BI 172
Introductory
Anatomy & Physiology II

Class & Lab Activities
updated 12/2011

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BI 172
Introductory Anatomy & Physiology II
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

Blood
1. Describe the components of blood, where they are produced, and give their functions.
2. Discuss the relationship between bone marrow and blood.
3. Describe what a hematocrit measures and the normal value.
4. Describe how blood RBC count is regulated and how this relates to hormones, bone marrow, and homeostasis.
5. Discuss factors that would increase or decrease RBCs in the body.
6. Discuss how blood clotting and wound healing occur and why these processes are necessary for life.
7. Describe how blood typing works and why this is clinically significant.
8. Explain what transfusions will work and which will cause a reaction, and give the reasons why.
9. Describe diseases of blood including anemia, sickle-cell anemia, hemophilia, and leukemia.

Cardiovascular System:
1. Use the terms atrium, ventricle, artery, vein, pulmonary, and systemic correctly when describing the heart.
2. Explain why the heart is a “double pump and how the heart anatomically fits this description.
3. Trace the pathway of blood through the human heart, to the body, and return it to the heart.
4. Describe the function and location of valves and relate heart sounds to the action of the valves.
5. Describe the cardiac cycle using correct vocabulary.
6. Explain the relationship between the myocardium and the coronary arteries.
7. Describe the intrinsic conduction system of the heart and how it operates.
8. Describe an ECG and explain what the waves signify in a heart.
9. Determine when an ECG or heart sound is incorrect, and why.
10. Contrast arteries, veins, and capillaries in terms of structure and function.
11. Explain how cardiac output is measured and the factors that affect it.
12. Explain factors that affect blood pressure.
13. Explain how the body would compensate for high or low blood pressure and why.
14. Explain the function of capillary beds and factors that would cause the beds to open or close.
15. Describe disorders of the cardiovascular system, such as arteriosclerosis, aneurism, hypertension, hypotension, tachycardia, bradycardia, hypovolemic shock, heart attack, and stroke.
Lymphatic System and Immunity.
1. State the general function and components of the lymphatic system.
2. Contrast lymphatic “circulation” with that of blood.
3. State the major locations of lymph nodes in the body.
4. Describe the mechanical and chemical barriers of the body and how they work to prevent infection.
5. Describe the inflammation response and why it is effective in stopping pathogens.
6. Describe B-cell immunity and T-cell immunity, noting location of cells, action upon finding pathogen, and the types of pathogens destroyed.
7. Describe the function of antibodies.
8. Discuss the role of helper T-cells in both B-cell and T-cell immunity.
9. Contrast primary immunity with secondary immune responses and how this relates to memory cells and vaccinations.
10. Discuss common disorders with the immune system, such as allergies, tissue rejection, and autoimmune disorders.
11. Discuss the biology of HIV infection, including how HIV is able to destroy the immune system and the steps necessary to prevent HIV infection.

Respiratory System.
1. State the function of the respiratory system.
2. List the main organs of the respiratory system.
3. Describe the function of mucous membranes in the nasal cavity.
4. State the function of the epiglottis.
5. Describe the structure of alveoli and justify why alveoli must be associated with a capillary.
6. Describe how inhalation and exhalation (ventilation) occurs and how this relates to the diaphragm.
7. Describe how gasses are transported in the blood.
8. Describe the homeostatic mechanism controlling breathing rate.
10. Describe some common respiratory disorders, such as asthma, bronchitis, COPD, and smoking-related illness.

Digestive System
1. List the organs that food would pass through in the alimentary canal, their function, the enzymes they produce, and the substrates for each.
2. Contrast mechanical digestion with chemical digestion.
3. List the major enzymes found in pancreatic juice and what they digest.
4. Describe the regulation of the pancreatic secretions.
5. Describe how the liver assists the digestive system and specifically describing bile.
6. Describe the structure and function of the intestines and how this structure relates to the intestines' functions.
7. Discuss the role of fiber in movement through the large intestine.
8. State some common disorders of the digestive system, including malnutrition, anorexia, bulimia, diarrhea, constipation, ulcers, esophageal reflux, and dieting.
Metabolism & Nutrition.
1. List the steps, location, and products of aerobic and anaerobic respiration.
2. Discuss the consequences to the body of anaerobic respiration and relate this to "oxygen debt."
3. List the fat-soluble and water-soluble vitamins and what they are for.
4. Describe the necessary nutrients of humans and sources for these nutrients.
5. Calculate BMI and body fat and use these values to determine health.
6. Critique different diet plans and state how they would affect overall health.
7. Describe the risks associated with overeating in our society and how these risks can be prevented.

