



LINCOLN-WOODSTOCK COOPERATIVE SCHOOL DISTRICT

COURSE SYLLABUS

Course Name: Early College/AP Biology

Length: Full Year

Teacher: Dave Webster

Course Description: This college-level course covers the principles of cell biology, including cellular physiology, cellular metabolism, molecular biology, biochemistry, and genetics. Laboratory exercises are designed to reinforce theoretical concepts presented in the lecture portion of the course.

Competencies or Standards Assessed:

Course Learning Objectives:

- CLO 1: Laboratory Safety and Ethics. Internalize and implement rigorous safety protocols with foresight and care, ensuring a secure environment for scientific inquiry.
- CLO 2: Experimental Design and Execution. Accurately execute complex experimental procedures, collect high-fidelity data, and perform comprehensive qualitative and quantitative analyses. (AP Bio SP 3)
- CLO 3: Technical Proficiency. Demonstrate mastery of fundamental cellular biology techniques, including the proper calibration, use, and maintenance of compound light microscopes.
- CLO 4: Data Interpretation and Modeling. Analyze generated scientific data to draw evidence-based conclusions, utilizing statistical tests where appropriate to validate findings. (NGSS HS-LS1-3)
- CLO 5: Professional Communication. Maintain a high standard of academic literacy by consistently applying correct grammar, syntax, and paragraph structure in all technical reports.
- CLO 6: Scientific Lexicon. Demonstrate fluency in biological terminology, applying course vocabulary accurately in oral discourse and written documentation.
- CLO 7: The Scientific Method. Articulate the iterative nature of the scientific method, from hypothesis generation to the refinement of theoretical models. (AP Bio SP 1)
- CLO 8: Biology in Society. Evaluate the intersection of biological science and societal issues, including ethical, environmental, and technological implications.

II. Core Biological Domains and Standards Alignment

The following content-specific competencies are required for mastery of the course:

Competency	Learning Objective	NGSS / AP Biology Standards
Cellular Structure & Function	Describe the specialized structures of the cell and how their specific organization supports essential life functions.	HS-LS1-2; AP Bio ENE-2

Biochemistry & Metabolism	Analyze the chemical processes of life, including enzyme catalysis and the metabolic pathways of cellular respiration (Krebs Cycle) and photosynthesis.	HS-LS1-5, HS-LS1-7; AP Bio ENE-3
Cellular Life Cycles	Explain the mechanisms of cellular reproduction, including the regulation and phases of mitosis and meiosis.	HS-LS1-4; AP Bio IST-1
Molecular Genetics	Demonstrate an understanding of the molecular basis of inheritance, including DNA replication, protein synthesis, and gene expression.	HS-LS1-1; AP Bio IST-2
Heredity & Regulation	Apply Mendelian and non-Mendelian principles to predict inheritance patterns and analyze the regulation of gene expression.	HS-LS 3-3; AP Bio IST-4

Mastery Requirement

Each competency is satisfied by the student's ability to routinely perform the associated action correctly and appropriately. Mastery is demonstrated through a combination of evidence-based laboratory reports, computational data analysis, and conceptual assessments.

Anchor Texts or Major Curriculum:
 All content will be accessed and delivered in the Google Classroom course utilizing the following: OER Textbook: <https://openstax.org/books/biology-ap-courses/>,
 Investigating Biology Lab Manual, 11th edition
 Routine access to Google Classroom

Course Outline (major units of study):	Essential Question or Overarching Understanding
Unit 1: First Week Introduction (summer assignment, 2 weeks)	
Big Idea & Enduring Understandings	Big Idea 1, 2, 4 EU 1C – Life continues to evolve within a changing environment EU 2C – organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis EU 4A – Interactions with biological systems lead to complex properties EU 4C – Naturally occurring diversity among and between components within biological systems affects interactions with the environment <i>Big Idea 1 is tied to Big Idea 4 in this introductory unit: the complexity of life, properties of living organisms, and how evolution is the unifying theory of biology.</i>
Overview of Lecture and Discussion Topics	- Scientific method and experimental design: Explain what is meant by scientific theory - Practice with data collection, analysis, and presentation - Address problems in research, such as confirmation bias - Emphasis on evidence collecting, why evolution is considered a unifying theory - Address the complexity of interactions within biological systems and between organisms and their environment



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	• Characteristics of life • Emphasis on maintaining homeostasis and the basics of feedback loops
Activities	1. Design and conduct an experiment, create and revise hypotheses, organize data, and present findings {SP} 2. Lead class discussion on experimental design by explaining the design process and identifying controls and variables 3. Read and learn to annotate scientific articles 4. Summarize and discuss the effects of maintaining homeostasis within biological systems and the effects of the environment on that organism through reading and annotating scientific articles. *Learning objective 2.16: The student can connect how organisms use negative feedback to maintain their internal environments.

