Main Criteria: Alabama Courses of Study
Secondary Criteria: JoVE
Subject: Science
Grade: 9-12
Correlation Options: Show Correlated
Adopted: 2015

STRAND / DOMAIN	AL.HS.PS.	PHYSICAL SCIENCE
OBJECTIVE / CATEGORY		Matter and Its Interactions
STANDARD	HS.PS.1.	Use the periodic table as a model to predict the relative properties and trends (e.g., reactivity of metals; types of bonds formed, including ionic, covalent, and polar covalent; numbers of bonds formed; reactions with oxygen) of main group elements based on the patterns of valence electrons in atoms. JoVE • Coordination Chemistry Complexes
STANDARD	HS.PS.2.	Plan and carry out investigations (e.g., squeezing a balloon, placing a balloon on ice) to identify the relationships that exist among the pressure, volume, density, and temperature of a confined gas. JoVE • Determining Rate Laws and the Order of Reaction • Ideal Gas Law • The Ideal Gas Law
STANDARD	HS.PS.5.	Use mathematical representations to support and verify the claim that atoms, and therefore mass, are conserved during a simple chemical reaction. JoVE • Determining the Empirical Formula
STRAND / DOMAIN	AL.HS.PS.	PHYSICAL SCIENCE
OBJECTIVE / CATEGORY		Matter and Its Interactions
STANDARD	HS.PS.6.	Develop models to illustrate the concept of half-life for radioactive decay.

RELATED CONTENT / EXPECTATION	HS.PS.6.a.	Research and communicate information about types of naturally occurring radiation and their properties. JoVE • Column Chromatography • Determining Rate Laws and the Order of Reaction
STRAND / DOMAIN	AL.HS.PS.	PHYSICAL SCIENCE
OBJECTIVE / CATEGORY		Energy
STANDARD	HS.PS.12.	Design, build, and test the ability of a device (e.g., Rube Goldberg devices, wind turbines, solar cells, solar ovens) to convert one form of energy into another form of energy. JoVE • fMRI: Functional Magnetic Resonance Imaging
STRAND / DOMAIN	AL.HS.PS.	PHYSICAL SCIENCE
OBJECTIVE / CATEGORY		Waves and Their Applications in Technologies for Information Transfer
STANDARD	HS.PS.14.	Propose and defend a hypothesis based on information gathered from published materials (e.g., trade books, magazines, Internet resources, videos) for and against various claims for the safety of electromagnetic radiation. JoVE • An Introduction to the Zebrafish: Danio rerio • Mouse Genotyping
STANDARD	HS.PS.15.	Obtain and communicate information from published materials to explain how transmitting and receiving devices (e.g., cellular telephones, medical-imaging technology, solar cells, wireless Internet, scanners, Sound Navigation and Ranging [SONAR]) use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. JoVE • Using GIS to Investigate Urban Forestry
STRAND / DOMAIN	AL.HS.B.	BIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.B.1.	Use models to compare and contrast how the structural characteristics of carbohydrates, nucleic acids, proteins, and lipids define their function in organisms. JoVE • 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 Developmental Genetics • An Introduction to Molecular Developmental Biology • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • 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 • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • C. elegans Maintenance • Capillary Electrophoresis (CE) • 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 • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • 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 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 • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • 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 • Ion-Exchange Chromatography • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • MALDI-TOF Mass Spectrometry • Metabolic Labeling • Molecular Cloning • Mouse Genotyping • PCR: The Polymerase Chain Reaction • Photometric Protein Determination • Plasmid Purification • Protein Crystallization • Purification of a Total Lipid Extract with Column Chromatography • 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 • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Restriction Enzyme Digests • SNP Genotyping • Separating Protein with SDS-PAGE • Separation of Mixtures via Precipitation • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Spectrophotometric Determination of an Equilibrium Constant • Surface Plasmon Resonance (SPR) • 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
STANDARD	HS.B.2.	Obtain, evaluate, and communicate information to describe the function and diversity of organelles and structures in various types of cells (e.g., muscle cells having a large amount of mitochondria, plasmids in bacteria, chloroplasts in plant cells). 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 Transfection • Annexin V and Propidium Iodide Labeling • Cell Cycle Analysis • Density Gradient Ultracentrifugation • Detecting Reactive Oxygen Species • Enzyme Assays and Kinetics • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Metabolic Labeling • The ATP Bioluminescence Assay • The TUNEL Assay
STRAND / DOMAIN	AL.HS.B.	BIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.B.3.	Formulate an evidence-based explanation regarding how the composition of deoxyribonucleic acid (DNA) determines the structural organization of proteins.
RELATED CONTENT / EXPECTATION	HS.B.3.a.	Obtain and evaluate experiments of major scientists and communicate their contributions to the development of the structure of DNA and to the development of the central dogma of molecular biology. JoVE • An Introduction to Developmental Genetics • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • Chromatin Immunoprecipitation • DNA Methylation Analysis • Detecting Reactive Oxygen Species

		• Electrophoretic Mobility Shift Assay (EMSA) • Expression Profiling with Microarrays • Gene Silencing with Morpholinos • Genome Editing • Molecular Cloning • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • Whole-Mount In Situ Hybridization
RELATED CONTENT / EXPECTATION	HS.B.3.b.	Obtain, evaluate, and communicate information that explains how advancements in genetic technology (e.g., Human Genome Project, Encyclopedia of DNA Elements [ENCODE] project, 1000 Genomes Project) have contributed to the understanding as to how a genetic change at the DNA level may affect proteins and, in turn, influence the appearance of traits. 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 Cognition • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Drosophila melanogaster • An Introduction to Molecular Developmental Biology • 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 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 Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • C. elegans Development and Reproduction • C. elegans Maintenance • Capillary Electrophoresis (CE) • Cell Cycle Analysis

		• Chick ex ovo Culture • Chromatin Immunoprecipitation • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • 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 • Electrophoretic Mobility Shift Assay (EMSA) • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Fate Mapping • Fundamentals of Breeding and Weaning • 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 the Microplate Reader • Invertebrate Lifespan Quantification • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Metabolic Labeling • Molecular Cloning • Mouse Genotyping • Murine In Utero Electroporation • Neuronal Transfection Methods • PCR: The Polymerase Chain Reaction • Plasmid Purification • Primary Neuronal Cultures • 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 • Restriction Enzyme Digests

