

# AP Biology Curriculum

2008

## Course Description

Class meets everyday for 45 minutes. Twice a week we have a double lab period that meets for 90 minutes. During the course of the year, we focus on all of the topics required in the AP Biology course description. These topics include the study of biochemistry, cell structure and function, metabolism, genetics, evolution, microbiology, plants, animals and ecology. Lectures, discussions, readings and labs are used to enhance student's understanding of the topics being discussed. A test is given at the end of each unit to assess student understanding.

The textbook used is Biology, 6<sup>th</sup> edition, Campbell & Reece. Lab activities include those in the AP Biology Laboratory Manual and others supplemented by me. I also include some web-based labs/activities to enhance student learning and understanding.

This course encourages students to develop their laboratory and critical thinking skills. Students are required to collect and analyze data along with drawing conclusions that show an understanding of the process at hand. Periodically, students are presented with journal articles to read and critique. Some of these articles will cover controversial topics, such as, genetic engineering of crops, evolution and global warming. Often these articles are used to jumpstart a class discussion. A final research paper is also assigned at the end of the year. This gives the student an opportunity to explore a topic of particular interest to them.

The **eight major themes of biology** are integrated throughout the course of study. **Evolution** is a unifying theme in biology and is interwoven into each unit of study. In order to help students understand how evolution not only unifies life but has also allowed for the great diversity of species found on the earth, they are assigned some of the evolution connection questions in the textbook throughout the year. These questions require the student to think critically about the relationships between organisms. These questions are used to either facilitate a class discussion or are assigned as a written assignment.

**Science as a process** is also interwoven into the curriculum. We do the twelve AP labs which require students to collect data and draw conclusions from the experiment. We also study and discuss classic biology experiments throughout the year. Some of these experiments include but are not limited to: The Hershey-Chase experiment demonstrating that DNA not protein is the genetic material of the T2 phage, Mendel's genetics experiments involving the pea plant and Went's experiments showing the effect of auxin on plant growth. Students are also encouraged to ask questions during classes which often leads to discussions that lead to a deeper understanding of the topic at hand. Discussions/debates held throughout the year also enable students to see science as a process. Students when discussing controversial topics, such as, genetic engineering and

prenatal testing come to an understanding of how new technology often leads to new scientific discoveries that sometimes have controversial outcomes.

The year begins with a study of the chemistry of life and ends with a study of ecology. This approach allows the student to understand the hierarchy of biological organization. As the year progresses students are able to see properties emerge at a higher level of organization that were not apparent at a lower level of organization. Approaching the subject in this manner **allows the student to see how life is connected and yet continually changing**. The **connectedness of life** is seen when discussing macromolecules that make up organisms, the structure of DNA, transcription and translation, the transfer of energy within ecosystems, glycolysis, etc. The **change in organisms** is not only apparent when studying evolution but also apparent during our units on animal and plant diversity.

**Relationships of structure to function** are seen when discussing enzymes, cell organelles, plant and animal organs, etc. **Regulation** is studied when discussing the mechanisms of thermoregulation, osmoregulation, hormonal controls of blood glucose levels and calcium levels, etc. Positive and negative feedback loops are studied to understand the mechanisms behind homeostasis.

**Interdependence in nature** is seen on a large scale when studying ecology in terms of **energy transfer** between organisms. It is also apparent on a much smaller scale between individual organisms in terms of symbiotic relationships.

**Science, technology and society** are discussed during our unit on DNA technology. Practical applications of DNA technology are discussed along with the ethical and social issues that come with this type of technology. At the end of the year, we do a forensics lab so that the students can better understand one of the practical applications of this technology. We also see the affect of technology during our study of phylogeny. We discuss how new molecular data is causing scientists to rethink the evolutionary relationship between organisms and the six kingdom system.

This course is taught in a way that allows the student to understand the complexity of biological systems, develop good laboratory skills and to encourage critical thinking. The course covers the three overarching topics of biology as listed in the AP Biology course description along with integrating the eight major themes also specified in the course description.

