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JoVE provides teaching and instructional videos on the core concepts and hands on techniques in scientific fields necessary for a career in medicine and health sciences. These videos are free for you to use through your library’s subscription to JoVE.

The goal for this page is to provide Pre-Health students with an effective, easy-to-use, and readily available resource to help supplement their courses and scientific understanding, as well as prepare them for future challenges such as the MCAT.
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
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
• 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
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
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
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
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
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
• 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
• 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
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


- *Mass Spectrometric Approaches to Study Protein Structure and Interactions in Lyophilized Powders* - 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
• gDNA Enrichment by a Transposase-Based Technology for NGS Analysis of the Whole Sequence of BRCA1, BRCA2, and 9 Genes Involved in DNA Damage repair - keyword - DNA Repair - Chemical and Physical Foundations of Biological Systems

• A Standard Methodology to Examine On-Site Mutagenicity as a Function of Point Mutation Repair Catalyzed by CRISPR/Cas9 and SsODN in Human Cells - keyword - DNA Mutation Repair - Chemical and Physical Foundations of Biological Systems

• Next Generation Sequencing for the Detection of Actionable Mutations in Solid and Liquid Tumors - keyword - Missense Mutation - Biological and Physical Foundations of Biological Systems

• Genetic Studies of Human DNA Repair Proteins Using Yeast as a Model System - keyword - Missense Mutation - Biological and Physical Foundations of Biological Systems

• In vitro Transcription and Capping of Gaussia Luciferase mRNA Followed by HeLa Cell Transfection - keyword - mRNA - Biological and Physical Foundations of Biological Systems

• Analysis of mRNA Nuclear Export Kinetics in Mammalian Cells by Microinjection - keyword - mRNA - Biological and Physical Foundations of Biological Systems

• Measuring the Kinetics of mRNA Transcription in Single Living Cells - keyword - mRNA - Biological and Physical Foundations of Biological Systems

• Genome-wide Analysis of Aminoacylation (Charging) Levels of tRNA Using Microarrays - keyword - tRNA - Biological and Physical Foundations of Biological Systems
- **In vitro tRNA Methylation Assay with the Entamoeba histolytica DNA and tRNA Methlytransferase Dnmt2 (Ehmeth) Enzyme** - keyword - tRNA - Biological and Physical Foundations of Biological Systems
- **An In Vitro Assay to Detect tRNA-Isopentenyl Transferase Activity** - keyword - tRNA - Biological and Physical Foundations of Biological Systems
- **Protein-tRNA Agarose Gel Retardation Assays for the Analysis of the N6-threonylcarbamoyladenosine TcdA Function** - keyword - tRNA - Biological and Physical Foundations of Biological Systems
- **RNA Isolation from Embryonic Zebrafish and cDNA Synthesis for Gene Expression Analysis** - keyword - rRNA - Biological and Physical Foundations of Biological Systems
- **Analysis of Translation Initiation During Stress Conditions by Polysome Profiling** - keyword - RNA Translation - Biological and Physical Foundations of Biological Systems
- **Assessment of Selective mRNA Translation in Mammalian Cells by Polysome Profiling** - keyword - RNA Translation - Biological and Physical Foundations of Biological Systems
- **Tools to Study the Role of Architectural Protein HMGB1 in the Processing of Helix Distorting, Site-specific DNA Interstrand Crosslinks** - keyword - Supercoiling - Biological and Physical Foundations of Biological Systems
- **Telomere Length and Telomerase Activity; A Yin and Yang of Cell Senescence** - keyword - Telomere - Biological and Physical Foundations of Biological Systems
- **Methods to Discover Alternative Promoter Usage and Transcriptional Regulation of Murine Bcrp1** - keyword - Transcriptional Regulation - Biological and Physical Foundations of Biological Systems