Urinary System, Water Balance, and Acid-Base Balance
1. State the function of the urinary system.
2. List the major organs of the urinary system.
3. Describe the process of filtration and identify substances that would be filtered and why.
4. Discuss factors that influence filtration pressure and rate.
5. Describe the renin-angiotensin system, noting where each component is produced.
6. Describe the process of tubular reabsorption and identify substances that would be reabsorbed.
7. Describe the process of tubular secretion and identify substances that may be secreted.
8. State the usual composition of urine and discuss what makes a UA normal/abnormal.
9. Describe the role of ADH and aldosterone on urine formation.
10. Relate acidosis and alkalosis with acid-base imbalance and the function of the urinary system.
11. Determine if symptoms show respiratory or metabolic, acidosis or alkalosis, and how the body will compensate for each.
12. Describe some disorders of the urinary system such as dehydration/overhydration, diabetes insipidus, acidurea, ketoneuria, glucosuria, and albuminuria.

Reproductive Systems
1. State the main organs of the male & female reproductive systems and give a function of each.
2. Describe the process of spermatogenesis (sperm production) and how this relates to meiosis and hormones.
3. List the male accessory reproductive organs and give their secretions.
4. Describe the homeostatic mechanism by which male sex hormones are controlled.
5. Describe the process of oogenesis (egg production) and how this relates to meiosis, follicles, and hormones.
6. List the female accessory reproductive organs and give their functions.
7. Describe the menstrual cycle and relate it to the endometrium, ovulation, hormones, and pregnancy.
8. Describe contraceptives and fertility drugs and state how they work.
9. Discuss disorders of the reproductive systems, including: erectile dysfunction, infertility, STDs, and menstrual irregularities.
Pregnancy, Growth, and Development & Genetics.

1. Place the processes of gametogenesis, fertilization, cleavage, and implantation into proper order and give a general time line for each stage.

2. Contrast an embryo with a fetus.

3. Discuss the role of hCG, progesterone, estrogen, and the placental hormones in maintaining pregnancy.

4. Describe the function of a placenta.

5. Discuss the anatomical and physiological changes that occur throughout pregnancy and childbirth.

6. Contrast ectoderm, mesoderm, and endoderm, and state the products of each.

7. Contrast fetal circulation with adult circulation and how these differences relate to the placenta.

8. Describe teratogens and the effects they cause.

9. Identify significant structures of the breast and discuss their function in light of lactation.

10. Discuss how lactation occurs, and how this relates to digestion, immunity, and nutrition.

11. Contrast dominant, recessive, and sex-linked traits, and give examples.

12. Perform simple genetics problems using correct terminology.

13. Contrast genetic traits with chromosomal disorders.

14. Discuss common disorders of pregnancy and genetics such as: pre-mature birth, placenta previa, eclampsia, PKU, trisomy-21, klinefelter, turner, and cystic fibrosis.
#1--A 14-year-old girl complained of fatigue and loss of stamina. Her appetite was marginal, as she was very conscious of maintaining her body weight at 96 pounds. Her monthly menstrual flow was always heavy and long from its onset at twelve years of age. Relevant laboratory findings included the following:

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematocrit (Hct)</td>
<td>28%</td>
</tr>
<tr>
<td>Hemoglobin (Hgb)</td>
<td>9 g/dL</td>
</tr>
<tr>
<td>Iron (blood)</td>
<td>16 µg/dL</td>
</tr>
<tr>
<td>Bone marrow iron</td>
<td>Absent</td>
</tr>
<tr>
<td>Erythrocytes</td>
<td>Small and pale</td>
</tr>
</tbody>
</table>

1. Explain the meaning of the tests below. That is, what does each test measure:

Hematocrit—

Hemoglobin—

Erythrocytes—

2. Based upon the laboratory analysis, what is the primary disorder of this individual?

3. What might be all possible causes of this disorder in this patient?

4. What are the versions of this disorder, and what causes them?

5. What dietary changes would you recommend for this patient?
Michael looked in the mirror one morning and noticed that his eyeballs were yellowing, and that his skin also had a yellow coloration. He went to the doctor and the doctor diagnosed him with Hepatitis.

1. What do you call Michael’s yellowing of the eyes and skin?

2. What is causing this?

3. Why is this symptom characteristic of hepatitis--i.e., what does the liver have to do with this?

4. Aside from hepatitis, what are other causes of this symptom?

5. Why are newborn babies sometimes yellow at birth? What does this say about their livers? Why might that be?
BI 172--Introductory A&P II
Blood Lab

Blood is vehicle that the body uses to transport nutrients and wastes throughout the body. The cardiovascular system’s job is to ensure that blood gets circulated correctly. Therefore, an understanding of blood is essential to understand the rest of the cardiovascular system as well as overall body health.

Part I: Identification of blood cells.

Procedure:

1. Take a prepared slide of human blood and look at it under a microscope.

2. Using your text, identify red blood cells (RBCs) and white blood cells (WBCs). Draw them below and label them.

   ![Red Blood Cell](image1)

   ![White Blood Cell](image2)

   a) What difference(s) do you see between the RBCs and the WBCs? How does this relate to their function?

   b) What type of cell (RBC or WBC) is more common in blood? Why would that be?

   c) If a person were to have an infection, what would happen to the levels of the WBCs? Why?

   d) What would happen to a person if their RBC count were too low? What about too high? Why?
Part II: Blood tests:

Procedure:

1. Complete the following table about blood typing before you begin. For each blood type given, indicate if clumping (agglutination) in the slides given. The first row is done for you.