		• Rodent Stereotaxic Surgery • SNP Genotyping • Separating Protein with SDS-PAGE • Solid-Liquid Extraction • Spatial Memory Testing Using Mazes • Spectrophotometric Determination of an Equilibrium Constant • Testing For Genetically Modified Foods • The ELISA Method • The TUNEL Assay • The Western Blot • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Two-Dimensional Gel Electrophoresis • 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
RELATED CONTENT / EXPECTATION	HS.B.3.c.	Obtain information to identify errors that occur during DNA replication (e.g., deletion, insertion, translocation, substitution, inversion, frame-shift, point mutations). 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 • Cell Cycle Analysis • DNA Ligation Reactions • Genetic Engineering of Model Organisms • Genetic Screens • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Method of Standard Addition • Molecular Cloning • PCR: The Polymerase Chain Reaction

		• Passaging Cells • Restriction Enzyme Digests • The TUNEL Assay • Yeast Maintenance • Yeast Transformation and Cloning
STRAND / DOMAIN	**AL.HS.B.**	**BIOLOGY**
OBJECTIVE / CATEGORY		**From Molecules to Organisms: Structures and Processes**
STANDARD	**HS.B.4.**	**Develop and use models to explain the role of the cell cycle during growth and maintenance in multicellular organisms (e.g., normal growth and/or uncontrolled growth resulting in tumors).** **JoVE** • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Cell Division • An Introduction to Cell Motility and Migration • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Molecular Developmental Biology • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Overview of Epigenetics • An Overview of Gene Expression • C. elegans Development and Reproduction • Cell Cycle Analysis • DNA Methylation Analysis • Development and Reproduction of the Laboratory Mouse • Development of the Chick • 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 • Induced Pluripotency • Live Cell Imaging of Mitosis • Murine In Utero Electroporation • RNA-Seq • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Whole-Mount In Situ Hybridization • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Reproduction and Development

STRAND / DOMAIN	AL.HS.B.	BIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.B.5.	Plan and carry out investigations to explain feedback mechanisms (e.g., sweating and shivering) and cellular processes (e.g., active and passive transport) that maintain homeostasis.
RELATED CONTENT / EXPECTATION	HS.B.5.a.	Plan and carry out investigations to explain how the unique properties of water (e.g., polarity, cohesion, adhesion) are vital to maintaining homeostasis in organisms. JoVE • Determination of Moisture Content in Soil • Dissolved Oxygen in Surface Water • High-Performance Liquid Chromatography (HPLC) • Nutrients in Aquatic Ecosystems • Preparing Anhydrous Reagents and Equipment • Proton Exchange Membrane Fuel Cells • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
STRAND / DOMAIN	AL.HS.B.	BIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.B.6.	Analyze and interpret data from investigations to explain the role of products and reactants of photosynthesis and cellular respiration in the cycling of matter and the flow of energy.
RELATED CONTENT / EXPECTATION	HS.B.6.a.	Plan and carry out investigations to explain the interactions among pigments, absorption of light, and reflection of light. JoVE • Reconstitution of Membrane Proteins
STRAND / DOMAIN	AL.HS.B.	BIOLOGY
OBJECTIVE / CATEGORY		Ecosystems: Interactions, Energy, and Dynamics
STANDARD	HS.B.7.	Develop and use models to illustrate examples of ecological hierarchy levels, including biosphere, biome, ecosystem, community, population, and organism. JoVE • Algae Enumeration via Culturable Methodology • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Molecular Developmental 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 Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • 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 Development and Reproduction • C. elegans Maintenance • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Culturing and Enumerating Bacteria from Soil Samples • Detection of Bacteriophages in Environmental Samples • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Dissolved Oxygen in Surface Water • Drosophila Development and Reproduction • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Filamentous Fungi • Genetic Engineering of Model Organisms • Isolation of Fecal Bacteria from Water Samples by Filtration • Murine In Utero Electroporation • Passaging Cells • Plasmid Purification • Purification of a Total Lipid Extract with Column Chromatography • Quantifying Environmental Microorganisms and Viruses Using qPCR • 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 • 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 • Zebrafish Reproduction and Development

STANDARD	**HS.B.8.**	**Develop and use models to describe the cycling of matter (e.g., carbon, nitrogen, water) and flow of energy (e.g., food chains, food webs, biomass pyramids, ten percent law) between abiotic and biotic factors in 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**
STANDARD	**HS.B.9.**	**Use mathematical comparisons and visual representations to support or refute explanations of factors that affect population growth (e.g., exponential, linear, logistic).** **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 • Yeast Maintenance • Yeast Reproduction
STRAND / DOMAIN	**AL.HS.B.**	**BIOLOGY**
OBJECTIVE / CATEGORY		**Heredity: Inheritance and Variation of Traits**
STANDARD	**HS.B.11.**	**Analyze and interpret data collected from probability calculations to explain the variation of expressed traits within a population.**
RELATED CONTENT / EXPECTATION	**HS.B.11.a.**	**Use mathematics and computation to predict phenotypic and genotypic ratios and percentages by constructing Punnett squares, including using both homozygous and heterozygous allele pairs.** **JoVE** • An Introduction to Caenorhabditis elegans • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Genetic Analysis • An Overview of Genetics and Disease • C. elegans Development and Reproduction • C. elegans Maintenance • Development and Reproduction of the Laboratory Mouse • Drosophila Development and Reproduction • Fundamentals of Breeding and Weaning • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Engineering of Model Organisms

		• Genetic Screens • Mouse Genotyping • RNAi in C. elegans • SNP Genotyping • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Reproduction and Development
RELATED CONTENT / EXPECTATION	HS.B.11.b.	Develop and use models to demonstrate codominance, incomplete dominance, and Mendel's laws of segregation and independent assortment. JoVE • An Introduction to Caenorhabditis elegans • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Overview of Epigenetics • An Overview of Genetic Analysis • An Overview of Genetics and Disease • C. elegans Development and Reproduction • Drosophila Development and Reproduction • Genetic Crosses • Genetic Screens • Mouse Genotyping
RELATED CONTENT / EXPECTATION	HS.B.11.c.	Analyze and interpret data (e.g., pedigree charts, family and population studies) regarding Mendelian and complex genetic disorders (e.g., sickle-cell anemia, cystic fibrosis, type 2 diabetes) to determine patterns of genetic inheritance and disease risks from both genetic and environmental factors. JoVE • An Introduction to Aging and Regeneration • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Endocytosis and Exocytosis • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Motor Control • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Chromatography-Based Biomolecule Purification Methods • Cytogenetics • Embryonic Stem Cell Culture and Differentiation • Fundamentals of Breeding and Weaning • Gene Silencing with Morpholinos

