### Objectives

1. Identify **nervous tissue** and its **components** (neurons and neuroglia) on micrographs and **histology slides**. Describe what you see and give examples of locations in the body where the tissue is found. (PhysioEx 9.0)

- **Neurons** \_\_\_\_\_
- **Neuroglia** \_\_\_\_\_

2. Identify the parts of **a neuron** on models and figures, and list the function of each.

Structure	Part of Structure	Function
<b>Perikaryon (soma, cell body)</b>	<i>Mitochondrion</i>	
	<i>Nissl bodies</i>	
	<i>Neurofibrils</i>	
<b>Dendrites</b>		
<b>Axon hillock</b>		
<b>Axon</b>	<i>neurofibrils</i>	
	<i>mitochondria</i>	
<b>Axonal terminal</b>	<i>presynaptic membrane</i>	
	<i>vesicles with neurotransmitter</i>	
	<i>endoplasmic reticulum</i>	
	<i>mitochondria</i>	
<b>Schwann cell</b>	<i>neurolemma (contains nucleus &amp; cytoplasm)</i>	
	<i>myelin sheath</i>	
<b>Nodes of Ranvier</b>		

- List the types of *neuroglial cells* and name the function of each.

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**CUTANEOUS SENSATION:** (6-2 ©2004 Carolina Biological Supply Company)

- Perform a stimulus sensitivity test. Follow **Activity A: Stimulus Sensitivity Testing** in the *Student Guide*
- Perform a two-point discrimination test. Follow **Activity B: Two-Point Discrimination** in the *Student Guide*.

*Optional (at the discretion of the instructor)*

- Perform a temperature sensation test. Follow **Activity C: Temperature Sensation** in the *Student Guide*.

### ***Student Guide***

#### ***Cutaneous Sensations*** (6-2 ©2004 Carolina Biological Supply Company)

##### **Background**

The skin is the largest sensory organ of the body. The skin has many receptor sites for cutaneous sensations (from the Latin *cutis*, meaning "skin") and is sensitive to many different kinds of stimuli, including touch, pressure, temperature, and pain. The ability to perceive these sensations is determined by specific sensory receptors and their pathways to the brain. The distribution of receptors varies at different locations on the body surface. Areas of the body such as the fingertips and the palm of the hand contain a higher receptor density and can therefore sense stimuli more accurately. In Activity A, you will test and document stimulus sensitivity using a medical monofilament, studying whether or not certain parts of the hand and arm are more sensitive to single-point pressure than others. In Activity B, you will map and measure the receptor density and receptor field size of different parts of the body using two-point discriminators to identify two-point thresholds. In Activity C, you will study cutaneous sensitivity to hot and cold stimuli.

##### **Activity A: Stimulus Sensitivity Testing**

Each team (or pair) of students should have a *Student Guide*. Each individual student should have a *Data Sheet*. Record the data provided by the test subject by coloring in the corresponding dot on the Data Sheet each time a stimulus is felt by the test subject.

- The test subject sits with eyes closed and with the stamped hand palm downward and motionless on the desk. The experimenter begins with the grid labeled "Back of Hand."

2. The experimenter begins in one quadrant of the dot grid and gently touches each dot with the **medical monofilament**. Hold the monofilament by the **paper handle** and touch it lightly to an ink dot on the test subject's skin. The test subject reports whether or not he or she feels a stimulus.
3. Repeat this activity, touching the other dots on the grid, reporting the sensation, and recording the response on the Data Sheet. Continue until all of the dots (or the required number of dots) have been tested.
4. Repeat this procedure for the palm and forearm locations and record the results. Remember that, in order to analyze and interpret data correctly, it must be organized, complete, and recorded accurately.
5. Compare the results for the different test areas. **What have you learned about the receptor densities for the regions you tested, based on the data you collected?**

### **Activity B: Two-Point Discrimination**

Each team (or pair) of students should have a *Student Guide*. Each individual student should have a *Data Sheet*. Record the data provided by the test subject by filling in the blanks in the data table on the Data Sheet. Test five different locations three times each. Gather data from the following body areas: fingertip, palm, forearm, back of the neck, and back of the lower leg (calf).

1. The test subject sits with eyes closed and one hand palm upward and motionless on the desk. The experimenter begins by testing the fingertip.
2. Start with the two points on the two-point discriminator touching each other. In increments of 1-2 mm, gradually increase the distance between the two points. Test the subject's skin after each adjustment. Each time the two points are touched to the skin, ask the test subject whether he or she feels only one point or two distinct points.
3. Repeat this procedure until the test subject reports feeling two distinct contact points. The measurement at which two distinct points are felt is called the "two-point threshold." This value is obtained by reading the number found between the two arrows in the middle of the sliding scale on the two-point discriminator. Record the test subject's two-point threshold in the "Trial 1" column of the data table.
4. Repeat steps 2 and 3, obtaining a two-point threshold measurement for the following areas of the test subject's body: the palm of the hand, the forearm, the back of the neck, and the lower leg or calf. Record each of these results in the "Trial 1" column of the data table.
5. Conduct two additional trials for each of these locations, following the procedure above. Record the results in the "Trial 2" and "Trial 3" columns of the data table.
6. Analyze the data from the three trials. **Based upon these data, what inferences can you make regarding receptor densities and receptive fields based on the two-point threshold data? Are some locations more sensitive than others are? Using data from the three trials, determine the test subject's average two-point threshold value at each location.**

### Activity C: Temperature Sensation

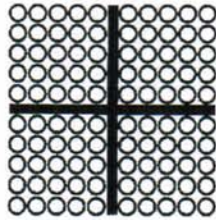
Each team (or pair) of students should have a *Student Guide*. Each individual student should have a *Data Sheet*. Record the data provided by the test subject by coloring in the corresponding dot on the Data Sheet each time a stimulus is felt by the test subject.

1. Place the aluminum **temperature probe** in cold water for a few minutes and allow it to cool. When the probe has cooled, remove it from the cold water and wipe it dry with a paper towel.
2. The test subject sits with eyes closed and with the stamped hand palm downward and motionless on the desk. The experimenter begins with the grid labeled "Back of Hand."
3. The experimenter begins in one quadrant of the dot grid and gently touches each dot with the temperature probe. The probe should remain on each dot for about two seconds. The test subject reports whether or not he or she feels a cool stimulus.
4. Repeat this activity, touching the other dots on the grid, reporting the sensation, and recording the response on the Data Sheet. Continue until all of the dots (or the required number of dots) have been tested.
5. Repeat this procedure for the palm and forearm locations and record the results. Remember that, in order to analyze and interpret data correctly, it must be organized, complete, and recorded accurately.
6. Repeat steps 1 through 5, this time using a warm temperature probe to map warmth receptors. Give the sensor time to warm up and then follow the same protocol, mapping warmth receptors for the back of the hand, the palm, and the forearm.
7. After you have performed all of the experiments, examine your data. **Did you identify more warm or cold receptor sites? Did different areas sense heat and cold differently, and if so, why do you think this occurred? Were some areas identified as both warm and cold? Why might this be so?**

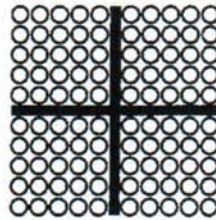
## Cutaneous Sensations Data Sheet

### Activity A: Stimulus Sensitivity Testing

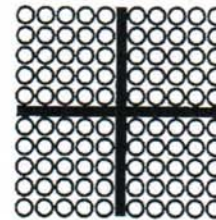
Test Subject: \_\_\_\_\_



**Back of Hand**



**Palm**



**Forearm**

### Activity B: Two-Point Discrimination Test

Test Subject: \_\_\_\_\_

Location	Trial 1	Trial 2	Trial 3
Fingertip	_____ mm	_____ mm	_____ mm
Palm	_____ mm	_____ mm	_____ mm
Forearm	_____ mm	_____ mm	_____ mm
Back of the Neck	_____ mm	_____ mm	_____ mm
Lower Leg (Calf)	_____ mm	_____ mm	_____ mm

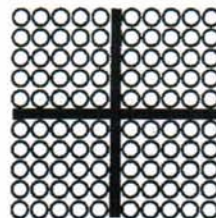
### Activity C: Temperature Sensation

#### Warm

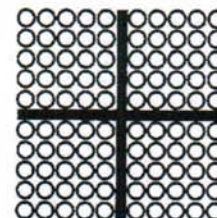
Test Subject: \_\_\_\_\_



**Back of Hand**



**Palm**



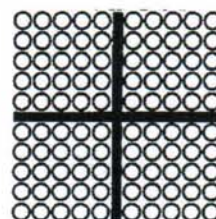
**Forearm**

#### Cool

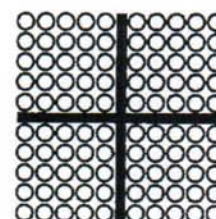
Test Subject: \_\_\_\_\_



**Back of Hand**



**Palm**



**Forearm**

## Lab #4

### Neurophysiology of Nerve Impulses

#### Central and Peripheral Nervous System

Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.

#### Materials

- Nervous system models
- Spinal cord models
- Reflex arc model
- Spinal vertebrae with spinal nerves model
- Histology slides and Histology Atlas
- PhysioEx 9.0 for Human Physiology
- Reflex hammer and Reaction time ruler

#### Objectives

#### **Neurophysiology of Nerve Impulses**

1. Perform the following activities. (PhysioEx 9.0; Ex. 3);

**\*\*\*The lecture instructor may require that students complete these exercises.**

Topic	Activity #	Conclusion/Notes
<i>Eliciting (Generating) a Nerve Impulse</i>	1. Electrical Stimulation	
	2. Mechanical Stimulation	
	3. Thermal Stimulation	
	4. Chemical Stimulation	
<i>Inhibiting a Nerve Impulse</i>	5. Testing the Effects of Ether	
	6. Testing the Effects of Curare	
	7. Testing the Effects of Lidocaine	
<i>Nerve Conduction Velocity</i>	8. Measuring Nerve Conduction Velocity	

2. Identify the indicated **sections of the spinal cord** and **the spinal nerves of each** section on models and figures. Indicate the number of spinal nerves in each section.

