BI 171
Introductory
Anatomy & Physiology I

Class & Lab Activities
updated 09/2012

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BI 171
Introductory Anatomy & Physiology I
Course Outcomes

Performance-Based Learning Outcomes

After completing this course, you will be able to:

1. Work collaboratively and independently to solve problems dealing with the human body in a health-care setting;
2. Utilize proper scientific and medical vocabulary where appropriate;
3. Perform basic laboratory skills related to the human body and life science;
4. Understand basic physiology within human cells;
5. Apply class material to new situations;
6. Understand how the body systems integrate to maintain life; and,
7. Appreciate science and the study of the human body.

Course Philosophy:

The focus of this course is to prepare you to enter the health field as well as for taking higher level biology classes. In addition, this class will prepare you to be an educated citizen about the human body.

In light of this, I teach this course as a “concept-driven” course. I consider it more important that you learn concepts that you can apply to new situations rather than memorizing facts that only apply to one situation. For example, it’s more important to your future to understand how homeostasis is essential for life than to memorize examples of every possible homeostatic mechanism. The former will apply to anything in the world; the latter only to what’s on a powerpoint somewhere.

To help you understand concepts, you will be doing case studies and class activities that will have you apply what you’re learning to something new. If you can do this, you understand. Also, class quizzes and exams will mirror these case studies allowing your understanding of concepts be a main factor in your final grade.

In addition to concepts, you also need to focus some time on how you learn. Being an effective learner and knowing study strategies that work for you will save you lots of time and result in greater success. Throughout the term, I’ll discuss learning strategies that may help you in learning an idea.
Specific Course Content:

Body Basics:
1. Place the levels of an organism into proper order.
2. Determine where a body parts falls within an organism's hierarchy.
3. Discuss why homeostasis is necessary for existence.
4. Describe homeostatic mechanisms and determine if they are negative-feedback or positive-feedback.
5. Explain how sensors, controllers, and effectors interact to perform homeostasis.
7. Use proper medical terminology to describe the human body.
8. State the major organ systems, organs within each, and a general function of each.
9. State the body’s main regions, planes & cavities, and their location. Also state organs within each.
10. Discuss how the organ systems integrate to keep you alive.

Chemistry Review.
1. State the pH scale and give examples of substances that have an acid or base pH.
2. State if a given pH is acid or basic. Also, state if a pH is normal for a human.
3. Discuss how the properties of water relate to polarity.
4. Understand the relationship between monomers and polymers and give examples.

Cells & Cellular Processes.
1. Describe the functions that cells must perform and the organelles that enable a cell to do these functions.
2. Contrast diffusion, osmosis, and active transport.
3. Use the terms “hypertonic” and “hypotonic” properly to describe osmosis.
4. State if a given solution will cause a cell to expand or shrink.
5. State how ribosomes, ER, and the golgi apparatus are involved in producing cell products.
6. Describe the reason cells divide and what would happen if this process did not occur or occurred incorrectly.
7. Describe how cell division relates to genetics and the nucleus.

Tissues.
1. State the main types of human tissue, their functions, and locations in the body.
2. Describe how a given tissue relates to its location and what would happen to its function if the tissue were to change.
3. When given a slide, identify the tissue you see.
4. Contrast how the three muscle tissues are controlled and why.
5. Describe the structure of serous membranes.
6. Contrast parietal with visceral membranes.
7. List key serous membranes of the body.
Integumentary System.
1. State the purpose of the integumentary system.
2. Contrast epidermis, dermis, and hypodermis in terms of structure, tissues found, and purpose.
3. State the role of keratin and melanin in skin and what would happen if they were not produced.
4. Relate skin structure to how skin grows, specifically the stratum basale.
5. Draw a cross-section of human skin and label significant structures.
6. Describe the function and structure of hair.
7. State the function of the various glands found in skin and why they are needed.
8. Discuss the problems associated with burns and what can be done to minimize these problems.
9. Discuss some common disorders of the integumentary system, such as burns, melanoma, freckles, warts, hirsutism (excess hair), and albinism.

Skeletal System.
1. State the functions of the skeletal system.
2. Describe a basic long bone.
3. Discuss the anatomy of an osteon and how it relates to bone's function.
4. Describe how osteoclasts and osteoblasts interact to regulate bone remodeling, the hormones that control each, and how this relates to homeostasis.
5. Contrast axial with appendicular skeleton and pectoral girdle with pelvic girdle.
6. State and identify the major bones of the body (see lab)
7. Contrast fibrous joints, cartilaginous joints, and synovial joints with regards to structure, strength, and mobility, and explain why each joint has these characteristics.
8. Identify examples of joints and classify them correctly.
9. List the different movements associated with synovial joints by using correct terminology.
10. Describe common disorders of the bones and joints, such as osteoporosis, osteoarthritis, rickets, rheumatoid arthritis, and gouty arthritis.

