

# **SYLLABUS: BIO K211 - ANATOMY & PHYSIOLOGY I**

Fall Semester, Aug 27, 2009 - Dec 16, 2009

Lecture: CRN 31188, Section T05, 6:00 - 9:00 Tuesday, Rm. E225

Lab: CRN 31189, Section T5A, 6:00 - 9:00 Thursday, Rm. A219

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Office Hours: Tuesday and Thursday; before or after class, or by appointment.

**COURSE:** BIO 211 - Anatomy & Physiology I is the first semester of a two semester sequence whose purpose is to facilitate the learning of body structure and function needed to serve as requirement for nursing and other allied health professions, as well as satisfy the lab science requirements for the Liberal Art/Sciences and General Studies major. In order to receive knowledge of all body systems, the student should complete this course along with BIO 212 - Anatomy & Physiology II. BIO 211 presents the students with a lecture/laboratory study of basic biological chemistry, cell, tissue, organ, body fluid and cavity organization and nervous, skeletal, and muscular. This is especially important if transferring to a four-year institution with a major requiring a full academic year of anatomy and physiology or if the student is enrolled in Three River's nursing.

**PRE-REQUISITE FOR THE COURSE:** General Biology I (BIO 121) and Concepts of Chemistry (CHE 111) or equivalent with a minimum grade of C or instructor's permission

**CREDIT:** 4 credit hours consisting of 3 contact hours of lecture and 3 hours of laboratory per week during the Fall semester.

**REQUIRED TEXTS:**

*Fundamentals of Anatomy and Physiology* by Frederic Marini, 7th edition, Benjamin-Cummings Publishers.

*Pictorial Anatomy of the Cat*, by Stephen Gilbert, University of Washington Press,

**OTHER REQUIRED MATERIALS:** Dissecting kit, disposable gloves, lab coat or apron which are available from the bookstore.

**ADDITIONAL REFERENCE TEXTS:** (optional)

*Applications Manual for Fundamentals of Anatomy and Physiology*, by Martini, Welch, and Newsome, 7th ed. Benjamin Cummings Publishers. (included free with the textbook)

*A Photographic Atlas for the Anatomy & Physiology Laboratory*, by K.M. Van De Graaff & J.L. Crawley, Morton Publishing Co. 6th ed.

*Fundamentals of Anatomy and Physiology, The Study Guide*, by Charles Seiger, Benjamin Cummings Publishers, 7th ed. ISBN: 0-13-046407-4

*Outline of Cat Anatomy with Reference to Human*, by Stephen Gilbert, Univ. of Washington Press 2000, ISBN: 0-295-97818-x

\*The texts listed above will also be used for BIO 212.

### **GENERAL COURSE OBJECTIVES:**

1. Provide students with a laboratory science to satisfy the science requirements of Three River's LAS or GS Associate Degree.
2. To fulfill pre-requisite and co-requisite anatomy and physiology requirements for Three River's Nursing.
3. To fulfill pre-requisite and co-requisite anatomy and physiology requirements for allied health programs.
4. Provide students with an undergraduate level study of human body systems.
5. Provide students with a foundation for study of the medical, biological, or physical sciences.
6. Provide students with critical thinking and problem solving skills.
7. Demonstrate the biological sciences and how they relate to other disciplines.
8. Illustrate the interdependence of all life forms operating on natural laws with the physical environment.
9. Encourage not only awareness of the student's natural uniqueness but also their role as an interrelated biological organism of this planet.

### **CLASS ATTENDANCE:**

Attendance of class is required. Attendance is taken. Absences can be very detrimental due to the nature of the material. An explanation of all absences is very much appreciated, especially if presented in advance when possible. It is the student's responsibility to obtain materials and notes for any classes that they miss.

**COLLEGE CLOSING:** For weather related closings call the college at (860) **886-0177**

### **METHODS OF STUDENT EVALUATION; GRADING POLICIES**

- A. The student's grade for the course represents their ability to master course objectives, attitude, rate of improvement, proficiency and knowledge of course material.
- B. Final course letter grades are determined by the total points accumulated. Students can estimate their progress toward a letter grade during the semester by using the table below after calculating their point percentage:

Letter Grade*	Approximated Percentages for Letter Grade	
A	100	92
A-	91.999...	90
B+	89.999...	87
B	86.999...	82
B-	81.999...	80
C+	79.999...	77
C	76.999...	72
C-	71.999...	70
D+	69.999...	65
D	64.999...	60
F	59.999...	0

\* The instructor reserves the right to use subjective evaluation, especially in cases where the final percentage score is on a borderline between grades

C. Points are obtained by the following methods of evaluation:

1. **Lecture (400 points plus 100 points from quizzes plus 30 points from pretest=530):**

- a. **Major Exams (400 points):** Four major exams worth 100 points each will be given. Each will evaluate the student's knowledge of the material given since the last major exam.
- b. **Weekly Quizzes of Lecture Materials for 100 points toward lecture points:** 10-11 quizzes worth 10 points each will be given once a week at the start of lecture class. The quizzes will include material since the previous quiz. The best 8 quiz scores count and the remaining lowest ones will be dropped.

**\*Missed Quizzes cannot be made-up and count as the lowest scores to be dropped**

- c. **Pretest of Basic Biology & Chemistry background (30 points):** A pre-test of 30 points over basic biology and chemistry knowledge will be given during the first week. If a score of 70% or higher is not attained, a post-test may be taken during the second week for 30 points if a score of 70% or higher is attained.  
*NOTE: 70% OR HIGHER WILL GIVE YOU THE FULL 30 POINTS*

2. **Laboratory (245 points):**

**Missed labs cannot be made up for logistical reasons.**

- \*a. **Special Quizzes (60 points):** A lab quiz over anatomical terminology worth 15 points and a lab quiz over the eye and ear worth 45 points will be given.
- \*b. **Practical exams (150 points):** Three identification type exams will be given: tissue identification, bone identification, and muscle identification. Each will be worth 50 points.
- c. **Lab reports (35 points):** A short report of a cellular biology lab exercise worth

15 points and a short report of an experiment of diffusion and osmosis, worth 20 points, will be written.

D. Exam and quiz questions for lecture and/or laboratory material may consist of multiple choice, true/false, fill in the blank, matching, or identification. Some questions might be reserved as an extra credit option.