		• SNP Genotyping • Tissue Regeneration with Somatic Stem Cells • Whole-Mount In Situ Hybridization
STRAND / DOMAIN	AL.HS.B.	BIOLOGY
OBJECTIVE / CATEGORY		Heredity: Inheritance and Variation of Traits
STANDARD	HS.B.12.	Develop and use a model to analyze the structure of chromosomes and how new genetic combinations occur through the process of meiosis.
RELATED CONTENT / EXPECTATION	HS.B.12.a.	Analyze data to draw conclusions about genetic disorders caused by errors in meiosis (e.g., Down syndrome, Turner syndrome). JoVE • An Introduction to Aging and Regeneration • An Introduction to Cell Division • An Introduction to Endocytosis and Exocytosis • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Motor Control • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Chromatography-Based Biomolecule Purification Methods • Cytogenetics • Embryonic Stem Cell Culture and Differentiation • Gene Silencing with Morpholinos • SNP Genotyping • Tissue Regeneration with Somatic Stem Cells • Whole-Mount In Situ Hybridization
STRAND / DOMAIN	AL.HS.B.	BIOLOGY
OBJECTIVE / CATEGORY		Unity and Diversity
STANDARD	HS.B.13.	Obtain, evaluate, and communicate information to explain how organisms are classified by physical characteristics, organized into levels of taxonomy, and identified by binomial nomenclature (e.g., taxonomic classification, dichotomous keys).
RELATED CONTENT / EXPECTATION	HS.B.13.a.	Engage in argument to justify the grouping of viruses in a category separate from living things. JoVE • An Introduction to the Laboratory Mouse: Mus musculus • An Overview of Genetic Engineering

		• Co-Immunoprecipitation and Pull-Down Assays • Detection of Bacteriophages in Environmental Samples • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR
STRAND / DOMAIN	**AL.HS.B.**	**BIOLOGY**
OBJECTIVE / CATEGORY		**Unity and Diversity**
STANDARD	**HS.B.14.**	**Analyze and interpret data to evaluate adaptations resulting from natural and artificial selection that may cause changes in populations over time (e.g., antibiotic-resistant bacteria, beak types, peppered moths, pest-resistant crops).** **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 Analysis • 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 • 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
STANDARD	HS.B.15.	Engage in argument from evidence (e.g., mathematical models such as distribution graphs) to explain how the diversity of organisms is affected by overpopulation of species, variation due to genetic mutations, and competition for limited resources. JoVE • Analysis of Earthworm Populations in Soil • Dissolved Oxygen in Surface Water • Tree Survey: Point-Centered Quarter Sampling Method • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy
STANDARD	HS.B.16.	Analyze scientific evidence (e.g., DNA, fossil records, cladograms, biogeography) to support hypotheses of common ancestry and biological evolution. JoVE • An Overview of Genetic Analysis • High-Performance Liquid Chromatography (HPLC)
STRAND / DOMAIN	AL.HS.C.	CHEMISTRY
OBJECTIVE / CATEGORY		Matter and Its Interactions
STANDARD	HS.C.1.	Obtain and communicate information from historical experiments (e.g., work by Mendeleev and Moseley, Rutherford's gold foil experiment, Thomson's cathode ray experiment, Millikan's oil drop experiment, Bohr's interpretation of bright line spectra) to determine the structure and function of an atom and to analyze the patterns represented in the periodic table. JoVE • Coordination Chemistry Complexes
STANDARD	HS.C.2.	Develop and use models of atomic nuclei to explain why the abundance-weighted average of isotopes of an element yields the published atomic mass. JoVE • Freezing-Point Depression to Determine an Unknown Compound • Introduction to Mass Spectrometry

		• MALDI-TOF Mass Spectrometry • Tandem Mass Spectrometry
STRAND / DOMAIN	AL.HS.C.	CHEMISTRY
OBJECTIVE / CATEGORY		Matter and Its Interactions
STANDARD	HS.C.3.	Use the periodic table as a systematic representation to predict properties of elements based on their valence electron arrangement.
RELATED CONTENT / EXPECTATION	HS.C.3.a.	Analyze data such as physical properties to explain periodic trends of the elements, including metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity and electron affinity, ionization energy, and atomic-covalent/ionic radii, and how they relate to position in the periodic table. JoVE • Coordination Chemistry Complexes
RELATED CONTENT / EXPECTATION	HS.C.3.b.	Develop and use models (e.g., Lewis dot, 3-D ball-and-stick, space-filling, valence-shell electron-pair repulsion [VSEPR]) to predict the type of bonding and shape of simple compounds. JoVE • Determining the Empirical Formula
RELATED CONTENT / EXPECTATION	HS.C.3.c.	Use the periodic table as a model to derive formulas and names of ionic and covalent compounds. JoVE • Determining the Empirical Formula
STRAND / DOMAIN	AL.HS.C.	CHEMISTRY
OBJECTIVE / CATEGORY		Matter and Its Interactions
STANDARD	HS.C.4.	Plan and conduct an investigation to classify properties of matter as intensive (e.g., density, viscosity, specific heat, melting point, boiling point) or extensive (e.g., mass, volume, heat) and demonstrate how intensive properties can be used to identify a compound. 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 a pH Meter • X-ray Fluorescence (XRF)
STRAND / DOMAIN	**AL.HS.C.**	**CHEMISTRY**
OBJECTIVE / CATEGORY		**Matter and Its Interactions**
STANDARD	**HS.C.5.**	**Plan and conduct investigations to demonstrate different types of simple chemical reactions based on valence electron arrangements of the reactants and determine the quantity of products and reactants.**
RELATED CONTENT / EXPECTATION	**HS.C.5.a.**	**Use mathematics and computational thinking to represent the ratio of reactants and products in terms of masses, molecules, and moles.** **JoVE** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Calibration Curves** **• Conducting Reactions Below Room Temperature** **• Coordination Chemistry Complexes** **• Determining Rate Laws and the Order of Reaction** **• Determining the Empirical Formula** **• Determining the Mass Percent Composition in an Aqueous Solution** **• Determining the Solubility Rules of Ionic Compounds** **• Freezing-Point Depression to Determine an Unknown Compound** **• Introduction to Catalysis** **• Introduction to Titration** **• Le Châtelier's Principle** **• Method of Standard Addition** **• Nuclear Magnetic Resonance (NMR) Spectroscopy** **• 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**
RELATED CONTENT / EXPECTATION	**HS.C.5.b.**	**Use mathematics and computational thinking to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.** **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 • 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
STRAND / DOMAIN	**AL.HS.C.**	**CHEMISTRY**
OBJECTIVE / CATEGORY		**Matter and Its Interactions**
STANDARD	**HS.C.6.**	**Use mathematics and computational thinking to express the concentrations of solutions quantitatively using molarity.**
RELATED CONTENT / EXPECTATION	**HS.C.6.a.**	**Develop and use models to explain how solutes are dissolved in solvents.** **JoVE** • An Introduction to the Micropipettor • 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 • Calibration Curves • Capillary Electrophoresis (CE) • Column Chromatography • Conducting Reactions Below Room Temperature • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Cyclic Voltammetry (CV) • Degassing Liquids with Freeze-Pump-Thaw Cycling • Density Gradient Ultracentrifugation • Determining the Mass Percent Composition in an Aqueous Solution • Dialysis: Diffusion Based Separation • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Freezing-Point Depression to Determine an Unknown Compound • Growing Crystals for X-ray Diffraction Analysis • Internal Standards • Introduction to Serological Pipettes and Pipettors • Introduction to the Microplate Reader • Ion-Exchange Chromatography

