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| **Physiology Lecture Outline                                 (Exam 1)**  **BIOL 123                                                                     (Fall '07)**      **1) Introduction**  Scientific method  Drug development  Homeostasis  Negative Feedback  Positive Feedback  Muscle Tissue  Skeletal vs. Cardiac vs. Smooth  Neural Tissue  Polarity  Dendrites, Soma, Axon, Terminal  Epithelium  Specializations  Simple vs. Stratified  Squamous vs. Cuboidal vs. Columnar  Connective Tissue    **2) Chemical Composition**  Atoms, Ions, and Bonds  Atomic Structure  Chemical Bonds  Covalent, Ionic, Hydrogen  Inorganic Compounds  Water  Polar Characteristics  Acids and Bases  Organic Compounds  Carbohydrates  Simple, Complex  Lipids  Triglycerides, Steroids  Proteins  Enzymes  Nucleic Acids  DNA, RNA, ATP, etc.    **3) Cell Structure**  Plasma Membrane  Composition  Transport  Diffusion  Phagocytosis  Pinocytosis  Carrier-Mediated Endocytosis  Exocytosis  Cilia, Flagelli, & Microvilli  Cytoplasm  Cytosol  Cytoskeleton  Organelles  Nucleus  Mitochondria  Lysozomes  Endoplasmic Reticulum  SER vs. RER  Golgi Complex  Protein Production    **4) Enzymes and Energy**  Enzymes as Catalysts  Mechanisms of Action  Control of Enzyme Activity  Temperature & pH  Cofactors & Coenzymes  Substrate Concentration  (Vmax & Km)  Reversible Reactions  Bioenergetics  Endergonic & Exergonic Rx  Coupled Reactions  (ATP or Oxidation-Reduction)  Energy Content of Food    **5) Cell Respiration and Metabolism**  Carbohydrate Metabolism  Glycolysis  Lactic Acid Pathway  Glycogenesis & Glycogenolysis  Cori Cycle & Gluconeogenesis  Kreb's Cycle  Oxidative Phosphorylation  Chemiosmotic Coupling of H+ gradient to ATP production  ATP Balance Sheet  Lipid Metabolism  Protein (Amino Acid) Metabolism    **6) Interactions Between Cells and the Extracellular Environment**  Diffusion and Osmosis  Carrier-mediated Transport  Facilitated Diffusion  Active Transport |

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| **Physiology Lecture Outline                                 (Exam 2)**  **BIOL 123                                                                     (Fall '07)**      **6)  Membranes and Transport**  Membrane Transport  Diffusion  Osmosis  Osmolarity and Tonicity  Carrier-mediated Transport  Faciliated Diffusion  Primaty Active Transport  Secondary Active Transport  Cotransp., Countertransp.  Vesicular Transport  Exocytosis  Endocytosis  Pinocytosis  Receptor-mediated Endocytosis  Transmembrane Potential  Nernst Potential    **7)  Neurons and Synapses**  Neurons  Structure  Dendrite  Soma  Axon  Spike Initiation Zone (= initial segment or axon hillock)  Bouton (= axon terminal)  Neuroglia  PNS -  Schwaan cells  Satellite cells  CNS -  Astrocytes  Oligodendrocytes  Microglia  Ependymal cells  Electrical Activity  Changes in Transmembr. Pot'l  Graded Potentials  Depol'n, Hyperpol'n  Action Potentials (AP)  All-or-None Principle  Threshold  Generation of AP  Volt.-gated Channels  Na+, K+  Refractory Period  Propagation of AP  Myelinat'n, Axon Diam.  Synapse  Electrical Synapses  Gap Junctions  Chemical Synapses  Neurotransmitters  Acetylcholine  Monoamines  Serotonin  Catecholamines  Dopamine  Norepinephrine  Epinephrine  Amino Acids  Glutamate (& Asp.)  