Advance Placement (AP®) Biology
Course Syllabus 2015-2016
Holy Martyrs Ferrahian High School

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Philosophy

In my estimation, the purpose of an AP Biology course is to encourage students to inquire about the environment they reside in and understand how all biological systems are interconnected. This AP Biology course is structured to provide the students with a strong foundation in college level Intro to Biology course. Furthermore, by focusing on the four Big Ideas, this course is designed to help students understand and gain appreciation or the study of life. I intend for my students to attain a strong understanding of the main themes and concepts of biology and recognize how these concepts relate to themselves and their environment. Students enhance their critical thinking skills as they gather, evaluate, and synthesize information for a variety of sources. For this reason, my goal is incorporate different sources of information and learning techniques in my lessons. Additionally, students of AP Biology need to effectively and responsibly use technology to enhance their problem solving skills. These goals are achieved not only through the use of the textbook but also through the laboratory component of the course and the research assignments completed throughout the academic year. Specifically, students are required to submit several papers over the course of the year, based on research from published scientific works found in newspaper articles and scientific journals.

Course Overview

The AP Biology class meets for 50 minutes a day, five days per week. On specified week, the students will have a laboratory period on Fridays. This allows us to incorporate the 12 labs in the AP Lab Manual for Students, but also enrichment labs and a fetal pig dissection. The course will be structured differently this year due to the changes made by the College Board. The new AP Biology curriculum encompasses 4 'Big Ideas', with Essential Knowledge and Process Skills that support each one.

Big Idea 1: Evolution The process of evolution drives the diversity and unity of life.	A. Change in the genetic makeup of a population over time is evolution. B. Organisms are linked by lines of descent from common ancestry. C. Live continues to evolve within a changing environment D. The origin of living systems is explained by natural processes
Big Idea 2: Cellular Processes (Energy and Communication) Biological systems utilize free energy and molecular building blocks to grow.	A. Growth, reproduction, and maintenance of the organization of living systems require free energy and matter. B. Growth, reproduction, and dynamic homeostasis require that cells create and maintain internal environment that are different from their external environments. C. Organisms use feedback mechanisms that regulate growth and reproduction, and to maintain dynamic homeostasis. D. Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment. E. Many biological processes involved in growth, reproduction, and dynamic homeostasis include temporal regulation and coordination.
Big Idea 3: Genetics and Information Transfer Living systems store, retrieve, transmit, and respond to information essential to life processes.	A. Heritable information provides for continuity of life. B. Expression of genetic information involves cellular and molecular mechanisms. C. The processing of genetic information is imperfect and is a source of genetic variation. D. Cells communicate by generating, transmitting, and receiving chemical signals. E. Transmission of information results in changes within a between biological systems.
Big Idea 4: Interactions Biological systems interact and these systems and their interactions possess complex properties.	A. Interactions within biological systems lead to complex properties. B. Competition and cooperation are important aspects of biological systems. C. Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

Science Practice 1	The student can use representations and models to communicate scientific phenomena and solve scientific problems
Science Practice 2	The student can use mathematics appropriately
Science Practice 3	The student can engage in scientific questioning to extend thinking or to guide investigation within the context of the AP course
Science Practice 4	The student ca plan and implement data collection strategies in relation to particular scientific question
Science Practice 5	The student can perform data analysis and evaluation of evidence
Science Practice 6	The student can work with scientific explanations and theories
Science Practice 7	The student is able to connect and relate knowledge across various scales, concepts and representations in and across domains

Text:

Reece, Urry, *Biology*, 10th edition AP 2014

AP Biology Exam:

May 9, 2016 at 08:00 A.M.

The exam is three hours in length and is designed to measure a student's knowledge and understanding of modern biology. On a 5 point scale, a score of 3 or better is passing. The following format will be used:

Section I: Multiple-Choice
Part A consists of 63 multiple-choice questions that represent the knowledge and science practices that you should understand and be able to apply.
Part B includes 6 grid-in questions that require the integration of science and mathematical skills. For the grid-in responses, you will need to calculate the correct answer for each question and enter it in a grid on that section of the answer sheet.
Section II: Free-Response You should use the mandatory reading period to read and review the questions and begin planning your responses. This section contains two types of free-response questions (short and long), and you will have a total of 80 minutes to complete all of the questions.

