

## LECTURE CHAPTER OBJECTIVES: BIOLOGY 109

**Disclaimer:** These chapter objectives are only brief summaries of the material we have covered in class; it is not all inclusive. Anything discussed (especially examples) in lecture is considered fair-game for an exam. These objective sheets should only be considered an alternative way of looking at your notes.

### Biology 109--Exam 1

**Chapter One.** Introduction to Anatomy and Physiology.

1. What are the definitions of anatomy and physiology? Examples?
2. What are the characteristics of life? Define metabolism.
3. Define homeostasis and list examples. List the five things that we discussed in class that must be maintained or regulated in the human body. Why is oxygen, water, and food important to the human body?
4. Understand and define all the levels of organization (in order).
5. Name the basic regions and cavities in the human body. Be able to explain why they are divided as they are. Why do we divide the human body into cavities? Know which organs are found in each cavity.
6. What is anatomical position and why it is important? Understand anatomical terminology (e.g., relative positions) & body sections.

**Chapter Two.** Basic Chemistry.

1. Know the answers to the "Discovery Questions" on basic chemistry.
2. What is an electrolyte? What is an acid and a base? What is the pH scale used for and how do you read the pH scale? What does it mean when a solution is acidic or basic? What is the pH for blood usually? What is acidosis and alkalosis and why are they dangerous? What is a buffer and list three buffers in the human body?

**Chapter Two.** Organic Chemistry.

1. What are the three characteristics of a macromolecule? What is an organic molecule? Why is carbon used by cells to construct macromolecules? What are the four general types of macromolecules? Name and draw the three functional groups we talked about in class.
2. Lipids are made up of CHOP are commonly called fats and oils. Know the three types of lipids we discussed in class and be able to identify or draw their basic chemical structure. What is the function of each type of lipid? What is the difference between a saturated, unsaturated, and polyunsaturated fatty acid? What is glycerol? What does hydrophilic and hydrophobic mean? What is the purpose of cholesterol in your body?
3. Know the basic structure and formula of a carbohydrate. Be able to draw a simple carbohydrate. Understand polymerization, polymers, monomers. What is the difference between a monosaccharide, disaccharide, and a polysaccharide and name some examples. What is a simple sugar and a complex carbohydrate? What are two functions of carbohydrates? Why do our bodies store energy as fat instead of carbohydrate? What is another name for blood sugar?
4. Know the basic structure of the two types of nucleic acids we discussed. What are the functions for the two types of nucleic acids? A nucleic acid is a polymer composed of monomers called nucleotides. Be able to draw a simple nucleotide that contains a sugar, a nitrogenous base, and a phosphate group. Know the five types of bases and what type of molecule they will be found on. List the structural and functional differences between DNA and RNA. What is ATP and what is it used for? Where is the high energy bond located? What is ADP?
5. Know the basic structure of amino acids. How many amino acids are used by the human body to build protein? What is a polypeptide and a protein? Understand that polypeptides and proteins are polymers composed of monomers called amino acids. Name the four molecular arrangements of a protein (e.g., primary, secondary, etc.). What are five ways that proteins can be denatured? List some functions of

proteins.

### **Chapter 3. Cell Structure, Movement of molecules, and Cell Division**

1. What is a cell? Describe the cell membrane. What are its functions? Name and describe the three types of proteins found in the cell membrane and name their functions. What are junctions and what are the three types?
2. Define selectively permeable. In general, what two types of molecules have a difficult time crossing a membrane? Name and discuss seven ways to get molecules across a cell membrane. Discuss how the processes are similar and different. Define hypertonic, hypotonic, isotonic. During osmosis, will water move toward a hyper-, hypo-, or isotonic solution? Explain what effect osmosis has on life (see RBC example).
3. What is an organelle? Name all the organelles/cell structures that we discussed and explain their function/special characteristics, etc. What is chromatin, chromosomes, and genes? Explain the entire process of protein synthesis (from DNA to secretory vesicles). Why is the lysosome so important to the cell? What is Tay Sach's disease and what causes it to occur? Where are mitochondria found in abundance in the human body? Name two functions of peroxisomes? What is the cytoskeleton and its functions? What are two components of the cytoskeleton and which is the largest and the smallest? Name three places a microtubule is found within a cell? What are flagella and cilia and what do they do in the human body?
4. What is cell division? What are three general purposes of cell division? Which cells cannot undergo cell division and why is that important to know? What are mitosis and cytokinesis? READ the handout and understand the phases of IPMAT (learn them, they will be on the exam and found in lab).
5. Know two types of internal and external controls of cell division. What happens to the S/V ratio as a cell increases in size? Understand what can happen when a cell loses control of cell division. What is cancer? What is a malignant and benign cancer? What is cell differentiation and how (in general) it is controlled?

