

Advanced Placement (AP) Biology Course Information

Instructor: Mr. Collea B.S. Biology, Ed.M. Ed. Tech.

Office Location: Room W-20

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Class Website: colleascorner.weebly.com

Google Classroom: TBD

I. Course Description:

This year-long study of biology is an introductory biology taken by biology majors during their first year of college. **WELCOME TO COLLEGE!** The course is structured around the *enduring understandings* within **four big ideas** in biology, and will provide a basis for students to develop a deep conceptual understanding as well as opportunities to integrate biological knowledge and science practices through inquiry-based activities and laboratory investigations.

After the successful completion of this course, students may receive college credit with a qualifying score on the AP exam.

(Note: Not all colleges accept the same exam scores, please check with your future college choices to ensure credit).

AP Biology is historically a challenging and difficult class, but with effort and dedication, many students do well. There are many resources available to help you and students using them often succeed. I am committed to helping you be as successful as you choose to be, so please do not hesitate to come in or contact me for any questions, concerns or assistance.

II. Course Content:

AP Biology is structured around four big ideas, the enduring understandings within the big ideas and the essential knowledge within the enduring understandings.

The Big Ideas:

Big Idea 1: *The process of evolution drives the diversity and unity of life.*

Big Idea 2: *Biological systems use energy and molecular building blocks to grow, to reproduce and to maintain homeostasis.*

Big Idea 3: *Living systems store, retrieve, transmit and respond to information essential to life processes.*

Big Idea 4: *Biological systems interact, and these systems and their interactions possess complex properties.*

III. Laboratory Component:

Students will be given the opportunity to engage in student-directed laboratory investigations throughout the course for a minimum of 25% of instructional time. Students will conduct a minimum of 4 inquiry-based investigations (*one per quarter...hopefully*). Additional labs and activities will be conducted to deepen students' conceptual understanding and to reinforce the application of science practices within a hands-on, discovery-based environment. Students will be given the opportunity to develop, record and communicate the results of their laboratory investigations via many ways including, but not limited to, formal laboratory reports.

A. Science Practices (SP) in AP Biology:

- SP1: Concept Explanation:** The student can use representations and models to explain biological concepts and processes.
- SP2: Visual Representations:** The student can analyze visual representations of biological concepts and processes.
- SP3: Questions and Methods:** The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.
- SP4: Representing and Describing Data:** The student can plan and implement data collection strategies appropriate to a particular scientific question and present the data appropriately.
- SP5: Statistical Tests and Data Analysis:** The student can perform statistical tests and mathematical calculations to analyze and interpret data.
- SP6: Argumentation:** The student can develop and justify scientific arguments using evidence.

The descriptions below summarize some of the major investigations we will do this year. Additional prescribed activities supplement the student inquiry.

Big Idea 1: Evolution

Hardy Weinberg: Students investigate factors affecting Hardy Weinberg Equilibrium.

Artificial Selection: Students will cross plants and/or breed organisms to select for specific traits.

Big Idea 2: Cellular Processes

Enzyme Investigation: Students will investigate factors that affect enzyme action.

Cellular Respiration: Students investigate some aspect of cellular respiration in organisms.

Photosynthesis: Students investigate photosynthetic rate under a variety of student selected conditions.

Diffusion/Osmosis: Students investigate diffusion and osmosis in model systems and in plant tissue.

Big Idea 3: Genetics and Information Transfer

Cell Division: Mitosis and Meiosis

Restriction Enzyme Analysis: Students investigate restriction enzyme analysis using gel electrophoresis.

Big Idea 4: Ecology

Energy Dynamics: Students analyze model systems that describe energy flow.

Animal Behavior: Students investigate animal response(s) to various stimuli.

Transpiration: Students investigate the movement of water through plants.

Population Sampling: Students estimate the size of various populations of organisms.

IV. Course Information:

Texts: BIOLOGY by Campbell and Reece, 6th Edition, ISBN 0-8053-6624-5

Review Book: TBD

Class Resources: www.colleascorner.weebly.com / Google Classroom

Evaluation:

Students are tested at the end of every unit with various types of homework quizzes in between. These quizzes mostly consist of multiple-choice questions included in their student study guides. Tests will mirror the AP exam and consist of multiple choice/short answer/lab-based questions and free response questions.

First Quarter		Second Quarter		Third Quarter		Fourth Quarter	
Tests	50%	Tests	60%	Tests	70%	Tests/Project	80%
Quizzes	20%	Quizzes	15%	Quizzes	10%	Quizzes/Labs	10%
Labs	20%	Labs	15%	Labs	10%	Participation	20%
Participation	10%	Participation	10%	Participation	10%		
<i>Father McShane Method of Class Participation</i>							

Attendance:

Class attendance and participation is essential for success and is worth 10% of your grade. It is your responsibility to check Collea's Corner and to clarify missed assignments with classmates or with me prior to the next class. No credit will be given for work missed due to an unexcused absence. All excused absence work, including labs, must be made up within the time frame of that unit of study. Requests for exceptions to these policies must be discussed with me in advance.