AP Exam College Credit:

Colleges vary in what score they will accept for credit. Generally a student needs to score at least a 4 for credit, but some schools will accept a 3. Check with the schools you are applying to for details.

Grading:

- **Exams** **60%**
  - Tests 40%
  - Quizzes 20%
    (1 lowest score for the quiz is dropped)
- **Homework** **10%**
  (No late work)
- **Labs/ Research Projects** **20%**
- **Participation** **10%**

Exams:

The Tests and Final will be a 50 minute exams covering the topics discussed in class and reading assignments from the book. The quizzes are 20 minute exams that will be given on weekly bases. There will be a notice in class and on my website at least one day before any quiz and one week before any test/ final.

Homework:

Homework will be assigned every day, including at home reading and practice problems. Homework will be due the next day and there will be no late work accepted.

Labs:

List of recommended laboratories in the *AP Biology Investigative Labs: An Inquiry-Based Approach*

Investigation 1	**Artificial Selection**
Investigation 2	**Mathematical Modeling: Hardy-Weinberg**
Investigation 3	**Comparing DNA Sequences to Understanding Evolutionary Relationship with BLAST**
Investigation 4	**Diffusion and Osmosis**
Investigation 5	**Photosynthesis**
Investigation 6	**Cellular Respiration**
Investigation 7	**Cell Division: Mitosis and Meiosis**
Investigation 8	**Biotechnology: Bacterial Transformation**
Investigation 9	**Biotechnology: Restriction Enzyme Analysis**
Investigation 10	**Energy Dynamics**
Investigation 11	**Transpiration**
Investigation 12	**Fruit Fly Behavior**
Investigation 13	**Enzyme Activity**

Laboratory experiments are extremely important in AP Biology course, allowing the students the ability to use the scientific methods that they are studying in the classroom environment. Labs will constitute at least 25% of the course work. The new curriculum includes more emphasis on inquiry based labs, which means you will design your own experimental procedures for a significant number of labs. In order to have as authentic a lab experience as possible, you will keep a lab notebook to record procedures and observations during labs. All labs will be done in pen. If you make a mistake, cross out (do not scribble out) the information and rewrite. In the scientific work, lab notebooks are considered legal documents and all information must be accessible. Formal lab write ups will be completed for each lab. You will turn in the formal write up, but keep your lab notebook. Lab notebooks will be reviewed for a grade twice a semester.

The Lab reports will include the Pre-lab write-up and questions, data and results, analysis, and post-lab questions (including conclusion). The key concepts of the lab will be included in all steps of the lab write-up.

Pre-lab write-up:

Includes the title of the lab, introduction and background information (answering the questions), purpose, hypothesis, procedure, and additional questions

Post-lab write-up:

Includes data analysis and results, answers to given questions, and conclusion.

In this course there will be two labs that are designed to be performed at home and will emphasize topics covered in the course that are not addressed in the recommended AP Biology Laboratories.

Research Projects:

There will four research projects over the course of two semesters. Research Project 1 and 2 will be due by the end of the first semester.

Project 1 the students will investigate research papers that have been published in the past 5 years on the topics of growth, reproduction, organization of living systems, homeostasis, biological processes involved in growth, or growth and dynamic homeostasis of a biological system that are influenced by changes in the system's environment. **Big Idea 2**

Project 2 the students will investigate research papers that have been published in the past 5 years on the topics of heritable information, expression of genetic information, genetic variation, generating, transmitting, and receiving chemical signals, or transmission of information that results in changes within a biological system. **Big Idea 3**

Project 3 the students will investigate research papers that have been published in the past 5 years on the topics of change in the genetic makeup of a population over time, evolutionary changes, or lines of descent from common ancestry. **Big Idea 1**

Project 4 the students will investigate research papers that have been published in the past 5 years on the topics of interactions within biological systems, competition and cooperation, or interactions of diverse components within biological systems and environment. **Big Idea 4**

Book Outline:

Big Idea 1: The process of evolution drives the diversity and unity of life.	
Enduring understanding 1.A: Change in the genetic makeup of a population over time is evolution.	**Chapter/Key Concepts**
1.A.1. Natural selection is a major mechanism of evolution.	1.1, 1.2, 13.4, 19.1, 19.2, 21.1, 21.3, 21.4, 22.1, 22.2, 22.3, 23.1, 23.3, 23.4, 25.6, 31.4, 32.4, 39.5, 53.4
1.A.2: Natural selection acts on phenotypic variations in populations.	1.1, 1.2, 7.1, 13.4, 22.2, 23.1, 23.3, 23.4, 26.1, 26.2, 48.3
1.A.3: Evolutionary change is also driven by random processes.	1.2, 6.5, 13.4, 21.5, 22.3, 23.2, 24.4
1.A.4: Biological evolution is supported by scientific evidence from many disciplines, including mathematics.	1.1, 1.2, 1.4, 4.1, 5.6, 7.1, 22.1, 23.3, 23.4, 24.1, 24.2, 25.1, 26.4, 32.2, 43.4
Enduring understanding 1.B: Organisms are linked by lines of descent from common ancestry.	**Chapter/Key Concepts**
1.B.1: Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.	1.2, 6.5, 7.1, 12.2, 17.1, 23.1, 25.6, 26.1, 26.2, 26.3, 26.4, 26.5, 26.6, 27.1, 28.1, 29.1, 29.2, 30.2, 30.3, 31.3, 31.4, 31.5, 32.1, 32.2, 32.3, 32.4, 34.1, 34.2, 34.3, 34.4, 34.5, 34.6, 34.7, 35.4, 47.2, 51.4
1.B.2: Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.	1.2, 22.2, 22.3, 24.1, 24.2, 25.3, 26.1, 26.2, 26.3, 26.5, 26.6, 27.1, 27.4, 28.1, 28.2, 28.3, 28.4, 28.5, 29.1, 29.3, 30.3, 31.3, 31.4, 32.3, 32.4, 33.1, 34.4, 34.5, 34.6, 34.7
Enduring understanding 1.C: Life continues to evolve within a changing environment.	**Chapter/Key Concepts**
1.C.1: Speciation and extinction have occurred throughout the Earth's history.	24.1, 24.4, 25.2, 25.4, 25.5, 29.1, 29.3, 30.4, 56.1
1.C.2: Speciation may occur when two populations become reproductively isolated from each other.	24.1, 24.2, 24.3, 25.5
1.C.3: Populations of organisms continue to evolve.	1.2, 5.6, 12.2, 17.1, 22.1, 22.2, 22.3, 23.2, 24.2, 24.4, 25.3, 25.5, 25.6, 26.6, 28.4, 28.5, 30.1, 32.2, 32.3, 32.4, 33.1, 33.2, 33.3, 33.4, 33.5

Enduring understanding 1.D: The origin of living systems is explained by natural processes.	**Chapter/Key Concepts**
1.D.1: There are several hypotheses about the natural origin of life on Earth, each with supporting scientific evidence.	1.3, 22.1, 25.1, 27.1, 27.3, 28.1
1.D.2: Scientific evidence from many different disciplines supports models of the origin of life.	3.2, 22.1, 25.1, 25.2, 27.1, 27.3, 28.1, 29.1
Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.	
Enduring understanding 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.	**Chapter/Key Concepts**
2.A.1: All living systems require constant input of free energy.	1.1, 6.5, 8.1, 8.2, 8.3, 28.6
• Energy pathways, ecosystem effects	1.1, 8.1, 8.2, 28.6
• Laws of thermodynamics/coupled reactions/exergonic, endergonic	8.1, 8.2, 8.3
2.A.2: Organisms capture and store free energy for use in biological processes.	1.1, 4.2, 4.3, 6.5, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 10.1, 10.2, 10.3, 10.4
• Light reactions/chemiosmosis/Calvin cycle	6.5, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 10.1–10.4, 39.3, 40.4 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 10.1, 10.2, 10.3, 10.4, 40.4
• Glycolysis, pyruvate oxidation, Krebs, ETC	1.1, 55.1, 55.2, 55.3, 55.4, 55.5
2.A.3: Organisms must exchange matter with the environment to grow, reproduce and maintain organization.	4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 5.4, 5.5, 37.3, 40.4, 55.1–55.5
• Role of carbon, nitrogen, and phosphorus in organic compounds	3.1, 3.2, 3.3, 55.4
• Properties of water	6.2, 40.4, 44.4, 44.5
• Surface area/volume ratios and exchange	11.5, 39.2, 39.4
• Role of apoptosis	
Enduring understanding 2.B: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.	**Chapter/Key Concepts**
2.B.1: Cell membranes are selectively permeable due to their structure.	1.1, 6.2, 6.4, 7.1, 7.2, 7.3, 7.4, 7.5, 11.1, 11.2, 11.3, 11.4, 11.5, 36.1, 36.2, 36.3, 36.5, 44.1, 44.2, 44.3
2.B.2: Growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes.	7.1, 7.2, 7.3, 7.4, 7.5, 11.1, 11.2, 11.3, 11.4, 11.5, 40.1, 40.2, 40.3, 40.4, 44.1, 44.2, 44.3, 44.4, 44.5
2.B.3: Eukaryotic cells maintain internal membranes that partition the cell into specialized regions.	6.1, 6.2, 6.3, 6.4, 6.6, 6.7