E. Absence on examination days:

### **Students are required to take exams as scheduled**

F. Final letter grades for the course are determined by the following steps:

1. Lecture is worth 70% of the course grade.

Converting lecture points into a percentage score →

$$100 \times (\text{student's points} / \text{possible total points}) \times 0.7 = \text{lecture percentage.}$$

2. Lab is worth 30% of the course grade.

Converting laboratory points into a percentage score →

$$100 \times (\text{student's points} / \text{possible total points}) \times 0.30 = \text{lab percentage.}$$

3. lecture percentage + laboratory percentage = percentage number used to determine a course letter grade using the table above

### **Procedure for Withdrawing from the Course(s):**

A student who finds it necessary to discontinue a course must complete a withdrawal form obtained from the Registrar's Office. Students may withdraw up to **December 9**. The student may need to have the instructor's or their advisor's signature in order to withdraw and receive a "W" grade for the course. **Students who do not withdraw but stop attending will be assigned a "F" grade**, signifying failure and no credit. F grades count as courses attempted and may adversely affect the good standing status of the student receiving the grade.

### **Academic Integrity at Three Rivers**

*Academic integrity is essential to a useful education. Failure to act with academic integrity severely limits a person's ability to succeed in the classroom and beyond. Furthermore, academic dishonesty erodes the legitimacy of every degree awarded by the College. In this class and in the course of your academic career, present only your own best work; clearly document the sources of the material you use from others; and act at all times with honor.* (taken from the Academic Integrity policy of Three Rivers Community College)

### **Disabilities:**

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact the Disabilities Counseling Services. To avoid any delay in the receipt of accommodations, you should contact the counselor as soon as possible. Please note that I cannot provide accommodations based upon disability until I have received an accommodation letter from the Disabilities Counselor. Your cooperation is appreciated.

### **Revisions to the Syllabus**

The instructor reserves the right to revise the academic schedule, objectives, and/or topical outline contained in this syllabus

## **SPECIFIC OBJECTIVES FOR THE LECTURE PORTION OF THE COURSE**

Objectives with an \* will not be covered formally in class but students are expected to learn on their own and will be tested.

### **I. Pre-Requisite Competencies**

It is expected that the student be competent in knowledge of basic biology and chemistry so that a study of the human body's structure and functions can be undertaken. This may be accomplished by a variety of means, the preferred being that the student review selected content they have learned in BIO 121 (General Biology I) and CHE 111 (Concepts of Chemistry) or equivalent taken as the pre-requisite courses for Anatomy & Physiology I.

### **At the beginning of the semester, students will be given a "pre-test"**

consisting of multiple choice questions worth 30 points to determine the status of their basic biology/chemistry knowledge base and create a self review before the class starts. It is a pass/fail test. Therefore if a score of 70% or better is attained, the student is automatically given the full 30 lecture points. If a score of 70% or better is not attained, no points will be given\*\*.

However, the student can choose to take a "post-test" of the same point value. If a score of 70% or better is attained on the "post-test", the student's score will be changed from 0 to 30 (full point value given as if the student passed the "pre-test". The "post-test" is taken by appointment anytime before Exam #1 is given (see class schedule)

*\*\*Failing the "pre-test" is not justification for withdrawal from the course.*

Some of the competencies that are included in the pre/post testing deal with basic chemistry and cell biology which are covered in chapters 2 and 3 of the textbook and listed in the Part I topics below.

Below is an outline list of topics that will be covered in this course. **All topics in Part I are testable in the Pre and Post Tests**, and it is expected that the students have learned these topics in detail.

- I. \*A. Be able to discuss the importance of matter and energy as it relates to the make-up of the life process
  1. Define matter (solid, liquid, gas) and energy (potential versus kinetic and forms such as chemical, light, mechanical, nuclear, heat, etc.).
  2. Define chemical elements and list the symbols of and major functions of the biologically importance elements. Be aware that carbon, hydrogen, oxygen, and nitrogen are the most abundant elements making up the construction of life.
  3. Describe atomic structure by defining: atom, subatomic particles (protons, neutrons, electrons), atomic number, atomic mass (weight), isotopes, and

radioisotopes.

4. Be able to state what determines the difference of atoms of one element from another (atomic number).
5. If given the atomic number and atomic mass, be able to determine the number of protons, neutrons, and electrons making up the structure of those atoms.
6. Define electron energy levels (shells) and state the significance of the outermost energy level.

Organize matter into most complex structure by becoming familiar with the following:

7. Compare ionic and covalent bonding (single versus double versus polar).
8. Define compounds, molecules, and ions (cation versus anion).
9. When reading or writing ions in symbolic form, be able to interpret the superscript as to the type of electrical charge (positive or negative) and its intensity.
10. When reading or writing a formula for a chemical compound, be able to interpret what elements are combined together and in what proportion. If reading a structural formula, also be able to interpret what type of chemical bonds are involved and the basic shape of the molecule.
11. Define molecular weight. If given a formula for a chemical compound and the atomic weights of the elements involved, be able to determine the molecular weight.

\*B. Describe the basics of chemical reactions by accomplishing the following:

1. Define chemical reaction, reactants, and products.
2. Define metabolism, catabolism, anabolism, exergonic (exothermic), endergonic (endothermic), catalysts, and enzyme.

\*C. Discuss the chemical make-up of living organisms based upon types of chemical compounds.

1. State the differences between inorganic and organic compounds and in reference to organic compounds, be able to define macromolecule, monomer, and polymer.
2. Discuss the importance of water.
  - a. Define solution, solute, solvent, hydrophilic, and hydrophobic.
  - b. Define ionization, electrolyte, acid, base, salts, and minerals.
  - c. Discuss measurements of solution concentrations such as percentage, gram-percent (gm/dl), mg-percent (mg/dl), moles or millimoles/liter, milliosmoles/liter, milliequivalents per liter (mEq/l). (See page 17 of *Applications Manual*)
  - d. Be able to use the pH scale to measure the concentration of hydrogen ions in an aquatic solution such as body fluids. If given a pH number, be able to state if it is neutral, acidic or basic (alkaline) and its relative strength. Be able to define acidosis and alkalosis by you knowing the normal pH of human blood.
3. Be able to discuss the role of carbohydrates in the life process.
  - a. Relate carbohydrates to sugars and starches and state the primary function of carbohydrates.
  - b. Relate simple sugars to monosaccharides and state the significance of glucose.
  - c. Relate complex sugars to disaccharides and polysaccharides. Define sucrose, glycogen, starch, and cellulose (plant fiber)
  - d. Describe how monosaccharides can be bonded together to form disaccharides or polysaccharides by a chemical mechanism called dehydration synthesis. Describe how polysaccharides or disaccharides are broken apart into

