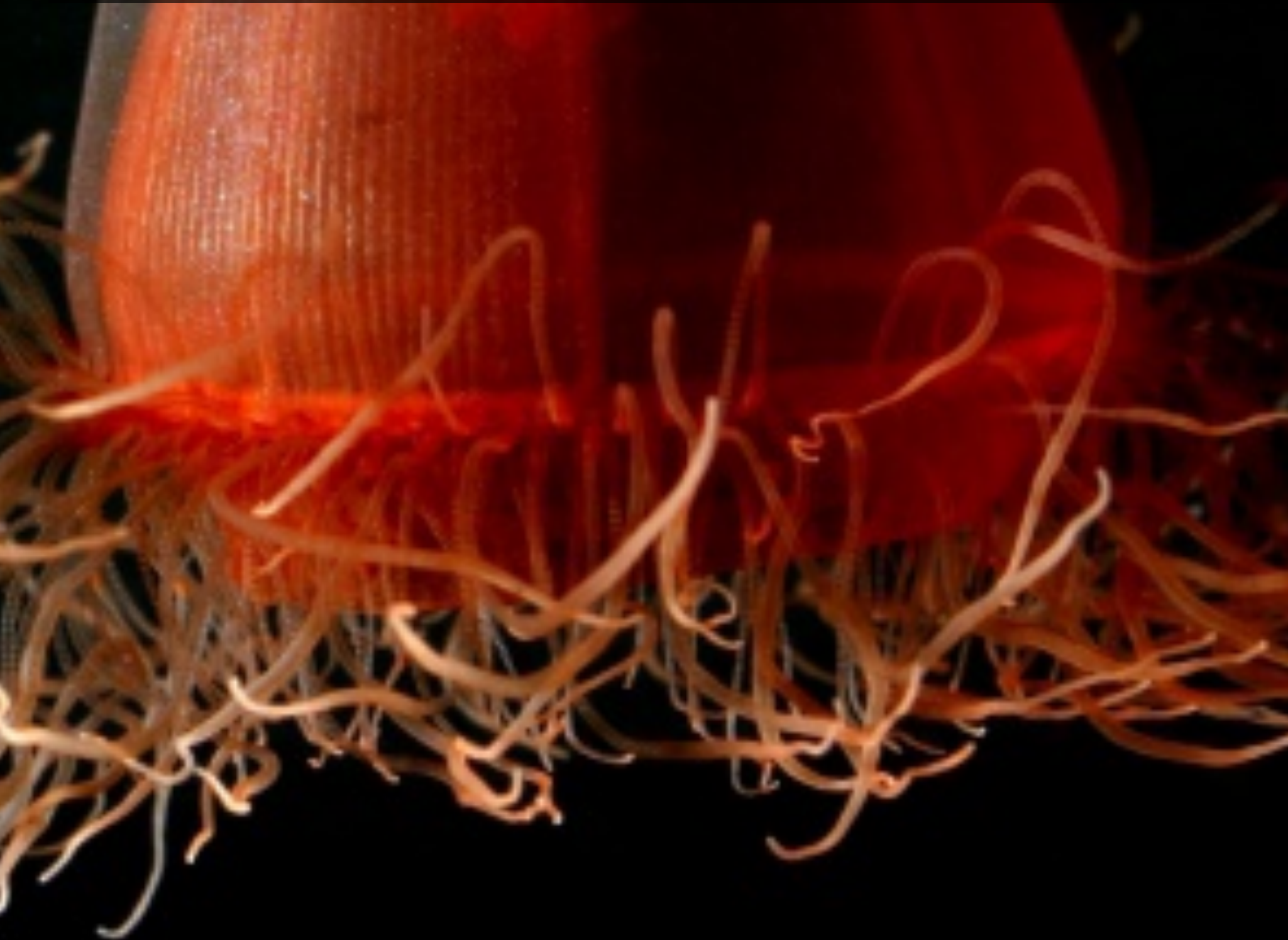


**HIGH SCHOOL
BIOLOGY HONORS
FOR THE STUDENTS OF
DR. LAURA LOWDER EDUCATIONAL
CONSULTING**



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COURSE DESCRIPTION

This course is designed and developed to be taught at the high school honors level. The course is intended to span an academic year and equates to a full high school biology credit with lab. This course will prepare students for advanced placement biology (AP) as well as for future studies of life science at the collegiate level.

Scholars will engage in three core units of study; evolution, genetics and heredity, and ecosystems. The core curriculum has been developed by a collaboration between a team of researchers from the University of Colorado Boulder and Northwestern University and a team of teachers from the Denver Public School System. All of the performance expectations for high school biology in the Next Generation Science Standards (NGSS) are addressed within this three unit curriculum.

The pedagogical basis for the units of study is inquiry-based, with a sequence of lessons focusing on a storyline with a quest for asking and discovering answers to questions, forming models, and synthesizing content to develop an understanding of phenomena. Students engage in all eight of the engineering and science practices to discover and make sense of Disciplinary Core Ideas (DCI) as well as crosscutting concepts and then use this knowledge to solve problems presented. By the end of the course, students will have engaged with all eight of the science and engineering practices.

As an extension of the inquiryHub Biology curriculum, scholars enrolled in Dr. Lowder's biology course will also engage in a series of Project Learning Tree service learning projects; at least two of which focuses on areas of biology; iTree and Biotechnology.

SCOPE AND SEQUENCE

SEPTEMBER

Introduction to the iHub Biology Curriculum

Unit One Evolution: Why don't antibiotics work like they used to?

Bend One: Addie

Lessons 1-8 (approximately 13, 50-minute sessions)

OCTOBER

Unit One Evolution: Why don't antibiotics work like they used to?

