Syllabus Development Guide: AP® Biology

The guide contains the following sections and information:

Curricular Requirements	The curricular requirements are the core elements of the course. Your syllabus must provide clear evidence that each requirement is fully addressed in your course.
Scoring Components	Some curricular requirements consist of complex, multipart statements. These particular requirements are broken down into their component parts and restated as "scoring components." Reviewers will look for evidence that each scoring component is included in your course.
Evaluation Guideline	These are the evaluation criteria that describe the level and type of evidence required to satisfy each scoring component.
Key Term(s)	These ensure that certain terms or expressions, within the curricular requirement or scoring component that may have multiple meanings, are clearly defined.
Samples of Evidence For each scoring component, three separate samples of evidence are provided. These statements provide clear descriptions of what acceptable evidence should look like.	

Syllabus Development Guide: AP® Biology

Syllabus Development Guide: AP® Biology

Curricular Requirement 1	Students and teachers use a recently published (within the last 10 years) college-level biology textbook.
Evaluation Guideline	The syllabus **must** cite the title, author, and publication date of a college-level textbook. The primary course textbook must be published within the last 10 years.
Key Term(s)	None at this time.

Samples of Evidence

1. The syllabus cites a textbook from the AP Example Textbook List for biology.

2. The syllabus cites a recently published college-level textbook for a biology major's course.

3. In the resources section of the syllabus, the syllabus cites a college-level textbook used for science majors.

Syllabus Development Guide: AP® Biology

Curricular Requirement 2	The course is structured around the enduring understandings within the big ideas as described in the AP Biology Curriculum Framework.
Evaluation Guideline	The syllabus **must** demonstrate how the course is structured around the enduring understandings in each of the big ideas as described in the Curriculum Framework. While all four big ideas need to be explicit, each of the enduring understandings does not need to be specifically listed.
Key Term(s)	**Big Ideas:** Encompass the core scientific principles, theories, and processes governing living organisms and biological systems. **Enduring Understandings:** Incorporate the core concepts that students should retain from the learning experience.

Samples of Evidence

1. The course planner section of the syllabus illustrates how the course is structured around the big ideas and enduring understandings identified in the Curriculum Framework.

2. The four big ideas are explicitly stated in the introduction of the syllabus, and enduring understandings are used throughout the syllabus as a structure for the course. For example, Big Ideas 1 through 4 are connected to applicable enduring understandings, within each unit of study.

3. The syllabus includes a "big ideas and enduring understandings to be addressed" section at the beginning of each unit within the course schedule.

Syllabus Development Guide: AP® Biology

Curricular Requirement 3	Students have opportunities to connect the AP Biology enduring understandings within each of the AP Biology big ideas to at least one other AP Biology big idea.
Scoring Component 3a	Students connect the enduring understandings within Big Idea 1 (the process of evolution drives the diversity and unity of life) to at least one other big idea.
Evaluation Guideline	The syllabus **must** describe at least one assignment or activity requiring students to connect one enduring understanding within Big Idea 1 to another big idea.
Key Term(s)	None at this time.

Samples of Evidence

1. The syllabus briefly describes how evolution of endothermy allows for radiation of animals into diverse environments. Students do a comparative study of maintenance of homeostasic mechanisms of warm- and cold-blooded animals. This activity connects Big Idea 1 (evolution) and enduring understanding 1.D (natural processes) to Big Idea 2 (cellular processes).

2. The syllabus describes a laboratory experience where students work with a data set that investigates the influence of interactions on the Hardy-Weinberg law of genetic equilibrium. This laboratory experience connects Big Idea 1 (evolution) and enduring understanding 1.A (change over time) to Big Idea 4 (interactions).

3. The syllabus states that students complete a study of sexual and asexual reproduction and write an essay where they compare and contrast reproductive processes and explain how these processes evolved. This study connects Big Idea 1 (evolution) and enduring understanding 1.C (life evolving in a changing environment) to Big Idea 3 (information).

Syllabus Development Guide: AP® Biology

Curricular Requirement 3	Students have opportunities to connect the AP Biology enduring understandings within each of the AP Biology big ideas to at least one other AP Biology big idea.
Scoring Component 3b	Students connect the enduring understandings within Big Idea 2 (biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis) to at least one other big idea.
Evaluation Guideline	The syllabus **must** describe at least one assignment or activity requiring students to connect one enduring understanding within Big Idea 2 to another big idea.
Key Term(s)	None at this time.

