Main Criteria: Maryland College and Career-Ready Standards
Secondary Criteria: JoVE
Subject: Science
Grade: 9-12
Correlation Options: Show Correlated
Adopted: 2007

STRAND / TOPIC / STANDARD	**MD.1.**	**Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.**
TOPIC / INDICATOR	**1.1.**	**The student will explain why curiosity, honesty, openness, and skepticism are highly regarded in science.**
INDICATOR / PROFICIENCY LEVEL	**1.1.1.**	**The student will recognize that real problems have more than one solution and decisions to accept one solution over another are made on the basis of many issues.** **JoVE** **• An Introduction to Cell Death** **• An Introduction to Cell Division** **• An Introduction to Cell Metabolism** **• An Introduction to Cell Motility and Migration** **• An Introduction to Endocytosis and Exocytosis** **• An Introduction to Transfection** **• Annexin V and Propidium Iodide Labeling** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Bacterial Transformation: Electroporation** **• Bacterial Transformation: The Heat Shock Method** **• Calibration Curves** **• Capillary Electrophoresis (CE)** **• Cell Cycle Analysis** **• Cell-surface Biotinylation Assay** **• Chromatography-Based Biomolecule Purification Methods** **• Co-Immunoprecipitation and Pull-Down Assays** **• Column Chromatography** **• Conducting Reactions Below Room Temperature** **• Coordination Chemistry Complexes** **• Cyclic Voltammetry (CV)** **• DNA Gel Electrophoresis**

		• DNA Ligation Reactions • Decision-making and the Iowa Gambling Task • 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 • FM Dyes in Vesicle Recycling • Fractional Distillation • Freezing-Point Depression to Determine an Unknown Compound • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Gel Purification • 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 • Invasion Assay Using 3D Matrices • Ion-Exchange Chromatography • Le Châtelier's Principle • Live Cell Imaging of Mitosis • MALDI-TOF Mass Spectrometry • Metabolic Labeling • Method of Standard Addition • Molecular Cloning • Nuclear Magnetic Resonance (NMR) Spectroscopy • PCR: The Polymerase Chain Reaction • Passaging Cells • Performing 1D Thin Layer Chromatography • Photometric Protein Determination • Plasmid Purification • Preparing Anhydrous Reagents and Equipment • Protein Crystallization • Purifying Compounds by Recrystallization • Raman Spectroscopy for Chemical Analysis • Reconstitution of Membrane Proteins • Restriction Enzyme Digests • Rotary Evaporation to Remove Solvent • Sample Preparation for Analytical Preparation

		• Scanning Electron Microscopy (SEM) • Schlenk Lines Transfer of Solvents • Separating Protein with SDS-PAGE • 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 ATP Bioluminescence Assay • The ELISA Method • The Ideal Gas Law • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using a pH Meter • X-ray Fluorescence (XRF)
INDICATOR / PROFICIENCY LEVEL	**1.1.4.**	**The student will recognize data that are biased.** **JoVE** • Algae Enumeration via Culturable Methodology • An Introduction to Aging and Regeneration • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to the Laboratory Mouse: Mus musculus • Anesthesia Induction and Maintenance • Aseptic Technique in Environmental Science • Bacterial Growth Curve Analysis and its Environmental Applications • Basic Care Procedures • Basic Chick Care and Maintenance • Basic Mouse Care and Maintenance • Blood Withdrawal I • Blood Withdrawal II • C. elegans Maintenance • Calibration Curves • Capillary Electrophoresis (CE) • Chromatography-Based Biomolecule Purification Methods • Community DNA Extraction from Bacterial Colonies • Compound Administration I • Compound Administration II

		• Compound Administration III • Compound Administration IV • Considerations for Rodent Surgery • Culturing and Enumerating Bacteria from Soil Samples • Cyclic Voltammetry (CV) • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detection of Bacteriophages in Environmental Samples • Diagnostic Necropsy and Tissue Harvest • Dialysis: Diffusion Based Separation • Drosophila Development and Reproduction • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Embryonic Stem Cell Culture and Differentiation • Ethics in Psychology Research • Experimentation using a Confederate • Explant Culture for Developmental Studies • Fate Mapping • From Theory to Design: The Role of Creativity in Designing Experiments • Fundamentals of Breeding and Weaning • Gas Chromatography (GC) with Flame-Ionization Detection • Genetic Screens • Gram Staining of Bacteria from Environmental Sources • High-Performance Liquid Chromatography (HPLC) • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Internal Standards • Introducing Experimental Agents into the Mouse • Introduction to Mass Spectrometry • Invertebrate Lifespan Quantification • Ion-Exchange Chromatography • Isolating Nucleic Acids from Yeast • Isolation of Fecal Bacteria from Water Samples by Filtration • Manipulating an Independent Variable through Embodiment • Method of Standard Addition • Mouse Genotyping • Neuronal Transfection Methods • Observational Research • Pilot Testing • Placebos in Research • Preparing Anhydrous Reagents and Equipment • Primary Neuronal Cultures • Protein Crystallization

		• Quantifying Environmental Microorganisms and Viruses Using qPCR • Raman Spectroscopy for Chemical Analysis • Realism in Experimentation • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold • Reliability in Psychology Experiments • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Self-report vs. Behavioral Measures of Recycling • Sterile Tissue Harvest • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Two-Dimensional Gel Electrophoresis • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • 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 Microinjection Techniques
INDICATOR / PROFICIENCY LEVEL	**1.1.5.**	**The student will explain factors that produce biased data (incomplete data, using data inappropriately, conflicts of interest, etc.).** **JoVE** • Algae Enumeration via Culturable Methodology • An Introduction to Aging and Regeneration • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to the Laboratory Mouse: Mus musculus • Anesthesia Induction and Maintenance • Aseptic Technique in Environmental Science • Bacterial Growth Curve Analysis and its Environmental Applications • Basic Care Procedures • Basic Chick Care and Maintenance

		• Basic Mouse Care and Maintenance • Blood Withdrawal I • Blood Withdrawal II • C. elegans Maintenance • Calibration Curves • Capillary Electrophoresis (CE) • Chromatography-Based Biomolecule Purification Methods • Community DNA Extraction from Bacterial Colonies • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Considerations for Rodent Surgery • Culturing and Enumerating Bacteria from Soil Samples • Cyclic Voltammetry (CV) • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detection of Bacteriophages in Environmental Samples • Diagnostic Necropsy and Tissue Harvest • Dialysis: Diffusion Based Separation • Drosophila Development and Reproduction • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Embryonic Stem Cell Culture and Differentiation • Ethics in Psychology Research • Experimentation using a Confederate • Explant Culture for Developmental Studies • Fate Mapping • From Theory to Design: The Role of Creativity in Designing Experiments • Fundamentals of Breeding and Weaning • Gas Chromatography (GC) with Flame-Ionization Detection • Genetic Screens • Gram Staining of Bacteria from Environmental Sources • High-Performance Liquid Chromatography (HPLC) • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Internal Standards • Introducing Experimental Agents into the Mouse • Introduction to Mass Spectrometry • Invertebrate Lifespan Quantification • Ion-Exchange Chromatography • Isolating Nucleic Acids from Yeast • Isolation of Fecal Bacteria from Water Samples by Filtration

		• Manipulating an Independent Variable through Embodiment • Method of Standard Addition • Mouse Genotyping • Neuronal Transfection Methods • Observational Research • Pilot Testing • Placebos in Research • Preparing Anhydrous Reagents and Equipment • Primary Neuronal Cultures • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • Raman Spectroscopy for Chemical Analysis • Realism in Experimentation • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold • Reliability in Psychology Experiments • Rodent Handling and Restraint Techniques • Rodent Identification I • Rodent Identification II • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Self-report vs. Behavioral Measures of Recycling • Sterile Tissue Harvest • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Two-Dimensional Gel Electrophoresis • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • 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 Microinjection Techniques
STRAND / TOPIC / STANDARD	**MD.1.**	**Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.**
TOPIC / INDICATOR	**1.2.**	**The student will pose scientific questions and suggest investigative approaches to provide answers to questions.**

INDICATOR / PROFICIENCY LEVEL	**1.2.1.**	**The student will identify meaningful, answerable scientific questions.** **JoVE** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design**
INDICATOR / PROFICIENCY LEVEL	**1.2.2.**	**The student will pose meaningful, answerable scientific questions. (NTB)** **JoVE** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design**
INDICATOR / PROFICIENCY LEVEL	**1.2.3.**	**The student will formulate a working hypothesis.** **JoVE** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design**
INDICATOR / PROFICIENCY LEVEL	**1.2.4.**	**The student will test a working hypothesis. (NTB)** **JoVE** **• Ethics in Psychology Research** **• Experimentation using a Confederate** **• From Theory to Design: The Role of Creativity in Designing Experiments** **• Manipulating an Independent Variable through Embodiment** **• Observational Research** **• Pilot Testing** **• Placebos in Research** **• Realism in Experimentation** **• Reliability in Psychology Experiments** **• The Factorial Experiment** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design** **• Turbidity and Total Solids in Surface Water** **• Within-subjects Repeated-measures Design**
INDICATOR / PROFICIENCY LEVEL	**1.2.5.**	**The student will select appropriate instruments and materials to conduct an investigation.** **JoVE** **• An Introduction to Working in the Hood** **• An Introduction to the Centrifuge** **• An Introduction to the Micropipettor** **• Common Lab Glassware and Uses** **• Histological Sample Preparation for Light Microscopy** **• Introduction to Fluorescence Microscopy** **• Introduction to Light Microscopy** **• Introduction to Serological Pipettes and Pipettors** **• Introduction to the Bunsen Burner** **• Introduction to the Microplate Reader**