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>A-well on slide</th>
<th>B-well on slide</th>
<th>Rh (D)-well</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-type blood</td>
<td>Clumping</td>
<td>None</td>
<td>N/A</td>
</tr>
<tr>
<td>B-type blood</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>AB-type blood</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>O-type blood</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Rh-Positive blood</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Rh-Negative blood</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

2. Perform the blood typing and/or hemoglobin tests as shown by your instructor.

Follow proper safety procedures and remember to put any blood-contaminated materials in the proper disposal area.

3. Record the values for the blood sample you tested:

   Blood type _____________________________
   Hemoglobin ____________________________

   a) If a person had A+ blood type (A-positive), what would you see on their blood typing slide? Why?

   b) What kind of person can receive blood from an A+ person?

   c) What kind of blood type is considered to be the “universal donor?” Why?

   d) What kind of blood type is considered to be the “universal recipient?” Why?
The heart is essentially a double pump—one side pumps blood to the lungs to receive oxygen (the pulmonary circuit) while the other side pumps blood to the rest of the body (system circuit). Chambers, valves, vessels and muscles must all work together for a heart to effectively push blood through the body in these two circuits.

**Part I: Heart Anatomy.**

Using the models, posters, or preserved specimens provided, identify the following heart structures and then label them on the diagrams below:

- Right & Left Atria
- Tricuspid Valve (Right A-V)
- Pulmonary Semi-lunar Valve
- Vena Cava
- Pulmonary Veins
- Right & Left Ventricles
- Bicuspid Valve (Mitral or Left A-V)
- Aortic Semi-lunar Valve
- Aorta
- Chordae Tendineae
- Interventricular Septum
- Pulmonary Artery
- Myocardium

What structures above are in contact with oxygenated blood?

What structures are in contact with de-oxygenated blood?
Questions:

1. Look at the **chambers** of the heart. What chamber has the thickest walls (myocardium)? Why?

2. Which **valve** of the heart do you think would be exposed to the most wear or pressure? Why? What will happen if this valve “busts out?” Why?

3. What do the **chordae tendineae** do? What would happen if the heart did not have these?

4. What is the function of the coronary arteries? What would happen if these became blocked or damaged? Why?

5. Listen to your partner’s heart with a stethoscope and record what you hear:
   a) What do these sounds represent?
   b) What valve(s) corresponds to each sound? Is the valve opening or closing?
   c) Does your partner have a murmur? How do you know? If not, what would a murmur sound like?

6. Take your partner’s pulse and record it below:
   How does your partner’s pulse compare to the “normal” value? Why might this be?

7. On what locations on the body can you take a pulse? Why there?
Part II: Electrical Conduction of the Heart.

Label the following diagram of the intrinsic conduction system:

- SA Node
- AV Node
- Bundle Branches
- Purkinje Fibers

When the SA node depolarizes, what wave of an ECG is created?

What chambers of the heart are in systole during the QRS complex? What node is responsible for this signal?

Why do the Purkinje Fibers start at the bottom of the heart and then go up? What is the biological necessity for this arrangement?

Have your instructor perform an ECG. Draw the ECG in the space below and label: p-wave, qrs-complex, t-wave.

Is your ECG normal? If not, what is abnormal about it?
BI 172--Introductory A&P II
Cardiovascular Claims Analysis

One day you attend a seminar hosted by a famous cardiologist. During the seminar, the speaker makes several claims about the cardiovascular system of the human body. Here are some of the claims he made:

- A man’s pulse and blood pressure increases more than a woman’s for the same amount of exercise.
- A person who weighs more will have a higher blood pressure and faster pulse than someone who weighs less both at rest and at exercise.
- The longer you exercise, the higher your pulse and blood pressure will get, but it will eventually flatten out.
- Older people have higher pulses and blood pressure than younger people for the same amount of activity.

You wonder if any of these claims are actually true, so you begin to ponder how to test them in a lab setting.

Procedure:

1. You and your group are to pick two of the claims above to test. Your job is to determine if the claim is true or false.

2. Make a hypothesis for each of the claims and write it below:
   Hypothesis #1 ___________________________________________________
   Hypothesis #2 ___________________________________________________

3. Develop an experiment to test each claim separately. In your experiment, you’ll need to address the following:
   - Number of people performing the experiment (victims 😊). Who?
   - Type of exercise and longevity. What kind? How long? Where?
   - Number of repetitions of the experiment. Will you do it once? Twice?
   - Controls—How will you ensure that everything is the same except what you’re testing?
   - How will you collect the data? How will you present the data?