Samples of Evidence

1. The syllabus states that regulatory mechanisms are studied at various levels of organization from the molecular to the organismal and the ecosystem level. Students read and discuss Rachel Carson's *Silent Spring,* then research and report on the effects of thalidomide on human development. This study connects Big Idea 2 and enduring understanding 2.C (maintain homeostasis) to Big Idea 4 (interactions).

2. Students create an illustration tracing the path of a carbon atom from the air into a plant during photosynthesis and then follow the journey of the same carbon atom from an ancient dinosaur and into a modern human through food webs (e.g., carbon cycle). This illustration connects Big Idea 2 (cellular processes) and enduring understanding 2.A (free energy and matter) to Big Idea 4 (interactions).

3. Students draw a model of organelles involved in helping a plant obtain a constant input of free energy to illustrate and identify the evidence that mitochondria and chloroplasts evolved from free-living organisms. This activity connects Big Idea 2 (cellular processes) and enduring understanding 2.A (free energy and matter) to Big Idea 1 (evolution).

Syllabus Development Guide: AP® Biology

Curricular Requirement 3	Students have opportunities to connect the AP Biology enduring understandings within each of the AP Biology big ideas to at least one other AP Biology big idea.
Scoring Component 3c	Students connect the enduring understandings within Big Idea 3 (living systems store, retrieve, transmit, and respond to information essential to life processes) to at least one other big idea.
Evaluation Guideline	The syllabus **must** describe at least one assignment or activity requiring students to connect one enduring understanding within Big Idea 3 to another big idea.
Key Term(s)	None at this time.

Samples of Evidence

1. The syllabus includes a comparative study where students investigate altruism among animal populations in preparation for an oral report. This comparative study connects Big Idea 3 (information) and enduring understanding 3.E (information transfer) to Big Idea 4 (interactions) or Big Idea 1 (evolution).

2. The syllabus describes an activity where students analyze the phenotypic changes that result when DNA sequences in organisms are altered by the environment. This activity connects Big Idea 3 (information) and enduring understanding 3.C (genetic variation) to Big Idea 1 (evolution) and Big Idea 4 (interactions).

3. Students review the experimental design or designs leading to the demonstration that DNA is the genetic material for all living organisms on Earth. This experiment review connects Big Idea 3 (information) and enduring understanding 3.A (heritable information) to Big Idea 1 (evolution).

Syllabus Development Guide: AP® Biology

Curricular Requirement 3	Students have opportunities to connect the AP Biology enduring understandings within each of the AP Biology big ideas to at least one other AP Biology big idea.
Scoring Component 3d	Students connect the enduring understandings within Big Idea 4 (biological systems interact and these systems and their interactions possess complex properties) to at least one other big idea.
Evaluation Guideline	The syllabus **must** describe at least one assignment or activity requiring students to connect one enduring understanding within Big Idea 4 to another big idea.
Key Term(s)	None at this time.

Samples of Evidence

1. The syllabus includes a short essay assignment where students identify emerging diseases and compare the effects of the interactions of pathogens and hosts. This assignment connects Big Idea 4 (interactions) and enduring understanding 4.B (competition) to Big Idea 1 (evolution).

2. The syllabus includes a lab activity where students investigate how Taq polymerase is used in polymerase chain reaction (PCR) studies and also allows an organism to survive in an extreme environment. This activity connects Big Idea 4 (interactions) and enduring understanding 4.C (naturally occurring diversity) to Big Idea 2 (cellular processes).

3. The syllabus includes an activity where students develop a model to illustrate how polymers function in various biological processes, and how abiotic factors influence the function of polymeric molecules (e.g., proteins). This activity connects Big Idea 4 (interactions) and enduring understanding 4.A (complex properties) to Big Idea 2 (cellular processes).

Syllabus Development Guide: AP® Biology

Curricular Requirement 4	Students are provided with opportunities to meet the learning objectives in the AP Biology Curriculum Framework within each of the big ideas. These opportunities must occur in addition to those within laboratory investigations.
Scoring Component 4a	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 1.
Evaluation Guideline	The syllabus **must** describe at least one assignment or activity outside of the laboratory investigations designed to meet one learning objective within Big Idea 1.
Key Term(s)	**Learning Objectives:** Provide clear and detailed articulation of what students should know and be able to do.

