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| **Physiology Lecture Outline                                 (Exam 1)****BIOL 123                                                                     (Fall '07)** **1) Introduction**Scientific methodDrug developmentHomeostasisNegative FeedbackPositive FeedbackMuscle TissueSkeletal vs. Cardiac vs. SmoothNeural TissuePolarityDendrites, Soma, Axon, TerminalEpitheliumSpecializationsSimple vs. StratifiedSquamous vs. Cuboidal vs. ColumnarConnective Tissue **2) Chemical Composition**Atoms, Ions, and BondsAtomic StructureChemical BondsCovalent, Ionic, HydrogenInorganic CompoundsWaterPolar CharacteristicsAcids and BasesOrganic CompoundsCarbohydratesSimple, ComplexLipidsTriglycerides, SteroidsProteinsEnzymesNucleic AcidsDNA, RNA, ATP, etc. **3) Cell Structure**Plasma MembraneCompositionTransportDiffusionPhagocytosisPinocytosisCarrier-Mediated EndocytosisExocytosisCilia, Flagelli, & MicrovilliCytoplasmCytosolCytoskeletonOrganellesNucleusMitochondriaLysozomesEndoplasmic ReticulumSER vs. RERGolgi ComplexProtein Production **4) Enzymes and Energy**Enzymes as CatalystsMechanisms of ActionControl of Enzyme ActivityTemperature & pHCofactors & CoenzymesSubstrate Concentration(Vmax & Km)Reversible ReactionsBioenergeticsEndergonic & Exergonic RxCoupled Reactions(ATP or Oxidation-Reduction)Energy Content of Food **5) Cell Respiration and Metabolism**Carbohydrate MetabolismGlycolysisLactic Acid PathwayGlycogenesis & GlycogenolysisCori Cycle & GluconeogenesisKreb's CycleOxidative PhosphorylationChemiosmotic Coupling of H+ gradient to ATP productionATP Balance SheetLipid MetabolismProtein (Amino Acid) Metabolism **6) Interactions Between Cells and the Extracellular Environment**Diffusion and OsmosisCarrier-mediated TransportFacilitated DiffusionActive Transport    |

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| **Physiology Lecture Outline                                 (Exam 2)****BIOL 123                                                                     (Fall '07)** **6)  Membranes and Transport**Membrane TransportDiffusionOsmosisOsmolarity and TonicityCarrier-mediated TransportFaciliated DiffusionPrimaty Active TransportSecondary Active TransportCotransp., Countertransp.Vesicular TransportExocytosisEndocytosisPinocytosisReceptor-mediated EndocytosisTransmembrane PotentialNernst Potential **7)  Neurons and Synapses**NeuronsStructureDendriteSomaAxonSpike Initiation Zone (= initial segment or axon hillock)Bouton (= axon terminal)NeurogliaPNS -  Schwaan cellsSatellite cellsCNS -  AstrocytesOligodendrocytesMicrogliaEpendymal cellsElectrical ActivityChanges in Transmembr. Pot'lGraded PotentialsDepol'n, Hyperpol'nAction Potentials (AP)All-or-None PrincipleThresholdGeneration of APVolt.-gated ChannelsNa+, K+Refractory PeriodPropagation of APMyelinat'n, Axon Diam.SynapseElectrical SynapsesGap JunctionsChemical SynapsesNeurotransmittersAcetylcholineMonoaminesSerotoninCatecholaminesDopamineNorepinephrineEpinephrineAmino AcidsGlutamate (& Asp.)GlycineGABANeuropeptidesSubstance PPeptide YEndogenous OpioidsEnkephalinsEndorphinsDynorphinsEndogenous CannabinoidNitric Oxide (& CO)Synaptic IntegrationPost-synaptic PotentialsEPSP, IPSPSummationSpatial, Temporal **8)  Central Nervous System**Organization of the BrainEmbryological Regions1o2o VesiclesProtection and Support of the BrainMeningesPia, Arachnoid, DuraCerebrospinal Fluid (CSF)Formation of CSFChoroid PlexusCirculation of CSFVentriclesAperturesArachnoid GranulationsCerebrumCerebral CortexLobesSensory CorticesAssociation CorticesHemispheric LateralizationBasal NucleiLimbic SystemPapez' CircuitDiencephalonEpithalamusPineal glandThalamusAnterior NucleusLateral Geniculate NucleusMedial Geniculate NucleusHypothalamusSupraoptic nucleus (ADH)Paraventricular Nucleus (oxytocin)Mammilary BodiesAutonomic control centersPituitary GlandPosteror & AnteriorMesencephalonTectumSuperior ColliculusInferior ColliculusTegmentumRed NucleusSubstantia NigraVentral Tegmental AreaPonspneumotaxic & apneustic centersCerebellumMedulla Oblongatacardiovascular centersrespiratory rythmicity centerreticular formationSpinal Cord TractsAscending PathwaysPosterior ColumnAnterolateral (spinothalamic)SpinocerebellarDescending PathwaysCorticospinal (pyramidal)ExtrapyramidalVestibulospinal TractReticulospinal TractTectospinal TractRubrospinal TractCranial NervesOlfactory (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 effectsParasympathetic