Assignments:

Doing the Interactive Learning Guides assigned for each class **BEFORE** coming to class is necessary to benefit from what we do in class and will make up part of your class participation grade. These guides will accompany the content in your Campbell Biology textbook and will be available for download on my course website. Students will be assigned homework in their Interactive Learning Guides on a daily basis along with other assignments including, in-class activities, lab exercises and reports, quizzes, and exams (*take-home and in-class*). Student expectations are high for this course. You should plan to work on AP Biology a **MINIMUM of 1.0 hour EVERY NIGHT** (*including weekends*). We will cover a maximum 2 chapters per week and will have multiple choice/short answer/FRQ exams that follow the same format as the actual AP exam you will be taking on May 15th, 2025. A midterm exam will be given before the end of the 2nd marking period and a final exam will be given right after all AP exams are done. The average of both exams will constitute your final exam grade for the course.

**No credit will be given for late work unless it was discussed in advance
or
due to unforeseen, extenuating circumstances.**

North Salem University AP Biology Honor Code:

Students are to submit only their own work for evaluation except when working with your lab partner on a lab report or with your fellow classmates on FRQ outlines. While conducting an experiment, the sharing of data is expected, however you must organize, analyze and come to conclusions based upon the data on your own. Asking a fellow classmate what they got for an answer on a multiple-choice study guide question is not “*working together*” it’s cheating. If this is ever observed homework quizzes will stop counting for a grade. The use of cell phones for cheating purposes is rampant and will NOT be tolerated. In fact, cell phone use is strictly prohibited during class and all phones should be turned off and placed in the cubby located in the back of the room prior to the start of class. Students who fail to comply with the North Salem University AP Biology Honor Code will be subject to disciplinary action. Plagiarism and cheating will not be tolerated and may lead to a zero on an assignment, a discipline referral to Dr. Murphy and even loss of credit or removal for the class.

Classroom Rules:

1. Turn off and store all personal electronic devices in your designated cubby **prior to the start of class.**
2. All policies set forth in the Student Handbook must be adhered to.
3. Safety is a primary concern and all students must comply with the Laboratory Safety Contract which will be reviewed the first days of school.
4. Come to class with an open mind and willingness to work hard.

Social and Ethical Concerns:

It is important that you connect your classroom knowledge to socially important issues. The course will allow you to learn about and discuss many such issues in a variety of formats. After the AP exam in May, you will be required to complete a bioethics research report and presentation focusing on a major controversial bioethical/social issue and/or use/misuse of science and technology in the 21st century. This report will constitute a large portion of your 4th quarter grade.

*“You have brains in your head.
You have feet in your shoes.
You can steer yourself
any direction you choose.
- Dr. Seuss*

AP Biology Exam Format

The AP Biology Exam is approximately 3 hours in length. There are two sections:

Section I: Multiple Choice

60 Questions | 1 hour 30 Minutes | 50% of Exam Score

Section II: Free Response

6 Questions | 1 hour 30 Minutes | 50% of Exam Score

There are 2 long questions and 4 short questions.

Long questions are worth 8–10 points each; short questions are worth 4 points each.

The long questions ask students to:

- Interpret and Evaluate Experimental Results
- Interpret and Evaluate Experimental Results with Graphing

The short-answer questions assess students' understanding of the following:

- Scientific Investigation
- Conceptual Analysis
- Analysis of a Model or Visual Representation
- Data Analysis

You are **NOT** expected to know the answers to **EVERY** question!!!

Task Verbs Used in Free Response Questions

The following **task verbs** are commonly used in the free-response questions:

Calculate: Perform mathematical steps to arrive at a final answer, including algebraic expressions, properly substituted numbers, and correct labeling of units and significant figures.

Construct/Draw: Create a diagram, graph, representation, or model that illustrates or explains relationships or phenomena. Labels may or may not be required.

Describe: Provide relevant characteristics of a specified topic.

Determine: Decide or conclude after reasoning, observation, or applying mathematical routines (calculations).

Evaluate: Judge or determine the significance or importance of information, or the quality or accuracy of a claim.

Explain: Provide information about how or why a relationship, process, pattern, position, situation, or outcome occurs, using evidence and/or reasoning to support or qualify a claim. Explain "how" typically requires analyzing the relationship, process, pattern, position, situation, or outcome; whereas explain "why" typically requires analysis of motivations or reasons for the relationship, process, pattern, position, situation, or outcome.