		• Introduction to the Spectrophotometer • Making Solutions in the Laboratory • Measuring Mass in the Laboratory • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold • Understanding Concentration and Measuring Volumes
INDICATOR / PROFICIENCY LEVEL	1.2.6.	The student will identify appropriate methods for conducting an investigation (independent and dependent variables, proper controls, repeat trials, appropriate sample size, etc.). JoVE • Calibration Curves • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Manipulating an Independent Variable through Embodiment • Observational Research • Pilot Testing • Placebos in Research • Realism in Experimentation • Reliability in Psychology Experiments • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Within-subjects Repeated-measures Design
INDICATOR / PROFICIENCY LEVEL	1.2.8.	The student will defend the need for verifiable data. JoVE • Aseptic Technique in Environmental Science • Calibration Curves • Capillary Electrophoresis (CE) • Chromatography-Based Biomolecule Purification Methods • Cyclic Voltammetry (CV) • Density Gradient Ultracentrifugation • Dialysis: Diffusion Based Separation • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Gas Chromatography (GC) with Flame-Ionization Detection • High-Performance Liquid Chromatography (HPLC) • Internal Standards • Introduction to Mass Spectrometry

		• Ion-Exchange Chromatography • Manipulating an Independent Variable through Embodiment • Method of Standard Addition • Observational Research • Pilot Testing • Placebos in Research • Preparing Anhydrous Reagents and Equipment • Protein Crystallization • Raman Spectroscopy for Chemical Analysis • Reliability in Psychology Experiments • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Self-report vs. Behavioral Measures of Recycling • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Two-Dimensional Gel Electrophoresis • Within-subjects Repeated-measures Design • X-ray Fluorescence (XRF)
STRAND / TOPIC / STANDARD	**MD.1.**	**Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.**
TOPIC / INDICATOR	**1.3.**	**The student will carry out scientific investigations effectively and employ the instruments, systems of measurement, and materials of science appropriately.**
INDICATOR / PROFICIENCY LEVEL	**1.3.1.**	**The student will develop and demonstrate skills in using lab and field equipment to perform investigative techniques. (NTB)** **JoVE** • An Introduction to Working in the Hood • An Introduction to the Centrifuge • An Introduction to the Micropipettor • Common Lab Glassware and Uses • Histological Sample Preparation for Light Microscopy • Introduction to Fluorescence Microscopy • Introduction to Light Microscopy • Introduction to Serological Pipettes and Pipettors • Introduction to the Bunsen Burner • Introduction to the Microplate Reader • Introduction to the Spectrophotometer • Making Solutions in the Laboratory • Measuring Mass in the Laboratory • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold • Understanding Concentration and Measuring Volumes

INDICATOR / PROFICIENCY LEVEL	**1.3.2.**	**The student will recognize safe laboratory procedures.** **JoVE** **• An Introduction to Working in the Hood** **• An Introduction to the Centrifuge** **• An Introduction to the Micropipettor** **• Aseptic Technique in Environmental Science** **• Common Lab Glassware and Uses** **• Conducting Reactions Below Room Temperature** **• Histological Sample Preparation for Light Microscopy** **• Introducing Experimental Agents into the Mouse** **• Introduction to Fluorescence Microscopy** **• Introduction to Light Microscopy** **• Introduction to Serological Pipettes and Pipettors** **• Introduction to the Bunsen Burner** **• Introduction to the Microplate Reader** **• Introduction to the Spectrophotometer** **• Making Solutions in the Laboratory** **• Measuring Mass in the Laboratory** **• Regulating Temperature in the Lab: Applying Heat** **• Regulating Temperature in the Lab: Preserving Samples Using Cold** **• Understanding Concentration and Measuring Volumes**
INDICATOR / PROFICIENCY LEVEL	**1.3.3.**	**The student will demonstrate safe handling of the chemicals and materials of science. (NTB)** **JoVE** **• An Introduction to Working in the Hood** **• An Introduction to the Centrifuge** **• An Introduction to the Micropipettor** **• Aseptic Technique in Environmental Science** **• Common Lab Glassware and Uses** **• Conducting Reactions Below Room Temperature** **• Histological Sample Preparation for Light Microscopy** **• Introducing Experimental Agents into the Mouse** **• Introduction to Fluorescence Microscopy** **• Introduction to Light Microscopy** **• Introduction to Serological Pipettes and Pipettors** **• Introduction to the Bunsen Burner** **• Introduction to the Microplate Reader** **• Introduction to the Spectrophotometer** **• Making Solutions in the Laboratory** **• Measuring Mass in the Laboratory** **• Regulating Temperature in the Lab: Applying Heat** **• Regulating Temperature in the Lab: Preserving Samples Using Cold** **• Understanding Concentration and Measuring Volumes**
INDICATOR / PROFICIENCY LEVEL	**1.3.4.**	**The student will learn the use of new instruments and equipment by following instructions in a manual or from oral direction. (NTB)**

		JoVE • An Introduction to Working in the Hood • An Introduction to the Centrifuge • An Introduction to the Micropipettor • Common Lab Glassware and Uses • Histological Sample Preparation for Light Microscopy • Introduction to Fluorescence Microscopy • Introduction to Light Microscopy • Introduction to Serological Pipettes and Pipettors • Introduction to the Bunsen Burner • Introduction to the Microplate Reader • Introduction to the Spectrophotometer • Making Solutions in the Laboratory • Measuring Mass in the Laboratory • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold • Understanding Concentration and Measuring Volumes
STRAND / TOPIC / STANDARD	**MD.1.**	**Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.**
TOPIC / INDICATOR	**1.4.**	**The student will demonstrate that data analysis is a vital aspect of the process of scientific inquiry and communication.**
INDICATOR / PROFICIENCY LEVEL	**1.4.1.**	**The student will organize data appropriately using techniques such as tables, graphs, and webs (for graphs: axes labeled with appropriate quantities, appropriate units on axes, axes labeled with appropriate intervals, independent and dependent variables on correct axes, appropriate title).** **JoVE** • 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 • 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 • 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 • Cyclic Voltammetry (CV) • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determination of Moisture Content in Soil • Determining Rate Laws and the Order of Reaction • Dichotic Listening

		• Electro-encephalography (EEG) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • 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 • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Gene Silencing with Morpholinos • Genetic Crosses • 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 • Inattentional Blindness • Incidental Encoding • Internal Standards • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Introduction to the Microplate Reader • Invasion Assay Using 3D Matrices • 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 • 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 • 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 • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Plasmid Purification • Positive Reinforcement Studies • Prospect Theory • Protein Crystallization • 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 • RNAi in C. elegans • Raman Spectroscopy for Chemical Analysis • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • SNP Genotyping • Self-administration Studies • Separation of Mixtures via Precipitation • Solid-Liquid Extraction • Solutions and Concentrations • 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 • The ATP Bioluminescence Assay • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Ideal Gas Law • The Inverted-face Effect • The Morris Water Maze • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Ultraviolet-Visible (UV-Vis) Spectroscopy • Understanding Concentration and Measuring Volumes • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action Observation • Using Your Head: Measuring Infants' Rational Imitation of Actions • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Yeast Maintenance • fMRI: Functional Magnetic Resonance Imaging
INDICATOR / PROFICIENCY LEVEL	**1.4.3.**	**The student will use experimental data from various investigators to validate results.** **JoVE** • Aseptic Technique in Environmental Science • Calibration Curves • Capillary Electrophoresis (CE) • Chromatography-Based Biomolecule Purification Methods • Cyclic Voltammetry (CV) • Density Gradient Ultracentrifugation • Dialysis: Diffusion Based Separation • Electrochemical Measurements of Supported Catalysts

		Using a Potentiostat/Galvanostat **• Ethics in Psychology Research** **• Experimentation using a Confederate** **• From Theory to Design: The Role of Creativity in Designing Experiments** **• Gas Chromatography (GC) with Flame-Ionization Detection** **• High-Performance Liquid Chromatography (HPLC)** **• Internal Standards** **• Introduction to Mass Spectrometry** **• Ion-Exchange Chromatography** **• Manipulating an Independent Variable through Embodiment** **• Method of Standard Addition** **• Observational Research** **• Pilot Testing** **• Placebos in Research** **• Preparing Anhydrous Reagents and Equipment** **• Protein Crystallization** **• Raman Spectroscopy for Chemical Analysis** **• Reliability in Psychology Experiments** **• Sample Preparation for Analytical Preparation** **• Scanning Electron Microscopy (SEM)** **• Self-report vs. Behavioral Measures of Recycling** **• The Factorial Experiment** **• The Multi-group Experiment** **• The Simple Experiment: Two-group Design** **• Two-Dimensional Gel Electrophoresis** **• Within-subjects Repeated-measures Design** **• X-ray Fluorescence (XRF)**
INDICATOR / PROFICIENCY LEVEL	**1.4.5.**	**The student will check graphs to determine that they do not misrepresent results.** **JoVE** **• 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 • 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 • 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 • Cyclic Voltammetry (CV) • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determination of Moisture Content in Soil • Determining Rate Laws and the Order of Reaction

		• Dichotic Listening • Electro-encephalography (EEG) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • 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 • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Gene Silencing with Morpholinos • Genetic Crosses • 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 • Inattentional Blindness • Incidental Encoding • Internal Standards • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Introduction to the Microplate Reader • Invasion Assay Using 3D Matrices • 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 • 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 • 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 • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Plasmid Purification • Positive Reinforcement Studies • Prospect Theory • Protein Crystallization • 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 • RNAi in C. elegans • Raman Spectroscopy for Chemical Analysis • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • SNP Genotyping • Self-administration Studies • Separation of Mixtures via Precipitation • Solid-Liquid Extraction • Solutions and Concentrations

		• 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 • The ATP Bioluminescence Assay • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Ideal Gas Law • The Inverted-face Effect • The Morris Water Maze • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Ultraviolet-Visible (UV-Vis) Spectroscopy • Understanding Concentration and Measuring Volumes • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action Observation • Using Your Head: Measuring Infants' Rational Imitation of Actions • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Yeast Maintenance • fMRI: Functional Magnetic Resonance Imaging
INDICATOR / PROFICIENCY LEVEL	**1.4.7.**	**The student will determine the sources of error that limit the accuracy or precision of experimental results.** **JoVE** • Calibration Curves • Capillary Electrophoresis (CE) • Chromatography-Based Biomolecule Purification Methods • Cyclic Voltammetry (CV) • Density Gradient Ultracentrifugation

		• Dialysis: Diffusion Based Separation • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Ethics in Psychology Research • Experimentation using a Confederate • From Theory to Design: The Role of Creativity in Designing Experiments • Gas Chromatography (GC) with Flame-Ionization Detection • High-Performance Liquid Chromatography (HPLC) • Internal Standards • Introduction to Mass Spectrometry • Ion-Exchange Chromatography • Manipulating an Independent Variable through Embodiment • Method of Standard Addition • Observational Research • Pilot Testing • Preparing Anhydrous Reagents and Equipment • Protein Crystallization • Raman Spectroscopy for Chemical Analysis • Realism in Experimentation • Reliability in Psychology Experiments • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Self-report vs. Behavioral Measures of Recycling • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Two-Dimensional Gel Electrophoresis • Within-subjects Repeated-measures Design • X-ray Fluorescence (XRF)
INDICATOR / PROFICIENCY LEVEL	1.4.8.	The student will use models and computer simulations to extend his/her understanding of scientific concepts. (NTB) JoVE • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Igneous Intrusive Rock • Igneous Volcanic Rock • Making a Geologic Cross Section • Using Topographic Maps to Generate Topographic Profiles
STRAND / TOPIC / STANDARD	MD.1.	Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.