STANDARD 5.5 (Characteristics of Life) All students will gain an understanding of the structure, characteristics, and basic needs of organisms and will investigate the diversity of life.

## Strands and Cumulative Progress Indicators

Building upon knowledge and skills gained in preceding grades, by the end of **Grade 12**, students will:

### A. Matter, Energy, and Organization in Living Systems

1. Relate the structure of molecules to their function in cellular structure and metabolism.
2. Explain how plants convert light energy to chemical energy.
3. Describe how plants produce substances high in energy content that become the primary source of energy for life.
4. Relate disease in humans and other organisms to infections or intrinsic failures of system other organisms to infections or intrinsic failures of system.

#### **Suggested Activities**

**Readings:** Chapters 1 – 11  
Chapters 35 - 39  
Chapters 40 - 55

**Labs:** AP Laboratory 1: Diffusion and Osmosis  
AP Laboratory 2: Enzyme Catalysis  
AP Laboratory 4: Plant Pigments and Photosynthesis  
AP Laboratory 5: Cell Respiration  
AP laboratory 9: Transpiration  
AP Laboratory 10: Physiology of the Circulatory System  
AP Laboratory 11: Animal Behavior  
AP laboratory 12: Dissolved Oxygen and Primary Productivity

**Activities:** - Protein folding with clay tuber  
- Students to model the processes of Photosynthesis, cellular respiration and chemical signaling

#### **Instructional Strategies**

Lecture/Discussion  
Labs/Activities as noted above

#### **Evaluation/Assessment**

Tests & Labs

## **B. Diversity and Biological Evolution**

1. Explain that through evolution the Earth's present species developed from earlier distinctly different species.
2. Explain how the theory of natural selection accounts for extinction as well as an increase in the proportion of individuals with advantageous characteristics within a species.

### **Suggested Activities**

**Readings:** Chapters 22 – 34

**Articles (Reaction papers due):**

- “Bacterial of the Living Dead”
- “Did Life Begin in Ice?”

**Evolution Connection Questions:** Chapters 1, 4, 7, 9, 12, 13, 14, 18, 20 and 30

**Labs:** Protista and Algae  
Phylogeny and Systematics

### **Instructional Strategies**

Lecture/Discussion

Labs as noted above

### **Evaluation/Assessment of Students**

Tests & Labs

Homework – Reaction papers

Evolution connection questions

## **C. Reproduction and Heredity**

1. Describe how information is encoded and transmitted in genetic material.
2. Explain how genetic material can be altered by natural and/or artificial means; mutations and new gene combinations may have positive, negative, or no effect on organisms or species.
3. Assess the impact of current and emerging technologies on our understanding of inherited human characteristics

### **Suggested Activities**

**Readings:** Chapters 14 – 21

**Articles to be assigned (Debate material and/or opinion papers to be written):**

- “U.S. Scientists break ground on stem cells”
- “Till Death Do Us Part”

**Labs:** AP laboratory 3: Mitosis and Meosis  
AP laboratory 7: Genetics of Organisms  
AP laboratory 6: Molecular Biology  
The Beckett Family Lab ([www.biology.arizona.edu/](http://www.biology.arizona.edu/))  
Bacterial Transformation “Dry Lab”  
Forensics Lab

**Power Point Presentation:** Students are to prepare a power point presentation regarding a topic within the realm of biotechnology. Possible topics might include: genetic engineering of plants, bioremediation, prenatal testing, etc. Students will present their research to the class along with pros and cons of using such technology. These student presentations will act a springboard to a class discussion/debate on these controversial issues.

### **Instructional Strategies**

Lecture/Discussion  
Labs as noted above  
Student presentations

### **Evaluation/Assessment of Students**

Tests & Labs  
Student PowerPoint presentations

## **Additional Activities**

### **AP Test Preparation**

In order to prepare the students for the AP test in May, a review process begins in January. At this time students are assigned weekly review questions that refer to previously discussed information. Each week the students will be assigned either multiple choice questions or essay questions that are from previous AP exams. All of these assignments are graded.