4. Have your instructor check your procedure before performing the experiment.

5. Perform your experiment as you designed and gather all necessary data.

6. Write a lab report (one/group) that addresses the following:
   - A table and a graph of your data as appropriate.
   - A conclusion stating what your data showed—what happened?
   - A statement telling the biological reasons for the conclusion. Why did this occur?
BI 172--Introductory A&P II
Circulatory Activity

Find the following arteries and veins on the diagrams or models:

- Ascending Aorta
- External Iliac Artery
- Tibial Artery
- Brachial Artery
- External Carotid
- Superior Vena Cava
- Saphenous Vein
- Axillary Vein
- Abdominal Aorta
- Internal Iliac Artery
- Brachiocephalic Artery
- Radial Artery
- Internal Carotid
- Inferior Vena Cava
- Renal Vein
- Brachial Vein
- Common Iliac Artery
- Femoral Artery
- Subclavian Artery
- Ulnar Artery
- Iliac Vein
- Brachiocephalic Vein
- Radial Vein
- Renal Artery
- Popliteal Artery
- Axillary Artery
- Common Carotid
- Femoral Vein
- Subclavian Vein
- Jugular Vein

1. What is the route (vessels) that a drop of blood would take to go:

   a) From your heart to your feet and back again?

   b) From your heart to your brain and back again?
Examine the following diagrams showing both sagittal (longitudinal) and cross sections of blood vessels:

Label the pictures above as an artery, a vein, or a capillary.

How did you tell the arteries and veins apart? Why is there this difference?

How does the capillaries’ structure relate to their function?
BI 172--Introductory A&P II
HIV Activity

Study the diagram on HIV and answer the following questions. The answers to these questions may not necessarily be found directly in the diagram.

1. How does HIV locate the proper cells in infect?

2. What specific cell does HIV infect in the human body?

3. What happens to the infected cells when the new HIV particles bud out of the cell?

4. What is the difference between HIV and AIDS?

5. Why do victims of AIDS have a higher rate of fungal infections, yeast infections, and bacterial infections than the rest of the population?

6. What diagnostic tests can be done to monitor HIV infection in the body? How does this relate to the biology of the virus?

7. Looking at the diagram, state at least three ways/stages that HIV can be controlled or prevented from spreading based upon its lifecycle.

8. HIV cannot fix mutations (changes in its genetic material) when it reproduces. How does this affect the ability to make an HIV vaccine? Why?
Hypotheses:

a) What nation/region has the highest rate of HIV infection? Why do you think this?

b) What is the main mode for HIV infection—i.e., what is the main way to catch HIV? Why do you think this?

c) What is the risk of HIV infection caused by a single exposure to these activities. Rank them as high, medium, or low in risk.

- Transfusion of contaminated blood products—
- Needle-stick injury—
- Mosquitoes—
- Breastfeeding—
- Perinatal exposure (placental or during birth)—
- Kissing—
- Hugging—
- Unprotected sex—
  - anal sex—
  - vaginal sex with infected male—
  - vaginal sex with infected female—
  - oral sex—
- Sharing a toothbrush—
- Sharing food/drinks—
- Presence of other STDs—
- Use of narcotics, especially intravenous drugs like heroin—

What is the main difference determining the risk of different behaviors? Why?
Complete the following table:

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Physical Digestion? (y/n)</th>
<th>Chemical Digestion? (y/n)</th>
<th>Nutrient Absorption? (y/n)</th>
<th>Enzymes? (y/n)</th>
<th>If so, What substrates?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esophagus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stomach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Intestine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Intestine</td>
<td></td>
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</tr>
</tbody>
</table>

1. Although food doesn’t touch them, the pancreas and liver are also considered organs of the digestive system. Why? What do they do to assist in digestion?

2. The cecum of your large intestine contains bacteria. What is their function? What would happen if these bacteria were not present in your large intestine?

3. What role does fiber play in the digestive system? Why?
#1 -- A 26-year-old business executive complained of a dull pain (heartburn) behind the sternum. The pain was postprandial (occurred after meals) and disappeared within a few minutes to an hour. It was often associated with belching and often was worse on lying down or on exertion after heavy meals. Sometimes it radiated to the back, jaws, shoulders, and down the inner aspects of the arms, simulating angina pectoris. X-rays revealed a small portion of the stomach above the diaphragm, and an endoscopic biopsy revealed mucosal inflammation.

Esophageal manometry (determining pressures at the lower esophageal sphincter, LES) revealed decreased LES pressure. Esophageal pH monitoring showed reflux of gastric contents into the esophagus and provided direct evidence of gastroesophageal reflux.

Recommended treatment for this individual is to stop smoking, change the diet to avoid strong stimulants of gastric acid secretion, and avoid certain drugs. Elevation of the head of the bed by about six inches is also recommended.

1. What is the disorder of this 26-year-old business executive? Explain.

2. What mechanisms normally prevent gastric reflux into the esophagus when lying down or bending over?

3. What changes in diet should this man do? Why?

4. Why is elevation of the head of the bed recommended?

5a. What is the normal pH of the esophagus?
5b. Of the stomach?
5c. Predict pH values for the gastroesophageal patient in this case for lower esophageal and stomach.
#2--Julie has sharp pains in her upper right quadrant whenever she eats fatty foods. The pain lasts for about an hour and then eventually goes away. The pain never seems to occur if she eats a diet low in fat.

