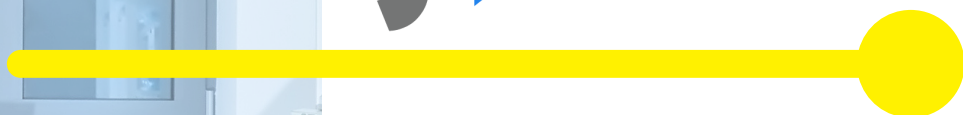


PRE- HEALTH PREP with

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BASIC BIOLOGY




Biological and Biochemical
Foundations of Living Systems

- Restriction Enzyme Digests
- DNA Ligation Reactions
- An Introduction to Transfection
- Plasmid Purification
- Bacterial Transformation: Electroporation
- DNA Gel Electrophoresis
- PCR: The Polymerase Chain Reaction

NEUROSCIENCE

Chemical and Physical Foundations of
Biological Systems

- An Introduction to Neurophysiology
 - Patch Clamp Electrophysiology
 - Calcium Imaging in Neurons
 - An Introduction to Neuroanatomy
 - An Introduction to Behavioral Neuroscience
 - An Introduction to Cellular and Molecular Neuroscience
 - An Introduction to Developmental Neurobiology
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DEVELOPMENTAL BIOLOGY


Biological and Biochemical
Foundations of Living Systems

- An Introduction to Developmental Genetics
- Genetic Engineering of Model Organisms
- Explant Culture for Developmental Studies
- An Introduction to Stem Cell Biology
- Induced Pluripotency
- An Introduction to Organogenesis
- An Introduction to Aging and Regeneration
- Tissue Regeneration with Somatic Stem Cells

GENETICS

Biological and Biochemical
Foundations of Living Systems

- An Overview of Genetic Analysis
- Genetic Crosses
- Genetic Screens
- An Overview of Genetics and Disease
- SNP Genotyping
- Cytogenetics
- An Overview of Gene Expression
- An Overview of Epigenetics
- DNA Methylation Analysis

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- Chromatin Immunoprecipitation
 - Recombineering and Gene Targeting


CELL BIOLOGY


Biological and Biochemical
Foundations of Living Systems

- An Introduction to Cell Division
- Cell Cycle Analysis
- An Introduction to Cell Motility and Migration
- An Introduction to Endocytosis and Exocytosis
- An Introduction to Cell Metabolism
- The ATP Bioluminescence Assay
- Detecting Reactive Oxygen Species
- An Introduction to Cell Death
- The TUNEL Assay

GENERAL CHEMISTRY


Chemical and Physical Foundations of
Biological Systems

- Solutions and Concentrations
 - Determining the Density of a Solid and Liquid
 - Determining the Empirical Formula
 - Determining the Solubility Rules of Ionic Compounds
 - Using a pH Meter
 - Introduction to Titration
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- Ideal Gas Law
 - Spectrophotometric Determination of an Equilibrium Constant
 - Le Chatelier's Principal
 - Freezing-Point Depression to Determine an Unknown Compound
 - Determining Rate Laws and the Order of Reaction
 - Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
 - Coordination Chemistry Complexes

ORGANIC CHEMISTRY

Chemical and Physical Foundations of Biological Systems

- Introduction to Catalysis
 - Assembly of a Reflux System for Heated Chemical Reactions
 - Degassing Liquids with Freeze-Pump-Thaw Cycling
 - Preparing Anhydrous Reagents and Equipment
 - Purifying Compounds by Recrystallization
 - Separation of Mixtures via Precipitation
 - Solid-Liquid Extraction
 - Fractional Distillation
 - Growing Crystals for X-Ray Diffraction Analysis
 - Performing 1D Thin Layer Chromatography
 - Column Chromatography
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ANALYTICAL CHEMISTRY

Biological and Physical Foundations
of Biological Systems

- Sample Preparation for Analytical Characterization
- Ultraviolet-Visible (UV-Vis) Spectroscopy
- Gas Chromatography (GC) with Flame-Ionization Detection
- High-Performance Liquid Chromatography (HPLC)
- Ion-Exchange Chromatography
- Introduction to Mass Spectrometry