Enduring understanding 2.C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis.	**Chapter/Key Concepts**
2.C.1: Organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes.	6.5, 30.4, 36.4, 36.6, 39.1, 39.2, 39.3, 39.4, 40.1, 40.2, 40.3, 40.4, 44.1, 44.2, 44.3, 44.5, 46.1, 46.2, 49.1
2.C.2: Organisms respond to changes in their external environments.	18.1, 28.6, 30.1, 30.2, 30.4, 31.5, 36.3, 36.4, 36.6, 39.1, 39.2, 39.3, 40.1, 40.2, 40.3, 40.4, 44.1, 44.2, 44.3, 46.1, 46.2, 49.1
Enduring understanding 2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.	**Chapter/Key Concepts**
2.D.1: All biological systems from cells and organisms to populations, communities and ecosystems are affected by complex biotic and abiotic interactions involving exchange of matter and free energy.	25.1, 28.6, 45.3, 52.1, 52.2, 52.3, 52.4, 53.1, 53.3, 54.3
2.D.2: Homeostatic mechanisms reflect both common ancestry and divergence due to adaptation in different environments.	40.1, 40.2, 40.3, 40.4, 44.1, 44.2, 44.3, 45.3, 49.1
2.D.3: Biological systems are affected by disruptions to their dynamic homeostasis.	36.3, 44.1, 44.2, 44.3, 45.1, 45.2, 45.3
2.D.4: Plants and animals have a variety of chemical defenses against infections that affect dynamic homeostasis.	5.4, 36.2, 39.4, 43.1, 43.2, 43.3, 50.1, 50.4, 53.5
Enduring understanding 2.E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.	**Chapter/Key Concepts**
2.E.1: Timing and coordination of specific events are necessary for the normal development of an organism, and these events are regulated by a variety of mechanisms.	17.1, 17.2, 17.3, 17.4, 38.1, 38.2, 40.1, 40.2, 40.3, 40.4
• Cell differentiation	17.5, 18.5, 47.1, 47.2, 47.3
• Homeotic genes/induction	18.4, 21.6, 37.3, 47.3
• Gene expression/microRNAs	17.1, 17.2, 17.3, 17.4, 17.5, 18.2, 18.3, 47.1 48.1, 48.2, 48.3, 48.4
2.E.2: Timing and coordination of physiological events are regulated by multiple mechanisms.	39.1, 39.2, 39.3
• Plants: photoperiodism/tropisms/germination	40.3, 40.4, 42.1, 48.3, 49.2, 49.3, 49.4, 49.5, 50.1–50.6, 51.1
• Animals	27.1, 27.2, 27.3, 27.4, 27.5, 27.6, 31.1, 31.2, 31.3, 40.3, 48.3 50.5, 50.6, 51.1, 51.2, 51.3, 51.4
• Fungi/protists/bacteria	46.4, 50.5, 50.6, 51.1, 51.2, 51.4
2.E.3: Timing and coordination of behavior are regulated by various mechanisms and are important in natural selection.	46.1, 46.2, 51.1, 51.2, 51.3, 51.4
• Innate behaviors/learning • Plant/animal behaviors • Cooperative behaviors	40.3, 51.2