TOPIC / INDICATOR	1.5.	The student will use appropriate methods for communicating in writing and orally the processes and results of scientific investigation.
INDICATOR / PROFICIENCY LEVEL	1.5.3.	The student will use computers and/or graphing calculators to produce the visual materials (tables, graphs, and spreadsheets) that will be used for communicating results. (NTB) <u>JoVE</u> • 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 • 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 • 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 • Cyclic Voltammetry (CV) • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determination of Moisture Content in Soil • Determining Rate Laws and the Order of Reaction • Dichotic Listening • Electro-encephalography (EEG) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • 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 • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Gene Silencing with Morpholinos • Genetic Crosses • 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 • Inattentional Blindness • Incidental Encoding • Internal Standards • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Introduction to the Microplate Reader • Invasion Assay Using 3D Matrices • 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 • 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 • 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 • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Plasmid Purification • Positive Reinforcement Studies • Prospect Theory • Protein Crystallization • 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 • RNAi in C. elegans • Raman Spectroscopy for Chemical Analysis • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • SNP Genotyping • Self-administration Studies • Separation of Mixtures via Precipitation • Solid-Liquid Extraction • Solutions and Concentrations • 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 • The ATP Bioluminescence Assay • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Ideal Gas Law • The Inverted-face Effect • The Morris Water Maze • The Precision of Visual Working Memory with Delayed Estimation • The Rouge Test: Searching for a Sense of Self • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Ultraviolet-Visible (UV-Vis) Spectroscopy • Understanding Concentration and Measuring Volumes • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action

		Observation **• Using Your Head: Measuring Infants' Rational Imitation of Actions** **• Verbal Priming** **• Visual Attention: fMRI Investigation of Object-based Attentional Control** **• Visual Search for Features and Conjunctions** **• Visual Statistical Learning** **• Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy** **• Water Quality Analysis via Indicator Organisms** **• Yeast Maintenance** **• fMRI: Functional Magnetic Resonance Imaging**
INDICATOR / PROFICIENCY LEVEL	**1.5.4.**	**The student will use tables, graphs, and displays to support arguments and claims in both written and oral communication.** **<u>JoVE</u>** **• 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** **• 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 • 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 • Cyclic Voltammetry (CV) • DNA Methylation Analysis • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determination of Moisture Content in Soil • Determining Rate Laws and the Order of Reaction • Dichotic Listening • Electro-encephalography (EEG) • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Event-related Potentials and the Oddball Task • Executive Function and the Dimensional Change Card Sort Task • Executive Function in Autism Spectrum Disorder • 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 • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Gene Silencing with Morpholinos • Genetic Crosses • 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 • Inattentional Blindness • Incidental Encoding • Internal Standards • Introduction to Catalysis • Introduction to Mass Spectrometry • Introduction to Titration • Introduction to the Microplate Reader • Invasion Assay Using 3D Matrices • 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 • 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 • 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 • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Plasmid Purification • Positive Reinforcement Studies • Prospect Theory • Protein Crystallization • 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 • RNAi in C. elegans • Raman Spectroscopy for Chemical Analysis • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • SNP Genotyping • Self-administration Studies • Separation of Mixtures via Precipitation • Solid-Liquid Extraction • Solutions and Concentrations • 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 • The ATP Bioluminescence Assay • The Attentional Blink • The Costs and Benefits of Natural Pedagogy • The ELISA Method • The Ideal Gas Law • The Inverted-face Effect • The Morris Water Maze • The Precision of Visual Working Memory with Delayed Estimation

		• The Rouge Test: Searching for a Sense of Self • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Ultraviolet-Visible (UV-Vis) Spectroscopy • Understanding Concentration and Measuring Volumes • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using TMS to Measure Motor Excitability During Action Observation • Using Your Head: Measuring Infants' Rational Imitation of Actions • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Yeast Maintenance • fMRI: Functional Magnetic Resonance Imaging
INDICATOR / PROFICIENCY LEVEL	**1.5.7.**	**The student will use, explain, and/or construct various classification systems.** **JoVE** • An Introduction to Caenorhabditis elegans • An Introduction to Drosophila melanogaster • An Introduction to Saccharomyces cerevisiae • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Basic Chick Care and Maintenance • Basic Mouse Care and Maintenance • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Categories and Inductive Inferences • Chick ex ovo Culture • Culturing and Enumerating Bacteria from Soil Samples • DNA Gel Electrophoresis • Detection of Bacteriophages in Environmental Samples • Development and Reproduction of the Laboratory Mouse • Development of the Chick

		• Drosophila Development and Reproduction • Drosophila Larval IHC • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Filamentous Fungi • Gel Purification • In ovo Electroporation of Chicken Embryos • Introducing Experimental Agents into the Mouse • Isolating Nucleic Acids from Yeast • Mouse Genotyping • Plasmid Purification • RNAi in C. elegans • Separating Protein with SDS-PAGE • The ELISA Method • The Western Blot • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Using GIS to Investigate Urban Forestry • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
INDICATOR / PROFICIENCY LEVEL	1.5.8.	The student will describe similarities and differences when explaining concepts and/or principles. <u>JoVE</u> • An Introduction to Working in the Hood • An Introduction to the Centrifuge • An Introduction to the Micropipettor • Histological Sample Preparation for Light Microscopy • Introduction to Fluorescence Microscopy • Introduction to Light Microscopy • Introduction to Serological Pipettes and Pipettors • Introduction to the Bunsen Burner • Introduction to the Microplate Reader • Measuring Mass in the Laboratory • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold
STRAND / TOPIC / STANDARD	MD.1.	Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
TOPIC / INDICATOR	1.6.	The student will use mathematical processes.

INDICATOR / PROFICIENCY LEVEL	**1.6.1.**	**The student will use ratio and proportion in appropriate situations to solve problems.** **JoVE** **• Using Topographic Maps to Generate Topographic Profiles**
INDICATOR / PROFICIENCY LEVEL	**1.6.4.**	**The student will manipulate quantities and/or numerical values in algebraic equations.** **JoVE** **• 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** **• Freezing-Point Depression to Determine an Unknown Compound** **• Ideal Gas Law** **• Introduction to Titration** **• Solutions and Concentrations** **• Spectrophotometric Determination of an Equilibrium Constant** **• The Ideal Gas Law** **• Using Differential Scanning Calorimetry to Measure Changes in Enthalpy** **• Using a pH Meter**
INDICATOR / PROFICIENCY LEVEL	**1.6.5.**	**The student will judge the reasonableness of an answer.** **JoVE** **• Aseptic Technique in Environmental Science** **• Calibration Curves** **• Capillary Electrophoresis (CE)** **• Chromatography-Based Biomolecule Purification Methods** **• Cyclic Voltammetry (CV)** **• Density Gradient Ultracentrifugation** **• Dialysis: Diffusion Based Separation** **• Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat** **• Ethics in Psychology Research** **• Experimentation using a Confederate** **• From Theory to Design: The Role of Creativity in Designing Experiments** **• Gas Chromatography (GC) with Flame-Ionization Detection** **• High-Performance Liquid Chromatography (HPLC)** **• Internal Standards** **• Introduction to Mass Spectrometry** **• Ion-Exchange Chromatography** **• Manipulating an Independent Variable through Embodiment**

		• Method of Standard Addition • Observational Research • Pilot Testing • Placebos in Research • Preparing Anhydrous Reagents and Equipment • Protein Crystallization • Raman Spectroscopy for Chemical Analysis • Reliability in Psychology Experiments • Sample Preparation for Analytical Preparation • Scanning Electron Microscopy (SEM) • Self-report vs. Behavioral Measures of Recycling • The Factorial Experiment • The Multi-group Experiment • The Simple Experiment: Two-group Design • Two-Dimensional Gel Electrophoresis • Within-subjects Repeated-measures Design • X-ray Fluorescence (XRF)
STRAND / TOPIC / STANDARD	**MD.1.**	**Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.**
TOPIC / INDICATOR	**1.7.**	**The student will show that connections exist both within the various fields of science and among science and other disciplines including mathematics, social studies, language arts, fine arts, and technology.**
INDICATOR / PROFICIENCY LEVEL	**1.7.1.**	**The student will apply the skills, processes, and concepts of biology, chemistry, physics, or earth science to societal issues.** **JoVE** • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • 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 • Embryonic Stem Cell Culture and Differentiation • Ethics in Psychology Research • Freezing-Point Depression to Determine an Unknown Compound • Introduction to Mass Spectrometry • Le Châtelier's Principle • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Passaging Cells • Raman Spectroscopy for Chemical Analysis • Realism in Experimentation