Samples of Evidence

1. ***Learning Objective 1.27*** *The student is able to describe a scientific hypothesis about the origin of life on Earth.*

   The syllabus includes an activity where the students research recent updates on the RNA World hypothesis and report to the class.

2. ***Learning Objective 1.1*** *The student is able to convert a data set from a table of numbers that reflect a change in the genetic makeup of a population over time and to apply mathematical methods and conceptual understandings to investigate the cause(s) and effect(s) of this change.*

   As preparation for the BLAST lab, students analyze a genetic database that allows them to use modern tools of science and understand a major concept of biology.

3. ***Learning Objective 1.5*** *The student is able to connect evolutionary changes in a population over time to a change in the environment.*

   The syllabus describes an activity where students analyze newspaper or online news articles about new cases of antibiotic resistance.

Syllabus Development Guide: AP® Biology

Curricular Requirement 4	Students are provided with opportunities to meet the learning objectives in the AP Biology Curriculum Framework within each of the big ideas. These opportunities must occur in addition to those within laboratory investigations.
Scoring Component 4b	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 2.
Evaluation Guideline	The syllabus **must** describe at least one assignment or activity outside of the laboratory investigations designed to meet one learning objective within Big Idea 2.
Key Term(s)	**Learning Objectives:** Provide clear and detailed articulation of what students should know and be able to do.

Samples of Evidence

1. ***Learning Objective 2.11*** *The student is able to construct models connecting the movement of molecules across membranes with membrane structure and function.*

   The syllabus includes an activity where students draw a model illustrating three different mechanisms of membrane transport.

2. ***Learning Objective 2.13*** *The student is able to explain how internal membranes and organelles contribute to cell functions.*

   The syllabus describes an assignment where students read about and discuss an experiment describing the effects of inhibitors on mitosis.

3. ***Learning Objective 2.9*** *The student is able to 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.*

   The syllabus describes an activity where students compare plants from different biomes and predict the rates of transpiration.

Syllabus Development Guide: AP® Biology

Curricular Requirement 4	Students are provided with opportunities to meet the learning objectives in the AP Biology Curriculum Framework within each of the big ideas. These opportunities must occur in addition to those within laboratory investigations.
Scoring Component 4c	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 3.
Evaluation Guideline	The syllabus **must** describe at least one assignment or activity outside of the laboratory investigations designed to meet one learning objective within Big Idea 3.
Key Term(s)	**Learning Objectives:** Provide clear and detailed articulation of what students should know and be able to do.

Samples of Evidence

1. ***Learning Objective 3.26*** *The student is able to explain the connection between genetic variations in organisms and phenotypic variations in populations.*

   In a written essay, students compare artificial and natural selection using an organism of their choice.

2. ***Learning Objective 3.13*** *The student is able to pose questions about ethical, social, or medical issues surrounding human genetic disorders.*

   The syllabus includes an assignment where students write a report questioning the ethics of genetic screening (e.g., Huntington's disease, cystic fibrosis, PKU).

3. ***Learning Objective 3.1*** *The student is able to 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.*

   The syllabus includes an assignment where students create a presentation comparing HIV to other viruses and their methods of replication.

Syllabus Development Guide: AP® Biology

Curricular Requirement 4	Students are provided with opportunities to meet the learning objectives in the AP Biology Curriculum Framework within each of the big ideas. These opportunities must occur in addition to those within laboratory investigations.
Scoring Component 4d	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 4.
Evaluation Guideline	The syllabus **must** describe at least one assignment or activity outside of the laboratory investigations designed to meet one learning objective within Big Idea 4.
Key Term(s)	**Learning Objectives:** Provide clear and detailed articulation of what students should know and be able to do.

Samples of Evidence

1. ***Learning Objective 4.27*** *The student is able to make scientific claims and predictions about how species diversity within an ecosystem influences ecosystem stability.*

   In preparation for a long-term environment study, students assess the impact of waste disposal on the local water quality to predict the diversity of microorganisms found in water samples.

2. ***Learning Objective 4.3*** *The student is able to use models to predict and justify that changes in the subcomponents of a biological polymer affect the functionality of the molecule.*

   Students compare a 3-D graphic model of DNA during the process of replication and transcription.

