Biology 2401
Human Anatomy and Physiology I
Summer 2019

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Course description: This course will examine histology, the integument, the skeletal system, the muscular system and the nervous system of the human and other mammals.
Prerequisite—C or better in Biol 1406 or equivalent.

Course objectives:
1) Identify the structures and understand functions of tissues, integument, skeletal, muscular, and nervous systems.
2) Understand the interrelationships among the various organ systems.
3) Understand regulatory mechanisms and homeostatic control of the organism.
4) Develop an understanding of the organism as a “whole” and the contributions each organ system makes.

Course Management:
This course will rely heavily on teams and team-work. You will be sorted into teams on the first day in lab. Teams will consist of 4 (or 3) people. A considerable portion of your grade will depend on your team members.

Required Materials: available in the bookstore and elsewhere.

1. TEXTBOOK: FREE TEXTBOOK at www.openstaxcollege.org OR ANY college level Human Anatomy and Physiology Text, Current or one previous edition.
   Suggested Authors: Seeley, Marieb, Tortora, Martini, Amerman (Do NOT purchase or use Hole’s book).
2. LAB BOOK: Human Anatomy and Physiology Laboratory Manual, 11th ed. (10th or 9th ed) by Marieb and Mitchell
   3. Scantrons for quizzes, lecture and lab exams.

Attendance:
Regular attendance in this class is ESSENTIAL and is your responsibility. These classes progress so quickly that even a single absence can negatively impact your grade. If you miss a class you will be depriving your team of your expertise for that quiz or test. Our classroom is C223 and our lab is C332.
Cheating:

Cheating, in any form, will not be tolerated UNDER ANY CIRCUMSTANCES. Please refrain from even the appearance of cheating. It can result in major consequences.

Food or Drink:

It is the policy of North Lake College that NO FOOD OR DRINK is allowed in classrooms or laboratories. Closed containers such as water bottles are permitted.

E-CAMPUS:

E-campus will be used extensively in this class. The web address is ecampus.dcccd.edu (NOTE: There is NO www in front of the web address).

Prior to the first day of classes each student MUST sign onto e-campus and fill out the student profile including a valid email address. E-campus will be used to communicate with students and to post grades.

Grading Policy:

1) Lecture:

There will be THREE LECTURE EXAMS. Lecture exams will be given in the Testing Center and are on the computer (L building, phone 972-273-3160).

You will have about 3 days to take the exam. TESTING CENTER hours are 8:30 am to 8:30 pm on MTWR and 8:30 to 3:30 on FS. The TESTING CENTER will NOT give out exams AFTER 2:00 pm on FS. The TESTING CENTER is closed on Sunday. No make-up lecture tests will be given.

Lecture Exams

Lecture exams will be 75 objective questions. These may be multiple choice, matching, etc. Although there are no short answer questions, answering information in that format is extremely helpful when studying. At the end of the syllabus there are study questions which can be completed.

Lecture exams will comprise 50% of the Final Grade. Each lecture exam may be taken twice—the average of the two grades will be used in grade calculation. The exams will come from a pool of questions so each person AND each attempt will be different.
**Quizzes:**

This class requires quite a bit of preparation outside of class. To make sure that you DO NOT get behind there will be QUIZZES over the previous materials (typically 15 questions). Quizzes are **team-based**. You will collaborate with your team-members and decide on the correct answers. You will need small (15 question) scantrons for quizzes.

Quizzes can be given IN LECTURE OR LAB. Please do NOT be late. LAB QUIZZES are announced but LECTURE QUIZZES ARE UNANNOUNCED. If you are late for the quiz you will not be allowed to take it with the group and you will not get the benefit of the group portion of the grade. Quizzes **CANNOT BE MADE UP**!!! However, the lowest 4 quizzes will be dropped.

Quizzes will comprise **25% of the Final Grade.**

2) **Laboratory:**

There will be **THREE LAB EXAMS.** Lab exams will be given in the **Testing Center** (L building, phone 972-273-3160) and are on the computer.