- monosaccharides by a chemical mechanism called hydrolysis.
- e. Be able to recognize the basic molecular structure of a carbohydrate.
  4. Discuss the role of lipids in relation to the life process.
    - a. List the functions of lipids.
    - b. Be familiar with the terms: fatty acids (saturated versus unsaturated, trans fats),
    - c. glycerol, di- and triglycerides, steroids, fat-soluble vitamins (A,D,E,K), prostaglandins, and phospholipids.
    - d. Relate the chemical mechanisms of dehydration synthesis and hydrolysis to the conversion of simple lipids like fatty acids to complex like triglycerides and visa versa.
    - e. Be able to recognize the basic molecular structure of a fatty acid and a steroid.
  5. Discuss the role of proteins in relation to the life process.
    - a. Define amino acids.
    - b. List the functions of proteins.
    - c. Be able to recognize the basic molecular structure of an amino acid.
    - d. Relate the chemical mechanism of dehydration synthesis and hydrolysis to the conversion of amino acids to polypeptides and visa versa.
    - e. Define peptide bond, antigen, antibody, and enzyme.
    - f. Briefly describe the mechanism of enzyme function using the terms substrate, active site, and product. (see page 52-53 of Martini)
  6. Briefly discuss the role of nucleic acids in relations to the life process.
    - a. Define nucleotides and be able to list the different types of N-bases.
    - b. Briefly describe the purpose of DNA and RNA.
  7. Discuss the role of adenosine tri-phosphate (ATP) for energy storage and transfer in biological chemical reactions
    - a. Define adenosine tri-phosphate (ATP) and adenosine di-phosphate (ADP).
- \*D. Be able to discuss the cell as the basic structure of the human body.
1. Be able to list the components of the cell theory. (see p. 63 of Martini)
  2. Describe the anatomy and physiology of a typical cell by being able to label a diagram, and/or describe the function of the following cellular structures:
 

cell membrane	endoplasmic reticulum	centrioles
centrosome	-granular vs agranular	ribosomes
nucleus	nuclear membrane	golgi complex
nucleoplasm	lysosome	chromatin
mitochondria	nucleolus	cytoplasm
  3. Describe amoeboid, ciliary, and flagella movement of cells.
  4. Briefly describe the process of cell reproduction.
    - a. Define mitosis and state the significant outcome of the process.
    - b. Describe basic chromosome structure and know how many human cells have.
    - c. Describe the main intracellular events that occur during the phases of mitosis.
    - d. Briefly compare mitosis and meiosis.

**\*will not be covered in class**

## Lecture Topics Begin at this point (Part II)

### II. Basic Biological Organization of the Human Body

Upon completion of a study of basic organization of the human body, the student should be able to correctly answer questions concerning the following:

- A. Be able to list and describe the characteristics of living material.
- B. Be able to describe the various levels of organization from atoms through organism level.
- C. Be able to list the various body systems.
- D. At the cellular level of biological organization, be able to describe the following:
  1. Distinguish between unicellular versus multicellular life forms. In reference to multicellular, understand what is meant by cell differentiation.
  2. Associated with cellular structures, be able to define and discuss the following in relation to respiration and the mitochondrion.

metabolism ATP-ADP glucose glycolysis glycogenesis glycogenolysis gluconeogenesis	pyruvic acid acetyl co-enzyme A Kreb's cycle mitochondrial structure outer/inner membrane cristae matrix	substrate level phosphorylation oxydative phosphorylation aerobic respiration anaerobic respiration
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- E. Discuss the organization of the potential dorsal and ventral cavities.
  1. Distinguish between cranial and vertebral cavity.
    - a. State the contents of each.
    - b. Define meninges and state their function.
  2. Distinguish between the divisions of the ventral cavity.
    - a. List the major contents of the thoracic cavity.
    - b. Pertaining to the thoracic cavity, define

mediastinum visceral pleura parietal pleura	diaphragm pleural fluid pericardium	pericardial cavity pericardial fluid pleural cavity
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- c. List the major contents of the abdominal and pelvic cavity.
- d. Pertaining to the above cavities, define:

visceral and parietal peritoneum peritoneal cavity	peritoneal fluid diaphragm
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### III. Tissues:

Upon completion of a study of tissues, the student should be able to correctly answer questions concerning the following:

- A. Define tissues and list the four main tissue types.
- B. Describe epithelial tissue.
  1. List functions of epithelium, structural specialization's of epithelial cells, and how they maintain their integrity
  2. Classify epithelial tissue by cellular shape, layers, and associated structures.

3. Give an example of the location of the following epithelial types:

simple and stratified squamous	simple and stratified columnar
simple and stratified cuboidal	ciliated pseudostratified columnar
transitional germinal epithelium	neural epithelium

4. Briefly organize glandular epithelium into endocrine versus exocrine, simple versus compound and modes of secretion.

C. Be able to discuss connective tissue

1. List the functions of the tissue.
2. Contrast connective tissue to epithelium using the terms extracellular protein fibers, ground substance, and matrix.
3. Distinguish between types of intercellular material by defining:

connective tissue proper	reticular fibers
fluid connective tissue	elastic fibers
supporting connective tissue	collagenous fibers
dense vs loose connective tissue	chondroitin sulfate
regular vs irregular connective tissue	

4. Define and state the function of the following connective tissue cells:

mesenchyme	osteocyte	hemocytoblast
adipocyte	osteoblast	mast cell
plasma cell	erythrocyte	chondrocyte
osteoclast	leukocyte	fibroblast
macrophage	platelet	melanocyte

5. Describe the structure and locations of the following types of connective tissue.

loose	adipose	elastic cartilage
dense	reticular	fibrocartilage
regular	elastic	fibrous
irregular	collagenous	bone
areolar	hyalin cartilage	blood

6. Describe the microstructure of cartilage by defining or labeling a diagram the following: perichondrium, matrix, lacuna, chondrocytes.