Spinal cord section /nerves	How many?	Notes
<i>Cervical</i>		
<i>Thoracic</i>		
<i>Lumbar</i>		
<i>Sacral</i>		

3. Locate **nerve plexuses** and **their major branches (nerves)** on models and figures.

Nerve Plexus	Spinal Nerve	Notes
<i>Cervical plexus:</i>	<i>Phrenic nerve</i>	
<i>Brachial plexus:</i>	<i>Axillary nerve</i>	
	<i>Musculocutaneous nerve</i>	
	<i>Radial nerve</i>	
	<i>Ulnar nerve</i>	
	<i>Median nerve</i>	
<i>Lumbar plexus:</i>	<i>Femoral nerve</i>	
<i>Sacral plexus:</i>	<i>Sciatic (ischiodic) nerve</i>	

4. Identify the structures of the **spinal cord** on models and figures, and name the function of each.

Structure	Function/Description
<i>Filum terminale</i>	
<i>Cauda equina</i>	
<i>Conus medullaris</i>	



5. Identify the structures of the **spinal cord** (transverse section) on models and figures, and name the function of each.

Structure	Description/Function
<i>Epidural space</i>	
<i>Dura mater</i>	
<i>Arachnoid mater</i>	
<i>Subarachnoid space</i>	
<i>Pia mater</i>	
<i>Spinal nerve:</i>	<i>Ventral (anterior) ramus</i>
	<i>Dorsal (posterior) ramus</i>
	<i>Ramus communicans (sympathetic chain)</i>
<i>Dorsal root ganglion (DRG)</i>	

6. Identify the indicated structures of the **spinal cord** on models, figures and **histology slides**, and list the function of each.

Structure	Part of Structure	Physical Characteristics
<i>Anterior (Ventral) root</i>		
<i>Posterior (Dorsal) root</i>		
<i>White matter:</i>	<i>Anterior column (funiculus)</i>	
	<i>Lateral column (funiculus)</i>	
	<i>Posterior column (funiculus)</i>	
<i>Gray matter:</i>	<i>Anterior (ventral) gray horn</i>	
	<i>Posterior (dorsal) gray horn</i>	
	<i>Lateral gray horn</i>	
	<i>Gray commissure</i>	
	<i>Central canal</i>	
<i>Anterior median fissure</i>		
<i>Posterior median sulcus</i>		

7. Name and identify the five components of a *somatic reflex arc* on figures and models. Describe the function of each component and trace the flow of information along a *somatic reflex arc*.

(1) RECEPTOR →

(2) \_\_\_\_\_ →

(3) \_\_\_\_\_ →

(4) \_\_\_\_\_ →

(5) \_\_\_\_\_

8. Perform, describe and state the results of a *stretch reflex*. Name the nerves and muscles involved in this reflex.

9. Perform the reaction time activities of *Basic and Learned or Acquired Reflexes*.

Activity	Trial	Reaction time		Conclusions
		1	2	
<p><b>Catching the ruler</b> Hold the ruler at the top. Place the other end between your partner's thumb and index finger (they should not be touching the ruler) at the "Thumb level". Drop the ruler and record the reaction time for three successful trials.</p>	1			
	2			
	3			
<p><b>Key word + catching the ruler</b> Choose a simple key word to be used as a signal for your partner to catch the ruler. Record the reaction time for three successful trials.</p>	1			
	2			
	3			
<p><b>Key word association + catching the ruler</b> As you drop the ruler say a simple word (e.g., red). Your partner should respond with a word she/he associates with the key word (e.g., fire), catching the ruler while responding. Record the reaction time for three successful trials.</p>	1			
	2			
	3			

10. Perform, describe and state the results of the **coordinated movement and balance** activities based on *Laboratory Investigations in Anatomy & Physiology* by Stephen N, Sarikas.<sup>1</sup> Your lab partner will make observations of your movements during these activities.

Activity	Observed Results	Conclusion
<p><b>Assessing Coordination</b></p> <ol style="list-style-type: none"> <li>1. While standing in anatomical position with your eyes open, touch your nose first with the right hand then with the left. Repeat with your eyes closed.</li> <li>2. While standing in anatomical position with your eyes open, abduct your arms to shoulder level then bring them together so that the index fingers touch. Repeat with your eyes closed.</li> </ol>		
<p><b>Assessing Balance</b></p> <ol style="list-style-type: none"> <li>1. Walk along a line your instructor has marked with tape on the floor. Repeat with your eyes closed.</li> <li>2. Stand as still as you can next to a vertical line. Your partner will observe movements such as swaying. Repeat with your eyes closed.</li> </ol>		
<p><b>Assessing Coordinated Movement &amp; Balance</b></p> <p>While standing in anatomical position, raise one leg off the ground and touch your heel to the shin of the other leg. Slowly move the heel downward toward the foot. Repeat with the other leg.</p>		

<sup>1</sup> Sarikas, Stephen. *Laboratory Investigations in Anatomy & Physiology*. 1st, Cat verstion. San Francisco: Pearson-Benjamin Cummings, 2007. 288-289. Print.

11. Perform, describe and state the results of **human reflexes**. Name the nerves and muscles involved in each reflex.

Reflex	Observed Results/ Conclusion	Muscle activated	Nerve supply
<i>Reflex Tests for the Upper Extremity</i>			
<p><b>Biceps Reflex</b> is tested by slightly flexing the arm at the elbow and supporting the forearm while placing the thumb on the tendon of the biceps brachii. Gently strike the thumb with a reflex hammer.</p> <p><a href="http://healthcaresciencesocw.wa.yne.edu/reflex/3_1.htm">http://healthcaresciencesocw.wa.yne.edu/reflex/3_1.htm</a></p>			
<p><b>Triceps Reflex</b> is tested by gently pulling the arm slightly backwards and allowing the forearm to dangle at the elbow. Strike the outside of the arm just above the elbow with a reflex hammer.</p> <p><a href="http://healthcaresciencesocw.wa.yne.edu/reflex/5_4.htm">http://healthcaresciencesocw.wa.yne.edu/reflex/5_4.htm</a></p>			
<i>Reflex Tests for the Lower Extremity</i>			
<p><b>Patellar (knee jerk) reflex</b> is tested when the subject is seated with the legs dangling. Strike the patellar ligament gently with a reflex hammer.</p> <p><a href="http://healthcaresciencesocw.wa.yne.edu/reflex/7_1.htm">http://healthcaresciencesocw.wa.yne.edu/reflex/7_1.htm</a></p>			
<p><b>Achilles (ankle jerk) reflex</b> is tested by slightly dorsiflexing the foot then gently striking the Achilles tendon.</p> <p><a href="http://healthcaresciencesocw.wa.yne.edu/reflex/9_1.htm">http://healthcaresciencesocw.wa.yne.edu/reflex/9_1.htm</a></p>			
<p><b>Babinski reflex</b> is tested by gently running the pointy end of the reflex hammer along the lateral surface of the sole then medially along the ball of the foot.</p> <p><a href="http://www.youtube.com/watch?v=kOq5Np0eZ6A">http://www.youtube.com/watch?v=kOq5Np0eZ6A</a>  <a href="http://www.youtube.com/watch?v=JrTBKItaUFc&amp;feature=related">http://www.youtube.com/watch?v=JrTBKItaUFc&amp;feature=related</a></p>			

## Lab #5 Central Nervous System

Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.

### Materials

- Histology slides and Histology Atlas
- Brain and brain ventricles models
- Videotape "The Human Nervous System: The Brain & Cranial Nerves" by R. L. Vines & R. Carter

### Objectives

#### **Anatomy of the Brain**

1. Identify the indicated structures of the **brain** on models and figures, and list the function of each.

Structure	Function
<i>Cerebrum</i>	
<i>Cerebellum</i>	
<i>Diencephalon</i>	
<i>Brainstem</i>	

2. Identify the indicated structures of the **cerebral hemispheres** on models and figures, and list the function of each.

Structure	Function
<i>Longitudinal fissure</i>	
<i>Lobes:</i>	
<i>Frontal</i>	
<i>Parietal</i>	
<i>Temporal</i>	
<i>Occipital</i>	
<i>Gyri (gyrus):</i>	
<i>Precentral gyrus</i>	
<i>Postcentral gyrus</i>	

<b><i>Sulci (sulcus)</i></b>	
<i>Central sulcus</i>	
<i>Lateral sulcus</i>	

3. Identify the listed ***meninges*** and *associated structures* of the brain on models and figures, and list the function of each.

<b>Structure</b>	<b>Function</b>
<b><i>Dura mater</i></b>	
<b><i>Superior sagittal sinus</i></b>	
<b><i>Falx cerebri</i></b>	
<b><i>Arachnoid mater</i></b> <i>(figures)</i>	
<b><i>Arachnoid villi</i></b> <i>(granulations)</i>	
<b><i>Subarachnoid space</i></b> <i>(figures only)</i>	
<b><i>Pia mater</i></b>	

4. Identify the indicated ***cerebral functional areas*** of the brain on models and figures, and state the function of each.

<b>Functional Area/Cortex</b>	<b>Function</b>
<b><i>Primary Somatosensory</i></b>	
<b><i>Somatosensory Association</i></b>	
<b><i>Primary Motor</i></b>	
<b><i>Prefrontal</i></b>	
<b><i>Broca's (Motor speech)</i></b>	
<b><i>Primary Auditory</i></b>	
<b><i>Auditory Association</i></b>	
<b><i>Primary Visual</i></b>	
<b><i>Visual Association</i></b>	

5. Identify the indicated *external structures* of the brain on models and figures, and state the function of each.

Region	Structure	Function
D I E N C E P H A L O N	<i>Olfactory bulbs</i>	
	<i>Olfactory tracts</i>	
	<i>Optic nerve</i>	
	<i>Optic chiasm</i>	
	<i>Optic tracts</i>	
	<i>Pituitary gland</i>	
	<i>Mammillary bodies</i>	
B R A I N S T E M	<i>Midbrain</i>	
	<i>Pons</i>	
	<i>Medulla oblongata</i>	
CEREBELLUM		

6. Identify the following *internal structures* of the *cerebral hemispheres* of the brain on models and figures, and list the function of each.