You will have about 3 days to take the exam. TESTING CENTER hours are 8:30 am to 8:30 pm on MTWR and 8:30 to 3:30 on FS. The TESTING CENTER will NOT give out exams AFTER 2:00 pm on FS. The TESTING CENTER **is closed on Sunday**. No make-up lab tests will be given.

Lab exams will be 50 questions consisting of matching, etc. Lab exams will be **VERY** similar to lab quizzes. They will consist of pictures of models, diagrams, etc.

Each lab exam **may** be taken twice—the **average of the two grades** will be used for grade calculation. The exams will come from a pool of questions so each person AND each attempt will be different.

Lab exams will comprise **25% of the Final Grade.**
Determination of Final Grade

Average of 3 Lecture Exams  x  50%

Average Quizzes  x  25%
(drop the four lowest)

Average of 3 Lab Exams  x  25%

100%

FINAL GRADE

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For a sequence of topics in lecture and lab, please refer to the course calendar. The course calendar is only tentative and changes may be made as needed. Do NOT print the calendar—refer to it on ecampus!!!
Questions to be used as a study guide

EXAM 1

Introduction:

What is anatomy? What is physiology? How are they different? Why study them together?

List the major parts and major functions of all of the body systems.

What is homeostasis? Describe it.

What are feedback systems? What are the components of a feedback system? How do they work?

What is negative feedback? What is positive feedback? How are they involved in homeostasis? Graph each!!

Give mechanical and biological examples of negative and positive feedback systems. Which is more common in the body?

Cavities, Planes of Dissection:

The human body can be sectioned by cutting it from various directions. Name and describe the planes (sections) used in human anatomical studies. At home, practice making sections on a banana! Identify sections by drawing and description.

Name and describe the sections used to describe tubes or organs. Why are they different than those used for an entire organism?

Label the body with the correct anatomical terms. These should be learned as soon as possible. Flip through the book—notice how these terms are used again and again.

What are anatomical landmarks? Complete Exercise 15 in the lab book using your own body and mirrors. How could these landmarks be used in a clinical situation?

What does dorsal, ventral, posterior, anterior, superior, inferior, medial, lateral, cranial, caudal, proximal, distal, superficial and deep mean? Practice using these—be able to identify them from a picture or a description. Use them as comparative terms. Practice them with your group members.

Draw and label the quadrants and regions of the trunk. What are the major organs in each? Are there organs that are found in more than one quadrant or region?

Why are region and quadrants used? Which is used more commonly in anatomy? medicine?

List the enclosed cavities—Draw and label the major ones and their subdivisions. What organs are located within these cavities?

List the serous membranes that line the ventral cavities. How many layers do serous membranes contain? Draw and label each. Practice these membranes using bubble wrap.

List the exposed cavities. Draw and label the major ones.

List the mucous membranes that line the exposed cavities. How many layers does a mucous membrane consist of? How are these membranes named?
Tissues:

What are the three embryonic (primary) tissues? Which adult tissue does each become?

What are the four adult tissues. What are the defining characteristics of each?

How are epithelial tissues named? How many layers are involved? How are cell shapes named? What does the name “ciliated pseudostratified columnar epithelium” tell you about this tissue?

Draw each epithelial tissue and describe it. Where are each located? What are their functions?

Compare and contrast exocrine and endocrine glands. Give an example of each.

Discuss the anatomical (structural) classifications of exocrine glands—What are the differences among acinar (alveolar), tubular and tubuloacinar.

Discuss the secretion (functional) patterns of exocrine glands. How do holocrine, apocrine and merocrine glands secrete their products?

What is mesenchyme? Why is it called an undifferentiated tissue? Which tissues can it become?

Discuss connective tissues. What is ground substance? What is matrix? Name the fibers present in matrix. Describe each. What are the different cell types found in connective tissues?

Name the different categories of connective tissues. What are the characteristics of each? Draw and identify each tissue. Where are the different tissues located? What are their functions?

