

**Biology 109**  
**Laboratory Objectives**

**Disclaimer:** These objectives are designed to help you, the student, prepare for lab practicals. However, there may be occasions where some of the material below may be dropped and some material may be added as the semester progresses. If you are unsure about what will be covered on a practical, please ask.

**Lab Schedule** (updated Aug 2003)

**Lab 1**

Orientation to lab and safety procedures

Exercise 1- measurement in science (6%)

Exercise 2 (on your own time)- A&P terminology (4%)

**Lab 2**

pH and buffers (handout) (9%)

**Lab 3**

Exercise 3- microscope use (14%)

**Lab 4**

Structure of Organic Molecules (handout) (12%)

Exercise 4 (except mitosis) (5%)

**Lab 5**

Exercise 5 (molecular movements) (8%)

**Lab 6**

Lab Quiz on Tissue Characteristics

Exercise 43- action of enzymes (5%)

Exercise 4 (mitosis only)

**Lab 7**

Exercise 6- Histology (33%)

**Lab 8**

Practical Exam I (100 points) - material covers labs 1-7.

**Lab 9**

Exercises 8, 9, 10, 11- bone identification

**Lab 10**

Exercises 8, 9, 10, 11 (review)

**Lab 11**

Exercise 7- skin histology

Exercises 8 -bone anatomy and histology

Exercise 12- articulations

**Lab 12**

Physiology Experiments- see handout on EEG

**Lab 13**

Exercise 20 -nervous system histology

Exercise 21 -brain anatomy

**Lab 14**

Exercises 23, 25, 26, 27- sensory experiments

**Lab 15**

Lab Practical II (worth 100 points)- covers labs 9-14

## Biology 109--Practical I

**Lab 1.**

Exercise 1. Scientific measurement.-- Bring a calculator.

1. Be familiar with the standard metric units for measuring length, volume, mass, and time.
2. Be able to measure items in lab using these units including: base unit, kilo, centi, milli, micro, and nano.
3. Is there an association with leg length and height? Hand length vs height?
4. What are statistics? Why are they important when analyzing data? Understand the terms mean, median, and range. Be able to do simple calculations. What is a “best fit” or linear regression?
5. NEXT lab...determine if median and mean fit students. Also, determine if linear regression gives accurate predictive power when using a real student.

Exercise 2. Body Organization and Terminology

1. Identify the following cavities on a diagram or model:

cranial	spinal
thoracic- diaphragm	abdominal
pelvic	oral
nasal	orbital

2. know the following sectioning planes:

sagittal  
frontal  
transverse

3. know directional terms found on table 2.1.

**Lab 2.**

pH and buffering systems - instructions found on a handout

1. What is pH? Know how to use both the pH indicator strips. What is the approximate pH of the following solutions: saliva, blood, urine, gastric juice, sweat, water from the water fountain, distilled water, Pepsi, orange juice, detergent, antacid? What happens when gastric juice and the antacid are combined? Why?
2. Buffering systems: What is this experiment simulating in the human body? What happens to the pH when a strong acid or base is added to distilled water (initial pH=7)? What happens to the pH of a buffered solution (initial pH=7) when a strong acid or base is added? Why is there a difference between distilled water and the buffered solution? How do buffers work?
3. Complete the questions at the end of the handout. Be able to draw and interpret graphs.

### Lab 3.

#### Exercise 3. Microscopy: Care and Use of the Compound Light Microscope

1. This exercise is designed to make you comfortable using a compound light microscope. Refer to the microscope handout. Know all information on that handout. On the practical, you will be graded on your microscope technique.
2. Look at the letter “e”. What three things occur to the letter “e” when viewed through a compound light microscope?
3. What is “field of view” and how was it measured? Why is the field of view important to know for each objective lens?
4. Be able to prepare a wet mount. What is the purpose of a wet mount?
5. Draw and identify cheek cells (squamous epithelial cells). Within a single cell, find:
  - a. nucleus
  - b. cell membrane
  - c. nuclear membrane
  - d. cytoplasm

\*STUDENTS with proficiency are allowed to skip this lab with permission from the instructor. However, students are still expected to understand this information.

### Lab 4.

#### Structure of organic molecules- instructions found on a handout

1. What is dehydration synthesis? Name three examples.
2. You should be able to recognize the following organic molecular shapes including: glycerol, the three types of fatty acids, triglycerides, steroids, glucose, fructose, disaccharides (sucrose), amino acids (general structure), and proteins.

#### Exercise 4. Cellular Structure

1. Observe and draw the following cell types: Recognize cell types and cell shapes.
  - Red Blood cells and White Blood cells
  - Neuron
  - Pseudostratified columnar epithelium
  - Skeletal muscle
  - sperm- demoed up front by the instructor

How does the shape of cells coincide with their function?