BIOCHEMISTRY

Biological and Biochemical
Foundations of Living Systems

- Dialysis: Diffusion Based Separation
 - Enzyme Assays and Kinetics
 - Chromatography-Based Biomolecule Purification Methods
 - Two-Dimensional Gel Electrophoresis
 - Metabolic Labeling
 - Electrophoretic Mobility Shift Assay (EMSA)
 - Photometric Protein Determination
 - Density Gradient Ultracentrifugation
 - Reconstitution of Membrane Proteins
 - Förster Resonance Energy Transfer (FRET)
- 




PHYSICS I


Chemical and Physical Foundations of Biological Systems

- Newton's Laws of Motion
- Force and Acceleration
- Vectors in Multiple Directions
- Kinematics and Projectile Motion
- Newton's Law of Universal Gravitation
- Conservation of Momentum
- Friction
- Hooke's Law and Simple Harmonic Motion
- Equilibrium and Free-Body Diagrams
- Torque
- Rotational Inertia
- Angular Momentum
- Energy and Work
- Enthalpy
- Entropy

PHYSICS II


Chemical and Physical Foundations of Biological Systems

- Electric Fields
 - Electric Potential
 - Magnetic Fields
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- Electric Charge in a Magnetic Field
 - Ohm's Law
 - Series and Parallel Resistors
 - Capacitance
 - Inductance
 - Semiconductors
 - Photoelectric Effect
 - Reflection and Refraction
 - Interference and Diffraction
 - Standing Waves
 - Sound Waves and Doppler Shifts

ENVIRONMENTAL MICROBIOLOGY

Biological and Biochemical
Foundations of Living Systems

- Gram Staining of Bacteria from Environmental Sources
 - Community DNA Extraction from Bacterial Colonies
 - Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis
 - RNA Analysis of Environmental Samples Using RT-PCR
 - Quantifying Environmental Microorganisms and Viruses Using qPCR
 - Water Quality Analysis via Indicator Organisms
 - Detection of Bacteriophages in Environmental Samples
 - Bacterial Growth Curve Analysis and its Environmental Applications
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BEHAVIORAL SCIENCE





Psychological, Social, and Biological
Foundations of Behavior

- An Introduction to Learning and Memory
- Fear Conditioning
- Spatial Memory Testing Using Mazes
- An Introduction to Cognition
- Electroencephalography
- Eye Tracking in Cognitive Experiments
- An Introduction to Motor Control
- Balance and Coordination Testing
- Assessing Dexterity with Reaching Tasks
- An Introduction to Reward and Addiction
- Positive Reinforcement Studies
- Self-Administration Studies
- An Introduction to Modeling Behavioral Disorders and Stress
- Modeling Social Stress
- Anxiety Testing

EXPERIMENTAL PSYCHOLOGY


Psychological, Social, and Biological
Foundations of Behavior


- Ethics in Psychology Research
 - Perspectives on Experimental Psychology
 - Observational Research
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- The Simple Experiment: Two-Group Design
 - The Multi-Group Experiment
 - Within-Subjects Repeated-Measures Design
 - Realism in Experimentation
 - Pilot Testing
 - The Factorial Experiment
 - Self-Reported vs. Behavioral Measures of Recycling
 - Reliability in Psychology Experiments
 - Placebos in Research
 - Manipulating an Independent Variable through Embodiment
 - Experimenting Using a Confederate

COGNITIVE PSYCHOLOGY


Psychological, Social, and Biological
Foundations of Behavior



- Dichotic Listening
 - Measuring Reaction Time and Donders' Method of Subtraction
 - Perspective on Cognitive Psychology
 - Visual Search for Features and Conjunctions
 - Binocular Rivalry
 - Multiple Object Tracking
 - Approximate Number Sense Test
 - Mental Rotation
 - Prospect Theory
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- Measuring Verbal Working Memory Span
 - The Precision of Visual Working Memory with Delayed Estimation
 - Verbal Priming
 - Incidental Encoding
 - Visual Statistical Learning
 - Motor Learning in Mirror Drawing