In what tissue(s) would you find fibroblasts? osteocytes? chondrocytes? adipocytes? reticulocytes? erythrocytes and leucocytes?

Discuss the 3 types of muscle. Where is each found? What are their functions?

How are they “specialized tissues”? What are they specialized to do? Where is each type of muscle found? Draw and label each.

What does striated mean? What are intercalated discs? Be able to differentiate these by picture or description.

Discuss nervous tissue. What are neurons and neuroglia? Draw and label each of these. Where is each found? What are their functions?

Skin:

Describe the integument. Discuss the epidermis, dermis and hypodermis layers. What type(s) of tissue is found in each?

Discuss (draw and label) the five layers of the epidermis of thick skin from the outside in. What are the primary functions of each layer? Which layers are dead cells? Which layer is missing in thin skin?

Discuss the cells of the epidermis. What are Keratinocytes? Melanocytes? Merkel cells? Langerhans cells? What are their functions?
What is keratin? What are the different types? Why are they important? Besides the epidermis where else is keratin found?

Describe the different types of tactile (touch) receptors (including the root hair plexus) located in the skin. How does each differ in structure and function?

How does “hair stand on end”? What purposes does it serve? What is the muscle called that produces this? What type of muscle is it?

Discuss the cross sectional anatomy of a hair follicle. Draw and label the different layers from the outside in or inside out. Know what each layer is made from. Discuss the cross-section of the hair itself.

List the 3 things that contribute to skin color. Discuss skin coloration and UV light. Why do peoples of the Earth vary so much in skin tone? What do rickets, vitamin D, and cancer have to do with skin color?

Discuss the 3 degrees of skin burns. What are the “defining” characteristics of each? What is the rule of nines? Describe it. Why is it useful in medicine? When are burns considered “critical”?

Bones:

How are bones classified (3 ways)? What are the divisions of the skeleton? What are the shape classifications for bone? What type bones belong to the so-called “special” shape classification? Be able to classify each bone.

How many named bones in the entire skeleton? Name the bones of the Axial skeleton. How many are there? Name the bones of the Appendicular skeleton. How many are there?

Name the bones of the skull. How many cranial bones are there? How many facial bones are there? What are the ear ossicles? How are each of the skull bones classified?

How many named bones in one hand? In one foot? In one leg (including foot)? In one arm (including hand)? In the skull? In the ribcage? How are each classified?

What two bones comprise the pectoral girdle? How are they classified?

How many pairs of ribs does a man have? a woman? What are vertebrosternal (true) ribs? Vertebrochondral (False) ribs? Vertebral (Floating ribs?)

How many vertebrae are there? How are they classified? What are the divisions of the spinal column? How many vertebrae in each?

Describe each type of vertebra. What is unique to each type? List the differences you would use to decide what type of vertebra one is.

What are the normal curvatures of the spine? Which 2 are primary? Which 2 are developmental (secondary)? Name 3 abnormal curvatures of the spine and give the area in which they are located.

How many vertebrae fuse to form the sacrum? The coccyx? Describe these bones.

What is the name for the hip bone? Is it the same in a child as in an adult (number of bones/fusion)? What is the difference between a pelvic girdle and a pelvis? Describe the “true” pelvis vs the “false” pelvis?

Describe the anatomical features (acetabulum, pubic angle, pelvic inlet (brim), pelvic outlet, etc.) of the pelvis of the male and female. How do female and male pelvi differ? How is a female pelvis more suited to child birth?
Bone Tissue:

Compare and contrast the structure of spongy bone and compact bone. Draw and label an osteon with the following: canaliculi, central canal, lamellae, perforating canals, lacunae. What are trabeculae?

Describe what happens when you soak a bone in vinegar? Put it in an oven? Why? What is it about the structure of bone that changes when these things are done?

Describe a long bone. Draw and label one. What is an epiphysis? A diaphysis? A medullary canal? An epiphyseal plate? An epiphyseal line? How does a child’s long bone look different than an adult’s long bone?

Compare and contrast intra-membraneous ossification and endochondral ossification. Name 3 bones that form in each way.


