Main Criteria: Hawaii Content and Performance Standards
Secondary Criteria: JoVE
Subject: Science
Grade: 9-12
Correlation Options: Show Correlated
Adopted: 2007

CONTENT STANDARD / COURSE	HI.SC.PS.	PHYSICAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PS.2.	The Scientific Process: NATURE OF SCIENCE: Understand that science, technology, and society are interrelated
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Science, Technology, and Society
EXPECTATION / TOPIC	SC.PS.2.1.	Explain how scientific advancements and emerging technologies have influenced society JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam IV: Acute Abdominal Pain Assessment • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Auscultation • Biofuels: Producing Ethanol from Cellulosic Material • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Cranial Nerves Exam I (I-VI) • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Ear Exam • Emergent Lateral Canthotomy and Inferior Catholysis • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Eye Exam • Histological Sample Preparation for Light Microscopy

		• Introduction to Fluorescence Microscopy • Introduction to Light Microscopy • Introduction to Mass Spectrometry • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • MALDI-TOF Mass Spectrometry • Nuclear Magnetic Resonance (NMR) Spectroscopy • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Ophthalmoscopic Examination • Percussion • Peripheral Vascular Exam Using a Continuous Wave Doppler • Proton Exchange Membrane Fuel Cells • Raman Spectroscopy for Chemical Analysis • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Surface Plasmon Resonance (SPR) • Tandem Mass Spectrometry • The Staircase Procedure for Finding a Perceptual Threshold • Turbidity and Total Solids in Surface Water • X-ray Fluorescence (XRF) • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.PS.2.2.	Compare the risks and benefits of potential solutions to technological issues JoVE • Raman Spectroscopy for Chemical Analysis
CONTENT STANDARD / COURSE	HI.SC.PS.	PHYSICAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PS.6.	Physical, Earth and Space Science: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Energy and its Transformation
EXPECTATION / TOPIC	SC.PS.6.1.	Describe endothermic and exothermic chemical reactions JoVE • Conducting Reactions Below Room Temperature • Determining Rate Laws and the Order of Reaction • Le Châtelier's Principle • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy

EXPECTATION / TOPIC	SC.PS.6.4.	Explain that changes in thermal energy can lead to a phase change of matter JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Degassing Liquids with Freeze-Pump-Thaw Cycling • Fractional Distillation • Freezing-Point Depression to Determine an Unknown Compound • Growing Crystals for X-ray Diffraction Analysis • Preparing Anhydrous Reagents and Equipment • Purifying Compounds by Recrystallization • Rotary Evaporation to Remove Solvent • Schlenk Lines Transfer of Solvents • Separation of Mixtures via Precipitation • Solid-Liquid Extraction • Solutions and Concentrations • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
CONTENT STANDARD / COURSE	HI.SC.PS.	PHYSICAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PS.6.	Physical, Earth and Space Science: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Waves
EXPECTATION / TOPIC	SC.PS.6.6.	Explain and provide examples of electromagnetic radiation and sound using a wave model JoVE • Abdominal Exam II: Percussion • Auscultation • Ear Exam • Nuclear Magnetic Resonance (NMR) Spectroscopy • Percussion • Raman Spectroscopy for Chemical Analysis • The Staircase Procedure for Finding a Perceptual Threshold
CONTENT STANDARD / COURSE	HI.SC.PS.	PHYSICAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PS.6.	Physical, Earth and Space Science: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe

INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Nature of Matter
EXPECTATION / TOPIC	SC.PS.6.7.	Explain how elements are arranged in the periodic table and describe trends among elemental properties JoVE • Coordination Chemistry Complexes
EXPECTATION / TOPIC	SC.PS.6.8.	Describe interactions among molecules JoVE • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Conducting Reactions Below Room Temperature • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Cyclic Voltammetry (CV) • Determining the Solubility Rules of Ionic Compounds • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Growing Crystals for X-ray Diffraction Analysis • Introduction to Catalysis • Introduction to Titration • Le Châtelier's Principle • Nuclear Magnetic Resonance (NMR) Spectroscopy • Photometric Protein Determination • Preparing Anhydrous Reagents and Equipment • Proton Exchange Membrane Fuel Cells • Purification of a Total Lipid Extract with Column Chromatography • Purifying Compounds by Recrystallization • Raman Spectroscopy for Chemical Analysis • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Rotary Evaporation to Remove Solvent • Separation of Mixtures via Precipitation • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • The ELISA Method • Ultraviolet-Visible (UV-Vis) Spectroscopy • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using a pH Meter
EXPECTATION / TOPIC	SC.PS.6.9.	Describe the factors that affect the rate of chemical reactions

		JoVE **• Conducting Reactions Below Room Temperature** **• Coordination Chemistry Complexes** **• Determining Rate Laws and the Order of Reaction** **• Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat** **• Enzyme Assays and Kinetics** **• Introduction to Catalysis**
EXPECTATION / TOPIC	**SC.PS.6.10.**	**Explain how atoms bond using valence electrons** **JoVE** **• An Overview of Alkenone Biomarker Analysis for Paleothermometry** **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Chromatography-Based Biomolecule Purification Methods** **• Column Chromatography** **• Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry** **• Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis** **• Determining the Solubility Rules of Ionic Compounds** **• Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Gas Chromatography (GC) with Flame-Ionization Detection** **• Growing Crystals for X-ray Diffraction Analysis** **• High-Performance Liquid Chromatography (HPLC)** **• Ion-Exchange Chromatography** **• Performing 1D Thin Layer Chromatography** **• Preparing Anhydrous Reagents and Equipment** **• Purification of a Total Lipid Extract with Column Chromatography** **• Purifying Compounds by Recrystallization** **• Raman Spectroscopy for Chemical Analysis** **• Reconstitution of Membrane Proteins** **• Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry** **• Solid-Liquid Extraction** **• Solutions and Concentrations** **• Sonication Extraction of Lipid Biomarkers from Sediment** **• Soxhlet Extraction of Lipid Biomarkers from Sediment** **• Ultraviolet-Visible (UV-Vis) Spectroscopy** **• X-ray Fluorescence (XRF)**
EXPECTATION / TOPIC	**SC.PS.6.11.**	**Describe a variety of chemical reactions**

		JoVE • Conducting Reactions Below Room Temperature • Coordination Chemistry Complexes • Cyclic Voltammetry (CV) • Determining Rate Laws and the Order of Reaction • Determining the Solubility Rules of Ionic Compounds • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Growing Crystals for X-ray Diffraction Analysis • Introduction to Catalysis • Introduction to Titration • Le Châtelier's Principle • Photometric Protein Determination • Preparing Anhydrous Reagents and Equipment • Proton Exchange Membrane Fuel Cells • Purifying Compounds by Recrystallization • Rotary Evaporation to Remove Solvent • Separation of Mixtures via Precipitation • Spectrophotometric Determination of an Equilibrium Constant • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using a pH Meter
CONTENT STANDARD / COURSE	**HI.SC.PS.**	**PHYSICAL SCIENCE**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.PS.6.**	**Physical, Earth and Space Science: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Energy and its Transformation**
EXPECTATION / TOPIC	**SC.PS.6.12.**	**Describe nuclear reactions and how they produce energy** **JoVE** **• Nuclear Magnetic Resonance (NMR) Spectroscopy**
CONTENT STANDARD / COURSE	**HI.SC.BS.**	**BIOLOGICAL SCIENCE**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.BS.1.**	**The Scientific Process: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Scientific Inquiry**
EXPECTATION / TOPIC	**SC.BS.1.1.**	**Describe how a testable hypothesis may need to be revised to guide a scientific investigation**

		JoVE • The Multi-group Experiment • The Simple Experiment: Two-group Design
EXPECTATION / TOPIC	SC.BS.1.2.	Design and safely implement an experiment, including the appropriate use of tools and techniques to organize, analyze, and validate data JoVE • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Manipulating an Independent Variable through Embodiment • Observational Research • Pilot Testing • Placebos in Research • Realism in Experimentation • Reliability in Psychology Experiments • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Within-subjects Repeated-measures Design
CONTENT STANDARD / COURSE	HI.SC.BS.	BIOLOGICAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.BS.1.	The Scientific Process: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Scientific Knowledge
EXPECTATION / TOPIC	SC.BS.1.8.	Describe the importance of ethics and integrity in scientific investigation JoVE • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Manipulating an Independent Variable through Embodiment • Observational Research • Pilot Testing • Placebos in Research • Reliability in Psychology Experiments • Self-report vs. Behavioral Measures of Recycling • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Within-subjects Repeated-measures Design

CONTENT STANDARD / COURSE	HI.SC.BS.	BIOLOGICAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.BS.2.	The Scientific Process: NATURE OF SCIENCE: Understand that science, technology, and society are interrelated
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Science, Technology, and Society
EXPECTATION / TOPIC	SC.BS.2.1.	Explain how scientific advancements and emerging technology have influenced society JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam II: Percussion • Abdominal Exam III: Palpation • Abdominal Exam IV: Acute Abdominal Pain Assessment • Algae Enumeration via Culturable Methodology • An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Cognition • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Drosophila melanogaster • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Molecular Developmental Biology • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Organogenesis • An Introduction to Reward and Addiction • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to Transfection • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering

		• An Overview of Genetics and Disease • Analysis of Earthworm Populations in Soil • Anesthesia Induction and Maintenance • Ankle Exam • Annexin V and Propidium Iodide Labeling • Anterograde Amnesia • Anxiety Testing • Approximate Number Sense Test • Are You Smart or Hardworking? How Praise Influences Children's Motivation • Arterial Line Placement • Aseptic Technique in Environmental Science • Assembly of a Reflux System for Heated Chemical Reactions • Assessing Dexterity with Reaching Tasks • Auscultation • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Balance and Coordination Testing • Basic Care Procedures • Basic Chick Care and Maintenance • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Binocular Rivalry • Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Calcium Imaging in Neurons • Capillary Electrophoresis (CE) • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Categories and Inductive Inferences • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Chick ex ovo Culture • Children's Reliance on Artist Intentions When Identifying Pictures

		• Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Color Afterimages • Column Chromatography • Community DNA Extraction from Bacterial Colonies • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Comprehensive Breast Exam • Considerations for Rodent Surgery • Coordination Chemistry Complexes • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Culturing and Enumerating Bacteria from Soil Samples • Cyclic Voltammetry (CV) • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Detection of Bacteriophages in Environmental Samples • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Dichotic Listening • Dissolved Oxygen in Surface Water • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Enzyme Assays and Kinetics • Ethics in Psychology Research

		• Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Experimentation using a Confederate • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Eye Exam • Eye Tracking in Cognitive Experiments • FM Dyes in Vesicle Recycling • Fate Mapping • Fear Conditioning • Filamentous Fungi • Finding Your Blind Spot and Perceptual Filling-in • Foot Exam • From Theory to Design: The Role of Creativity in Designing Experiments • Fundamentals of Breeding and Weaning • Gel Purification • Gene Silencing with Morpholinos • General Approach to the Physical Exam • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • Gram Staining of Bacteria from Environmental Sources • Growing Crystals for X-ray Diffraction Analysis • Habituation: Studying Infants Before They Can Talk • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • How Children Solve Problems Using Causal Reasoning • In ovo Electroporation of Chicken Embryos • Inattentional Blindness • Incidental Encoding • Induced Pluripotency • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Introducing Experimental Agents into the Mouse • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Invasion Assay Using 3D Matrices • Invertebrate Lifespan Quantification • Isolating Nucleic Acids from Yeast • Isolation of Fecal Bacteria from Water Samples by Filtration • Just-noticeable Differences • Knee Exam • Language: The N400 in Semantic Incongruity

		• Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • Lower Back Exam • Lymph Node Exam • MALDI-TOF Mass Spectrometry • Male Rectal Exam • Manipulating an Independent Variable through Embodiment • Measuring Children's Trust in Testimony • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Verbal Working Memory Span • Measuring Vital Signs • Memory Development: Demonstrating How Repeated Questioning Leads to False Memories • Mental Rotation • Metabolic Labeling • Metacognitive Development: How Children Estimate Their Memory • Modeling Social Stress • Molecular Cloning • Motion-induced Blindness • Motor Exam I • Motor Exam II • Motor Learning in Mirror Drawing • Motor Maps • Mouse Genotyping • Multiple Object Tracking • Murine In Utero Electroporation • Mutual Exclusivity: How Children Learn the Meanings of Words • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Neuronal Transfection Methods • Nose, Sinuses, Oral Cavity and Pharynx Exam • Nuclear Magnetic Resonance (NMR) Spectroscopy • Numerical Cognition: More or Less • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Observation and Inspection • Observational Research • Ophthalmoscopic Examination • PCR: The Polymerase Chain Reaction • Palpation • Passaging Cells • Patch Clamp Electrophysiology • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam

		• Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Perspectives on Cognitive Psychology • Perspectives on Experimental Psychology • Perspectives on Neuropsychology • Perspectives on Sensation and Perception • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Pilot Testing • Placebos in Research • Plasmid Purification • Positive Reinforcement Studies • Primary Neuronal Cultures • Proper Adjustment of Patient Attire during the Physical Exam • Prospect Theory • Protein Crystallization • Proton Exchange Membrane Fuel Cells • Purifying Compounds by Recrystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Realism in Experimentation • Recombineering and Gene Targeting • Reliability in Psychology Experiments • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Restriction Enzyme Digests • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Rodent Stereotaxic Surgery • SNP Genotyping • Scanning Electron Microscopy (SEM) • Self-administration Studies • Self-report vs. Behavioral Measures of Recycling • Sensory Exam • Separating Protein with SDS-PAGE • Shoulder Exam I • Shoulder Exam II • Solid-Liquid Extraction • Solutions and Concentrations • Spatial Cueing

		• Spatial Memory Testing Using Mazes • Sterile Tissue Harvest • Surface Plasmon Resonance (SPR) • Surgical Cricothyrotomy • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The Ames Room • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Factorial Experiment • The Inverted-face Effect • The McGurk Effect • The Morris Water Maze • The Multi-group Experiment • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Rubber Hand Illusion • The Simple Experiment: Two-group Design • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Two-Dimensional Gel Electrophoresis • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Using Your Head: Measuring Infants' Rational Imitation of Actions • Using a pH Meter • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Whole-Mount In Situ Hybridization • Within-subjects Repeated-measures Design

		• Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.BS.2.2.	Compare the risks and benefits of potential solutions to technological issues <u>JoVE</u> • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam IV: Acute Abdominal Pain Assessment • Algae Enumeration via Culturable Methodology • An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Cell Metabolism • An Introduction to Cognition • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Molecular Developmental Biology • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to Transfection • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Arterial Line Placement • Assembly of a Reflux System for Heated Chemical Reactions • Auscultation • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • C. elegans Development and Reproduction • Calcium Imaging in Neurons

		• Capillary Electrophoresis (CE) • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Chick ex ovo Culture • Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Column Chromatography • Community DNA Extraction from Bacterial Colonies • Coordination Chemistry Complexes • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Culturing and Enumerating Bacteria from Soil Samples • Cyclic Voltammetry (CV) • Cytogenetics • DNA Ligation Reactions • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Reactive Oxygen Species • Detection of Bacteriophages in Environmental Samples • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Ear Exam • Electro-encephalography (EEG) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Enzyme Assays and Kinetics • Ethics in Psychology Research • Event-related Potentials and the Oddball Task • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Eye Exam • Eye Tracking in Cognitive Experiments • Fate Mapping • Fear Conditioning • Fundamentals of Breeding and Weaning • Gene Silencing with Morpholinos

		• General Approach to the Physical Exam • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • Gram Staining of Bacteria from Environmental Sources • Growing Crystals for X-ray Diffraction Analysis • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Introducing Experimental Agents into the Mouse • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Invertebrate Lifespan Quantification • Isolation of Fecal Bacteria from Water Samples by Filtration • Language: The N400 in Semantic Incongruity • Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • MALDI-TOF Mass Spectrometry • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Vital Signs • Metabolic Labeling • Molecular Cloning • Motor Exam II • Motor Maps • Mouse Genotyping • Murine In Utero Electroporation • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Neuronal Transfection Methods • Nose, Sinuses, Oral Cavity and Pharynx Exam • Nuclear Magnetic Resonance (NMR) Spectroscopy • Nutrients in Aquatic Ecosystems • Ophthalmoscopic Examination • Passaging Cells • Patch Clamp Electrophysiology • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation

		• Physiological Correlates of Emotion Recognition • Plasmid Purification • Primary Neuronal Cultures • Protein Crystallization • Purifying Compounds by Recrystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Realism in Experimentation • Recombineering and Gene Targeting • Reliability in Psychology Experiments • Respiratory Exam II: Percussion and Auscultation • Restriction Enzyme Digests • Rodent Stereotaxic Surgery • SNP Genotyping • Scanning Electron Microscopy (SEM) • Self-administration Studies • Self-report vs. Behavioral Measures of Recycling • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Solid-Liquid Extraction • Solutions and Concentrations • Surface Plasmon Resonance (SPR) • Surgical Cricothyrotomy • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The ELISA Method • The TUNEL Assay • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Two-Dimensional Gel Electrophoresis • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action Observation • Using a pH Meter • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Whole-Mount In Situ Hybridization • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging

CONTENT STANDARD / COURSE	HI.SC.BS.	BIOLOGICAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.BS.3.	Life and Environmental Sciences: ORGANISMS AND THE ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Cycles of Matter and Energy
EXPECTATION / TOPIC	SC.BS.3.1.	Describe biogeochemical cycles within ecosystems JoVE • Algae Enumeration via Culturable Methodology • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Analysis of Earthworm Populations in Soil • Bacterial Growth Curve Analysis and its Environmental Applications • Carbon and Nitrogen Analysis of Environmental Samples • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Culturing and Enumerating Bacteria from Soil Samples • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Filamentous Fungi • Fundamentals of Breeding and Weaning • Metabolic Labeling • Nutrients in Aquatic Ecosystems • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Using GIS to Investigate Urban Forestry
EXPECTATION / TOPIC	SC.BS.3.2.	Explain the chemical reactions that occur in photosynthesis and cellular respiration that result in cycling of energy JoVE

		• An Introduction to Cell Metabolism • Biofuels: Producing Ethanol from Cellulosic Material • Detecting Reactive Oxygen Species • The ATP Bioluminescence Assay
EXPECTATION / TOPIC	SC.BS.3.3.	Explain how matter and energy flow through living systems and the physical environment <u>JoVE</u> • Algae Enumeration via Culturable Methodology • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Bacterial Growth Curve Analysis and its Environmental Applications • Carbon and Nitrogen Analysis of Environmental Samples • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Culturing and Enumerating Bacteria from Soil Samples • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Filamentous Fungi • Metabolic Labeling • Nutrients in Aquatic Ecosystems • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Using GIS to Investigate Urban Forestry
CONTENT STANDARD / COURSE	HI.SC.BS.	BIOLOGICAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.BS.3.	Life and Environmental Sciences: ORGANISMS AND THE ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Interdependence
EXPECTATION / TOPIC	SC.BS.3.4.	Explain dynamic equilibrium in organisms, populations, and ecosystems; explain the effect of equilibrium shifts

		JoVE • Algae Enumeration via Culturable Methodology • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Analysis of Earthworm Populations in Soil • Aseptic Technique in Environmental Science • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Basic Mouse Care and Maintenance • C. elegans Maintenance • Culturing and Enumerating Bacteria from Soil Samples • Detection of Bacteriophages in Environmental Samples • Dissolved Oxygen in Surface Water • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Filamentous Fungi • Isolation of Fecal Bacteria from Water Samples by Filtration • Passaging Cells • Plasmid Purification • Quantifying Environmental Microorganisms and Viruses Using qPCR • Yeast Maintenance • Yeast Reproduction
CONTENT STANDARD / COURSE	HI.SC.BS.	BIOLOGICAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.BS.4.	Life and Environmental Sciences: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Cells, Tissues, Organs, and Organ Systems
EXPECTATION / TOPIC	SC.BS.4.1.	Describe different cell parts and their functions JoVE • An Introduction to Aging and Regeneration • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Neurobiology • An Introduction to Endocytosis and Exocytosis

		• An Introduction to Molecular Developmental Biology • An Introduction to Neurophysiology • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to Transfection • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Balance and Coordination Testing • C. elegans Development and Reproduction • Calcium Imaging in Neurons • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Cytogenetics • DNA Ligation Reactions • Density Gradient Ultracentrifugation • Detecting Reactive Oxygen Species • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Enzyme Assays and Kinetics • Explant Culture of Neural Tissue • FM Dyes in Vesicle Recycling • Förster Resonance Energy Transfer (FRET) • Gene Silencing with Morpholinos • Genetic Crosses • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Invasion Assay Using 3D Matrices • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Metabolic Labeling • Molecular Cloning • Murine In Utero Electroporation • Neuronal Transfection Methods • Passaging Cells • Patch Clamp Electrophysiology • Plasmid Purification • Primary Neuronal Cultures • Protein Crystallization • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Restriction Enzyme Digests • Surface Plasmon Resonance (SPR) • The ATP Bioluminescence Assay • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Tissue Regeneration with Somatic Stem Cells • Whole-Mount In Situ Hybridization • Yeast Maintenance

		• Yeast Reproduction • Yeast Transformation and Cloning
EXPECTATION / TOPIC	SC.BS.4.2.	Explain how cells are specialized into different tissues and organs <u>JoVE</u> • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Cell Motility and Migration • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Learning and Memory • An Introduction to Molecular Developmental Biology • An Introduction to Organogenesis • An Introduction to Stem Cell Biology • An Overview of Epigenetics • An Overview of Gene Expression • C. elegans Development and Reproduction • Chick ex ovo Culture • DNA Methylation Analysis • Detecting Reactive Oxygen Species • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Drosophila Development and Reproduction • Drosophila Larval IHC • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Fate Mapping • Gene Silencing with Morpholinos • Genetic Engineering of Model Organisms • Histological Sample Preparation for Light Microscopy • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Murine In Utero Electroporation • RNA-Seq • Sterile Tissue Harvest • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Reproduction and Development
EXPECTATION / TOPIC	SC.BS.4.3.	Differentiate between the processes of mitosis and meiosis <u>JoVE</u> • An Introduction to Cell Division