		• Reliability in Psychology Experiments • Self-administration Studies • Solid-Liquid Extraction • Testing For Genetically Modified Foods • Turbidity and Total Solids in Surface Water • Using a pH Meter
INDICATOR / PROFICIENCY LEVEL	1.7.2.	The student will identify and evaluate the impact of scientific ideas and/or advancements in technology on society. <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 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 • 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 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 Cognitive Psychology • Perspectives on Experimental Psychology • Perspectives on Neuropsychology • Perspectives on Sensation and Perception • Photometric Protein Determination • Physical Properties Of Minerals I: Crystals and Cleavage • Physical Properties Of Minerals II: Polymineralic Analysis • Physiological Correlates of Emotion Recognition • Piaget's Conservation Task and the Influence of Task Demands • Pilot Testing • Placebos in Research • Plasmid Purification • Positive Reinforcement Studies • Preparing Anhydrous Reagents and Equipment • Primary Neuronal Cultures • Proper Adjustment of Patient Attire during the Physical Exam • Prospect Theory • Protein Crystallization • Proton Exchange Membrane Fuel Cells • Purification of a Total Lipid Extract with Column Chromatography • Purifying Compounds by Recrystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Raman Spectroscopy for Chemical Analysis • Realism in Experimentation • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold

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

		• The Rouge Test: Searching for a Sense of Self • The Rubber Hand Illusion • The Simple Experiment: Two-group Design • The Split Brain • The Staircase Procedure for Finding a Perceptual Threshold • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Understanding Concentration and Measuring Volumes • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Using Topographic Maps to Generate Topographic Profiles • Using Your Head: Measuring Infants' Rational Imitation of Actions • Using a pH Meter • Verbal Priming • Visual Attention: fMRI Investigation of Object-based Attentional Control • Visual Search for Features and Conjunctions • Visual Statistical Learning • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Water Quality Analysis via Indicator Organisms • Whole-Mount In Situ Hybridization • Within-subjects Repeated-measures Design • X-ray Fluorescence (XRF) • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging
INDICATOR / PROFICIENCY LEVEL	**1.7.6.**	**The student will explain how development of scientific knowledge leads to the creation of new technology and**

		how technological advances allow for additional scientific accomplishments. **<u>JoVE</u>** **• Abdominal Exam I: Inspection and Auscultation** **• Abdominal Exam IV: Acute Abdominal Pain Assessment** **• Algae Enumeration via Culturable Methodology** **• An Introduction to Aging and Regeneration** **• An Introduction to Behavioral Neuroscience** **• An Introduction to Cell Death** **• An Introduction to Cell Division** **• An Introduction to Cell Metabolism** **• An Introduction to Cell Motility and Migration** **• An Introduction to Cognition** **• An Introduction to Developmental Neurobiology** **• An Introduction to Drosophila melanogaster** **• An Introduction to Endocytosis and Exocytosis** **• An Introduction to Learning and Memory** **• An Introduction to Motor Control** **• An Introduction to Neuroanatomy** **• An Introduction to Neurophysiology** **• An Introduction to Organogenesis** **• An Introduction to Reward and Addiction** **• An Introduction to Saccharomyces cerevisiae** **• An Introduction to Stem Cell Biology** **• An Introduction to Transfection** **• An Introduction to the Centrifuge** **• An Introduction to the Laboratory Mouse: Mus musculus** **• An Introduction to the Micropipettor** **• An Overview of Alkenone Biomarker Analysis for Paleothermometry** **• An Overview of Epigenetics** **• An Overview of Genetic Analysis** **• An Overview of Genetic Engineering** **• An Overview of Genetics and Disease** **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Anesthesia Induction and Maintenance** **• Annexin V and Propidium Iodide Labeling** **• Arterial Line Placement** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Auscultation** **• Bacterial Growth Curve Analysis and its Environmental Applications** **• Bacterial Transformation: Electroporation** **• Bacterial Transformation: The Heat Shock Method** **• Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation**

		• Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • Calcium Imaging in Neurons • Calibration Curves • Capillary Electrophoresis (CE) • Carbon and Nitrogen Analysis of Environmental Samples • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • 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 • 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 • 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 • 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 • Diagnostic Necropsy and Tissue Harvest • Dialysis: Diffusion Based Separation • Dissolved Oxygen in Surface Water • Ear 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 • Event-related Potentials and the Oddball Task • 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 • Finding Your Blind Spot and Perceptual Filling-in • Fractional Distillation • Freezing-Point Depression to Determine an Unknown Compound • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization Detection • Gel Purification • 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 • High-Performance Liquid Chromatography (HPLC)

		• Histological Sample Preparation for Light Microscopy • Histological Staining of Neural Tissue • Ideal Gas Law • Induced Pluripotency • Internal Standards • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • 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 Spectrophotometer • Invasion Assay Using 3D Matrices • Ion-Exchange Chromatography • Isolation of Fecal Bacteria from Water Samples by Filtration • 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 • MALDI-TOF Mass Spectrometry • Making Solutions in the Laboratory • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Mass in the Laboratory • Measuring Tropospheric Ozone • Measuring Vital Signs • Metabolic Labeling • Method of Standard Addition • Molecular Cloning • Motion-induced Blindness • Motor Exam II • Motor Maps • Murine In Utero Electroporation • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Nose, Sinuses, Oral Cavity and Pharynx Exam • Nuclear Magnetic Resonance (NMR) Spectroscopy • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Ophthalmoscopic Examination • PCR: The Polymerase Chain Reaction • Passaging Cells • Patch Clamp Electrophysiology • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam

		• Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Photometric Protein Determination • Physical Properties Of Minerals I: Crystals and Cleavage • Physical Properties Of Minerals II: Polymineralic Analysis • Physiological Correlates of Emotion Recognition • Plasmid Purification • Positive Reinforcement Studies • Preparing Anhydrous Reagents and Equipment • 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-Seq • Raman Spectroscopy for Chemical Analysis • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Regulating Temperature in the Lab: Applying Heat • Regulating Temperature in the Lab: Preserving Samples Using Cold • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Respiratory Exam II: Percussion and Auscultation • Restriction Enzyme Digests • 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 • Separating Protein with SDS-PAGE • 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

		• 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 Attentional Blink • The ELISA Method • The Ideal Gas Law • The Rubber Hand Illusion • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • 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 a pH Meter • Visual Attention: fMRI Investigation of Object-based Attentional Control • X-ray Fluorescence (XRF) • Yeast Transformation and Cloning • fMRI: Functional Magnetic Resonance Imaging
STRAND / TOPIC / STANDARD	**MD.2.**	**Concepts Of Earth/Space Science: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain the physical behavior of the environment, Earth, and the universe.**
TOPIC / INDICATOR	**2.1.**	**The student will identify and describe techniques used to investigate the universe and Earth.**
INDICATOR / PROFICIENCY LEVEL	**2.1.1.**	**The student will describe the purpose and advantage of current tools, delivery systems and techniques used to study the universe.** **JoVE** **• Using GIS to Investigate Urban Forestry**
INDICATOR / PROFICIENCY LEVEL	**2.1.2.**	**The student will describe the purpose and advantage of current tools, delivery systems and techniques used to study the atmosphere, land and water on Earth.**

		JoVE **• Determining Spatial Orientation of Rock Layers with the Brunton Compass** **• Using GIS to Investigate Urban Forestry**
STRAND / TOPIC / STANDARD	**MD.2.**	**Concepts Of Earth/Space Science: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain the physical behavior of the environment, Earth, and the universe.**
TOPIC / INDICATOR	**2.3.**	**The student will explain how the transfer of energy and matter affect Earth systems.**
INDICATOR / PROFICIENCY LEVEL	**2.3.1.**	**The student will describe how energy and matter transfer affect Earth systems.** **JoVE** **• An Overview of Alkenone Biomarker Analysis for Paleothermometry** **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Dissolved Oxygen in Surface Water** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Purification of a Total Lipid Extract with Column Chromatography** **• Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry** **• Sonication Extraction of Lipid Biomarkers from Sediment** **• Soxhlet Extraction of Lipid Biomarkers from Sediment** **• Using GIS to Investigate Urban Forestry**
INDICATOR / PROFICIENCY LEVEL	**2.3.2.**	**The student will explain how global conditions are affected when natural and human-induced change alter the transfer of energy and matter.** **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Dissolved Oxygen in Surface Water** **• Introduction to Mass Spectrometry** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Making a Geologic Cross Section** **• Measuring Tropospheric Ozone** **• Nutrients in Aquatic Ecosystems** **• Proton Exchange Membrane Fuel Cells**

		• Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
STRAND / TOPIC / STANDARD	**MD.2.**	**Concepts Of Earth/Space Science: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain the physical behavior of the environment, Earth, and the universe.**
TOPIC / INDICATOR	**2.4.**	**The student will analyze the dynamic nature of the geosphere.**
INDICATOR / PROFICIENCY LEVEL	**2.4.1.**	**The student will compare the origin and structure of igneous, metamorphic and sedimentary rocks.** **JoVE** **• Igneous Intrusive Rock** **• Igneous Volcanic Rock**
INDICATOR / PROFICIENCY LEVEL	**2.4.3.**	**The student will explain changes in Earth's surface using plate tectonics.** **JoVE** **• Determining Spatial Orientation of Rock Layers with the Brunton Compass** **• Igneous Intrusive Rock** **• Igneous Volcanic Rock** **• Making a Geologic Cross Section** **• Using Topographic Maps to Generate Topographic Profiles**
STRAND / TOPIC / STANDARD	**MD.2.**	**Concepts Of Earth/Space Science: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain the physical behavior of the environment, Earth, and the universe.**
TOPIC / INDICATOR	**2.5.**	**The student will investigate methods that geologists use to determine the history of Earth.**
INDICATOR / PROFICIENCY LEVEL	**2.5.1.**	**The student will apply geologic principles used to date Earth's geologic and biologic events.** **JoVE** **• Making a Geologic Cross Section**
INDICATOR / PROFICIENCY LEVEL	**2.5.2.**	**The student will compare events in Earth's history that have been grouped according to similarities.** **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** **• Purification of a Total Lipid Extract with Column Chromatography**

		• Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry
STRAND / TOPIC / STANDARD	**MD.3.**	**Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.**
TOPIC / INDICATOR	**3.1.**	**The student will be able to explain the correlation between the structure and function of biologically important molecules and their relationship to cell processes.**
INDICATOR / PROFICIENCY LEVEL	**3.1.1.**	**The student will be able to describe the unique characteristics of chemical substances and macromolecules utilized by living systems.** **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 Cellular and Molecular Neuroscience** **• An Introduction to Developmental Genetics** **• An Introduction to Molecular Developmental Biology** **• An Introduction to Saccharomyces cerevisiae** **• An Introduction to Transfection** **• An Overview of Epigenetics** **• An Overview of Gene Expression** **• An Overview of Genetic Analysis** **• An Overview of Genetic Engineering** **• An Overview of Genetics and Disease** **• Annexin V and Propidium Iodide Labeling** **• Bacterial Transformation: Electroporation** **• Bacterial Transformation: The Heat Shock Method** **• Biofuels: Producing Ethanol from Cellulosic Material** **• C. elegans Maintenance** **• Cell Cycle Analysis** **• Cell-surface Biotinylation Assay** **• Chromatin Immunoprecipitation** **• Chromatography-Based Biomolecule Purification Methods** **• Co-Immunoprecipitation and Pull-Down Assays** **• Column Chromatography** **• Community DNA Extraction from Bacterial Colonies** **• Cyclic Voltammetry (CV)** **• 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 • 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 • Method of Standard Addition • Molecular Cloning • Mouse Genotyping • Nuclear Magnetic Resonance (NMR) Spectroscopy • PCR: The Polymerase Chain Reaction • Passaging Cells • Photometric Protein Determination • Plasmid Purification • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Restriction Enzyme Digests • SNP Genotyping

		• Sample Preparation for Analytical Preparation • Separating Protein with SDS-PAGE • 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
INDICATOR / PROFICIENCY LEVEL	**3.1.2.**	**The student will be able to discuss factors involved in the regulation of chemical activity as part of a homeostatic mechanism.** **JoVE** • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Neurobiology • An Introduction to Endocytosis and Exocytosis • An Introduction to Molecular Developmental Biology • An Introduction to Stem Cell Biology • Annexin V and Propidium Iodide Labeling • C. elegans Development and Reproduction • Calcium Imaging in Neurons • Cell-surface Biotinylation Assay • Detecting Reactive Oxygen Species • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Explant Culture of Neural Tissue • FM Dyes in Vesicle Recycling • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Isolating Nucleic Acids from Yeast • Murine In Utero Electroporation • Patch Clamp Electrophysiology • Reconstitution of Membrane Proteins • The ATP Bioluminescence Assay • The TUNEL Assay

		• Tissue Regeneration with Somatic Stem Cells • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning
INDICATOR / PROFICIENCY LEVEL	3.1.3.	The student will be able to compare the transfer and use of matter and energy in photosynthetic and non-photosynthetic organisms. JoVE • Algae Enumeration via Culturable Methodology • An Introduction to Drosophila melanogaster • An Introduction to the Chick: Gallus gallus domesticus • Zebrafish Maintenance and Husbandry • Zebrafish Reproduction and Development
STRAND / TOPIC / STANDARD	MD.3.	Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.
TOPIC / INDICATOR	3.2.	The student will demonstrate an understanding that all organisms are composed of cells which can function independently or as part of multicellular organisms.
INDICATOR / PROFICIENCY LEVEL	3.2.1.	The student will explain processes and the function of related structures found in unicellular and multicellular organisms. JoVE • An Introduction to Caenorhabditis elegans • An Introduction to Cell Division • An Introduction to Cell Motility and Migration • An Introduction to Drosophila melanogaster • An Introduction to Saccharomyces cerevisiae • Bacterial Growth Curve Analysis and its Environmental Applications • C. elegans Development and Reproduction • Genetic Crosses • Isolating Nucleic Acids from Yeast • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning
INDICATOR / PROFICIENCY LEVEL	3.2.2.	The student will conclude that cells exist within a narrow range of environmental conditions and changes to that environment, either naturally occurring or induced, may cause changes in the metabolic activity of the cell or organism. JoVE • An Introduction to Cell Death • An Introduction to Cell Division

		• An Introduction to Cell Metabolism • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Neurobiology • An Introduction to Endocytosis and Exocytosis • An Introduction to Molecular Developmental Biology • An Introduction to Stem Cell Biology • Annexin V and Propidium Iodide Labeling • C. elegans Development and Reproduction • Calcium Imaging in Neurons • Cell-surface Biotinylation Assay • Detecting Reactive Oxygen Species • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Explant Culture of Neural Tissue • FM Dyes in Vesicle Recycling • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Isolating Nucleic Acids from Yeast • Murine In Utero Electroporation • Patch Clamp Electrophysiology • Reconstitution of Membrane Proteins • The ATP Bioluminescence Assay • The TUNEL Assay • Tissue Regeneration with Somatic Stem Cells • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning
STRAND / TOPIC / STANDARD	**MD.3.**	**Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.**
TOPIC / INDICATOR	**3.3.**	**The student will analyze how traits are inherited and passed on from one generation to another.**
INDICATOR / PROFICIENCY LEVEL	**3.3.1.**	**The student will demonstrate that the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring.** **JoVE** • An Introduction to Cell Division • Genetic Crosses • Recombineering and Gene Targeting • Yeast Reproduction
INDICATOR / PROFICIENCY LEVEL	**3.3.2.**	**The student will illustrate and explain how expressed traits are passed from parent to offspring.** **JoVE** • An Introduction to Caenorhabditis elegans

		• An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Genetic Analysis • An Overview of Genetics and Disease • C. elegans Development and Reproduction • C. elegans Maintenance • DNA Methylation Analysis • Drosophila Development and Reproduction • Drosophila Larval IHC • 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 • Yeast Maintenance • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Reproduction and Development
INDICATOR / PROFICIENCY LEVEL	**3.3.3.**	**The student will explain how a genetic trait is determined by the code in a DNA molecule.** **JoVE** • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to Molecular Developmental Biology • 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 Genetic Engineering • An Overview of Genetics and Disease • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • C. elegans Development and Reproduction • C. elegans Maintenance

		• Cell Cycle Analysis • Chromatin Immunoprecipitation • Community DNA Extraction from Bacterial Colonies • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Development and Reproduction of the Laboratory Mouse • Drosophila Development and Reproduction • 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 • Fundamentals of Breeding and Weaning • Förster Resonance Energy Transfer (FRET) • Gel Purification • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Molecular Cloning • Mouse Genotyping • PCR: The Polymerase Chain Reaction • Photometric Protein Determination • Plasmid Purification • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Recombineering and Gene Targeting • Restriction Enzyme Digests • SNP Genotyping • Testing For Genetically Modified Foods • The TUNEL Assay • Two-Dimensional Gel Electrophoresis • Whole-Mount In Situ Hybridization • Yeast Maintenance

		• Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry
INDICATOR / PROFICIENCY LEVEL	3.3.4.	The student will interpret how the effects of DNA alteration can be beneficial or harmful to the individual, society, and/or the environment. JoVE • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetics and Disease • Genetic Engineering of Model Organisms • Genetic Screens • Isolating Nucleic Acids from Yeast • Passaging Cells • The TUNEL Assay
STRAND / TOPIC / STANDARD	MD.3.	Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.
TOPIC / INDICATOR	3.4.	The student will explain the mechanism of evolutionary change.
INDICATOR / PROFICIENCY LEVEL	3.4.1.	The student will explain how new traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population. 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 • C. elegans Development and Reproduction • Genetic Engineering of Model Organisms • Genetic Screens • Isolating Nucleic Acids from Yeast • Passaging Cells • SNP Genotyping • The TUNEL Assay • Yeast Reproduction • Zebrafish Maintenance and Husbandry
INDICATOR / PROFICIENCY LEVEL	3.4.2.	The student will estimate degrees of relatedness among organisms or species. JoVE • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Zebrafish: Danio rerio
STRAND / TOPIC / STANDARD	MD.3.	Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.
TOPIC / INDICATOR	3.5.	The student will investigate the interdependence of diverse living organisms and their interactions with the components of the biosphere.
INDICATOR / PROFICIENCY LEVEL	3.5.1.	The student will analyze the relationships between biotic diversity and abiotic factors in environments and the resulting influence on ecosystems. JoVE • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment

		• Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy
INDICATOR / PROFICIENCY LEVEL	3.5.2.	The student will analyze the interrelationships and interdependencies among different organisms and explain how these relationships contribute to the stability of the ecosystem. JoVE • Analysis of Earthworm Populations in Soil • Bacterial Growth Curve Analysis and its Environmental Applications • Culturing and Enumerating Bacteria from Soil Samples • Filamentous Fungi • 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 • Zebrafish Maintenance and Husbandry
INDICATOR / PROFICIENCY LEVEL	3.5.3.	The student will investigate how natural and man-made changes in environmental conditions will affect individual organisms and the dynamics of populations. JoVE • Analysis of Earthworm Populations in Soil • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determination of Moisture Content in Soil • Dissolved Oxygen in Surface Water • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
STRAND / TOPIC / STANDARD	MD.3.	Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.
TOPIC / INDICATOR	3.6.	The student will investigate a biological issue and develop an action plan.
INDICATOR / PROFICIENCY LEVEL	3.6.1.	The student will analyze the consequences and/or trade-offs between technological changes and their effect on the individual, society, and the environment. They may select topics such as bioethics, genetic engineering,

		endangered species, or food supply. (NTB) **<u>JoVE</u>** **• An Introduction to Aging and Regeneration** **• 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 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** **• Dissolved Oxygen in Surface Water** **• Embryonic Stem Cell Culture and Differentiation** **• Explant Culture for Developmental Studies** **• Explant Culture of Neural Tissue** **• Fate Mapping** **• Fundamentals of Breeding and Weaning** **• Gene Silencing with Morpholinos** **• Genetic Crosses** **• Genetic Engineering of Model Organisms** **• Genetic Screens** **• Genome Editing** **• In ovo Electroporation of Chicken Embryos** **• Induced Pluripotency** **• Invertebrate Lifespan Quantification** **• Le Châtelier's Principle** **• Molecular Cloning** **• Mouse Genotyping** **• Murine In Utero Electroporation** **• Neuronal Transfection Methods** **• Nutrients in Aquatic Ecosystems** **• Plasmid Purification** **• Primary Neuronal Cultures** **• RNAi in C. elegans** **• Recombineering and Gene Targeting** **• Restriction Enzyme Digests** **• Rodent Stereotaxic Surgery** **• Solid-Liquid Extraction** **• Testing For Genetically Modified Foods** **• The TUNEL Assay**

		• Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Turbidity and Total Solids in Surface Water • Whole-Mount In Situ Hybridization • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
INDICATOR / PROFICIENCY LEVEL	3.6.2.	The student will investigate a biological issue and be able to defend their position on topics such as animal rights, drug and alcohol abuse, viral diseases (e.g., AIDS), genetic engineering, bioethics, biodiversity, population growth, global sustainability, or origin of life. (NTB) <u>JoVE</u> • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam IV: Acute Abdominal Pain Assessment • Algae Enumeration via Culturable Methodology • An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Drosophila melanogaster • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Molecular Developmental Biology • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Introduction to Organogenesis • An Introduction to Reward and Addiction • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Introduction to Transfection • 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 Genetic Analysis • An Overview of Genetic Engineering

		• An Overview of Genetics and Disease • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Anesthesia Induction and Maintenance • Annexin V and Propidium Iodide Labeling • Arterial Line Placement • Assembly of a Reflux System for Heated Chemical Reactions • Auscultation • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Biofuels: Producing Ethanol from Cellulosic Material • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Development and Reproduction • Calcium Imaging in Neurons • Calibration Curves • Capillary Electrophoresis (CE) • Carbon and Nitrogen Analysis of Environmental Samples • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • 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 • 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 • 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 • 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 • Dissolved Oxygen in Surface Water • Ear 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 • 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** **• Finding Your Blind Spot and Perceptual Filling-in** **• Fractional Distillation** **• Freezing-Point Depression to Determine an Unknown Compound** **• 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** **• High-Performance Liquid Chromatography (HPLC)** **• Histological Sample Preparation for Light Microscopy** **• Histological Staining of Neural Tissue** **• Ideal Gas Law** **• In ovo Electroporation of Chicken Embryos** **• Induced Pluripotency** **• Internal Standards** **• Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation** **• Intraosseous Needle Placement** **• 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 Spectrophotometer** **• Invasion Assay Using 3D Matrices** **• Invertebrate Lifespan Quantification** **• Ion-Exchange Chromatography** **• Isolation of Fecal Bacteria from Water Samples by Filtration** **• 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**

		• MALDI-TOF Mass Spectrometry • Making Solutions in the Laboratory • Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain • Measuring Mass in the Laboratory • Measuring Tropospheric Ozone • Measuring Vital Signs • Metabolic Labeling • Method of Standard Addition • Molecular Cloning • Motion-induced Blindness • Motor Exam II • Motor Maps • Mouse Genotyping • Murine In Utero Electroporation • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Neuronal Transfection Methods • Nose, Sinuses, Oral Cavity and Pharynx Exam • Nuclear Magnetic Resonance (NMR) Spectroscopy • Nutrients in Aquatic Ecosystems • Object Substitution Masking • Ophthalmoscopic Examination • PCR: The Polymerase Chain Reaction • Passaging Cells • Patch Clamp Electrophysiology • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Performing 1D Thin Layer Chromatography • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Photometric Protein Determination • Physical Properties Of Minerals I: Crystals and Cleavage • Physical Properties Of Minerals II: Polymineralic Analysis • Physiological Correlates of Emotion Recognition • Plasmid Purification • Positive Reinforcement Studies • Preparing Anhydrous Reagents and Equipment • Primary Neuronal Cultures • 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-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 II: Percussion and Auscultation** **• Restriction Enzyme Digests** **• 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** **• Separating Protein with SDS-PAGE** **• 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** **• 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 Attentional Blink** **• The ELISA Method** **• The Ideal Gas Law** **• The Rubber Hand Illusion** **• The TUNEL Assay** **• The Transwell Migration Assay** **• The Western Blot** **• Tissue Regeneration with Somatic Stem Cells** **• Transplantation Studies** **• 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 a pH Meter • Visual Attention: fMRI Investigation of Object-based Attentional Control • Whole-Mount In Situ Hybridization • X-ray Fluorescence (XRF) • 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 / TOPIC / STANDARD	**MD.4.**	**Concepts Of Chemistry: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain composition and interactions of matter in the world in which we live.**
TOPIC / INDICATOR	**4.1.**	**The student will explain that atoms have structure and this structure serves as the basis for the properties of elements and the bonds that they form.**
INDICATOR / PROFICIENCY LEVEL	**4.1.1.**	**The student will analyze the structure of the atom and describe the characteristics of the particles found there.** **JoVE** • Coordination Chemistry Complexes • Nuclear Magnetic Resonance (NMR) Spectroscopy • Raman Spectroscopy for Chemical Analysis • Scanning Electron Microscopy (SEM) • X-ray Fluorescence (XRF)
INDICATOR / PROFICIENCY LEVEL	**4.1.2.**	**The student will demonstrate that the arrangement and number of electrons and the properties of elements repeat in a periodic manner illustrated by their arrangement in the periodic table.** **JoVE** • Coordination Chemistry Complexes
INDICATOR / PROFICIENCY LEVEL	**4.1.3.**	**The student will explain how atoms interact with other atoms through the transfer and sharing of electrons in the formation of chemical bonds.** **JoVE** • An Overview of Alkenone Biomarker Analysis for Paleothermometry

		• An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Determining the Solubility Rules of Ionic Compounds • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Purification of a Total Lipid Extract with Column Chromatography • Raman Spectroscopy for Chemical Analysis • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Ultraviolet-Visible (UV-Vis) Spectroscopy • X-ray Fluorescence (XRF)
STRAND / TOPIC / STANDARD	**MD.4.**	**Concepts Of Chemistry: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain composition and interactions of matter in the world in which we live.**
TOPIC / INDICATOR	**4.2.**	**The student will explain how the properties of compounds are related to the arrangement and type of atoms they contain.**
INDICATOR / PROFICIENCY LEVEL	**4.2.1.**	**The student will explain how the properties of a molecule are determined by the atoms it contains and their arrangement.** **<u>JoVE</u>** **• Chromatography-Based Biomolecule Purification Methods** **• Co-Immunoprecipitation and Pull-Down Assays** **• Density Gradient Ultracentrifugation** **• Dialysis: Diffusion Based Separation** **• Electrophoretic Mobility Shift Assay (EMSA)** **• Enzyme Assays and Kinetics** **• FM Dyes in Vesicle Recycling** **• Förster Resonance Energy Transfer (FRET)** **• Introduction to Mass Spectrometry** **• MALDI-TOF Mass Spectrometry** **• Metabolic Labeling** **• Nuclear Magnetic Resonance (NMR) Spectroscopy** **• Photometric Protein Determination** **• Protein Crystallization** **• Raman Spectroscopy for Chemical Analysis** **• Reconstitution of Membrane Proteins** **• Surface Plasmon Resonance (SPR)** **• Tandem Mass Spectrometry** **• Two-Dimensional Gel Electrophoresis**

INDICATOR / PROFICIENCY LEVEL	**4.2.2.**	**The student will explain why organic compounds are so numerous and diverse.** **JoVE** **• An Overview of Alkenone Biomarker Analysis for Paleothermometry** **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Chromatography-Based Biomolecule Purification Methods** **• Column Chromatography** **• Conducting Reactions Below Room Temperature** **• Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry** **• Coordination Chemistry Complexes** **• Degassing Liquids with Freeze-Pump-Thaw Cycling** **• Density Gradient Ultracentrifugation** **• Dialysis: Diffusion Based Separation** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Fractional Distillation** **• Growing Crystals for X-ray Diffraction Analysis** **• Introduction to Catalysis** **• Ion-Exchange Chromatography** **• MALDI-TOF Mass Spectrometry** **• Metabolic Labeling** **• Nuclear Magnetic Resonance (NMR) Spectroscopy** **• Performing 1D Thin Layer Chromatography** **• Preparing Anhydrous Reagents and Equipment** **• 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** **• Schlenk Lines Transfer of Solvents** **• Separation of Mixtures via Precipitation** **• Solid-Liquid Extraction** **• Sonication Extraction of Lipid Biomarkers from Sediment** **• Soxhlet Extraction of Lipid Biomarkers from Sediment** **• Tandem Mass Spectrometry** **• Two-Dimensional Gel Electrophoresis** **• Ultraviolet-Visible (UV-Vis) Spectroscopy**
INDICATOR / PROFICIENCY LEVEL	**4.2.3.**	**The student will describe the properties of solutions and explain how they form.** **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 • Determining the Solubility Rules of Ionic Compounds • Dialysis: Diffusion Based Separation • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Freezing-Point Depression to Determine an Unknown Compound • Gas Chromatography (GC) with Flame-Ionization Detection • Growing Crystals for X-ray Diffraction Analysis • High-Performance Liquid Chromatography (HPLC) • Internal Standards • Introduction to Serological Pipettes and Pipettors • Introduction to Titration • Introduction to the Microplate Reader • Introduction to the Spectrophotometer • Ion-Exchange Chromatography • Le Châtelier's Principle • Making Solutions in the Laboratory • Method of Standard Addition • Performing 1D Thin Layer Chromatography • Photometric Protein Determination • Preparing Anhydrous Reagents and Equipment • 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 • Separation of Mixtures via Precipitation • Solid-Liquid Extraction