Name the different types of bone cells? Draw each. What is the function of each? Where are each found?

What is remodeling? Describe the process. When and why does it take place?

Describe the fetal/infant skull? What are fontanels? What is their function? What would happen if the fontanels closed prematurely? Draw and label the major fontanels.

Define the following terms: trochanter, tubercle, fissure, fossa, foramen, condyle, spine, process, crest, line, notch, tuberosity, groove, canal.

Name the carpals in order proximal row first (lateral to medial) distal row second (lateral to medial)—What is the point of “steve left the party….to take cathy home”?

Name the tarsals in order distal row first (medial to lateral) proximal row second (medial to lateral)—What is the point of “my instructor lectures constantly….never to cease”?


Describe the roles of human growth hormone and the sex hormones in the maintaining the homeostasis and growth of the skeleton.

What effect does castration (removal of the gonads) before puberty have on adult height? Why is this true? Describe the growth pattern of a castrated individual compared to an intact individual.

What are the normal blood levels of calcium ions? Where is most calcium of the body found/stored? Discuss the regulation of blood calcium by PTH and Calcitonin. What is the effect of these hormones on bone cells and bone mass?

What are the targets of PTH and Calcitonin? How do they affect each?

EXAM 2

Joints:
Name the 3 anatomical classifications of joints. What is this classification based on? Give an example of each.

Name the 3 physiological classifications of joints. What is this classification based on? Give an example of each.

Name the six types of diarthroses/synovial joints and give an example of each. Describe them. What are the bone shapes found at each of these joints?

How are ligaments named? What is an extracapsular ligament? An intracapsular ligament? Give examples of each.

Draw and label diagrams of the hip, elbow, knee and shoulder. Make sure you include the synovial cavity, joint capsule, synovial membrane, synovial fluid, ligaments, bursae, tendon sheaths.

Draw and describe the following movements: abduction, adduction, elevation, depression, flexion, extension, hyperextension, opposition, rotation, circumduction, lateral flexion, supination, pronation, eversion, inversion, plantar flexion, dorsal flexion, medial rotation.

What is osteoporosis? Osteomalacia? Paget's disease? Rickets?

Neurophysiology:

Describe the organization of the nervous system. What is the CNS? What is the PNS? What does SA, SE, VA, VE (ANS) mean? What are the two divisions of the VE (ANS)?

What are the 3 functions of the nervous system? Describe each?

What are the 3 structural types of neurons? Draw and describe each. Label the different parts. What is the function of each?

What are the 3 functional types of neurons? Draw and describe each. What is the function of each?

What are the six types of neuroglia? What is the function of each? Where do you find each?

What is myelin? Why is it important? Which cells produce myelin in the CNS? In the PNS?

Discuss the structure of the neuron cell membrane. What are the functions of the proteins in the membrane?

Describe channels. What are the different types? How do leak channels differ from gated channels? What are the different types of gated channels? What causes each to open?

Describe the sodium/potassium/ATPase pump. What does it do? In what ratio? Why is this important?

Discuss the ions sodium and potassium and their importance in the nervous system.

What is the trans-membrane potential? How is it measured? Calculated? How are sodium and potassium involved?

What is the Nernst equation? Write it. Discuss how changes in the concentrations of Na+ and K+ affect the transmembrane potential.

Discuss resting potential? How is it produced? Maintained? What is the average voltage across the membrane on neurons? Describe the characteristics of the neuron cell membrane (pumps, channels, etc.) and its environment (ion concentrations) that contribute to the resting potential.
What is a stimulus? Name the two types of stimuli. Which ion is associated with each? Define Depolarization? Repolarization? Return to Resting Potential? How are these related to stimuli?

Discuss graded potentials. How long do they last? How far do they travel? What are their sizes? What does their size depend on?

Discuss action potentials. How long do they last? How far do they travel? What happens at Threshold Potential? Which gates open? Which ion moves?

Draw and label the graph of an action potential (AP), including all appropriate ion movements, opening and closing of channels, etc.