		• An Introduction to Saccharomyces cerevisiae • Cell Cycle Analysis • Genetic Crosses • Live Cell Imaging of Mitosis • Recombineering and Gene Targeting • Yeast Reproduction • Yeast Transformation and Cloning
EXPECTATION / TOPIC	SC.BS.4.4.	Describe how homeostatic balance occurs in cells and organisms <u>JoVE</u> • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam II: Percussion • Abdominal Exam III: Palpation • Abdominal Exam IV: Acute Abdominal Pain Assessment • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Molecular Developmental Biology • An Introduction to Reward and Addiction • An Introduction to Stem Cell Biology • Anesthesia Induction and Maintenance • Ankle Exam • Annexin V and Propidium Iodide Labeling • Arterial Line Placement • Assessing Dexterity with Reaching Tasks • Auscultation • Balance and Coordination Testing • Basic Care Procedures • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Development and Reproduction • Calcium Imaging in Neurons • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Cell-surface Biotinylation Assay • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance

		• Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Comprehensive Breast Exam • Considerations for Rodent Surgery • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Detecting Reactive Oxygen Species • Diagnostic Necropsy and Tissue Harvest • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Explant Culture of Neural Tissue • Eye Exam • FM Dyes in Vesicle Recycling • Fear Conditioning • Foot Exam • General Approach to the Physical Exam • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Isolating Nucleic Acids from Yeast • Knee Exam • Lower Back Exam • Lymph Node Exam • Male Rectal Exam • Measuring Vital Signs • Motor Exam I • Motor Exam II • Murine In Utero Electroporation • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Nose, Sinuses, Oral Cavity and Pharynx Exam • Observation and Inspection • Ophthalmoscopic Examination • Palpation • Patch Clamp Electrophysiology

		• Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Physiological Correlates of Emotion Recognition • Proper Adjustment of Patient Attire during the Physical Exam • Reconstitution of Membrane Proteins • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Self-administration Studies • Sensory Exam • Shoulder Exam I • Shoulder Exam II • Spatial Memory Testing Using Mazes • Sterile Tissue Harvest • Surgical Cricothyrotomy • The ATP Bioluminescence Assay • The TUNEL Assay • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Tree Identification: How To Use a Dichotomous Key • Using a pH Meter • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Maintenance and Husbandry
EXPECTATION / TOPIC	SC.BS.4.5.	Describe the components and functions of a variety of macromolecules active in biological systems <u>JoVE</u> • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Molecular Developmental Biology • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering

		• An Overview of Genetics and Disease • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Biofuels: Producing Ethanol from Cellulosic Material • C. elegans Maintenance • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Column Chromatography • Community DNA Extraction from Bacterial Colonies • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Dialysis: Diffusion Based Separation • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Electrophoretic Mobility Shift Assay (EMSA) • Embryonic Stem Cell Culture and Differentiation • Enzyme Assays and Kinetics • Explant Culture for Developmental Studies • Expression Profiling with Microarrays • FM Dyes in Vesicle Recycling • Förster Resonance Energy Transfer (FRET) • Gel Purification • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Introduction to Catalysis • Introduction to Mass Spectrometry • Invasion Assay Using 3D Matrices • Invertebrate Lifespan Quantification • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis

		• MALDI-TOF Mass Spectrometry • Metabolic Labeling • Method of Standard Addition • Molecular Cloning • Mouse Genotyping • PCR: The Polymerase Chain Reaction • Photometric Protein Determination • Plasmid Purification • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Restriction Enzyme Digests • Rodent Stereotaxic Surgery • SNP Genotyping • Separating Protein with SDS-PAGE • Spectrophotometric Determination of an Equilibrium Constant • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The ELISA Method • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Whole-Mount In Situ Hybridization • Yeast Maintenance • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
CONTENT STANDARD / COURSE	**HI.SC.BS.**	**BIOLOGICAL SCIENCE**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.BS.4.**	**Life and Environmental Sciences: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Classification**
EXPECTATION / TOPIC	**SC.BS.4.6.**	**Explain the organization of life on Earth using the modern classification system** **JoVE**

		• Algae Enumeration via Culturable Methodology • An Introduction to Caenorhabditis elegans • An Introduction to Drosophila melanogaster • An Introduction to Saccharomyces cerevisiae • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Aseptic Technique in Environmental Science • Bacterial Growth Curve Analysis and its Environmental Applications • Basic Chick Care and Maintenance • Basic Mouse Care and Maintenance • Biofuels: Producing Ethanol from Cellulosic Material • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Chick ex ovo Culture • Culturing and Enumerating Bacteria from Soil Samples • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detection of Bacteriophages in Environmental Samples • Determination of Moisture Content in Soil • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Filamentous Fungi • Genetic Crosses • Genetic Engineering of Model Organisms • Gram Staining of Bacteria from Environmental Sources • In ovo Electroporation of Chicken Embryos • Introducing Experimental Agents into the Mouse • Isolating Nucleic Acids from Yeast • Mouse Genotyping • RNAi in C. elegans • Recombineering and Gene Targeting • Sonication Extraction of Lipid Biomarkers from Sediment • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Using GIS to Investigate Urban Forestry • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling

		• Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
CONTENT STANDARD / COURSE	**HI.SC.BS.**	**BIOLOGICAL SCIENCE**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.PS.5.**	**Life and Environmental Sciences: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Biological Evolution**
EXPECTATION / TOPIC	**SC.BS.5.1.**	**Explain the theory of evolution and describe evidence that supports this theory** **JoVE** • An Introduction to the Chick: Gallus gallus domesticus • An Overview of Genetic Analysis • High-Performance Liquid Chromatography (HPLC)
EXPECTATION / TOPIC	**SC.BS.5.2.**	**Explain the theory of natural selection** **JoVE** • An Overview of Genetic Analysis
CONTENT STANDARD / COURSE	**HI.SC.BS.**	**BIOLOGICAL SCIENCE**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.PS.5.**	**Life and Environmental Sciences: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Unity and Diversity**
EXPECTATION / TOPIC	**SC.BS.5.3.**	**Explain the structural properties of DNA and the role of DNA in heredity and protein synthesis** **JoVE** • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Molecular Developmental Biology • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease

		• Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Cell Cycle Analysis • Chromatin Immunoprecipitation • Community DNA Extraction from Bacterial Colonies • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Development and Reproduction of the Laboratory Mouse • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Electrophoretic Mobility Shift Assay (EMSA) • Embryonic Stem Cell Culture and Differentiation • Enzyme Assays and Kinetics • Explant Culture for Developmental Studies • Expression Profiling with Microarrays • Förster Resonance Energy Transfer (FRET) • Gel Purification • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Method of Standard Addition • Molecular Cloning • Mouse Genotyping • PCR: The Polymerase Chain Reaction • Photometric Protein Determination • Plasmid Purification • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • Recombineering and Gene Targeting • Restriction Enzyme Digests • SNP Genotyping • Testing For Genetically Modified Foods • The TUNEL Assay • Two-Dimensional Gel Electrophoresis • Whole-Mount In Situ Hybridization

		• Yeast Maintenance • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling
EXPECTATION / TOPIC	SC.BS.5.4.	Explain how Mendel's laws of heredity can be used to determine the traits of possible offspring JoVE • An Introduction to Developmental Genetics • Fundamentals of Breeding and Weaning • Genetic Crosses
EXPECTATION / TOPIC	SC.BS.5.5.	Explain chromosomal mutations, their possible causes, and their effects on genetic variation JoVE • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetics and Disease • Genetic Engineering of Model Organisms • Genetic Screens • Isolating Nucleic Acids from Yeast • Passaging Cells • The TUNEL Assay
CONTENT STANDARD / COURSE	HI.SC.ES.	EARTH SPACE SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.ES.2.	The Scientific Process: NATURE OF SCIENCE: Understand that science, technology, and society are interrelated
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Science, Technology, and Society
EXPECTATION / TOPIC	SC.ES.2.1.	Explain how scientific advancements and emerging technology have influenced society JoVE • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology

		• Analysis of Earthworm Populations in Soil • Biofuels: Producing Ethanol from Cellulosic Material • Carbon and Nitrogen Analysis of Environmental Samples • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Dissolved Oxygen in Surface Water • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Fractional Distillation • Igneous Intrusive Rock • Igneous Volcanic Rock • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Making a Geologic Cross Section • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Physical Properties Of Minerals I: Crystals and Cleavage • Physical Properties Of Minerals II: Polymineralic Analysis • Proton Exchange Membrane Fuel Cells • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Using GIS to Investigate Urban Forestry • Using Topographic Maps to Generate Topographic Profiles
EXPECTATION / TOPIC	SC.ES.2.2.	Compare the risks and benefits of potential solutions to technological issues JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Introduction to Mass Spectrometry • Lead Analysis of Soil Using Atomic Absorption Spectroscopy

		• Making a Geologic Cross Section • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Proton Exchange Membrane Fuel Cells • Turbidity and Total Solids in Surface Water • Using GIS to Investigate Urban Forestry • Water Quality Analysis via Indicator Organisms
EXPECTATION / TOPIC	SC.ES.2.3.	Explain the impact of humans on the Earth system JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Introduction to Mass Spectrometry • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Making a Geologic Cross Section • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
EXPECTATION / TOPIC	SC.ES.2.4.	Describe technologies used to collect information about the universe JoVE • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Using GIS to Investigate Urban Forestry
CONTENT STANDARD / COURSE	HI.SC.ES.	EARTH SPACE SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.ES.8.	Physical, Earth, and Space Sciences: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Forces that Shape the Earth
EXPECTATION / TOPIC	SC.ES.8.1.	Describe how elements and water move through solid Earth, the oceans, atmosphere, and living things as part of geochemical cycles JoVE • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry

		• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Using GIS to Investigate Urban Forestry
EXPECTATION / TOPIC	SC.ES.8.2.	Describe how to estimate geologic time JoVE • Making a Geologic Cross Section
CONTENT STANDARD / COURSE	HI.SC.ES.	EARTH SPACE SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.ES.8.	Physical, Earth, and Space Sciences: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Forces that Shape the Earth
EXPECTATION / TOPIC	SC.ES.8.4.	Describe how heat and energy transfer into and out of the atmosphere and their involvement in global climate JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Turbidity and Total Solids in Surface Water
EXPECTATION / TOPIC	SC.ES.8.5.	Explain the effects of movements of crustal plates JoVE • Igneous Volcanic Rock
CONTENT STANDARD / COURSE	HI.SC.ES.	EARTH SPACE SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.ES.8.	Physical, Earth, and Space Sciences: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Earth in the Solar System
EXPECTATION / TOPIC	SC.ES.8.8.	Describe the major internal and external sources of energy on Earth JoVE • Turbidity and Total Solids in Surface Water

CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.2.	Nature of Science - Understand that science, technology, and society are interrelated
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Science, Technology, and Society
EXPECTATION / TOPIC	SC.PH.2.1.	Explain how scientific advancements and emerging technologies have influenced society JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam IV: Acute Abdominal Pain Assessment • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Auscultation • Biofuels: Producing Ethanol from Cellulosic Material • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Cranial Nerves Exam I (I-VI) • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Ear Exam • Emergent Lateral Canthotomy and Inferior Catholysis • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Eye Exam • Histological Sample Preparation for Light Microscopy • Introduction to Fluorescence Microscopy • Introduction to Light Microscopy • Introduction to Mass Spectrometry • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • MALDI-TOF Mass Spectrometry • Nuclear Magnetic Resonance (NMR) Spectroscopy • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Ophthalmoscopic Examination • Percussion • Peripheral Vascular Exam Using a Continuous Wave Doppler • Proton Exchange Membrane Fuel Cells • Raman Spectroscopy for Chemical Analysis • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry

		• Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Surface Plasmon Resonance (SPR) • Tandem Mass Spectrometry • The Staircase Procedure for Finding a Perceptual Threshold • Turbidity and Total Solids in Surface Water • X-ray Fluorescence (XRF) • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.PH.2.2.	Compare the risks and benefits of potential solutions to technological issues JoVE • Raman Spectroscopy for Chemical Analysis
CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.3.	Matter and Energy Conservation - Understand the nature of momentum and energy transformations
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Matter
EXPECTATION / TOPIC	SC.PH.3.1.	Measure or determine physical quantities such as density and mass of samples JoVE • An Introduction to the Micropipettor • Determining the Density of a Solid and Liquid • Introduction to Serological Pipettes and Pipettors • Making Solutions in the Laboratory • Measuring Mass in the Laboratory • Solid-Liquid Extraction • Understanding Concentration and Measuring Volumes
EXPECTATION / TOPIC	SC.PH.3.2.	Differentiate among mass, weight, and inertia JoVE • Determining the Density of a Solid and Liquid • Measuring Mass in the Laboratory
CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.3.	Matter and Energy Conservation - Understand the nature of momentum and energy transformations
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Energy and Momentum
EXPECTATION / TOPIC	SC.PH.3.6.	Differentiate between different energy manifestations (e.g., kinetic [KE = 1/2 mv2], gravitational potential [PE =

		mgh], thermal, chemical, nuclear, electromagnetic, or mechanical) JoVE • An Introduction to Cell Metabolism • Detecting Reactive Oxygen Species • The ATP Bioluminescence Assay
CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.4.	Force and Motion - Understand the relationship between force, mass, and motion of objects
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Motion
EXPECTATION / TOPIC	SC.PH.4.3.	Solve two-dimensional problems involving balanced forces (i.e., statics) JoVE • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Making a Geologic Cross Section • Using Topographic Maps to Generate Topographic Profiles
EXPECTATION / TOPIC	SC.PH.4.5.	Describe the nature of centripetal force and centripetal acceleration (e.g., the formula a = v2/r), and use these ideas to predict the motion of an object JoVE • An Introduction to the Centrifuge
CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.5.	Heat and Thermodynamics - Understand the laws of thermodynamics, and their applications
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Heat and Temperature
EXPECTATION / TOPIC	SC.PH.5.2.	Differentiate between heat, specific heat, and temperature JoVE • Conducting Reactions Below Room Temperature • Freezing-Point Depression to Determine an Unknown Compound • Ideal Gas Law • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold

		• The Ideal Gas Law • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.5.	Heat and Thermodynamics - Understand the laws of thermodynamics, and their applications
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Laws of Thermodynamics
EXPECTATION / TOPIC	SC.PH.5.3.	Explain the laws of thermodynamics, and describe some practical applications JoVE • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.6.	Waves - Understand the nature of waves, including the characteristic properties of the electromagnetic spectrum, optics, and sound waves
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Calculations
EXPECTATION / TOPIC	SC.PH.6.2.	Solve problems involving wavelength, frequency, amplitude, speed, absorption, reflection, and refraction JoVE • Raman Spectroscopy for Chemical Analysis
CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.6.	Waves - Understand the nature of waves, including the characteristic properties of the electromagnetic spectrum, optics, and sound waves
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: The Electromagnetic spectrum
EXPECTATION / TOPIC	SC.PH.6.4.	Describe the range of the electromagnetic spectrum (e.g., radio waves, microwaves, infrared radiation) JoVE • Ultraviolet-Visible (UV-Vis) Spectroscopy
CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.7.	Electric and Magnetic Phenomena - Understand the nature and applications of electricity and magnetism

INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Electrical and Magnetic Fields
EXPECTATION / TOPIC	SC.PH.7.1.	Describe the relationships among charged particles, electrical current, electrical potential, electric fields, and magnetic fields JoVE • Cyclic Voltammetry (CV) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Freezing-Point Depression to Determine an Unknown Compound • High-Performance Liquid Chromatography (HPLC) • Introduction to Mass Spectrometry • Nuclear Magnetic Resonance (NMR) Spectroscopy • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.PH.7.4.	Describe how electric and magnetic fields contain energy and act as vector force fields JoVE • Introduction to Mass Spectrometry • Nuclear Magnetic Resonance (NMR) Spectroscopy
CONTENT STANDARD / COURSE	HI.SC.PH.	PHYSICS
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PH.7.	Electric and Magnetic Phenomena - Understand the nature and applications of electricity and magnetism
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Electrical Circuits
EXPECTATION / TOPIC	SC.PH.7.7.	Analyze simple arrangements of components (e.g., resistors, capacitors, transistors) in series or parallel circuits, both quantitatively and qualitatively JoVE • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat
EXPECTATION / TOPIC	SC.PH.7.8.	Predict the current, voltage, and power in simple direct current electric circuits JoVE • Nuclear Magnetic Resonance (NMR) Spectroscopy
CONTENT STANDARD / COURSE	HI.SC.CH.	CHEMISTRY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.CH.1.	Scientific Investigation - Discover, invent, and investigate using the skills necessary to engage in the scientific process

INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Scientific knowledge**
EXPECTATION / TOPIC	**SC.CH.1.8.**	**Describe the importance of ethics and integrity in scientific investigation** **JoVE** **• Calibration Curves** **• Capillary Electrophoresis (CE)** **• Chromatography-Based Biomolecule Purification Methods** **• Cyclic Voltammetry (CV)** **• Density Gradient Ultracentrifugation** **• Dialysis: Diffusion Based Separation** **• Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat** **• Gas Chromatography (GC) with Flame-Ionization Detection** **• High-Performance Liquid Chromatography (HPLC)** **• Internal Standards** **• Introduction to Mass Spectrometry** **• Ion-Exchange Chromatography** **• Method of Standard Addition** **• Preparing Anhydrous Reagents and Equipment** **• Protein Crystallization** **• Raman Spectroscopy for Chemical Analysis** **• Sample Preparation for Analytical Preparation** **• Scanning Electron Microscopy (SEM)** **• Two-Dimensional Gel Electrophoresis** **• X-ray Fluorescence (XRF)**
CONTENT STANDARD / COURSE	**HI.SC.CH.**	**CHEMISTRY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.CH.2.**	**Nature of Science - Understand that science, technology, and society are interrelated**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Science, Technology, and Society**
EXPECTATION / TOPIC	**SC.CH.2.1.**	**Explain how scientific advancements and emerging technologies have influenced society** **JoVE** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Calibration Curves** **• Capillary Electrophoresis (CE)** **• Chromatography-Based Biomolecule Purification Methods** **• Co-Immunoprecipitation and Pull-Down Assays** **• Column Chromatography**

		• Common Lab Glassware and Uses • Conducting Reactions Below Room Temperature • Coordination Chemistry Complexes • Cyclic Voltammetry (CV) • Degassing Liquids with Freeze-Pump-Thaw Cycling • Density Gradient Ultracentrifugation • Determining Rate Laws and the Order of Reaction • Determining the Density of a Solid and Liquid • Determining the Empirical Formula • Determining the Mass Percent Composition in an Aqueous Solution • Determining the Solubility Rules of Ionic Compounds • Dialysis: Diffusion Based Separation • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Electrophoretic Mobility Shift Assay (EMSA) • Enzyme Assays and Kinetics • Fractional Distillation • Freezing-Point Depression to Determine an Unknown Compound • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Growing Crystals for X-ray Diffraction Analysis • High-Performance Liquid Chromatography (HPLC) • Ideal Gas Law • Internal Standards • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Ion-Exchange Chromatography • Le Châtelier's Principle • MALDI-TOF Mass Spectrometry • Metabolic Labeling • Method of Standard Addition • Nuclear Magnetic Resonance (NMR) Spectroscopy • Performing 1D Thin Layer Chromatography • Photometric Protein Determination • Preparing Anhydrous Reagents and Equipment • Protein Crystallization • Purifying Compounds by Recrystallization • Raman Spectroscopy for Chemical Analysis • Reconstitution of Membrane Proteins • Rotary Evaporation to Remove Solvent • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Schlenk Lines Transfer of Solvents • Separation of Mixtures via Precipitation • Solid-Liquid Extraction • Solutions and Concentrations • Spectrophotometric Determination of an Equilibrium Constant

		• Surface Plasmon Resonance (SPR) • Tandem Mass Spectrometry • The Ideal Gas Law • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using a pH Meter • X-ray Fluorescence (XRF)
EXPECTATION / TOPIC	SC.CH.2.2.	Compare the risks and benefits of potential solutions to technological issues <u>JoVE</u> • Assembly of a Reflux System for Heated Chemical Reactions • Calibration Curves • Capillary Electrophoresis (CE) • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Cyclic Voltammetry (CV) • Density Gradient Ultracentrifugation • Determining the Solubility Rules of Ionic Compounds • Dialysis: Diffusion Based Separation • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Electrophoretic Mobility Shift Assay (EMSA) • Enzyme Assays and Kinetics • Freezing-Point Depression to Determine an Unknown Compound • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • High-Performance Liquid Chromatography (HPLC) • Internal Standards • Introduction to Mass Spectrometry • Ion-Exchange Chromatography • Le Châtelier's Principle • MALDI-TOF Mass Spectrometry • Metabolic Labeling • Method of Standard Addition • Nuclear Magnetic Resonance (NMR) Spectroscopy • Photometric Protein Determination • Protein Crystallization • Proton Exchange Membrane Fuel Cells • Raman Spectroscopy for Chemical Analysis • Reconstitution of Membrane Proteins • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Solid-Liquid Extraction • Surface Plasmon Resonance (SPR)

		• Tandem Mass Spectrometry • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Using a pH Meter • X-ray Fluorescence (XRF)
CONTENT STANDARD / COURSE	HI.SC.CH.	CHEMISTRY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.CH.3.	Properties of Matter -Understand different states of matter
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Acids and Bases
EXPECTATION / TOPIC	SC.CH.3.1.	Explain the properties of acids, bases, and salt solutions JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Determining the Empirical Formula • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Introduction to Titration • Ion-Exchange Chromatography • Le Châtelier's Principle • Two-Dimensional Gel Electrophoresis • Using a pH Meter
EXPECTATION / TOPIC	SC.CH.3.2.	Use the pH scale to characterize acid and base solutions JoVE • High-Performance Liquid Chromatography (HPLC) • Introduction to Titration • Le Châtelier's Principle • Passaging Cells • Using a pH Meter
EXPECTATION / TOPIC	SC.CH.3.3.	Calculate the pH from the hydrogen-ion concentration JoVE • Introduction to Titration • Using a pH Meter
EXPECTATION / TOPIC	SC.CH.3.4.	Explain that buffers stabilize pH in acid-base reactions JoVE • Determining the Mass Percent Composition in an Aqueous Solution • Dialysis: Diffusion Based Separation • Le Châtelier's Principle • Using a pH Meter
CONTENT STANDARD / COURSE	HI.SC.CH.	CHEMISTRY

STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.CH.3.**	**Properties of Matter -Understand different states of matter**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Gases and their Properties**
EXPECTATION / TOPIC	**SC.CH.3.5.**	**Apply gas laws to relationships between pressure, volume, and temperature of any amount of an ideal gas or any mixture of ideal gases using PV = nRT** **JoVE** **• Determining Rate Laws and the Order of Reaction** **• Ideal Gas Law** **• The Ideal Gas Law**
EXPECTATION / TOPIC	**SC.CH.3.6.**	**Explain the diffusion of gases using the Kinetic Molecular Theory of Matter** **JoVE** **• Chromatography-Based Biomolecule Purification Methods** **• Dialysis: Diffusion Based Separation**
CONTENT STANDARD / COURSE	**HI.SC.CH.**	**CHEMISTRY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.CH.4.**	**Atomic Structure and Bonding - Understand properties of the periodic table, atoms, and bond formation**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Periodic Table**
EXPECTATION / TOPIC	**SC.CH.4.1.**	**Explain how columns in the periodic table represent elements with common properties and identify metals, semimetals, nonmetals, and halogens** **JoVE** **• Coordination Chemistry Complexes**
EXPECTATION / TOPIC	**SC.CH.4.3.**	**Use the periodic table to determine the number of valence electrons of an element** **JoVE** **• Coordination Chemistry Complexes**
CONTENT STANDARD / COURSE	**HI.SC.CH.**	**CHEMISTRY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.CH.4.**	**Atomic Structure and Bonding - Understand properties of the periodic table, atoms, and bond formation**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Nature of Matter**

EXPECTATION / TOPIC	**SC.CH.4.5.**	**Explain that spectral lines are the result of transitions of electrons between energy levels and that these lines correspond to photons with a frequency related to the energy spacing between levels by using Planck's relationship (E=hv)** **JoVE** **• Coordination Chemistry Complexes** **• Förster Resonance Energy Transfer (FRET)** **• Gas Chromatography (GC) with Flame-Ionization Detection** **• Introduction to Fluorescence Microscopy** **• Introduction to the Microplate Reader** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• MALDI-TOF Mass Spectrometry** **• Method of Standard Addition** **• Nuclear Magnetic Resonance (NMR) Spectroscopy** **• Raman Spectroscopy for Chemical Analysis** **• Tandem Mass Spectrometry** **• X-ray Fluorescence (XRF)**
EXPECTATION / TOPIC	**SC.CH.4.6.**	**Explain that atoms combine to form molecules by sharing the outermost electrons to form covalent, or metallic bonds or by transferring electrons to form ionic bonds** **JoVE** **• An Overview of Alkenone Biomarker Analysis for Paleothermometry** **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry** **• Determining the Solubility Rules of Ionic Compounds** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Purification of a Total Lipid Extract with Column Chromatography** **• Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry** **• Sonication Extraction of Lipid Biomarkers from Sediment** **• Soxhlet Extraction of Lipid Biomarkers from Sediment** **• Ultraviolet-Visible (UV-Vis) Spectroscopy** **• X-ray Fluorescence (XRF)**
EXPECTATION / TOPIC	**SC.CH.4.7.**	**Describe why the chemical bonds between atoms in molecules, such as H2, CH4, NH3, C2H4, N2, Cl2, and many large biological molecules are covalent** **JoVE** **• An Overview of Alkenone Biomarker Analysis for**

		Paleothermometry **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Purification of a Total Lipid Extract with Column Chromatography** **• Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry** **• Sonication Extraction of Lipid Biomarkers from Sediment** **• Soxhlet Extraction of Lipid Biomarkers from Sediment** **• Ultraviolet-Visible (UV-Vis) Spectroscopy**
EXPECTATION / TOPIC	**SC.CH.4.8.**	**Explain the movement and properties of atoms and molecules in liquids** **JoVE** **• Chromatography-Based Biomolecule Purification Methods** **• Degassing Liquids with Freeze-Pump-Thaw Cycling** **• Dialysis: Diffusion Based Separation** **• Fractional Distillation** **• Growing Crystals for X-ray Diffraction Analysis** **• Purifying Compounds by Recrystallization** **• Schlenk Lines Transfer of Solvents** **• Separation of Mixtures via Precipitation** **• Solid-Liquid Extraction**
EXPECTATION / TOPIC	**SC.CH.4.10.**	**Identify and explain physical properties of substances (e.g. melting points, boiling points, and volatility) based on the strength of molecular attractions** **JoVE** **• An Overview of Alkenone Biomarker Analysis for Paleothermometry** **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Common Lab Glassware and Uses** **• Conducting Reactions Below Room Temperature** **• Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry** **• Determining the Density of a Solid and Liquid** **• Determining the Mass Percent Composition in an Aqueous Solution** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Fractional Distillation** **• Freezing-Point Depression to Determine an Unknown**

		Compound • Gas Chromatography (GC) with Flame-Ionization Detection • Growing Crystals for X-ray Diffraction Analysis • Performing 1D Thin Layer Chromatography • Purification of a Total Lipid Extract with Column Chromatography • Purifying Compounds by Recrystallization • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Rotary Evaporation to Remove Solvent • Separation of Mixtures via Precipitation • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment
CONTENT STANDARD / COURSE	HI.SC.CH.	CHEMISTRY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.CH.5.	Chemical Reactions - Understand the nature of chemical interactions and solutions
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Molar Definition
EXPECTATION / TOPIC	SC.CH.5.1.	Explain how the quantity of one mole is set (e.g. defining one mole of carbon 12 atoms to have a mass of exactly 12 grams) and describe its properties (e.g. one mole is 6.02 x 1023 particles (atoms or molecules)) JoVE • Ideal Gas Law • The Ideal Gas Law
CONTENT STANDARD / COURSE	HI.SC.CH.	CHEMISTRY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.CH.5.	Chemical Reactions - Understand the nature of chemical interactions and solutions
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Molar Conversion
EXPECTATION / TOPIC	SC.CH.5.2.	Calculate the number of moles needed to produce a given gas, volume, mass, and/or number of moles of a product given a chemical equation JoVE • Calibration Curves • Capillary Electrophoresis (CE) • Determining Rate Laws and the Order of Reaction • Determining the Mass Percent Composition in an Aqueous Solution

		• Freezing-Point Depression to Determine an Unknown Compound • Gas Chromatography (GC) with Flame-Ionization Detection • High-Performance Liquid Chromatography (HPLC) • Internal Standards • Introduction to Titration • Introduction to the Microplate Reader • Introduction to the Spectrophotometer • Le Châtelier's Principle • Making Solutions in the Laboratory • Photometric Protein Determination • Sample Preparation for Analytical Preparation • Solutions and Concentrations • Spectrophotometric Determination of an Equilibrium Constant • Understanding Concentration and Measuring Volumes
EXPECTATION / TOPIC	SC.CH.5.3.	Determine the molar mass of a molecule from its chemical formula and a table of atomic masses and convert the mass of a molecular substance to moles, number of particles, or volume of gas at a standard temperature and pressure JoVE • Calibration Curves • Capillary Electrophoresis (CE) • Determining Rate Laws and the Order of Reaction • Determining the Empirical Formula • Determining the Mass Percent Composition in an Aqueous Solution • Freezing-Point Depression to Determine an Unknown Compound • Gas Chromatography (GC) with Flame-Ionization Detection • High-Performance Liquid Chromatography (HPLC) • Internal Standards • Introduction to Titration • Introduction to the Microplate Reader • Introduction to the Spectrophotometer • Le Châtelier's Principle • Making Solutions in the Laboratory • Photometric Protein Determination • Sample Preparation for Analytical Preparation • Solutions and Concentrations • Spectrophotometric Determination of an Equilibrium Constant • Understanding Concentration and Measuring Volumes
CONTENT STANDARD / COURSE	HI.SC.CH.	CHEMISTRY

STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.CH.5.**	**Chemical Reactions - Understand the nature of chemical interactions and solutions**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Conservation of Matter and Stoichiometry**
EXPECTATION / TOPIC	**SC.CH.5.4.**	**Write balanced equations to describe chemical reactions** **JoVE** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Conducting Reactions Below Room Temperature** **• Coordination Chemistry Complexes** **• Determining Rate Laws and the Order of Reaction** **• Determining the Empirical Formula** **• Determining the Solubility Rules of Ionic Compounds** **• Introduction to Catalysis** **• Introduction to Titration** **• Le Châtelier's Principle** **• Preparing Anhydrous Reagents and Equipment** **• Proton Exchange Membrane Fuel Cells** **• Solutions and Concentrations** **• Spectrophotometric Determination of an Equilibrium Constant** **• Using Differential Scanning Calorimetry to Measure Changes in Enthalpy**
EXPECTATION / TOPIC	**SC.CH.5.6.**	**Balance reactions that involve oxidation and reduction** **JoVE** **• Cyclic Voltammetry (CV)** **• Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat** **• Introduction to Titration** **• Photometric Protein Determination** **• Proton Exchange Membrane Fuel Cells**
CONTENT STANDARD / COURSE	**HI.SC.CH.**	**CHEMISTRY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.CH.5.**	**Chemical Reactions - Understand the nature of chemical interactions and solutions**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Solutions**
EXPECTATION / TOPIC	**SC.CH.5.8.**	**Distinguish between pure substances and mixtures based on physical properties (e.g. boiling point, melting point, and density)** **JoVE** **• Calibration Curves** **• Capillary Electrophoresis (CE)**

		• Chromatography-Based Biomolecule Purification Methods • Column Chromatography • Conducting Reactions Below Room Temperature • Cyclic Voltammetry (CV) • Degassing Liquids with Freeze-Pump-Thaw Cycling • Density Gradient Ultracentrifugation • Determining the Density of a Solid and Liquid • Determining the Mass Percent Composition in an Aqueous Solution • Dialysis: Diffusion Based Separation • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Fractional Distillation • Freezing-Point Depression to Determine an Unknown Compound • Gas Chromatography (GC) with Flame-Ionization Detection • High-Performance Liquid Chromatography (HPLC) • Internal Standards • Ion-Exchange Chromatography • Method of Standard Addition • Performing 1D Thin Layer Chromatography • Photometric Protein Determination • Sample Preparation for Analytical Preparation • Schlenk Lines Transfer of Solvents • Separation of Mixtures via Precipitation • Solid-Liquid Extraction • Solutions and Concentrations • Two-Dimensional Gel Electrophoresis
EXPECTATION / TOPIC	SC.CH.5.9.	Calculate the concentration of a solute in terms of molarity, parts per million, grams per liter, and percent composition <u>JoVE</u> • Calibration Curves • Capillary Electrophoresis (CE) • Determining Rate Laws and the Order of Reaction • Determining the Empirical Formula • Determining the Mass Percent Composition in an Aqueous Solution • Freezing-Point Depression to Determine an Unknown Compound • Gas Chromatography (GC) with Flame-Ionization Detection • High-Performance Liquid Chromatography (HPLC) • Internal Standards • Introduction to Mass Spectrometry • Introduction to Titration • Introduction to the Microplate Reader • Introduction to the Spectrophotometer

		• Le Châtelier's Principle • MALDI-TOF Mass Spectrometry • Making Solutions in the Laboratory • Photometric Protein Determination • Sample Preparation for Analytical Preparation • Solutions and Concentrations • Spectrophotometric Determination of an Equilibrium Constant • Tandem Mass Spectrometry • Understanding Concentration and Measuring Volumes
CONTENT STANDARD / COURSE	HI.SC.CH.	CHEMISTRY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.CH.6.	Chemical Thermodynamics - Understand and apply the laws of thermodynamics
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Energy and its Transformation
EXPECTATION / TOPIC	SC.CH.6.1.	Explain that chemical processes either absorb (endothermic) or release (exothermic) thermal energy JoVE • Using a pH Meter
EXPECTATION / TOPIC	SC.CH.6.2.	Use known values of specific heat and latent heat of phase change to solve problems involving heat flow and temperature JoVE • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
CONTENT STANDARD / COURSE	HI.SC.CH.	CHEMISTRY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.CH.7.	Chemical Reaction Rates - Understand the nature of how reaction rates are affected
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Chemical Changes
EXPECTATION / TOPIC	SC.CH.7.1.	Describe how reaction rates are quantitatively affected by changes of concentration and qualitatively affected by changes of temperature and surface area. JoVE • Conducting Reactions Below Room Temperature • Determining Rate Laws and the Order of Reaction • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Introduction to Catalysis

EXPECTATION / TOPIC	SC.CH.7.2.	Describe how a catalyst increases reaction rates JoVE • Coordination Chemistry Complexes • Determining Rate Laws and the Order of Reaction • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Introduction to Catalysis
EXPECTATION / TOPIC	SC.CH.7.3.	Explain the concept of dynamic equilibrium JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Le Châtelier's Principle • Separation of Mixtures via Precipitation • Spectrophotometric Determination of an Equilibrium Constant
CONTENT STANDARD / COURSE	HI.SC.CH.	CHEMISTRY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.CH.8.	Nuclear Reactions and Energy - Understand the properties of nuclear energy
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Energy Release
EXPECTATION / TOPIC	SC.CH.8.2.	Determine the amount of radioactive substance remaining after an integral number of half-lives have passed JoVE • Determining Rate Laws and the Order of Reaction
CONTENT STANDARD / COURSE	HI.SC.ENV.	ENVIRONMENTAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.ENV.1.	Scientific Investigation - Discover, invent, and investigate using the skills necessary to engage in the scientific process
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Scientific Knowledge
EXPECTATION / TOPIC	SC.ENV.1.8.	Describe the importance of ethics and integrity in scientific investigation JoVE • Aseptic Technique in Environmental Science
CONTENT STANDARD / COURSE	HI.SC.ENV.	ENVIRONMENTAL SCIENCE

STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.ENV.2.**	**Nature of Science - Understand that science, technology, and society are interrelated**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Science, Technology, and Society**
EXPECTATION / TOPIC	**SC.ENV.2.1.**	**Explain how scientific advancements and emerging technology have influenced society** **JoVE** **• Abdominal Exam I: Inspection and Auscultation** **• Abdominal Exam II: Percussion** **• Abdominal Exam III: Palpation** **• Abdominal Exam IV: Acute Abdominal Pain Assessment** **• Algae Enumeration via Culturable Methodology** **• An Introduction to Aging and Regeneration** **• An Introduction to Behavioral Neuroscience** **• An Introduction to Caenorhabditis elegans** **• An Introduction to Cell Death** **• An Introduction to Cell Division** **• An Introduction to Cell Metabolism** **• An Introduction to Cell Motility and Migration** **• An Introduction to Cellular and Molecular Neuroscience** **• An Introduction to Cognition** **• An Introduction to Developmental Genetics** **• An Introduction to Developmental Neurobiology** **• An Introduction to Drosophila melanogaster** **• An Introduction to Endocytosis and Exocytosis** **• An Introduction to Learning and Memory** **• An Introduction to Modeling Behavioral Disorders and Stress** **• An Introduction to Molecular Developmental Biology** **• An Introduction to Motor Control** **• An Introduction to Neuroanatomy** **• An Introduction to Neurophysiology** **• An Introduction to Organogenesis** **• An Introduction to Reward and Addiction** **• An Introduction to Saccharomyces cerevisiae** **• An Introduction to Stem Cell Biology** **• An Introduction to Transfection** **• An Introduction to the Chick: Gallus gallus domesticus** **• An Introduction to the Laboratory Mouse: Mus musculus** **• An Introduction to the Zebrafish: Danio rerio** **• An Overview of Epigenetics** **• An Overview of Gene Expression** **• An Overview of Genetic Analysis** **• An Overview of Genetic Engineering** **• An Overview of Genetics and Disease** **• Analysis of Earthworm Populations in Soil**

		• Anesthesia Induction and Maintenance • Ankle Exam • Annexin V and Propidium Iodide Labeling • Anterograde Amnesia • Anxiety Testing • Approximate Number Sense Test • Are You Smart or Hardworking? How Praise Influences Children's Motivation • Arterial Line Placement • Aseptic Technique in Environmental Science • Assessing Dexterity with Reaching Tasks • Auscultation • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Balance and Coordination Testing • Basic Care Procedures • Basic Chick Care and Maintenance • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Binocular Rivalry • Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Calcium Imaging in Neurons • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Categories and Inductive Inferences • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Chick ex ovo Culture • Children's Reliance on Artist Intentions When Identifying Pictures • Chromatin Immunoprecipitation • Color Afterimages • Community DNA Extraction from Bacterial Colonies • Compound Administration I • Compound Administration II

		• Compound Administration III • Compound Administration IV • Comprehensive Breast Exam • Considerations for Rodent Surgery • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Culturing and Enumerating Bacteria from Soil Samples • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Detection of Bacteriophages in Environmental Samples • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Dichotic Listening • Dissolved Oxygen in Surface Water • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Ethics in Psychology Research • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Experimentation using a Confederate • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Eye Exam • Eye Tracking in Cognitive Experiments • FM Dyes in Vesicle Recycling • Fate Mapping

		• Fear Conditioning • Filamentous Fungi • Finding Your Blind Spot and Perceptual Filling-in • Foot Exam • From Theory to Design: The Role of Creativity in Designing Experiments • Fundamentals of Breeding and Weaning • Gel Purification • Gene Silencing with Morpholinos • General Approach to the Physical Exam • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • Gram Staining of Bacteria from Environmental Sources • Habituation: Studying Infants Before They Can Talk • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • How Children Solve Problems Using Causal Reasoning • In ovo Electroporation of Chicken Embryos • Inattentional Blindness • Incidental Encoding • Induced Pluripotency • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Introducing Experimental Agents into the Mouse • Invasion Assay Using 3D Matrices • Invertebrate Lifespan Quantification • Isolating Nucleic Acids from Yeast • Isolation of Fecal Bacteria from Water Samples by Filtration • Just-noticeable Differences • Knee Exam • Language: The N400 in Semantic Incongruity • Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • Lower Back Exam • Lymph Node Exam • Male Rectal Exam • Manipulating an Independent Variable through Embodiment • Measuring Children's Trust in Testimony • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Tropospheric Ozone • Measuring Verbal Working Memory Span • Measuring Vital Signs • Memory Development: Demonstrating How Repeated

		Questioning Leads to False Memories **• Mental Rotation** **• Metacognitive Development: How Children Estimate Their Memory** **• Modeling Social Stress** **• Molecular Cloning** **• Motion-induced Blindness** **• Motor Exam I** **• Motor Exam II** **• Motor Learning in Mirror Drawing** **• Motor Maps** **• Mouse Genotyping** **• Multiple Object Tracking** **• Murine In Utero Electroporation** **• Mutual Exclusivity: How Children Learn the Meanings of Words** **• Neck Exam** **• Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment** **• Neuronal Transfection Methods** **• Nose, Sinuses, Oral Cavity and Pharynx Exam** **• Numerical Cognition: More or Less** **• Nutrients in Aquatic Ecosystems** **• Object Substitution Masking** **• Observation and Inspection** **• Observational Research** **• Ophthalmoscopic Examination** **• PCR: The Polymerase Chain Reaction** **• Palpation** **• Passaging Cells** **• Patch Clamp Electrophysiology** **• Pelvic Exam I: Assessment of the External Genitalia** **• Pelvic Exam II: Speculum Exam** **• Pelvic Exam III: Bimanual and Rectovaginal Exam** **• Percussion** **• Percutaneous Cricothyrotomy (Seldinger Technique)** **• Pericardiocentesis** **• Peripheral Vascular Exam** **• Peripheral Vascular Exam Using a Continuous Wave Doppler** **• Peripheral Venous Cannulation** **• Perspectives on Cognitive Psychology** **• Perspectives on Experimental Psychology** **• Perspectives on Neuropsychology** **• Perspectives on Sensation and Perception** **• Physiological Correlates of Emotion Recognition** **• Piaget's Conservation Task and the Influence of Task Demands** **• Pilot Testing** **• Placebos in Research** **• Plasmid Purification** **• Positive Reinforcement Studies**

		• Primary Neuronal Cultures • Proper Adjustment of Patient Attire during the Physical Exam • Prospect Theory • Proton Exchange Membrane Fuel Cells • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Realism in Experimentation • Recombineering and Gene Targeting • Reliability in Psychology Experiments • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Restriction Enzyme Digests • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Rodent Stereotaxic Surgery • SNP Genotyping • Self-administration Studies • Self-report vs. Behavioral Measures of Recycling • Sensory Exam • Separating Protein with SDS-PAGE • Shoulder Exam I • Shoulder Exam II • Spatial Cueing • Spatial Memory Testing Using Mazes • Sterile Tissue Harvest • Surgical Cricothyrotomy • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The Ames Room • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Factorial Experiment • The Inverted-face Effect • The McGurk Effect • The Morris Water Maze • The Multi-group Experiment • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Rubber Hand Illusion • The Simple Experiment: Two-group Design • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay

		• The Western Blot • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Using Your Head: Measuring Infants' Rational Imitation of Actions • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Whole-Mount In Situ Hybridization • Within-subjects Repeated-measures Design • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.ENV.2.2.	Compare the risks and benefits of potential solutions to technological issues JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Measuring Tropospheric Ozone • Proton Exchange Membrane Fuel Cells • Self-report vs. Behavioral Measures of Recycling • Using GIS to Investigate Urban Forestry
CONTENT STANDARD / COURSE	HI.SC.ENV.	ENVIRONMENTAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.ENV.3.	Earth Science - Understand the physical systems of the earth.

INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Forces that shape the earth**
EXPECTATION / TOPIC	**SC.ENV.3.2.**	**Compare different erosion processes** **JoVE** **• Turbidity and Total Solids in Surface Water**
EXPECTATION / TOPIC	**SC.ENV.3.4.**	**Compare different methods of generating electricity (e.g., fossil fuels, nuclear)** **JoVE** **• Bacterial Growth Curve Analysis and its Environmental Applications** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Fractional Distillation** **• Proton Exchange Membrane Fuel Cells** **• Raman Spectroscopy for Chemical Analysis**
CONTENT STANDARD / COURSE	**HI.SC.ENV.**	**ENVIRONMENTAL SCIENCE**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.ENV.4.**	**Life Science - Understand the interconnections of living systems.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Systems and Connections**
EXPECTATION / TOPIC	**SC.ENV.4.1.**	**Explain how scientists organize the biosphere** **JoVE** **• An Overview of Alkenone Biomarker Analysis for Paleothermometry** **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Purification of a Total Lipid Extract with Column Chromatography** **• Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry** **• Sonication Extraction of Lipid Biomarkers from Sediment** **• Soxhlet Extraction of Lipid Biomarkers from Sediment**
EXPECTATION / TOPIC	**SC.ENV.4.2.**	**Explain why populations undergo cyclic fluctuations** **JoVE** **• Algae Enumeration via Culturable Methodology**

		• An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Analysis of Earthworm Populations in Soil • Aseptic Technique in Environmental Science • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Basic Mouse Care and Maintenance • C. elegans Maintenance • Culturing and Enumerating Bacteria from Soil Samples • Detection of Bacteriophages in Environmental Samples • Dissolved Oxygen in Surface Water • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Filamentous Fungi • Isolation of Fecal Bacteria from Water Samples by Filtration • Passaging Cells • Plasmid Purification • Quantifying Environmental Microorganisms and Viruses Using qPCR • Yeast Maintenance • Yeast Reproduction
EXPECTATION / TOPIC	SC.ENV.4.3.	Explain how ecosystems respond to human activities JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
CONTENT STANDARD / COURSE	HI.SC.ENV.	ENVIRONMENTAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.ENV.4.	Life Science - Understand the interconnections of living systems.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Flow of Matter and Energy

EXPECTATION / TOPIC	SC.ENV.4.5.	Explain the relationship between the carbon cycle and fossil fuels JoVE • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Carbon and Nitrogen Analysis of Environmental Samples • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Metabolic Labeling • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Using GIS to Investigate Urban Forestry
CONTENT STANDARD / COURSE	HI.SC.ENV.	ENVIRONMENTAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.ENV.5.	Interdependence of The Environment and Human Societies - Understand the interdependence between environmental systems and human societies.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Human Impact
EXPECTATION / TOPIC	SC.ENV.5.1.	Explain how economic and societal decisions affect global and local ecosystems JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Proton Exchange Membrane Fuel Cells • Self-report vs. Behavioral Measures of Recycling • Turbidity and Total Solids in Surface Water
EXPECTATION / TOPIC	SC.ENV.5.2.	Assess the effect of human actions on an environmental system

		JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Introduction to Mass Spectrometry • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Self-report vs. Behavioral Measures of Recycling • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
EXPECTATION / TOPIC	SC.ENV.5.3.	Explain how population growth and natural resource consumption affect global sustainability JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Nutrients in Aquatic Ecosystems
CONTENT STANDARD / COURSE	HI.SC.ENV.	ENVIRONMENTAL SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.ENV.5.	Interdependence of The Environment and Human Societies - Understand the interdependence between environmental systems and human societies.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Resource Use
EXPECTATION / TOPIC	SC.ENV.5.4.	Describe the relationship between the environment and the growth rate of a population JoVE • Nutrients in Aquatic Ecosystems
EXPECTATION / TOPIC	SC.ENV.5.5.	Compare the consumption of natural resources by different nations JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Dissolved Oxygen in Surface Water • Igneous Intrusive Rock • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Using GIS to Investigate Urban Forestry • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy
EXPECTATION / TOPIC	SC.ENV.5.6.	Explain why recycling and conservation of resources are important

		JoVE • Electrophoretic Mobility Shift Assay (EMSA) • Self-report vs. Behavioral Measures of Recycling
CONTENT STANDARD / COURSE	**HI.SC.MS.**	**MARINE SCIENCE**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.MS.1.**	**Scientific Investigation - Discover, invent, and investigate using the skills necessary to engage in the scientific process**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Scientific Knowledge**
EXPECTATION / TOPIC	**SC.MS.1.8.**	**Describe the importance of ethics and integrity in scientific investigation** JoVE • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Manipulating an Independent Variable through Embodiment • Observational Research • Pilot Testing • Placebos in Research • Reliability in Psychology Experiments • Self-report vs. Behavioral Measures of Recycling • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Within-subjects Repeated-measures Design
CONTENT STANDARD / COURSE	**HI.SC.MS.**	**MARINE SCIENCE**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.MS.2.**	**Nature of Science - Understand that science, technology, and society are interrelated**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Science, Technology, and Society**
EXPECTATION / TOPIC	**SC.MS.2.1.**	**Explain how scientific advancements and emerging technology have influenced society** JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam II: Percussion • Abdominal Exam III: Palpation • Abdominal Exam IV: Acute Abdominal Pain Assessment • Algae Enumeration via Culturable Methodology

		• An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Cognition • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Drosophila melanogaster • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Molecular Developmental Biology • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Organogenesis • An Introduction to Reward and Addiction • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to Transfection • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Analysis of Earthworm Populations in Soil • Anesthesia Induction and Maintenance • Ankle Exam • Annexin V and Propidium Iodide Labeling • Anterograde Amnesia • Anxiety Testing • Approximate Number Sense Test • Are You Smart or Hardworking? How Praise Influences Children's Motivation • Arterial Line Placement • Aseptic Technique in Environmental Science • Assessing Dexterity with Reaching Tasks • Auscultation • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Balance and Coordination Testing

		• Basic Care Procedures • Basic Chick Care and Maintenance • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Binocular Rivalry • Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Calcium Imaging in Neurons • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Categories and Inductive Inferences • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Chick ex ovo Culture • Children's Reliance on Artist Intentions When Identifying Pictures • Chromatin Immunoprecipitation • Color Afterimages • Community DNA Extraction from Bacterial Colonies • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Comprehensive Breast Exam • Considerations for Rodent Surgery • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Culturing and Enumerating Bacteria from Soil Samples • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis

		• Detecting Reactive Oxygen Species • Detection of Bacteriophages in Environmental Samples • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Dichotic Listening • Dissolved Oxygen in Surface Water • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Ethics in Psychology Research • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Experimentation using a Confederate • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Eye Exam • Eye Tracking in Cognitive Experiments • FM Dyes in Vesicle Recycling • Fate Mapping • Fear Conditioning • Filamentous Fungi • Finding Your Blind Spot and Perceptual Filling-in • Foot Exam • From Theory to Design: The Role of Creativity in Designing Experiments • Fundamentals of Breeding and Weaning • Gel Purification • Gene Silencing with Morpholinos • General Approach to the Physical Exam • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • Gram Staining of Bacteria from Environmental Sources • Habituation: Studying Infants Before They Can Talk • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue

		• How Children Solve Problems Using Causal Reasoning • In ovo Electroporation of Chicken Embryos • Inattentional Blindness • Incidental Encoding • Induced Pluripotency • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Introducing Experimental Agents into the Mouse • Invasion Assay Using 3D Matrices • Invertebrate Lifespan Quantification • Isolating Nucleic Acids from Yeast • Isolation of Fecal Bacteria from Water Samples by Filtration • Just-noticeable Differences • Knee Exam • Language: The N400 in Semantic Incongruity • Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • Lower Back Exam • Lymph Node Exam • Male Rectal Exam • Manipulating an Independent Variable through Embodiment • Measuring Children's Trust in Testimony • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Verbal Working Memory Span • Measuring Vital Signs • Memory Development: Demonstrating How Repeated Questioning Leads to False Memories • Mental Rotation • Metacognitive Development: How Children Estimate Their Memory • Modeling Social Stress • Molecular Cloning • Motion-induced Blindness • Motor Exam I • Motor Exam II • Motor Learning in Mirror Drawing • Motor Maps • Mouse Genotyping • Multiple Object Tracking • Murine In Utero Electroporation • Mutual Exclusivity: How Children Learn the Meanings of Words • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Neuronal Transfection Methods

		• Nose, Sinuses, Oral Cavity and Pharynx Exam • Numerical Cognition: More or Less • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Observation and Inspection • Observational Research • Ophthalmoscopic Examination • PCR: The Polymerase Chain Reaction • Palpation • Passaging Cells • Patch Clamp Electrophysiology • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Perspectives on Cognitive Psychology • Perspectives on Experimental Psychology • Perspectives on Neuropsychology • Perspectives on Sensation and Perception • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Pilot Testing • Placebos in Research • Plasmid Purification • Positive Reinforcement Studies • Primary Neuronal Cultures • Proper Adjustment of Patient Attire during the Physical Exam • Prospect Theory • Proton Exchange Membrane Fuel Cells • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Realism in Experimentation • Recombineering and Gene Targeting • Reliability in Psychology Experiments • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Restriction Enzyme Digests • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Rodent Stereotaxic Surgery

		• SNP Genotyping • Self-administration Studies • Self-report vs. Behavioral Measures of Recycling • Sensory Exam • Separating Protein with SDS-PAGE • Shoulder Exam I • Shoulder Exam II • Spatial Cueing • Spatial Memory Testing Using Mazes • Sterile Tissue Harvest • Surgical Cricothyrotomy • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The Ames Room • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Factorial Experiment • The Inverted-face Effect • The McGurk Effect • The Morris Water Maze • The Multi-group Experiment • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Rubber Hand Illusion • The Simple Experiment: Two-group Design • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Using Your Head: Measuring Infants' Rational Imitation of Actions • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide

		Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Whole-Mount In Situ Hybridization • Within-subjects Repeated-measures Design • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging
CONTENT STANDARD / COURSE	**HI.SC.MS.**	**MARINE SCIENCE**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.MS.3.**	**Oceanography - Understand the physical features of the ocean and its influences on weather and climate.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Physical Characteristics of the Ocean**
EXPECTATION / TOPIC	**SC.MS.3.2.**	**Describe the effect of plate tectonics on the topography of the ocean floor** **JoVE** • Igneous Intrusive Rock • Igneous Volcanic Rock
EXPECTATION / TOPIC	**SC.MS.3.3.**	**Explain how the ocean participates in the geochemical cycling of elements** **JoVE** • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Using GIS to Investigate Urban Forestry

CONTENT STANDARD / COURSE	HI.SC.MS.	MARINE SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.MS.4.	Ecological Systems - Understand the locations and characteristics of marine ecosystems.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Ecosystems
EXPECTATION / TOPIC	SC.MS.4.1.	Differentiate freshwater, brackish, and saltwater ecosystems JoVE • Dissolved Oxygen in Surface Water • Nutrients in Aquatic Ecosystems • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms • Zebrafish Maintenance and Husbandry
CONTENT STANDARD / COURSE	HI.SC.MS.	MARINE SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.MS.5.	Structure, Function, and Interdependence - Understand the structure, function, and interdependence of marine organisms.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Structure And Function
EXPECTATION / TOPIC	SC.MS.5.1.	Explain how adaptations help animals survive in a marine environment JoVE • An Introduction to the Zebrafish: Danio rerio • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
EXPECTATION / TOPIC	SC.MS.5.2.	Compare the characteristics of marine organisms (e.g., planktonic, invertebrate, vertebrate) JoVE • Algae Enumeration via Culturable Methodology
CONTENT STANDARD / COURSE	HI.SC.MS.	MARINE SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.MS.5.	Structure, Function, and Interdependence - Understand the structure, function, and interdependence of marine organisms.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Interdependence

EXPECTATION / TOPIC	SC.MS.5.3.	Compare forms of marine symbiosis JoVE • An Introduction to the Zebrafish: Danio rerio • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
CONTENT STANDARD / COURSE	HI.SC.MS.	MARINE SCIENCE
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.MS.6.	Interdependence of Humans and the Ocean - Understand the interdependence of humans and the ocean.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Human Impact
EXPECTATION / TOPIC	SC.MS.6.4.	Explain how human activities and development lead to marine pollution (e.g., point sources, non-point sources) JoVE • Dissolved Oxygen in Surface Water • Introduction to Mass Spectrometry • Making a Geologic Cross Section • Nutrients in Aquatic Ecosystems • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
EXPECTATION / TOPIC	SC.MS.6.5.	Describe how urbanization has impacted the ocean JoVE • Dissolved Oxygen in Surface Water • Le Châtelier's Principle • Nutrients in Aquatic Ecosystems • Turbidity and Total Solids in Surface Water
CONTENT STANDARD / COURSE	HI.SC.PAH.	PLANTS AND ANIMALS IN HAWAII
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PAH.1:	Scientific Investigation--Discover, invent, and investigate using the skills necessary to engage in the scientific process
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Scientific Inquiry
EXPECTATION / TOPIC	SC.PAH.1.1.	Describe how a testable hypothesis may need to be revised to guide a scientific investigation JoVE • The Multi-group Experiment • The Simple Experiment: Two-group Design
EXPECTATION / TOPIC	SC.PAH.1.2.	Design and safely implement an experiment, including the appropriate use of tools and techniques to organize,

		analyze, and validate data JoVE • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Manipulating an Independent Variable through Embodiment • Observational Research • Pilot Testing • Placebos in Research • Realism in Experimentation • Reliability in Psychology Experiments • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Within-subjects Repeated-measures Design
CONTENT STANDARD / COURSE	HI.SC.PAH.	PLANTS AND ANIMALS IN HAWAII
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PAH.1:	Scientific Investigation--Discover, invent, and investigate using the skills necessary to engage in the scientific process
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Scientific Knowledge
EXPECTATION / TOPIC	SC.PAH.1.8.	Describe the importance of ethics and integrity in scientific investigation JoVE • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Manipulating an Independent Variable through Embodiment • Observational Research • Pilot Testing • Placebos in Research • Reliability in Psychology Experiments • Self-report vs. Behavioral Measures of Recycling • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Within-subjects Repeated-measures Design
CONTENT STANDARD / COURSE	HI.SC.PAH.	PLANTS AND ANIMALS IN HAWAII
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PAH.2:	Nature of Science--Understand that science, technology, and society are interrelated

INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Science, Technology, and Society
EXPECTATION / TOPIC	SC.PAH.2.1.	Explain how scientific advancements and emerging technology have influenced society JoVE • An Introduction to Aging and Regeneration • An Introduction to Drosophila melanogaster • An Introduction to Molecular Developmental Biology • An Introduction to Organogenesis • An Introduction to Stem Cell Biology • An Introduction to Transfection • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Genetic Engineering • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • C. elegans Development and Reproduction • Chick ex ovo Culture • DNA Ligation Reactions • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Fate Mapping • Fundamentals of Breeding and Weaning • Gene Silencing with Morpholinos • Genetic Engineering of Model Organisms • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Invertebrate Lifespan Quantification • Molecular Cloning • Mouse Genotyping • Nutrients in Aquatic Ecosystems • Plasmid Purification • RNAi in C. elegans • Restriction Enzyme Digests • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Solid-Liquid Extraction • Testing For Genetically Modified Foods • The TUNEL Assay • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Whole-Mount In Situ Hybridization

		• Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
EXPECTATION / TOPIC	SC.PAH.2.2.	Compare the risks and benefits of potential solutions to technological issues <u>JoVE</u> • An Introduction to Aging and Regeneration • An Introduction to Drosophila melanogaster • An Introduction to Molecular Developmental Biology • An Introduction to Organogenesis • An Introduction to Stem Cell Biology • An Introduction to Transfection • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Genetic Engineering • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • C. elegans Development and Reproduction • Chick ex ovo Culture • DNA Ligation Reactions • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Fate Mapping • Fundamentals of Breeding and Weaning • Gene Silencing with Morpholinos • Genetic Engineering of Model Organisms • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Invertebrate Lifespan Quantification • Molecular Cloning • Mouse Genotyping • Plasmid Purification • RNAi in C. elegans • Restriction Enzyme Digests • Self-report vs. Behavioral Measures of Recycling • Solid-Liquid Extraction • Testing For Genetically Modified Foods • The TUNEL Assay • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry

		• Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
CONTENT STANDARD / COURSE	**HI.SC.PAH.**	**PLANTS AND ANIMALS IN HAWAII**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.PAH.3.**	**Organisms and the Environment--Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Cycles of Matter and Energy**
EXPECTATION / TOPIC	**SC.PAH.3.1.**	**Illustrate biogeochemical cycles within the Hawaiian ecosystem and describe how abiotic and biotic influences have impacted these cycles** **JoVE** • Algae Enumeration via Culturable Methodology • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Analysis of Earthworm Populations in Soil • Bacterial Growth Curve Analysis and its Environmental Applications • Carbon and Nitrogen Analysis of Environmental Samples • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Culturing and Enumerating Bacteria from Soil Samples • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Filamentous Fungi • Fundamentals of Breeding and Weaning • Metabolic Labeling • Nutrients in Aquatic Ecosystems • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Using GIS to Investigate Urban Forestry
EXPECTATION / TOPIC	**SC.PAH.3.2.**	**Explain how the chemical reactions that occur in photosynthesis and cellular respiration result in cycling**

		of energy within the ecosystem of Hawaii JoVE • An Introduction to Cell Metabolism • Biofuels: Producing Ethanol from Cellulosic Material • Detecting Reactive Oxygen Species • The ATP Bioluminescence Assay
EXPECTATION / TOPIC	SC.PAH.3.3.	Explain how matter and energy flow through living systems and the physical environments (e.g., subalpine, rainforest, montane bogs, dryland and mesic forests, subterranean, freshwater, coastal) found in Hawaii JoVE • Algae Enumeration via Culturable Methodology • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Bacterial Growth Curve Analysis and its Environmental Applications • Carbon and Nitrogen Analysis of Environmental Samples • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Culturing and Enumerating Bacteria from Soil Samples • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Filamentous Fungi • Metabolic Labeling • Nutrients in Aquatic Ecosystems • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Using GIS to Investigate Urban Forestry
CONTENT STANDARD / COURSE	HI.SC.PAH.	PLANTS AND ANIMALS IN HAWAII
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PAH.3.	Organisms and the Environment--Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment

INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Interdependence
EXPECTATION / TOPIC	SC.PAH.3.4.	Explain dynamic equilibrium in populations and the shifts in equilibrium due to abiotic (e.g., changes in climate, soil composition) and biotic (e.g., presence of invasive species such as the brown tree snake, two spotted leaf hopper, feral pigs and goats, nonindigenous grasses, miconia) factors on flora and fauna populations found within Hawaii's land and oceanic environments JoVE • Algae Enumeration via Culturable Methodology • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Analysis of Earthworm Populations in Soil • Aseptic Technique in Environmental Science • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Basic Mouse Care and Maintenance • C. elegans Maintenance • Culturing and Enumerating Bacteria from Soil Samples • Detection of Bacteriophages in Environmental Samples • Dissolved Oxygen in Surface Water • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Filamentous Fungi • Isolation of Fecal Bacteria from Water Samples by Filtration • Passaging Cells • Plasmid Purification • Quantifying Environmental Microorganisms and Viruses Using qPCR • Tree Survey: Point-Centered Quarter Sampling Method • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Yeast Maintenance • Yeast Reproduction
EXPECTATION / TOPIC	SC.PAH.3.6.	Explain how human actions (e.g., conservation, introduction of nonindigenous species, destruction and fragmentation of native habitat, hunting, over harvesting, poor land use practices, stream diversion) have impacted organisms in Hawaii since the first Polynesians JoVE • Analysis of Earthworm Populations in Soil

		• Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
CONTENT STANDARD / COURSE	**HI.SC.PAH.**	**PLANTS AND ANIMALS IN HAWAII**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.PAH.4.**	**Structure and Function in Organisms--Understand the structures and functions of living organisms and how organisms can be compared scientifically**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Cells, Tissues, Organs, and Organ Systems**
EXPECTATION / TOPIC	**SC.PAH.4.1.**	**Describe different cell parts and their functions** **JoVE** • An Introduction to Aging and Regeneration • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Neurobiology • An Introduction to Endocytosis and Exocytosis • An Introduction to Molecular Developmental Biology • An Introduction to Neurophysiology • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to Transfection • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Balance and Coordination Testing • C. elegans Development and Reproduction • Calcium Imaging in Neurons • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Cytogenetics • DNA Ligation Reactions • Density Gradient Ultracentrifugation • Detecting Reactive Oxygen Species • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation

		• Enzyme Assays and Kinetics • Explant Culture of Neural Tissue • FM Dyes in Vesicle Recycling • Förster Resonance Energy Transfer (FRET) • Gene Silencing with Morpholinos • Genetic Crosses • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Invasion Assay Using 3D Matrices • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Metabolic Labeling • Molecular Cloning • Murine In Utero Electroporation • Neuronal Transfection Methods • Passaging Cells • Patch Clamp Electrophysiology • Plasmid Purification • Primary Neuronal Cultures • Protein Crystallization • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Restriction Enzyme Digests • Surface Plasmon Resonance (SPR) • The ATP Bioluminescence Assay • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Tissue Regeneration with Somatic Stem Cells • Whole-Mount In Situ Hybridization • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning
EXPECTATION / TOPIC	SC.PAH.4.2.	Explain how cells are specialized into different tissues and organs <u>JoVE</u> • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Cell Motility and Migration • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Learning and Memory • An Introduction to Molecular Developmental Biology • An Introduction to Organogenesis • An Introduction to Stem Cell Biology • An Overview of Epigenetics • An Overview of Gene Expression • C. elegans Development and Reproduction • Chick ex ovo Culture

		• DNA Methylation Analysis • Detecting Reactive Oxygen Species • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Drosophila Development and Reproduction • Drosophila Larval IHC • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Fate Mapping • Gene Silencing with Morpholinos • Genetic Engineering of Model Organisms • Histological Sample Preparation for Light Microscopy • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Murine In Utero Electroporation • RNA-Seq • Sterile Tissue Harvest • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Reproduction and Development
EXPECTATION / TOPIC	SC.PAH.4.3.	Differentiate between the processes of mitosis and meiosis JoVE • An Introduction to Cell Division • An Introduction to Saccharomyces cerevisiae • Cell Cycle Analysis • Genetic Crosses • Live Cell Imaging of Mitosis • Recombineering and Gene Targeting • Yeast Reproduction • Yeast Transformation and Cloning
EXPECTATION / TOPIC	SC.PAH.4.4.	Describe how homeostatic balance occurs in cells and organisms (e.g., salt balance) JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam II: Percussion • Abdominal Exam III: Palpation • Abdominal Exam IV: Acute Abdominal Pain Assessment • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism

		• An Introduction to Cellular and Molecular Neuroscience • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Molecular Developmental Biology • An Introduction to Reward and Addiction • An Introduction to Stem Cell Biology • Anesthesia Induction and Maintenance • Ankle Exam • Annexin V and Propidium Iodide Labeling • Arterial Line Placement • Assessing Dexterity with Reaching Tasks • Auscultation • Balance and Coordination Testing • Basic Care Procedures • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Development and Reproduction • Calcium Imaging in Neurons • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Cell-surface Biotinylation Assay • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Comprehensive Breast Exam • Considerations for Rodent Surgery • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Detecting Reactive Oxygen Species • Diagnostic Necropsy and Tissue Harvest • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement)

		• Emergent Lateral Canthotomy and Inferior Catholysis • Explant Culture of Neural Tissue • Eye Exam • FM Dyes in Vesicle Recycling • Fear Conditioning • Foot Exam • General Approach to the Physical Exam • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Isolating Nucleic Acids from Yeast • Knee Exam • Lower Back Exam • Lymph Node Exam • Male Rectal Exam • Measuring Vital Signs • Motor Exam I • Motor Exam II • Murine In Utero Electroporation • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Nose, Sinuses, Oral Cavity and Pharynx Exam • Observation and Inspection • Ophthalmoscopic Examination • Palpation • Patch Clamp Electrophysiology • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Physiological Correlates of Emotion Recognition • Proper Adjustment of Patient Attire during the Physical Exam • Reconstitution of Membrane Proteins • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Self-administration Studies • Sensory Exam • Shoulder Exam I

		• Shoulder Exam II • Spatial Memory Testing Using Mazes • Sterile Tissue Harvest • Surgical Cricothyrotomy • The ATP Bioluminescence Assay • The TUNEL Assay • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Tree Identification: How To Use a Dichotomous Key • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using a pH Meter • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Maintenance and Husbandry
EXPECTATION / TOPIC	SC.PAH.4.5.	Describe the components and functions of a variety of macromolecules active in biological systems <u>JoVE</u> • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Molecular Developmental Biology • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Biofuels: Producing Ethanol from Cellulosic Material • C. elegans Maintenance • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Column Chromatography • Community DNA Extraction from Bacterial Colonies • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions

		• DNA Methylation Analysis • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Dialysis: Diffusion Based Separation • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Electrophoretic Mobility Shift Assay (EMSA) • Embryonic Stem Cell Culture and Differentiation • Enzyme Assays and Kinetics • Explant Culture for Developmental Studies • Expression Profiling with Microarrays • FM Dyes in Vesicle Recycling • Förster Resonance Energy Transfer (FRET) • Gel Purification • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Introduction to Catalysis • Introduction to Mass Spectrometry • Invasion Assay Using 3D Matrices • Invertebrate Lifespan Quantification • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • MALDI-TOF Mass Spectrometry • Metabolic Labeling • Method of Standard Addition • Molecular Cloning • Mouse Genotyping • PCR: The Polymerase Chain Reaction • Photometric Protein Determination • Plasmid Purification • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Restriction Enzyme Digests

		• Rodent Stereotaxic Surgery • SNP Genotyping • Separating Protein with SDS-PAGE • Spectrophotometric Determination of an Equilibrium Constant • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The ELISA Method • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Whole-Mount In Situ Hybridization • Yeast Maintenance • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
CONTENT STANDARD / COURSE	**HI.SC.PAH.**	**PLANTS AND ANIMALS IN HAWAII**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.PAH.4.**	**Structure and Function in Organisms--Understand the structures and functions of living organisms and how organisms can be compared scientifically**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Classification**
EXPECTATION / TOPIC	**SC.PAH.4.6.**	**Classify a variety of Hawaiian organisms using the modern classification system and explain the evidence (e.g., structural similarities, fossil record, genetic relationships) that supports the system's organization** **JoVE** • An Introduction to Caenorhabditis elegans • An Introduction to Drosophila melanogaster • An Introduction to Saccharomyces cerevisiae • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Aseptic Technique in Environmental Science • Basic Chick Care and Maintenance • Basic Mouse Care and Maintenance • Biofuels: Producing Ethanol from Cellulosic Material • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Chick ex ovo Culture • Culturing and Enumerating Bacteria from Soil Samples

		• Detection of Bacteriophages in Environmental Samples • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Filamentous Fungi • Genetic Crosses • In ovo Electroporation of Chicken Embryos • Introducing Experimental Agents into the Mouse • Isolating Nucleic Acids from Yeast • Mouse Genotyping • RNAi in C. elegans • Recombineering and Gene Targeting • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Using GIS to Investigate Urban Forestry • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
CONTENT STANDARD / COURSE	**HI.SC.PAH.**	**PLANTS AND ANIMALS IN HAWAII**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.PAH.5.**	**Diversity, Genetics, and Evolution--Understand genetics and biological evolution and their impact on the unity and diversity of organisms**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Biological Evolution**
EXPECTATION / TOPIC	**SC.PAH.5.1.**	**Explain the theory of evolution and describe evidence that supports this theory** **JoVE** • An Introduction to the Chick: Gallus gallus domesticus • An Overview of Genetic Analysis • High-Performance Liquid Chromatography (HPLC)
EXPECTATION / TOPIC	**SC.PAH.5.2.**	**Explain how the theory of natural selection accounts for the development of a wide diversity of some species and lack of others on Hawaii** **JoVE** • An Overview of Genetic Analysis

CONTENT STANDARD / COURSE	HI.SC.PAH.	PLANTS AND ANIMALS IN HAWAII
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.PAH.5.	Diversity, Genetics, and Evolution--Understand genetics and biological evolution and their impact on the unity and diversity of organisms
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Unity and Diversity
EXPECTATION / TOPIC	SC.PAH.5.3.	Explain the structural properties of DNA and the role of DNA in heredity and protein synthesis JoVE • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Molecular Developmental Biology • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Cell Cycle Analysis • Chromatin Immunoprecipitation • Community DNA Extraction from Bacterial Colonies • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Development and Reproduction of the Laboratory Mouse • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Electrophoretic Mobility Shift Assay (EMSA) • Embryonic Stem Cell Culture and Differentiation • Enzyme Assays and Kinetics • Explant Culture for Developmental Studies • Expression Profiling with Microarrays • Förster Resonance Energy Transfer (FRET) • Gel Purification • Gene Silencing with Morpholinos

		• Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Method of Standard Addition • Molecular Cloning • Mouse Genotyping • PCR: The Polymerase Chain Reaction • Photometric Protein Determination • Plasmid Purification • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • Recombineering and Gene Targeting • Restriction Enzyme Digests • SNP Genotyping • Testing For Genetically Modified Foods • The TUNEL Assay • Two-Dimensional Gel Electrophoresis • Whole-Mount In Situ Hybridization • Yeast Maintenance • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling
EXPECTATION / TOPIC	SC.PAH.5.4.	Explain how Mendel's laws of heredity can be used to determine the traits of possible offspring JoVE • An Introduction to Developmental Genetics • Fundamentals of Breeding and Weaning • Genetic Crosses
EXPECTATION / TOPIC	SC.PAH.5.5.	Explain chromosomal mutations, their possible causes, and their effects on genetic variation JoVE • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Introduction to the Zebrafish: Danio rerio

		• An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetics and Disease • Genetic Engineering of Model Organisms • Genetic Screens • Isolating Nucleic Acids from Yeast • Passaging Cells • The TUNEL Assay
CONTENT STANDARD / COURSE	HI.SC.HP.	HUMAN PHYSIOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.HP.1.	Scientific Investigation--Discover, invent, and investigate using the skills necessary to engage in the scientific process
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Scientific Inquiry
EXPECTATION / TOPIC	SC.HP.1.1.	Describe how a testable hypothesis may need to be revised to guide a scientific investigation JoVE • The Multi-group Experiment • The Simple Experiment: Two-group Design
EXPECTATION / TOPIC	SC.HP.1.2.	Design and safely implement an experiment, including the appropriate use of tools and techniques to organize, analyze, and validate data JoVE • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Manipulating an Independent Variable through Embodiment • Observational Research • Pilot Testing • Placebos in Research • Realism in Experimentation • Reliability in Psychology Experiments • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Within-subjects Repeated-measures Design
CONTENT STANDARD / COURSE	HI.SC.HP.	HUMAN PHYSIOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.HP.1.	Scientific Investigation--Discover, invent, and investigate using the skills necessary to engage in the scientific process

INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Scientific Knowledge**
EXPECTATION / TOPIC	**SC.HP.1.8.**	**Describe the importance of ethics and integrity in scientific investigation** **JoVE** **• Ethics in Psychology Research** **• Experimentation using a Confederate** **• From Theory to Design: The Role of Creativity in Designing Experiments** **• Manipulating an Independent Variable through Embodiment** **• Observational Research** **• Pilot Testing** **• Placebos in Research** **• Reliability in Psychology Experiments** **• Self-report vs. Behavioral Measures of Recycling** **• The Factorial Experiment** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design** **• Within-subjects Repeated-measures Design**
CONTENT STANDARD / COURSE	**HI.SC.HP.**	**HUMAN PHYSIOLOGY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.HP.2.**	**Nature of Science--Understand that science, technology, and society are interrelated**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Science, Technology, and Society**
EXPECTATION / TOPIC	**SC.HP.2.1.**	**Explain how scientific advancements and emerging technology have influenced society** **JoVE** **• Abdominal Exam I: Inspection and Auscultation** **• Abdominal Exam II: Percussion** **• Abdominal Exam III: Palpation** **• Abdominal Exam IV: Acute Abdominal Pain Assessment** **• Algae Enumeration via Culturable Methodology** **• An Introduction to Aging and Regeneration** **• An Introduction to Behavioral Neuroscience** **• An Introduction to Caenorhabditis elegans** **• An Introduction to Cell Death** **• An Introduction to Cell Division** **• An Introduction to Cell Metabolism** **• An Introduction to Cell Motility and Migration** **• An Introduction to Cellular and Molecular Neuroscience** **• An Introduction to Cognition** **• An Introduction to Developmental Genetics**

		• An Introduction to Developmental Neurobiology • An Introduction to Drosophila melanogaster • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Molecular Developmental Biology • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Organogenesis • An Introduction to Reward and Addiction • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to Transfection • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Analysis of Earthworm Populations in Soil • Anesthesia Induction and Maintenance • Ankle Exam • Annexin V and Propidium Iodide Labeling • Anterograde Amnesia • Anxiety Testing • Approximate Number Sense Test • Are You Smart or Hardworking? How Praise Influences Children's Motivation • Arterial Line Placement • Aseptic Technique in Environmental Science • Assembly of a Reflux System for Heated Chemical Reactions • Assessing Dexterity with Reaching Tasks • Auscultation • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Balance and Coordination Testing • Basic Care Procedures • Basic Chick Care and Maintenance • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Binocular Rivalry

		• Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Calcium Imaging in Neurons • Capillary Electrophoresis (CE) • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Categories and Inductive Inferences • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Chick ex ovo Culture • Children's Reliance on Artist Intentions When Identifying Pictures • Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Color Afterimages • Column Chromatography • Community DNA Extraction from Bacterial Colonies • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Comprehensive Breast Exam • Considerations for Rodent Surgery • Coordination Chemistry Complexes • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Culturing and Enumerating Bacteria from Soil Samples • Cyclic Voltammetry (CV) • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species

		• Detection of Bacteriophages in Environmental Samples • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Dichotic Listening • Dissolved Oxygen in Surface Water • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Enzyme Assays and Kinetics • Ethics in Psychology Research • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Experimentation using a Confederate • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Eye Exam • Eye Tracking in Cognitive Experiments • FM Dyes in Vesicle Recycling • Fate Mapping • Fear Conditioning • Filamentous Fungi • Finding Your Blind Spot and Perceptual Filling-in • Foot Exam • From Theory to Design: The Role of Creativity in Designing Experiments • Fundamentals of Breeding and Weaning • Gel Purification • Gene Silencing with Morpholinos • General Approach to the Physical Exam • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • Gram Staining of Bacteria from Environmental Sources • Growing Crystals for X-ray Diffraction Analysis • Habituation: Studying Infants Before They Can Talk

		• Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • How Children Solve Problems Using Causal Reasoning • In ovo Electroporation of Chicken Embryos • Inattentional Blindness • Incidental Encoding • Induced Pluripotency • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Introducing Experimental Agents into the Mouse • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Invasion Assay Using 3D Matrices • Invertebrate Lifespan Quantification • Isolating Nucleic Acids from Yeast • Isolation of Fecal Bacteria from Water Samples by Filtration • Just-noticeable Differences • Knee Exam • Language: The N400 in Semantic Incongruity • Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • Lower Back Exam • Lymph Node Exam • MALDI-TOF Mass Spectrometry • Male Rectal Exam • Manipulating an Independent Variable through Embodiment • Measuring Children's Trust in Testimony • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Verbal Working Memory Span • Measuring Vital Signs • Memory Development: Demonstrating How Repeated Questioning Leads to False Memories • Mental Rotation • Metabolic Labeling • Metacognitive Development: How Children Estimate Their Memory • Modeling Social Stress • Molecular Cloning • Motion-induced Blindness • Motor Exam I • Motor Exam II • Motor Learning in Mirror Drawing • Motor Maps • Mouse Genotyping

		• Multiple Object Tracking • Murine In Utero Electroporation • Mutual Exclusivity: How Children Learn the Meanings of Words • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Neuronal Transfection Methods • Nose, Sinuses, Oral Cavity and Pharynx Exam • Nuclear Magnetic Resonance (NMR) Spectroscopy • Numerical Cognition: More or Less • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Observation and Inspection • Observational Research • Ophthalmoscopic Examination • PCR: The Polymerase Chain Reaction • Palpation • Passaging Cells • Patch Clamp Electrophysiology • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Perspectives on Cognitive Psychology • Perspectives on Experimental Psychology • Perspectives on Neuropsychology • Perspectives on Sensation and Perception • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Pilot Testing • Placebos in Research • Plasmid Purification • Positive Reinforcement Studies • Primary Neuronal Cultures • Proper Adjustment of Patient Attire during the Physical Exam • Prospect Theory • Protein Crystallization • Proton Exchange Membrane Fuel Cells • Purifying Compounds by Recrystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR

		• RNA-Seq • RNAi in C. elegans • Realism in Experimentation • Recombineering and Gene Targeting • Reliability in Psychology Experiments • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Restriction Enzyme Digests • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Rodent Stereotaxic Surgery • SNP Genotyping • Scanning Electron Microscopy (SEM) • Self-administration Studies • Self-report vs. Behavioral Measures of Recycling • Sensory Exam • Separating Protein with SDS-PAGE • Shoulder Exam I • Shoulder Exam II • Solutions and Concentrations • Spatial Cueing • Spatial Memory Testing Using Mazes • Sterile Tissue Harvest • Surface Plasmon Resonance (SPR) • Surgical Cricothyrotomy • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The Ames Room • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Factorial Experiment • The Inverted-face Effect • The McGurk Effect • The Morris Water Maze • The Multi-group Experiment • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Rubber Hand Illusion • The Simple Experiment: Two-group Design • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies

		• Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Two-Dimensional Gel Electrophoresis • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Using Your Head: Measuring Infants' Rational Imitation of Actions • Using a pH Meter • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Whole-Mount In Situ Hybridization • Within-subjects Repeated-measures Design • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.HP.2.2.	Compare the risks and benefits of potential solutions to technological issues JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam IV: Acute Abdominal Pain Assessment • Algae Enumeration via Culturable Methodology • An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Cell Metabolism • An Introduction to Cognition • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to the Laboratory Mouse: Mus

		musculus **• An Overview of Genetic Analysis** **• An Overview of Genetic Engineering** **• An Overview of Genetics and Disease** **• Arterial Line Placement** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Auscultation** **• Bacterial Growth Curve Analysis and its Environmental Applications** **• Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation** **• Blood Pressure Measurement** **• Calcium Imaging in Neurons** **• Capillary Electrophoresis (CE)** **• Cardiac Exam II: Auscultation** **• Cardiac Exam III: Abnormal Heart Sounds** **• Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance** **• Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance** **• Central Venous Catheter Insertion: Subclavian Vein** **• Chromatin Immunoprecipitation** **• Chromatography-Based Biomolecule Purification Methods** **• Co-Immunoprecipitation and Pull-Down Assays** **• Column Chromatography** **• Community DNA Extraction from Bacterial Colonies** **• Coordination Chemistry Complexes** **• Cranial Nerves Exam I (I-VI)** **• Cranial Nerves Exam II (VII-XII)** **• Culturing and Enumerating Bacteria from Soil Samples** **• Cyclic Voltammetry (CV)** **• Cytogenetics** **• DNA Ligation Reactions** **• DNA Methylation Analysis** **• Decision-making and the Iowa Gambling Task** **• Decoding Auditory Imagery with Multivoxel Pattern Analysis** **• Detecting Reactive Oxygen Species** **• Detection of Bacteriophages in Environmental Samples** **• Ear Exam** **• Electro-encephalography (EEG)** **• Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat** **• Embryonic Stem Cell Culture and Differentiation** **• Emergency Tube Thoracostomy (Chest Tube Placement)** **• Emergent Lateral Canthotomy and Inferior Catholysis** **• Enzyme Assays and Kinetics** **• Event-related Potentials and the Oddball Task**

		• Expression Profiling with Microarrays • Eye Exam • Eye Tracking in Cognitive Experiments • Fate Mapping • Fear Conditioning • General Approach to the Physical Exam • Genetic Crosses • Genetic Screens • Genome Editing • Gram Staining of Bacteria from Environmental Sources • Growing Crystals for X-ray Diffraction Analysis • Induced Pluripotency • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Introducing Experimental Agents into the Mouse • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Isolation of Fecal Bacteria from Water Samples by Filtration • Language: The N400 in Semantic Incongruity • Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • MALDI-TOF Mass Spectrometry • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Vital Signs • Metabolic Labeling • Molecular Cloning • Motor Exam II • Motor Maps • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Nose, Sinuses, Oral Cavity and Pharynx Exam • Nuclear Magnetic Resonance (NMR) Spectroscopy • Ophthalmoscopic Examination • Patch Clamp Electrophysiology • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Physiological Correlates of Emotion Recognition • Protein Crystallization • Purifying Compounds by Recrystallization

		• Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA-Seq • Recombineering and Gene Targeting • Respiratory Exam II: Percussion and Auscultation • Rodent Stereotaxic Surgery • SNP Genotyping • Scanning Electron Microscopy (SEM) • Solutions and Concentrations • Surface Plasmon Resonance (SPR) • Surgical Cricothyrotomy • Tandem Mass Spectrometry • The ATP Bioluminescence Assay • The ELISA Method • The TUNEL Assay • Tissue Regeneration with Somatic Stem Cells • Two-Dimensional Gel Electrophoresis • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action Observation • Using a pH Meter • Visual Attention: fMRI Investigation of Object-based Attentional Control • fMRI: Functional Magnetic Resonance Imaging
CONTENT STANDARD / COURSE	**HI.SC.HP.**	**HUMAN PHYSIOLOGY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.HP.3.**	**Structure and Function--Understand cells, tissues, and orientation.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Cancer and Homeostasis**
EXPECTATION / TOPIC	**SC.HP.3.1.**	**Analyze, using evidence, the process of cellular division as it relates to human physiology** **JoVE** • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Organogenesis • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Zebrafish: Danio rerio • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Cell Cycle Analysis • Chick ex ovo Culture • Coordination Chemistry Complexes • DNA Methylation Analysis

		• Detecting Reactive Oxygen Species • Ear Exam • Expression Profiling with Microarrays • Genome Editing • Introducing Experimental Agents into the Mouse • Invasion Assay Using 3D Matrices • Live Cell Imaging of Mitosis • Lymph Node Exam • Male Rectal Exam • Mouse Genotyping • Passaging Cells • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • The TUNEL Assay • The Transwell Migration Assay
EXPECTATION / TOPIC	SC.HP.3.2.	Explain how cells, tissues, and organs maintain homeostasis through cellular transport mechanisms JoVE • An Introduction to Endocytosis and Exocytosis • An Introduction to Neurophysiology • An Introduction to Transfection • Calcium Imaging in Neurons • Cell-surface Biotinylation Assay • Detecting Reactive Oxygen Species • FM Dyes in Vesicle Recycling • In ovo Electroporation of Chicken Embryos • Patch Clamp Electrophysiology • Reconstitution of Membrane Proteins • The TUNEL Assay • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Yeast Transformation and Cloning
CONTENT STANDARD / COURSE	HI.SC.HP.	HUMAN PHYSIOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.HP.3.	Structure and Function--Understand cells, tissues, and orientation.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Tissues and Orientation
EXPECTATION / TOPIC	SC.HP.3.3.	Classify the various types of human tissue (e.g., muscle, epithelial, connective, nervous) by structure and function JoVE • An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Cognition • An Introduction to Developmental Neurobiology

		• An Introduction to Endocytosis and Exocytosis • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Reward and Addiction • An Introduction to Stem Cell Biology • An Overview of Gene Expression • Ankle Exam • Anterograde Amnesia • Balance and Coordination Testing • Calcium Imaging in Neurons • Color Afterimages • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Detecting Reactive Oxygen Species • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Emergent Lateral Canthotomy and Inferior Catholysis • Event-related Potentials and the Oddball Task • Explant Culture of Neural Tissue • Eye Exam • FM Dyes in Vesicle Recycling • Finding Your Blind Spot and Perceptual Filling-in • Foot Exam • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • Inattentional Blindness • Induced Pluripotency • Just-noticeable Differences • Knee Exam • Lower Back Exam • MALDI-TOF Mass Spectrometry • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Motion-induced Blindness • Motor Exam I • Motor Exam II • Murine In Utero Electroporation • Neck Exam • Neuronal Transfection Methods • Object Substitution Masking • Ophthalmoscopic Examination • Passaging Cells • Patch Clamp Electrophysiology • Physiological Correlates of Emotion Recognition • Primary Neuronal Cultures

		• Rodent Stereotaxic Surgery • Self-administration Studies • Sensory Exam • Shoulder Exam I • Shoulder Exam II • Spatial Cueing • Tandem Mass Spectrometry • The Ames Room • The Attentional Blink • The ELISA Method • The Inverted-face Effect • The McGurk Effect • The Rubber Hand Illusion • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • Tissue Regeneration with Somatic Stem Cells • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action Observation • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.HP.3.4.	Use correct terminology (e.g., proximal, dorsal, medial, lateral, visceral, superficial, deep) to describe the orientation of body parts and regions JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam II: Percussion • Abdominal Exam III: Palpation • Abdominal Exam IV: Acute Abdominal Pain Assessment • An Introduction to Behavioral Neuroscience • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Learning and Memory • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Reward and Addiction • Ankle Exam • Anterograde Amnesia • Anxiety Testing • Approximate Number Sense Test • Arterial Line Placement • Assessing Dexterity with Reaching Tasks • Auscultation