Eventually, Julie sees the doctor and the doctor says she has a gallstone blocking her bile duct.

1. What is a gallstone? Where does it form?

2. What is the function of the bile duct? What would happen if this duct were blocked?

3. How does the presence of a gallstone explain Julie’s symptoms?

4. Can Julie still digest fats with the gallstone present? Why or why not?

5. What treatments might be available for Julie?

6. What dietary recommendations would you give her?

7. What would happen if the gallstone completely blocked Julie's pancreatic duct as well? Why?
Part I: Digestive Organs.

Identify and label the following terms on the diagrams and models:

- Esophagus
- Liver
- Stomach
- Pancreas
- Small Intestine
- Ascending Colon
- Duodenum
- Ilium
- Pancreatic Duct
- Gall Bladder
- Bile Duct
- Pyloric Region of the stomach
- Cardiac Region of the stomach
- Ascending Colon
- Descending Colon
- Rectum
- Anus
- Intestinal Folds

1. What is the job of a sphincter? Where are the sphincters located in your body?
2. What sphincters are voluntary? What sphincters are involuntary? What kind of muscle tissue (MT) forms the voluntary sphincters?

3. Your liver receives nutrients from the small intestines via the Hepatic Portal System of veins. What does your liver do with these nutrients after they have been absorbed by the small intestine?

4. Why is the small intestine coiled?

**Part II: Mouth & Teeth**

Identify the following mouth and teeth structures:
- Root
- Crown
- Pulp Cavity
- Root Canal
- Enamel
- Gingiva
- Periodontal Ligament
- Parotid Salivary Gland
- Sub-lingual Salivary Gland
- Sub-mandibular Salivary Gland

1. Why are your "baby teeth" often called your "milk teeth?"

2. How many teeth do children have? How many in adults?

3. What would happen to your teeth if the periodontal ligament were weak? Why?
Part I: Food Labels and Nutrition.

Look at the "Nutrition Facts" on several food labels. Use information from the labels and your textbook to answer these questions.

1. What are the main functions of carbohydrates, proteins, and fats in the diet?

2. From a food label, what are the % Daily Value (%DV) for carbohydrates, proteins, and fats?

3. What fat-soluble vitamins are listed on the label?

4. What items on the food label should a person try to maximize—that is, meet or exceed the recommended daily value? Why?

5. What items on the label should a person try to minimize—that is, stay below the %DV? Why?

6. Approximately how many Calories should an average person consume daily? What about if the person were a pregnant woman? What about a sedentary individual? Why?
Part II: Weight, Body Fat, and BMI.

Weight:

1. Weigh yourself. My weight ______________
2. Determine your frame size. My frame size ____________
3. Look up your “ideal weight” using the references provided. Record your “ideal weight” for your frame. My “Ideal Weight” ________________
4. How does your real weight compare to your “ideal weight?”
5. Can someone be at their ideal weight and be unhealthy? Explain.
6. Can a person be above or below their “ideal weight” and be healthy? Explain.
7. How accurate of a health measure is ideal weight on its own? Why?

Body Fat

1. Calculate your percentage body fat following the directions outlined by your instructor. My Body Fat % __________________
2. Using references, determine the values for “normal” percentage body fat for your gender and record them below. How does your body fat percentage compare to the expected percentages?
3. How do the body fats recommended for men and women differ? Why?

4. How does having too much body fat affect the body? Why?

5. How does having too little body fat affect the body? Why?

**BMI**

1. Using the references provided, determine your BMI.
   My BMI ____________.

2. What classification is your BMI (i.e., acceptable, etc.)
   My classification ________________.

**Waist/Hip Ratio**

1. Measure your waist (narrowest part, usually at your belly button).
   _________________________

2. Measure your hips (widest part). _________________________.

3. Divide your waist by your hips. This is the Waist/Hip Ratio.
   _________________________.

4. Waist/Hip ratios over 1.0 tend to be unhealthy. Why might that be?

**Summary:**

Based upon the health measurements you have taken, how would you describe your overall body health? Why?
The respiratory system’s job is to deliver oxygen and remove carbon dioxide from the bloodstream. Although these processes occur mostly automatically in the body, some biological and environmental factors can affect them to the point of causing a disease. In this lab, you will investigate factors that affect the respiratory system and relate these factors to health.

**Part I: Structures:**

Identify the following structures on the diagrams and models:

<table>
<thead>
<tr>
<th>Nose</th>
<th>Pharynx</th>
<th>Larynx</th>
<th>Epiglottis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trachea</td>
<td>Tracheal Cartilage</td>
<td>Bronchi</td>
<td>Alveoli</td>
</tr>
<tr>
<td>Vocal Cords</td>
<td>Lung Lobes</td>
<td>Pleural Membrane</td>
<td>Diaphragm</td>
</tr>
</tbody>
</table>

1. What does your epiglottis do? What kind of tissue is it made out of? Why?

2. Why does your trachea have cartilage rings? Why doesn’t your esophagus have these rings?

3. In asthma, the bronchi constrict. What happens to your ability to breathe if this occurs, and why?
Part II: Breathing Rates and Tidal Volume.

