Human physiology

Science, Genetics

Human Physiology Exam 1 Part 2 Study Guide Chapter 1 Define homeostasis * Maintenance of constant conditions in the internal environment. Composition, temperature and volume of extracellular fluid do not change significantly under normal conditions Know the components of a homeostatic control mechanism * Regulated Variable- Regulated to stay within relatively narrow limits * Set Point- normal desire value * Error Signal- difference between the actual value and the set point * Sensors- cells sensitive to variable * Integrating Center- sensors relay signals to IC compares the regulated variable to the set point and makes the appropriate response * Effectors- receive signal from IC and effectors bring about the final response What is negative feedback, give an example in the human body. * If a regulated variable increases, the system responds by making it decrease and vice versa. Minimizes changes in physiological variables * Example: * Cruise control in a car- operates to keep the speed of the car steady at a certain desired point * Car goes from level ground up a hill- car begins to slow down * Control mechanism detects a difference between the actual speed and the desired speed, feeds more gas to engine, car’s speed increases * Car’s speed reaches desired point and the system throttles back to maintain that speed * As long as speed is maintained- system makes no further adjustments to the flow of gas What is positive feedback. * Response of the system goes in the same direction as the change that sets it in motion. Allows a variable to change rapidly in response to a stimulus * Example: * Females- pituitary gland secretes a hormone luteinizing hormone (LH) stimulates ovaries to secret hormones called estrogens (regulate reproductive function) * Rise in plasma estrogen concentration trigger an

increase in the secretion of LH stimulates estrogen secretion enhances LH secretion even more * Result rapid rise in plasma LH (LH surge) triggers ovulation Chapter 2 Review the function of the cell organelles CELL PART | STRUCTURE | FUNCTION | PLASMA MEMBRANE | Lipid bilayer with scattered proteins and cholesterol molecules | Maintains boundary of cell and integrity of cell structure; embedded proteins serve multiple function | NUCLEUS | Surrounded by double- layered nuclear envelope | Houses the DNA, which dictates cellular function and protein synthesis | Nucleolus | Dark oval structure inside the nucleus | Synthesis of RNA | CYTOSOL | Gel-like fluid | Cell metabolism, storage | MEMBRANOUS ORGANELLES | | | Rough Endoplasmic Reticulum | Continuous with the nuclear envelope; flatted sacs dotted with ribosomes | Protein synthesis and post-translational processing | Smooth Endoplasmic Reticulum | Continuous with rough ER; tubular structure w/o ribosomes | Lipid synthesis and post-translational processing of proteins; transport of molecules from ER to Golgi apparatus; calcium storage | Golgi Apparatus | Series of flattened sacs called cisternae near the ER (cis face/trans face) | Post-translational processing; packaging and sorting of proteins | Mitochondria | Oval-shaped, with an outer membrane and an inner membrane w/ folds called cristae that project into the matrix | ATP synthesis | Lysosomes | Granular, saclike; scattered throughout cytoplasm; single membrane | Breakdown of cellular and extracellular debris | Peroxisomes | Similar in appearance to lysosomes, but smaller | Breakdown of toxic substances; including hydrogen peroxide | NONMEMBRANOUS ORGANELLES | | | Vaults | Small, barrel- shaped | Unknown; possibly transport of molecules between nucleus and cytoplasm | Ribosomes | Granular organelles composed

of proteins and rRNA; located in cytosol or on surface of rough ER | Translation of mRNA to synthesize proteins | Centrioles | Two cylindrical bundles of protein filaments that are perpendicular to each other | Direction of mitotic spindle development during cell division | CYTOSKELETON | Composed of protein filaments, including microfilaments, intermediate filaments, and microtubules | Structural support of cell; cell movement and contraction | What is a covalent bond? * Bonds formed between atoms due to the sharing pairs of electrons What is a polar molecule? * An unequal sharing of electron pairs- one atom slightly more negative than another; creates a minor charge difference within the molecule What are the biomolecules we discussed in class. 1. Carbohydrates What are CHOÊ¼s primarily composed of? * C, H & O CH2On 1: 2: 1 ratio Are they water soluble or lipid soluble? * Polar molecules- water soluble What is the difference between a mono-, di- and polysaccaride? * Monosaccharides: simple sugars composed of a single unit * most common- glucose (important source of energy for cells), fructose and galactose, ribose, deoxyribose * Disaccharides: carbohydrates formed by covalent bonding of two monosaccharides * Most common- sucrose (table sugar) glucose/fructose; lactose (found in milk) glucose/galactose * Polysaccharides: carbohydrates formed by covalent bonding of several monosaccharides * Glycogen- polymer of glucose subunits found in animal cells * Starch- found in plants * Cellulose- found in plants What are the primary functions of CHOÊ¼s? * Energy storage (1% of total) * Most common molecule used in ATP production (useable form of energy for cells) * Components of cell membrance structures 2. Lipids What are lipids primarily composed of? * C &