2. Find the following organelles on some or all of the slides listed above:
  - cilia- found on pseudostratified columnar only
  - flagella- found on sperm only
  - nucleus- seen in all cells except RBCs
  - nuclear membrane- seen in all cells except RBC
  - nucleolus- seen in neuron (dark blue dot, nucleus surrounds it as a pale cloud)
  - cytoplasm- seen in all cells
  - cell membrane- seen in all cells

### Lab 5.

Exercise 5. Movement of molecules

1. What is Brownian movement and how was it demonstrated in lab? How would an increase in temperature affect Brownian movement?-- don't do this part of the experiment, just think about it.
2. What is diffusion? How does molecular weight affect the rate of diffusion? How was this principle demonstrated? What is the affect of temperature on diffusion?
3. What is osmosis? What does hyper-, hypo-, and isotonic mean? Be able to discuss the experiments on osmosis. Which membranes gained/lost water and why? What happens to RBCs when placed in hyper, hypo, or isotonic solutions? Why?
4. What is filtration? Be able to discuss the filtration experiment. What substances passed through the filter and why?

**Lab 6. Tissue Quiz Today**Exercise 4 (continued). Mitosis.

slides needed: whitefish blastula, demoed in the front of the classroom

The cell cycle (mitosis): What is mitosis? Use "whitefish blastula" slides to locate the following stages of mitosis (these slides are demoed for you in the front of the class).

interphase    prophase    metaphase    anaphase    telophase

Exercise 43. Action of a digestive enzyme (work in groups of three)

1. What is amylase? Where is it found naturally in the human body (2)? What substrate will it bind to? What product is formed after the chemical reaction is over? Understand all the experiments that were conducted. What is the purpose of IKI? The benedict's test? Did amylase break down cellulose? Remember that cellulose is another name for fiber.

**Lab 7. Identification of tissue types.**Exercise 6. Identification of tissue types-- refer to tissue handout.

Slides needed: see tissue handout for complete list

1. What is histology? Know the four general tissue types, be able to always identify them, and their locations in the body.
2. Know all the information on the tissue handout given to you.
3. Be able to identify all tissue types discussed and listed on the handout.
4. Know that blood and bone are living connective tissues. However, we will identify these tissues in detail later in the semester or in Biology 110...you will not need to know them now.
5. Know the locations and general functions for each of the tissues.

**Lab 8. Practical Exam I. (100 points).** Material covers labs 1-7.

**END PRACTICAL I**

**Biology 109--Practical II**

**Lab 9.**

Items needed: two articulated skeletons and two examples of most bones (disarticulated)

Exercise 9, 10, & 11. Identification of bones and processes.

1. Identify all the bones indicated on pp. 96, 127, 128, 129 of your lab manual. Also, include the talus bone, coccyx, and sacrum.
2. Refer to the bone handout.

**Lab 10.**

Exercise 9, 10, & 11 (continued). Identification of bones and processes.

1. Refer to the bone handout. Be able to identify all processes and bones in a disarticulated state. Be able to identify left and right bones.

**Lab 11.**

Exercise 7. Skin

Slides needed: human scalp with hair, negro skin slide

1. Observe a slide of the human scalp with hair. Find:
  - epidermis- stratified squamous epithelial (cells are called keratinocytes)
    - stratum basale- deepest layer of epidermis
    - stratum corneum- most superficial layer of epidermis
  - dermis- dense irregular CT
  - hypodermis- adipose tissue and areolar
  - hair shaft- composed of dead, tightly packed keratinocytes
  - hair follicle- structure that produces the hair shaft
    - region of cell division
  - sweat gland- produces sweat to cool body
  - sebaceous gland- produces sebum to keep skin, hair soft and pliable
  - epidermal ridges- in surface area between epidermis and dermis to strengthen connection
  - arrector pili muscle- will make hair shafts stand “on-end”
2. Observe the skin model and locate all the structures indicated above.
3. Observe the negro skin slide (probably demoed by the instructor)- notice the large amount of melanin

Exercise 8. Structure of Bone.

Slides needed: compact bone

1. Examine a longitudinal section of a long bone and find:
  - epiphysis- expanded ends of a long bone that will articulate with another bone
  - diaphysis- middle shaft of the bone
  - articular cartilage- provides cushion and reduces friction between adjacent bones
  - periosteum- outer CT covering that allows tendons and ligaments to attach to bones
  - medullary cavity- hollow portion of diaphysis that contains yellow marrow
  - yellow marrow- contains adipose tissue
  - processes- where tendons and ligaments will attach to the periosteum
  - epiphyseal disk- area of bone growth, composed of hyaline cartilage
  - \*where is red marrow found?                      \*where compact bone is located?
  - \*where spongy bone is located?
2. Examine a slide of a cross section of compact bone and find:
  - osteon- the series of osteocytes and lacunae around an osteonic canal
  - lacunae (osteocytes will be found in there, but cannot be seen)
  - canaliculi- within these small channels gap junctions form between nearby osteocytes
  - osteonic canal- blood vessels and nerves are found in these cavities
  - lamella- concentric rings of calcium matrix

### Exercise 12. Articulations.

Items needed:

synovial joint of an ox

1. Understand the basic synovial joint- be able to label all its parts and all of its functions.
2. Use the cow synovial joint to identify different structures including: subchondral bone, meniscus, articular cartilage, synovial membrane, ligaments, diaphysis, epiphysis, spongy bone, compact bone, epiphyseal disk.
3. Find on a human articulated skeleton two examples of the following types of joints: ball and socket, hinge, and pivot.