Identify: Indicate or provide information about a specified topic, without elaboration or explanation.

Justify: Provide evidence to support, qualify, or defend a claim, and/or provide reasoning to explain how that evidence supports or qualifies the claim.

Make a claim: Make an assertion that is based on evidence or knowledge.

Predict/Make a prediction: Predict the causes or effects of a change in, or disruption to, one or more components in a relationship, pattern, process, or system.

Represent: Use appropriate graphs, symbols, words, illustrations, and/or tables of numerical values to describe biological concepts, characteristics, and/or relationships.

State (the null/alternative hypothesis): Indicate or provide a hypothesis to support or defend a claim about a scientifically testable question.

Support a claim: Provide reasoning to explain how evidence supports or qualifies a claim.

AP Biology Equations and Formulas

Statistical Analysis and Probability								
Mean			Standard Deviation					
$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$			$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$					
Standard Error of the Mean			Chi-Square					
$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$			$\chi^2 = \sum \frac{(o - e)^2}{e}$					
Chi-Square Table								
<i>p</i> value	Degrees of Freedom							
	1	2	3	4	5	6	7	8
0.05	3.84	5.99	7.81	9.49	11.07	12.59	14.07	15.51
0.01	6.63	9.21	11.34	13.28	15.09	16.81	18.48	20.09
Laws of Probability								
If A and B are mutually exclusive, then:								
$P(A \text{ or } B) = P(A) + P(B)$								
If A and B are independent, then:								
$P(A \text{ and } B) = P(A) \times P(B)$								
Hardy-Weinberg Equations								
$p^2 + 2pq + q^2 = 1$		p = frequency of allele 1 in a population						
$p + q = 1$		q = frequency of allele 2 in a population						
Metric Prefixes								
Factor	Prefix	Symbol						
10^9	giga	G						
10^6	mega	M						
10^3	kilo	k						
10^{-1}	deci	d						
10^{-2}	centi	c						
10^{-3}	milli	m						
10^{-6}	micro	μ						
10^{-9}	nano	n						
10^{-12}	pico	p						
Mode = value that occurs most frequently in a data set								
Median = middle value that separates the greater and lesser halves of a data set								
Mean = sum of all data points divided by number of data points								
Range = value obtained by subtracting the smallest observation (sample minimum) from the greatest (sample maximum)								

Rate and Growth		Water Potential (Ψ)
<p>Rate $\frac{dY}{dt}$</p> <p>Population Growth $\frac{dN}{dt} = B - D$</p> <p>Exponential Growth $\frac{dN}{dt} = r_{\max}N$</p> <p>Logistic Growth $\frac{dN}{dt} = r_{\max}N\left(\frac{K - N}{K}\right)$</p>	<p>dY = amount of change</p> <p>dt = change in time</p> <p>B = birth rate</p> <p>D = death rate</p> <p>N = population size</p> <p>K = carrying capacity</p> <p>r_{\max} = maximum per capita growth rate of population</p>	<p>$\Psi = \Psi_p + \Psi_s$</p> <p>Ψ_p = pressure potential</p> <p>Ψ_s = solute potential</p> <p>The water potential will be equal to the solute potential of a solution in an open container because the pressure potential of the solution in an open container is zero.</p> <p>The Solute Potential of a Solution</p> <p>$\Psi_s = -iCRT$</p> <p>i = ionization constant (1.0 for sucrose because sucrose does not ionize in water)</p> <p>C = molar concentration</p> <p>R = pressure constant ($R = 0.0831$ liter bars/mole K)</p> <p>T = temperature in Kelvin ($^{\circ}\text{C} + 273$)</p>
<p>Simpson's Diversity Index</p> <p>Diversity Index = $1 - \sum\left(\frac{n}{N}\right)^2$</p> <p>$n$ = total number of organisms of a particular species</p> <p>N = total number of organisms of all species</p>		<p>pH = $-\log[\text{H}^+]$</p>

Surface Area and Volume

<p>Surface Area of a Sphere $SA = 4\pi r^2$</p>	<p>Volume of a Sphere $V = \frac{4}{3}\pi r^3$</p>	<p>r = radius</p> <p>l = length</p>
<p>Surface Area of a Rectangular Solid $SA = 2lh + 2lw + 2wh$</p>	<p>Volume of a Rectangular Solid $V = lwh$</p>	<p>h = height</p> <p>w = width</p>
<p>Surface Area of a Cylinder $SA = 2\pi rh + 2\pi r^2$</p>	<p>Volume of a Cylinder $V = \pi r^2 h$</p>	<p>s = length of one side of a cube</p>
<p>Surface Area of a Cube $SA = 6s^2$</p>	<p>Volume of a Cube $V = s^3$</p>	<p>SA = surface area</p> <p>V = volume</p>