Bend One: Addie (continued)

Lessons 9-13 (approximately 10, 50-minute sessions)

Post-Assessment

Add Unit Products to Portfolio

Project Learning Tree Service Learning Project # One: Project iTree Unit
(approximately 5, 50-minute sessions)

Session One-Tree Benefits and Identification

Session Two-Tree Value

Session Three-Land Manager Role Play

Post-Assessment

Add Unit Products to Portfolio

Project Learning Tree Service Learning Project # Two: Exploring Environmental Issues-
Focus on Risk Biotechnology (approximately 5, 50-minute sessions)

Session One-Biotechnology and You

Session Two-Bioremediation

Session Three-Biotechnology and Human Health

Session Four-Forest Biotechnology

Post-Assessment

Add Unit Products to Portfolio

NOVEMBER

Unit Two Genetics and Heredity: How can science help make our lives better?

Bend One: DMD

Lessons 1-9 (approximately 19, 50-minute sessions)

Post-Assessment

Add Unit Products to Portfolio

DECEMBER

Unit Two Genetics and Heredity: How can science help make our lives better?

Bend Two: CRISPR

Lessons 10-15 (approximately 10, 50-minute sessions)

Post-Assessment

Add Unit Products to Portfolio

JANUARY

Unit Three Ecosystems: How do small changes make big impacts on ecosystems?

Bend One: Serengeti

Lessons 1-10 (approximately 16, 50-minute sessions)

Post-Assessment

Add Unit Products to Portfolio

FEBRUARY

Unit Three Ecosystems: How do small changes make big impacts on ecosystems?

Bend Two: Trees; How can trees reduce climate change?

Lessons 11-24 (approximately 25, 50-minute sessions)

Post-Assessment

Add Unit Products to Portfolio

MARCH-MAY

Optional Opportunity to Begin AP Biology as an Individualized Online Course

STANDARDS FOR LEARNING

UNIT ONE: EVOLUTION (INQUIRYHUB)

Performance Expectations:

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-3: Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HS-LS3-1: Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS2-8: Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

PROJECT LEARNING TREE SERVICE LEARNING PROJECT # ONE: ITREE

NEXT GENERATION SCIENCE STANDARDS (NGSS)

Middle and High School

The following topics found in the Next Generation Science Standards are addressed in this Unit.

ESS: Earth and Space Sciences	Teaching with i-Tree Activity
Middle School	
ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	Activity 2–Tree Value Activity 3–Land Manager Role Play
High School	
ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.	Activity 2–Tree Value Activity 3–Land Manager Role Play
ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.	Activity 2–Tree Value Activity 3–Land Manager Role Play
ESS: Life Sciences	Teaching with i-Tree Activity
Middle School	
LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Activity 2–Tree Value Activity 3–Land Manager Role Play
LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.	Activity 2–Tree Value Activity 3–Land Manager Role Play
High School	
LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.	Activity 2–Tree Value Activity 3–Land Manager Role Play
LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.	Activity 2–Tree Value Activity 3–Land Manager Role Play
ETS: Engineering, Technology, and Application of Science	Teaching with i-Tree Activity
Middle School	
ETS1-1. Design the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	Activity 2–Tree Value Activity 3–Land Manager Role Play
ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	Activity 2–Tree Value Activity 3–Land Manager Role Play
ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	Activity 2–Tree Value Activity 3–Land Manager Role Play
High School	
ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	Activity 2–Tree Value Activity 3–Land Manager Role Play
ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	Activity 2–Tree Value Activity 3–Land Manager Role Play
ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.	Activity 2–Tree Value Activity 3–Land Manager Role Play
ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	Activity 2–Tree Value Activity 3–Land Manager Role Play

For more information on the Next Generation Science Standards, visit: <https://www.nextgenscience.org/>

COMMON CORE ENGLISH LANGUAGE ARTS STANDARDS

Grades 6–12

The following Common Core Standards in the Literacy in History/Social Studies, Science, and Technical Subjects are addressed in this Unit.

Reading Standards for Literacy in Science and Technical Subjects (RST)	Teaching with i-Tree Activity
Key Ideas and Details	
RST 3. Cite specific textual evidence to support analysis of science and technical texts.	Activity 2–Tree Value Activity 3–Land Manager Role Play
Craft and Structure	
RST 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.	Activity 2–Tree Value Activity 3–Land Manager Role Play
Integration of Knowledge and Ideas	
RST 7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually.	Activity 2–Tree Value Activity 3–Land Manager Role Play
Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects (WHST)	Teaching with i-Tree Activity
Text Types and Purposes	
WHST 2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Activity 2–Tree Value
Production and Distribution of Writing	
WHST 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	Activity 2–Tree Value
WHST 6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.	Activity 2–Tree Value

For more information on the Common Core Standards, visit: <http://www.corestandards.org/>

PROJECT LEARNING TREE SERVICE LEARNING PROJECT # TWO: EXPLORING ENVIRONMENTAL ISSUES

[Conceptual Framework with standards links](#)

[Unit Description with Skills](#)

UNIT TWO: GENETICS AND HEREDITY (INQUIRYHUB)

Performance Expectations:

HS-LS1-1: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-4: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS3-1: Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2: Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3-3: Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

UNIT THREE: ECOSYSTEMS (INQUIRYHUB)

Performance Expectations:

HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-4: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS1-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1-6: Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon based molecules.

HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.

HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect the carrying capacity of ecosystems at different scales.

HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-3: Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

HS-LS2-4: Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

HS-LS2-5: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

HS-LS2-6: Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS2-8: Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

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INQUIRY HUB

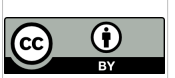
inquiryHub: Research-based Curricula Supporting Next Generation Science

Institute of Cognitive Science

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PROJECT LEARNING TREE

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