Muscular System.
1. State the functions of muscles.
2. Describe how the thick and thin filaments interact to produce a muscle contraction.
3. Discuss the role of ATP in muscle contraction and how muscles acquire the ATP they need.
4. Discuss adaptations that the body and/or muscles can have to better use/produce ATP.
5. Contrast fast- and slow-twitch muscle fibers.
6. Discuss how recruitment and summation are used by the muscular system.
7. Describe why muscles exist as antagonistic pairs, and give examples.
8. State the major muscles of the body. (see lab).
9. Describe some common disorders of the muscular system, such as cramps, rigor mortis, and muscle fatigue.
Nervous System.
1. State the functions of the nervous system.
2. Contrast PNS and CNS, afferent (sensory) and efferent (motor), and somatic and autonomic motor nervous systems and explain how these terms relate to each other and a response.
3. Contrast the function of dendrites and axons.
4. Explain the role of myelin in a nerve impulse.
5. Describe how a nerve impulse (action potential) is created and propagated.
6. State the role of neurotransmitters in chemical synapses.
7. List some common neurotransmitters (NTs) and how they affect the post-synaptic neurons.
8. Relate NTs with addiction and explain how addiction and homeostasis relate.
9. Draw a brain and label the major lobes and structures. (see lab)
10. List the major parts of the brain, and give their function.
11. Contrast motor areas, sensory areas, and association areas.
12. Contrast the right and left brains in terms of body control.
13. Specifically describe the brain areas responsible for speech.
14. Relate brain areas to stroke symptoms.
15. Describe the role of the meninges and cerebral spinal fluid.
16. Describe the structure of the spinal cord.
17. Discuss how reflexes and reactions occur and how they differ in their structure and function.
18. Contrast sympathetic and parasympathetic nervous systems in terms of symptoms.
19. Give examples of situations where sympathetic/parasympathetic responses might occur.
20. Describe disorders of the nervous system such as strokes, Alzheimer’s paralysis, quadriplegia, paraplegia, and neurotoxins.

Special Senses.
1. Describe how olfactory and taste sensation occurs and why they are considered similar senses.
2. Describe the pathway of light through the eye and the purpose of the eye structures the light passes through.
3. Contrast rods with cones in terms of function and location in the eye.
4. Describe the anatomy of the outer, middle, and inner ear.
5. Relate the structure of the tympanic membrane, cochlea, oval window, and hair cells to hearing.
6. Discuss how the ear assists in equilibrium and state the ear structures where balance occurs.
7. For all special senses, state the brain areas responsible for their interpretation.
8. Perform and interpret standard eye and hearing tests (see lab)
9. Describe some disorders/problems with the special senses, such as vertigo, motion sickness, blindness, color blindness, cataracts, and glaucoma.

Endocrine System.
1. State the function of the endocrine system.
2. List the major glands of the endocrine system and the hormones they produce, the general function and site of action.
3. State how hyper- or hypo-secretion of hormones would affect a person and why.
4. Describe the homeostasis of hormone levels and what happens if this should fail.
5. State major disorders associated with the endocrine system, such as hypothyroidism, hyperthyroidism, Cushing’s syndrome, Diabetes mellitus Type I and Type II, and Diabetes insipidus.
Read the following paragraph and then answer the questions.

When a person eats a meal, blood sugar increases after about an hour. When the blood sugar levels increase past the normal set point (90-110 mg/100ml blood), the pancreas produces the hormone insulin. Insulin causes the body’s cells to absorb the sugar from the blood. Thus, the blood sugar levels decline.

If a person does not eat, the blood sugar levels fall. The pancreas produces another hormone called glucagon that tells the body’s cells to release stored sugar to raise the blood sugar level.

Questions:

1. What is meant by “set point?” What body system usually determines set point?

2. What body system is producing the insulin? What about the glucagon?

3. What organ is producing the hormones?

4. What kind of homeostasis is being described here? How do you know?

5. Why are there two hormones (insulin and glucagon)? Why can’t the body regulate blood sugar with only one hormone?

6. A person with Type I diabetes cannot produce insulin. Based upon your knowledge and the paragraph above, what happens to a diabetic’s blood sugar and why?

7. Would a diabetic's blood sugar be an example of positive feedback? Why or why not?
Work as teams for the following activity:

1. Record the breathing rate (inhalation & exhalation per minute) for your partner in a manner you both feel comfortable.

2. Have your partner exercise by walking for two minutes.

3. Immediately after walking, record your partner’s breathing rate again.

4. Have your partner rest for five minutes and then record the breathing rate again.

5. Reverse your roles and go again.

<table>
<thead>
<tr>
<th>Name</th>
<th>Resting Rate</th>
<th>After Exercise</th>
<th>After Rest</th>
</tr>
</thead>
</table>

Questions:

1. Make a rough graph of the data for both individuals.

2. What kind of homeostasis is being illustrated by your graph? How do you know?

3. How would the graph be affected if both partners routinely exercised? What about if both partners were out of shape? Why?
Basic Body Terminology

Vocabulary is essential in any technical field, and the health field is no exception. Being able to accurately describe and locate anatomical structures allows precision in treating patients, as well as preventing medical errors. In this lab, you will learn and use some of the more common anatomical terms regarding the human body.