### **Student Chapter Presentations**

Students are expected to present a chapter to their peers during the second half of the school year. The students are allowed pick a chapter that interests them. A power point presentation is provided for them which they can adjust to their liking. The students choose a chapter from chapters 35 – 55 in the AP Biology textbook.

### **Research Paper**

In lieu of a final exam, students are required to write a 10-12 research paper after the AP exam. The students can pick a topic of their choosing. This enables the student to learn about a topic that may have piqued their interest during the year in much greater detail.

## **Evaluation/Assessment of Curriculum:**

This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the five-year curriculum review schedule.

## 8. Technological Literacy

STANDARD 8.1 (Computer and information literacy ) All students will use computer applications to gather and organize information and to solve problems.

### Strands and Cumulative Progress Indicators

Building upon knowledge and skills gained in preceding grades, by the end of **Grade 12**, students will:

#### A. Basic Computer Skills and Tools

1. Create a multi-page document with citations using word processing software in conjunction with other tools that demonstrates the ability to format, edit, and print.
2. Create documents including a resume and a business letter using professional format.
3. Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.
4. Given a database, define fields, input data from multiple records, produce a report using sort and query, and interpret the data.
5. Produce a multimedia project using text, graphics, moving images, and sound.
6. Produce and edit page layouts in different formats using desktop publishing and graphics software.
7. Develop a document or file for inclusion into a website or web page.
8. Discuss and/or demonstrate the capability of emerging technologies and software in the creation of documents or files.
9. Merge information from one document to another.

#### B. Application of Productivity Tools Social Aspects

1. Describe the potential and implications of contemporary and emerging computer applications for personal, social, lifelong learning, and workplace needs.
2. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.
3. Make informed choices among technology systems, resources, and services in a variety of contexts.
4. Use appropriate language when communicating with diverse audiences using computer and information literacy.

#### Information Access and Research

5. Select and use specialized databases for advanced research to solve real world problems.
6. Identify new technologies and other organizational tools to use in personal, home, and/or work environments for information retrieval, entry, and presentation.
7. Evaluate information sources for accuracy, relevance, and appropriateness.
8. Compose, send, and organize e-mail messages with and without attachments.

#### Problem Solving and Decision Making

9. Create and manipulate information, independently and/or collaboratively, to solve problems and design and develop products.
10. Identify, diagnose, and suggest solutions for non-functioning technology systems.
11. Identify a problem in a content area and formulate a strategy to solve the problem using brainstorming, flowcharting, and appropriate resources.
12. Integrate new information into an existing knowledge base and communicate the results in a project or presentation.

#### Suggested Activities

- Bring students to library and have them meet with librarian to learn about search engines to be used for research.
- Students to write a research paper during the year.

#### CPIs

B3, B5

A1, A8, A9, B5, B7

- Students to communicate with each other and teacher via e-mail throughout the year. B8
- Students to e-mail electronic quizzes to teacher. B8
- Students to discuss/debate the legal and ethical problems with the use of biotechnology. B2
- Students will be encouraged to prepare required graphs for labs 1, 2, 4, 5, 6, 9, 10, 11 and 12 using an appropriate computer software. A3
- Students to work collaboratively to set up labs. Students will identify and correct any set-ups that are not performing properly. B9, B10, B11
- Students to prepare a PowerPoint presentation on biotechnology. A5, A8, A9, B4
- Students to present PowerPoint on Biotechnology. B12

### **Resource/Bibliography**

Campbell & Reece. Biology, 6<sup>th</sup> edition. San Francisco: Benjamin Cummings, 2002.