Glycine  GABA  Neuropeptides  Substance P  Peptide Y  Endogenous Opioids  Enkephalins  Endorphins  Dynorphins  Endogenous Cannabinoid  Nitric Oxide (& CO)  Synaptic Integration  Post-synaptic Potentials  EPSP, IPSP  Summation  Spatial, Temporal    **8)  Central Nervous System**  Organization of the Brain  Embryological Regions  1o2o Vesicles  Protection and Support of the Brain  Meninges  Pia, Arachnoid, Dura  Cerebrospinal Fluid (CSF)  Formation of CSF  Choroid Plexus  Circulation of CSF  Ventricles  Apertures  Arachnoid Granulations  Cerebrum  Cerebral Cortex  Lobes  Sensory Cortices  Association Cortices  Hemispheric Lateralization  Basal Nuclei  Limbic System  Papez' Circuit  Diencephalon  Epithalamus  Pineal gland  Thalamus  Anterior Nucleus  Lateral Geniculate Nucleus  Medial Geniculate Nucleus  Hypothalamus  Supraoptic nucleus (ADH)  Paraventricular Nucleus (oxytocin)  Mammilary Bodies  Autonomic control centers  Pituitary Gland  Posteror & Anterior  Mesencephalon  Tectum  Superior Colliculus  Inferior Colliculus  Tegmentum  Red Nucleus  Substantia Nigra  Ventral Tegmental Area  Pons  pneumotaxic & apneustic centers  Cerebellum  Medulla Oblongata  cardiovascular centers  respiratory rythmicity center  reticular formation  Spinal Cord Tracts  Ascending Pathways  Posterior Column  Anterolateral (spinothalamic)  Spinocerebellar  Descending Pathways  Corticospinal (pyramidal)  Extrapyramidal  Vestibulospinal Tract  Reticulospinal Tract  Tectospinal Tract  Rubrospinal Tract  Cranial Nerves  Olfactory (I)  Optic (II)  Oculomotor (III)  Trochlear (IV)  Trigeminal (V)  Abducens (VI)  Facial (VII)  Vestibulocochlear (VIII)  Glossopharyngeal (IX)  Vagus (X)  Spinal Accessory (XI)  Hypoglossal (XII) |

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| **Physiology Lecture Outline                                          (Exam 3)**  **BIOL 123                                                                              (Fall '07)**        **9)  Autonomic Nervous System**  Sympathetic Division  = Thoracolumbar  "Fight-or-Flight"  Adrenergic effects  Parasympathetic Division  = Craniosacral  "Rest & Digest"  Cholinergic effects  Dual Innervation  Control by higher CNS centers      **10) Sensory Systems**  General Sensory Concepts  Functional categories  Tonic vs. phasic responses  Sensory adaptation  Law of Specific Nerve Energies  Cutaneous Sensations  Types of receptors  Receptive fields & acuity  Lateral inhibition  Gustation  Taste Receptors  Taste Primaries  CNS Pathways  Nucleus of the Solitary Tract  Gustatory Cortex  Hypothalamus  Olfaction  Olfactory Receptors  CNS Pathways  Common Chemical Sense  Trigeminal nerve (CN V)  Irritant stimuli  Interactions with taste & smell  Equilibrium  Hair Cells  Stereocilia  Kinocilia  Tip Junctions  Endolymph  Saccule & Utricle  Maculae  Semicircular Ducts  Cristae  Vestibular Nucleus  Nystagmus & Vertigo  Hearing  Outer Ear  Pinna, Canal  Middle Ear  Tympanic Membrane  Malleus, Incus, Stapes  Tensor tympani & Stapedius  Auditory Tube  Cochlea  Vestibular Duct  Tympanic Duct  Cochlear Duct  Organ of Corti  Basilar Membrane  Tectorial Membrane  Hair Cell Rows  Endolymph  Auditory Pathways  Cochlear Nuclei  Inferior Colliculus  Medial Geniculate Nucleus  Auditory Cortex  Hearing Impairments  Conduction Deafness  Sensorineural Deafness  Vision  Fibrous Tunic  Cornea  Refraction  Vascular Tunic  Ciliary Body  Lens  Accommodation  Visual Acuity  Iris  Pupil Control  Aqueous Humor  Neural Tunic  Retinal layers  Phototransduction  Color Vision  CNS Pathways  Lateral Geniculate Nucleus  Visual Cortex  Superior Colliculus  Suprachiasmatic Nucleus |