7. Describe the microstructure of bone by defining or labeling a diagram the following: matrix, lacuna, Haversian canal, osteocytes, lamella, canaliculi, osteon.

8. Compare the differences and similarities of providing nutrients to chondrocytes of cartilage versus osteocytes of bone.

D. Be able to describe muscle tissue.

1. Describe the functions of and the characteristics of muscle tissue.
2. Describe the basic structural characteristics and location of skeletal, smooth, and cardiac muscle.

E. Briefly describe nervous tissue. (p. 134-135 of Martini only)

1. Briefly describe the characteristics of the tissue.
2. Briefly define: neuron, cell body, axon, dendrite, and neuroglia.

#### IV. Skin:

Upon completion of a study of the integumentary system, the student should be able to correctly answer questions concerning the following:

- A. Define an organ, based upon tissue types functioning together, by using skin as an example.
- B. List the functions of skin.
- C. Describe or label on a diagram, the following skin structures:

epidermis	keratinocytes	sweat glands
stratum corneum	keratin	nerve receptors
stratum granulosum	dermis	pilomotor (arrector pili)
stratum basale	Hair (follicles, root, shaft)	muscle
melanocytes	sebaceous glands	ceruminous glands
		mammary glands

#### V. Organization and Communication Between Fluid Compartments:

Upon completion of a study of fluid compartments, the student should be able to correctly answer questions concerning the following:

- A. Be able to discuss the organization of the body into fluid compartments.
  1. Define: total body water, intracellular fluid, extracellular fluid, plasma and interstitial fluid.
  2. State the normal quantity of fluid in each of the above.
  3. Discuss the effect of age, sex, and quantity of adipose tissue on percentage of body weight made up of fluid.
  4. Discuss the relative distribution of different types of electrolytes and protein between the fluid compartments.
  5. List the normal routes of intake and output of fluids.
  6. List miscellaneous extracellular fluid compartments.
  7. State the route of communication between intracellular and interstitial fluids and between interstitial and plasma fluid compartments.
- B. Discuss transport of materials through the cell membrane.
  1. Describe the molecular construction of the cell membrane.
    - a. Define phospholipid bilayer
    - b. Organize membrane proteins into the following and be able to define each:

integral vs peripheral protein	enzymes
fibrous vs globular protein	receptors
anchors	carrier (transport) proteins
recognition proteins	channel proteins (leak vs gated)

2. Define permeability and its various degrees.
3. Discuss the following methods of moving chemicals through the cell membranes and factors influencing each:

diffusion	osmosis	passive transport
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active transport filtration	pinocytosis endocytosis	phagocytosis exocytosis
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4. Relating to osmosis, define isotonic, hypertonic, hypotonic, crenation, plasmolysis, hemolysis, normal saline, 5% dextrose, lactate Ringer's solution.
  5. Define transmembrane potential and state the cause of a resting membrane potential by relating diffusion, leak channels, and active transport of  $\text{Na}^+$  and  $\text{K}^+$  and explaining the Na-K pump.
- C. Discuss communication between plasma and interstitial fluid via capillaries.
1. Describe the general structure of a capillary.
  2. Define the following and relate them to inward and outward movements fluids through capillary walls:

capillary pressure tissue pressure effective hydrostatic pressure plasma colloid osmotic pressure	tissue colloid osmotic pressure effective osmotic pressure filtration pressure absorption pressure
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- D. Discuss the role of the lymphatic system for body fluid regulation.
- \*1. Describe the basic anatomy of the lymphatic system.
  - \*2. Describe routes of lymphatic drainage for various areas of the body.
  - \*3. Discuss the composition of, formation of, purpose of, and movement of lymph.
  - \*4. List structures not drained by lymphatics.
  - \*5. List various causes of edema.

**\*will not be covered in class**

## VI. Skeletal System:

Upon completion of a study of the skeletal system, the student should be able to correctly answer questions concerning the following:

- A. List the major functions of the skeletal system.
- \*B. Describe the microscopic construction of bone tissue (review objective III-C-7, p 10).
- C. Organize the skeleton into axial and appendicular portions.
- D. Organize bones into long, short, flat and irregular.
- E. Diagram and discuss the structure of long bones using the following terms:

epiphysis diaphysis articular cartilage periosteum metaphysis endosteum	epiphyseal plate medullar cavity red and yellow marrow spongy and compact bone trabeculae
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- F. Differentiate between intramembranous and endochondral ossification.
- G. Define and state the cause of the vertebral column curvatures.
- H. Organize skeleton articulations (joints).
  1. Define articulation and classify them into synarthrosic, amphiarthrotic, or diarthrosic according to degree of movement permitted.
  2. Classify joints according to structure into sutures, synchondrosis,

syndesmosis, symphysis, and synovial.

3. Diagram and discuss the basic structure of a synovial joint.

\*I. Define the following joint movements:

flexion extension abduction adduction rotation	circumduction inversion eversion supination pronation	protraction retraction dorsiflexion plantarflexion
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\*J. Define: ligament, tendon, tendon sheath, and bursae

**\*will not be covered in class**

## VII Nervous System:

Upon completion of a study of the nervous system, the student will be able to correctly answer questions concerning the following subject matter:

A. Describe the overall construction, organization, and terminology associated with nervous tissue.

1. List the specialized characteristics of nervous tissue.
2. Describe the organization of neurons.

a. Describe the following parts of the neuron:

cell body, axon, dendrites,	teledendria, myelin sheath,	node of Ranvier, Schwann cells
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\*b. Differentiate between the following types of neurons:

myelinated non-myelinated unipolar	bipolar multipolar alpha, beta, and gamma	motor sensory internuncial
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3. Define neuroglia (glial cells).

4. Describe the structure of a nerve.

a. Be able to define epineurium, perineurium, endoneurium, and fasciculi as parts of a nerve.

\*b. Distinguish between motor, sensory, and mixed nerves.

\*5. Define the following nervous system terminology:

central nervous system peripheral nervous system receptor	somatic visceral effector	ganglia sensory (afferent) motor (efferent)
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\*6. Distinguish between gray and white matter by defining:

cortex, nuclei, horns,	associational, projectional, ascending and descending	nerve tracts, commissural,
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B. Discuss the processes involved in nerve impulse generation and conduction using

such terms as:

ion channels (discuss types) sodium-potassium pump transmembrane potentials resting membrane potential	depolarization repolarization graded potential threshold potentials	action potentials hyper-hypopolarization refractory periods (absolute, relative)
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C. Diagram and describe the synapse.