1. Using a method you both find comfortable, measure the breathing rate of your partner at rest and record it in the table provided.

2. Measure your partner’s tidal volume using a spirometer as shown by your instructor and record in the table, also.

3. Now, have your partner do a brief exercise. Record a new breathing rate and tidal volume as before.

**Respiration values**

<table>
<thead>
<tr>
<th>Name</th>
<th>Breathing rate @ rest</th>
<th>Tidal Volume @ rest</th>
<th>Rate after exercise</th>
<th>Tidal Volume after exercise</th>
</tr>
</thead>
</table>

**Questions:**

1. Calculate the total amount of air delivered to the lungs per minute at rest and after exercise. To do this, multiply the breathing rate by the tidal volume.

2. How did the amount of air delivered to the lungs at rest and after exercise compare? Why might this be?

3. Compare your answers with another student. Did both of you have the same changes in breathing rate and/or tidal volume?

4. If a person were to breathe more often (hyperventilation) would they have a greater or less tidal volume compared to someone who breathes less often (hypoventilation)? Why?
Part III: Vital Capacity.

1. Make sure you are standing for this experiment.

2. Take a few deep breaths to “limber up” your lungs.

3. Take as deep a breath as you can and then exhale into the spirometer as shown by your instructor. Your goal is to exhale all of the air in your lungs, so it is allowed to lean forward or cross your chest with your arms to help expel the air.

4. Record the value in the table below. Then rest while your partner performs the test.

5. Repeat this test three times each and then average the results.

Vital Capacities:

<table>
<thead>
<tr>
<th>Name</th>
<th>Trial #1</th>
<th>Trial #2</th>
<th>Trial #3</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. How do you think sitting down will affect your VC? Why? Sit and measure your VC as before.

Questions:

1. Did your vital capacity “improve” with each of the original three trials? Why might that be?

2. How does your average vital capacity compare to the theoretical values provided by your instructor? Why?

3. Why are respiratory tests done with the patient standing?

4. List factors that would affect a person’s vital capacity. For each one, determine if it is actually changeable by the person? That is, which one(s) does a person have control over?
Part IV: Hyperventilation.

1. Breath regularly in open air for a few seconds.

2. Hold your breath and have your partner time how long you can hold your breath.

3. Record your values in the table and then switch. Wait at least ten minutes.

4. Now, hyperventilate into a bag for a few minutes or until you feel lightheaded.

5. Hold your breath and have your partner time you. Record in the table and then switch.

6. After waiting at least ten minutes, hyperventilate into open air for a few minutes or until you feel lightheaded.

7. Hold your breath and time as before.

Time for holding breath:

<table>
<thead>
<tr>
<th>Name</th>
<th>Regular Breathing</th>
<th>Hyperventilation—Into bag</th>
<th>Hyperventilation—Open air</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Questions:

1. How did hyperventilation into the bag affect your ability to hold your breath? Why?

2. How did hyperventilatating into the open air affect your ability to hold your breath? Why?

3. How would your time for holding your breath have changed if you were nervous? What about when you were sleeping? Why?

4. How would the breathing rate of a bear be affected during hibernation? Why?
Examine the following table:

<table>
<thead>
<tr>
<th></th>
<th>Concentration in Blood (mg/ml)</th>
<th>Concentration in Filtrate (mg/ml)</th>
<th>Concentration in Urine (mg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>128</td>
<td>128</td>
<td>0</td>
</tr>
<tr>
<td>Albumin</td>
<td>50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RBCs</td>
<td>5 million/ml</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>WBCs</td>
<td>5,000/ml</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sodium</td>
<td>136</td>
<td>136</td>
<td>Variable</td>
</tr>
<tr>
<td>Potassium</td>
<td>4</td>
<td>4</td>
<td>Variable</td>
</tr>
<tr>
<td>Urea</td>
<td>26</td>
<td>26</td>
<td>100</td>
</tr>
<tr>
<td>Uric Acid</td>
<td>0.05</td>
<td>0.05</td>
<td>0.6</td>
</tr>
<tr>
<td>Water</td>
<td>900</td>
<td>900</td>
<td>Variable</td>
</tr>
<tr>
<td>pH</td>
<td>7.4</td>
<td>7.4</td>
<td>6</td>
</tr>
</tbody>
</table>

1. What substances are able to enter the nephron of the kidney? How do you know?

2. What substances are reabsorbed into the blood stream from the kidney? How do you know?

3. What substances are secreted (pumped) out of the blood into the kidney? How do you know?

4. What happens to the acidity of urine as it moves through the kidney?

5. Why are the salt levels and water level variable in the urine? How are these levels controlled?
The function of the urinary (excretory) system is to regulate the composition of the bloodstream. The kidneys act as giant filters and remove excess wastes and other substances from the bloodstream to maintain homeostasis.