Big Idea 3: **Living systems store, retrieve, transmit, and respond to information essential to life processes.**	
Enduring understanding 3.A: Heritable information provides for continuity of life.	**Chapter/Key Concepts**
3.A.1: DNA, and in some cases RNA, is the primary source of heritable information.	5.5, 5.6, 6.3, 14.1, 14.2, 14.3, 14.4, 16.1, 16.2, 16.3, 17.1, 17.2, 17.3, 17.4, 17.5, 28.1, 28.2, 28.3
• Structure and function	1.1, 5.5, 6.3, 14.1–14.4, 16.1, 16.2, 18.3, 19.2, 28.1, 28.2, 28.3
• Replication	1.1, 5.5, 5.6, 14.1, 14.2, 14.3, 14.4, 16.2, 19.2, 38.3
• Role of RNA and its processing	17.1, 17.2, 17.3, 17.4, 17.5, 19.2
• Prokaryotic/viral differences	16.1, 19.1, 19.2, 19.3, 27.1–27.6, 28.1, 28.2
• Manipulation of DNA	15.4, 20.1, 20.2, 20.3, 20.4, 38.3
3.A.2: In eukaryotes, heritable information is passed to the next generation via processes that include the cell cycle and mitosis or meiosis plus fertilization.	12.1, 12.2, 12.3, 13.1, 13.2, 13.3, 18.2, 38.1, 38.2
3.A.3: The chromosomal basis of inheritance provides an understanding of the pattern of passage (transmission) of genes from parent to offspring.	1.1, 12.1, 12.2, 12.3, 13.1, 13.2, 13.3, 13.4, 14.1, 14.2, 14.3, 14.3, 15.2, 15.3, 15.4, 16.1, 16.2, 16.3, 20.1, 38.3, 46.3
3.A.4: The inheritance pattern of many traits cannot be explained by simple Mendelian genetics.	1.2, 14.4, 17.1, 17.2, 17.3, 17.4, 17.5, 19.1, 19.2, 38.3
Enduring understanding 3.B: Expression of genetic information involves cellular and molecular mechanisms.	**Chapter/Key Concepts**
3.B.1: Gene regulation results in differential gene expression, leading to cell specialization.	16.2, 18.4, 18.5, 20.1, 20.3, 46.4, 46.5
3.B.2: A variety of intercellular and intracellular signal transmissions mediate gene expression.	15.1, 15.2, 15.3, 20.2
Enduring understanding 3.C: The processing of genetic information is imperfect and is a source of genetic variation.	**Chapter/Key Concepts**
3.C.1: Changes in genotype can result in changes in phenotype.	1.4, 13.4, 14.1, 14.2, 14.3, 14.4, 15.1, 15.2, 15.3, 15.4, 15.5, 19.3, 20.1, 20.3, 25.5
3.C.2: Biological systems have multiple processes that increase genetic variation.	13.4, 15.5, 17.5, 20.1, 21.1, 21.2, 21.3, 21.4, 21.5, 21.6, 23.1, 23.2
3.C.3: Viral replication results in genetic variation and viral infection can introduce genetic variation into the hosts.	16.1, 19.1, 19.2, 19.3, 27.2
Enduring understanding 3.D: Cells communicate by generating, transmitting and receiving chemical signals.	**Chapter/Key Concepts**
3.D.1: Cell communication processes share common features that reflect a shared evolutionary history.	11.1, 42.1, 43.3, 45.3, 48.3
3.D.2: Cells communicate with each other through direct contact with other cells or from a distance via chemical signaling.	6.7, 11.1, 11.2, 11.3, 11.4, 11.5, 31.1, 31.2, 31.3, 32.1, 39.1, 43.2, 43.3, 43.4, 45.1, 45.2