DEVELOPMENTAL PSYCHOLOGY

Psychological, Social, and Biological
Foundations of Behavior

- Habituation: Studying Infants Before They Can Talk
 - Using Your Head: Measuring Infants' Rational Imitation of Actions
 - The Rouge Test: Searching for a Sense of Self
 - Numerical Cognition: More or Less
 - Mutual Exclusivity: How Children Learn the Meanings of Words
 - How Children Solve Problems Using Causal Reasoning
 - Metacognitive Development: How Children Estimate Their Memory
 - Executive Function and the Dimensional Change Card Sort Task
 - Categories and Inductive Inferences
 - The Costs and Benefits of Natural Pedagogy
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- Piaget's Conservation Task and the Influence of Task Demands
 - Children's Reliance on Artist Intentions When Identifying Pictures
 - Measuring Children's Trust in Testimony
 - How Praise Influences Children's Motivation
 - Memory Development: Demonstrating How Repeated Questioning Leads to False Memories
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JoVE Core Videos

Undergraduate

Biology and Chemistry Concepts

BIOLOGICAL AND BIOCHEMICAL FOUNDATIONS OF LIVING SYSTEMS

- What are Proteins?
 - Protein Organization
 - Protein Folding
 - Macromolecules
 - The Central Dogma
 - What is Gene Expression?
 - The DNA Helix
 - DNA Packaging
 - Organization of Genes
 - Karyotyping
 - Replication in Prokaryotes
 - Replication in Eukaryotes
 - Transcription
 - Translation
 - Ribosomes
 - What are Nucleic Acids?
 - Phosphodiester Linkages
 - RNA Structure
 - Types of RNA
 - MicroRNAs
 - RNA Splicing
 - Proofreading
 - Mismatch Repair
 - Nucleotide Excision Repair
 - Mutations
 - Epigenetic Regulation
 - RNA Interference
 - What is Metabolism?
 - First Law of Thermodynamics
 - Second Law of Thermodynamics
 - Kinetic Energy
 - Potential Energy
 - Free Energy
 - Activation Energy
 - Induced-fit Model
 - Hydrolysis of ATP
 - Phosphorylation
 - Feedback Inhibition
 - What is Glycolysis?
 - Energy-requiring Steps of Glycolysis
 - Energy-releasing Steps of Glycolysis
 - Pyruvate Oxidation
 - The Citric Acid Cycle
 - Electron Transport Chains
 - Chemiosmosis
 - Electron Carriers
 - Fermentation
- 



BIOLOGICAL AND BIOCHEMICAL FOUNDATIONS OF LIVING SYSTEMS

- Dietary Connections
 - What are Cells?
 - Cell Size
 - Eukaryotic Compartmentalization
 - What are Lipids?
 - The Fluid Mosaic Model
 - What is an Electrochemical Gradient?
 - Diffusion
 - Osmosis
 - Tonicity in Animals
 - Protein Associations
 - Facilitated Transport
 - Primary Active Transport
 - Secondary Active Transport
 - Receptor-mediated Endocytosis
 - Pinocytosis
 - Phagocytosis
 - Exocytosis
 - Contact-dependent Signaling
 - The Nucleus
 - Microtubules
 - Mitochondria
 - The Extracellular Matrix
 - Tissues
 - Prokaryotic Cells
 - Bacterial Signaling
 - Genomic DNA in Prokaryotes
 - Binary Fission
 - Replication in Prokaryotes
 - Bacterial Transformation
 - What are Viruses?
 - Viral Structure
 - Lytic Cycle of Bacteriophages
 - Lysogenic Cycle of Bacteriophages
 - Retrovirus Life Cycles
 - Viral Recombination
 - Viral Mutations
 - Mitosis and Cytokinesis
 - What is the Cell Cycle?
 - Interphase
 - Positive Regulator Molecules
 - Negative Regulator Molecules
 - Intracellular Signaling Cascades
 - Spermatogenesis
 - Oogenesis
 - Fertilization
 - Cleavage and Blastulation
 - Gastrulation
 - Neurulation
 - Cell Migration
 - Determination
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BIOLOGICAL AND BIOCHEMICAL FOUNDATIONS OF LIVING SYSTEMS