Structure	Function
<i>Corpus callosum</i>	
<i>Fornix</i>	
<i>Basal (lentiform &amp; caudate) nuclei</i>	
<i>Lateral ventricles</i>	
<i>Choroid plexus of the lateral ventricle</i>	

7. Identify the following *internal structures* of the brain on models and figures, and list the function of each.

Region	Structure	Part of Structure	Function	
D I E N C E P H A L O N	<i>Thalamus</i>			
		<i>Intermediate mass</i>		
		<i>Third ventricle</i>		
	<i>Hypothalamus</i>		<i>Infundibulum</i>	
			<i>Pituitary gland</i>	
			<i>Mammillary bodies</i>	
	<i>Epithalamus</i>		<i>Pineal body</i>	
			<i>Choroid plexus of 3<sup>rd</sup> ventricle</i>	
	B R A I N S T E M	<i>Midbrain</i>		<i>Cerebral peduncle</i>
			<i>Corpora quadrigemina: superior colliculi inferior colliculi</i>	
			<i>Aqueduct of Sylvius (mesencephalic = cerebral aqueduct)</i>	
<i>Pons</i>			<i>4<sup>th</sup> ventricle</i>	
			<i>Choroid plexus of the 4<sup>th</sup> ventricle</i>	
<i>Medulla oblongata</i>				
CEREBELLUM		<i>Arbor vitae</i>		

*Optional (at the discretion of the instructor; refer to the Histology Atlas)*

8. Identify the cerebral cortex (gray matter) and cerebral medulla (white matter) of the cerebrum on a histology slide.

9. Identify the pyramidal cells (multipolar neurons) of the cerebral cortex on a histology slide.

10. Identify the gray matter and white matter of the cerebellum on a histology slide.



## Lab #6 Central and Peripheral Nervous System

Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.

### Materials

- Brain and brain ventricles models
- Preserved sheep brain
- Videotape "The Human Nervous System: The Spinal Cord & Spinal Nerves" by R. L. Vines & R. Carter.

### Objectives

1. Identify the **twelve (12) cranial nerves** on models and figures. State the general function (mixed [sensory and motor], primarily sensory, or primarily motor), and give an example of a specific function for each *cranial nerve*.

#	Name	General Function	Specific Functions	Origin / Destination
<i>I</i>	<i>Olfactory</i>	<b>Sensory</b>	Smell	
<i>II</i>	<i>Optic</i>	<b>Sensory</b>	Vision	
<i>III</i>	<i>Oculomotor</i>	<b>Motor</b>	Eye movements, change lens shape to focus objects, pupil size	
<i>IV</i>	<i>Trochlear</i>	<b>Motor</b>	Eye movements	
<i>V</i>	<i>Trigeminal</i>	<b>Mixed</b>	Sensation from face, nose, mouth Motor to chewing muscles	
<i>VI</i>	<i>Abducens</i>	<b>Motor</b>	Eye movements	
<i>VII</i>	<i>Facial</i>	<b>Mixed</b>	Sensory from anterior taste buds Motor to muscles of facial expression	
<i>VIII</i>	<i>Vestibulocochlear</i>	<b>Sensory</b>	Balance and hearing	
<i>IX</i>	<i>Glossopharyngeal</i>	<b>Mixed</b>	Sensory from posterior taste buds, and blood pressure receptors in carotid arteries Motor for swallowing & salivation	
<i>X</i>	<i>Vagus</i>	<b>Mixed</b>	Sensory & motor, from & to thoracic & abdominal viscera; (motor- autonomic parasympathetic fibers regulate digestion & heart rate)	
<i>XI</i>	<i>Accessory</i>	<b>Motor</b>	Muscles of neck & upper back (trapezius & sternocleidomastoid)	
<i>XII</i>	<i>Hypoglossal</i>	<b>Motor</b>	Tongue movements	

## WHAT NERVES

This number drawing should help you remember the twelve cranial nerves. Beneath the drawing are listed the nerves that correspond with the numbers in the picture and some of the actions or sensations controlled by those nerves.



- I. Olfactory (1) -- smell
- II. Optic (2) -- vision
- III. Oculomotor (3) -- iris (pupil size) and eye movements
- IV. Trochlear (4) -- eye movements
- V. Trigeminal (5) -- upper and lower mouth and teeth, forehead, anterior half of scalp
- VI. Abducens (6) -- eye movement (lateral)
- VII. Facial (7) -- facial expression, anterior tongue taste buds, parotid salivary glands
- VIII. Vestibulocochlear (8) -- hearing, balance
- IX. Glossopharyngeal (9) -- taste buds on posterior part of tongue, throat sensations, salivary glands (submandibular and sublingual), tongue movements
- X. Vagus (10) -- swallowing, vocal cords, goes to abdominal organs
- XI. Accessory (11) -- head and shoulder movements
- XII. Hypoglossal (12) -- chewing, speaking, swallowing (intrinsic tongue muscles)

*Adapted from Beatrice Humphries, RN*

## THE SHEEP BRAIN

2. Identify the indicated *meninges* on the sheep brain.

Meninges	Description/Notes
<i>Dura mater</i>	
<i>Arachnoid mater</i>	
<i>Pia mater</i>	

3. Identify the listed *external* and *internal* structures on the sheep brain.

View	Structure	Part of Structure	Notes
<b>EXTERNAL STRUCTURES</b>			
<b>V E N T R A L</b>	<i>Olfactory bulbs</i>		
	<i>Olfactory tract</i>		
	<i>Pituitary gland</i>		
	<i>Optic nerves</i>		
	<i>Optic chiasm</i>		
	<i>Optic tracts</i>		
	<i>Hypothalamus:</i>	<i>Mammillary body</i>	
	<i>Midbrain:</i>	<i>Cerebral peduncles</i>	
		<i>Oculomotor (optional)</i>	
	<i>Pons:</i>	<i>Trigeminal nerve (optional)</i>	
<i>Medulla oblongata</i>			

<b>D O R S A L</b>	<i>Cerebral hemispheres</i>			
	<i>Longitudinal fissure</i>			
	<i>Cerebellum</i>			
	<i>Corpora quadrigemina:</i>	<i>Superior colliculi</i>		
		<i>Inferior colliculi</i>		
<i>Pineal body</i>				
<b>INTERNAL STRUCTURES</b>				
<b>S A G I T T A L</b>	<i>Cerebrum</i>			
	<i>Corpus callosum</i>			
	<i>Fornix</i>			
	<i>Thalamus:</i>	<i>Intermediate mass</i>		
		<i>Third ventricle</i>		
	<i>Lateral ventricles:</i>	<i>Choroid plexus</i>		
	<i>Hypothalamus:</i>	<i>Infundibulum</i>		
	<i>Pineal body</i>			
<i>Optic chiasm</i>				

		<i>Corpora quadrigemina</i>	
	<b>Midbrain:</b>	<i>Cerebral aqueduct</i>	
		<i>Cerebral peduncles</i>	
	<b>Pons</b>		
	<b>Medulla oblongata</b>		
	<b>Fourth ventricle:</b>	<i>Choroid plexus</i>	
	<b>Cerebellum:</b>	<i>Arbor vitae</i>	

## SPINAL NERVE

4. Identify the structures of *a human spinal nerve* on figures, micrographs and a **histology slide**, and list the function of each. (PhysioEx 9.0)

Structure	Physical Features/Notes	Function
<i>Nerve fiber (axon)</i>		
<i>Myelin sheath</i>		
<i>Endoneurium</i>		
<i>Fascicle</i>		
<i>Perineurium</i>		
<i>Epineurium</i>		

## Lab #7 Special Senses

*Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.*

### Materials

- Eye and ear models
- Histology slides and Histology Atlas
- Cochlea model
- Labyrinth model
- Model of the nose with nasal sinuses
- PhysioEx 9.0 for Human Physiology: Histology Atlas & Review Supplement, Ex. H (Stabler)

### Objectives

1. Identify **accessory structures of the eye** on figures and models, and state the function of each.

Structure	Description/Function
<i>Conjunctiva</i>	
<i>Lacrimal apparatus:</i> Lacrimal gland	
Lacrimal gland ducts	
Lacrimal canaliculi	
Lacrimal sac	
Nasolacrimal duct	
<i>Lacrimal Caruncle</i> (at medial canthus)	
<i>Optic nerve</i>	

2. Identify the indicated **extraocular muscles of the eye** on figures and models, and state the function and nerve supply of each.