		• Making Solutions in the Laboratory • Method of Standard Addition • 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 • Sample Preparation for Analytical Preparation • Schlenk Lines Transfer of Solvents • Solid-Liquid Extraction • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Understanding Concentration and Measuring Volumes
RELATED CONTENT / EXPECTATION	HS.C.6.b.	Analyze and interpret data to explain effects of temperature on the solubility of solid, liquid, and gaseous solutes in a solvent and the effects of pressure on the solubility of gaseous solutes. 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 • Growing Crystals for X-ray Diffraction Analysis • 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 • Sample Preparation for Analytical Preparation • Solutions and Concentrations • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment
RELATED CONTENT / EXPECTATION	HS.C.6.c.	Design and conduct experiments to test the conductivity of common ionic and covalent substances in a solution. JoVE • Calibration Curves • Conducting Reactions Below Room Temperature • Cyclic Voltammetry (CV) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat

RELATED CONTENT / EXPECTATION	HS.C.6.d.	Use the concept of pH as a model to predict the relative properties of strong, weak, concentrated, and dilute acids and bases (e.g., Arrhenius and Brønsted-Lowry acids and bases). JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • High-Performance Liquid Chromatography (HPLC) • Introduction to Titration • Ion-Exchange Chromatography • Le Châtelier's Principle • Passaging Cells • Two-Dimensional Gel Electrophoresis • Using a pH Meter
STRAND / DOMAIN	AL.HS.C.	CHEMISTRY
OBJECTIVE / CATEGORY		Matter and Its Interactions
STANDARD	HS.C.7.	Plan and carry out investigations to explain the behavior of ideal gases in terms of pressure, volume, temperature, and number of particles.
RELATED CONTENT / EXPECTATION	HS.C.7.a.	Use mathematics to describe the relationships among pressure, temperature, and volume of an enclosed gas when only the amount of gas is constant. JoVE • Determining Rate Laws and the Order of Reaction • Ideal Gas Law • The Ideal Gas Law
RELATED CONTENT / EXPECTATION	HS.C.7.b.	Use mathematical and computational thinking based on the ideal gas law to determine molar quantities. JoVE • Determining Rate Laws and the Order of Reaction • Ideal Gas Law • The Ideal Gas Law
STRAND / DOMAIN	AL.HS.C.	CHEMISTRY
OBJECTIVE / CATEGORY		Matter and Its Interactions
STANDARD	HS.C.8.	Refine the design of a given chemical system to illustrate how LeChâtelier's principle affects a dynamic chemical equilibrium when subjected to an outside stress (e.g., heating and cooling a saturated sugar-water solution). JoVE • Assembly of a Reflux System for Heated Chemical Reactions

		• Le Châtelier's Principle • Spectrophotometric Determination of an Equilibrium Constant
STRAND / DOMAIN	**AL.HS.C.**	**CHEMISTRY**
OBJECTIVE / CATEGORY		**Motion and Stability: Forces and Interactions**
STANDARD	**HS.C.9.**	**Analyze and interpret data (e.g., melting point, boiling point, solubility, phase-change diagrams) to compare the strength of intermolecular forces and how these forces affect physical properties and changes.** **JoVE** • Assembly of a Reflux System for Heated Chemical Reactions • Conducting Reactions Below Room Temperature • Fractional Distillation • Freezing-Point Depression to Determine an Unknown Compound • Growing Crystals for X-ray Diffraction Analysis • Purifying Compounds by Recrystallization • Rotary Evaporation to Remove Solvent • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
STRAND / DOMAIN	**AL.HS.C.**	**CHEMISTRY**
OBJECTIVE / CATEGORY		**Energy**
STANDARD	**HS.C.10.**	**Plan and conduct experiments that demonstrate how changes in a system (e.g., phase changes, pressure of a gas) validate the kinetic molecular theory.**
RELATED CONTENT / EXPECTATION	**HS.C.10.a.**	**Develop a model to explain the relationship between the average kinetic energy of the particles in a substance and the temperature of the substance (e.g., no kinetic energy equaling absolute zero [0K or -273.15°C]).** **JoVE** • Fractional Distillation • Ideal Gas Law • The Ideal Gas Law
STRAND / DOMAIN	**AL.HS.C.**	**CHEMISTRY**
OBJECTIVE / CATEGORY		**Energy**
STANDARD	**HS.C.11.**	**Construct an explanation that describes how the release or absorption of energy from a system depends upon changes in the components of the system.**
RELATED CONTENT / EXPECTATION	**HS.C.11.a.**	**Develop a model to illustrate how the changes in total bond energy determine whether a chemical reaction is endothermic or exothermic.**

		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
RELATED CONTENT / EXPECTATION	HS.C.11.b.	Plan and conduct an investigation that demonstrates the transfer of thermal energy in a closed system (e.g., using heat capacities of two components of differing temperatures). JoVE • Assembly of a Reflux System for Heated Chemical Reactions • 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
STRAND / DOMAIN	AL.HS.P.	PHYSICS
OBJECTIVE / CATEGORY		Energy
STANDARD	HS.P.5.	Construct models that illustrate how energy is related to work performed on or by an object and explain how different forms of energy are transformed from one form to another (e.g., distinguishing between kinetic, potential, and other forms of energy such as thermal and sound; applying both the work-energy theorem and the law of conservation of energy to systems such as roller coasters, falling objects, and spring-mass systems; discussing the effect of frictional forces on energy conservation and how it affects the motion of an object). JoVE • fMRI: Functional Magnetic Resonance Imaging
STANDARD	HS.P.6.	Investigate collisions, both elastic and inelastic, to evaluate the effects on momentum and energy conservation. JoVE • Raman Spectroscopy for Chemical Analysis
STRAND / DOMAIN	AL.HS.P.	PHYSICS
OBJECTIVE / CATEGORY		Waves and Their Applications in Technologies for Information Transfer
STANDARD	HS.P.8.	Investigate the nature of wave behavior to illustrate the concept of the superposition principle responsible for wave patterns, constructive and destructive interference, and standing waves (e.g., organ pipes, tuned exhaust systems).