		• Solutions and Concentrations • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Spectrophotometric Determination of an Equilibrium Constant • Two-Dimensional Gel Electrophoresis • Understanding Concentration and Measuring Volumes • Using a pH Meter
INDICATOR / PROFICIENCY LEVEL	4.2.4.	The student will differentiate among acids, bases, and salts based on their properties. JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Determining the Empirical Formula • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Introduction to Titration • Ion-Exchange Chromatography • Le Châtelier's Principle • Two-Dimensional Gel Electrophoresis • Using a pH Meter
STRAND / TOPIC / STANDARD	MD.4.	Concepts Of Chemistry: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain composition and interactions of matter in the world in which we live.
TOPIC / INDICATOR	4.3.	The student will apply the basic concepts of thermodynamics (thermochemistry) to phases of matter and phase and chemical changes.
INDICATOR / PROFICIENCY LEVEL	4.3.1.	The student will explain that thermal energy in a material consists of the ordered and disordered motions of its colliding particles. JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Determining Rate Laws and the Order of Reaction • Fractional Distillation • Ideal Gas Law • Le Châtelier's Principle • The Ideal Gas Law • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
INDICATOR / PROFICIENCY LEVEL	4.3.2.	The student will describe observed changes in pressure, volume, or temperature of a sample in terms of macroscopic changes and the behavior of particles. JoVE • Assembly of a Reflux System for Heated Chemical

		Reactions • Determining Rate Laws and the Order of Reaction • Fractional Distillation • Ideal Gas Law • Le Châtelier's Principle • The Ideal Gas Law • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
INDICATOR / PROFICIENCY LEVEL	4.3.3.	The student will explain why the interactions among particles involve a change in the energy system. JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Determining Rate Laws and the Order of Reaction • Fractional Distillation • Ideal Gas Law • Le Châtelier's Principle • The Ideal Gas Law • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
STRAND / TOPIC / STANDARD	MD.4.	Concepts Of Chemistry: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain composition and interactions of matter in the world in which we live.
TOPIC / INDICATOR	4.4.	The student will explain how and why substances are represented by formulas.
INDICATOR / PROFICIENCY LEVEL	4.4.1.	The student will illustrate that substances can be represented by formulas. JoVE • Determining the Empirical Formula
INDICATOR / PROFICIENCY LEVEL	4.4.2.	The student will show that chemical reactions can be represented by symbolic or word equations that specify all reactants and products involved. JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Conducting Reactions Below Room Temperature • Coordination Chemistry Complexes • Determining Rate Laws and the Order of Reaction • Determining the Empirical Formula • Determining the Solubility Rules of Ionic Compounds • Introduction to Catalysis • Introduction to Titration • Le Châtelier's Principle • Preparing Anhydrous Reagents and Equipment • Proton Exchange Membrane Fuel Cells • Solutions and Concentrations

		• Spectrophotometric Determination of an Equilibrium Constant • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
INDICATOR / PROFICIENCY LEVEL	4.4.3.	The student will use mole relationships. JoVE • Calibration Curves • Capillary Electrophoresis (CE) • Determining Rate Laws and the Order of Reaction • Determining the Mass Percent Composition in an Aqueous Solution • Freezing-Point Depression to Determine an Unknown Compound • Gas Chromatography (GC) with Flame-Ionization Detection • High-Performance Liquid Chromatography (HPLC) • Internal Standards • Introduction to Titration • Introduction to the Microplate Reader • Introduction to the Spectrophotometer • Le Châtelier's Principle • Making Solutions in the Laboratory • Photometric Protein Determination • Sample Preparation for Analytical Preparation • Solutions and Concentrations • Spectrophotometric Determination of an Equilibrium Constant • Understanding Concentration and Measuring Volumes
STRAND / TOPIC / STANDARD	MD.4.	Concepts Of Chemistry: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain composition and interactions of matter in the world in which we live.
TOPIC / INDICATOR	4.5.	The student will explain that matter undergoes transformations, resulting in products that are different from the reactants.
INDICATOR / PROFICIENCY LEVEL	4.5.1.	The student will describe the general types of chemical reactions. JoVE • Conducting Reactions Below Room Temperature • Coordination Chemistry Complexes • Cyclic Voltammetry (CV) • Determining Rate Laws and the Order of Reaction • Determining the Solubility Rules of Ionic Compounds • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Growing Crystals for X-ray Diffraction Analysis • Introduction to Catalysis

		• Introduction to Titration • Le Châtelier's Principle • Photometric Protein Determination • Preparing Anhydrous Reagents and Equipment • Proton Exchange Membrane Fuel Cells • Purifying Compounds by Recrystallization • Rotary Evaporation to Remove Solvent • Separation of Mixtures via Precipitation • Spectrophotometric Determination of an Equilibrium Constant • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Using a pH Meter
INDICATOR / PROFICIENCY LEVEL	4.5.2.	The student will balance simple equations (not to include redox reactions). JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Conducting Reactions Below Room Temperature • Coordination Chemistry Complexes • Determining Rate Laws and the Order of Reaction • Determining the Empirical Formula • Determining the Solubility Rules of Ionic Compounds • Introduction to Catalysis • Introduction to Titration • 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
INDICATOR / PROFICIENCY LEVEL	4.5.3.	The student will demonstrate that adjusting quantities of reactants may affect the amounts of products formed. 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
INDICATOR / PROFICIENCY LEVEL	4.5.4.	The student will recognize that chemical reactions occur at different speeds. JoVE • Conducting Reactions Below Room Temperature • Determining Rate Laws and the Order of Reaction • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Enzyme Assays and Kinetics • Introduction to Catalysis
STRAND / TOPIC / STANDARD	MD.5.	Concepts Of Physics: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain and predict the outcome of certain interactions which occur between matter and energy.
TOPIC / INDICATOR	5.1.	The student will know and apply the laws of mechanics to explain the behavior of the physical world.
INDICATOR / PROFICIENCY LEVEL	5.1.5.	The student will analyze systems with regard to the conservation laws. JoVE • Determining the Empirical Formula
STRAND / TOPIC / STANDARD	MD.5.	Concepts Of Physics: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain and predict the outcome of certain interactions which occur between matter and energy.
TOPIC / INDICATOR	5.2.	The student will know and apply the laws of electricity and magnetism and explain their significant role in nature and technology.
INDICATOR / PROFICIENCY LEVEL	5.2.2.	The student will describe the sources and effects of electric and magnetic fields. JoVE • Introduction to Mass Spectrometry • Nuclear Magnetic Resonance (NMR) Spectroscopy
STRAND / TOPIC / STANDARD	MD.5.	Concepts Of Physics: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain and predict the outcome of certain interactions which occur between matter and energy.
TOPIC / INDICATOR	5.3.	The student will recognize and relate the laws of thermodynamics to practical applications.
INDICATOR / PROFICIENCY LEVEL	5.3.1.	The student will relate thermodynamics to the balance of energy in a system. JoVE

		• Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
STRAND / TOPIC / STANDARD	MD.5.	Concepts Of Physics: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain and predict the outcome of certain interactions which occur between matter and energy.
TOPIC / INDICATOR	5.4.	The student will explain and demonstrate how vibrations and waves provide a model for our understanding of various physical phenomena.
INDICATOR / PROFICIENCY LEVEL	5.4.2.	The student will describe wave characteristics using both diagrams and calculations. JoVE • Raman Spectroscopy for Chemical Analysis
STRAND / TOPIC / STANDARD	MD.5.	Concepts Of Physics: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain and predict the outcome of certain interactions which occur between matter and energy.
TOPIC / INDICATOR	5.5.	The student will investigate certain topics in modern physics.
INDICATOR / PROFICIENCY LEVEL	5.5.2.	The student will qualitatively explain the processes associated with nuclear energy and its applications. JoVE • Nuclear Magnetic Resonance (NMR) Spectroscopy
STRAND / TOPIC / STANDARD	MD.6.	Environmental Science: The student will demonstrate the ability to use the scientific skills and processes (Core Learning Goal 1) and major environmental science concepts to understand interrelationships of the natural world and to analyze environmental issues and their solutions.
TOPIC / INDICATOR	6.1.	The student will explain how matter and energy move through the biosphere (lithosphere, hydrosphere, atmosphere and organisms).
INDICATOR / PROFICIENCY LEVEL	6.1.1.	The student will demonstrate that matter cycles through and between living systems and the physical environment constantly being recombined in different ways (At least - nitrogen cycle; carbon cycle; phosphorus cycle (rock/mineral); hydrologic cycle). 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
INDICATOR / PROFICIENCY LEVEL	6.1.2.	The student will analyze how the transfer of energy between atmosphere, land masses and oceans results in areas of different temperatures and densities that produce weather patterns and establish climate zones around the earth (At least - differential heating and cooling; oceanic and atmospheric circulation patterns; climates and microclimates; biomes). JoVE • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Using GIS to Investigate Urban Forestry
STRAND / TOPIC / STANDARD	MD.6.	Environmental Science: The student will demonstrate the ability to use the scientific skills and processes (Core Learning Goal 1) and major environmental science concepts to understand interrelationships of the natural world and to analyze environmental issues and their solutions.
TOPIC / INDICATOR	6.2.	The student will investigate the interdependence of organisms within their biotic environment.
INDICATOR / PROFICIENCY LEVEL	6.2.1.	The student will explain how organisms are linked by the transfer and transformation of matter and energy at the ecosystem level (At least - Photosynthesis/respiration; Producers, consumers, decomposers; Trophic levels;

		Pyramid of energy/pyramid of biomass). **<u>JoVE</u>** **• Algae Enumeration via Culturable Methodology** **• An Introduction to Cell Metabolism** **• An Introduction to Drosophila melanogaster** **• An Introduction to the Chick: Gallus gallus domesticus** **• Analysis of Earthworm Populations in Soil** **• Bacterial Growth Curve Analysis and its Environmental Applications** **• Biofuels: Producing Ethanol from Cellulosic Material** **• C. elegans Maintenance** **• Carbon and Nitrogen Analysis of Environmental Samples** **• Culturing and Enumerating Bacteria from Soil Samples** **• Detecting Reactive Oxygen Species** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Dissolved Oxygen in Surface Water** **• Filamentous Fungi** **• Fundamentals of Breeding and Weaning** **• Nutrients in Aquatic Ecosystems** **• Quantifying Environmental Microorganisms and Viruses Using qPCR** **• RNA Analysis of Environmental Samples Using RT-PCR** **• Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium** **• The ATP Bioluminescence Assay** **• Using GIS to Investigate Urban Forestry** **• Zebrafish Maintenance and Husbandry** **• Zebrafish Reproduction and Development**
INDICATOR / PROFICIENCY LEVEL	**6.2.2.**	**The student will explain why interrelationships & interdependencies of organisms contribute to the dynamics of ecosystems (At least - Interspecific and intraspecific competition; Niche; Cycling of materials among organisms; Equilibrium/cyclic fluctuations; Dynamics of disturbance and recovery; Succession: aquatic and terrestrial).** **<u>JoVE</u>** **• Algae Enumeration via Culturable Methodology** **• An Introduction to the Zebrafish: Danio rerio** **• Analysis of Earthworm Populations in Soil** **• Bacterial Growth Curve Analysis and its Environmental Applications** **• C. elegans Development and Reproduction** **• Carbon and Nitrogen Analysis of Environmental Samples** **• Culturing and Enumerating Bacteria from Soil Samples** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy**