Unit 2: Biochemistry and energy (4 weeks) [CR2]	Essential Question or Overarching Understanding
Big Idea & Enduring Understandings	Big Idea 2 (and 1 & 4) EU 2A – Growth, reproduction, and maintenance of the organization of living systems require free energy and matter EU 2D – Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment EU 1D – The origin of living systems is explained by natural processes. EU 4A – Interactions within biological systems lead to complex properties. <i>Big Idea 2 is addressed in this unit and tied to Big Idea 1 about the diversity of life.</i> <i>Big Idea 2 is tied to Big Idea 4 in showing how complex processes maintain homeostasis, especially through the enzyme lab and case study</i>
Overview of Lecture and Discussion Topics	• Identify basic elements of living organisms • Distinguish between inorganic and organic compounds • Describe water's unique properties • Describe the structure of organic compounds • Understand the pH scale, redox reactions, and hydrolysis/condensation. Apply the laws of thermodynamics to biological systems • Explain how life maintains a high degree of organization. Apply concepts of homeostasis • Investigate enzyme structure and function
Activities	1. Connecting chemistry to biology 2. Properties of Water: video clip and "Popcorn Water" case study-analyze the effect of water, salt, and sugar levels on health of environment and humans 3. Macromolecule poster and presentation: students are assigned a macromolecule, conduct research, become an expert, and teach that molecule to the other 3 people in their group. Students must quantitatively represent the molecules, their building blocks, and their use in living organisms. 4. Learning objective 4.2: The student can refine representations and models to explain how the subcomponents of a biological polymer and their sequence determine the properties of that polymer.

	- Macromolecule concept map. - Learning objective 2.9: The student can represent graphically or model quantitatively the exchange of molecules between an organism and its environment, and the subsequent use of these molecules to build new molecules that facilitate dynamic homeostasis, growth, and reproduction. - Enzyme Lab: Conduct an experiment to determine the optimal pH and temperature of the enzyme catalase - Cell Energy activity: cut and manipulate an organic molecule to show the ATP, ADP cycle
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Unit 3: Cellular Processes (5 weeks)	Essential Question or Overarching Understanding
Big Idea & Enduring Understandings	Big Idea 2 and 1, 4 EU 2B – Growth, reproduction, and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environment EU 2C – organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis EU 2D – Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment EU 2E – Many biological processes involved in growth, reproduction, and dynamic homeostasis include temporal regulation and coordination. EU 1B – Organisms are linked by lines of descent from common ancestry EU 1C – Life continues to evolve within a changing environment EU 1D – The origin of living systems is explained by natural processes EU 4C – Naturally occurring diversity among and between components within biological systems affects interactions with the environment <i>Big ideas 4 and 2 are connected through the case study and cell plasmolysis lab, as regulation of homeostasis is studied during the interaction of cells with the environment.</i>
Overview of Lecture and Discussion Topics	- Review basic cellular components, construct models comparing differences between prokaryotic, eukaryotic, animal, and plant cells - Explain the concept of a selectively permeable membrane as it applies to the cell membrane, and distinguish between active and passive transport - Understand methods of cell-to-cell connection and communication. - Understand the process by which the cell theory was developed - Understand the Endosymbiosis theory and its connection to evolution. - illustrate how transport is used to maintain an internal environment - Understand the role of photosynthesis and cellular respiration in maintaining homeostasis.
Activities	- Create cell models using a story and pictures. - Discussion of the Endosymbiosis Theory, which includes an article annotation and summary. - Diagram method of cell-to-cell interaction - Cells and Plasmolysis Lab: Comparing Plant and Animal Cells, viewing effects of changing the environment on maintaining homeostasis [CR 6] - Diffusion and Osmosis Lab [CR6] - Case Study: Osmosis is Serious Business: Predict the cause of real-life crop production problems and hospital deaths due to imbalances in homeostasis. Students must use the provided data to solve the “case” by figuring out how homeostasis was disrupted and why that caused cell death. [CR4b] [CR5]