RELATED CONTENT / EXPECTATION	HS.P.8.a.	Predict and explore how wave behavior is applied to scientific phenomena such as the Doppler effect and Sound Navigation and Ranging (SONAR). JoVE • Peripheral Vascular Exam Using a Continuous Wave Doppler
STRAND / DOMAIN	AL.HS.P.	PHYSICS
OBJECTIVE / CATEGORY		Waves and Their Applications in Technologies for Information Transfer
STANDARD	HS.P.9.	Obtain and evaluate information regarding technical devices to describe wave propagation of electromagnetic radiation and compare it to sound propagation. (e.g., wireless telephones, magnetic resonance imaging [MRI], microwave systems, Radio Detection and Ranging [RADAR], SONAR, ultrasound). JoVE • An Introduction to Behavioral Neuroscience • An Introduction to Cognition • An Introduction to Learning and Memory • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Auscultation • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Color Afterimages • 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 • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determining the Empirical Formula • Electro-encephalography (EEG) • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Eye Tracking in Cognitive Experiments • Fear Conditioning • Finding Your Blind Spot and Perceptual Filling-in • Förster Resonance Energy Transfer (FRET)

		• Gas Chromatography (GC) with Flame-Ionization Detection • Growing Crystals for X-ray Diffraction Analysis • Internal Standards • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to the Spectrophotometer • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Learning and Memory: The Remember-Know Task • MALDI-TOF Mass Spectrometry • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Metabolic Labeling • Method of Standard Addition • Motion-induced Blindness • Motor Maps • Nuclear Magnetic Resonance (NMR) Spectroscopy • Nutrients in Aquatic Ecosystems • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Photometric Protein Determination • Physical Properties Of Minerals I: Crystals and Cleavage • Plasmid Purification • Protein Crystallization • Purifying Compounds by Recrystallization • Raman Spectroscopy for Chemical Analysis • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Solid-Liquid Extraction • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Spatial Cueing • Spectrophotometric Determination of an Equilibrium Constant • Tandem Mass Spectrometry • The Attentional Blink • The Rubber Hand Illusion • Ultraviolet-Visible (UV-Vis) Spectroscopy • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action Observation • Visual Attention: fMRI Investigation of Object-based Attentional Control • X-ray Fluorescence (XRF)

		• Yeast Maintenance • fMRI: Functional Magnetic Resonance Imaging
STANDARD	HS.P.11.	Develop and use models to illustrate electric and magnetic fields, including how each is created (e.g., charging by either conduction or induction and polarizing; sketching field lines for situations such as point charges, a charged straight wire, or a current carrying wires such as solenoids; calculating the forces due to Coulomb's laws), and predict the motion of charged particles in each field and the energy required to move a charge between two points in each field. JoVE • Gas Chromatography (GC) with Flame-Ionization Detection
STANDARD	HS.P.12.	Use the principles of Ohm's and Kirchhoff's laws to design, construct, and analyze combination circuits using typical components (e.g., resistors, capacitors, diodes, sources of power). JoVE • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat
STRAND / DOMAIN	AL.HS.HAP.	HUMAN ANATOMY AND PHYSIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.HAP.1.	Develop and use models and appropriate terminology to identify regions, directions, planes, and cavities in the human body to locate organs and systems. 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 Neuroanatomy • Ankle Exam • Arterial Line Placement • Auscultation • 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 • Comprehensive Breast Exam • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Ear Exam • Elbow Exam • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis • Eye Exam • Foot Exam • General Approach to the Physical 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 • Lymph Node Exam • Male Rectal Exam • Measuring Vital Signs • Motor Exam I • Motor Exam II • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Nose, Sinuses, Oral Cavity and Pharynx Exam • Observation and Inspection • Ophthalmoscopic Examination • Palpation • 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 • Proper Adjustment of Patient Attire during the Physical Exam • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Sensory Exam • Shoulder Exam I • Shoulder Exam II • Surgical Cricothyrotomy • Thyroid Exam

STANDARD	HS.HAP.2.	Analyze characteristics of tissue types (e.g., epithelial tissue) and construct an explanation of how the chemical and structural organizations of the cells that form these tissues are specialized to conduct the function of that tissue (e.g., lining, protecting). JoVE • An Introduction to Cell Motility and Migration • An Introduction to Developmental Neurobiology • Calcium Imaging in Neurons • Explant Culture of Neural Tissue • Histological Staining of Neural Tissue • Murine In Utero Electroporation • Neuronal Transfection Methods • Patch Clamp Electrophysiology • Primary Neuronal Cultures
STRAND / DOMAIN	AL.HS.HAP.	HUMAN ANATOMY AND PHYSIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.HAP.3.	Obtain and communicate information to explain the integumentary system's structure and function, including layers and accessories of skin and types of membranes.
RELATED CONTENT / EXPECTATION	HS.HAP.3.a.	Analyze the effects of pathological conditions (e.g., burns, skin cancer, bacterial and viral infections, chemical dermatitis) to determine the body's attempt to maintain homeostasis. JoVE • An Introduction to the Zebrafish: Danio rerio • Mouse Genotyping
STRAND / DOMAIN	AL.HS.HAP.	HUMAN ANATOMY AND PHYSIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.HAP.4.	Use models to identify the structure and function of the skeletal system (e.g., classification of bones by shape, classification of joints and the appendicular and axial skeletons).
RELATED CONTENT / EXPECTATION	HS.HAP.4.a.	Obtain and communicate information to demonstrate understanding of the growth and development of the skeletal system (e.g., bone growth and remodeling). 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
RELATED CONTENT / EXPECTATION	HS.HAP.4.b.	Obtain and communicate information to demonstrate understanding of the pathology of the skeletal system (e.g., types of bone fractures and their treatment, osteoporosis, rickets, other bone diseases). 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
STRAND / DOMAIN	AL.HS.HAP.	HUMAN ANATOMY AND PHYSIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.HAP.5.	Develop and use models to illustrate the anatomy of the muscular system, including muscle locations and groups, actions, origins and insertions.
RELATED CONTENT / EXPECTATION	HS.HAP.5.a.	Plan and conduct investigations to explain the physiology of the muscular system (e.g., muscle contraction/relaxation, muscle fatigue, muscle tone), including pathological conditions (e.g., muscular dystrophy). JoVE • An Introduction to Cell Motility and Migration • An Introduction to Motor Control • An Introduction to the Zebrafish: Danio rerio • Ankle Exam • Balance and Coordination Testing • 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 • Tissue Regeneration with Somatic Stem Cells
STRAND / DOMAIN	**AL.HS.HAP.**	**HUMAN ANATOMY AND PHYSIOLOGY**
OBJECTIVE / CATEGORY		**From Molecules to Organisms: Structures and Processes**
STANDARD	**HS.HAP.6.**	**Obtain, evaluate, and communicate information regarding how the central nervous system and peripheral nervous system interrelate, including how these systems affect all other body systems to maintain homeostasis.**
RELATED CONTENT / EXPECTATION	**HS.HAP.6.a.**	**Use scientific evidence to evaluate the effects of pathology on the nervous system (e.g., Parkinson's disease, Alzheimer's disease, cerebral palsy, head trauma) and argue possible prevention and treatment options.** **JoVE** • An Introduction to Behavioral Neuroscience • An Introduction to Caenorhabditis elegans • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Overview of Genetics and Disease • Ankle Exam • Anterograde Amnesia • Anxiety Testing • Assessing Dexterity with Reaching Tasks • Balance and Coordination Testing • C. elegans Chemotaxis Assay • Chromatin Immunoprecipitation • 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 • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Eye Tracking in Cognitive Experiments • Foot Exam • Genetic Screens • Hand and Wrist Exam • Hip Exam • Incidental Encoding • Knee Exam • Learning and Memory: The Remember-Know Task • Lower Back 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 • Multiple Object Tracking • Neck Exam • Physiological Correlates of Emotion Recognition • Prospect Theory • Sensory Exam • Shoulder Exam I • Spatial Memory Testing Using Mazes • 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 • Tissue Regeneration with Somatic Stem Cells • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Verbal Priming • Visual Search for Features and Conjunctions • fMRI: Functional Magnetic Resonance Imaging
RELATED CONTENT / EXPECTATION	HS.HAP.6.b.	Design a medication to treat a disorder associated with neurotransmission, including mode of entry into the body, form of medication, and desired effects. <u>JoVE</u> • An Introduction to Behavioral Neuroscience • An Introduction to Caenorhabditis elegans • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Motor Control • An Introduction to Neuroanatomy