**Basic Directional Terms:**

- Superior / Inferior
- Anterior / Posterior
- Right / Left
- Lateral / Medial
- Superficial / Deep
- Proximal / Distal

**Body Regions:**

- Frontal
- Orbital
- Nasal
- Oral
- Mental
- Cervical
- Buccal
- Sternal
- Thoracic
- Deltoid
- Mammary
- Pectoral
- Umbilical
- Abdominal
- Inguinal
- Femoral
- Patellar
- Tarsal
- Pedal
- Plantar
- Brachial
- Ante-cubital
- Cubital
- Carpal
- Digital
- Occipital
- Scapular
- Lumbar
- Sacral
- Perineal
- Gluteal
- Popliteal
- Sural
- Pubic
- Axillary
- Otic
- Palmar
- Dorsal
- Ventral

**Body Cavities:**

- Cranial
- Vertebral
- Thoracic
- Abdominal
- Pelvic

**Body Planes & Sections:**

- Sagittal
- Coronal / Frontal
- Transverse / Cross
Use the appropriate terms to complete the sentences below:

1. The ears are ________________ to the eyes.

2. The lungs are ________________ to the heart.

3. The intestines are ________________ to the skin on the abdomen.

4. The shoulders are ________________ to the lungs.

5. The knee is ________________ to the foot and ________________ to the hip.

6. The kidneys are ________________ to the navel.

7. The nose is ________________ to the tongue.

8. The elbow is ________________ to the wrist.

9. The heart is ________________ to the vertebral column.

10. The breastbone is ________________ to the ribs.

11. If a doctor wants to cut the heart so that it is in two equal right and left halves, what kind of cut (section) would she use?

12. If a nurse tells you that she will give you a shot in your proximal lateral femoral region, what part of your body should you expose?

13. What cavity would have to be opened to do the following:
   a. remove a cancerous lung lobe?
   b. remove an ovary?
   c. remove an appendix?
   d. do open-heart surgery?

14. What anatomical structure forms the boundary (dividing line) between:
   a. the thoracic and abdominal cavities?
   b. the abdominal and pelvic cavities?
   c. the cranial and vertebral cavity?
15. List one body region(s) the following medical professions would be most interested in:
   b. Optometrist
   c. Gynecologist
   d. Sports Medicine
   e. Otolaryngology

16. Translate the following sentences into "conversational English"
   a. A mid-sagittal incision moving inferiorly down the thoracic region.
   b. A injection given just deep to the skin superficial to the brachial region.
   c. The infection showed signs of moving proximally from its point of entry at the plantar region.

17. Covert the underlined words into "doctor speak"
   a. The scalpel moved from the belly button sideways to the patient's sides.
   b. The car wreck caused lower-back pain and a broken bone in my forearm and ankle.
   c. The doctor looked at my fingers, in my ears, and also a skin exam over my chest.

18. How is the anatomical position different from how a person normally stands?
Label the following drawings with the appropriate terms as needed.
Cells are the basic units of life. By examining cells, biologists can understand all of life’s functions. In today’s lab, you will look at your own cells and gain experience in using a microscope.

**Procedure:**

Your instructor will lead you through some basic workings of the microscope.

Once you are familiar and comfortable with using a microscope, then proceed to the procedures below:

**Procedure:**

1. Using a clean toothpick, scrape the inside lining of your cheek a few times.
2. Place the “goo” from your cheek on a clean slide.
3. Add a small drop of isotonic saline.
4. Add a small drop of Methylene Blue stain.
5. Add a cover slip to the slide.
6. Focus on the slide using lowest power.
7. When you are comfortable, increase the magnification.

Draw what you see below and label any structures that you can identify. Note the total magnification of your view as well.

From what you observe, what is the purpose of the Methylene Blue stain? What would you see if you didn’t use it? Test this out by doing another cheek cell slide. Were you correct?

Why do you add “isotonic saline” to the cheek cells and not some other solution?
Cells use several processes to regulate what enters and leaves them. Diffusion, active transport, and osmosis are the most common ways for cells to bring material into and out of the cell membrane. In the lab, you will investigate osmosis and diffusion using non-living items since studying a living system would be significantly more complex an undertaking.

Experiment 1: Osmosis.

Procedure:
1. Obtain four pieces of dialysis tubing and prepare the tubes as shown by your instructor.
2. Fill each tube as outlined below:
   - Tube #1 = distilled water
   - Tube #2 = 5% sugar
   - Tube #3 = 10% sugar
   - Tube #4 = 20% sugar
3. Weigh each tube and record the weights in a table.
4. Place each tube into a separate beaker, each containing enough 10% sugar solution to cover the tubes.
5. Begin timing.
6. Write a hypothesis about what will happen to the weight of each tube and write your hypotheses in the space below:
   - Tube #1 should ____________________________
   - Tube #2 should ____________________________
   - Tube #3 should ____________________________
   - Tube #4 should ____________________________
7. After every ten minutes, re-weigh your tubes. Make sure to pat the tubes dry before weighing. Record your data in the table.