1. Be able to define synapse.
2. Relate the following to synapses:

bouton synaptic cleft pre-postsynaptic membrane synaptic vesicles	neurotransmitter spacial summation EPSP IPSP	calcium adrenergic cholinergic temporal summation
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3. Be able to list and discuss chemicals used as neurotransmitters.
5. Compare and contrast adrenergic and cholinergic synapses and receptors involved

D. Diagram and discuss the anatomy of the brain.

1. Define and list the main structures of the telencephalon, diencephalon, mesencephalon, rhombencephalon, brain stem, and diagram the connection of each.
2. Diagram and describe the cerebrum using the following terms:

cerebral hemisphere cerebral cortex longitudinal fissure central sulcus lateral fissure transverse fissure	frontal lobe parietal lobe occipital lobe temporal lobe	convolutions sulcus fissure primary motor area pre-motor area	somesthetic area corpus callosum optic chiasma basal nucleus lymbic system
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- \*3. Describe the location of and list the functions of the following lower brain structures: thalamus, hypothalamus, midbrain, pons, medulla, cerebellum.

E. Diagram and discuss the parts of and the function of the spinal cord.

1. Given a diagram of a cross-section view of the spinal cord, be able to divide the gray matter into anterior and posterior horns.
2. State the purposes of the following spinal nerve tracts: spinocerebellar, funiculus gracilis, funiculus cuneatus, rubrospinal, spinothalamic, corticospinal, pyramidal, and extrapyramidal.
3. State the level at which the spinal cord terminates.
4. Define cauda equina.
5. Divide the spinal cord into cervical, thoracic, lumbar, and sacral segments.

F. Describe the anatomy and function of the meninges by defining dura mater, venous sinus, epidural space, subdural space, arachnoid mater, subarachnoid space, and pia mater.

**\*will not be covered in class**

G. State the origin and trace the path of circulation of cerebro-spinal fluid using the

following terms:

choroid plexus	aqueduct of Sylvius
lateral ventricles	4th ventricle
foramen of Monroe	foramen of Luschka and Magendie
3rd ventricle	arachnoid villi

- H. Discuss the organization of the peripheral nervous system.
- \*1. State the name, number, and general function of the cranial nerves.
  - \*2. Describe spinal nerves.
    - a. State the total number and number of cervical, thoracic, lumbar, and sacral, and coccygeal.
    - b. Describe the origin of spinal nerves by defining dorsal and ventral roots, dorsal root ganglia, anterior and posterior rami.
  - \*3. Define, state the location of, and the spinal nerves involved in the make-up of the cervical, brachial, lumbar, and sacral plexus.
  - \*4. State the general location and function of the following peripheral nerves: axillary, musculocutaneous, radial, median, ulnar, femoral, obturator, sciatic, pudendal, and phrenic nerves.
  - \*5. Organize receptors into types: exteroceptors, proprioceptors, and interoceptors. Briefly state the functions of the following exteroceptors: free dendritic endings, Merkel discs, Meissner's, Ruffini's, and Pacinian corpuscles
- I. Describe the reflex arc as the basic function of the nervous system.
- 1. Using the spinal cord, correctly locate sensory, internuncial, and anterior horn cells and describe the path of impulse conduction for the myotactic (knee jerk), and withdrawal reflex.
  - 2. Trace the pathway sensory nerve impulses would take as they ascend up the spinal cord to the brain using the dorsal column and spinalthalamic tracts.
  - 3. Trace the pathway motor nerve impulses would take as they descend down the spinal cord from the brain using the corticospinal tracts.
- J. Define the purpose of and describe the make-up of the autonomic nervous system.
- 1. Contrast autonomic and somatic reflexes.
  - 2. Discuss the difference between the parasympathetic and sympathetic divisions using such terms as:

craniosacral	post-ganglionic fibers	mesenteric ganglia
thoracolumbar	sympathetic chain ganglia	adrenergic fibers
pre-ganglionic fibers	*celiac, superior and inferior	cholinergic fibers

- 3. Be able to describe the effect of sympathetic or parasympathetic stimulation on any major visceral organ.

**\*will not be covered in class**

## VIII. Myology (study of muscle)

Upon completion of a study of muscle tissue, the student should be able to correctly answer questions concerning the following:

- A. List and define properties of muscle tissue.
- B. Contrast skeletal, smooth, and cardiac muscle tissue according to cellular structure, location, arrangement, innervation, and physiological properties.
  1. Describe cellular structure of the three muscle types using the following terms:

muscle fiber	myofibrils	I, A, H, and Z bands
sarcolemma	multinucleated	intercalated discs
sarcoplasm	striations	tight junctions

2. Describe location of the muscle types.
  3. Contrast innervation of muscle tissue types and define motor end plate.
  4. Define motor unit.
  5. Contrast the basic physiological differences between muscle tissue types according to speed of contraction, latent period, fatigue, refractory periods all or none principle, tonus, tetany, isometric and isotonic contraction.
- C. Describe the overall anatomy of a skeletal muscle.
1. Describe the gross structure of a skeletal muscle by defining origin, insertion, and belly.
  2. Describe muscle attachments such as tendons and aponeuroses.
  3. Describe the fascia arrangement using the terms: epimysium, fasciculus, perimysium, and endomysium.
- D. Describe the ultra-micro structure of skeletal muscle fibers using the following terms:

motor end plate	sarcoplasm	T-tubules	cross bridges
sarcolemma	calcium	triad	Z-bands
myofibrils	sarcoplasmic reticulum	myofilaments	sarcomere
synaptic cleft	longitudinal tubules	actin	troponin
synaptic vesicles	cisternae	myosin	tropomyosin

- E. Describe the contractile mechanism for skeletal muscle.
1. Discuss stimulation of the muscle fiber by describing the conduction across the motor end plate, depolarization of the sarcolemma and conduction into the myofibrils by T-tubules.
  2. Describe release of calcium ions and the calcium pump associated with the sarcoplasmic reticulum.
  3. Describe the ratchet theory of contraction using the relationships of calcium, actin complex, myosin, troponin, tropomyosin, ATP, ADP, creatine phosphate, and creatine.
  4. Discuss ATP replacement by defining aerobic, anaerobic respiration, lactic acid, and oxygen debt.
  5. List causes of skeletal muscle fatigue.
  6. List the effects of exercise on skeletal muscle.
- F. Discuss how muscles work as groups using such terms as prime mover, synergistic muscles, and antagonistic muscles.
- \*G. Identify the location of major muscles and muscle groups of the body.  
(Correlation with lab work)

**\*will not be covered in class**

## **SPECIFIC OBJECTIVES FOR THE LABORATORY PORTION OF THE COURSE**

Laboratory content is divided into the following learning units.