List the characteristics of an AP vs a graded potential. Compare and contrast an AP with a graded potential. List all the differences!!

Discuss continuous conduction and saltatory conduction. Which is faster? Why? What substance is required for saltatory conduction? Which cells make it? What would happen if you interfere with the production, maintenance, or distribution of this substance? What are neurofibral nodes (Nodes of Ranvier)? Why are they important?

Discuss the steps in synaptic transmission. What is a neurotransmitter? What ion is important for vesicle migration and neurotransmitter release? What would happen if you interfere or enhance the amount of the ion?

What is ACH? What is ACHe (acetylcholinesterase)? Why is having ACHe just as important as having ACH?

Sarin (gas) is a toxin which inhibits ACHe. Tetradotoxin (from the puffer fish) is a toxin that prevents voltage gated sodium channels from opening. Atropine (from deadly nightshade plant) prevents chemical gated channels from opening, The above are poisons. What effect would each of these have on the function of neurons? Describe what happens when you ingest each of these. How do each “kill” you?

What is an EPSP? an IPSP? Which channels and which ions are involved in each? Do they result in a depolarization or hyperpolarization? Why are they graded potentials?

Discuss temporal and spatial summation. How many neurons are involved with each? How and when do they fire? What is each “used” for?

How does presynaptic facilitation and presynaptic inhibition work? How is calcium involved? What effects do they produce? Describe a situation where each is seen.

Muscle physiology:

What are the 4 properties that all muscles share?

Compare and contrast the 3 types of muscle. Draw a picture of each.

What are the connective tissue coverings of skeletal muscle. What tissue comprises each? What does each surround?

Discuss the structure of a skeletal muscle cell. What are myofibrils? What is the sarcoplasmic reticulum? What ion does the SR contain? What are transverse tubules?

Draw and label a sarcomere. Include all bands, zones, lines, thick filaments and thin filaments.

What proteins (3) make up the thin filament? What binding sites does each contain?
What protein makes up the thick filament? What binding sites does it contain? What is important about the “neck or hinge” region?

List the steps in a muscle contraction. Start with the AP on a SE neuron. Do not forget synaptic transmission and the AP on the muscle cell. Please be as detailed as you can be. List what each protein does and how the myofilaments interact with each other. Why is this called the “sliding filament mechanism”?

Draw and label the graph of a muscle twitch? What is going on during the latent period? the contraction period? the relaxation period?

Draw a graph of wave summation? Incomplete tetanus? Complete tetanus?

Where does the muscle cell get the energy to contract? What happens when the cell begins to run out of energy? What is fatigue?

What is a spasm (cramp)? Why do think a fatigued muscle is more apt to become spastic than a fresh muscle? Explain how/why rigor mortis develops. Why does a body get “stiff” after death? Draw the graph of a muscle fiber in a “fresh” state? “fatigued” state? “rigor mortis”?

Discuss isometric and isotonic contractions. Within isotonic, differentiate between concentric and eccentric contractions.

What are the different types of skeletal muscle fibers? How do they differ in relation to speed, color, myoglobin content, ATP production? What muscles would you expect to have a high proportion of each?

Describe cardiac muscle cells and smooth muscle cells. How are they different from skeletal muscle cells?

What protein is found in cardiac and skeletal muscle but is absent in smooth muscle. What is it replaced with?

What are the two properties that cardiac muscle exhibits that skeletal muscle does not? How and why do they occur?

What is an intercalated disc? What is its function?

Identify the anatomical parts corresponding to the generic components of a lever system. Describe the arrangement of these parts in first, second, and third class lever systems.

List the ways in which muscles are named? Give examples.

What is an origin, an insertion, an action? What is a prime mover? a stabilizer? a synergist? an antagonist? Give examples of each.

Identify the anatomical parts corresponding to the generic components of a lever system. Describe the arrangement of these parts in first, second, and third class lever systems. Draw each. How do you differentiate between the 3 types of lever systems?