   Data table: Tube weights vs. time.

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<thead>
<tr>
<th></th>
<th>Initial</th>
<th>10min</th>
<th>20min</th>
<th>30min</th>
<th>40min</th>
<th>50min</th>
<th>60min</th>
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</thead>
<tbody>
<tr>
<td>Tube #1</td>
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<td>Tube #2</td>
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<tr>
<td>Tube #3</td>
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<tr>
<td>Tube #4</td>
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</tbody>
</table>
Lab Report:
1. After completing the experiment, create and turn in a lab report about your data as follows (one for each group):

   - A graph showing the weight of each tube throughout the course of the experiment.
   - A paragraph explaining what happened to each tube, and why. Make sure you use proper osmosis terminology and concepts.
   - The answers to the questions below:

2. Your dialysis tube was semi-permeable, meaning that it allowed only some substances through.

   a. What chemical(s) were smaller than the holes in the dialysis tubing? How do you know?

   b. What chemical(s) might be bigger than the holes?

   c. What would have happened if the tubing was \textit{impermeable}?

   d. What about if it was \textit{totally} permeable? Why?

Experiment #2: Diffusion.

Procedure:

1. Obtain a Petri dish as indicated by your instructor containing Potassium Permanganate & Methylene Blue.

Which crystal diffused the fastest?

Given the fact that Methylene Blue is a larger molecule than Potassium Permanganate, how does size of molecules relate to diffusion speed? Why might that be?
Tissues are a collection of cells that perform a purpose. In your body, four different tissues combine to form all of your organs. The tissues are: Epithelial tissue (ET), connective tissue (CT), muscle tissue (MT), and nervous tissue (NT). With these four tissues, you can construct any organ of the body and have it function.

Identify the following tissues:
**Questions:**

1. What tissue has a basement membrane? What is the job of this membrane?

2. Why is the lining of your mouth stratified but the lining of your small intestine is not?

3. Other than your mouth, what other areas of your body would have a stratified lining?

4. Other than your small intestines, what other areas of your body would have a simple lining?

5. Why is it helpful to have adipose tissue under the skin rather than deeper in the body?

6. What would happen if cardiac or smooth MT were voluntary?

7. From the following analogies, try to determine the tissue:

   a. “It’s like adding layers of clothing for more protection.”
   b. “Looks like grease in the sink.”
   c. “Looks like Cat’s eyes.”
   e. “Looks like tree rings.”

8. Which of the tissues that you’ve learned can regenerate themselves if damaged? How does this relate to their function?

9. Why is MT not able to function in the body without CT?
**Histology:**
Examine the slides provided. Draw the tissues in the spaces provided along with the name of the tissue and the total magnification.
A student took a vacation to Australia and sunbathed on the beach for over six hours. Later that night, he notices that the skin on his trunk, legs, and arms has become red and swollen. By morning, all of the affected areas have developed blisters. The inflamed areas cover about 30% of the trunk (front and back) and 40% of the arms and legs.

1. What **organ system** and what **organ** have been damaged?

2. What type of **tissue(s)** has been damaged? Where are these tissues located in the organ?

3. What **layers** of the skin have been damaged? What **strata**?

4. Based upon the evidence given, what kind of burn has the student received? How do you know?

5. What is a blister? What layer(s) of the skin does it affect?

6. What percentage of the body has been burned? (Use the “rule of nines”)

7. Is the burn critical? A critical burn is one in which: (a) 25% of the body is covered by 2nd degree burns, or (b) 10% of the body is covered by 3rd degree burns.

8. What hazards to the body does a critical burn create? Why?

9. What should the student do help his skin heal? Why?

10. Why would the student’s skin be more susceptible to chafing or trauma until it is fully healed?
Part I: Skin Identification.

Label the following:
epidermis, dermis, hypodermis, hair follicle, sweat gland, sebaceous gland, blood vessel, nerve endings for touch, nerve endings for pressure, hair shaft, Stratum Corneum, Stratum Basale

What layer is the most superficial of the skin?

What stratum is the deepest within the layer you mentioned above?

Draw a skin slide.
How can you tell what part of the skin in the slide is the superficial end?
Part II: Skin Color.
Press the heel of your hand against the glass petri dishes provided for a few seconds. 
What is the color of the compressed skin? Why?

What would happen if the pressure continued in this area for a long time? Why? What disease is this?

Part III: Sweat Glands.
1. Paint an area along the medial aspect of the palm and left forearm with the iodine solution.
2. Tape a piece of bond paper over each painted area and leave it for at least ten minutes.
3. After the time has elapsed, remove the papers and count the number of blue-black dots on the paper. 
   Each blue-black dot indicates an active sweat gland.

What part of your arm had the greatest density of sweat glands? Why there?

What kind of sweat gland (eccrine or apocrine) are these glands?

Where would you look to find the other kind of sweat glands?