### **Chapter 4. Cellular Metabolism**

1. Know the answers to the "Discovery Questions" on metabolism and enzymes.

#### Catabolic Reactions:

2. What is the generalized reaction to break down glucose into water and carbon dioxide? How does the cell avoid producing too much heat (and save energy for ATP production) during catabolic reactions? What are NAD<sup>+</sup> and FAD<sup>+</sup> used for and why are they important? What is an oxidation/reduction reaction?
3. Understand how glucose can be used aerobically or anaerobically to produce ATP. Understand how fat and proteins can be used to produce ATP aerobically.
4. Be able to write out the general chemical reactions of Glycolysis. What are the substrates, products, # of ATP and NADH produced? Is O<sub>2</sub> used during these reactions? What is the purpose of glycolysis? Where does glycolysis occur within a cell? Where is most of the energy trapped after glycolysis is finished?
5. Be able to write out the general chemical reaction for fermentation. What are the substrates, products, # of ATP and NADH produced? Is O<sub>2</sub> used during these reactions? What is the purpose of fermentation? Where does fermentation occur within a cell? What are the drawbacks to fermentation?
6. Understand the Citric acid cycle (i.e., the Krebs Cycle) and the electron transport chain. Be able to write out the general chemical reactions for the Krebs Cycle. What are the substrates, products, # of ATP, FADH, NADH, and CO<sub>2</sub> produced per turn of the cycle? What is the purpose of the Krebs Cycle? Where does the Krebs cycle occur within a cell?
7. Understand the electron transport chain. How many ATP are produced from NADH and FADH? What is the name of enzyme that helps produce ATP? What is the terminal electron acceptor for the ETC and what is it converted to when it accepts electrons?

8. Be able to determine the number of ATP produced from glucose in glycolysis, fermentation, Krebs Cycle, and the ETC?
9. Read your handout on using fat and protein as alternative energy sources and closely examine the flow chart provided to you explaining aerobic respiration and fermentation. Understand the digestion of triglycerides and proteins and where they will enter the ATP generating catabolic reactions of the cell. Understand that pyruvate is converted to Acetyl CoA in the first step of the Krebs Cycle (called transition step).

#### Anabolic Reactions:

10. Which bases will form weak bonds with each other (complementary base pairs)? What does it mean to create a complementary strand of DNA or RNA? What is transcription, translation and how do they occur? What are triplets, codons, and anticodons? What is mRNA and tRNA, where are they found, and what do they do?. How are ribosomes involved in translation? Be able to do examples of translation and transcription (e.g., if I give you a DNA strand with CTGACT then you should be able to make complementary strands and take me through protein synthesis or vice versa).
11. What is a mutation? How can mutations affect protein synthesis? Why are mutations usually so devastating to a cell?

### **Biology 109--Exam 2**

**Chapter 5.** Tissues. Refer to the tissue handout to answer these questions.

1. What is a tissue? What is histology? What are the four general types of tissues?
2. Epithelial: What are the characteristics and functions for epithelial tissue? Know how to identify the tissue types (understand layers and shapes). Name at least one location where each tissue can be found. What are exocrine and endocrine glands? Which tissue secretes mucus and possess cilia? Which tissues secrete and absorb? What tissue can stretch and where is it found?
3. Connective: What are the characteristics and functions of CT? What is matrix? What are fibroblasts, chondrocytes, and osteocytes and what are their functions and where are they found? What are the three types of fibers produced by fibroblasts and what are their characteristics? Know how to identify the different tissue types of connective tissues and functions. Which connective tissues lack vascularization and how does that affect healing? How does fiber organization and density affect strength of the tissue? Which CT is used to store fat? What are lacunae and what tissues are they found in? How can you tell the difference between the three types of cartilage? Know that blood and bone are connective tissues and understand their general functions.
4. Understand the differences in the three muscle types (striations, nuclei, length & shape, intercalated disks, and location). Know the functions and general locations for each type?
5. What are the two general types of cells within nervous tissue and what is their function?

**Chapter 6.** Integumentary system...

1. What is a membrane? What are the four types of membranes and what are they composed of? Where are they found and what are their functions? Know where the serous membranes are located and their functions.
2. What are the functions of the skin and what layers of the skin or accessory organs are responsible for each?
3. Where is the epidermis, dermis, and hypodermis found? What are they composed of and what tissue types make up each?
4. Epidermis: How does the epidermis get nutrition and rid itself of waste? What is a keratinocyte and what is its function? What is the function of keratin? What are epidermal ridges, what is the function? What are fingerprints and what is their function and where are they found? Why do keratinocytes form desmosomes?

Why do keratinocytes eventually die? Is the skin permeable to water?