- Induced Pluripotent Stem Cells
 - Embryonic Stem Cells
 - What is a Nervous System?
 - The Sympathetic Nervous System
 - The Parasympathetic Nervous System
 - Neuron Structure
 - Glial Cells
 - Action Potentials
 - The Resting Membrane Potential
 - Long-term Potentiation
 - Long-term Depression
 - Ion Channels
 - G-protein Coupled Receptors
 - Synaptic Signaling
 - Enzyme-linked Receptors
 - What is the Endocrine System?
 - Intracellular Hormone Receptors
 - Cell-surface Signaling
 - Feedback Loops
 - Hypothalamic-Pituitary Axis
 - Paracrine Signaling
 - Endocrine Signaling
 - What are Second Messengers?
 - Intracellular Signaling Cascades
 - The Respiratory System
 - Breathing
 - Lung Capacity
 - Gas Exchange and Transport
 - Anatomy of the Circulatory System
 - Anatomy of the Heart
 - The Cardiac Cycle
 - Blood Flow
 - Physiology of the Circulatory System
 - What is the Immune System?
 - Cell-mediated Immune Responses
 - Humoral Immune Responses
 - Antibody Structure
 - Affinity and Avidity
 - Cross-reactivity
 - Allergic Reactions
 - Inflammation
 - Vaccinations
 - What is Monogastric Digestion?
 - Anatomy of the Intestines
 - Accessory Organs
 - Lipid Digestion
 - Protein Digestion
- 



BIOLOGICAL AND BIOCHEMICAL FOUNDATIONS OF LIVING SYSTEMS

- Carbohydrate Digestion
- Neural Regulation
- Hormonal Regulation
- Kidney Structure
- Filtration
- Urea Cycle
- Hormonal Regulation
- Spermatogenesis
- Fertilization
- Skeletal Muscle Anatomy
- Muscle Contraction
- Classification of Skeletal Muscle Fibers
- Cross-bridge Cycle
- Motor Units
- What is the Skeletal System?
- Bone Structure
- Joints
- Bone Remodeling
- Somatosensation

SCIENTIFIC INQUIRY AND REASONING SKILLS


- Thermosensation
 - Levels of Organization
 - Taxonomy
 - Phylogeny
 - Inductive Reasoning
 - Deductive Reasoning
 - Correlation and Causation
 - The Scientific Method
- 



PSYCHOLOGICAL, SOCIAL, AND BIOLOGICAL FOUNDATIONS OF BEHAVIOR


- What is a Sensory System?
- The Tongue and Taste Buds
- Gustation
- Olfaction
- Hearing
- Hair Cells
- The Cochlea
- The Vestibular System
- The Retina
- Somatosensation
- Thermosensation

CHEMICAL AND PHYSICAL FOUNDATIONS OF BIOLOGICAL SYSTEMS

- The Periodic Table and Organismal Elements
 - Atomic Structure
 - Electron Behavior
 - Electron Orbital Model
 - Molecules and Compounds
 - Molecular Shapes
 - Carbon Skeletons
 - Covalent Bonds
 - Ionic Bonds
 - Hydrogen Bonds
 - Van der Waals Interactions
 - pH
 - Solvents
 - Specific Heat
 - Vaporization
 - What are Proteins?
 - Protein Organization
 - Protein Folding
 - What are Carbohydrates?
- 



CHEMICAL AND PHYSICAL FOUNDATIONS OF BIOLOGICAL SYSTEMS

- What are Lipids?
 - What are Nucleic Acids?
 - Cohesion
 - States of Water
 - Blood Flow
 - Gas Exchange and Transport
 - Lung Capacity
 - Physiology of the Circulatory System
 - Diffusion and Osmosis
 - Diffusion
 - Osmosis
 - Cellular Respiration
 - Chemical Reactions
 - Redox Reactions
 - Isotopes
 - What is an Electrochemical Gradient?
 - Electron Transport Chains
 - What is a Sensory System?
 - Hearing
 - Hair Cells
 - The Retina
 - Vision
 - The Periodic Table and Organismal Elements
 - Adhesion
 - Electron Carriers
 - Glial Cells
 - Action Potentials
 - The Resting Membrane Potential
 - Long-term Potentiation
 - Long-term Depression
 - Energy-requiring Steps of Glycolysis
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JoVE Journal Relevant Videos