Part IV: Hair.
Examine the section in your texts and the model to answer the following questions:

a. Examine a square centimeter patch on the top of your skull and another part of your body (like your arm). Which site has a greater density of hairs or hair follicles? Why?

b. Hairs go through a growing phase and a resting phase. Predict how the length of these two phases vary between the hair on your head and your eyebrows.

c. A hair shaft has three layers--cuticle, cortex, medulla. What part of the hair is responsible for the following cosmetic conditions--
   "split ends"
   coloring hair
Your 78-year-old aunt is putting away some utensils in the kitchen when she accidentally runs into the edge of the counter with her hip. Immediately, there is a “snap” and she feels a sharp pain run through her side. She collapses onto the floor. You find her an hour later and call for help.

Your aunt is taken to the hospital where an X-ray shows that she has a broken head of the femur. The X-ray also shows weakened bone mass in the rest of the long bones and the lumbar vertebrae.

1. What **system** was damaged when your aunt hit the counter? What **organ**?

2. What is the most likely diagnosis for your aunt’s condition? How do you know?

3. Why is the fact that your aunt is a) elderly, and b) a woman contribute to her condition?

4. What bone cell (**osteoblasts**, **-clasts**, **-cytes**) have caused your aunt’s condition?

5. What hormone is responsible for #4?

6. If a drug were available that mimicked either calcitonin or PTH, which one would you want to give your aunt and why?

7. Explain why it was your aunt's femur and lumbar vertebrae that are primarily affected. How does this relate to the function of bones and bone growth?
Part I: Bone Histology.

Label the following structures:

- Osteon
- Periosteum
- Epiphysis
- Epiphyseal Line
- Central Canal
- Compact Bone
- Diaphysis
- Articular Cartilage
- Perforating Canal
- Marrow Cavity
- Spongey Bone
- Endosteum
Part II: Skeleton.
Label the following diagram with the bone names below, then identify the same bones on the skeletons provided.

Frontal  Scapula  Ilium
Parietal  Humerus  Ischium
Occipital  Radius  Pubis
Temporal  Ulna  Femur
Zygomatic  Carpals  Patella
Maxilla  Metacarpals  Tibia
Mandible  Phalanges  Fibula
Ethmoid  Vertebræ  Tarsals
Sphenoid  Cervical  Metatarsals
Nasal  Thoracic  Phalanges
Hyoid  Lumbar
Clavicle
Sternum
Ribs (true & false)
Sacrum
Part III: Joints.

Fill in the following chart with the appropriate information. The first one is done for you:

<table>
<thead>
<tr>
<th>Bone Name</th>
<th>Joins with . . .?</th>
<th>Joint Type?</th>
<th>Movements?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femur</td>
<td>Tibia</td>
<td>Synovial</td>
<td>Flex/Extend</td>
</tr>
</tbody>
</table>

1. Which joints of the body have menisci (pads) inside of them? Why are pads in these joints? What type of tissue are these pads made of?

2. What kind of joint are your teeth in your jaw? How do you know?
Part I: Muscle Histology

Label the following parts of a sarcomere:

Actin       Myosin       Z-Line/Disc       Sarcomere

When a muscle contracts, what part of a sarcomere moves?

What happens to the distance between the Z-lines when a muscle contracts?

Actin and Myosin are proteins. What organelle makes them?

Part II: Muscle Identification.

Label the following figures with the muscles from the list below, then locate these same muscles on the models.

Zygomaticus Major       Serratus Anterior       Quadriceps Group
Masseter                 Intercostals (external)  Hamstring Group
Orbicularis Oris         Abdominis Rectus       Adductor Group
Orbicularis Oculi         External Oblique       Gastrocnemius
Sternocleidomastoid      Trapezius            Biceps Brachii
Temporalis                Latissimus Dorsii     Triceps Brachii
Deltoid                   Gluteus Maximus       Flexors of the hand
Pectoralis Major          Sartorius            Extensors of the hand

What muscle(s) above moves the head?

What muscle(s) above are on the posterior side of the body?
Identify the muscle(s) used to perform the following actions.

1. Flexion of the forearm uses the __________________________.
2. Extension of the forearm uses the ________________________.
3. You use the _______________________________ to extend the knee.
4. You use the ________________________________ to adduct the leg.
5. If you were to rise up on your toes, you would need to use your ____________.
6. What muscle(s) enables you to chew? ________________
7. What muscle(s) enables you to whistle? ________________.
8. The “kissing muscle” is technically called the ________________.
9. If you were to extend the hip, you would use the ______________________.
10. This is the main muscle you use during a sit-up. ________________.
11. To cross your legs “Indian style” would require you to use your ____________.
12. To close your hand into a fist requires these muscles: ________________

13. What exercise can you do to strengthen your Pectoralis Major muscle?

14. If you saw someone in the gym doing a "lat pull," what muscle is being exercised? How is this exercise performed?
Neurotransmitters (NTs) are chemicals that cross the synapse and cause a response in the following nerve or muscle. Based upon your understanding of this process, speculate what would happen in the following situations:

1. A person becomes infected with botulinin toxin. This toxin is produced by Botulism bacteria and blocks excitatory neurotransmitters from being released from nerves to muscles. What would happen to someone who was exposed to Botulinin? Why?