		• Dissolved Oxygen in Surface Water • Filamentous Fungi • Fundamentals of Breeding and Weaning • Nutrients in Aquatic Ecosystems • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • 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 • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
INDICATOR / PROFICIENCY LEVEL	6.2.3.	The student will conclude that populations grow or decline due to a variety of factors (At least - Linear/exponential growth; Carrying capacity/limiting factors; Species specific reproductive factors (such as birth rate, fertility rate); Factors unique to the human population (medical, agricultural, cultural); Immigration/emigration; Introduced species). <u>JoVE</u> • Algae Enumeration via Culturable Methodology • An Introduction to Drosophila melanogaster • An Introduction to Saccharomyces cerevisiae • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • 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 Development and Reproduction • 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 Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning
INDICATOR / PROFICIENCY LEVEL	6.2.4.	The student will provide examples and evidence showing that natural selection leads to organisms that are well suited for survival in particular environments (At least - coevolutionary relationships, e.g. symbiotic relationships; variation within a species increases survival potential; natural selection provides a mechanism for evolution; adaptations of organisms within biomes). JoVE • An Overview of Genetic Analysis • High-Performance Liquid Chromatography (HPLC)
STRAND / TOPIC / STANDARD	MD.6.	Environmental Science: The student will demonstrate the ability to use the scientific skills and processes (Core Learning Goal 1) and major environmental science concepts to understand interrelationships of the natural world and to analyze environmental issues and their solutions.
TOPIC / INDICATOR	6.3.	The student will analyze the relationships between humans and the earth's resources.
INDICATOR / PROFICIENCY LEVEL	6.3.1.	The student will evaluate the interrelationship between humans and air quality (At least - ozone; greenhouse gases; volatile organic compounds (smog); acid rain; indoor air; human health). JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Gas Chromatography (GC) with Flame-Ionization Detection • Measuring Tropospheric Ozone • Using GIS to Investigate Urban Forestry
INDICATOR / PROFICIENCY LEVEL	6.3.2.	The student will evaluate the interrelationship between humans and water quality and quantity (At least - fresh water supply; point source/nonpoint source pollution; waste water treatment; thermal pollution; Chesapeake Bay and its watershed; eutrophication; human health). JoVE • Algae Enumeration via Culturable Methodology • Detection of Bacteriophages in Environmental Samples • Determining the Solubility Rules of Ionic Compounds • Dissolved Oxygen in Surface Water

		• Introduction to Mass Spectrometry • Isolation of Fecal Bacteria from Water Samples by Filtration • Le Châtelier's Principle • Making a Geologic Cross Section • Nutrients in Aquatic Ecosystems • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • Self-report vs. Behavioral Measures of Recycling • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms • Zebrafish Maintenance and Husbandry
INDICATOR / PROFICIENCY LEVEL	6.3.3.	The student will evaluate the interrelationship between humans and land resources (At least - wetlands; soil conservation; mining; solid waste management; land use planning; human health). JoVE • Analysis of Earthworm Populations in Soil • Biofuels: Producing Ethanol from Cellulosic Material • Carbon and Nitrogen Analysis of Environmental Samples • Community DNA Extraction from Bacterial Colonies • Culturing and Enumerating Bacteria from Soil Samples • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Determination of Moisture Content in Soil • Gram Staining of Bacteria from Environmental Sources • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • Self-report vs. Behavioral Measures of Recycling • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy
INDICATOR / PROFICIENCY LEVEL	6.3.4.	The student will evaluate the interrelationship between humans and biological resources (At least - food production/agriculture; forest and wildlife resources; species diversity/genetic resources; integrated pest management; human health). 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 Moisture Content in Soil • 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 • Molecular Cloning • Mouse Genotyping • Nutrients in Aquatic Ecosystems • Plasmid Purification • RNAi in C. elegans • Restriction Enzyme Digests • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • 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 • Using GIS to Investigate Urban Forestry • Visualizing Soil Microorganisms via the Contact Slide Assay and Microscopy • Whole-Mount In Situ Hybridization • Zebrafish Breeding and Embryo Handling • Zebrafish Maintenance and Husbandry • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development

INDICATOR / PROFICIENCY LEVEL	**6.3.5.**	**The student will evaluate the interrelationship between humans and energy resources (At least - renewable; nonrenewable; human health).** **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Proton Exchange Membrane Fuel Cells** **• Raman Spectroscopy for Chemical Analysis**
STRAND / TOPIC / STANDARD	**MD.6.**	**Environmental Science: The student will demonstrate the ability to use the scientific skills and processes (Core Learning Goal 1) and major environmental science concepts to understand interrelationships of the natural world and to analyze environmental issues and their solutions.**
TOPIC / INDICATOR	**6.4.**	**The student will develop and apply knowledge and skills gained from an environmental issue investigation to an action project which protects and sustains the environment.**
INDICATOR / PROFICIENCY LEVEL	**6.4.1.**	**Identify an environmental issue and formulate related research questions (Methods of gathering information may include: writing letters; performing a literature search; using the internet; interviewing experts).** **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determining the Mass Percent Composition in an Aqueous Solution** **• Determining the Solubility Rules of Ionic Compounds** **• Dissolved Oxygen in Surface Water** **• Le Châtelier's Principle** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Nutrients in Aquatic Ecosystems** **• Solid-Liquid Extraction** **• Testing For Genetically Modified Foods** **• Turbidity and Total Solids in Surface Water**
INDICATOR / PROFICIENCY LEVEL	**6.4.2.**	**Design and conduct the research (Methods of data collection may include: field or laboratory; questionnaire/opinionnaire).** **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determining the Mass Percent Composition in an Aqueous Solution** **• Determining the Solubility Rules of Ionic Compounds** **• Dissolved Oxygen in Surface Water** **• Le Châtelier's Principle** **• Lead Analysis of Soil Using Atomic Absorption**

		Spectroscopy **• Nutrients in Aquatic Ecosystems** **• Solid-Liquid Extraction** **• Testing For Genetically Modified Foods** **• Turbidity and Total Solids in Surface Water**
INDICATOR / PROFICIENCY LEVEL	**6.4.3.**	**Interpret the findings to draw conclusions and make recommendations to help resolve the issue.** **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determining the Mass Percent Composition in an Aqueous Solution** **• Determining the Solubility Rules of Ionic Compounds** **• Dissolved Oxygen in Surface Water** **• Le Châtelier's Principle** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Nutrients in Aquatic Ecosystems** **• Solid-Liquid Extraction** **• Testing For Genetically Modified Foods** **• Turbidity and Total Solids in Surface Water**
INDICATOR / PROFICIENCY LEVEL	**6.4.4.**	**Apply the conclusions to develop and implement an action project (Methods of implementation may include: physical action; persuasion; consumer action; political action).** **JoVE** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Electrophoretic Mobility Shift Assay (EMSA)** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Self-report vs. Behavioral Measures of Recycling**
INDICATOR / PROFICIENCY LEVEL	**6.4.5.**	**Analyze the effectiveness of the action project in terms of achieving the desired outcomes.** **JoVE** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Electrophoretic Mobility Shift Assay (EMSA)** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Self-report vs. Behavioral Measures of Recycling**

Grade: **9** - Adopted: **2011**

STRAND / TOPIC / STANDARD	**MD.RST.**	**Reading Standards for Literacy in Science and Technical Subjects**
TOPIC / INDICATOR		**Craft and Structure**
INDICATOR / PROFICIENCY LEVEL	**RST4.CCR.**	**Anchor Standard: Interpret words and phrases as they are used in a text, including determining technical,**

		connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
OBJECTIVE	**RST.9-10.4.**	**Determine the meaning of symbols, key terms, and other domain specific-words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.** **<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 / TOPIC / STANDARD	**MD.RST.**	**Reading Standards for Literacy in Science and Technical Subjects**
TOPIC / INDICATOR		**Craft and Structure**
INDICATOR / PROFICIENCY LEVEL	**RST5.CCR.**	**Anchor Standard: Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.**
OBJECTIVE	**RST.9-10.5.**	**Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, frictions, reaction force, energy).**

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		• 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 / TOPIC / STANDARD	**MD.RST.**	**Reading Standards for Literacy in Science and Technical Subjects**
TOPIC / INDICATOR		**Integration of Knowledge and Ideas**
INDICATOR / PROFICIENCY LEVEL	**RST7.CCR.**	**Anchor Standard: Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.**
OBJECTIVE	**RST.9-10.7.**	**Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or a 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 / TOPIC / STANDARD	**MD.WHST.**	**Writing Standards for Literacy in Science and Technical Subjects**
TOPIC / INDICATOR		**Text Types and Purposes**
INDICATOR / PROFICIENCY LEVEL	**WHST1.CCR.**	**Anchor Standard: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.**
OBJECTIVE	**WHST.9-10.1.**	**Write arguments focused on discipline-specific content.**
EXPECTATION	**WHST.9-10.1a.**	**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 / TOPIC / STANDARD	**MD.WHST.**	**Writing Standards for Literacy in Science and Technical Subjects**
TOPIC / INDICATOR		**Text Types and Purposes**
INDICATOR / PROFICIENCY LEVEL	**WHST2.CCR.**	**Anchor Standard: Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.**
OBJECTIVE	**WHST.9-10.2.**	**Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.**
EXPECTATION	**WHST.9-10.2d.**	**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