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	6. Learning objective 2.12: The student can use representations and models to analyze situations or solve problems qualitatively and quantitatively to investigate whether dynamic homeostasis is maintained by the active movement of molecules across membranes. 7. Light intensity and wavelength simulation: online simulation of how the rate of photosynthesis is affected 8. Photosynthesis Lab [CR6] 9. Cellular Respiration Lab [CR6] - also connects Big Idea 2 to Big Idea 4 [CR3B] and [CR3D]
Unit 4: Cell Cycle and Communication (5 weeks)	Essential Question or Overarching Understanding
Big Idea & Enduring Understandings	Big Idea 3 and 2 EU 3A – Heritable information provides for the continuity of life EU 3B – Expression of genetic information involves cellular and molecular mechanisms EU 3C – The processing of genetic information is imperfect and is a source of genetic variation EU 2D – Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment EU 2E – Many biological processes involved in growth, reproduction, and dynamic homeostasis include temporal regulation and coordination. EU 1D – The origin of living systems is explained by natural processes <i>Big Idea 3 is tied to 2 as genetic information, and the regulation of that information is tied to dynamic homeostasis and feedback mechanisms to maintain and use that information.</i>
Overview of Lecture and Discussion Topics	• Mitosis and Meiosis, and the Cell Cycle • What is cancer? • Mendelian genetics (Law of Segregation, Independent Assortment, Dominance) • Mathematical predictions (Punnett squares) and Chi-Square Analysis • Chromosomal Patterns of Inheritance (sex linkage) • Human Genetic Disorders
Activities	1. Modeling of the cell cycle 2. Cancer and HeLa cells article and discussion: understanding cancer, its development and regulation, as well as research and ethical issues surrounding it. 3. Mitosis, Cancer, and Karyotype Lab: Microscope observations of mitosis and meiosis, identifying chromosome disorders in karyotypes. 4. Genetic Disorders Presentation * Learning Objective 3.13: The student can pose questions about ethical, social, or medical issues surrounding human genetic disorders. 5. Practice genetic problems. 6. M&M activity: into Chi-Squared 7. Fruit Fly Genetics Lab.
Unit 5: Genetics and Gene Activity (5 weeks)	Essential Question or Overarching Understanding

Big Idea & Enduring Understandings	Big Idea 1, 2, 3, and 4 EU 1A – Change in the genetic makeup of a population over time is evolution. EU 1C – Life continues to evolve within a changing environment EU 2C – Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis. EU 3A – Heritable information provides for the continuity of life EU 3B – Expression of genetic information involves cellular and molecular mechanisms EU 3C – The processing of genetic information is imperfect and is a source of genetic variation EU 3D – Cells communicate by generating, transmitting, and receiving chemical signals EU 3E – Transmission of information results in changes within and between biological systems EU 4A Interactions within biological systems lead to complex properties. <i>Big Idea 3 is connected to 2c through the investigation of try and lab operons and how these feedback mechanisms are involved in gene regulation and expression.</i> <i>Big Idea 1c is linked to 3 using the “infectious cure” case study and the bacterial transformation lab: connecting the idea of retroviruses and bacterial evolution with certain environments to how that can affect gene transition and expression.</i>
Overview of Lecture and Discussion Topics	• DNA is the genetic material (historical experiments, DNA structure and function, DNA replication) • Flow of genetic information (genetic code, role of other polymers, transcription, translation) • Mutations • Gene expression (operon systems in prokaryotes, eukaryotic gene expression) • Cell signaling with regulation of gene expression and epigenetics • Restriction enzymes, plasmids, and transformation • DNA technology (how gel electrophoresis works and applications of this technology). • Biotechnology: stem cells, synthetic biology, genetically modified foods. • Virus and bacterial interactions
Activities	1. DNA Concept Map. 2. GATTACA activity: DNA Modeling, showing transcription and translation. Starting with a raw DNA sequence of a gene, students will transcribe and translate the DNA into an amino acid that they will identify with given traits. 3. Learning Objective 3.1 The student can construct scientific explanations that use the structures and mechanisms of DNA and RNA to support the claim that DNA and, in some cases, RNA, are the primary sources of heritable information. 4. lac/ tryp operon diagram and coloring. 5. Restriction Enzymes & Gel Electrophoresis 6. Bacterial Transformation Lab - <i>also ties Big Idea 3 to Big Idea 1</i> 7. discussions on biotechnology and bioethics, student-led discussions * Learning objective 1.3: The student can apply mathematical methods to data from a real or simulated population to predict what will happen to the population in the future.