2. The poison-dart frog of the Amazon secretes a chemical called curare from its skin. This chemical blocks receptors on muscles that receive excitatory NTs. Why would this chemical work well for poison darts?

3. Nerve gases (such as Sarin) are synthetic forms of curare that can be absorbed through the skin. How can nerve gas kill you?

4. Tetanus is a disease that causes the body to stiffen, hence the common name of “lockjaw.” How could tetanus cause the body’s muscles to contract and stay contracted?

5. Morphine and other opiates are given to reduce pain. How might they do this?

6. Explain how neurotransmitters show "form fits function."
A reflex is a simple arc (loop) of impulses from a sensor to the spinal cord and out to an effector. Reflex tests are often used in the medical field to check on overall nervous system health.

**Procedure:**

Perform the following reflex tests as illustrated by your instructor:

- Patellar reflex--
- Plantar (Achilles) reflex--
- Abdominal reflex--
- Babinski’s reflex--
- Biceps reflex--
- Pupillary reflex--
- Cilio-spinal reflex--

**Questions:**

1. For each of the reflexes that you performed, list the sensor and effector.

2. Thinking about the patellar reflex, what do you think is the evolutionary advantage of a reflex? Why are they useful to the body?

3. What would happen if a reflex impulse went to the brain instead of the spinal cord only? Why?
4. The bottom of the page has a diagram showing a simple reflex arc.

a. What is the stimulus?

b. What kind of tissue (ET, CT, MT, NT) is the:
   
   sensor—

   effector—

c. How many synapses occur in this reflex arc?

d. Label the diagram with the following terms:

   Sensory Neuron       Afferent       Efferent
   Interneuron (Association Neuron)  Motor Neuron  Effector

   http://apycp.blogspot.com/

   e. Use arrows to show the direction an impulse would travel through this reflex arc.
5. Label the following nerve diagram:

<table>
<thead>
<tr>
<th>Dendrites</th>
<th>Axon</th>
<th>Cell Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myelin</td>
<td>Nucleus</td>
<td>Nodes</td>
</tr>
<tr>
<td>Direction of Impulse</td>
<td>Synapse</td>
<td></td>
</tr>
</tbody>
</table>

a. Using your text, what kind of neuron (unipolar, bipolar, multipolar) is this neuron? Where might this type of neuron be found in the body? Where are the other types of neurons found?

b. Why does the end of the axon fork?

c. Where does an action potential occur on a neuron?

d. How does the myelin affect an neuron's function? Why?

e. Where do you think the longest neuron is on the body, length wise?
Shaken Baby Syndrome is when an infant or small child is held off the ground and shaken. Since babies are unable to keep their heads from moving, the head jostles back and forth, often violently.

1. Why are babies unable to keep their heads from moving? What enables adults to stabilize the head?

2. How does CSF relate to brain protection? What about sutures in the skull?

3. Speculate how each of the following would affect the child, and why
   a. The head of the baby were slammed forward—
   b. The head were slammed rearward.
   c. The head were jostled side-to-side.

4. Sometimes, parents will hit a child at the base of the head. What might happen if you did this? Why?

5. Who is most likely to shake a baby?

6. What would you do to deal with this issue in our society?
Part I: Brain Anatomy.

Locate the following structures and note their location and structure.

Meninges—
  Dura Mater
  Pia Mater

Cerebralspinalfluid (CSF)—

Cerebrum—
  Frontal lobe—
  Parietal lobe—
  Occipital lobe—
  Temporal lobe—

Cerebellum—
  Arbor Vita

Corpus Callosum--

Diencephalon—
  Thalamus—
  Hypothalamus—
  Epithalamus (choroid plexus)

Pituitary Gland--

Brain stem—
  Pons—
  Medulla Oblongata—

Spinal Cord
Questions:

1. a) What brain areas are responsible for sensory functions?

   b) What brain areas are responsible for motor functions?

   c) What brain areas are responsible for association functions?

2. Looking at the cerebrum, notice the ridges (gyri) and fissures (sulci) of this area. What do you think are the functions of these “bumps” on the brain? What advantage do they serve?

3. What would happen to a person if there were damage to their brain stem area? Why?

4. How would a stroke in the thalamus affect a person? What about in the hypothalamus? Why?

5. If a person suffers a stroke (loss of blood flow to a brain area), the nerves in the area of the stroke die.

   a) Can nerve cells regenerate? How does this relate to the permanence of a stroke or nerve damage?

   b) If a person suffered a stroke in the left parietal lobe, what side of the body would have symptoms? What symptoms would you see? Why?

6. What part(s) of the brain are considered part of the endocrine system? Why?
The Autonomic Nervous System (ANS) is divided into two major branches—the sympathetic nervous system and the parasympathetic nervous system. Each one causes different responses by target organs.