EXAM 3

CNS anatomy:

What is the “basic pattern” seen in the brain and spinal cord? What is the difference between white matter and gray matter? Compare spinal cord to lower brain to cortex?
Draw and label the cross-section of the spinal cord. Include horns, tracts, spinal nerves (with roots) and a somatic afferent fiber, association fiber, and a somatic efferent fiber.

Draw a cross-section of the spinal cord and label the ascending tracts and the descending tracts.

Discuss the gray matter of the spinal cord? Draw the “butterfly” (gray matter) and label the areas devoted to SA, SE, VA, VE.

How many fibers are involved in the different sensory tracts? What are they named? How many fibers are involved in the motor tracts? What are they named?

Describe the development of the CNS? List the parts of the telecephalon, diencephalon, mesencephalon, metencephalon, and myelencephalon.

What are the hollow spaces inside the brain and spinal cord? Draw and label the ventricles. What is CSF? How does it protect and aid brain function? Describe the origin and circulation of CSF. How much is produced per day?

Describe the protective coverings of the brain and spinal cord. How are the dura, arachnoid and pia different?

What are the major fissures and sulci of the cerebral cortex? What are the major gyri? Name the lobes of the Cerebral Cortex. What sulcus separates each?


Define decussation. Define somatotopy. Why are these important?

What is a sensory and/or motor homunculus (little man)?

What is the function of association areas? Why do you think that they are bigger than the sensory area they are associated with?

Discuss how the right cerebral cortex is different from the left cerebral cortex. What does it mean to be “right-brain dominant”? “left brain dominant”?

What is the function of the prefrontal cortex? What would happen to a person if damage were to occur to this area? This area is the last to mature—discuss how this may affect a teenager’s behavior vs an older adult. What is a stroke (a CVA)? How does it affect the brain and brain function?

Where are most peoples speech centers located? Discuss the differences in symptoms with damage to Broca’s and damage to Wernicke’s.

If you were to ask a “right-brain dominant” person and a “left-brain dominant” person for directions, how might their answers differ?

What are the 3 types of white matter in the cerebrum? What do they each connect?

Describe what a person would be like if the corpus callosum were severed.

What are the functions of the Thalamus? Why can it be described as a “gate-keeper” to the cortex? What percent of sensory material is edited out and not passed to the cortex? What happens if you prevent its editing function?

What are the functions of the hypothalamus? Why is it sometimes called the “link” between the nervous and endocrine systems? What 2 hormones are produced by the
hypothalamus? What are releasing and inhibiting factors used for? Discuss the nuclei found here: hunger, satiety, rage, pleasure, etc.

What area mediates visual reflexes? Auditory reflexes? What are the cerebral peduncles?

What vital centers are found in the pons? In the medulla?

There are 12 pairs of cranial nerves. List the name, origin, route through the skull, organ innervated, function and whether they are sensory/motor/both of each. Which cranial nerves carry autonomic nervous system fibers?

Discuss the cerebellum. Name the lobes. What are folia? Arbor vitae? Vermis? What are the primary functions of the cerebellum?

What is flaccid paralysis? Spastic paralysis? Hemiparalysis, Paraparalysis, Quadraparalysis? Describe how each occurs and what the symptoms of the patient might be.

Discuss reflexes? What is the difference between spinal and cranial? Innate and acquired? Somatic and visceral?

List the components of a typical reflex. How many neurons are involved?

Autonomic nervous system:

Using the anatomical names of the ANS (i.e. craniosacral and thoracolumber) compare and contrast the anatomical arrangements of the sympathetic and parasympathetic nervous systems. List the ganglia associated with each.

Using the physiological names of the ANS (i.e. Fight or Flight and Rest and Digest) describe the functions of the sympathetic and parasympathetic nervous systems.

Compare the sympathetic and parasympathetic as to: length of preganglionic and postganglionic fibers, neurotransmitters released, types of receptors.


Describe the effects of the sympathetic and parasympathetic nervous systems on the: heart, pupil of the eye, ciliary muscle of the eye, salivary glands, bronchioles in the lungs, digestive system.