**Part I: Urinary Structures:**

Identify the following structures on the diagram or models:

<table>
<thead>
<tr>
<th>Structure</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney</td>
<td>Renal Artery</td>
</tr>
<tr>
<td>Urinary Bladder</td>
<td>Renal Pyramids</td>
</tr>
<tr>
<td>Renal Capsule</td>
<td>Renal Pelvis (Sinus)</td>
</tr>
<tr>
<td>Descending Loop of Henle</td>
<td>Ascending Loop of Henle</td>
</tr>
<tr>
<td>Collecting Duct</td>
<td>Proximal Convoluted Tubule</td>
</tr>
<tr>
<td></td>
<td>Distal Convoluted Tubule</td>
</tr>
</tbody>
</table>

Ureter                           | Renal Cortex                     |
Urethra                           | Renal Medulla                    |
Renal Medulla                     | Glomerulus                       |
Questions:

1. If a person loses a lot of body fat (say, by excess dieting), it will cause the kidneys to “drop” (ptosis). How would this affect a person and why?

2. The length of the Loop of Henle (“Nephron Loop”) determines the amount of water that can be reabsorbed into the bloodstream from the filtrate. Would you expect a desert-species of lizard to have longer or short Loops of Henle than a human? Why or why not?

3. Suppose that a patient was suffering from intense dehydration.
   a) What hormone would the body produce to compensate for the dehydration?
   b) What does this hormone do to the feeling of thirst?
   c) Where is this hormone made?
   d) What effect would this hormone have on the nephrons?
   e) How would this affect the urine concentration? What about its color? Why?

4. Suppose that a patient has been a heavy smoker for decades:
   a) What would be happening to the blood acidity? What is this condition called?
   b) How would this condition affect the smoker’s urine? Why?
Part II: Urinalysis.

1. Explain what each of the following urine abnormalities would indicate, and why:

   Presence of RBCs
   Presence of Ketones
   Presence of albumin
   Presence of pus
   Presence of glucose

2. Perform urinalyses for the patients provided and determine if the patient is normal or abnormal, and why. If abnormal, determine the patient’s condition from the urinalysis data.

<table>
<thead>
<tr>
<th></th>
<th>Pt. #1</th>
<th>Pt. #2</th>
<th>Pt #3</th>
<th>Pt #4</th>
<th>Pt #5</th>
<th>Pt #6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood/Hemoglobin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ketones</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is your conclusion for each of the patients? Are they normal or ill? Why?

When would blood in a urine sample be considered normal and not a pathology?
Complete the following table regarding the male reproductive organs.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Function</th>
<th>Internal or external?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epididymis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scrotum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vas Deferens</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seminal Vesicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prostate Gland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulbourethral Gland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erectile Tissues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. The seminal vesicles, prostate gland, and bulbourethral glands are considered to be “accessory reproductive glands.” Why?

2. How does the circulatory system relate to erectile tissues?
Complete the following table regarding the female reproductive organs.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Function</th>
<th>Internal or external?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ovaries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fallopian Tubes (uterine tubes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uterus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervix</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vagina</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bartholin’s (Vestibular) Glands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labia majora &amp; Labia minora</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clitoris</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Where does ovulation take place?
2. Where does conception/fertilization take place?
3. Where does pregnancy take place?

4. In what way are the testes and ovaries the same in terms of function? How about the vas deferens and fallopian tube? What about the clitoris and penis?

5. What is the vulva and what structures are included in it?
Part I: Reproductive Anatomy.

Identify the following structures on the diagrams or models:

<table>
<thead>
<tr>
<th>Testis</th>
<th>Epididymis</th>
<th>Scrotum</th>
<th>Vas Deferens</th>
<th>Seminal Vesicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>Ejaculatory Duct</td>
<td>Urethra</td>
<td>Bladder</td>
<td>Peni</td>
</tr>
<tr>
<td>Erectile Tissues</td>
<td>Penis Blood Vessels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ovaries</td>
<td>Fallopian Tubes</td>
<td>Uterus</td>
<td>Cervix</td>
<td>Vagina</td>
</tr>
<tr>
<td>Endometrium</td>
<td>Clitoris</td>
<td>Labia Majora</td>
<td>Labia Minora</td>
<td>Urethra</td>
</tr>
<tr>
<td>Anus</td>
<td>Mons Pubis</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Questions:

1. What makes the genetics of a “sex cell” different from a “somatic cell”? Why?

2. How does the egg “travel” down the Fallopian tubes if it doesn’t have a tail like sperm?

3. Some women develop ectopic pregnancies. What does this mean? Why is the pregnancy not viable?

4. Men can get inguinal hernias. Women can get uterine prolapse. What anatomically accounts for these two similar problems?

5. If a man has an enlarged prostate, what symptoms would you expect to see? Why?

6. Identify the following stages in the ovary diagram below:
   - Developing egg (oocyte)
   - Ovulation
   - Corpus Luteum

   At what stage is the endometrium the thickest? Why?
1. Discuss how each type of contraception works, in general.