### **I. Introduction to the Human Body Lab**

Upon completion of the following laboratory studies, the student should be able to correctly answer questions concerning the following:

- A. Discuss the derivation of medical terminology.
- B. Define and correctly use anatomical directions, planes, and regions when describing the human body.
- C. Organize the body into its potential body cavities and list major organs found in each.
- D. Locate exterior features and landmarks of the human body.

### **II. Cell Structure and Mitosis Lab**

Upon completion of a lab study of microscopic usage, cell structure, and mitosis, the student should correctly complete a lab report.

- A. Identify the major parts of a microscope and use the instrument effectively in study.
- B. Be able to prepare a wet-mount slide for study under a microscope.
- C. Identify major cellular structures with a light microscope using a variety of live and prepared specimens.
- D. Identify cells in various stages of mitosis.

### **III Identification of Tissues Lab**

The following tissue types are to be correctly identified by the student on a lab practical exam:

- A. Epithelial tissue:
 

1. simple squamous	5. simple columnar
2. stratified squamous	6. stratified columnar
3. simple cuboidal	7. ciliated pseudostratified columnar
4. stratified cuboidal	8. transitional
  
- B. Connective tissue:
 

1. areolar	6. fibrocartilage
2. adipose	7. elastic
3. reticular	8. collagenous
4. hyalin cartilage	9. bone
5. elastic cartilage	10. blood cells (erythrocytes, leukocytes, platelets)
  
- C. Muscle tissue: (smooth, skeletal, versus cardiac)
- D. Nervous tissue: (neurons versus glial cells)

### **IV. Principles of Diffusion and Osmosis Lab**

Upon completion of experimental procedures and terminology associated with diffusion through a liquid and colloidal solution, osmotic pressure, and tonicity, the student should correctly complete a laboratory report of their data and conclusions.

### **V. Anatomy and Physiology of the Ear Lab**

Upon completion of a study of the ear, the student should be able to correctly answer questions concerning the following:

- A. Describe the anatomy of the ear by locating and stating the functions of the following:

temporal bone mastoid process outer, middle, inner ear cerumenous glands auricle tympanic membrane ear ossicles malleus -incus	stapes scala vestibula eustachian tube stapedius basilar membrane tensor tympani semicircular canals cochlea scala tympani oval window round window vestibular membrane	cochlear duct (scala media) tectoral membrane organ of Corti vestibular-cochlear nerve endolymph perilymph
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\*B. Define middle ear (bone) and nerve deafness.

**\*will not be covered in class**

## VI. Anatomy and Physiology of the Eye Lab

Upon completion of a study of the eye and its associated structures, the student should be able to correctly answer questions concerning the following:

- A. List the five special senses.  
B. Briefly describe the orbits.  
1. List the openings into the orbit and their purpose.  
2. List the contents of the orbit.  
C. Describe the construction of the anterior coverings of the orbit.  
1. State the purpose of the eyelids.  
2. Define medial and lateral angles, palpebral fissure, conjunctiva, conjunctival sac, tarsal plates, and their associated glands.  
3. Locate, state the nerve supply, and the function of the levator palpebral superioris and orbicularis oculi muscle.  
D. Describe the lacrimal apparatus.  
E. Locate, state the nerve supply, and the function of the muscles that move the eyeball.  
F. Describe the anatomy of the eye by locating and stating the functions of the following:

sclera	ciliary body	optic disc
cornea	suspensory ligaments	anterior and posterior cavity
choroid	retina	anterior and posterior chamber
iris	rods and cones	aqueous humor
pupil	macula	vitreous humor
lens	fovea centralis	optic nerve

\*G. Define the following

ptosis	astigmatism
glaucoma	conjunctivitis
myopia	accommodation
hypermetropia	refraction

H. Successfully complete the following optional exercises:

near point of accommodation	two-point discrimination
visual acuity	location of tastebuds

color blindness  
 Rinne and Weber hearing test  
 localization

examination of retina  
 examination of tympanic membrane  
 olfactory nerve testing

**\*will not be covered in class**

## VII Anatomy of the Skeleton Lab

Upon completion of a study of the skeleton, the student should be able to correctly identify the following on a timed laboratory practical examination.

- A. Be familiar with the following terms as they apply to skeletal parts.
- |         |            |        |         |
|---------|------------|--------|---------|
| condyle | trochanter | fossa  | spine   |
| crest   | tubercle   | sinus  | foramen |
| head    | tuberosity | meatus |         |
- B. Identify any bone as a member of the axial or appendicular skeleton.
- C. Given a human skull, accurately identify the following bones and their details:
1. frontal bone
    - a. frontal sinus
    - b. supraoptic foramen
  2. parietal bone
  3. temporal bone
    - a. mastoid process
    - e. mandibular fossa
    - b. external auditory meatus
    - f. styloid process
    - c. zygomatic process
    - g. carotid canal
    - d. zygomatic arch
    - h. jugular foramen
  4. occipital bone
    - a. foramen magnum
    - c. occiput (external occipital protuberance)
    - b. occipital condyles
  5. sphenoid
    - a. sella turcica
    - c. foramen ovali
    - b. optic foramen
    - d. foramen rotundum
    - c. sphenoid sinus
  6. ethmoid
    - a. cribriform plate
    - d. ethmoid sinus (air cells)
    - b. concha
    - e. perpendicular plate
    - c. crista galli
  7. maxillary bone (maxilla)
    - a. alveolar process
    - c. infraorbital foramen
    - b. maxillary sinus
  8. zygomatic
    - a. temporal process
    - b. zygomatic arch
  9. lacrimal
  10. palatine
  11. nasal
  12. vomer
  13. mandible
    - a. body
    - d. coronoid process
    - g. body
    - b. condyloid (condylar) process
    - e. ramus
    - h. mental foramen
    - c. alveolar process
    - f. angle
    - i. mandibular foramen
  14. hyoid
  15. other structures