Using your text and own knowledge, complete the table below:

<table>
<thead>
<tr>
<th></th>
<th>Sympathetic Response</th>
<th>Parasympathetic Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart rate (pulse)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breathing rate &amp; depth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood flow to muscles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood flow to skin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood flow to digestive organs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweat glands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salivary glands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immune System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity of the digestive organs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reproductive organs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. How would prolonged activity of the sympathetic nervous system affect long-term health of a person? Why?
Part I: Vision Structures.
Identify and label the following diagram with the appropriate terms listed:

Cornea, Lens, Iris/Pupil, Fovea Centralis, Ciliary Bodies
Aqueous Humor, Vitreous Humor, Retina, Optic Nerve/Disk

1. List in order the structures above that a beam of light would pass through from an object you are looking at until the image entered your nervous system.

2. If the lens of the eye makes an image that is “upside down,” why is it that what we see is “rightside up?”

3. What would happen to someone if their optic nerve were damaged? Why?

4. What would happen if someone’s lens could not change shape? Why?
**Part II: Hearing Structures.**
Identify and label the following diagram with the appropriate terms listed:

External Ear, External Auditory Canal, Cochlea, Tympanic Membrane (eardrum)
Ossicles—hammer, anvil, stirrup, Semicircular Canals, Auditory (Pharyngotympanic or Eustachean) Tube

1. List in order the structures above that a sound would pass through from an object you are hearing until the sound entered your nervous system.

2. What parts of the ear detect balance and equilibrium? How do these work?

3. Explain why hearing and balance are considered "mechanoreceptors."
Most people do not pay attention to their special senses (hearing, seeing, etc.) until they begin to lose
one of them. By then, it’s often too late to make repairs to damaged structures. In this lab, you will
perform a variety of tests related to the special senses to determine your normal level of functioning of
each. Additionally, you will also examine how the special senses relate to our perception of the world
around us.

I. Vision.

a. Eye Acuity:
Eye acuity is a measure of how well a person can see at 20 feet as compared to a “standard.” Hence,
normal vision is called 20/20.

Procedure: Stand 20 feet away from the standard eye chart and cover one eye.
Read the letters on each line. Have your partner check.
Stop at the row you can no longer see, or when you make many errors.
Repeat with the other eye.
Record your eye acuity for each eye ________________.

b. Astigmatism:
An astigmatism is a warping in the eyeball. This causes a slight out-of-focus area of the visual field.

Procedure: Stand 20 feet away from the astigmatism chart and close one eye.
Observe if any of the bars appear darker than the others, or out of focus.
If some bars appear different, then an astigmatism is present.
Repeat with the other eye.
Did either of your eyes have an astigmatism?

c. Near point:
Near point is how close an object can be to your eyes and still remain in focus. Usually, this value
decreases with age.

Procedure: Close one eye.
Bring a dissecting needle toward the open eye, keeping it in focus.
At the point where it loses its focus, have your partner measure the
distance to your eye and record.
Repeat for the other eye.
Look up the “age” for each eye in the table provided

Near point for each eye (in cm.) ________________ Age: ________________
d. Accommodation reflex:
   Bring a pencil or dissecting needle towards the face with both eyes open.
   Have your partner observe what happens with the eyes.
   Repeat.

What happens to the eyes as something comes closer to the face?

e. Color-blindness:
Color blindness is caused by a lack of photosensitive pigments in the eyes. The most common form is red-green color blindness. Color-blindness affects males considerably more than females due to its genetic inheritance.

If available, perform the color-blindness test as outlined by your instructor.

Are you color blind?

f. Blindspot test:

Procedure:
   Close your left eye.
   Look at the cross and move the page forward or backward until the dot disappears.
   Repeat by closing the right eye and looking at the dot.

Why don't you have a "blind spot" during normal vision?

g. Corneal Reflex:

Procedure:
   Look forward with both eyes
   At some random moment, your lab partner should try to quickly touch your cornea with a cotton swab.

What did your eyes do? Did the cotton swab have to touch the cornea? Why or why not?
II. Hearing.

a. Weber test:
A Weber test is designed to test for deafness. Normally, a person should hear a pure sound equally in both ears. If one side is louder or softer than the other, then deafness could be present.

Procedure: Strike a tuning fork.
Place the end of the tuning fork in the middle of the forehead.
Have the person note the sound volume in each ear.

Does either side have a louder or softer sound than the other? If so, then there is deafness.

b. Clock ticking method:
Listening to a clock can be a measure of overall hearing acuity. The more distant that a clock’s tick can be heard, the better the hearing.

Procedure:
Plug one ear with cotton.
Place a clock about three feet away from the person’s ear without cotton.
Slowly bring the clock closer to the person’s ear.
When the first audible “tick” is heard, measure the distance to the person’s ear.
Repeat for the other side.

Record your distances for both ears: ____________________________.

III. Smell.

Habituation (sensory adaptation)
Constant smells eventually become less acute due to our chemoreceptors becoming less sensitive to the stimulus. This is called habituation.

Procedure:
Hold a bottle of extract under your nose.
Notice the smell.
Continue to hold the bottle under your nose for a few minutes.

What happened to the smell over time? Why?

Now change to a different smell. What do you notice?

Now change back to the original smell. What do you notice now?
IV. Equilibrium.