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Unit 6: Evolution (6 weeks)	Essential Question or Overarching Understanding
Big Idea & Enduring Understandings	Big Idea 1, 3, 4 EU 1A – Change in the genetic makeup of a population over time is evolution EU 1B – Organisms are linked by lines of descent from common ancestry EU 1C – Life continues to evolve within a changing environment EU 1D – The origin of living systems is explained by natural processes. EU 3A – Heritable information provides for the continuity of life. EU 3C – The processing of genetic information is imperfect and is a source of genetic variation. EU 4C – Naturally occurring diversity among and between components within biological systems affects interactions with the environment <i>Big Idea 1 is tied to 4, as the interactions of systems with the environment are tied to the changing genetic makeup of a population over time.</i>
Overview of Lecture and Discussion Topics	• How natural selection serves as a mechanism for evolution • Scientific evidence supporting evolution • Hardy-Weinberg equilibrium • Origin of Life; Fossil Records, Concepts of Speciation • Current events in evolution, resistance to antibiotics, pesticides, and artificial selection • Cladogram and basic phylogeny
Activities	1. Hardy-Weinberg activity and problem set - this also ties Big Idea 1, 2. How to make a cladogram online information and practice: http://evolution.berkeley.edu/evolibrary/article/evo_ 3. Cladogram and BLAST lab * Learning objective 1.5: The student can connect evolutionary changes in a population over time to a change in the environment.

Unit 7: Plant Diversity and Ecology (4 weeks)	Essential Question or Overarching Understanding
Big Idea & Enduring Understandings	Big Idea 1, 2, 3, & 4 EU 1B – Organisms are linked by lines of descent from common ancestry EU 1C – Life continues to evolve within a changing environment EU 2E – many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination EU 3E – Transmission of information results in changes within and between biological systems EU 4A – Interactions with biological systems lead to complex properties EU 4B – Competition and cooperation are important aspects of biological systems EU 4C – Naturally occurring diversity among and between components within biological systems affects interactions with the environment <i>Big Idea 4 is connected to Big Ideas 2 and 1 as students study the effect of environmental changes and natural selection on biodiversity and how organism is affected by such changes.</i>
Overview of Lecture and Discussion Topics	• Plant Diversity and Phylogeny

	• Species diversity. Composition and regulation of growth, Transpiration, and plant feedback control loops • Regulation and Plant Hormones • Biodiversity and Sustainability • Human Activities that threaten biodiversity [CR5] • Population growth models • Primary productivity with Energy flow and chemical cycling
Activities	1. Mapping of plant phylogeny, creating a phylogenetic tree 2. Transpiration Lab: measuring change in plant mass in different environments over time also connects Big Idea 2 to Big Idea 4 3. Plant diversity lab: applying understanding of plant reproduction and phylogeny with real plant samples, while identifying adaptations and predicting interactions and other reasons for natural selection. <i>- This again ties big idea 4 with 1, as competition and biological interactions are investigated, looking at how these changes cause life to continue to evolve [CR3d]</i> 4. Plant Hormone and Tropism WebQuest: students investigate plant hormonal regulation and its real-life applications through a series of online resources and videos <i>This ties big idea 4 with while looking at the temporal and hormonal regulation of plants and how that helps regulate biological systems</i>

Unit 8: Biological Systems- Organism Form and Function	Essential Question or Overarching Understanding
Big Idea & Enduring Understandings	Big Idea 4, 1, 2, 3 EU 1. B – Organisms are linked by lines of descent from common ancestry. EU 2. A – Growth, reproduction, and maintenance of the organization of living systems require free energy and matter. EU 2C – organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis EU 2D – Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment EU 2E – Many biological processes involved in growth, reproduction, and dynamic homeostasis include temporal regulation and coordination. EU 3E – Transmission of information results in changes within and between biological systems EU 4A – Interactions with biological systems lead to complex properties EU 4B – Competition and cooperation are important aspects of biological systems <i>Big Idea 1 is tied to Big Idea 4 as comparative anatomy emphasizes the relationships between organisms and similarities that imply common descent, as well as differences due to adaptations to different environments.</i>
Overview of Lecture and Discussion Topics	• Feedback control loops in animals • Nervous System • Immune System and Immunology • Vaccines & Antibiotics • Social Issues in Disease Transmission • Advances in medicine, bioethical discussion • Structure and function in body systems • Comparative anatomy
Activities	1. Diagramming a feedback loop in the nervous system



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| 2. HIV and Immunology, how to find a cure for a rapidly evolving virus - ties <i>Big Idea 1</i> to <i>Big Idea 4</i> [CR3d] and [CR3a] |
| 3. Lab Bench Virtual Lab: Circulatory Physiology |

Portrait of a Learner

Independent Learner

I make thoughtful plans and do my best to reach personal goals using feedback to work through challenges.