H linked together by nonpolar covalent bonds Are they water soluble or lipid soluble? * Nonpolar and do not dissolve in water * Amphipathic- molecule contains both polar and nonpolar regions What are the 4 types of lipids? Be familiar with their characteristics and their functions. * 1 — Triglycerides- one glycerol (3 carbon alcohol) molecule and 3 fatty acid chains (long chains of carbon atoms with a carboxyl group (-COOH) at one end * Function: long term energy storage, protection and insulation * 2 — Phospholipids- one glycerol, 2 fatty acids (non polar) and a phosphate group (polar) * Form specific orientation when in water * Function: form the major components of all cell membrances * 3 — Eicosaniods- 20 carbon fatty acid, arachidonic acid and 5 caron ring in the middle; ring causes molecule to fold upon itself * Polar molecules * Funtion: cellular communication molecules * 4 — Steroids — 3 6 carbon rings and 1 5 carbon ring * Cholestrol- precursor to all other steroids * Function- cellular communication- hormones 3. Proteins What are proteins composed of? * Composed of amino acids (20 types) Are they polar or nonpolar? * Polar What is the basic structure of amino acids? * Central carbon, amino group, carboxyl group, hydrogen and R or residual group What type of bond links amino acids and what is the name of the reaction that forms these bonds? * Peptide bonds- joining of amino acids * Condensation reaction (dehydration synthesis) — reaction releases water as two small molecules are joined together What are the 4 levels of protein structure? * 1 — Primary — sequence and # of amino acids * 2 — Secondary — folding pattern due to hydrogen bonds forming between the hydrogen atom in the amino group and the oxygen atom in the carboxyl group; form sheets or helices * 3 — Tertiary — folding due to interactions between R

groups of the polypeptide * 4 — Quaternary — formation of proteins with more than one polypeptide chain What are the primary functions of proteins? * Structural molecules, chemical messengers (hormones), receptors and enzymes 4. Nucleotides and Nucleic Acids What is the function of nucleotides? * Genetic codes for protein production (DNA) and decoding of DNA and conversion of information into amino acid sequences (RNA); transfer of energy within cells What are nucleotides composed of? * C, H, O, P, N atoms 5 carbon carbohydrate (ribose/deoxyribose), a nitrogenous base (Pyrimidines- single carbon ring & C T U; Purines- double carbon ring & A G) and one or more phosphate groups; polar molecules What are the two subclasses of nucleic acids and their characteristics and functions? * Deoxyribonucleic acid * Found in cell's nucleus store genetic information * Double strand Helical shape * Bases: A G C T * Ribonucleic acid * Found in cell's nucleus and cytoplasm expression of genetic info * Single strand helix may fold into complex shapes * Bases: A G C U What is the law of complimentary base pairing? * Whenever two strands of nucleic acids are held together by hydrogen bonds, G in one strand is always paired with C in the opposite strand, and A is always paired with T in DNA (U in RNA) What is the process of transcription? Where does it occur? * Conversion of DNA base sequence into mRNA whose base sequence is complimentary to DNA base sequence * Occurs in nucleus * Promoter sequence- section of DNA with the gene specific base sequence where enzyme RNA polymerase can bind initiates separation of DNA into two strands DNA uncoils and separates pre-mRNA undergoes post-transcriptional processing mRNA * Removal of introns, exons joined together, addition of CAP- necessary for initiating translation,

poly A tail- protects mRNA from degradation in the cytoplasm What is the process of translation? Where does it occur? * Process where polypeptides are synthesized using mRNA codons as a template for the assembly of the correct amino acids along the sequence * Occurs in cytoplasm at ribosomes * Anticodon- tRNA contains a base sequence complementary to the mRNA codon Chapter 3 Be able to summarize the following types of reactions: Hydrolysis and condensation reactions * Hydrolysis: water reacts w/ molecules causing breakage of the bonds that link a molecule together * Condensation: Reverse of hydrolysis involves the joining together of two or more smaller molecules to form a larger one; water is generated as a product Phosphorylation and dephosphorylation * Phosphorylation: addition of a phosphate group (inorganic phosphate (Pi) (also condensation) * Dephosphorylation: removal of a phosphate group (also hydrolysis) Oxidation-Reduction reactions * Oxidation-reduction: central to energy metabolism * Oxidation- reactions that remove electrons from an atom or molecule. Electrons removed must be accepted by another atom or molecule in a process reduction What is an enzyme? * Biomolecules specialized to act as catalysts How does an enzyme work? * Enzymes physically orient the reactant to maximize the efficiency of the reaction; speed up reaction rates What is cellular respiration? This is the reaction of oxygen and glucose to yield water and energy, this process is often referred to as cellular respiration. * $C6H12O6 + 6 O2 + 38 ADP + 38 Pi 6CO2 + 6H2O + 38 ATP$ How much ATP is produced during cellular respiration (glucose oxidation) * 38 ATP What is the energy currency in the body? Where is the energy stored? * Glucose: Large glucose storage molecule called glycogen body