Division= Craniosacral"Rest & Digest"Cholinergic effectsDual InnervationControl by higher CNS centers**10) Sensory Systems**General Sensory ConceptsFunctional categoriesTonic vs. phasic responsesSensory adaptationLaw of Specific Nerve EnergiesCutaneous SensationsTypes of receptorsReceptive fields & acuityLateral inhibitionGustationTaste ReceptorsTaste PrimariesCNS PathwaysNucleus of the Solitary TractGustatory CortexHypothalamusOlfactionOlfactory ReceptorsCNS PathwaysCommon Chemical SenseTrigeminal nerve (CN V)Irritant stimuliInteractions with taste & smellEquilibriumHair CellsStereociliaKinociliaTip JunctionsEndolymphSaccule & UtricleMaculaeSemicircular DuctsCristaeVestibular NucleusNystagmus & VertigoHearingOuter EarPinna, CanalMiddle EarTympanic MembraneMalleus, Incus, StapesTensor tympani & StapediusAuditory TubeCochleaVestibular DuctTympanic DuctCochlear DuctOrgan of CortiBasilar MembraneTectorial MembraneHair Cell RowsEndolymphAuditory PathwaysCochlear NucleiInferior ColliculusMedial Geniculate NucleusAuditory CortexHearing ImpairmentsConduction DeafnessSensorineural DeafnessVisionFibrous TunicCorneaRefractionVascular TunicCiliary BodyLensAccommodationVisual AcuityIrisPupil ControlAqueous HumorNeural TunicRetinal layersPhototransductionColor VisionCNS PathwaysLateral Geniculate NucleusVisual CortexSuperior ColliculusSuprachiasmatic Nucleus |

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| **Physiology Lecture Outline                                           (Exam 4)****BIOL 123                                                                               (Fall '07)** **11)  Endocrine System**Intercellular communicationEndocrine, Paracrine, AutocrineClasses of hormonesAmino acid derivativesPeptidesLipids – steroids, eicosanoidsMechanisms of actionNuclear receptors:steroid hormonesthyroxins (T3/T4)G-protein activated:adenylate cyclasephosphodiesterasephospholipase CPituitary glandNeurohypophysisAxons from hypothalamusSupraoptic nucleusAntidiuretic hormoneParaventricular nucleusOxytocinAdenohypophysisDerived from gut tubeHypothalamo-hypophyseal portal systemThyroid-stimulating hormoneTRHTSHT3/T4Adrenocorticotropic hormoneCRHACTHsteroidsGonadotropinsGnRHFSH/LHsteroidsProlactinPRF/PIHProlactinGrowth hormoneGHRH/GHIHGHsomatomedinsact on liverAdrenal glandMedullaEpinephrineCortexGlucocorticoiddsMineralocorticoidsSex steroidsThyroid glandFolliclesTyrosineT3/T4Increase metabolismParafollicular cellsCalcitoninDecrease [Ca++]Parathyroid glandsParathyriod hormoneIncrease [Ca++]PancreasInsulin –  cellsDecrease [sugar]Glucagon –  cellsIncrease [sugar]GonadsTestesSeminiferous tubulesSpermatogenesisLeydig cellsTestosteroneOvariesFollicular cellsOogenesisEstrogenCorpus luteumProgesteroneMenstrual cycle **12)  Muscle Tissue**Anatomy of skeletal muscleConnective tissuesTendon, epimysium, perimysium, endomysiumSkeletal muscle fibersSarcolemmaTransverse tubulesSarcoplasmic reticulumSarcomeresI bandZ disc, actinA bandH zone, M line, myosinFilaments – actin/myosinContraction of sk. mm.Sliding filament mechanismCa++, troponin, tropomyosin, myosin cross-bridges, ATP hydrolysisExcitation-contraction couplingAChAPCa++Tension productionLength-tension relationshipSummationtetanusRecruitmentEnergy useATP & creatine phosphateMuscle fiber performanceFast-twitch – white muscleglycolyticanaerobicSlow-twitch – red muscleoxidativeaerobicCardiac muscleintercalated discsgap junctionsautomatic rhythmic potentialsautonomic controlSmooth musclenon-striated – no sarcomeresdense bodies, calmodulinmyogenic contractionsMonosynaptic reflexesStretch reflex (knee-jerk)Muscle Spindle OrganIntrafusal & Extrafusal fibers &  motor neuronsPolysynaptic reflexesTendon reflexes (Golgi)Withdrawal (flexor) reflexesCrossed extensor reflexes **13) Heart & Circulation**PlasmaWaterElectrolytesProteinsAlbuminGlobulinsFibrinogenFormed Elements of BloodErythrocytesHemoglobinO2 carryingAntigens & Blood TypingLeukocytesPhagocyticInflammation responsePlateletsMegakaryocytesClotting responseCardiac CyclePressure & Volume changesDiastole / SystoleHeart soundsElectric Activity of the HeartConducting systemSinoatrial nodeAtrioventricular nodeAV bundlePurkinje fibersElectrocardiogramP waveQ-R-S complexT waveBlood vesselsTunica interna, media, externaArteries, capillaries, veinsAtherosclerosisLymphatic vessels **14) Cardiac Output**CO = HR x SVHeart rateAutonomic innervationStroke volumeEnd-diastolic volumePreloadVenous returnEnd-systolic volumeContractilityAfterload  |