		• An Introduction to Neurophysiology • An Overview of Genetics and Disease • Ankle Exam • Anterograde Amnesia • Anxiety Testing • Assessing Dexterity with Reaching Tasks • Balance and Coordination Testing • C. elegans Chemotaxis Assay • Chromatin Immunoprecipitation • 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 • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • Eye Tracking in Cognitive Experiments • Foot Exam • Genetic Screens • Hand and Wrist Exam • Hip Exam • Incidental Encoding • Knee Exam • Learning and Memory: The Remember-Know Task • Lower Back 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 • Multiple Object Tracking • Neck Exam • Physiological Correlates of Emotion Recognition • Prospect Theory • Sensory Exam • Shoulder Exam I • Spatial Memory Testing Using Mazes • 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

		• Tissue Regeneration with Somatic Stem Cells • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Verbal Priming • Visual Search for Features and Conjunctions • fMRI: Functional Magnetic Resonance Imaging
STRAND / DOMAIN	**AL.HS.HAP.**	**HUMAN ANATOMY AND PHYSIOLOGY**
OBJECTIVE / CATEGORY		**From Molecules to Organisms: Structures and Processes**
STANDARD	**HS.HAP.7.**	**Use models to determine the relationship between the structures in and functions of the cardiovascular system (e.g., components of blood, blood circulation through the heart and systems of the body, ABO blood groups, anatomy of the heart, types of blood vessels).**
RELATED CONTENT / EXPECTATION	**HS.HAP.7.a.**	**Engage in argument from evidence regarding possible prevention and treatment options related to the pathology of the cardiovascular system (e.g., myocardial infarction, mitral valve prolapse, varicose veins, arteriosclerosis, anemia, high blood pressure).** **JoVE** • An Overview of Genetics and Disease • Anxiety Testing • 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 • Emergent Lateral Canthotomy and Inferior Catholysis • Eye Exam • Modeling Social Stress • Ophthalmoscopic Examination • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler
RELATED CONTENT / EXPECTATION	**HS.HAP.7.b.**	**Design and carry out an experiment to test various conditions that affect the heart (e.g., heart rate, blood pressure, electrocardiogram [ECG] output).** **JoVE** • An Introduction to Behavioral Neuroscience • An Introduction to Cognition • An Introduction to Learning and Memory • An Introduction to Motor Control • An Introduction to Neurophysiology

		• Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Electro-encephalography (EEG) • Event-related Potentials and the Oddball Task • Language: The N400 in Semantic Incongruity • Measuring Vital Signs • Pericardiocentesis • Physiological Correlates of Emotion Recognition • Rodent Stereotaxic Surgery • fMRI: Functional Magnetic Resonance Imaging
STRAND / DOMAIN	**AL.HS.HAP.**	**HUMAN ANATOMY AND PHYSIOLOGY**
OBJECTIVE / CATEGORY		**From Molecules to Organisms: Structures and Processes**
STANDARD	**HS.HAP.8.**	**Communicate scientific information to explain the relationship between the structures and functions, both mechanical (e.g., chewing, churning in stomach) and chemical (e.g., enzymes, hydrochloric acid [HCl] in stomach), of the digestive system, including the accessory organs (e.g., salivary glands, pancreas).**
RELATED CONTENT / EXPECTATION	**HS.HAP.8.a.**	**Obtain and communicate information to demonstrate an understanding of the disorders of the digestive system (e.g., ulcers, Crohn's disease, diverticulitis).** **JoVE** **• An Introduction to Cell Metabolism** **• Detecting Reactive Oxygen Species** **• Eye Exam** **• Ophthalmoscopic Examination** **• Peripheral Vascular Exam** **• Peripheral Vascular Exam Using a Continuous Wave Doppler** **• The ATP Bioluminescence Assay**
STRAND / DOMAIN	**AL.HS.HAP.**	**HUMAN ANATOMY AND PHYSIOLOGY**
OBJECTIVE / CATEGORY		**From Molecules to Organisms: Structures and Processes**
STANDARD	**HS.HAP.9.**	**Develop and use a model to explain how the organs of the respiratory system function.**
RELATED CONTENT / EXPECTATION	**HS.HAP.9.a.**	**Engage in argument from evidence describing how environmental (e.g., cigarette smoke, polluted air) and genetic factors may affect the respiratory system, possibly leading to pathological conditions (e.g., cystic fibrosis).** **JoVE** **• An Introduction to Saccharomyces cerevisiae** **• Chromatography-Based Biomolecule Purification Methods**