3. ***Learning Objective 4.19*** *The student is able to use data analysis to refine observations and measurements regarding the effect of population interactions on patterns of species distribution and abundance.*

   The syllabus includes an activity where students identify an invasive species in their community and design a plan to investigate its impact on the community.

Syllabus Development Guide: AP® Biology

Curricular Requirement 5	The course provides students with opportunities to connect their biological and scientific knowledge to major social issues (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.
Evaluation Guideline	The syllabus **must** describe at least one assignment or activity requiring students to connect their biological and scientific knowledge to understand social or ethical issues.
Key Term(s)	None at this time.

Samples of Evidence

1. The syllabus states that students read and report on *The Immortal Life of Henrietta Lacks,* focusing on the ethics and benefits of using human tissue in cancer and other biological research.

2. The course outline includes biological topics with ethical and social issues such as genetic diseases, global warming, or the release of genetically modified organisms, and includes an activity where students debate the evidence of human causation of climate change.

3. The syllabus states that students will view *Gattaca*, or another science/science fiction film and evaluate the ethical and scientific merits of the film.

Syllabus Development Guide: AP® Biology

Curricular Requirement 6	The student-directed laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Biology Curriculum Framework and include at least two lab experiences in each of the four big ideas.
Evaluation Guideline	The syllabus **must** include and describe, for each of the four big ideas, at least two laboratory experiences that emphasize student-directed investigations for a minimum of eight labs. Descriptions of the investigations **must** indicate how, collectively, the lab experiences provide students opportunities to apply all seven science practices. (It is not required that all seven practices be included within any one laboratory investigation.)
Key Term(s)	None at this time.

Samples of Evidence

1. The syllabus outlines the incorporation of each of the seven science practices learned in the laboratory. For example, the syllabus includes the following outline describing each laboratory investigation:

   Lab title: Fruit Fly Behavior
   Learning Objectives: 2.38 and 4.15
   Skills applied: data analysis and using visual representation

2. The syllabus lists the seven science practice skills and indicates next to each one which of the investigations will employ each particular skill. This list will then be used to create a balance of skills experienced by students throughout the laboratory investigations.

   Science practice skill: 3
   Skills applied: scientific questioning
   Lab: Photosynthesis

3. The seven science practices are illustrated in a matrix that describes how they are used by teachers and students for all laboratory investigations. For example:

Laboratory Investigation	***Scientific Practice(s)***
Big Idea 1: Artificial Selection and Analyzing Genes with BLAST	*Statistical analysis, mathematical modeling, and computer science.*
Big Idea 2: Osmosis and Diffusion	*Measuring volumes, calculating surface area-to-volume ratios, calculating rate, calculating water potential, graphing.*

Syllabus Development Guide: AP® Biology

Curricular Requirement 7	Students are provided the opportunity to engage in investigative laboratory work integrated throughout the course for a minimum of 25 percent of instructional time.
Evaluation Guideline	The syllabus **must** include an explicit statement that at least 25 percent of instructional time is spent in laboratory experiences.
Key Term(s)	None at this time.

Samples of Evidence

1. The syllabus includes the following statement: "Students are engaged in student-directed investigation during the 25 percent of instructional time devoted to laboratory work."

2. The syllabus states that the total lab time will be a minimum of 25 percent of total instructional time, with investigations distributed throughout the course.

3. The syllabus includes a statement to indicate that 25 percent of this course is spent doing laboratory/field studies.

Syllabus Development Guide: AP® Biology

Curricular Requirement 8	The course provides opportunities for students to develop and record evidence of their verbal, written, and graphic communication skills through laboratory reports, summaries of literature or scientific investigations, and oral, written, or graphic presentations.
Evaluation Guideline	The syllabus **must** describe how students report on all the laboratory investigations they engage in throughout the course.
Key Term(s)	None at this time.

Samples of Evidence

1. The syllabus includes a specific statement indicating that students will maintain a laboratory notebook or portfolio throughout the course that documents all of their laboratory investigations.

2. The syllabus includes an end-of-year reflective statement where students compile lab write-ups for the year and describe the scientific skills they gained.

3. The syllabus includes opportunities for students to formally present lab findings based on their written lab reports.