Eye Muscle	Function	Nerve supply
<i>Superior oblique</i>	Depresses eye & turns it laterally	
<i>Inferior oblique</i>	Elevates eye & turns it laterally	
<i>Superior rectus</i>	Elevates eye	
<i>Inferior rectus</i>	Depresses eye	

<b><i>Medial rectus</i></b>	Moves eye medially	
<b><i>Lateral rectus</i></b>	Moves eye laterally	

3. Identify the ***internal structures of the eye*** on figures and models, and state the function of each.

<b>Structure</b>	<b>Part of Structure</b>	<b>Description/Function</b>
<b><i>Fibrous tunic</i></b>	<i>Sclera</i>	
	<i>Cornea</i>	
<b><i>Vascular tunic (uvea)</i></b>	<i>Choroid</i>	
	<i>Iris</i>	
	<i>Ciliary body</i>	
	<i>Suspensory ligaments</i>	
	<i>Lens</i>	
	<i>Pupil</i>	
<b><i>Sensory (neural) tunic</i></b>	<i>Retina</i>	
	<i>Macula lutea with Fovea centralis</i>	
	<i>Optic disk (Blind spot)</i>	
<b><i>Anterior chamber</i></b>	<i>Aqueous humor</i>	
<b><i>Posterior chamber</i></b>	<i>Vitreous humor</i>	

4. Define and indicate the location and function of the photoreceptors of the retina.

- ***Rods*** \_\_\_\_\_
  
- ***Cones*** \_\_\_\_\_

## Cow or sheep eye

5. Examine and identify the structures of the eyeball on *a fresh or preserved eyeball*.

Structure	Physical Features
<i>Conjunctiva (palpebrae)</i>	
<i>Sclera</i>	
<i>Choroid</i>	
<i>Cornea</i>	
<i>Iris</i>	
<i>Pupil</i>	
<i>Lens</i>	
<i>Suspensory ligaments</i>	
<i>Ciliary body</i>	
<i>Posterior cavity/Vitreous humor</i>	
<i>Retina</i>	
<i>Optic nerve/Optic disc</i>	



6. Perform the listed *visual tests*.

Visual Test	Observed Results	Conclusion
<p><b>Blind Spot</b></p> <ul style="list-style-type: none"> <li>on an index card draw a plus sign (+) and a dot at the opposite ends about half an inch from each edge,</li> <li>hold the card about 18 in (46 cm) from your eyes;</li> <li>cover one eye with the palm of your hand &amp; focus the other eye on the plus sign</li> <li>move the card slowly toward your face until the dot disappears</li> </ul>		<p>Explain why the dot disappears.</p>
<p><b>Near-Point Accommodation (optional)</b></p> <ul style="list-style-type: none"> <li>cover one eye with a card or the palm of your hand</li> <li>Hold a dissecting pin at arm's length in front of the open eye</li> <li>Slowly move the pin toward that eye until the image becomes distorted</li> <li>Have your lab partner measure the distance (in cm) between the pin and your eye</li> <li>Repeat this test for the other eye</li> </ul>		<p>Explain the mechanism of near-point accommodation.</p>
<p><b>Visual Acuity (Snellen chart)</b></p> <ul style="list-style-type: none"> <li>stand 20 ft (6 m) from the posted Snellen chart</li> <li>cover one eye with a card or the palm of your hand</li> <li>read each row of letters from top to the bottom</li> <li>record the number of the line with the smallest-sized letters read.</li> </ul> <p>*If you wear glasses, take the test twice-with and without glasses</p>		<p>Explain the ratios of: 20/20; 20/40; and 20/15</p>
<p><b>Astigmatism (astigmatism chart)</b></p> <ul style="list-style-type: none"> <li>view the chart with one eye covered focusing on the center of the chart</li> <li>repeat the test with the other eye</li> </ul> <p>*If you wear glasses, take the test twice-with and without glasses</p>		<p>Explain what defects may result in astigmatism.</p>
<p><b>Pupillary Reflexes (optional)</b></p> <ul style="list-style-type: none"> <li>cover one eye with a card or the palm of your hand</li> <li>have your lab partner shine a flashlight, at an angle(not directly), into the open eye for ~5-10 sec. at a distance of 8 in (20 cm)</li> <li>after ~3-5 min repeat the test with the other eye</li> </ul>		<p>Explain the change that occurred in each eye.</p>
<p><b>Color Blindness (Ishihara color plates)</b></p> <ul style="list-style-type: none"> <li>hold the color plates in bright light ~30 in (0.8 m) away from your eyes</li> <li>within 2-3 sec. report to your lab partner what you see in each plate</li> </ul>		<p>Explain the purpose of this test.</p>

7. Define each of the listed *visual terms* and *disorders*.

Term	Definition
<i>Emmetropia</i>	
<i>Myopia</i>	
<i>Hyperopia</i>	
<i>Presbyopia</i>	
<i>Astigmatism</i>	
<i>Detached retina</i>	
<i>Cataract</i>	
<i>Glaucoma</i>	

8. Identify the indicated *layers of the retina of the eye* on figures and a **histology slide**. *Optional (at the discretion of the instructor)*

- *Choroid*
- *Pigmented layer of retina*
- *Outer segments of rods and cones*
- *Axons of ganglion cells*

9. Identify the three *major areas of the ear* on figures and models, and state the function of each.

- *External (outer) ear*
- *Middle ear*
- *Inner ear*

10. Identify the indicated structures of the *external, middle and inner ear* on figures and models, and state the function of each.

Structure	Description/Function	Notes
<b>EXTERNAL EAR</b>		
<i>Auricle</i>		
<i>External acoustic canal</i>		
<i>Tympanic membrane</i>		
<b>MIDDLE EAR</b>		
<i>Malleus</i>		
<i>Incus</i>		
<i>Stapes</i>		
<i>Oval window</i>		
<i>Auditory tube (Eustachian or Pharyngotympanic tube)</i>		
<b>INNER EAR</b>		
<i>Bony labyrinth</i>		
<i>Perilymph</i>		
<i>Membranous labyrinth</i>		
<i>Endolymph</i>		
<i>Semicircular canals (anterior, posterior, lateral)</i>		
<i>Vestibule</i>		
<i>Utricle</i>		
<i>Sacculle</i>		
<i>Cochlea</i>		
<i>Round window</i>		
<i>Scala vestibuli (Vestibular duct)</i>		
<i>Vestibular membrane</i>		

<i>Cochlear duct (Scala media)</i>		
<i>Basilar membrane</i>		
<i>Scala tympani (Tympanic duct)</i>		
<i>Organ of Corti</i>		
<i>Tectorial membrane</i>		
<i>Vestibulocochlear nerve (VIII)</i>		
<i>Vestibular branch</i>		
<i>Cochlear branch</i>		

11. Define the term **OTITIS MEDIA** and indicate the ear structures associated with this condition.

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12. Name and identify the cranial nerve serving the ear.

13. Differentiate between conductive and sensorineural hearing loss.

14. Perform the listed *hearing tests*. **Optional** (at the discretion of the instructor)

<i>Test</i>	<i>Results/Conclusions</i>
<i>Hearing Acuity</i>	
<i>Localizing Sound</i>	
<i>Weber Test</i>	
<i>Rinne Test</i>	

15. Identify the indicated structures of the *Organ of Corti* on figures and a **histology slide**. (PhysioEx 9.0; Histology Atlas) **Optional** (*at the discretion of the instructor*)

- *Scala vestibuli*
- Vestibular **membrane**
- **Tectoral** membrane
- Hair (receptor) cells
- **Fibers of the cochlear nerve**
- *Basilar membrane*
- *Scala tympani*

16. Perform the listed exercises to examine the function of the ear in equilibrium and hearing. **Optional** (*at the discretion of the instructor*)

**a) Equilibrium:**

- Stand erect with your feet close together and eyes closed. Observe for swaying and loss of balance, characteristic in disease of posterior white columns. This is the Romberg test used in neurological examinations. **Results?**
  
- Standing on one foot, hold your other foot and leg well off the floor. Rotate your body several times on one heel with eyes closed. Observe movement of eyes. Normally the eyes respond to stimulation of the semicircular canals with a rhythmic jerking movement called nystagmus. **Results?**
  
- Define **nystagmus**

**b)Hearing:**

- Rest the handle of a vibrating tuning fork upon the top of your head; when the sound is no longer audible, remove it. After an interval of 5 seconds, return the vibrating fork to the original position on the head. **Is the sound heard again after the period of rest?**
  
- Repeat the test above with the tuning fork held at the side of the ear at a uniform distance from the head. **Explain your observations:**
  
- Test the ability of a blindfolded subject to locate a sound source (loud ticking watch, etc.) behind, above, in front of, and on both sides of him. **Results?**

**Sense of Smell**

17. Identify the **olfactory bulb** and **olfactory nerves** on diagrams and a model (*nose with nasal sinuses*)
18. Perform a stimulus intensity test. Follow the instructions under *Stimulus Intensity* in the *Student Guide*. **Optional** at the discretion of the instructor
19. Perform an adaptation test. Follow the instructions under *Adaptation* in the *Student Guide*. **Optional** at the discretion of the instructor
20. Perform an identification of odors test. Follow the instructions under *Detection, Recognition, and Identification of Odors* in the *Student Guide*. **Optional** at the discretion of the instructor)

21. Perform an identification of sensations that are detected by the trigeminal nerve. Follow the instructions under *Trigeminal Sensations* in the *Student Guide*. **Optional at the discretion of the instructor**

### **Student Guide Sense of Smell Kit**

(6-2 ©2004 Carolina Biological Supply Company)

#### **Stimulus Intensity**

The **intensity** of odor sensations depends upon the concentration of odor molecules present in the stimulus. Open the two odor vials labeled with the blue dots and take a small sniff of each one. These vials contain the same chemical but at two different concentrations. Can you tell which one has the stronger odor? Check your response by locating the star (\*) on the bottom of the vial containing the higher concentration.

#### **Adaptation**

Repetitive exposure to an odor stimulus leads to a decrease in the perceived intensity of odor sensation. This phenomenon is known as adaptation. To demonstrate adaptation, the vial of higher concentration (labeled with the\*) from the stimulus intensity demonstration will be used. Sniff the contents of the vial repeatedly (approximately one sniff every second) and count the number of sniffs required for the intensity of this odor sensation to decrease to the level of intensity in the vial containing the lower concentration.

#### **Detection, Recognition, and Identification of Odors**

Sniff the contents of each of the 10 vials. After sampling each vial, fill in Columns 1 to 3 on the Data Sheet. If an odor is detected in the vial, place a check in **Column 1**. If the odor is recognized as familiar or as one that has been smelled in the past, place a check in **Column 2**. In **Column 3**, attempt to name each odor. If you are unable to identify the odor, leave this column blank. After all 10 vials have been sampled, the identification task is repeated for each vial. This time, however, use the odor selection list provided by your instructor to assist in identifying the correct name for each odor. Enter the selected names in **Column 4**.