Spin test.
Dynamic equilibrium is how your body “knows” when you’re moving. It is determined by the motion of fluid in the inner ear.

Procedure:
- Have your partner sit in a swivel chair.
- Spin your partner several times quickly.
- Suddenly, stop your partner and look into his or her eyes.

What are the eyes of your partner doing once he or she is stopped from spinning?

Romberg Test.
Usually your body uses vision as the main way to determine balance. With the eyes closed, the body must rely on other clues to determine balance.

Procedure:
- Have your partner stand back against a wall with his or her eyes closed.
- Watch and see if your partner begins to sway slightly.

Why did your partner sway?

With the eyes closed, what other sources of information about balance does the body use?

V. Proprioception.
Proprioceptors tell your body where it is. It enables your body to monitor its own movements. Essentially, these receptors enable you to “feel” where you are.

Procedure:
- Hold a pencil eraser in front of your partner, about chest high.
- Have your partner touch the end of the eraser with his or her finger.
- Have your partner close his or her eyes and repeat.

How does your partner perform with eyes closed? Why?
VI. Touch Sensation.

a. Thermosensation.
Thermosensation is your body’s ability to detect temperature.

Procedure:
Place one hand into cold water.
Place the other hand into hot water.
Leave both hands in the water for several minutes.
Take both hands and place into the warm water together.

What do you feel?

b. Touch Density.
Different areas of your body have different densities of touch receptors. Hence, different areas have a differing level of touch discernment.

Procedure:
Have your partner close his or her eyes.
Using a compass, touch the following areas of your partner’s body.
Have your partner indicate if the touch was one point or two.
Keep decreasing the compass until the partner can only feel one point.
Measure this distance and record.

<table>
<thead>
<tr>
<th>Area</th>
<th>Distance (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back of hand</td>
<td></td>
</tr>
<tr>
<td>Back of neck</td>
<td></td>
</tr>
<tr>
<td>Lips</td>
<td></td>
</tr>
<tr>
<td>Fingertips</td>
<td></td>
</tr>
<tr>
<td>Lower back</td>
<td></td>
</tr>
</tbody>
</table>

Questions:

1. Based upon the tests performed and reference materials provided, comment on your sight and hearing acuity. How do they compare to normal? Why might this be?

2. What would happen to a person’s visual accommodation and acuity as they age? Why?
3. How would the clicking clock test have turned out if you had been exposed to loud noises throughout your life? Why?

4. Why did the “spin test” affect the eyes the way it did?

5. Explain the results of the thermosensation test.

6. How does the result of the touch density test relate to human activities such as kissing or reading by Braille? Why?

7. Explain the results of the smell test.

8. How would your results of the proprioreception test be affected by frequent practice? How does this relate to sports?
Complete the following table regarding the endocrine organs.

<table>
<thead>
<tr>
<th>Hormone</th>
<th>Source?</th>
<th>Target?</th>
<th>Action?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth Hormone (GH)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroid-Stimulating (TSH)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prolactin (PRL)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adrenocorticotropin (ACTH)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-diuretic (ADH)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxytocin (OT)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroid (T3 &amp; T4) or Thyroxine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcitonin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parathyroid (PTH)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mineral-corticoids= &quot;Aldosterone&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gluco-Corticoids= &quot;Cortisol&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucagon</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. What hormones on your list are antagonists? Why?

b. If a hormone does not have an antagonist, how can its effect be reduced or reversed?
Determine what would happen to someone who had the following endocrine (hormone) disorders and explain why.

1. Hypersecretion of GH—
2. Hyposcretion of GH—
3. Hyposcretion of PRL—
4. Hypersecretion of PTH—
5. Hyposcretion of Calcitonin—
6. Hypersecretion of ADH—
7. Hyposcretion of ADH—
8. Hypersecretion of T3 or T4 (thryoxine)—
9. Hyposcretion of thyroxine—
10. Hypersecretion of insulin—
11. Hyposcretion of insulin—
12. Hypersecretion of aldosterone—
13. What would cause the body to produce extra (hyper-secrete) TSH? How does this relate to homeostasis?

52
1. Name the glands shown on this drawing.

If this drawing were of a male, what glands would be different?

What makes endocrine glands different from other types of glands, like sweat glands or mammary glands?

What endocrine glands play a role in:

a) The digestive system?

b) The reproductive system?
2. For each of the following descriptions, determine the hormone and whether it’s in excess (hyper-secretion) or inadequate (hypo-secretion):

a. Excessive urination, dehydration, and thirst.

b. Abnormally small stature; dwarfism (in children)

c. Lethargy, low metabolic rate, obesity

d. Depression of the immune system; excess blood sugar and “fight or flight” responses.

e. Abnormally large stature; gigantism (in children)

f. Increased nervousness, increased pulse, weight loss.

g. Lack of menstruation, breast enlargement and tenderness (without being pregnant.)

h. Goiter.

i. Hyperglycemia (high blood sugar).

j. Loss of calcium from bones.

k. Hypoglycemia (low blood sugar)

4. What endocrine gland is called the “master gland?” Why?