5. Melanocytes: where are they, what do they produce, and what is their function? What is cytokine secretion and why is it conducted and necessary? Name and describe two skin disorders caused by UV. What are two types of skin cancer and which is most dangerous/treatable? What are the factors affecting skin color?
6. Dermis: What are the different tissue types found in the dermis and what structures do they make up? What is collagen and elastic fibers used for in skin? Know that the dermis is the thickest layer of skin and contains most of the accessory organs of skin.
7. Hypodermis: What is the importance of the hypodermis and what is it composed of? Why is it important to have adipose here (2)?
8. Know the accessory structures found within the skin including hair follicles, nails, and exocrine glands. What are they composed of, their functions, and components? What is a pheromone? What determines the color of hair? What is the function of the arrector pili muscle? What glands are associated with hair follicles? What is acne?
9. How does the body regulate body temperature? What are the body's responses to hypo or hyperthermia? What is a fever and how is it maintained? When does a fever occur and what is its purpose? What does it mean when a fever "breaks"?

## **Chapter 7-- Bones!**

1. What are the functions of bones?
2. What is a long bone? Know the general structure of the long bone. Where is the epiphysis and diaphysis located? Where in the long bone is compact bone found mostly? In what portion of the long bone? What is the periosteum and how does it help form joints? Where is articular cartilage and what is its function? What are the functions of processes and why are they "rough"?
3. Identify and know functions of the following compact bone structures: osteocytes, lacunae, lamella, Osteonic canals, Volkmann's canals, canaliculi, gap junctions, osteon, medullary cavity, and yellow marrow.
4. Identify and know functions of the following spongy bone structures: trabeculae, red marrow, osteocytes. How is spongy bone's microscopic structure different than compact bone? Which bone type is lighter? Which is stronger?
5. What is ossification? Understand how bones develop in intramembranous and endochondral ossification. How do long bones lengthen? Identify: primary ossification center, secondary ossification centers (where found, where do they move?), epiphyseal disk, osteoblasts, osteoclasts, hyaline cartilage. Why is it necessary that the cells found in the epiphyseal disk continue to grow and divide if a bone is to lengthen? When and why will a long bone no longer lengthen?
6. How does a bone widen, and how is that process different from bone lengthening? When can bone growth (lengthening and widening) occur in a person's life? How is a medullary cavity formed?
7. Why is maintaining bone density an example of homeostasis? How do bone & prostate cancers affect bone density and why? How does age generally affect bone density?
8. Understand and identify all the ways in which bone growth and bone density can be affected (as discussed in class). Where is vitamin D found or made? What is rickets and osteomalacia? What are pituitary dwarfism, pituitary giantism, and acromegaly? Why are acromegaly and pituitary giantism different? How are androgens (e.g., testosterone) and estrogens alike in how they affect bone growth and bone density?
9. Why is estrogen so important to normal bone density in women? What are some ways that women lose "normal" levels of estrogen? What is osteoporosis? What are some ways to reverse, prevent, or slow down osteoporosis? How much calcium is found in an 8oz glass of milk? Why is Vitamin D fortified in milk? How much calcium does an adult need in one day?

**Chapter 8. Joints....**

1. What are the three main types of joints found within the human body? In what ways are they different? Know examples of type. Which type of joint allows the most movement of bones? Which type is most abundant in the body?
2. Know the complex shape of a general synovial joint. Be able to describe or identify each structure including articular cartilage, subchondral bone, ligaments, tendons, periosteum, synovial membrane, bursae, meniscus, joint capsule.
3. Know the types of synovial joints. Where is each type found and what kind of motion do they allow. Which allows for the most flexibility?
4. Answer your "Discovery Questions".
  - Understand the types of joint movements found in your book (e.g., flexion, extension, etc..).
  - Know the different types of joint disorders and characteristics of each type.

**End Exam II****Begin Exam III****Chapter 10. Microanatomy and physiology of the nervous system...**

1. What are the divisions of the nervous system and what duties do they perform including: the central nervous system, the peripheral nervous system, the afferent division, the efferent division, somatic and autonomic nervous systems. What is an effector? What is a sensory receptor?
2. What are the two general types of cells found within the CNS? Which cell can reproduce? What is brain cancer? Can severed axons be repaired? If so, where? Know all the neuroglia cells, where they are found, and their functions? What is myelin and why is it important? What is a node of Ranvier? What is white matter and gray matter of the CNS and what is the general function for each?
3. Know basic neuron structure: cell body (nucleus, nucleolus, Nissl bodies), axons, collateral branches, synaptic knobs, dendrites, and that they don't have centrioles. What are the general purposes of all the structures above? Read your handout to find out about specialized shapes of neurons: bipolar, unipolar, and multipolar and where they are usually found or their general function. Know specialized functions: sensory, interneurons, and motor. What are their functions and where are they found?
4. Understand how molecules are moved by active transport and facilitated diffusion. What are two stimuli that will cause an integral protein to open? Where and what type of ions are found inside and outside a neuron? How is resting potential generated in a cell? What is potential difference? How much charge is usually generated during resting potential?
5. What is a threshold stimulus? What occurs during depolarization and what happens to the potential difference? What occurs during repolarization and what happens to the potential difference? What is hyperpolarization? How is the resting potential restored after depolarization and repolarization? What is the absolute refractory period and why is it important?
6. What is continuous/saltatory conduction? Why do we need saltatory conduction? What are two real life examples of losing myelination and what are the effects?
7. Understand what happens at the synapse following action potential stimulation. Know the effects of acetylcholine/dopamine, serotonin, neuromodulators (endorphins). How does morphine work? Why is morphine withdrawal for a morphine addict so painful?