Total the number of check marks or correct identifications in each column. Use the answer key provided by your instructor to score the number of correct identifications for Columns 3 and 4. **How many odors were familiar but difficult to label? Did the use of the odor selection list help increase the number of correctly identified odors?**

#### **Trigeminal Sensations**

Select vials 1 and 8 and take three strong sniffs from each. Describe the difference in sensations. Did one produce a cooling or tingling sensation in the nasal cavity? Some chemicals stimulate the nerve endings of the trigeminal (fifth cranial) nerve complex in addition to stimulating the smell receptor cells. These trigeminal nerve endings are located throughout the nasal cavity and are very sensitive to strong chemicals that can be irritating and sometimes painful. **Can you think of a reason why trigeminal nasal sensations may be useful for detecting some types of chemicals?**

### Data Sheet: Perception of Odors

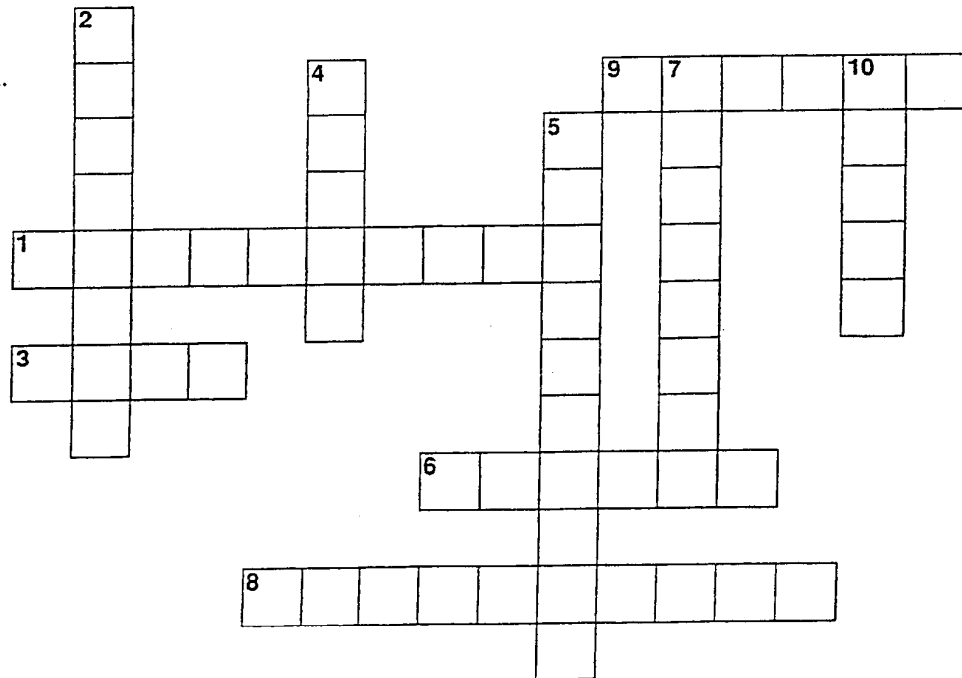
Place a check in Column 1 to indicate detection of an odor in each vial and in column 2 to indicate recognition of a familiar odor. In columns 3 and 4, write the name of the odor (if identifiable) for each vial. Total the number of check marks or correct identifications in each column and enter the totals at the bottom.

Vial no.	Column 1 Detection	Column 2 Recognition	Column 3 Identification	Column 4 Selection
1	_____	_____	_____	_____
2	_____	_____	_____	_____
3	_____	_____	_____	_____
4	_____	_____	_____	_____
5	_____	_____	_____	_____
6	_____	_____	_____	_____
7	_____	_____	_____	_____
8	_____	_____	_____	_____
9	_____	_____	_____	_____
10	_____	_____	_____	_____
<b>Totals</b>	_____	_____	_____	_____

### Sense of Smell Crossword Puzzle

*Instructions*

1. Each numbered bottle has a smell.
2. Guess the smell.
3. Write the name of the smell on the puzzle.



## Carolina Biological Supply Company

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# Lab #8

## Endocrine System

### Endocrine System Physiology

Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.

#### Materials

- Head plaque models
- Human torso
- Female and male pelvis
- Histology slides and Histology Atlas
- PhysioEx 9.0 for Human Physiology: Histology Atlas & Review Supplement, Ex. H
- Videotape "Selected Actions of Hormones & Other Chemical Messengers" by J. Barrena & R.L. Vines
- Videotape "Endocrine System" by D. T. Morgan & J. C. Rowley III.

#### Objectives

1. Define the **endocrine system** and an **endocrine gland/organ**, and give examples of endocrine glands/organs.

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2. Identify the indicated **endocrine glands/organs** on models and figures, and give examples of **hormones** produced and/or secreted by each.

Endocrine gland/organ	Hormones Produced/Secreted/Stored
<i>Hypothalamus</i>	
<i>Pineal body</i>	
<i>Pituitary gland</i>	

<i>Thyroid gland</i>	
<i>Parathyroid glands</i>	
<i>Adrenal glands</i>	
<i>Pancreas</i>	
<i>Ovaries</i>	
<i>Testes</i>	
<i>Thymus</i>	

3. Examine **histology** of the indicated **endocrine glands** on micrographs and **histology slides**, and give examples of **hormones** produced and/or secreted by each.  
(PhysioEx 9.0)

<b>Gland</b>	<b>Structure of Gland</b>	<b>Hormones/Functions</b>
<i>Pituitary gland</i>	<i>Anterior pituitary</i>	
	<i>Posterior pituitary</i>	
	<i>Infundibulum</i>	

<b>Thyroid</b>	<i>Follicle</i>	
	<i>Follicular cells (simple cuboidal)</i>	
	<i>Colloid</i>	
	<i>Parafollicular cells (C cells)</i>	
<b>Parathyroid</b>	<i>Chief (principal) cells</i>	
	<i>Oxyphil cells</i>	function unknown
<b>Pancreas</b>	<i>Pancreatic islets (Islets of Langerhans)</i>	
<b>Adrenal gland</b>	<i>Capsule</i>	
	<i>Cortex</i>	
	<i>Medulla</i>	
<b>Ovaries</b>	<i>Developing follicles</i>	
<b>Testis</b>	<i>Interstitial Cells</i>	

6. Perform the following computer simulation activities (PhysioEx 9.0; Ex. 4):  
**\*\*\*The lecture instructor may require that students complete these exercises even if the lab instructor does not.**

Topic	Activity #	Conclusion
<i>Hormones and Metabolism</i>	1. Determining Baseline Metabolic Rates	
	2. Determining the Effect of Thyroxine on Metabolic Rate	
	3. Determining the Effect of TSH on Metabolic Rate	
	4. Determining the Effect of Propylthiouracil on Metabolic Rate	
<i>Hormone Replacement Therapy</i>	5. Hormone Replacement Therapy	
<i>Insulin and Diabetes</i>	6. Obtaining a Glucose Standard Curve	
	7. Measuring Fasting Plasma Glucose	
	8. Measuring Cortisol and Adrenocorticotropic Hormone	

## Experiments on Hormone Action

7. Observe the listed experiments on the videotape "*Selected Actions of Hormones and Other Chemical Messengers*" by J. Barrena and R.L. Vines and answer the questions.

Experiment	Conclusion
<i>Determining the Effect of Pituitary Hormones on the Ovary</i>	1. Which of these two anterior pituitary hormones triggered <b>ovulation</b> ?
	2. The normal function of the second hormone involved, _____ is to
	3. Why was a second frog injected with saline?
<i>Observing the Effects of Hyperinsulinism</i>	1. What was happening when the fish was immersed in the insulin solution?
	2. What is the mechanism of the recovery process observed?
	3. What would you do to help a friend who had taken an overdose of insulin?
	4. What is a glucose tolerance test?
	5. How does <b>diabetic coma</b> differ from <b>insulin shock</b> ?
<i>Testing the Effect of Epinephrine and Acetylcholine on the Heart</i>	1. What is the effect of <b>epinephrine</b> on the force and rate of the heartbeat?
	2. What is the role of this effect in the " <b>fight-or-flight</b> " response?
	3. What is the effect of <b>acetylcholine</b> on the force and rate of the heartbeat?

## Lab #9 Skeletal System

*Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.*

### Materials

- Compact bone model
- Human real and artificial bones
- Histology slides and Histology Atlas

### Objectives

1. Define anatomical **terms for bone features** and recognize examples of each.

Term	Definition	Examples
<b>Elevation and projections</b>		
<b>Process</b>	Any projection or bump	
<b>Ramus</b>	An extension of a bone marking an angle to the rest of the structure	
<b>Openings allowing BLOOD VESSELS and NERVES to pass.</b>		
<b>Meatus</b>	Canal-like passageway	
<b>Fossa</b>	Shallow, basin-like depression in a bone	
<b>Fissure</b>	Narrow, slit-like opening	
<b>Foramen</b>	Round or oval opening through a bone	
<b>Cavity</b>		
<b>Sinus</b>	A chamber within a bone, normally filled with air	
<b>Projections (processes) for MUSCLE and LIGAMENT ATTACHMENT</b>		
<b>Trochanter</b>	A large, rough projection	
<b>Tuberosity</b>	A smaller, rough projection	
<b>Tubercle</b>	A small, rounded projection	
<b>Crest</b>	A prominent ridge	
<b>Line</b>	A low ridge, less prominent than a crest	
<b>Spine</b>	Sharp, slender, often pointed projection	
<b>Projections for JOINT FORMATION</b>		
<b>Head</b>	Expanded articular end of an epiphysis, separated from the shaft by the neck	
<b>Neck</b>	A narrow connection between the epiphysis and diaphysis	
<b>Condyle</b>	A smooth, rounded articular process	
<b>Trochlea</b>	A smooth, grooved articular process shaped like a pulley	
<b>Facet</b>	A small, flat articular surface	

2. Identify two general types of osseous tissue.

3. Examine *microscopic anatomy of compact bone* on models, figures and histology slide, and indicate the function of each component.