Biology Lab Manual. 2001

[http://www.3dmoleculardesigns.com/15\\_Tacks.pdf](http://www.3dmoleculardesigns.com/15_Tacks.pdf)

The Biology Project, <http://www.biology.arizona.edu/>

<http://education.sdsc.edu/teachertech/downloads/molbio.pdf>

# AP Biology Syllabus

## Unit 1 - Chemistry of life

1. Structure of an atom
2. Chemical bonding
3. Functional groups
4. Water
5. Structure and function of macromolecules

### **At the end of this unit students will be able to:**

- ◆ Identify the structure of an atom and how atomic structure determines the behavior of an element.
- ◆ Differentiate between different types of chemical bonds and understand the importance of hydrogen bonds in living systems.
- ◆ Differentiate between the properties of water and their importance to organisms and the environment.
- ◆ Differentiate between the different functional groups and the importance of carbon in the structure of macromolecules.
- ◆ Differentiate between carbohydrates, lipids, proteins and nucleic acids in terms of their structure and function.
- ◆ Differentiate between the different structures of a protein and how chemical bonds/interactions are involved in a proteins structure and function.

**Homework:** Read Chapters 1 – 5  
Evolution Connection Questions: Chapters 2 and 4

## Unit 2 - The cell

1. Prokaryotic and eukaryotic cells
2. Membrane transport
3. Cell organelles

### **At the end of this unit students will be able to:**

- ◆ Differentiate between prokaryotic and eukaryotic cells.
- ◆ Differentiate between plant and animal cells.
- ◆ Differentiate between the different organelles in terms of their structure and function.
- ◆ Determine the molecular structure of a cell membrane and how its structure results in selective permeability.

**Homework:** Read Chapters 7 and 8  
Evolution Connection Question: Chapter 7

**Labs:** AP Laboratory 1: Diffusion and Osmosis

## Unit 3 - Metabolism

1. Free Energy
2. Enzymes
3. Cellular Respiration
4. Photosynthesis

### **At the end of this unit students will be able to:**

- ◆ Determine whether chemical reactions are exergonic or endergonic based on free-energy changes.

- ◆ Understand the role of enzymes within biological systems and how they change the rate of chemical reactions.
- ◆ Distinguish between the three metabolic stages of cellular respiration in terms of where they occur within the cell and ATP output.
- ◆ Differentiate between substrate phosphorylation and oxidative phosphorylation.
- ◆ Differentiate between aerobic and anaerobic respiration.
- ◆ Differentiate between the light reaction and calvin cycle of photosynthesis and understand how they are dependent upon one another.
- ◆ Differentiate between non-cyclic and cyclic photosynthesis.
- ◆ Differentiate between alternate mechanisms of carbon fixation ( $C_3$ ,  $C_4$  and CAM plants).

**Homework:** Read chapters 6, 9 and 10  
 Evolution Connection Question: Chapter 9

**Labs:** AP Laboratory 2: Enzyme Catalysis  
AP Laboratory 4: Plant Pigments and Photosynthesis  
AP Laboratory 5: Cell Respiration

### **Unit 4 - Cell Communication**

1. Local vs. long distance signaling
2. Signal transduction pathways
3. Phosphorylation cascades
4. Cellular response

**At the end of this unit students will be able to:**

- ◆ Differentiate between paracrine signaling, synaptic signaling and hormonal signaling
- ◆ Differentiate between the steps within a signal transduction pathway
- ◆ Differentiate between different receptor molecules in terms of their structure and function.
- ◆ Understand how phosphorylation cascades work and their role in biological amplification.

**Homework:** Read Chapter 11  
 Evolution Question: Chapter 11

### **Unit 5 - Cell Division**

1. The Cell Cycle
2. Meiosis and Sexual Life Cycles

**At the end of this unit students will be able to:**

- ◆ Differentiate between the different stages of the cell cycle.
- ◆ Differentiate between mitosis and meiosis
- ◆ Understand the evolutionary significance of meiosis.

**Homework:** Read chapters 12 and 13  
 Evolution Connection Question: Chapters 12 and 13

**Labs:** AP Laboratory 3: Mitosis and Meiosis

### **Unit 6 - Genetics**

1. Mendelian and Non-Mendelian Genetics
2. Chromosomes and Inheritance
3. Structure of DNA & DNA Replication

**At the end of this unit students will be able to:**

- ◆ Understand Mendel's experiments and how they brought a quantitative and experimental approach to genetics.