		• Peripheral Vascular Exam Using a Continuous Wave Doppler • Respiratory Exam I: Inspection and Palpation • SNP Genotyping
STRAND / DOMAIN	AL.HS.HAP.	HUMAN ANATOMY AND PHYSIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.HAP.10.	Obtain, evaluate, and communicate information to differentiate between the male and female reproductive systems, including pathological conditions that affect each.
RELATED CONTENT / EXPECTATION	HS.HAP.10.a.	Use models to demonstrate what occurs in fetal development at each stage of pregnancy. 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 • Passaging Cells • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies
STRAND / DOMAIN	AL.HS.HAP.	HUMAN ANATOMY AND PHYSIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.HAP.12.	Obtain and communicate information to explain the lymphatic organs and their structure and function.
RELATED CONTENT / EXPECTATION	HS.HAP.12.a.	Develop and use a model to explain the body's lines of defense and immunity. JoVE • An Introduction to the Laboratory Mouse: Mus musculus • Co-Immunoprecipitation and Pull-Down Assays • MALDI-TOF Mass Spectrometry • The TUNEL Assay
STRAND / DOMAIN	AL.HS.HAP.	HUMAN ANATOMY AND PHYSIOLOGY
OBJECTIVE / CATEGORY		From Molecules to Organisms: Structures and Processes
STANDARD	HS.HAP.13.	Obtain, evaluate, and communicate information to support the claim that the endocrine glands secrete hormones that help the body maintain homeostasis through feedback loops.
RELATED CONTENT / EXPECTATION	HS.HAP.13.a.	Analyze the effects of pathological conditions (e.g., pituitary dwarfism, Addison's disease, diabetes mellitus)

		caused by imbalance of the hormones of the endocrine glands. JoVE • An Introduction to Modeling Behavioral Disorders and Stress • Self-administration Studies • Thyroid Exam
STRAND / DOMAIN	AL.HS.ESS.	EARTH AND SPACE SCIENCE
OBJECTIVE / CATEGORY		Earth's Place in the Universe
STANDARD	HS.ESS.1.	Develop and use models to illustrate the lifespan of the sun, including energy released during nuclear fusion that eventually reaches Earth through radiation. JoVE • Turbidity and Total Solids in Surface Water
STRAND / DOMAIN	AL.HS.ESS.	EARTH AND SPACE SCIENCE
OBJECTIVE / CATEGORY		Earth's Systems
STANDARD	HS.ESS.7.	Analyze and interpret evidence regarding the theory of plate tectonics, including geologic activity along plate boundaries and magnetic patterns in undersea rocks, to explain the ages and movements of continental and oceanic crusts. JoVE • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Igneous Intrusive Rock • Igneous Volcanic Rock • Using Topographic Maps to Generate Topographic Profiles
STANDARD	HS.ESS.8.	Develop a time scale model of Earth's biological and geological history to establish relative and absolute age of major events in Earth's history (e.g., radiometric dating, models of geologic cross sections, sedimentary layering, fossilization, early life forms, folding, faulting, igneous intrusions). 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 • Making a Geologic Cross Section • Purification of a Total Lipid Extract with Column

		Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry
STANDARD	HS.ESS.9.	Obtain, evaluate, and communicate information to explain how constructive and destructive processes (e.g., weathering, erosion, volcanism, orogeny, plate tectonics, tectonic uplift) shape Earth's land features (e.g., mountains, valleys, plateaus) and sea features (e.g., trenches, ridges, seamounts). JoVE • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Igneous Intrusive Rock • Igneous Volcanic Rock • Making a Geologic Cross Section • Turbidity and Total Solids in Surface Water • Using Topographic Maps to Generate Topographic Profiles
STANDARD	HS.ESS.10.	Construct an explanation from evidence for the processes that generate the transformation of rocks in Earth's crust, including chemical composition of minerals and characteristics of sedimentary, igneous, and metamorphic rocks. JoVE • Igneous Intrusive Rock • Igneous Volcanic Rock • Physical Properties Of Minerals II: Polymineralic Analysis
STANDARD	HS.ESS.13.	Analyze and interpret data of interactions between the hydrologic and rock cycles to explain the mechanical impacts (e.g., stream transportation and deposition, erosion, frost-wedging) and chemical impacts (e.g., oxidation, hydrolysis, carbonation) of Earth materials by water's properties. JoVE • Turbidity and Total Solids in Surface Water
STANDARD	HS.ESS.14.	Construct explanations from evidence to describe how changes in the flow of energy through Earth's systems (e.g., volcanic eruptions, solar output, ocean circulation, surface temperatures, precipitation patterns, glacial ice volumes, sea levels, Coriolis effect) impact the climate. JoVE • Biofuels: Producing Ethanol from Cellulosic Material
STRAND / DOMAIN	AL.HS.ES.	ENVIRONMENTAL SCIENCE

OBJECTIVE / CATEGORY		Earth and Human Activity
STANDARD	HS.ES.1.	Investigate and analyze the use of nonrenewable energy sources (e.g., fossil fuels, nuclear, natural gas) and renewable energy sources (e.g., solar, wind, hydroelectric, geothermal) and propose solutions for their impact on the environment. 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 • Dissolved Oxygen in Surface Water • Fractional Distillation • 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 • Raman Spectroscopy for Chemical Analysis • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
STANDARD	HS.ES.2.	Use models to illustrate and communicate the role of photosynthesis and cellular respiration as carbon cycles through the biosphere, atmosphere, hydrosphere, and geosphere. JoVE • An Introduction to Cell Metabolism • Biofuels: Producing Ethanol from Cellulosic Material • Detecting Reactive Oxygen Species • The ATP Bioluminescence Assay
STANDARD	HS.ES.4.	Engage in argument from evidence to evaluate how biological or physical changes within ecosystems (e.g., ecological succession, seasonal flooding, volcanic eruptions) affect the number and types of organisms, and that changing conditions may result in a new or altered ecosystem. 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 • Determination of Moisture Content in Soil • 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 • Nutrients in Aquatic Ecosystems • Passaging Cells • Plasmid Purification • Quantifying Environmental Microorganisms and Viruses Using qPCR • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Yeast Maintenance • Yeast Reproduction
STANDARD	HS.ES.6.	Obtain, evaluate, and communicate information to describe how human activity may affect biodiversity and genetic variation of organisms, including threatened and endangered species. 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 • Biofuels: Producing Ethanol from Cellulosic Material • C. elegans Development and Reproduction • Chick ex ovo Culture • DNA Ligation Reactions • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Development and Reproduction of the Laboratory