3.D.3: Signal transduction pathways link signal reception with cellular response.	11.1, 11.2, 11.3, 27.2, 39.1, 45.1, 45.2, 47.2, 47.3
3.D.4: Changes in signal transduction pathways can alter cellular response.	11.2, 11.3, 11.4, 27.2, 39.1, 45.1, 45.2, 47.2, 47.3
Enduring understanding 3.E: Transmission of information results in changes within and between biological systems.	**Chapter/Key Concepts**
3.E.1: Individuals can act on information and communicate it to others.	54.1, 54.2, 54.3
3.E.2: Animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.	48.1, 48.2, 48.3, 48.4, 49.1, 49.2, 49.3, 49.4, 49.5, 50.5, 50.6, 51.1, 51.2, 51.3, 51.4
• Neurons/synapses/signaling	45.2, 45.3, 48.1, 48.2, 48.3, 48.4
• Mammalian brain	45.2, 45.3, 49.2, 49.3, 49.4, 50.1, 50.4
Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.	
Enduring understanding 4.A: Interactions within biological systems lead to complex properties.	**Chapter/Key Concepts**
4.A.1: The subcomponents of biological molecules and their sequence determine the properties of that molecule.	2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 5.4, 5.5
4.A.2: The structure and function of subcellular components, and their interactions, provide essential cellular processes.	1.1, 2.3, 2.4, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 5.4, 5.5
4.A.3: Interactions between external stimuli and regulated gene expression result in specialization of cells, tissues and organs.	1.1, 18.4, 20.3, 35.1, 35.2, 35.3, 35.4, 35.5, 40.1 54.2, 54.3
4.A.4: Organisms exhibit complex properties due to interactions between their constituent parts.	1.1, 52.3, 52.4, 53.1, 53.2, 53.4, 53.5, 53.6, 54.1, 54.2, 54.3
4.A.5: Communities are composed of populations of organisms that interact in complex ways.	1.3, 52.2, 52.3, 52.4, 53.3, 54.1, 54.2, 54.3, 56.2, 56.4
• Ecological field data	53.3, 53.5, 53.6, 54.2, 54.3, 54.4, 54.5, 56.2
• Growth curves, demographics	28.6, 37.1, 37.2, 37.3, 54.2, 55.1, 55.2, 55.3, 55.4, 55.5
4.A.6: Interactions among living systems and with their environment result in the movement of matter and energy. • Human impact on ecosystems	3.3, 30.3, 54.3, 54.5, 56.1, 56.3, 56.4, 56.5
Enduring understanding 4.B: Competition and cooperation are important aspects of biological systems.	**Chapter/Key Concepts**
4.B.1: Interactions between molecules affect their structure and function.	4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 5.4, 5.5, 8.4, 8.5
• Enzymes and their action	4.2, 5.1, 5.4, 8.1, 8.4, 8.5, 18.1
4.B.2: Cooperative interactions within organisms promote efficiency in the use of energy and matter.	41.1, 41.2, 41.3, 42.1, 42.2, 42.3, 42.4, 42.5, 42.6, 42.7
• Compartments, e.g., digestion, excretion, circulation	41.1, 41.2, 41.3, 41.4, 41.5, 42.1, 42.2, 42.3, 42.4, 42.5, 42.6, 42.7

4.B.3: Interactions between and within populations influence patterns of species distribution and abundance.	52.4, 53.1, 53.3, 53.4, 53.5, 53.6, 54.1, 56.1, 56.2, 56.3, 56.4, 56.5
4.B.4: Distribution of local and global ecosystems changes over time.	52.1, 52.2, 52.3, 54.4
Enduring understanding 4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.	**Chapter/Key Concepts**
4.C.1: Variation in molecular units provides cells with a wider range of functions.	6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7
4.C.2: Environmental factors influence the expression of the genotype in an organism.	18.1, 52.2, 52.4, 53.1
4.C.3: The level of variation in a population affects population dynamics.	1.1, 1.2, 52.4, 53.4, 53.5, 53.6, 54.2, 56.1, 56.2, 56.3
4.C.4: The diversity of species within an ecosystem may influence the stability of the ecosystem.	1.2, 52.4, 53.1, 53.2, 53.3, 53.4, 53.5, 53.6, 54.2, 56.1, 56.2, 56.3, 56.4

Course Planner:

1. Evolution, the Themes of Biology, and Scientific Inquiry
   The Chemistry of Life: 1-2 WEEKS
   a. Scientific methods (Chapter 1)
   b. Chemical context of life
      Water and Life (Chapters 2-3)
      Sills Taught: Biochemical processes, chemistry of water
   c. Carbon and Molecular Diversity of Life
      The Structure of Function of Large Biological Molecules (Chapter 4-5)
      Skills Taught: Organic chemistry and Caron compounds, Bonding of carbon to four other atoms, Molecular Function

   Lab(s): **Investigation 4, Diffusion and Osmosis**
   Investigation 10, Energy Dynamics
2. The Cell: 6-8 WEEKS
   a. Understanding of the Cell (Chapters 6-7)
      Skills Taught: Cell Function, Comparing Prokaryotic and Eukaryotic, Cell organelles and their functions, Membranes and transports
   b. Metabolism, Cellular Respiration and Fermentation, Photosynthesis (Chapters 8-10)
      Skills Taught: Organism's metabolism, transformation of matter, energy, and laws of thermodynamics, Enzymatic reactions, ATP production through Cellular Respiration, Conversion of Solar Energy to Chemical Energy.
   c. Cell Communication, The Cell Cycle (Chapters 11-12)
      Skills Taught: External Signaling, Receptor Protein, Transduction, Response, Apoptosis, Cellular Division

   Lab(s): **Investigation 6, Cellular Respiration**
   Investigation 5, Photosynthesis
   Investigation 13, Enzyme Activity
3. Genetics: 6-7 WEEKS
   a. Meiosis and Sexual Life Cycles (Chapter 13)
      Skills Taught: Acquired genes, Fertilization and meiosis, Genetic variation
   b. Mendel and the Gene Idea, The Chromosomal Basis of Inheritance, The Molecular Basis of Inheritance (Chapters 14-16)
      Skills Taught: Mendel, Laws of Inheritance, Probability Laws, Inheritance Patterns and Human Traits, Sex-linked Genes, Chromosomes, Genetic Materials
   c. Gene Expression: From Gene to Protein, Regulation of Gene Expression (Chapters 17-18)
      Skills Taught: Transcription vs. Translation, RNA modification, Polypeptide Synthesis, Gene Expression, Cancer results

d. Viruses, DNA Tools and Biotechnology, Genomes and Their Evolution (Chapters 19-21)
Skills Taught: Nucleic Acids in Viruses, DNA Sequencing and DNA cloning, DNA based Biotechnology.
Lab(s): **Investigation 2: Mathematical Modeling: Hardy-Weinberg**
Investigation 7: Cell Division: Mitosis and Meiosis
Investigation 8: Biotechnology: Bacterial Transformation
Investigation 9: Biotechnology: Restriction Enzyme Analysis

4. Evolution: 6-8 WEEKS
   a. Descent with Modification, The Evolution of Population, The Origin of Species, The History of Life on Earth (Chapters 22-25)
   Skills Taught: Darwinian Revolution, Natural Selection, Genetic Variation Making Evolution Possible, Genetic Drift and Gene Flow, Adaptive Evolution, Speciation, Hybridization, Fossil Records, Rise and Fall of groups, Changes in Body Form
   b. Phylogeny and the Tree of Life, Bacteria and Archaea, Plant Diversity (Chapters 26, 27, 29, and 30)
   Skills Taught: Phylogenies Showing Evolutionary Relationships, Evolutionary History, Adaptation, Rapid Reproduction, Mutation, Genetic Recombination, Plants
   c. Overview of Animal Diversity, Introduction of Invertebrates and Evolution of Vertebrates (Chapters 32-34)
   Skills Taught: Invertebrates, Vertebrates
   Lab(s): **Investigation 3: Comparing DNA Sequences to Understanding Evolutionary Relationship with BLAST**
5. Animal Form and Function: 5 WEEKS
   a. Diversity and Physiology (Chapters 40-51) Skills Taught: body systems, movement, digestion, circulation, immunity, nervous system, endocrine, excretion, gas exchange, fertilization and embryonic development
   Lab(s): **Fetal Pig Dissection**
6. Ecology: 4 WEEKS
   a. Ecology and Biosphere, Population Ecology, Community, Ecosystems and Restoration (Chapters 52-55)