- a. orbits (superior and inferior orbital fissures)
  - b. sagittal suture
  - c. coronal suture
  - d. lambdoidal suture
  - e. squamosal suture
- D. If given a vertebra, identify its basic parts:
- |  |                                     |
|--|-------------------------------------|
| spinous process                                | odontoid process (dens) (axis only) |
| transverse process                             | demifacet (thoracic only)           |
| superior and inferior articular process/facets | transverse foramen (cervical only)  |
| pedicle  | intervertebral foramen              |
| vertebral foramen                              | lamina                              |
| body   |                                     |
- E. Identify the intervertebral disc and define its parts; annulus fibrosus and nucleus pulposus (p. 269-270). Discuss disc problems (p. 276)
- F. List the types and number of vertebrae, according to their locations. If given an individual vertebrae, be able to identify if it is a cervical, thoracic, lumbar, or sacral.
- G. Identify the first two cervical vertebrae as the atlas and the axis and state how each allows head movement.
- H. If given a sternum, differentiate between its manubrium, body, xiphoid process, sternal (jugular) notch, and sternal angle
- I. State the number of pairs of and the difference between true, false, and floating ribs and identify the following parts: body or shaft, head, neck, tubercle, angle, costal groove, costal cartilages, and intercostal spaces.
- J. Identify the following bones of the pectoral girdle and their details:
1. clavicle
    - a. sternal end
    - b. acromial end
  2. scapula
    - a. supraspinous fossa
    - b. infraspinous fossa
    - c. subscapular fossa
    - d. glenoid fossa
    - e. acromion process
    - f. spine
    - g. coracoid process
    - h. superior and inferior angle
    - i. body
- K. Identify the following bones of the upper extremities and their details:
1. humerus
    - a. head
    - b. greater tubercle
    - c. lesser tubercle
    - d. medial epicondyles
    - e. lateral epicondyles
    - f. capitulum
    - g. trochlear
    - h. olecranon fossa
    - i. coronoid fossa
    - j. bicipital (intertubercular) groove
    - k. anatomical/surgical neck
  2. ulna
    - a. olecranon process
    - b. semilunar (trochlear) notch
    - c. coronoid process
    - d. radial notch
    - e. styloid process
  3. radius
    - a. styloid process
    - b. ulnar notch
    - c. head
  4. carpals: scaphoid, lunate, triquetrium, pisiform, trapezium, trapezoid, capitate, hamate (Also define carpal tunnel and carpal tunnel syndrome)
  5. metacarpals: I - V
  6. phalanges: proximal, middle, distal
- L. Identify the pair of coxal (innominant), that as hip bones, form the pelvic girdle. Identify the areas of the coxal bone that are the ilium, ishium, and pubis. Also identify the following features:
1. iliac crest
  8. greater or false pelvis

2. pubic symphysis
  3. anterior superior iliac spine
  4. greater sciatic notch
  5. ischial tuberosity
  6. acetabulum
  7. obturator foramen
  9. lesser or true pelvis
  10. pelvic brim
  11. posterior superior iliac spine
  12. ischial spine
  13. pelvic inlet
- M. Identify the following bones of the lower extremities and their details:
1. femur
    - a. head
    - b. neck
    - c. greater & lesser trochanter
    - d. shaft
    - e. medial & lateral condyles
    - f. medial & lateral epicondyle
  2. patella
  3. tibia
    - a. medial and lateral condyles
    - b. medial malleolus
    - c. tibial tuberosity
  4. fibula
    - a. head
    - b. lateral malleolus
  5. tarsals: calcaneus, talus, navicular, cuboid, cuneiforms (first, second, third)
  6. metatarsals: I - V
  7. phalanges: proximal, middle, distal

### VIII. Dissection of Major Skeletal Muscles of the Cat

Upon completion of dissection, the students should be able to correctly identify the following muscles on a dissected cat, a diagram of human musculature, and/or upon themselves on a laboratory practical exam.

- A. Superficial Thoracic Muscles:
1. pectoralis major
  2. pectoralis minor
- B. Abdominal wall muscles:
1. external abdominal oblique
  2. internal abdominal oblique
  3. linea alba (a line of connective tissue on midline where the aponeuroses of the above muscles fuse together)
  4. transversus abdominis
  5. rectus abdominis
- C. Deep Thoracic muscles:
1. serratus ventralis (anterior)
  2. scalenus ("the scalenes)
  3. external intercostals
  4. internal intercostals
- D. Superficial back muscles:
1. clavotrapezium
  2. clavobrachialis
  3. acromiotrapezius
  4. spinotrapezius
  5. latissimus dorsi
- E. Deep back muscles:
1. multifidus spinae
  2. longissimus dorsi
  3. spinalis dorsi
- F. Muscles of the neck:
1. sternomastoid
  2. cleidomastoid
  3. sternohyoid
  4. sternothyroid
  5. cricothyroid
  6. digastric
  7. mylohyoid
  8. thyrohyoid
- G. Deep muscles of the neck and back:
1. rhomboideus minor (cervicis)
  2. rhomboideus major (thoracis)
  3. splenius

- H. Muscles of the head:
1. masseter
  2. temporalis
- I. Shoulder muscles:
1. supraspinatus\*
  2. infraspinatus\*
  3. teres major\*
  4. subscapularis\*
  5. acromiodeltoid
  6. spinodeltoid
  7. teres minor
- \*"rotator cuff" muscles
- J. Muscles of the upper arm (brachium)
1. biceps brachii
  2. triceps brachii
  3. brachialis
- K. Superficial muscles of the medial side of the thigh:
1. sartorius
  2. gracilis
- L. Superficial muscles of the lateral side of the thigh:
1. biceps femoris☒
  2. tensor fascia latae
- M. Deep muscles of the medial side of the thigh:
1. pectineus
  2. adductor longus
  3. adductor femoris
  4. psoas major
  5. semimembranosus☒
  6. semitendinosus☒
- ☒"hamstring" muscles
- N. Deep muscles of the lateral side of the thigh
1. vastus medialis●
  2. rectus femoris●
  3. vastus lateralis●
  4. vastus intermedius●
  5. semimembranosus (deep surface)
  6. semitendinosus (deep surface)
- "quadriceps (quads) femoris" group
- O. Muscles of the calf
1. tibialis anterior (cranialis)
  2. gastrocnemius
  3. soleus
- P. Muscles of the hip
1. gluteus maximus◆
  2. gluteus medius
- ◆Note the position of the sciatic nerve deep to the belly of this muscle