stores energy for future use What is beta oxidation? * Fatty acids are catabolized to acetyl CoA in the mitochondrial matrix Chapter 4 Define diffusion, dialysis and osmosis. * Diffusion: solutes move along a concentration gradient from areas of high concentration of a molecule to areas of low concentration of that molecule; no membrane involved (evaporation, odors moving through air) * Dialysis: materials (solutes) which diffuse through cell membrane directly (lipid soluble compounds and dissolved gases) * Osmosis: water molecules diffuse across cell membranes toward the solution with the higher solute concentration i. e. lower water concentration; volume will increase on the side with higher concentration of solutes due to water movement not solute concentration What is the difference between active and passive transport. * Passive Transport: * No ATP used * Molecules may diffuse through the phospholipid bilayer using a protein carrier or channel due to random molecular motion occurring by the thermal energy in the molecules * Move with the concentration gradient * Active Transport: * Requires ATP * Requires membrane protein acting as a carrier * Moves molecules against a concentration gradient What are the types of passive transport we discussed? * Facilitated diffusion * Carrier: mediated transport- using protein carriers to move molecules along a concentration gradient * Protein Channels: proteins extending across membranes acting as an opening to allow molecules (usually water soluble) to move from 1 side to the other What are the types of active transport we discussed? * Primary Active Transport: using ATP as a direct energy source to move molecules across membranes against concentration gradients * Secondary Active Transport: use of a concentration gradient produced by

primary active transport as an “ energy source" to move other molecules against their gradient What factors need to be met in order to have a solute diffuse from one side of a membrane to another? * Electrochemical driving force- overall force that drives passive transport * Distance the particle has to move * Gradient size- difference between high and low concentration * Molecule size- smaller is faster * Temperature- more heat, faster motion What determines osmotic pressure? * The force of a solute concentration gradient that acts to create a gradient for water diffusion * Equal to the force needed to theoretically block osmosis Chapter 5 What are the 3 functional classifications of chemical messengers? CLASS | SECRETORY CELL TYPE | DISTANCE TO TARGET CELL | MODE OF TRANSPORT TO TARGET CELL | CHEMICAL CLASSIFICATION OF MESSENGER | Paracrine | (Several) | Short | Diffusion | Amines, peptides/proteins, eicosanoids | Neurotransmitter | Neuron | Short | Diffusion | Amino acids, amines, peptides/proteins | Hormone | Endocrine | Long | Blood | Amines, steroids, peptides/proteins | * Paracrines; communicate with neighboring cells; Ex. Histamine- important in allergic reactions and inflammation and is secreted by mast cells scattered t/o the body * Neurotransmitter: chemicals released into interstitial fluid from nervous system cells called neurons; Ex. Acetylcholine- released by the neurons that trigger contraction of skeletal muscles * Hormones: chemicals released from endocrine glands into the interstitial fluid where they can then diffuse into the blood; Ex. Insulin- secreted by the pancreas and acts on target cells t/ the body to regulate energy metabolism What are the 5 chemical classifications of messengers? Class | Chemical Property | Location of receptors on target cell | Functional classification | Amino acids |

Lipophobic | Plasma membrane | Neurotransmitters | Amines | Lipophobic | Plasma membrane | Paracrines, neurotransmitters, hormones | Peptides/proteins | Lipophobic | Plasma membrane | Paracrines, neurotransmitters, hormones | Steroids | Lipophilic | Cytosol | Hormones | Eicosanoids | Lipophilic | Cytosol | paracrines | * Examples: * Amino acids-glutamate, aspartate, glycine, gamma-aminobutyric acid (GABA) * Amine messengers: serotonin, thyroid hormones, histamine * Steroids: cholesterol * Eicosanoids: prostaglandins, leukotrienes and thromboxanes What determines the location of the receptor on the target cell? * Signal Transduction- Chemical messengers transmit their signals by binding to target cell receptors located either on the plasma membrane, in the cytosol or in the nucleus. Location of receptor depends on whether the messenger is lipophobic or lipophilic. Binding of messenger to receptor either changes the activity of proteins already present in the cell or stimulates the synthesis of new proteins. * Lipophobic messengers cannot permeate the plasma membrane * Receptors located on the plasma membrane with the binding site facing the extracellular fluid * Lipophilic messengers- Receptors located in the cystol or nucleus of target cells- readily available * These messengers can easily permeate the plasma membrane