- ◆ Different inheritance patterns including monohybrid and dihybrid crosses, incomplete dominance, polygenic inheritance, codominance, pleiotropy, sex-linkage and epistasis.
- ◆ Differentiate between recessively inherited disorders and dominantly inherited disorders.
- ◆ Debate the ethical concerns of prenatal genetic testing.
- ◆ Understand the importance of the drosophila as an experimental organism in the study of genetics.
- ◆ Show that genetic recombinants are due to the independent assortment of chromosomes and crossing over
  - Understand the evolutionary significance of independent assortment and crossing over
- ◆ Develop a linkage map based on recombinant frequencies.
- ◆ Research certain human disorders that are due to meiotic errors.
- ◆ Demonstrate an understanding of the structure of DNA and how DNA replicates itself.

**Homework:** Read chapters 14, 15 and 16

Research and prepare for class debate regarding social and ethical concerns of genetic testing.

Evolution Connection Questions: Chapters 14 and 16

**Labs:** AP Laboratory 7: Genetics of Organisms

Karyotype Lab – Nondisjunction ([www.biology.arizona.edu/](http://www.biology.arizona.edu/))

## **Unit 7 – Transcription and Translation**

1. Formation of mRNA from DNA
2. Protein synthesis

**At the end of this unit students will be able to:**

- ◆ Differentiate between prokaryotic and eukaryotic cells in terms of transcription and translation.
- ◆ Demonstrate how point mutations can affect protein structure and function.
- ◆ Understand the evolutionary significance of the nearly universal genetic code

**Homework:** Read chapter 17

## **Unit 8 - Prokaryotic and Eukaryotic Genomes**

1. Reproductive Cycles of Viruses
2. Control of prokaryotic and eukaryotic genomes

**At the end of this unit students will be able to:**

- ◆ Differentiate between different types of viruses in terms of their structure.
- ◆ Differentiate between the lytic and lysogenic cycles of a phage virus.
- ◆ Understand the reproductive cycle of a retrovirus.
- ◆ Understand how viruses cause disease in both plant and animals.
- ◆ Differentiate between viroids and prions.
- ◆ Differentiate between generalized and specialized transduction.
- ◆ Understand how conjugation of bacteria transfers genetic material between bacterium.
- ◆ Understand how gene regulation occurs in the prokaryotic genome.
- ◆ Discuss how gene expression is controlled in the eukaryotic genome.
- ◆ Understand the genetic changes that may lead to cancer.

## **Unit 8 - Prokaryotic and Eukaryotic Genomes (continued)**

**Homework:** Read chapters 18 and 19

**Labs:** AP Laboratory 6A: Molecular Biology

## **Unit 9 – DNA Technology**

1. Recombinant DNA
2. Cloning
3. Gel electrophoresis
4. Practical applications of DNA technology

**At the end of this unit students will be able to:**

- ◆ Discuss the different technologies available that make gene cloning possible.
- ◆ Identify cells that contain recombinant DNA
- ◆ Read gel electrophoresis.
- ◆ Discuss the practical applications of DNA technology.
- ◆ Debate the ethical and safety concerns of DNA technology.

**Homework:** Read chapter 20

Research the ethical and safety issues in regard to genetically modified foods.  
Evolution Connection Question Chapter 20

**Labs:** AP Laboratory 6b: Molecular Biology

The Beckett Family – Gel Electrophoresis ([www.biology.arizona.edu/](http://www.biology.arizona.edu/))  
Forensics Lab

## **Unit 10 – Genetic Basis of Development**

1. Model Organisms
2. Cloning
3. Genetic Analysis of Drosophila Development

**At the end of this unit students will be able to:**

- ◆ Understand the importance of cell division, differentiation and morphogenesis in the development of a multicellular organism.
- ◆ Understand the importance of cytoplasmic determinants in the egg and induction in the early embryo.
- ◆ Differentiate between the methods used to clone plants and animals.
- ◆ Understand the different genetic mechanisms involved in the development of the drosophila.
- ◆ Understand the evolutionary significance of homeobox genes.