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| **Physiology Lecture Outline                                           (Exam 4)**  **BIOL 123                                                                               (Fall '07)**      **11)  Endocrine System**  Intercellular communication  Endocrine, Paracrine, Autocrine  Classes of hormones  Amino acid derivatives  Peptides  Lipids – steroids, eicosanoids  Mechanisms of action  Nuclear receptors:  steroid hormones  thyroxins (T3/T4)  G-protein activated:  adenylate cyclase  phosphodiesterase  phospholipase C  Pituitary gland  Neurohypophysis  Axons from hypothalamus  Supraoptic nucleus  Antidiuretic hormone  Paraventricular nucleus  Oxytocin  Adenohypophysis  Derived from gut tube  Hypothalamo-hypophyseal portal system  Thyroid-stimulating hormone  TRHTSHT3/T4  Adrenocorticotropic hormone  CRHACTHsteroids  Gonadotropins  GnRHFSH/LHsteroids  Prolactin  PRF/PIHProlactin  Growth hormone  GHRH/GHIHGHsomatomedins  act on liver  Adrenal gland  Medulla  Epinephrine  Cortex  Glucocorticoidds  Mineralocorticoids  Sex steroids    Thyroid gland  Follicles  TyrosineT3/T4  Increase metabolism  Parafollicular cells  Calcitonin  Decrease [Ca++]  Parathyroid glands  Parathyriod hormone  Increase [Ca++]  Pancreas  Insulin –  cells  Decrease [sugar]  Glucagon –  cells  Increase [sugar]  Gonads  Testes  Seminiferous tubules  Spermatogenesis  Leydig cells  Testosterone  Ovaries  Follicular cells  Oogenesis  Estrogen  Corpus luteum  Progesterone  Menstrual cycle    **12)  Muscle Tissue**  Anatomy of skeletal muscle  Connective tissues  Tendon, epimysium, perimysium, endomysium  Skeletal muscle fibers  Sarcolemma  Transverse tubules  Sarcoplasmic reticulum  Sarcomeres  I band  Z disc, actin  A band  H zone, M line, myosin  Filaments – actin/myosin    Contraction of sk. mm.  Sliding filament mechanism  Ca++, troponin, tropomyosin, myosin cross-bridges, ATP hydrolysis  Excitation-contraction coupling  AChAPCa++  Tension production  Length-tension relationship  Summationtetanus  Recruitment  Energy use  ATP & creatine phosphate  Muscle fiber performance  Fast-twitch – white muscle  glycolyticanaerobic  Slow-twitch – red muscle  oxidativeaerobic  Cardiac muscle  intercalated discs  gap junctions  automatic rhythmic potentials  autonomic control  Smooth muscle  non-striated – no sarcomeres  dense bodies, calmodulin  myogenic contractions  Monosynaptic reflexes  Stretch reflex (knee-jerk)  Muscle Spindle Organ  Intrafusal & Extrafusal fibers   &  motor neurons  Polysynaptic reflexes  Tendon reflexes (Golgi)  Withdrawal (flexor) reflexes  Crossed extensor reflexes    **13) Heart & Circulation**  Plasma  Water  Electrolytes  Proteins  Albumin  Globulins  Fibrinogen    Formed Elements of Blood  Erythrocytes  Hemoglobin  O2 carrying  Antigens & Blood Typing  Leukocytes  Phagocytic  Inflammation response  Platelets  Megakaryocytes  Clotting response  Cardiac Cycle  Pressure & Volume changes  Diastole / Systole  Heart sounds  Electric Activity of the Heart  Conducting system  Sinoatrial node  Atrioventricular node  AV bundle  Purkinje fibers  Electrocardiogram  P wave  Q-R-S complex  T wave  Blood vessels  Tunica interna, media, externa  Arteries, capillaries, veins  Atherosclerosis  Lymphatic vessels    **14) Cardiac Output**  CO = HR x SV  Heart rate  Autonomic innervation  Stroke volume  End-diastolic volume  Preload  Venous return  End-systolic volume  Contractility  Afterload |