### **Lab 12. Measurement of an EEG-** refer to the EEG handout and answer all of those questions

1. What does EEG stand for? What does an EEG measure? What are the four different types of waves found on an EEG? What is amplitude of a wave and what unit is used to measure it? What is a wavelength? What is frequency?
2. Understand the experimental conditions for this experiment. What was the control and why was it important here?
3. What is alpha block? What is synchronization? What occurs to alpha wave amplitude when the eyes are open? What affect did hyperventilation have on alpha wave amplitude? Understand why these changes in the EEG occurred.

### **Lab 13.**

#### Exercise 20. Introduction to the nervous system.

Slides needed: multipolar neuron, cross-section & longitudinal section of a nerve fiber, astrocyte, ependymal cells.

1. Observe multipolar neurons from a spinal cord smear. Locate and know the functions of:

cell body	nucleus	nucleolus
neuroglia cells (outside neuron)	nerve filaments (either axon or dendrite)	

2. Examine a cross section of a nerve fiber: Locate:

nucleus of schwann cell	myelin sheath	axon
neurolimmal sheath		

3. Examine the slide of an astrocyte- find the astrocytes, filaments of an astrocytes, and a neuron cell body

Where is it found in the CNS (exactly) and what are their functions?

### Exercise 21. Structure and Function of the Brain

1. Be able to located and identify all the following structures on a sheep's brain:

Locate a whole sheep's brain and find:

- cerebrum and its left and right cerebral hemispheres
- pia mater (one of the meninges) (thin membrane on top of cerebrum)
- general location of frontal, temporal, parietal, and occipital lobes of cerebrum
- gyri (any)
- frontal and lateral sulcus (shallow grooves)
- identify any other sulci
- longitudinal and transverse fissures (deep grooves)
- cerebellum
- corpora quadrigemina
- brain stem (find each smaller part: midbrain, pons, medulla oblongata)
- olfactory bulb (transmits info about smell to brain)
- optic nerve, optic chiasma, optic tract (transmits info about vision to brain)
- pituitary gland
- mammillary body
- olfactory bulbs, olfactory tracts
- spinal cord (technically not part of the brain of course)

Locate a sagittal section of a sheep's brain and find:

- cerebrum and frontal, parietal, temporal, and occipital lobes, corpus callosum
- diencephalon region: finds its parts: thalamus, hypothalamus, infundibulum, and mammillary body, pineal gland, pituitary gland (if you can see it, otherwise look at the model of the brain)
- optic nerve, optic chiasma, optic tract (you can only see ½ of it)
- cerebellum including cerebellar cortex and arbor vitae
- corpora quadrigemina
- brain stem including midbrain, pons, medulla oblongata
- spinal cord
- ventricles (any hollow cavity within the brain)

(continued)

Locate a frontal (coronal) section of a sheep's brain and find:

cerebral cortex- outer rim of gray matter of cerebrum  
 white matter found underneath cerebral cortex  
 lateral ventricles (1 & 2<sup>nd</sup>), third ventricle  
 corpus callosum, longitudinal fissure

2. Look at the human brain.
  - a. Notice how large the cerebrum is compared to the sheep's brain.
  - b. The human brain's are older. Please just find and identify:
    - cerebrum and its left and right cerebral hemispheres
    - general location of frontal, temporal, parietal, and occipital lobes of cerebrum
    - pia mater and unattached dura matter of the meninges
    - cerebellum (and its two lateral hemispheres)
    - central and lateral sulcus
    - longitudinal and transverse fissures (deep grooves)
    - brain stem including midbrain, pons, medulla oblongata
    - optic nerve, optic chiasma, optic tract
  
3. Locate the brain models. Be able to locate much of the above structures.

## **Lab 14.**

### Exercise 23. Nervous System Physiology

1. What is a reflex?
2. Conduct: patellar reflex, calcaneal reflex, eye reflexes. Why do doctors conduct these tests?

### Exercise 25. Taste and Smell.

Slides needed: taste bud slide (demoed)

1. Examine a slide of taste buds. Identify: papillae, taste bud, taste cells, taste pore.
  2. Conduct: taste determination of solid materials, mapping of taste buds, visual cues, olfactory discrimination, adaptation to smell, taste and olfactory tests.
- What are the purposes of these experiments?

### Exercise 26. Eye and Vision.

1. Dissect a sheep's eye: be able to identify the following structures found on/in the cow's eye: cornea, sclera, iris, pupil, ciliary body, lens, vitreous humor, retina, choroid coat, optic nerve, optic disk, anterior and posterior cavities.
  
2. Conduct the following experiments: Snellen test, astigmatism test, pupillary reactions, color blindness.

### Exercise 27. Ear, Hearing, and Equilibrium.

1. Use a model to identify the following structures of the ear: outer ear, middle ear, inner ear, auricle, auditory canal, tympanic membrane, ossicles (malleus, incus, stapes), semicircular canals, vestibule, cochlea, cochlear nerve, oval window, auditory tube.

**Lab 15. Lab Practical Exam II.** Worth 100 points. covers labs 9-14.

**END PRACTICAL II**