		• Balance and Coordination Testing • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Binocular Rivalry • Blood Pressure Measurement • Calcium Imaging in Neurons • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Co-Immunoprecipitation and Pull-Down Assays • Color Afterimages • Comprehensive Breast Exam • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Dichotic Listening • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Explant Culture of Neural Tissue • Eye Exam • Eye Tracking in Cognitive Experiments • Fear Conditioning • Finding Your Blind Spot and Perceptual Filling-in • Foot Exam • General Approach to the Physical Exam • Habituation: Studying Infants Before They Can Talk • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • Inattentional Blindness • Incidental Encoding • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation

		• Intraosseous Needle Placement • Just-noticeable Differences • Knee Exam • Language: The N400 in Semantic Incongruity • Learning and Memory: The Remember-Know Task • Lower Back Exam • Lymph Node Exam • Male Rectal Exam • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Verbal Working Memory Span • Measuring Vital Signs • Mental Rotation • Modeling Social Stress • Motion-induced Blindness • Motor Exam I • Motor Exam II • Motor Learning in Mirror Drawing • Motor Maps • Multiple Object Tracking • Murine In Utero Electroporation • Mutual Exclusivity: How Children Learn the Meanings of Words • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Neuronal Transfection Methods • Nose, Sinuses, Oral Cavity and Pharynx Exam • Object Substitution Masking • Observation and Inspection • Ophthalmoscopic Examination • Palpation • Patch Clamp Electrophysiology • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Physiological Correlates of Emotion Recognition • Primary Neuronal Cultures • Proper Adjustment of Patient Attire during the Physical Exam • Prospect Theory • Respiratory Exam I: Inspection and Palpation

		• Respiratory Exam II: Percussion and Auscultation • Rodent Stereotaxic Surgery • Self-administration Studies • Sensory Exam • Shoulder Exam I • Shoulder Exam II • Spatial Cueing • Spatial Memory Testing Using Mazes • Surgical Cricothyrotomy • The Ames Room • The Attentional Blink • The Inverted-face Effect • The McGurk Effect • The Morris Water Maze • The Precision of Visual Working Memory with Delayed Estimation • The Rubber Hand Illusion • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • Thyroid Exam • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action Observation • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Within-subjects Repeated-measures Design • fMRI: Functional Magnetic Resonance Imaging
CONTENT STANDARD / COURSE	**HI.SC.HP.**	**HUMAN PHYSIOLOGY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.HP.4.**	**Organ Systems--Understand the functions of various organ systems.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Circulatory and Respiratory systems**
EXPECTATION / TOPIC	**SC.HP.4.1.**	**Evaluate the function of the various structures within the circulatory system in transportation and cellular support** **JoVE** • An Introduction to Cell Motility and Migration • Arterial Line Placement • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation

		• Blood Pressure Measurement • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Eye Exam • Intraosseous Needle Placement • Invasion Assay Using 3D Matrices • MALDI-TOF Mass Spectrometry • Measuring Vital Signs • Ophthalmoscopic Examination • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Physiological Correlates of Emotion Recognition • The Transwell Migration Assay
EXPECTATION / TOPIC	SC.HP.4.2.	Determine the function of the various structures of the respiratory system in gas exchange JoVE • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Emergency Tube Thoracostomy (Chest Tube Placement) • Measuring Vital Signs • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Percutaneous Cricothyrotomy (Seldinger Technique) • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Surgical Cricothyrotomy
CONTENT STANDARD / COURSE	HI.SC.HP.	HUMAN PHYSIOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.HP.4.	Organ Systems--Understand the functions of various organ systems.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Nutrition, Digestion, and Excretion
EXPECTATION / TOPIC	SC.HP.4.3.	Evaluate the structure and function of the digestive system in transportation and absorption of nutrients

		JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam II: Percussion • Abdominal Exam III: Palpation • Abdominal Exam IV: Acute Abdominal Pain Assessment • Male Rectal Exam
EXPECTATION / TOPIC	SC.HP.4.4.	Explain how the excretory system regulates body wastes JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam II: Percussion • Abdominal Exam III: Palpation • Abdominal Exam IV: Acute Abdominal Pain Assessment • Male Rectal Exam
CONTENT STANDARD / COURSE	HI.SC.HP.	HUMAN PHYSIOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.HP.4.	Organ Systems--Understand the functions of various organ systems.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Muscular, Skeletal, and Integumentary systems
EXPECTATION / TOPIC	SC.HP.4.5.	Explain how the muscular system functions (e.g., locations, origins, insertions, muscle groups, types of muscles) JoVE • An Introduction to Cell Motility and Migration • An Introduction to Motor Control • Ankle Exam • Elbow Exam • Foot Exam • Hand and Wrist Exam • Hip Exam • Invasion Assay Using 3D Matrices • Knee Exam • Lower Back Exam • Motor Exam I • Motor Exam II • Neck Exam • Shoulder Exam I • Shoulder Exam II • The Transwell Migration Assay
EXPECTATION / TOPIC	SC.HP.4.6.	Explain how the skeletal system functions to support and protect the body JoVE

		• An Introduction to Motor Control • Ankle Exam • Elbow Exam • Foot Exam • Hand and Wrist Exam • Hip Exam • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Knee Exam • Lower Back Exam • Motor Exam I • Motor Exam II • Neck Exam • Shoulder Exam I • Shoulder Exam II
EXPECTATION / TOPIC	SC.HP.4.7.	Relate the structure of the integumentary system to its functions JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam IV: Acute Abdominal Pain Assessment • Observation and Inspection • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Sensory Exam • The Rubber Hand Illusion
CONTENT STANDARD / COURSE	HI.SC.HP.	HUMAN PHYSIOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.HP.4.	Organ Systems--Understand the functions of various organ systems.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Nervous System
EXPECTATION / TOPIC	SC.HP.4.8.	Trace and describe the pathway of a neural impulse JoVE • An Introduction to Behavioral Neuroscience • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Reward and Addiction

		• Ankle Exam • Anterograde Amnesia • Balance and Coordination Testing • Calcium Imaging in Neurons • Color Afterimages • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Detecting Reactive Oxygen Species • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Emergent Lateral Canthotomy and Inferior Catholysis • Event-related Potentials and the Oddball Task • Explant Culture of Neural Tissue • Eye Exam • FM Dyes in Vesicle Recycling • Finding Your Blind Spot and Perceptual Filling-in • Foot Exam • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • Inattentional Blindness • Just-noticeable Differences • Knee Exam • Lower Back Exam • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Motion-induced Blindness • Motor Exam I • Motor Exam II • Murine In Utero Electroporation • Neck Exam • Neuronal Transfection Methods • Object Substitution Masking • Ophthalmoscopic Examination • Patch Clamp Electrophysiology • Physiological Correlates of Emotion Recognition • Primary Neuronal Cultures • Rodent Stereotaxic Surgery • Self-administration Studies • Sensory Exam • Shoulder Exam I • Shoulder Exam II • Spatial Cueing • The Ames Room • The Attentional Blink • The Inverted-face Effect • The McGurk Effect • The Rubber Hand Illusion • The Split Brain

		• The Staircase Procedure for Finding a Perceptual Threshold • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action Observation • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.HP.4.9.	Explain how the central nervous system functions in regulating physiological activities JoVE • An Introduction to Behavioral Neuroscience • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • Assessing Dexterity with Reaching Tasks • Balance and Coordination Testing • Color Afterimages • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Detecting Reactive Oxygen Species • Electro-encephalography (EEG) • Finding Your Blind Spot and Perceptual Filling-in • Histological Staining of Neural Tissue • Inattentional Blindness • Just-noticeable Differences • Motion-induced Blindness • Object Substitution Masking • Rodent Stereotaxic Surgery • Spatial Cueing • Spatial Memory Testing Using Mazes • The Ames Room • The Attentional Blink • The Inverted-face Effect • The McGurk Effect • The Staircase Procedure for Finding a Perceptual Threshold • Tissue Regeneration with Somatic Stem Cells • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.HP.4.10.	Describe the relationship between the peripheral nervous system and how the body responds to maintain a stable internal environment JoVE • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology

		• Ankle Exam • Elbow Exam • Foot Exam • Hand and Wrist Exam • Hip Exam • Knee Exam • Lower Back Exam • Motor Exam I • Motor Exam II • Neck Exam • Rodent Stereotaxic Surgery • Shoulder Exam II
CONTENT STANDARD / COURSE	**HI.SC.HP.**	**HUMAN PHYSIOLOGY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.HP.4.**	**Organ Systems--Understand the functions of various organ systems.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Reproductive and Endocrine Systems**
EXPECTATION / TOPIC	**SC.HP.4.11.**	**Compare the reproductive organs in the male and female body in terms of structure and function** **JoVE** • Comprehensive Breast Exam • Male Rectal Exam • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam
EXPECTATION / TOPIC	**SC.HP.4.12.**	**Determine the role of the reproductive system in human growth and development** **JoVE** • Comprehensive Breast Exam • Male Rectal Exam • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam
EXPECTATION / TOPIC	**SC.HP.4.13.**	**Trace the development of a human from the formation of gametes, fertilization, embryonic development, and gestation** **JoVE** • An Introduction to Aging and Regeneration • An Introduction to Cell Motility and Migration • An Introduction to Organogenesis • An Introduction to Stem Cell Biology • Cytogenetics • Embryonic Stem Cell Culture and Differentiation • Fate Mapping

		• Invasion Assay Using 3D Matrices • Passaging Cells • The Transwell Migration Assay • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies
EXPECTATION / TOPIC	SC.HP.4.14.	Determine the role of hormones and feedback loops in bodily functions JoVE • Anxiety Testing • Modeling Social Stress • Thyroid Exam
CONTENT STANDARD / COURSE	HI.SC.HP.	HUMAN PHYSIOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.HP.5.	Interdependence of Body Systems--Understand the interdependence of body systems and the hazards associated with system failure and aging.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Interdependence
EXPECTATION / TOPIC	SC.HP.5.1.	Analyze the interdependence of various body systems to each other JoVE • An Introduction to Behavioral Neuroscience • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Learning and Memory • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • Ankle Exam • Anterograde Amnesia • Anxiety Testing • Assessing Dexterity with Reaching Tasks • Balance and Coordination Testing • Calcium Imaging in Neurons • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Elbow Exam • Foot Exam • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • Knee Exam • Learning and Memory: The Remember-Know Task • Lower Back Exam • Modeling Social Stress • Motor Exam I • Motor Exam II • Motor Learning in Mirror Drawing

		• Motor Maps • Neck Exam • Patch Clamp Electrophysiology • Physiological Correlates of Emotion Recognition • Rodent Stereotaxic Surgery • Shoulder Exam I • Shoulder Exam II • The Split Brain • fMRI: Functional Magnetic Resonance Imaging
EXPECTATION / TOPIC	SC.HP.5.2.	Determine the relationship between the skeletal and muscular systems JoVE • Ankle Exam • Assessing Dexterity with Reaching Tasks • Balance and Coordination Testing • Elbow Exam • Foot Exam • Hand and Wrist Exam • Hip Exam • Knee Exam • Lower Back Exam • Motor Exam I • Motor Exam II • Neck Exam • Shoulder Exam I • Shoulder Exam II
CONTENT STANDARD / COURSE	HI.SC.HP.	HUMAN PHYSIOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.HP.5.	Interdependence of Body Systems--Understand the interdependence of body systems and the hazards associated with system failure and aging.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: System Failure and Aging
EXPECTATION / TOPIC	SC.HP.5.3.	Identify potential system failures due to the effects of aging JoVE • An Introduction to Cognition • An Introduction to Learning and Memory • Are You Smart or Hardworking? How Praise Influences Children's Motivation • Balance and Coordination Testing • Categories and Inductive Inferences • Children's Reliance on Artist Intentions When Identifying Pictures • Executive Function and the Dimensional Change Card Sort Task • Eye Tracking in Cognitive Experiments

		• Habituation: Studying Infants Before They Can Talk • How Children Solve Problems Using Causal Reasoning • Language: The N400 in Semantic Incongruity • Measuring Children's Trust in Testimony • Memory Development: Demonstrating How Repeated Questioning Leads to False Memories • Metacognitive Development: How Children Estimate Their Memory • Mutual Exclusivity: How Children Learn the Meanings of Words • Numerical Cognition: More or Less • Piaget's Conservation Task and the Influence of Task Demands • The Costs and Benefits of Natural Pedagogy • The Rouge Test: Searching for a Sense of Self • Using Your Head: Measuring Infants' Rational Imitation of Actions
EXPECTATION / TOPIC	SC.HP.5.4.	Explain how a disorder in any major organ system affects normal body function <u>JoVE</u> • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam IV: Acute Abdominal Pain Assessment • An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Endocytosis and Exocytosis • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Ankle Exam

		• Anterograde Amnesia • Anxiety Testing • Arterial Line Placement • Assessing Dexterity with Reaching Tasks • Balance and Coordination Testing • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Blood Pressure Measurement • C. elegans Chemotaxis Assay • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Cell Cycle Analysis • Chick ex ovo Culture • Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Coordination Chemistry Complexes • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Culturing and Enumerating Bacteria from Soil Samples • Cytogenetics • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Reactive Oxygen Species • Detection of Bacteriophages in Environmental Samples • Dichotic Listening • Ear Exam • Elbow Exam • Embryonic Stem Cell Culture and Differentiation • Emergent Lateral Canthotomy and Inferior Catholysis • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Expression Profiling with Microarrays • Eye Exam • Eye Tracking in Cognitive Experiments • Fear Conditioning • Foot Exam • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Screens • Genome Editing • Gram Staining of Bacteria from Environmental Sources • Hand and Wrist Exam

		• Hip Exam • Incidental Encoding • Introducing Experimental Agents into the Mouse • Invasion Assay Using 3D Matrices • Isolation of Fecal Bacteria from Water Samples by Filtration • Knee Exam • Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • Lower Back Exam • Lymph Node Exam • Male Rectal Exam • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Verbal Working Memory Span • Modeling Social Stress • Motor Exam I • Motor Exam II • Motor Maps • Mouse Genotyping • Multiple Object Tracking • Neck Exam • Ophthalmoscopic Examination • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Physiological Correlates of Emotion Recognition • Prospect Theory • Protein Crystallization • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • Recombineering and Gene Targeting • Respiratory Exam I: Inspection and Palpation • SNP Genotyping • Self-administration Studies • Sensory Exam • Shoulder Exam I • Shoulder Exam II • Spatial Memory Testing Using Mazes • The ATP Bioluminescence Assay • The Inverted-face Effect • The Morris Water Maze • The Precision of Visual Working Memory with Delayed Estimation • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay

		• The Transwell Migration Assay • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using a pH Meter • Verbal Priming • Visual Search for Features and Conjunctions • Whole-Mount In Situ Hybridization • fMRI: Functional Magnetic Resonance Imaging
CONTENT STANDARD / COURSE	HI.SC.Z.	ZOOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.Z.1.	Scientific Investigation--Discover, invent, and investigate using the skills necessary to engage in the scientific process.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Scientific Inquiry
EXPECTATION / TOPIC	SC.Z.1.1.	Describe how a testable hypothesis may need to be revised to guide a scientific investigation JoVE • The Multi-group Experiment • The Simple Experiment: Two-group Design
EXPECTATION / TOPIC	SC.Z.1.2.	Design and safely implement an experiment, including the appropriate use of tools and techniques to organize, analyze, and validate data JoVE • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Manipulating an Independent Variable through Embodiment • Observational Research • Pilot Testing • Placebos in Research • Realism in Experimentation • Reliability in Psychology Experiments • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Within-subjects Repeated-measures Design
CONTENT STANDARD / COURSE	HI.SC.Z.	ZOOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.Z.1.	Scientific Investigation--Discover, invent, and investigate using the skills necessary to engage in the scientific process.

INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Scientific Knowledge**
EXPECTATION / TOPIC	**SC.Z.1.8.**	**Describe the importance of ethics and integrity in scientific investigation** **JoVE** **• Ethics in Psychology Research** **• Experimentation using a Confederate** **• From Theory to Design: The Role of Creativity in Designing Experiments** **• Manipulating an Independent Variable through Embodiment** **• Observational Research** **• Pilot Testing** **• Placebos in Research** **• Reliability in Psychology Experiments** **• Self-report vs. Behavioral Measures of Recycling** **• The Factorial Experiment** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design** **• Within-subjects Repeated-measures Design**
CONTENT STANDARD / COURSE	**HI.SC.Z.**	**ZOOLOGY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.Z.2.**	**Nature of Science--Understand that science, technology, and society are interrelated.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Science, Technology, and Society**
EXPECTATION / TOPIC	**SC.Z.2.1.**	**Explain how scientific advancements and emerging technology have influenced society** **JoVE** **• An Introduction to Aging and Regeneration** **• An Introduction to Drosophila melanogaster** **• An Introduction to Molecular Developmental Biology** **• An Introduction to Organogenesis** **• An Introduction to Stem Cell Biology** **• An Introduction to Transfection** **• An Introduction to the Chick: Gallus gallus domesticus** **• An Introduction to the Laboratory Mouse: Mus musculus** **• An Introduction to the Zebrafish: Danio rerio** **• An Overview of Genetic Engineering** **• Bacterial Transformation: Electroporation** **• Bacterial Transformation: The Heat Shock Method** **• C. elegans Development and Reproduction** **• Chick ex ovo Culture** **• DNA Ligation Reactions**

		• Development and Reproduction of the Laboratory Mouse • Development of the Chick • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Fate Mapping • Fundamentals of Breeding and Weaning • Gene Silencing with Morpholinos • Genetic Engineering of Model Organisms • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Invertebrate Lifespan Quantification • Molecular Cloning • Mouse Genotyping • Plasmid Purification • RNAi in C. elegans • Restriction Enzyme Digests • The TUNEL Assay • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
EXPECTATION / TOPIC	SC.Z.2.2.	Compare the risks and benefits of potential solutions to technological issues JoVE • An Introduction to Aging and Regeneration • An Introduction to Drosophila melanogaster • An Introduction to Molecular Developmental Biology • An Introduction to Organogenesis • An Introduction to Stem Cell Biology • An Introduction to Transfection • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Genetic Engineering • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • C. elegans Development and Reproduction • Chick ex ovo Culture • DNA Ligation Reactions • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Fate Mapping

		• Fundamentals of Breeding and Weaning • Gene Silencing with Morpholinos • Genetic Engineering of Model Organisms • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Invertebrate Lifespan Quantification • Molecular Cloning • Mouse Genotyping • Plasmid Purification • RNAi in C. elegans • Restriction Enzyme Digests • The TUNEL Assay • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
CONTENT STANDARD / COURSE	**HI.SC.Z.**	**ZOOLOGY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.Z.3.**	**Structure and function in Animals--Understand the relationship between the structure and function of an animal's body.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Patterns of Organization**
EXPECTATION / TOPIC	**SC.Z.3.2.**	**Evaluate the different levels of bodily organization (e.g., unicellular, diploblastic, triploblastic) and the body plans associated with each (e.g., acoelomate, pseudocoelomate, coelomate)** **JoVE** • An Introduction to Caenorhabditis elegans • An Introduction to Cell Division • An Introduction to Cell Motility and Migration • An Introduction to Developmental Neurobiology • An Introduction to Drosophila melanogaster • An Introduction to Saccharomyces cerevisiae • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Anesthesia Induction and Maintenance • Bacterial Growth Curve Analysis and its Environmental Applications • Basic Chick Care and Maintenance • Basic Mouse Care and Maintenance • Blood Withdrawal I • Blood Withdrawal II

		• C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Chick ex ovo Culture • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Considerations for Rodent Surgery • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Fundamentals of Breeding and Weaning • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Engineering of Model Organisms • In ovo Electroporation of Chicken Embryos • Introducing Experimental Agents into the Mouse • Invertebrate Lifespan Quantification • Isolating Nucleic Acids from Yeast • Mouse Genotyping • Murine In Utero Electroporation • Neuronal Transfection Methods • Primary Neuronal Cultures • RNAi in C. elegans • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Sterile Tissue Harvest • The Morris Water Maze • Whole-Mount In Situ Hybridization • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
EXPECTATION / TOPIC	SC.Z.3.3.	Compare vertebrates and invertebrates <u>JoVE</u> • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans

		• An Introduction to Drosophila melanogaster • An Introduction to Transfection • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Basic Chick Care and Maintenance • Basic Mouse Care and Maintenance • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Chick ex ovo Culture • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Explant Culture for Developmental Studies • In ovo Electroporation of Chicken Embryos • Introducing Experimental Agents into the Mouse • Invertebrate Lifespan Quantification • Mouse Genotyping • RNAi in C. elegans • Transplantation Studies • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
CONTENT STANDARD / COURSE	**HI.SC.Z.**	**ZOOLOGY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.Z.3.**	**Structure and function in Animals--Understand the relationship between the structure and function of an animal's body.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Physiology and Life Cycles**
EXPECTATION / TOPIC	**SC.Z.3.4.**	**Trace the development of genetically identical stem cells into specialized cells (e.g., skin, liver, muscle, nerve)** **JoVE** • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology

		• An Introduction to Drosophila melanogaster • An Introduction to Molecular Developmental Biology • An Introduction to Organogenesis • An Introduction to Stem Cell Biology • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Gene Expression • Basic Chick Care and Maintenance • C. elegans Development and Reproduction • Chick ex ovo Culture • Cytogenetics • DNA Methylation Analysis • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Fate Mapping • Gene Silencing with Morpholinos • Genetic Engineering of Model Organisms • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Invertebrate Lifespan Quantification • Metabolic Labeling • Murine In Utero Electroporation • Passaging Cells • RNA-Seq • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
EXPECTATION / TOPIC	**SC.Z.3.5.**	**Trace the life cycles of various groups of animals (e.g., plasmodium, cnidarians, nematodes, insects, tunicates, anurans)** **JoVE** • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Drosophila melanogaster • An Introduction to the Chick: Gallus gallus domesticus

		• An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • C. elegans Development and Reproduction • C. elegans Maintenance • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Fundamentals of Breeding and Weaning • Invertebrate Lifespan Quantification • Zebrafish Breeding and Embryo Handling • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
EXPECTATION / TOPIC	SC.Z.3.6.	Compare the physiology of the nine major phyla of the animal kingdom <u>JoVE</u> • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Developmental Neurobiology • An Introduction to Drosophila melanogaster • An Introduction to Neuroanatomy • An Introduction to Transfection • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Anesthesia Induction and Maintenance • Basic Care Procedures • Basic Chick Care and Maintenance • Basic Mouse Care and Maintenance • Blood Withdrawal I • Blood Withdrawal II • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Calcium Imaging in Neurons • Chick ex ovo Culture • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Considerations for Rodent Surgery • Development and Reproduction of the Laboratory Mouse • Development of the Chick

		• Diagnostic Necropsy and Tissue Harvest • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Fate Mapping • Fundamentals of Breeding and Weaning • Gene Silencing with Morpholinos • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Introducing Experimental Agents into the Mouse • Mouse Genotyping • Murine In Utero Electroporation • Patch Clamp Electrophysiology • RNAi in C. elegans • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Rodent Stereotaxic Surgery • Sterile Tissue Harvest • The Morris Water Maze • Transplantation Studies • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
CONTENT STANDARD / COURSE	**HI.SC.Z.**	**ZOOLOGY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.Z.4.**	**Animals and the Environment--Understand the interaction of animals with their environment.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Behavior and Symbiosis**
EXPECTATION / TOPIC	**SC.Z.4.1.**	**Explain how animals' behavior (e.g., parental care, division of labor, niche, innate hive behavior in insects) may enhance the species' chances of survival** **JoVE** • An Introduction to Caenorhabditis elegans • An Introduction to Learning and Memory • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Motor Control • An Introduction to Reward and Addiction • An Introduction to the Laboratory Mouse: Mus

		musculus • An Introduction to the Zebrafish: Danio rerio • Anesthesia Induction and Maintenance • Anxiety Testing • Assessing Dexterity with Reaching Tasks • Balance and Coordination Testing • Basic Care Procedures • Basic Chick Care and Maintenance • Basic Mouse Care and Maintenance • C. elegans Chemotaxis Assay • Considerations for Rodent Surgery • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Drosophila Development and Reproduction • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Fear Conditioning • Filamentous Fungi • Fundamentals of Breeding and Weaning • Modeling Social Stress • Positive Reinforcement Studies • RNAi in C. elegans • Rodent Handling and Restraint Techniques • Self-administration Studies • Spatial Memory Testing Using Mazes • Sterile Tissue Harvest • The Morris Water Maze • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Reproduction and Development
EXPECTATION / TOPIC	SC.Z.4.2.	Determine how species enhance their rate of survival by using symbiosis (e.g., mutualism, commensalism, parasitism) and mimicry JoVE • C. elegans Development and Reproduction • Genetic Crosses • Recombineering and Gene Targeting • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy
CONTENT STANDARD / COURSE	HI.SC.Z.	ZOOLOGY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.Z.5.	Genetics and Evolution--Understand the relationship between genetics and evolution.

INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Genetics**
EXPECTATION / TOPIC	**SC.Z.5.2.**	**Describe how evolution depends on variation with individuals, population genetics, and the species gene pool** **JoVE** **• An Introduction to the Chick: Gallus gallus domesticus** **• An Overview of Genetic Analysis**
CONTENT STANDARD / COURSE	**HI.SC.Z.**	**ZOOLOGY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.Z.5.**	**Genetics and Evolution--Understand the relationship between genetics and evolution.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Evolution**
EXPECTATION / TOPIC	**SC.Z.5.4.**	**Explain how the adaptations of the different phyla enhance their survival** **JoVE** **• An Introduction to Caenorhabditis elegans** **• An Introduction to Cognition** **• An Introduction to Drosophila melanogaster** **• An Introduction to Learning and Memory** **• An Introduction to the Chick: Gallus gallus domesticus** **• An Introduction to the Laboratory Mouse: Mus musculus** **• An Introduction to the Zebrafish: Danio rerio** **• Basic Chick Care and Maintenance** **• Basic Mouse Care and Maintenance** **• C. elegans Chemotaxis Assay** **• Development of the Chick** **• Drosophila Development and Reproduction** **• Drosophila Maintenance** **• Fear Conditioning** **• Positive Reinforcement Studies** **• Spatial Memory Testing Using Mazes** **• Yeast Maintenance**
EXPECTATION / TOPIC	**SC.Z.5.5.**	**Use evidence (e.g., molecular, anatomical, fossil) to determine the phylogeny of a species** **JoVE** **• An Introduction to the Chick: Gallus gallus domesticus** **• An Introduction to the Zebrafish: Danio rerio**
CONTENT STANDARD / COURSE	**HI.SC.B.**	**BOTANY**

STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.B.1.**	**Scientific Investigation--Discover, invent, and investigate using the skills necessary to engage in the scientific process.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Scientific Inquiry**
EXPECTATION / TOPIC	**SC.B.1.1.**	**Describe how a testable hypothesis may need to be revised to guide a scientific investigation** **JoVE** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design**
EXPECTATION / TOPIC	**SC.B.1.2.**	**Design and safely implement an experiment, including the appropriate use of tools and techniques to organize, analyze, and validate data** **JoVE** **• Ethics in Psychology Research** **• Experimentation using a Confederate** **• From Theory to Design: The Role of Creativity in Designing Experiments** **• Manipulating an Independent Variable through Embodiment** **• Observational Research** **• Pilot Testing** **• Placebos in Research** **• Realism in Experimentation** **• Reliability in Psychology Experiments** **• The Factorial Experiment** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design** **• Within-subjects Repeated-measures Design**
CONTENT STANDARD / COURSE	**HI.SC.B.**	**BOTANY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.B.1.**	**Scientific Investigation--Discover, invent, and investigate using the skills necessary to engage in the scientific process.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Scientific Knowledge**
EXPECTATION / TOPIC	**SC.B.1.8.**	**Describe the importance of ethics and integrity in scientific investigation** **JoVE** **• Ethics in Psychology Research** **• Experimentation using a Confederate** **• From Theory to Design: The Role of Creativity in Designing Experiments** **• Manipulating an Independent Variable through Embodiment**

		• Observational Research • Pilot Testing • Placebos in Research • Reliability in Psychology Experiments • Self-report vs. Behavioral Measures of Recycling • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Within-subjects Repeated-measures Design
CONTENT STANDARD / COURSE	**HI.SC.B.**	**BOTANY**
STANDARD / PERFORMANCE INDICATOR / DOMAIN	**SC.B.2.**	**Nature of Science--Understand that science, technology, and society are interrelated.**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		**TOPIC: Science, Technology, and Society**
EXPECTATION / TOPIC	**SC.B.2.1.**	**Explain how scientific advancements and emerging technology have influenced society** **JoVE** • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • An Overview of Genetic Engineering • Embryonic Stem Cell Culture and Differentiation • Ethics in Psychology Research • Nutrients in Aquatic Ecosystems • Passaging Cells • Realism in Experimentation • Reliability in Psychology Experiments • Self-administration Studies • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Solid-Liquid Extraction • Testing For Genetically Modified Foods • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy
EXPECTATION / TOPIC	**SC.B.2.2.**	**Compare the risks and benefits of potential solutions to technological issues** **JoVE** • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • An Overview of Genetic Engineering • Embryonic Stem Cell Culture and Differentiation • Ethics in Psychology Research • Nutrients in Aquatic Ecosystems • Passaging Cells • Realism in Experimentation • Reliability in Psychology Experiments

		• Self-administration Studies • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Solid-Liquid Extraction • Testing For Genetically Modified Foods • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy
CONTENT STANDARD / COURSE	HI.SC.B.	BOTANY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.B.3.	Plant Structure and Function--Understand the metabolism, anatomy, and physiology of plants.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Cells, Tissues and Metabolism
EXPECTATION / TOPIC	SC.B.3.1.	Determine the relationship between cell structure and function in photosynthetic organisms JoVE • An Introduction to Cell Metabolism • Density Gradient Ultracentrifugation • Reconstitution of Membrane Proteins
EXPECTATION / TOPIC	SC.B.3.2.	Evaluate the function of various plant tissues (e.g., stem, root, leaf) in terms of transport of materials, waste disposal, protein synthesis, energy capture and release, information feedback, movement, and homeostasis JoVE • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Using GIS to Investigate Urban Forestry
EXPECTATION / TOPIC	SC.B.3.3.	Trace the pathway of plant metabolism including the role of pigments in the light-dependent reactions and oxygen in the light-independent reactions JoVE • An Introduction to Cell Metabolism • Reconstitution of Membrane Proteins
CONTENT STANDARD / COURSE	HI.SC.B.	BOTANY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.B.4.	Plants and the Environment-- Understand interactions between plants, the environment, and humans.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Interaction with the environment
EXPECTATION / TOPIC	SC.B.4.1.	Describe how plant products (e.g., drugs, timber, spices, herbs, fossil fuels, fibers) impact human life

		JoVE • An Overview of Genetic Engineering • Biofuels: Producing Ethanol from Cellulosic Material • Testing For Genetically Modified Foods • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Using GIS to Investigate Urban Forestry
EXPECTATION / TOPIC	SC.B.4.2.	Evaluate the effect of biotic and abiotic factors (e.g., succession, competition, human influences) on plant stability within the environment JoVE • An Overview of Genetic Engineering • Biofuels: Producing Ethanol from Cellulosic Material • Testing For Genetically Modified Foods
EXPECTATION / TOPIC	SC.B.4.3.	Compare the form and function of various plants as producers in biomes JoVE • Algae Enumeration via Culturable Methodology
CONTENT STANDARD / COURSE	HI.SC.B.	BOTANY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.B.5.	Plant Genetics and Evolution--Understand plant classification, genetics, and evolution.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Genetics
EXPECTATION / TOPIC	SC.B.5.1.	Evaluate the impact of plant genetics (e.g., monohybrid and dihybrid crosses, molecular manipulation of genes, biotechnology) on society JoVE • An Overview of Genetic Engineering • Solid-Liquid Extraction • Testing For Genetically Modified Foods
CONTENT STANDARD / COURSE	HI.SC.B.	BOTANY
STANDARD / PERFORMANCE INDICATOR / DOMAIN	SC.B.5.	Plant Genetics and Evolution--Understand plant classification, genetics, and evolution.
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK		TOPIC: Evolution and classification
EXPECTATION / TOPIC	SC.B.5.3.	Compare the major plant divisions JoVE • Tree Identification: How To Use a Dichotomous Key

		• Tree Survey: Point-Centered Quarter Sampling Method • Using GIS to Investigate Urban Forestry

Grade: **9** - Adopted: **2010**

CONTENT STANDARD / COURSE	HI.CC.RST.9-10.	Reading Standards for Literacy in Science and Technical Subjects
STANDARD / PERFORMANCE INDICATOR / DOMAIN		Craft and Structure
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK	RST.9-10.4.	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. JoVE • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam II: Percussion • Abdominal Exam III: Palpation • Abdominal Exam IV: Acute Abdominal Pain Assessment • Algae Enumeration via Culturable Methodology • An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Cognition • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Drosophila melanogaster • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Molecular Developmental Biology • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Organogenesis • An Introduction to Reward and Addiction • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to Transfection • An Introduction to Working in the Hood • An Introduction to the Centrifuge • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus

		• An Introduction to the Micropipettor • An Introduction to the Zebrafish: Danio rerio • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Analysis of Earthworm Populations in Soil • Anesthesia Induction and Maintenance • Ankle Exam • Annexin V and Propidium Iodide Labeling • Anterograde Amnesia • Anxiety Testing • Approximate Number Sense Test • Are You Smart or Hardworking? How Praise Influences Children's Motivation • Arterial Line Placement • Aseptic Technique in Environmental Science • Assembly of a Reflux System for Heated Chemical Reactions • Assessing Dexterity with Reaching Tasks • Auscultation • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Balance and Coordination Testing • Basic Care Procedures • Basic Chick Care and Maintenance • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Binocular Rivalry • Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Calcium Imaging in Neurons • Calibration Curves • Capillary Electrophoresis (CE) • Carbon and Nitrogen Analysis of Environmental Samples • Cardiac Exam I: Inspection and Palpation

		• Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Categories and Inductive Inferences • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Chick ex ovo Culture • Children's Reliance on Artist Intentions When Identifying Pictures • Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Color Afterimages • Column Chromatography • Common Lab Glassware and Uses • Community DNA Extraction from Bacterial Colonies • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Comprehensive Breast Exam • Conducting Reactions Below Room Temperature • Considerations for Rodent Surgery • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Coordination Chemistry Complexes • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Culturing and Enumerating Bacteria from Soil Samples • Cyclic Voltammetry (CV) • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Degassing Liquids with Freeze-Pump-Thaw Cycling • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Detection of Bacteriophages in Environmental Samples • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determination of Moisture Content in Soil

		• Determining Rate Laws and the Order of Reaction • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Determining the Density of a Solid and Liquid • Determining the Empirical Formula • Determining the Mass Percent Composition in an Aqueous Solution • Determining the Solubility Rules of Ionic Compounds • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Dialysis: Diffusion Based Separation • Dichotic Listening • Dissolved Oxygen in Surface Water • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Electrophoretic Mobility Shift Assay (EMSA) • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Enzyme Assays and Kinetics • Ethics in Psychology Research • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Experimentation using a Confederate • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Eye Exam • Eye Tracking in Cognitive Experiments • FM Dyes in Vesicle Recycling • Fate Mapping • Fear Conditioning • Filamentous Fungi • Finding Your Blind Spot and Perceptual Filling-in • Foot Exam • Fractional Distillation • Freezing-Point Depression to Determine an Unknown

		Compound **• From Theory to Design: The Role of Creativity in Designing Experiments** **• Fundamentals of Breeding and Weaning** **• Förster Resonance Energy Transfer (FRET)** **• Gas Chromatography (GC) with Flame-Ionization Detection** **• Gel Purification** **• Gene Silencing with Morpholinos** **• General Approach to the Physical Exam** **• Genetic Crosses** **• Genetic Engineering of Model Organisms** **• Genetic Screens** **• Genome Editing** **• Gram Staining of Bacteria from Environmental Sources** **• Growing Crystals for X-ray Diffraction Analysis** **• Habituation: Studying Infants Before They Can Talk** **• Hand and Wrist Exam** **• High-Performance Liquid Chromatography (HPLC)** **• Hip Exam** **• Histological Sample Preparation for Light Microscopy** **• Histological Staining of Neural Tissue** **• How Children Solve Problems Using Causal Reasoning** **• Ideal Gas Law** **• Igneous Intrusive Rock** **• Igneous Volcanic Rock** **• In ovo Electroporation of Chicken Embryos** **• Inattentional Blindness** **• Incidental Encoding** **• Induced Pluripotency** **• Internal Standards** **• Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation** **• Intraosseous Needle Placement** **• Introducing Experimental Agents into the Mouse** **• Introduction to Catalysis** **• Introduction to Fluorescence Microscopy** **• Introduction to Light Microscopy** **• Introduction to Mass Spectrometry** **• Introduction to Serological Pipettes and Pipettors** **• Introduction to Titration** **• Introduction to the Bunsen Burner** **• Introduction to the Microplate Reader** **• Introduction to the Spectrophotometer** **• Invasion Assay Using 3D Matrices** **• Invertebrate Lifespan Quantification** **• Ion-Exchange Chromatography** **• Isolating Nucleic Acids from Yeast** **• Isolation of Fecal Bacteria from Water Samples by Filtration** **• Just-noticeable Differences** **• Knee Exam**

		• Language: The N400 in Semantic Incongruity • Le Châtelier's Principle • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • Lower Back Exam • Lymph Node Exam • MALDI-TOF Mass Spectrometry • Making Solutions in the Laboratory • Making a Geologic Cross Section • Male Rectal Exam • Manipulating an Independent Variable through Embodiment • Measuring Children's Trust in Testimony • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Mass in the Laboratory • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Tropospheric Ozone • Measuring Verbal Working Memory Span • Measuring Vital Signs • Memory Development: Demonstrating How Repeated Questioning Leads to False Memories • Mental Rotation • Metabolic Labeling • Metacognitive Development: How Children Estimate Their Memory • Method of Standard Addition • Modeling Social Stress • Molecular Cloning • Motion-induced Blindness • Motor Exam I • Motor Exam II • Motor Learning in Mirror Drawing • Motor Maps • Mouse Genotyping • Multiple Object Tracking • Murine In Utero Electroporation • Mutual Exclusivity: How Children Learn the Meanings of Words • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Neuronal Transfection Methods • Nose, Sinuses, Oral Cavity and Pharynx Exam • Nuclear Magnetic Resonance (NMR) Spectroscopy • Numerical Cognition: More or Less • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Observation and Inspection

		• Observational Research • Ophthalmoscopic Examination • PCR: The Polymerase Chain Reaction • Palpation • Passaging Cells • Patch Clamp Electrophysiology • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Perspectives on Sensation and Perception • Photometric Protein Determination • Physical Properties Of Minerals I: Crystals and Cleavage • Physical Properties Of Minerals II: Polymineralic Analysis • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Pilot Testing • Placebos in Research • Plasmid Purification • Positive Reinforcement Studies • Preparing Anhydrous Reagents and Equipment • Primary Neuronal Cultures • Proper Adjustment of Patient Attire during the Physical Exam • Prospect Theory • Protein Crystallization • Proton Exchange Membrane Fuel Cells • Purification of a Total Lipid Extract with Column Chromatography • Purifying Compounds by Recrystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Raman Spectroscopy for Chemical Analysis • Realism in Experimentation • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold • Reliability in Psychology Experiments

		• Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Restriction Enzyme Digests • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Rodent Stereotaxic Surgery • Rotary Evaporation to Remove Solvent • SNP Genotyping • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Schlenk Lines Transfer of Solvents • Self-administration Studies • Self-report vs. Behavioral Measures of Recycling • Sensory Exam • Separating Protein with SDS-PAGE • Separation of Mixtures via Precipitation • Shoulder Exam I • Shoulder Exam II • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Solid-Liquid Extraction • Solutions and Concentrations • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Spatial Cueing • Spatial Memory Testing Using Mazes • Spectrophotometric Determination of an Equilibrium Constant • Sterile Tissue Harvest • Surface Plasmon Resonance (SPR) • Surgical Cricothyrotomy • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The Ames Room • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Factorial Experiment • The Ideal Gas Law • The Inverted-face Effect • The McGurk Effect • The Morris Water Maze • The Multi-group Experiment • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Rubber Hand Illusion

		• The Simple Experiment: Two-group Design • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Understanding Concentration and Measuring Volumes • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Using Topographic Maps to Generate Topographic Profiles • Using Your Head: Measuring Infants' Rational Imitation of Actions • Using a pH Meter • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Whole-Mount In Situ Hybridization • Within-subjects Repeated-measures Design • X-ray Fluorescence (XRF) • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK	**RST.9-10.5.**	**Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).**

		JoVE **• Abdominal Exam I: Inspection and Auscultation** **• Abdominal Exam II: Percussion** **• Abdominal Exam III: Palpation** **• Abdominal Exam IV: Acute Abdominal Pain Assessment** **• Algae Enumeration via Culturable Methodology** **• An Introduction to Aging and Regeneration** **• An Introduction to Behavioral Neuroscience** **• An Introduction to Caenorhabditis elegans** **• An Introduction to Cell Death** **• An Introduction to Cell Division** **• An Introduction to Cell Metabolism** **• An Introduction to Cell Motility and Migration** **• An Introduction to Cellular and Molecular Neuroscience** **• An Introduction to Cognition** **• An Introduction to Developmental Genetics** **• An Introduction to Developmental Neurobiology** **• An Introduction to Drosophila melanogaster** **• An Introduction to Endocytosis and Exocytosis** **• An Introduction to Learning and Memory** **• An Introduction to Modeling Behavioral Disorders and Stress** **• An Introduction to Molecular Developmental Biology** **• An Introduction to Motor Control** **• An Introduction to Neuroanatomy** **• An Introduction to Neurophysiology** **• An Introduction to Organogenesis** **• An Introduction to Reward and Addiction** **• An Introduction to Saccharomyces cerevisiae** **• An Introduction to Stem Cell Biology** **• An Introduction to Transfection** **• An Introduction to Working in the Hood** **• An Introduction to the Centrifuge** **• An Introduction to the Chick: Gallus gallus domesticus** **• An Introduction to the Laboratory Mouse: Mus musculus** **• An Introduction to the Micropipettor** **• An Introduction to the Zebrafish: Danio rerio** **• An Overview of Alkenone Biomarker Analysis for Paleothermometry** **• An Overview of Epigenetics** **• An Overview of Gene Expression** **• An Overview of Genetic Analysis** **• An Overview of Genetic Engineering** **• An Overview of Genetics and Disease** **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Analysis of Earthworm Populations in Soil** **• Anesthesia Induction and Maintenance** **• Ankle Exam**

		• Annexin V and Propidium Iodide Labeling • Anterograde Amnesia • Anxiety Testing • Approximate Number Sense Test • Are You Smart or Hardworking? How Praise Influences Children's Motivation • Arterial Line Placement • Aseptic Technique in Environmental Science • Assembly of a Reflux System for Heated Chemical Reactions • Assessing Dexterity with Reaching Tasks • Auscultation • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Balance and Coordination Testing • Basic Care Procedures • Basic Chick Care and Maintenance • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Binocular Rivalry • Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Calcium Imaging in Neurons • Calibration Curves • Capillary Electrophoresis (CE) • Carbon and Nitrogen Analysis of Environmental Samples • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Categories and Inductive Inferences • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Chick ex ovo Culture • Children's Reliance on Artist Intentions When Identifying Pictures

		• Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Color Afterimages • Column Chromatography • Common Lab Glassware and Uses • Community DNA Extraction from Bacterial Colonies • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Comprehensive Breast Exam • Conducting Reactions Below Room Temperature • Considerations for Rodent Surgery • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Coordination Chemistry Complexes • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Crowding • Culturing and Enumerating Bacteria from Soil Samples • Cyclic Voltammetry (CV) • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Degassing Liquids with Freeze-Pump-Thaw Cycling • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Detection of Bacteriophages in Environmental Samples • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determination of Moisture Content in Soil • Determining Rate Laws and the Order of Reaction • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Determining the Density of a Solid and Liquid • Determining the Empirical Formula • Determining the Mass Percent Composition in an Aqueous Solution • Determining the Solubility Rules of Ionic Compounds • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest

		• Dialysis: Diffusion Based Separation • Dichotic Listening • Dissolved Oxygen in Surface Water • Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Electrophoretic Mobility Shift Assay (EMSA) • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Enzyme Assays and Kinetics • Ethics in Psychology Research • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Experimentation using a Confederate • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Eye Exam • Eye Tracking in Cognitive Experiments • FM Dyes in Vesicle Recycling • Fate Mapping • Fear Conditioning • Filamentous Fungi • Finding Your Blind Spot and Perceptual Filling-in • Foot Exam • Fractional Distillation • Freezing-Point Depression to Determine an Unknown Compound • From Theory to Design: The Role of Creativity in Designing Experiments • Fundamentals of Breeding and Weaning • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Gel Purification • Gene Silencing with Morpholinos • General Approach to the Physical Exam • Genetic Crosses

		• Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • Gram Staining of Bacteria from Environmental Sources • Growing Crystals for X-ray Diffraction Analysis • Habituation: Studying Infants Before They Can Talk • Hand and Wrist Exam • High-Performance Liquid Chromatography (HPLC) • Hip Exam • Histological Sample Preparation for Light Microscopy • Histological Staining of Neural Tissue • How Children Solve Problems Using Causal Reasoning • Ideal Gas Law • Igneous Intrusive Rock • Igneous Volcanic Rock • In ovo Electroporation of Chicken Embryos • Inattentional Blindness • Incidental Encoding • Induced Pluripotency • Internal Standards • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Introducing Experimental Agents into the Mouse • Introduction to Catalysis • Introduction to Fluorescence Microscopy • Introduction to Light Microscopy • Introduction to Mass Spectrometry • Introduction to Serological Pipettes and Pipettors • Introduction to Titration • Introduction to the Bunsen Burner • Introduction to the Microplate Reader • Introduction to the Spectrophotometer • Invasion Assay Using 3D Matrices • Invertebrate Lifespan Quantification • Ion-Exchange Chromatography • Isolating Nucleic Acids from Yeast • Isolation of Fecal Bacteria from Water Samples by Filtration • Just-noticeable Differences • Knee Exam • Language: The N400 in Semantic Incongruity • Le Châtelier's Principle • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • Lower Back Exam • Lymph Node Exam • MALDI-TOF Mass Spectrometry • Making Solutions in the Laboratory

		• Making a Geologic Cross Section • Male Rectal Exam • Manipulating an Independent Variable through Embodiment • Measuring Children's Trust in Testimony • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Mass in the Laboratory • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Tropospheric Ozone • Measuring Verbal Working Memory Span • Measuring Vital Signs • Memory Development: Demonstrating How Repeated Questioning Leads to False Memories • Mental Rotation • Metabolic Labeling • Metacognitive Development: How Children Estimate Their Memory • Method of Standard Addition • Modeling Social Stress • Molecular Cloning • Motion-induced Blindness • Motor Exam I • Motor Exam II • Motor Learning in Mirror Drawing • Motor Maps • Mouse Genotyping • Multiple Object Tracking • Murine In Utero Electroporation • Mutual Exclusivity: How Children Learn the Meanings of Words • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Neuronal Transfection Methods • Nose, Sinuses, Oral Cavity and Pharynx Exam • Nuclear Magnetic Resonance (NMR) Spectroscopy • Numerical Cognition: More or Less • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Observation and Inspection • Observational Research • Ophthalmoscopic Examination • PCR: The Polymerase Chain Reaction • Palpation • Passaging Cells • Patch Clamp Electrophysiology • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam

		• Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Perspectives on Sensation and Perception • Photometric Protein Determination • Physical Properties Of Minerals I: Crystals and Cleavage • Physical Properties Of Minerals II: Polymineralic Analysis • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Pilot Testing • Placebos in Research • Plasmid Purification • Positive Reinforcement Studies • Preparing Anhydrous Reagents and Equipment • Primary Neuronal Cultures • Proper Adjustment of Patient Attire during the Physical Exam • Prospect Theory • Protein Crystallization • Proton Exchange Membrane Fuel Cells • Purification of a Total Lipid Extract with Column Chromatography • Purifying Compounds by Recrystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Raman Spectroscopy for Chemical Analysis • Realism in Experimentation • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold • Reliability in Psychology Experiments • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Restriction Enzyme Digests • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II

		• Rodent Stereotaxic Surgery • Rotary Evaporation to Remove Solvent • SNP Genotyping • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Schlenk Lines Transfer of Solvents • Self-administration Studies • Self-report vs. Behavioral Measures of Recycling • Sensory Exam • Separating Protein with SDS-PAGE • Separation of Mixtures via Precipitation • Shoulder Exam I • Shoulder Exam II • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Solid-Liquid Extraction • Solutions and Concentrations • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Spatial Cueing • Spatial Memory Testing Using Mazes • Spectrophotometric Determination of an Equilibrium Constant • Sterile Tissue Harvest • Surface Plasmon Resonance (SPR) • Surgical Cricothyrotomy • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The Ames Room • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Factorial Experiment • The Ideal Gas Law • The Inverted-face Effect • The McGurk Effect • The Morris Water Maze • The Multi-group Experiment • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Rubber Hand Illusion • The Simple Experiment: Two-group Design • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot

		• Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Understanding Concentration and Measuring Volumes • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Using Topographic Maps to Generate Topographic Profiles • Using Your Head: Measuring Infants' Rational Imitation of Actions • Using a pH Meter • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Whole-Mount In Situ Hybridization • Within-subjects Repeated-measures Design • X-ray Fluorescence (XRF) • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging
CONTENT STANDARD / COURSE	**HI.CC.RST.9-10.**	**Reading Standards for Literacy in Science and Technical Subjects**
STANDARD / PERFORMANCE INDICATOR / DOMAIN		**Integration of Knowledge and Ideas**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK	**RST.9-10.7.**	**Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.** **JoVE**

		• Algae Enumeration via Culturable Methodology • An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Caenorhabditis elegans • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Drosophila melanogaster • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Motor Control • An Introduction to Neurophysiology • An Introduction to Reward and Addiction • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of Genetic Analysis • An Overview of Genetics and Disease • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Analysis of Earthworm Populations in Soil • Annexin V and Propidium Iodide Labeling • Anterograde Amnesia • Anxiety Testing • Approximate Number Sense Test • Are You Smart or Hardworking? How Praise Influences Children's Motivation • Assembly of a Reflux System for Heated Chemical Reactions • Assessing Dexterity with Reaching Tasks • Bacterial Growth Curve Analysis and its Environmental Applications • Balance and Coordination Testing • Basic Mouse Care and Maintenance • Binocular Rivalry • Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • C. elegans Chemotaxis Assay • Calcium Imaging in Neurons • Calibration Curves • Capillary Electrophoresis (CE) • Carbon and Nitrogen Analysis of Environmental Samples • Categories and Inductive Inferences • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Children's Reliance on Artist Intentions When Identifying Pictures • Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification

		Methods **• Co-Immunoprecipitation and Pull-Down Assays** **• Column Chromatography** **• Community DNA Extraction from Bacterial Colonies** **• Conducting Reactions Below Room Temperature** **• Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry** **• Coordination Chemistry Complexes** **• Crowding** **• Culturing and Enumerating Bacteria from Soil Samples** **• Cyclic Voltammetry (CV)** **• DNA Methylation Analysis** **• Decision-making and the Iowa Gambling Task** **• Decoding Auditory Imagery with Multivoxel Pattern Analysis** **• Degassing Liquids with Freeze-Pump-Thaw Cycling** **• Density Gradient Ultracentrifugation** **• Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis** **• Detecting Reactive Oxygen Species** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Determination of Moisture Content in Soil** **• Determining Rate Laws and the Order of Reaction** **• Determining Spatial Orientation of Rock Layers with the Brunton Compass** **• Determining the Density of a Solid and Liquid** **• Determining the Empirical Formula** **• Determining the Mass Percent Composition in an Aqueous Solution** **• Determining the Solubility Rules of Ionic Compounds** **• Development and Reproduction of the Laboratory Mouse** **• Dialysis: Diffusion Based Separation** **• Dichotic Listening** **• Dissolved Oxygen in Surface Water** **• Drosophila Development and Reproduction** **• Electro-encephalography (EEG)** **• Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat** **• Electrophoretic Mobility Shift Assay (EMSA)** **• Enzyme Assays and Kinetics** **• Ethics in Psychology Research** **• Event-related Potentials and the Oddball Task** **• Executive Function and the Dimensional Change Card Sort Task** **• Executive Function in Autism Spectrum Disorder** **• Experimentation using a Confederate** **• Expression Profiling with Microarrays** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Eye Tracking in Cognitive Experiments**

		• FM Dyes in Vesicle Recycling • Fate Mapping • Fear Conditioning • Fractional Distillation • Freezing-Point Depression to Determine an Unknown Compound • From Theory to Design: The Role of Creativity in Designing Experiments • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Screens • Growing Crystals for X-ray Diffraction Analysis • Habituation: Studying Infants Before They Can Talk • High-Performance Liquid Chromatography (HPLC) • How Children Solve Problems Using Causal Reasoning • Ideal Gas Law • Igneous Intrusive Rock • Igneous Volcanic Rock • Inattentional Blindness • Incidental Encoding • Internal Standards • Introducing Experimental Agents into the Mouse • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Introduction to the Microplate Reader • Introduction to the Spectrophotometer • Invasion Assay Using 3D Matrices • Invertebrate Lifespan Quantification • Ion-Exchange Chromatography • Isolating Nucleic Acids from Yeast • Just-noticeable Differences • Language: The N400 in Semantic Incongruity • Le Châtelier's Principle • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Learning and Memory: The Remember-Know Task • MALDI-TOF Mass Spectrometry • Making Solutions in the Laboratory • Making a Geologic Cross Section • Manipulating an Independent Variable through Embodiment • Measuring Children's Trust in Testimony • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Tropospheric Ozone • Measuring Verbal Working Memory Span

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		• Realism in Experimentation • Reconstitution of Membrane Proteins • Reliability in Psychology Experiments • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Rotary Evaporation to Remove Solvent • SNP Genotyping • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Schlenk Lines Transfer of Solvents • Self-administration Studies • Self-report vs. Behavioral Measures of Recycling • Separation of Mixtures via Precipitation • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Solid-Liquid Extraction • Solutions and Concentrations • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Spatial Cueing • Spatial Memory Testing Using Mazes • Spectrophotometric Determination of an Equilibrium Constant • Surface Plasmon Resonance (SPR) • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Factorial Experiment • The Ideal Gas Law • The Inverted-face Effect • The Morris Water Maze • The Multi-group Experiment • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Simple Experiment: Two-group Design • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Understanding Concentration and Measuring Volumes

		• Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Using Topographic Maps to Generate Topographic Profiles • Using Your Head: Measuring Infants' Rational Imitation of Actions • Using a pH Meter • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Within-subjects Repeated-measures Design • X-ray Fluorescence (XRF) • Yeast Maintenance • fMRI: Functional Magnetic Resonance Imaging
CONTENT STANDARD / COURSE	**HI.CC.WHST.9-10.**	**Writing Standards for Literacy in Science and Technical Subjects**
STANDARD / PERFORMANCE INDICATOR / DOMAIN		**Text Types and Purposes**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK	**WHST.9-10.1.**	**Write arguments focused on discipline-specific content.**
EXPECTATION / TOPIC	**WHST.9-10.1(a)**	**Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.** **JoVE** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design**
CONTENT STANDARD / COURSE	**HI.CC.WHST.9-10.**	**Writing Standards for Literacy in Science and Technical Subjects**
STANDARD / PERFORMANCE INDICATOR / DOMAIN		**Text Types and Purposes**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK	**WHST.9-10.2.**	**Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.**

EXPECTATION / TOPIC	**WHST.9-10.2(a)**	**Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.** **JoVE** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design**
EXPECTATION / TOPIC	**WHST.9-10.2(d)**	**Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.** **JoVE** **• Abdominal Exam I: Inspection and Auscultation** **• Abdominal Exam II: Percussion** **• Abdominal Exam III: Palpation** **• Abdominal Exam IV: Acute Abdominal Pain Assessment** **• Algae Enumeration via Culturable Methodology** **• An Introduction to Aging and Regeneration** **• An Introduction to Behavioral Neuroscience** **• An Introduction to Caenorhabditis elegans** **• An Introduction to Cell Death** **• An Introduction to Cell Division** **• An Introduction to Cell Metabolism** **• An Introduction to Cell Motility and Migration** **• An Introduction to Cellular and Molecular Neuroscience** **• An Introduction to Cognition** **• An Introduction to Developmental Genetics** **• An Introduction to Developmental Neurobiology** **• An Introduction to Drosophila melanogaster** **• An Introduction to Endocytosis and Exocytosis** **• An Introduction to Learning and Memory** **• An Introduction to Modeling Behavioral Disorders and Stress** **• An Introduction to Molecular Developmental Biology** **• An Introduction to Motor Control** **• An Introduction to Neuroanatomy** **• An Introduction to Neurophysiology** **• An Introduction to Organogenesis** **• An Introduction to Reward and Addiction** **• An Introduction to Saccharomyces cerevisiae** **• An Introduction to Stem Cell Biology** **• An Introduction to Transfection** **• An Introduction to Working in the Hood** **• An Introduction to the Centrifuge** **• An Introduction to the Chick: Gallus gallus domesticus** **• An Introduction to the Laboratory Mouse: Mus musculus**

		• An Introduction to the Micropipettor • An Introduction to the Zebrafish: Danio rerio • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Analysis of Earthworm Populations in Soil • Anesthesia Induction and Maintenance • Ankle Exam • Annexin V and Propidium Iodide Labeling • Anterograde Amnesia • Anxiety Testing • Approximate Number Sense Test • Are You Smart or Hardworking? How Praise Influences Children's Motivation • Arterial Line Placement • Aseptic Technique in Environmental Science • Assembly of a Reflux System for Heated Chemical Reactions • Assessing Dexterity with Reaching Tasks • Auscultation • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Balance and Coordination Testing • Basic Care Procedures • Basic Chick Care and Maintenance • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Binocular Rivalry • Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Calcium Imaging in Neurons • Calibration Curves • Capillary Electrophoresis (CE) • Carbon and Nitrogen Analysis of Environmental Samples

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		UV-VIS Spectroscopy **• Determination of Moisture Content in Soil** **• Determining Rate Laws and the Order of Reaction** **• Determining Spatial Orientation of Rock Layers with the Brunton Compass** **• Determining the Density of a Solid and Liquid** **• Determining the Empirical Formula** **• Determining the Mass Percent Composition in an Aqueous Solution** **• Determining the Solubility Rules of Ionic Compounds** **• Development and Reproduction of the Laboratory Mouse** **• Development of the Chick** **• Diagnostic Necropsy and Tissue Harvest** **• Dialysis: Diffusion Based Separation** **• Dichotic Listening** **• Dissolved Oxygen in Surface Water** **• Drosophila Development and Reproduction** **• Drosophila Larval IHC** **• Drosophila Maintenance** **• Drosophila melanogaster Embryo and Larva Harvesting and Preparation** **• Ear Exam** **• Elbow Exam** **• Electro-encephalography (EEG)** **• Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat** **• Electrophoretic Mobility Shift Assay (EMSA)** **• Embryonic Stem Cell Culture and Differentiation** **• Emergency Tube Thoracostomy (Chest Tube Placement)** **• Emergent Lateral Canthotomy and Inferior Catholysis** **• Enzyme Assays and Kinetics** **• Ethics in Psychology Research** **• Event-related Potentials and the Oddball Task** **• Executive Function and the Dimensional Change Card Sort Task** **• Executive Function in Autism Spectrum Disorder** **• Experimentation using a Confederate** **• Explant Culture for Developmental Studies** **• Explant Culture of Neural Tissue** **• Expression Profiling with Microarrays** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Eye Exam** **• Eye Tracking in Cognitive Experiments** **• FM Dyes in Vesicle Recycling** **• Fate Mapping** **• Fear Conditioning** **• Filamentous Fungi** **• Finding Your Blind Spot and Perceptual Filling-in**

		• Foot Exam • Fractional Distillation • Freezing-Point Depression to Determine an Unknown Compound • From Theory to Design: The Role of Creativity in Designing Experiments • Fundamentals of Breeding and Weaning • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Gel Purification • Gene Silencing with Morpholinos • General Approach to the Physical Exam • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • Gram Staining of Bacteria from Environmental Sources • Growing Crystals for X-ray Diffraction Analysis • Habituation: Studying Infants Before They Can Talk • Hand and Wrist Exam • High-Performance Liquid Chromatography (HPLC) • Hip Exam • Histological Sample Preparation for Light Microscopy • Histological Staining of Neural Tissue • How Children Solve Problems Using Causal Reasoning • Ideal Gas Law • Igneous Intrusive Rock • Igneous Volcanic Rock • In ovo Electroporation of Chicken Embryos • Inattentional Blindness • Incidental Encoding • Induced Pluripotency • Internal Standards • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Introducing Experimental Agents into the Mouse • Introduction to Catalysis • Introduction to Fluorescence Microscopy • Introduction to Light Microscopy • Introduction to Mass Spectrometry • Introduction to Serological Pipettes and Pipettors • Introduction to Titration • Introduction to the Bunsen Burner • Introduction to the Microplate Reader • Introduction to the Spectrophotometer • Invasion Assay Using 3D Matrices • Invertebrate Lifespan Quantification • Ion-Exchange Chromatography • Isolating Nucleic Acids from Yeast

		• Isolation of Fecal Bacteria from Water Samples by Filtration • Just-noticeable Differences • Knee Exam • Language: The N400 in Semantic Incongruity • Le Châtelier's Principle • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Learning and Memory: The Remember-Know Task • Live Cell Imaging of Mitosis • Lower Back Exam • Lymph Node Exam • MALDI-TOF Mass Spectrometry • Making Solutions in the Laboratory • Making a Geologic Cross Section • Male Rectal Exam • Manipulating an Independent Variable through Embodiment • Measuring Children's Trust in Testimony • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Mass in the Laboratory • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Tropospheric Ozone • Measuring Verbal Working Memory Span • Measuring Vital Signs • Memory Development: Demonstrating How Repeated Questioning Leads to False Memories • Mental Rotation • Metabolic Labeling • Metacognitive Development: How Children Estimate Their Memory • Method of Standard Addition • Modeling Social Stress • Molecular Cloning • Motion-induced Blindness • Motor Exam I • Motor Exam II • Motor Learning in Mirror Drawing • Motor Maps • Mouse Genotyping • Multiple Object Tracking • Murine In Utero Electroporation • Mutual Exclusivity: How Children Learn the Meanings of Words • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Neuronal Transfection Methods • Nose, Sinuses, Oral Cavity and Pharynx Exam

		• Nuclear Magnetic Resonance (NMR) Spectroscopy • Numerical Cognition: More or Less • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Observation and Inspection • Observational Research • Ophthalmoscopic Examination • PCR: The Polymerase Chain Reaction • Palpation • Passaging Cells • Patch Clamp Electrophysiology • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Perspectives on Sensation and Perception • Photometric Protein Determination • Physical Properties Of Minerals I: Crystals and Cleavage • Physical Properties Of Minerals II: Polymineralic Analysis • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Pilot Testing • Placebos in Research • Plasmid Purification • Positive Reinforcement Studies • Preparing Anhydrous Reagents and Equipment • Primary Neuronal Cultures • Proper Adjustment of Patient Attire during the Physical Exam • Prospect Theory • Protein Crystallization • Proton Exchange Membrane Fuel Cells • Purification of a Total Lipid Extract with Column Chromatography • Purifying Compounds by Recrystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Raman Spectroscopy for Chemical Analysis • Realism in Experimentation

		• Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold • Reliability in Psychology Experiments • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Restriction Enzyme Digests • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Rodent Stereotaxic Surgery • Rotary Evaporation to Remove Solvent • SNP Genotyping • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Schlenk Lines Transfer of Solvents • Self-administration Studies • Self-report vs. Behavioral Measures of Recycling • Sensory Exam • Separating Protein with SDS-PAGE • Separation of Mixtures via Precipitation • Shoulder Exam I • Shoulder Exam II • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Solid-Liquid Extraction • Solutions and Concentrations • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Spatial Cueing • Spatial Memory Testing Using Mazes • Spectrophotometric Determination of an Equilibrium Constant • Sterile Tissue Harvest • Surface Plasmon Resonance (SPR) • Surgical Cricothyrotomy • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The Ames Room • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Factorial Experiment • The Ideal Gas Law • The Inverted-face Effect

		• The McGurk Effect • The Morris Water Maze • The Multi-group Experiment • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Rubber Hand Illusion • The Simple Experiment: Two-group Design • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Understanding Concentration and Measuring Volumes • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Using Topographic Maps to Generate Topographic Profiles • Using Your Head: Measuring Infants' Rational Imitation of Actions • Using a pH Meter • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Whole-Mount In Situ Hybridization • Within-subjects Repeated-measures Design • X-ray Fluorescence (XRF) • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry

		• Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging
CONTENT STANDARD / COURSE	**HI.CC.WHST.9-10.**	**Writing Standards for Literacy in Science and Technical Subjects**
STANDARD / PERFORMANCE INDICATOR / DOMAIN		**Text Types and Purposes**
INDICATOR / GRADE LEVEL EXPECTATION / BENCHMARK	**WHST.9-10.3.**	**(See note; not applicable as a separate requirement)**
EXPECTATION / TOPIC	**WHST.9-10.3(a)**	**Note: Students' narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In science and technical subjects, students must be able to write precise enough descriptions of the step-by-step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results.** **JoVE** **• Ethics in Psychology Research** **• Experimentation using a Confederate** **• From Theory to Design: The Role of Creativity in Designing Experiments** **• Manipulating an Independent Variable through Embodiment** **• Observational Research** **• Pilot Testing** **• Placebos in Research** **• Realism in Experimentation** **• Reliability in Psychology Experiments** **• The Factorial Experiment** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design** **• Within-subjects Repeated-measures Design**