Structure	Function	Description/Notes
<i>Osteon (Haversian system)</i>		
<i>Central (Haversian) canal</i>		
<i>Lamella (lamellae)</i>		
<i>Lacuna (lacunae)</i>		
<i>Osteocyte</i>		
<i>Canaliculi</i>		
<i>Perforating (Volkmann's) canals</i>		

4. Classify *bones according to shape*, and give an example of each.

Bone	Description	Examples
<i>Long</i>		
<i>Short</i>		
<i>Irregular</i>		
<i>Flat</i>		
<i>Sesamoid</i>		
<i>Wormian (sutural)</i>		

5. Examine the anatomy and identify the structures of **long bones** on figures, models and bones.

Name	Description/Notes
<i>Diaphysis</i>	
<i>Epiphysis</i>	
<i>Metaphysis</i>	
<i>Medullary cavity</i>	
<i>Yellow bone marrow</i>	
<i>Red bone marrow</i>	
<i>Endosteum</i>	
<i>Periosteum</i>	
<i>Spongy bone</i>	
<i>Compact bone</i>	
<i>Articular cartilage</i>	

6. Define **axial** and **appendicular** skeleton and list examples of bones for each.

Term	Define	Examples
<i>Axial skeleton</i>		
<i>Appendicular skeleton</i>		



## Skull

7. Identify the indicated *cranial* and *facial bones* and their bone markings on figures and skulls. State the function of each.

	Bone	Bone Markings	Muscle attachment/Nerves/Blood vessels/Notes	
C R A N I A L  B O N E S	<i>Frontal</i>	Coronal suture		
	<i>Parietal</i>	Sagittal suture		
	<i>Temporal</i>	Squamous suture		
		Zygomatic process		Masseter
		External acoustic meatus (canal)		
		Internal acoustic meatus (canal)		facial & vestibulocochlear
		Jugular foramen		glossopharyngeal, vagus, accessory
		Carotid canal		
		Mastoid process		
		Styloid process		
		Mandibular fossa		
	<i>Occipital</i>	Lambdoid suture		
		Foramen magnum		
		Occipital condyles		
		Hypoglossal canal		Hypoglossal

	<i>Sphenoid</i>	Sella turcica	
		Optic canal	Optic
		Superior orbital fissure	oculomotor, trochlear, trigeminal, abducens
	<i>Ethmoid</i>	Crista galli	
		Cribriform plate	
		Olfactory foramina	Olfactory
F A C I A L  B O N E S	<i>Mandible</i>	Mandibular condyle	
		Ramus	
		Coronoid process	Temporalis
	<i>Maxilla</i>	Palatine process	
	<i>Palatine</i>		
	<i>Zygomatic</i>		
	<i>Lacrimal</i>		
	<i>Nasal</i>		

8. the functions of the *paranasal sinuses* (cavities) and identify them on figures, models and skulls.

Sinus	Description/Notes
<i>Ethmoidal</i>	
<i>Frontal</i>	
<i>Maxillary</i>	
<i>Sphenoidal</i>	

NOTE: Future dentists/dental hygienists should familiarize themselves with the following additional foramina that will not be on the lab exam: foramen spinosum, incisive foramen, greater palatine foramen, mandibular foramen, and mental foramen.

### Fetal Skull

9. Identify the indicated *bones* and *fontanel*s on figures and fetal skull, and state the function of each.

	Name	Function/Description
<b>B O N E S</b>	<i>Frontal</i>	
	<i>Parietal</i>	
	<i>Temporal</i>	
	<i>Occipital</i>	
	<i>Mandible</i>	
	<i>Maxilla</i>	
	<i>Palatine</i>	
	<b>F O N T A N E L</b>	<i>Anterior (Frontal)</i>
<i>Posterior (Occipital)</i>		
<i>Mastoid</i>		
<i>Sphenoidal</i>		

## Vertebral Column and Rib Cage

10. Examine and state the function of the indicated structures of the *vertebral column*.

- *Intervertebral disk*
- *Intervertebral foramina*

11. Examine and identify general and specific properties of *all vertebrae* on models, figures and bones.

Vertebra	How many	Features/Unique*	Function/Muscle attachment/Notes
C E R V I C A L		<i>Body</i>	
		<i>Pedicle</i>	
		<i>Transverse processes</i>	
		<i>Transverse foramina*</i>	
		<i>Lamina</i>	
		<i>Vertebral (Spinal) foramen</i>	
		<i>Spinous process</i>	
	Atlas-C1	<i>No body, no spinous process</i>	
Axis-C2	<i>Dens (odontoid process)*</i>		
T		<i>Body</i>	trapezius, latissimus dorsi

		<i>Pedicle</i>	
		<i>Transverse processes</i>	
		<i>Spinous process</i>	
		<i>Lamina</i>	
		<i>Vertebral (Spinal) foramen</i>	
		<i>Costal facets*</i> (transverse, superior, inferior)	
L U M B A R		<i>Body</i>	latissimus dorsi, iliopsoas (psoas major)
		<i>Pedicle</i>	
		<i>Transverse processes</i>	
		<i>Lamina</i>	
		<i>Spinous process</i>	
		<i>Vertebral (Spinal) foramen</i>	
S A C R U M		<i>Median sacral crest*</i>	iliopsoas (iliacus), gluteus maximus
		<i>Transverse lines*</i>	
		<i>Sacral promontory*</i>	
		<i>Sacral canal*</i>	
		<i>Sacral foramina*</i>	
COCCYX			gluteus maximus

12. Define and identify the *normal* and *abnormal* curvatures of the vertebral column.

N O R M A L	Curvature		Definition/Description
	<i>Primary</i>	thoracic	
		sacral	
	<i>Secondary</i>	cervical	
		lumbar	

<b>ABNORMAL</b>	<i>Scoliosis</i>		
	<i>Kyphosis</i>		
	<i>Lordosis</i>		

13. Identify bones of the thoracic cavity and the hyoid bone on bones, models and figures.

<b>Structure</b>	<b>Part of Structure</b>		<b>Muscle attachment/ Notes</b>
Hyoid bone			
<b>Sternum</b>	<i>Manubrium</i>		Sternocleidomastoid, pectoralis major, diaphragm
	<i>Body</i>		pectoralis major
	<i>Xiphoid process</i>		rectus abdominis
<b>Ribs</b>	<i>True = vertebrosternal ribs (pairs 1-7)</i>		serratus anterior, pectoralis minor, internal & external intercostals, rectus abdominis (5-7), external oblique (5-7)
	<i>False ribs (pairs 8-12)</i>	vertebrochondral (pairs 8-10)	serratus anterior (8-9), internal & external intercostals, external oblique, internal oblique (10), transversus abdominis
		floating=vertebral (pairs 11-12)	internal & external intercostals, diaphragm (12), external & internal oblique

## Lab #10

### Skeletal System: Appendicular Skeleton Articulations and Movement

Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.

#### Materials

- Human real and artificial bones
- Knee joint models

#### Objectives

1. Describe how the **pectoral** (shoulder) **girdle** is attached to the skeleton.
2. Identify the indicated bones and associated **markings on bones**, models and figures, and state the general function of each.

		Bone	Bone Marking	Muscle attachment/Notes
<b>Pectoral Girdle</b>		<i>Clavicle</i>		sternocleidomastoid, pectoralis major, deltoid
		<i>Scapula</i>	Acromion process	deltoid, trapezius
			Coracoid process	pectoralis minor, biceps brachii
			Glenoid cavity	triceps brachii,
			Spine	deltoid, trapezius
			Supraspinous fossa	supraspinatus
			Infraspinous fossa	infraspinatus
	Subscapular fossa	subscapularis		
<b>U P P E R  A R M  A P P E N D A G E</b>	<b>A R M</b>	<i>Humerus</i>	Head	
			Anatomical neck	
			Surgical neck	
			Deltoid tuberosity	deltoid
			Intertubercular groove	pectoralis major, latissimus dorsi, teres minor, biceps brachii
			Capitulum (lateral condyle)	
			Trochlea (medial condyle)	
			Medial epicondyle	
			Lateral epicondyle	
			Olecranon fossa	
			Coronoid fossa	

<b>F O R E A R M  H A N D</b>	<b><i>Radius</i></b>	Head	
		Radial tuberosity	biceps brachii
		Styloid process	brachioradialis
	<b><i>Ulna</i></b>	Olecranon process (olecranon)	triceps brachii
		Coronoid process	brachialis, pronator teres
		Trochlear (semilunar) notch	
		Styloid process	
		Radial notch	
	<b><i>Carpals</i></b>	8 bones	
	<b><i>Metacarpals</i></b>	number these (1-5)	Flexor carpi radialis & ulnaris,
	<b><i>Phalanges (digits)</i></b>	distal,	Extensor digitorum
		middle	
		proximal	
	<b>*thumb</b>	proximal and distal phalanges	

3. Identify the indicated bones of the upper appendage as *right* or *left*:

- *Scapula*
- *Humerus*
- *Ulna*

4. Describe how the *pelvic* (hip) *girdle* is attached to the axial skeleton and identify the *sacroiliac joint*.



5. Identify the indicated bones and their associated **bone markings** on real and artificial bones, models and figures, and state the function of each.