		Mouse **• Development of the Chick** **• Dissolved Oxygen in Surface Water** **• 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** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Measuring Tropospheric Ozone** **• Molecular Cloning** **• Mouse Genotyping** **• Nutrients in Aquatic Ecosystems** **• 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** **• 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** **• Whole-Mount In Situ Hybridization** **• Zebrafish Breeding and Embryo Handling** **• Zebrafish Maintenance and Husbandry** **• Zebrafish Microinjection Techniques** **• Zebrafish Reproduction and Development**
STANDARD	**HS.ES.7.**	**Analyze and interpret data to investigate how a single change on Earth's surface may cause changes to other Earth systems (e.g., loss of ground vegetation causing an increase in water runoff and soil erosion).** **JoVE** **• Igneous Intrusive Rock** **• Igneous Volcanic Rock** **• Turbidity and Total Solids in Surface Water**
STANDARD	**HS.ES.8.**	**Engage in an evidence-based argument to explain how over time Earth's systems affect the biosphere and the biosphere affects Earth's systems (e.g., microbial life increasing the formation of soil; corals creating reefs that alter patterns of erosion and deposition along coastlines).**

		JoVE **• 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** **• C. elegans Maintenance** **• 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** **• Dissolved Oxygen in Surface Water** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Filamentous Fungi** **• Quantifying Environmental Microorganisms and Viruses Using qPCR** **• RNA Analysis of Environmental Samples Using RT-PCR** **• 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**
STANDARD	**HS.ES.9.**	**Develop and use models to trace the flow of water, nitrogen, and phosphorus through the hydrosphere, atmosphere, geosphere, and biosphere.** **JoVE** **• Dissolved Oxygen in Surface Water** **• Nutrients in Aquatic Ecosystems** **• Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium** **• Using GIS to Investigate Urban Forestry**
STANDARD	**HS.ES.10.**	**Design solutions for protection of natural water resources (e.g., bioassessment, methods of water treatment and conservation) considering properties, uses, and pollutants (e.g., eutrophication, industrial effluents, agricultural runoffs, point and nonpoint pollution resources).** **JoVE** **• Algae Enumeration via Culturable Methodology** **• Detection of Bacteriophages in Environmental Samples** **• Determining the Solubility Rules of Ionic Compounds** **• Dissolved Oxygen in Surface Water** **• Gram Staining of Bacteria from Environmental Sources** **• Introduction to Mass Spectrometry** **• Isolation of Fecal Bacteria from Water Samples by**

		Filtration **• Le Châtelier's Principle** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Making a Geologic Cross Section** **• Nutrients in Aquatic Ecosystems** **• Quantifying Environmental Microorganisms and Viruses Using qPCR** **• RNA Analysis of Environmental Samples Using RT-PCR** **• Turbidity and Total Solids in Surface Water** **• Water Quality Analysis via Indicator Organisms** **• Zebrafish Maintenance and Husbandry**
STANDARD	**HS.ES.11.**	**Engage in argument from evidence to defend how coastal, marine, and freshwater sources (e.g., estuaries, marshes, tidal pools, wetlands, beaches, inlets, rivers, lakes, oceans, coral reefs) support biodiversity, economic stability, and human recreation.** **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**
STANDARD	**HS.ES.12.**	**Analyze and interpret data and climate models to predict how global or regional climate change can affect Earth's systems (e.g., precipitation and temperature and their associated impacts on sea level, glacial ice volumes, and atmosphere and ocean composition).** **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material**
STANDARD	**HS.ES.13.**	**Obtain, evaluate, and communicate information based on evidence to explain how key natural resources (e.g., water sources, fertile soils, concentrations of minerals and fossil fuels), natural hazards, and climate changes influence human activity (e.g., mass migrations).** **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Dissolved Oxygen in Surface Water** **• Igneous Intrusive Rock** **• Igneous Volcanic Rock** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Measuring Tropospheric Ozone** **• Nutrients in Aquatic Ecosystems** **• Proton Exchange Membrane Fuel Cells**

		• 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
STANDARD	HS.ES.14.	Analyze cost-benefit ratios of competing solutions for developing, conserving, managing, recycling, and reusing energy and mineral resources to minimize impacts in natural systems (e.g., determining best practices for agricultural soil use, mining for coal, and exploring for petroleum and natural gas sources). 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
STANDARD	HS.ES.15.	Construct an explanation based on evidence to determine the relationships among management of natural resources, human sustainability, and biodiversity (e.g., resources, waste management, per capita consumption, agricultural efficiency, urban planning). JoVE • Dissolved Oxygen in Surface Water • Electrophoretic Mobility Shift Assay (EMSA) • Isolation of Fecal Bacteria from Water Samples by Filtration • Nutrients in Aquatic Ecosystems • Self-report vs. Behavioral Measures of Recycling • Turbidity and Total Solids in Surface Water
STANDARD	HS.ES.16.	Obtain and evaluate information from published results of scientific computational models to illustrate the relationships among Earth's systems and how these relationships may be impacted by human activity (e.g., effects of an increase in atmospheric carbon dioxide on photosynthetic biomass, effect of ocean acidification on marine populations). JoVE • Algae Enumeration via Culturable Methodology • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determining the Solubility Rules of Ionic Compounds • Dissolved Oxygen in Surface Water • Introduction to Mass Spectrometry • Le Châtelier's Principle

		• 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

Grade: **9** - Adopted: **2014**

STRAND / DOMAIN	**AL.RH.9-10.**	**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / CATEGORY		**Craft and Structure**
STANDARD	**RH.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
STANDARD	RH.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). <u>JoVE</u> • 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
STRAND / DOMAIN	**AL.RH.9-10.**	**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / CATEGORY		**Integration of Knowledge and Ideas**

STANDARD	**RH.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 • 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 • Motion-induced Blindness • Motor Learning in Mirror Drawing • Motor Maps • Multiple Object Tracking • Mutual Exclusivity: How Children Learn the Meanings of Words • Nuclear Magnetic Resonance (NMR) Spectroscopy • Numerical Cognition: More or Less • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Observational Research • PCR: The Polymerase Chain Reaction • Patch Clamp Electrophysiology • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam Using a Continuous Wave Doppler • Perspectives on Cognitive Psychology • Perspectives on Neuropsychology • 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 • 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 • 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
STRAND / DOMAIN	**AL.WHST.9-10.**	**Writing Standards for Literacy in Science, and Technical Subjects**
OBJECTIVE / CATEGORY		**Text Types and Purposes**
STANDARD	**WHST.9-10.1.**	**Write arguments focused on discipline-specific content.**
RELATED CONTENT / EXPECTATION	**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**
STRAND / DOMAIN	**AL.WHST.9-10.**	**Writing Standards for Literacy in Science, and Technical Subjects**
OBJECTIVE / CATEGORY		**Text Types and Purposes**
STANDARD	**WHST.9-10.2.**	**Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.**

RELATED CONTENT / EXPECTATION	**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**
RELATED CONTENT / EXPECTATION	**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

		• 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**