Abstinence—

Withdrawal (*coitus interruptus* aka “pull and pray”)—

Physical Barriers (e.g., condoms)—

Chemical Barriers (e.g., spermicides—

Hormonal Regulation (e.g., birth control pills)—

Intra-Uterine (IUD)—

Fertility Awareness/Natural Family Planning—

Sterilization—

2. For each of the following people, determine the best method of contraception, and then justify your reasoning.

A young teenage couple--

A recently married couple who wish to delay children for three to five years--

A married couple who already have two children and do not want any more--

A single woman who wants to have a career and no children, ever--

A young, sexually active male who doesn’t want to “settle down”—

A prostitute addicted to heroin--
Questions:

1. If Sexually Transmitted Diseases (STDs) were an issue, what kinds of contraception would be the best? Why?

2. Are there more contraceptives available for men or women? Why might that be?

3. Natural Family Planning (NFP) relies on detecting a woman’s ovulation time to minimize conception.
   a) What are the hormonal signs that a woman is ovulating?
   b) What should happen to the cervix during ovulation? Why?
   c) Why is only ovulation time important for this method of contraception?

4. Some people consider abortion to be a method of contraception. Is this technically correct? Why or why not?

5. Does giving teenagers access to contraceptives increase the likelihood of sexual activity? Why or why not?

6. The United States has one of the highest rates of teenage pregnancy in the developed world. Why might this be? What would you do to deal with this problem?
Teratogens are substances (chemicals) that can cross the placenta and cause damage to a developing embryo or baby. The effect and severity of teratogens depends on the teratogen type, dosage, and timing of pregnancy.

Using the chart below as a guide, answer the following questions:

<table>
<thead>
<tr>
<th>Effects</th>
<th>Pre-natal Period</th>
<th>Embryo Period</th>
<th>Fetal Period</th>
<th>Full Term</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>weeks</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CNS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Limbs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Limbs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teeth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Genitals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ear</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chart adapted from *Human Biology* by Sturr & McMillan

1. If an embryo were exposed to Warfarin (an anti-coagulant rat poison) only during the first trimester (0-12 weeks), what might happen to the embryo? What about exposure only during the second trimester (12-24 weeks)?

2. Thalidomide babies are born with almost total loss of their limbs and with some ear defects. Speculate when thalidomide was taken by pregnant women to have caused these effects.

3. If a baby were born with mal-formed genitals, would it also have heart defects as well? Can you be sure?

4. What body system (area) is the most affected by teratogens throughout pregnancy? Why might that be? What are substances that would affect this system during gestation?
Successful pregnancy and embryonic development require a large number of changes to a woman’s body. The developing embryo must implant into the endometrium and successfully divide to form tissues and then organs, all while absorbing nutrients from the maternal blood supply.

**Part I: Pregnancy Structures.**

For each of the following characteristics/function, state the structure that would perform this task.

The fertilized egg is also known as an _____________

The organ that secretes estrogen and progesterone prior to pregnancy ________________

A hormone produced by the embryo to prevent menstruation. ________________

The organ that secretes estrogen and progesterone during pregnancy ________________

Fluid-filled sac surrounding the fetus is called the _____________

This structure allows blood to flow from the baby to the placenta and back again ________________

Finger-like projections of the blastocyst that can be sampled for genetic counseling are known as ____________________________

Name for the embryo after eight weeks of gestation ____________________________

**Questions:**

1. Why doesn’t a woman menstruate during pregnancy? What hormones would account for this? Where are they made?

2. What would happen to an embryo that failed to manufacture endoderm? Why?

3. a) What hormones are responsible for increasing production of milk prior to birth?   
   b) What hormones are responsible for ejecting the milk after birth?
4. Explain why the following symptoms of pregnancy occur. That is, what is causing them and why:

a) Breast size increases & areolae darken—

b) Pelvic ligaments relax—

c) Lordosis—

d) Number of RBCs may increase—

e) Nausea and heartburn—

f) Constipation & Incontinence or urinary urgency—

5. Why are the placental arteries blue and not red? Why is the placental vein red and not blue?

Label the following breast diagram with the following structures:

Nipple  Areola  Milk Glands  Milk Ducts

Can a woman every "run out of milk?" Why or why not?
**BI 172--Introductory A&P II**  
**Genetics Activity**

Fill in the following chart showing common, visible genetic traits of humans with the appropriate information:

<table>
<thead>
<tr>
<th>Trait</th>
<th>My Phenoype</th>
<th>My Genotype</th>
<th>Am I sure of the genotype?</th>
<th>Number in the class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tongue Roller / Non-roller</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free Ear Lobes/ Attached Lobes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Widow’s Peak / Straight hairline</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital Hair / No Hair</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimples / No Dimples</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freckles / No Freckles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Thumb / Right Thumb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Arm / Right Arm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Leg / Right Leg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight Hair / Wavy Hair / Curly Hair</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTC Taster / Non-taster</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. What would you have to do to be sure of your genotype(s)?

2. Are all dominant traits common? Why or why not?