Responsible Collaborator

I work with others to achieve shared goals by listening actively, contributing ideas, and managing conflict.

Critical Thinker

I analyze information, ask thoughtful questions, and apply reasoning skills to solve problems and make decisions.

Effective Communicator

I express ideas clearly, adapting strategies based on the audience, setting, and/or purpose.

Global Citizen

I show that I care and take responsibility by helping in my community and the world around me.

Late Work Policy: Adherence to the established course schedule is mandatory. Due to the accelerated pace of the curriculum, timely completion of all assignments is essential for maintaining academic standing and ensuring mastery of sequential concepts.

- Late Work and Credit
- Submission Deadlines: To be eligible for maximum point allocation, all assignments must be submitted by the specified date and time.
- Impact of Delays: Submissions received after the deadline may be subject to grade depreciation or may not be accepted, depending on the specific criteria outlined in the course grading rubric.
- Attendance and Responsibility
- Absenteeism: In the event of an absence, the student retains full responsibility for the acquisition of missed instructional materials.
- Peer Collaboration: Students are expected to coordinate with classmates to obtain lecture notes, handouts, and primary information regarding missed classroom discourse.
- Instructional Continuity: Missing a session does not exempt a student from upcoming deadlines or the responsibility to remain current with the course progression.

Note: Students are encouraged to develop a contingency plan for information retrieval early in the semester to mitigate the risks associated with unforeseen absences.

Academic Integrity, Cheating, and Plagiarism

Honesty is expected of all LRCC students. In academic matters this includes the submission of work that clearly indicates its sources. Dishonest acts include cheating and plagiarism, as well as other forms of academic misconduct.

- Cheating is defined as copying or otherwise using material from others, or using sources not approved by faculty.
- Plagiarism is defined as using the work (ideas, words, artwork, etc.) of another person as one's own. The failure to cite sources or the extensive use of others' work in written material are the most common types of plagiarism.

Cheating, plagiarism, and other forms of academic misconduct are considered serious disciplinary matters and are subject to the same penalties and procedures as other LW disciplinary matters. Students should be aware that penalties levied in substantiated cases of cheating or plagiarism may include, but are not limited to, the issuance of a grade of F, which may in turn lead to delay of graduation. Repeated offenses may lead to dismissal from a program or from the college. Refer to the Academic Honesty Policy in the Student Handbook.

- Electronics in the Classroom: New Hampshire state law (HB2/SB 206) mandates a "bell-to-bell" ban on the use of personal cell phones and electronic devices in all public and chartered schools.
- Unsafe lab practices will cause your dismissal from that day's lab exercise, and you will not be allowed to make up the missed work.
- Check your student email and Google Classroom frequently! Updates, schedule changes, and other important announcements will be posted on Google Classroom and sometimes emailed. It is your responsibility to stay current with any announcements or changes posted.

HELPFUL HINTS

- Don't Panic: Physics is a journey of problem-solving. Stay calm and take it one step at a time.
- Find Your Tribe: Join a study group immediately. They are your most valuable resource. If your current group isn't clicking or stays off-task, don't hesitate to find a new one that better supports your learning.
- The "Pre-Game" Strategy: Always pre-read the textbook and lab manual before you walk into class. Lectures are designed to reinforce and clarify what you've already encountered, not to introduce it for the very first time.



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- Mindset Matters: Maintain a positive outlook. Physics can be challenging, but don't let negative self-talk stall your progress.
- Open Communication: If you're struggling or need a different explanation, tell me! I can only adapt to your learning style if I know what you need.
- Teach to Learn: The best way to master a concept is to explain it to someone else. Teach your classmates, or go home and explain a concept to your friends and family.
- Maximize Your Textbook: * Focus on the summaries at the beginning and end of chapters.
 - Analyze the diagrams and visuals—physics is a highly visual science!
 - Remember: Anything in the assigned reading is "fair game" for exams, even if we didn't cover it in detail during class.

I reserve the right to change these policies if necessary, given unexpected or unusual circumstances – please see Google Classroom for announcements of changes and posted revisions