		Bone	Bone Marking	Muscle attachment/Notes
<b>Pelvic Girdle</b> ( <i>Os Coxa = Coxal Bone</i> )	<i>Ilium</i>		Iliac crest	external oblique, internal oblique, latissimus dorsi, iliopsoas (iliacus), vastus medialis
			Iliac tuberosity	
			Greater sciatic notch	
		<i>Ischium</i>	Ischial tuberosity	adductor magnus, biceps femoris, semitendinosus, semimembranosus
	<i>Pubis (pubic bone)</i>		Symphysis pubis (pubic symphysis)	rectus abdominis, transversus abdominis, adductor longus
			Obturator foramen	
			Acetabulum	rectus femoris
<b>L O W E R  T H I G H</b>	<i>Femur</i>		Head	
			Neck	
			Greater trochanter	vastus lateralis, gluteus medius & minimus
			Lesser trochanter	Iliopsoas
			Gluteal tuberosity	gluteus maximus
			Linea aspera	adductor magnus & longus, vastus lateralis & medialis, biceps femoris
			Lateral condyle	semimembranosus, gastrocnemius
			Medial condyle	Gastrocnemius

<b>A P P E N D A G E</b>	<b>L E G</b>	<i>Patella</i>		rectus femoris, vastus lateralis, medialis, & intermedius	
		<i>Tibia</i>	Lateral condyle	biceps femoris, tibialis anterior	
			Medial condyle	Semimembranosus	
			Tibial tuberosity	rectus femoris, vastus lateralis, medialis, & intermedius	
			Medial malleolus		
		<i>Fibula</i>	Head	Soleus	
			Lateral malleolus		
		<i>Tarsals</i> (7 bones)	Calcaneus	gastrocnemius, soleus	
			Talus		
		<b>F O O T</b>	<i>Metatarsals</i>	number these (1-5)	tibialis anterior & posterior
			<i>Phalanges</i>	distal	
				middle	
				proximal	
			*great toe	proximal and distal phalanges	

6. Identify the indicated bones of the lower appendage as *right* or *left*:

- *Os coxa*
- *Femur*
- *Tibia*

7. Determine the sex of the skeleton following the features of the ox coxae and skull.

*Optional (at the discretion of the instructor)*

Feature	Male	Female
<b><i>Ox Coxae</i></b>		
General size	<i>More robust &amp; muscle-marked</i>	<i>Less robust</i>
Superior inlet	<i>Heart shape</i>	<i>Spacious, wide &amp; oval</i>
Greater sciatic notch	<i>Narrow &amp; deep</i>	<i>Wide &amp; shallow</i>
Body of pubis	<i>Short &amp; triangular</i>	<i>Longer &amp; more rectangular</i>
Subpubic angle ( <i>area underneath the two pubic bone</i> )	<i>Narrow, V-shaped</i>	<i>Broader, more convex</i>
Preauricular sulcus ( <i>depression between greater sciatic notch and sacroiliac articulation</i> )	<i>Usually absent</i>	<i>Usually present</i>
<b><i>Skull</i></b>		
General size	<i>More robust</i>	<i>More delicate</i>
Mastoid process	<i>Larger</i>	<i>Smaller</i>
Supra-orbital margin ( <i>upper orbit rim</i> )	<i>Thick, rounded, blunt border</i>	<i>Thin, sharp border</i>
Supra-orbital ridge ( <i>"brow ridges"</i> )	<i>Prominent</i>	<i>Little or no prominence</i>
Mental eminence (chin)	<i>Squarish, greater forward projection</i>	<i>More pointed, little forward projection</i>

\* adapted from Valerie O'Loughlin, May 2005

8. Define *articulation* and list their functions.

9. Define, give examples, and be able to identify the following *functional* and *structural* types of joints.

Structural Type	Functional Type – amount of movement in joint		
	<i>Synarthroses</i> immovable	<i>Amphiarthroses</i> - slightly movable	<i>Diarthroses</i> - freely movable
<b>Fibrous</b> – bones are joint by fibrous tissue	<b>Suture</b> -united by very short connective tissue fibers <i>Example:</i> frontal, sagittal	<b>Syndesmosis</b> - united by short ligaments of dense fibrous tissue <i>Example:</i> distal end of tibia and fibula	
<b>Cartilaginous</b> – bones are joint by a pad or plate of cartilage	<b>Synchondrosis</b> – bony portions united by hyaline cartilage <i>Example:</i> between ribs (1-7) and sternum	<b>Symphysis</b> – connected by fibrocartilage <i>Example:</i> pubic symphysis of pelvis	
<b>Synovial</b> – bone ends are separated by a joint cavity containing synovial fluid			<b>Freely moveable joints</b> <i>Example:</i> shoulder, hip

10. Identify the indicated structural features of the *knee joint* on figures and models.

Structure	Description/Notes
<i>Femur</i>	
<i>Tibia</i>	
<i>Fibula</i>	
<i>Quadriceps tendon</i>	
<i>Patella</i>	
<i>Patellar ligament</i>	
<i>Lateral meniscus</i>	
<i>Medial meniscus</i>	
<i>Articular cartilage</i>	
<i>Articular capsule</i> (figures)	
<i>Synovial membrane</i> (figures)	
<i>Synovial (joint) cavity</i>	
<i>Anterior cruciate ligament (ACL)</i>	
<i>Posterior cruciate ligament (PCL)</i>	

Structure	Description/Notes
<i>Fibular (lateral) collateral ligament</i>	
<i>Tibial (medial) collateral ligament</i>	

11. Define and identify motions of synovial and cartilaginous joints verbally and by demonstration.

Movement	Definition	Examples
<i>Flexion</i>		
<i>Extension</i>		
<i>Abduction</i>		
<i>Adduction</i>		
<i>Rotation</i>		
<i>Circumduction</i>		
<i>Supination</i>		
<i>Pronation</i>		

<i>Protraction</i>		
<i>Retraction</i>		
<i>Elevation</i>		
<i>Depression</i>		
<i>Dorsiflexion,</i>		
<i>Plantar flexion</i>		
<i>Inversion</i>		
<i>Eversion</i>		

12. Complete the **Skeletal System Activity - *Optional*** at the discretion of the instructor

**Axial Skeleton:** Consists of skull, vertebrae, and bony thorax.

**Skull:** consists of cranial bones and facial bones

**Cranial bones:** surround the brain = temporal, sphenoid, ethmoid, frontal, parietal, occipital

**Facial bones:** make up remainder of face = mandible, maxilla, palatine, zygomatic, lacrimal, nasal (also vomer and inferior nasal conchae)

**Vertebrae:** cervical, thoracic, lumbar, sacrum, coccyx

**Bony Thorax:** ribs, sternum

**Appendicular Skeleton:** Consists of pectoral girdle, arm, pelvic girdle, leg

**Pectoral girdle:** attaches arm to axial skeleton (scapula, clavicle)

**Arm bones:** humerus, radius, ulna, carpals, metacarpals, phalanges (distal, middle, proximal)

**Pelvic girdle:** attaches leg to skeleton (ilium, ischium, pubis)

**Leg bones:** femur, tibia, fibula, patella, tarsals (talus, calcaneous, others), metatarsals, phalanges (distal, middle, proximal)

**NOTE:** For features marked with \*, your lab instructor ***may*** ask you to indicate the SPECIFIC muscle(s) that insert or originate on it. You will only be responsible to know the muscles selected on the muscle activity chart.

**NOTE:** For features marked with \*\*, your lab instructor ***may*** ask you to indicate the SPECIFIC blood vessel or nerve(s) that pass through it.

### Features and Their Functions

Bone	Feature	Function or Importance of Feature
Frontal	Coronal suture	Articulation between:
	Frontal sinus	Importance:
Parietal	Sagittal suture	Articulation between:
Temporal	Squamous suture	Articulation between:
	Zygomatic process*	Attachment (origin) of:
	External acoustic (auditory) meatus	Importance:
	Internal acoustic (auditory) meatus**	Passage of:
	Mandibular fossa	Articulation with:



Bone	Feature	Function or Importance of Feature
	Jugular foramen**	Passage of:
	Carotid canal**	Passage of:
	Mastoid process*	Attachment (insertion) of:
	Styloid process	Attachment of:
Occipital	Lambdoidal suture	Articulation between:
	Foramen magnum**	Passage of:
	Occipital condyles	Articulation with:
	Hypoglossal canal**	Passage of:
Sphenoid	Sella turcica	Surrounds:
	Optic canal**	Passage of:
	Superior orbital fissure**	Passage of:
	Sphenoid sinus	Importance:
Ethmoid	Crista galli	Attachment of:
	Cribriform plate	Importance:
	Olfactory foramina**	Passage of:
	Ethmoid air cells	Importance:
Mandible	Mandibular condyle	Articulation with:
	Coronoid process*	Attachment (insertion) of:
	Ramus*	Attachment (insertion) of:
Maxilla	Palatine process	Importance:

Bone	Feature	Function or Importance of Feature
	Maxillary sinus	Importance:
Cervical vertebrae	Transverse foramina**	Passage of:
	Dens (odontoid process) (axis only)	Articulation with:
Thoracic vertebra	Costal facets	Articulation with:
All vertebrae	Body	Articulation with:
	Vertebral foramen	Passage of:
	Spinous process*	Attachment (origin) of (on thoracic and lumbar vertebrae):
	Lamina	Importance:
Sacrum	Sacral promontory	Importance:
	Sacral canal**	Passage of:
	Sacral foramina**	Passage of:
Sternum	Xiphoid process	Importance:
Scapula	Acromion process*	Attachment (origin) of: Attachment (insertion) of:
	Coracoid process*	Attachment (origin) of:
	Glenoid cavity*	Articulation with:
	Spine*	Attachment (origin) of: Attachment (insertion) of:
	Subscapular Fossa*	Attachment (origin) of:
	Supraspinous fossa*	Attachment (origin) of:

Bone	Feature	Function or Importance of Feature
	Infraspinous fossa*	Attachment (origin) of:
	Medial boarder*	Attachment of:
Humerus	Head	Articulation with:
	Surgical neck	Importance:
	Deltoid tuberosity*	Attachment (insertion) of:
	Capitulum	Articulation with:
	Greater tubercle*	Attachment (insertion) of:
	Lesser tubercle*	Attachment (insertion) of:
	Trochlea	Articulation with:
	Olecranon fossa*	Articulation with:
	Coronoid fossa	Articulation with:
	Lateral epicondyle*	Attachment (origin) of:
	Medial epicondyle*	Attachment (origin) of:
	Bicipital Groove* (Intertubercle groove)	Attachment (insertion) of:
Radius	Head	Articulation with:
	Radial tuberosity*	Attachment (insertion) of:
	Styloid process*	Attachment of:
Ulna	Coronoid process	Attachment of:

Bone	Feature	Function or Importance of Feature
	Olecranon process*	Attachment (insertion) of: Attachment (origin) of:
	Trochlear (semilunar) notch	Articulation with:
	Styloid process*	Attachment of:
	Radial notch	Articulation with:
Carpals	Just identify them generally	
Metacarpals	Identify 1-5 Attachment (insertion) of:	
Phalanges	<ul style="list-style-type: none"> <li>• Identify Proximal/Distal for 1<sup>st</sup> digit</li> <li>• Identify Proximal/Middle/Distal for digits 2-5</li> </ul>	
Ilium	Sacroiliac joint	Articulation with:
	Anterior <b>inferior</b> iliac spine*	Attachment (origin) of:
	Anterior <b>superior</b> iliac spine*	Attachment (origin) of:
	Iliac crest*	Attachment of:
Ischium	Ischial tuberosity*	Attachment (origin) of:
	Acetabulum	Articulation with:
	Obturator foramen**	Passage of:
Pubis	Symphysis pubis (pubic symphysis)	Importance: Attachment (insertion) of:
Femur	Head	Articulation with:
	Neck	Importance of:
	Linea aspera*	Attachment (origin) of: Attachment (insertion) of:
	Gluteal tuberosity*	Attachment (insertion) of:

Bone	Feature	Function or Importance of Feature
	Greater trochanter*	Attachment (origin) of:
	Lesser trochanter*	Attachment of:
	Lateral condyle*	Attachment (origin) of: Articulation with:
	Medial condyle*	Attachment (origin) of: Articulation with:
	Adductor tubercle*	Attachment (insertion) of:
Tibia	Lateral condyle*	Articulation with: Attachment (insertion) of: Attachment (origin) of:
	Medial condyle	Articulation with:
	Tibial tuberosity*	Attachment (insertion) of:
	Medial malleolus	Articulation with:
Fibula	Head	Attachment of:
	Lateral malleolus	Articulation with:
Tarsals	Calcaneus*	Attachment (insertion) of:
	Talus	Articulation with:
Metatarsals	Identify 1-5	
Phalanges	<ul style="list-style-type: none"> <li>• Identify Proximal/Distal for 1<sup>st</sup> digit</li> <li>• Identify Proximal/Middle/Distal for digits 2-5</li> </ul>	

# Lab #11

## The Muscular System and Skeletal Muscle Physiology

Students are strongly encouraged to write out definitions of terms, descriptions, locations and functions of structures to be studied before coming to lab.

### Materials

- Skeletal, cardiac and smooth muscle models
- Histology Slides and Histology Atlas
- PhysioEx 9.0 for Human Physiology: Histology Atlas & Review Supplement, Ex. H
- Videotape "Human Musculature" by R. L. Vines and A. Hinderstein

### Objectives

#### Histology of Muscle Tissue

1. Examine and identify the skeletal, cardiac and smooth muscle tissues figure, models, micrographs and **histology slides**; list their physical features, functions and locations. (PhysioEx 9.0)

Muscle tissue	Physical Features	Function	Location
<i>Skeletal</i>			
<i>Cardiac</i>			
<i>Smooth</i>			

2. Identify the structures of a **skeletal muscle cell** (fiber) on figures and models, and state the function of each.

Structures of a Muscle Fiber	Function
<i>Sarcolemma</i>	
<i>Triad:</i>	
<i>Transverse tube</i>	
<i>Sarcoplasmic reticulum (terminal cisternae)</i>	
<i>Myofibrils</i>	
<i>Sarcomere</i>	

<b>Myosin filaments</b>	
<b>Actin filaments</b>	
<i>Nuclei</i>	
<i>Mitochondria</i>	

3. Identify the connective tissue **coverings** and associated structures of a skeletal muscle on models and figures.

*Epimysium*

*Perimysium: Fascicle*

*Endomysium*

4. Define **motor unit**.

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5. Identify the components of the **neuromuscular junction** and **motor unit** on figures, models and **histology slides**, and state the function of each.

<b>Structure</b>	<b>Function/Description</b>
<i>Axonal terminal</i>	
<i>Presynaptic membrane</i>	
<i>Synaptic vesicles</i>	
<i>Synaptic cleft</i>	
<i>Muscle fiber (cell)</i>	
<i>Sarcolemma</i>	
<b>Motor end plate</b>	

6. Define the terms and give examples of each

Term	Definition	Examples
<i>Agonist (prime mover)</i>		
<i>Antagonist</i>		
<i>Synergist</i>		
<i>Fixator</i>		

7. Define these terms, state the function and give examples of each on figures and models.

Term	Function/Description
<i>Origin</i>	
<i>Insertion</i>	
<i>Tendon</i>	
<i>Aponeurosis</i>	
<i>Ligament</i>	



8. Perform the listed muscle physiology computer simulation activities. (PhysioEx 9.0; Ex. 2) **\*\*\*The lecture instructor may require that students complete these exercises even if the lab instructor doesn't.**

Topic	Activity	Conclusion
<b>Electrical Stimulation: Single Stimulus</b>	1. Practicing generating a tracing	
	2. Determining the latent period	
<b>Electrical Stimulation: The Graded Muscle Response to Increased Stimulus Intensity</b>	3. Investigating Graded Muscle Response to Increased Stimulus Intensity	
<b>Electrical Stimulation: Multiple Stimuli</b>	4. Investigating Treppe	
	5. Investigating Wave Summation	
	6. Investigating Fusion Frequency/Tetanus	
	7. Investigating Muscle Fatigue	
<b>Isometric Contraction</b>	8. Investigating Isometric Contraction	
<b>Isotonic contraction</b>	9. Investigating the Effect of Load on Skeletal Muscle	

## Lab #12

### Gross Anatomy of the Muscular System

*Students are strongly encouraged to write out definitions of terms, description, location and function of structures to be studied before coming to lab.*

#### Materials

- *Muscle man models*
- *Muscle arm and leg models*
- *Gross Anatomy of the Muscular System Tables*

See table: **GROSS ANATOMY OF THE MUSCULAR SYSTEM** to complete the following objectives.

#### Objectives

1. Identify on figures and models, and state the actions of the muscles that move the **head, neck, and face**. Identify on figures and models, and state the actions of the muscles that move the **trunk**.
2. Identify on figures and models, and state the actions of the muscles that move the **shoulder**.
3. Identify on figures and models, and state the actions of the muscles that move the **forearm, wrist** and **phalanges**.
4. Identify on figures and models, and state the actions of the muscles that move the **hip** and **knee**.
5. Identify on figures and models, and state the actions of the muscles that move the **ankle** and **foot**.
6. State the *origin, insertion, and innervation* (nerve supply) for 20-30 muscles. Your lab instructor will specify which origins, insertions and innervations you will need to know for which specific 25 to 30 muscles.





GROSS ANATOMY OF THE MUSCULAR SYSTEM

MUSCLE NAME		ORIGIN	INSERTION	ACTION	NERVE SUPPLY/ NOTES
<i>Muscles of the Head and Neck:</i>					
Occipito-frontalis	Frontalis				
	Occipitalis				
Orbicularis oculi					
Orbicularis oris					
Buccinator					
Masseter					
Temporalis					
Sternocleidomastoid					
Platysma					

MUSCLE NAME	ORIGIN	INSERTION	ACTION	NERVE SUPPLY/ NOTES
<i>Muscles of the Thorax (move the vertebral column or ribs) and Abdominal Wall:</i>				
Trapezius				
External oblique				
Internal oblique				
Transversus abdominis				
Rectus abdominis				
Diaphragm				
External intercostal muscles				
Internal intercostal muscles				

MUSCLE NAME		ORIGIN	INSERTION	ACTION	NERVE SUPPLY/ NOTES
<i>Muscles of the Thorax and Shoulder:</i>					
Rotator Cuff	Supraspinatus (rotator cuff)				
	Infraspinatus (rotator cuff)				
	Subscapularis (rotator cuff)				
	Teres minor (rotator cuff)				
Teres major					
Pectoralis major					
Pectoralis minor					
Serratus anterior					

MUSCLE NAME	ORIGIN	INSERTION	ACTION	NERVE SUPPLY/ NOTES
<i>Muscles of the Thorax, Shoulder and Abdominal Wall (continued):</i>				
Deltoid				
Coracobrachialis				
Latissimus dorsi				
Levator scapulae				
Rhomboids				
<i>Muscles of the Upper Appendage (Arm) that act on the Forearm:</i>				
Biceps brachii				
Brachialis				
Brachioradialis				



MUSCLE NAME	ORIGIN	INSERTION	ACTION	NERVE SUPPLY/ NOTES
Triceps brachii				
Supinator				
Pronator teres				
Anconeus				
<i>Muscles of the Upper Appendage (Forearm) that act on the Wrist, Hand, and Fingers:</i>				
Flexor carpi ulnaris				
Palmaris longus				
Flexor carpi radialis				
Flexor digitorum superficialis				
Extensor carpi ulnaris				

MUSCLE NAME	ORIGIN	INSERTION	ACTION	NERVE SUPPLY/ NOTES
Extensor digitorum				
Flexor pollicis longus				
Flexor digitorum profundus				
Pronator quadratus				
Extensor carpi radialis longus				
Extensor carpi radialis brevis				
<i>Muscles of the Hand That Move the Thumb</i>				
Extensor pollicis longus				
Extensor pollicis brevis				
Abductor pollicis longus				
<i>Muscles of the Pelvis and Lower Appendage That Act on the Thigh and Upper Leg</i>				
Iliopsoas	Iliacus			

MUSCLE NAME		ORIGIN	INSERTION	ACTION	NERVE SUPPLY/ NOTES
	Psoas major				
	Gluteus maximus				
	Gluteus medius				
<i>Muscles of the Lower Appendage (Thigh) that act on the Knee:</i>					
<i>Hamstrings</i>	Biceps femoris				
	Semimembranosus				
	Semitendinosus				
<i>Quadriceps femoris</i>	Rectus femoris				
	Vastus lateralis				

MUSCLE NAME		ORIGIN	INSERTION	ACTION	NERVE SUPPLY/ NOTES
	Vastus intermedius				
	Vastus medialis				
Sartorius					
<i>Adductors</i>	Adductor magnus				
	Adductor longus				
	Gracilis				
Muscles of the Lower Appendage (Leg) that act on the Knee:					
<i>Triceps surae</i>	Gastrocnemius				
	Soleus				
Tibialis anterior					

MUSCLE NAME	ORIGIN	INSERTION	ACTION	NERVE SUPPLY/ NOTES
<i>Muscles of the Lower Appendage (Leg) that act on the Foot</i>				
Tibialis posterior				
Fibularis (peroneus) longus				
Fibularis (peroneus) tertius				
Fibularis (peroneus) brevis				
Flexor digitorum longus				
Extensor digitorum longus				