## TOPICAL OUTLINE - BIO 211 - HUMAN ANATOMY & PHYSIOLOGY I

- I. Review of chemical organization of Life
- A. Matter and energy
1. Elements of life
  2. Atoms, ions, and molecules
  3. Chemical bonding
- B. Chemical makeup of life
1. Water, solutions, and measurement
  2. Biological organic compounds
- C. Chemical reactions
1. Types of metabolic reactions
  2. ATP
  3. Role of enzymes and nucleic acids

## II. Review of cellular structure and organization

- A. Cell theory
- B. Cellular structure and function
  - 1. Organelles and inclusions
  - 2. Respiration
  - 3. Movement
  - 4. Mitosis

## III. Organization of the Human Body

- A. Structural interrelationships
- B. Homeostasis and feedback regulation
- C. Respiration
- D. Body cavities
  - 1. Dorsal cavity
    - a. subdivisions
    - b. contents
    - c. meninges
  - 2. Ventral cavity
    - a. subdivisions
    - b. contents
    - c. pleura and peritoneum
- E. Anatomical directions, planes, and regions

## IV. Tissues

- A. Definition and types of tissues
- B. Organization of epithelium
- C. Organization of connective
- D. Muscle and nervous

## V. Skin as an example of an organ

- A. Functions of skin
- B. Epidermal and dermal structures

## VI. Fluid compartment organization

- A. Fluid compartments
  - 1. Definitions and quantities
  - 2. Chemical compositions
  - 3. Intake and output
- B. Cell membrane physiology
  - 1. Molecular structure
  - 2. Transport across cell membranes
  - 3. Membrane electrical potentials
- C. Capillary dynamics
  - 1. Structure
  - 2. Pressures
- D. Lymphatic system

## VII. Skeletal system

- A. Organization and general structure
- B. Ossification

- C. Vertebral column curvatures
- D. Joint organization and movements
- E. Anatomy of the skeleton

### VIII. Nervous system

- A. Overall construction, organization and terminology
  - 1. Neurons
  - 2. Nerves
- B. Nerve impulses
- C. Synapses
- D. Central nervous system
  - 1. Brain
  - 2. Spinal cord
  - 3. Meninges
  - 4. Cerebrospinal fluid
- E. Peripheral nervous system
  - 1. Cranial nerves
  - 2. Spinal nerves and nerve plexus
  - 3. Major peripheral nerves
  - 4. Sense receptors
  - 5. Reflex arcs
  - 6. Autonomic nervous system
  - 7. Eye and ear and other special senses

### IX. Muscular system

- A. Organization, structure, and characteristics of muscle tissue
- B. Anatomy of a typical skeletal muscle
- C. Microstructure of skeletal muscle fibers
- D. Physiology of contraction
- E. Location of major skeletal muscles

## Tentative Academic Schedule – Lecture - **Fall Semester, 2009**

All readings are from *Fundamentals of Anatomy & Physiology*, by Martini, Prentice Hall Publishers unless otherwise stated.

Class #	Date	Topic, Text Chapters
1	Sept 1	Review of Biological & Chemical Organization , Tissues & Fluids, Chap 1, 2, 4
2	Sept 8	Compartmentalization, Anatomical references Chap 1, 2, 4
3	Sept 15	Integumentary System Chap 4 & 5
4	Sept 22	Integumentary System Chap 4 & 5
5	Sept 29	<b>Test 1</b> then Lecture: Skeletal System, Chap 6, 7, 8, 9
6	Oct 6	Skeletal System, Chap 6, 7, 8, 9
7	Oct 13	Skeletal System, Chap 6, 7, 8, 9
8	Oct 20	<b>Test 2</b> then Lecture: Nervous System, Chap 12, 13, 14, 15, 1, 17
9	Oct 27	Nervous System, Chap 12, 13, 14, 15, 1, 17
10	Nov 3	Nervous System, Chap 12, 13, 14, 15, 1, 17
11	Nov 10	Nervous System, Chap 12, 13, 14, 15, 1, 17
12	Nov 17	Nervous System, Chap 12, 13, 14, 15, 1, 17
13	Nov 24	<b>Test 3</b> then Lecture: Muscle, Chap 10, 11
14	Dec 1	Muscle, Chap 10, 11
15	Dec 8	Muscle, Chap 10, 11
16	Dec 15	<b>Test 4</b>

## Tentative Academic Schedule – Lab

Lab	Date	Activity
1	Aug 27	Lecture: levels of organization, glycolysis, aerobic respiration, oxidative phosphorylation
2	Sept 3	<b>Pre-test</b> / Anatomical Terminology; (lab handout)
3	Sept 10	<b>Quiz</b> over anatomical terminology followed by: Cell Structure and Mitosis lab exercise (chap. 3 and lab handout) <b>Post-test</b>
4	Sept 17	Tissue anatomy; microscopic examination: (chap. 4 and lab handout)
5	Sept 24	Muscle and Nervous tissue lecture followed by Tissue anatomy (con't.)
6	Oct 1	Diffusion and osmosis lab experiment, (chap. 3 and lab handout)
7	Oct 8	<b>Lab practical exam</b> over tissues; Special senses - ear lab; chap. 17, <i>Applications Manual</i> : pp. 104-106 and handout
8	Oct 15	Special senses (con't) - eye lab (with dissection*) chap. 17 and handout
9	Oct 22	<b>Quiz</b> over eye/ear anatomy: Begin study of bones; chap. 6-9
10	Oct 29	Skeletal anatomy study (con't)
11	Nov 5	Cat muscle dissection*; (Muscles chapter in Gilbert and chap. 11 in Martini)
12	Nov 12	<b>Lab practical exam</b> over bones followed by Muscle dissection* (con't)
13	Nov 19	Muscle dissection* (con't)
14	Dec 3	<b>Lab practical exam</b> over muscles
15	Dec 10	Lecture: Myology
*dissection tools required; gloves recommended		