- *Synthesis of Monocyte-Targeting Peptide Amphiphile Micelles for Imaging of Atherosclerosis* - keyword - **Hydrophobic/Hydrophilic Amino Acids** - Biological and Physical Foundations of Biological Systems
- *Protein WISDOM: A Workbench for In Silico De novo Design of BioMolecules* - keyword - **Hydrophobic/Hydrophilic Amino Acids** - Biological and Physical Foundations of Biological Systems
- *A Protocol for Computer-Based Protein Structure and Function Prediction* - keyword - **Protein Structure** - Biological and Physical Foundations of Biological Systems
- *Contrast-Matching Detergent in Small-Angle Neutron Scattering Experiments for Membrane Protein Structure Analysis and Ab Initio Modeling* - keyword - **Protein Structure** - Biological and Physical Foundations of Biological Systems
- *Time-resolved ElectroSpray Ionization Hydrogen-Deuterium Exchange Mass Spectrometry for Studying Protein Structure and Dynamics* - keyword - **Protein Structure** - Biological and Physical Foundations of Biological Systems
- *Mass Spectrometric Approaches to Study Protein Structure and Interactions in Lyophilized Powders* - keyword - **Protein Structure** - Biological and Physical Foundations of Biological Systems
- *Optimized Negative Staining: a High-Throughput Protocol for Examining Small and Asymmetric Protein Structure by Electron Microscopy* - keyword - **Protein Structure** - Biological and Physical Foundations of Biological Systems

- *Capillary Electrophoresis Separation of Monoclonal Antibody Isoforms Using a Neutral Capillary* - keyword - **Isoelectric Point Protein Separation** - Biological and Physical Foundations of Biological Systems
- *Highly Sensitive and Quantitative Detection of Proteins and their Isoforms by Capillary Isoelectric Focusing Method* - keyword - **Isoelectric Point Protein Separation** - Biological and Physical Foundation of Biological Systems
- *Total Protein Extraction and 2-D Gel Electrophoresis Methods for Burkholderia Species* - keyword - **Isoelectric Point Protein Separation** - Biological and Physical Foundations of Biological Systems
- *Electrophoretic Separation of Proteins* - keyword - **Electrophoresis Protein Separation** - Biological and Physical Foundations of Biological Systems
- *A Novel Saturation Mutagenesis Approach: Single Step Characterization of Regulatory Protein Binding Sites in RNA Using Phosphorothioates* - keyword - **Protein Binding** - Biological and Physical Foundations of Biological Systems
- *Dissipative Microgravimetry to Study the Binding Dynamics of the Phospholipid Binding Protein Annexin A2 to Solid-Supported Lipid Bilayers using a Quartz Resonator* - keyword - **Protein Binding** - Biological and Physical Foundations of Biological Systems
- *Profiling of Methyltransferases and Other S-Adenosyl-L-Homocysteine-binding Proteins by Capture Compound Mass Spectrometry* - keyword - **Protein Binding** - Biological and Physical Foundations of Biological Systems

- *Measuring Protein Binding to F-actin by Co-sedimentation* - keyword - **Protein Binding** - Biological and Physical Foundations of Biological Systems
- *DNA Polymerase Activity Assay Using Near-Infrared Fluorescent Labeled DNA Visualized by Acrylamide Gel Electrophoresis* - keyword - **Michaelis-Menten Kinetics** - Biological and Physical Foundations of Biological Systems
- *An Optimized Hemagglutination Inhibition (HI) Assay to Quantify Influenza-Specific Antibody Titers* - keyword - **Enzyme Inhibition Assay** - Biological and Physical Foundations of Biological Systems
- *Visualization of Mitochondrial DNA Replication to Individual Cells by EdU Signal Amplification* - keyword - **DNA Replication** - Chemical and Physical Foundations of Biological Systems
- *Profiling DNA Replication Timing Using Zebrafish as an In Vivo Model System* - keyword - **DNA Replication** - Chemical and Physical Foundations of Biological Systems
- *Direct Observation of Enzymes Replicating DNA Using a Single-Molecule DNA Stretching Assay* - keyword - **DNA Replication** - Chemical and Physical Foundations of Biological Systems
- *Application of Stopped-Flow Kinetics Methods to Investigate the Mechanism of Action of a DNA Repair Protein* - keyword - **DNA Repair** - Chemical and Physical Foundations of Biological Systems
- *Genetics Studies of Human DNA Repair Proteins Using Yeast as a Model System* - keyword - **DNA Repair** - Chemical and Physical Foundations of Biological Systems