**Chapter 11. Gross anatomy and physiology of the CNS...**

1. Read the book and answer the discovery questions on Chapter 11.
2. Name each layer of the meninges and know where it is found. What is the function of the dura mater? What are the functions of cerebrospinal fluid?
3. What is the cervical enlargement and the lumbar enlargement. Where is the central canal? What is found in the central canal? Where is the gray and white mater found in the spinal cord? What does each do within the spinal cord (specifically)? What is a reflex? Give examples. What is a reflex arc?
4. What connects the two hemispheres of the cerebrum together? What are gyri, sulci, fissures? Where and what is the cerebral cortex? What lies below the cerebral cortex (generally) and what is its function? Find and locate all the regions/lobes of the cerebrum. What are the four general functions of the cerebrum? Locate and give functions for the primary motor and sensory regions, Broca's area, and the general interpretative area. Where and the general locations where taste, sound, sight, and smell are interpreted in the cerebrum? What is hemisphere dominance? What is memory (and its two types) and how are memories stored? Where are long term memories stored?
5. Where are the basal ganglia located and what are its primary function?
6. What are ventricles and where are they generally located? What is the choroid plexuses and what does it do? Remember that the ventricles, the central canal, and the arachnoid space are interconnected.
7. Know these regions of the diencephalon: thalamus, hypothalamus, pituitary gland and know their functions.
8. What are the regions of the brain stem? What are the general functions of the brain stem? Why are they mostly reflexes? How are the hypothalamus and the brain stem functionally interconnected? Why is the reticular formation so important?
9. The cerebellum consists of two hemispheres and is connected together by what? Where is the cerebellar cortex? Where do most higher brain functions of the cerebellum occur? What does the tissue below the cortex look like? What is the function of the cerebellum?

## **Chapter 12. Somatic and special senses...**

1. Read the book and answer the discovery questions on chapter 12.
2. What does the body need in order to sense information about its environment? Where are (specifically) most interpretations made? If all nerve impulses are alike, how can we have different sensations? What is, reception, transmission, and a sensation? What is an example of a sensation? What is sensory adaptation? What is the function of sensory adaptation? Give examples. What is synesthesia?
3. Sense of smell-- How many olfactory receptors are found in the nasal cavity? What type of cells are olfactory receptors and where are the "cilia" found on these cells? How many different types of olfactory receptors are there? Be able to explain how we smell something. Do we lose our sense of smell as we age? Does our sense of smell undergo sensory adaptation?
4. Sense of taste-- What are taste cells and where are they located? How many taste buds are found in the mouth? Where are taste buds found? What are papillae? How do we taste something? Do we lose our "sense of taste" over time? How many different types of taste receptors do we have and what are they? Does our sense of taste undergo sensory adaptation?
5. Sense of hearing-- Know all the parts of the outer, middle, inner ear and know their functions. Which cavity is filled with air? Which with fluid? What is the name of the fluid within the inner ear? What produces the fluid? What do auditory ossicle do (2)? Where is the oval window and what is its function? What is the tympanic reflex and why is it important? Why do we need an auditory tube and give an example. What happens when the air pressure is not equalized on both sides of the tympanic membrane? Know the three divisions of the inner ear (i.e., the labyrinth). What in general does each division do? Know that inside the cochlea are hair cells, stereocilia, and tectorial membranes (composing the organ of Corti). Be able to explain how we hear something. How is pitch and volume sensed by the ear?
6. Sense of sight-- Know all the accessory organs of the eye and their general function. Know the three

layers of the eye and all of their parts and function. How and why is the cornea transparent? Why is the choroid coat black? Where is the ciliary body and what does it do? What is glaucoma? What is the purpose of the iris, the lens? Know that receptor cells are found in the retina. What is the fovea centralis and what do we do with it when we are looking at something? What is the blind-spot and why do we have one? What is the anterior and posterior cavities and what is found in them? What is the functions of the humors? What are the two types of photoreceptors and what are the differences between them? Why can we get more acute images from cones than rods even though we have many more rods? How do we see color? What is stereoscopic vision and why is it important? Be able to explain how we see.