**Homework:** Read chapter 21

Evolution Connection Question: Chapter 21

## **Unit 11 - Evolution**

1. Darwin
2. Natural Selection
3. Evidence for Evolution
4. Evolution of Populations
5. Mechanisms of Speciation

**At the end of this unit students will be able to:**

- ◆ Understand the implications of geologic process in influencing Darwin's theory of evolution.
- ◆ Understand natural selection and how it is the mechanism for evolution.

## **Unit 11 – Evolution (continued)**

- ◆ Determine how homologous structures, embryological homologies and molecular homologies give credence to the theory of evolution.
- ◆ Differentiate between methods that allow for genetic variation in population to occur: bottleneck effect, founder effect, genetic drift, etc.
- ◆ Solve Hardy-Weinberg Equilibrium problems.
- ◆ Differentiate between allopatric and sympatric modes of speciation

- ◆ Differentiate between prezygotic and postzygotic barriers and understand their role in reproductive isolation between species.
- ◆ Differentiate between punctuated equilibrium and the gradualism model of speciation.

**Homework:** Read chapters 22, 23 and 24

**Labs:** AP Laboratory 8: Population Genetics & Evolution

### **Unit 12 - Phylogeny and Systematics**

1. History of the Earth
2. Fossil Record
3. Classification
4. Cladistic Analysis

**At the end of this unit students will be able to:**

- ◆ Understand how fossils are formed and how the fossil record helps us reconstruct the history of earth's organisms.
- ◆ Differentiate between relative dating and absolute dating.
- ◆ Understand the Linnaean system of classification.
- ◆ Understand how to construct and read a cladogram.
- ◆ Understand how molecular data provides the scientists with new information which sometimes leads to changes in evolutionary relationships between organisms.

**Homework:** Read chapter 25

### **Unit 13 – The Origin of Prokaryotes and Eukaryotes**

1. Early Earth and the Origin of Life
2. Prokaryotes and the Origins of Metabolic Diversity
3. The Origins of Eukaryotic Diversity

**At the end of this unit students will be able to:**

- ◆ Students will demonstrate an understanding of the major events in the history of life.
- ◆ Differentiate between spontaneous generation and biogenesis.
- ◆ Understand the experiments of Miller and Urey how they demonstrate that life on the early earth may have come about via spontaneous generation.
- ◆ Understand how new technology is requiring us to question our six kingdom system of classification.
- ◆ Differentiate between prokaryotes in terms of their structure, metabolism and nutritional needs.
- ◆ Differentiate between the types of organisms found in the domains bacteria and archaea in terms of how they obtain energy.
- ◆ Understand the ecological importance of prokaryotes.
- ◆ Understand the use of prokaryotes in bioremediation.
- ◆ Understand the vast diversity of organisms found in the kingdom protista.
- ◆ Understand how eukaryotic cells arose from more primitive prokaryote cells, and the role of endosymbiosis.

### **Unit 13 – The Origin of Prokaryotes and Eukaryotes (continued)**

**Homework:** Read chapters 26, 27 and 28

Evolution Connection Questions: Chapter 27 and 28

**Labs:** Protista Lab (wet lab)

## **Unit 14 – Plant Diversity**

1. How Plants Colonized Land
2. The Evolution of Seed Plants

### **At the end of this unit students will be able to:**

- ◆ Differentiate between the four main groups of land plants.
- ◆ Understand the evolutionary relationship between charophyceans and land plants
- ◆ Differentiate between the sporophyte and gametophyte generations found in the reproductive cycle of plants.
- ◆ Demonstrate an understanding of the evolutionary advantage of vascular plants and seed plants.
- ◆ Differentiate between gymnosperms and angiosperms in regard to the following:
  - Alternation of generation
  - Seed production

**Homework:** Read Chapter 29 and 30  
Evolution Connection Question: Chapter 29

## **Unit 15 – Fungi**

### **At the end of this unit students will be able to:**

- ◆ Demonstrate an understanding of the structure of a fungus and how they obtain their nutrition.
- ◆ Differentiate between Chytridiomycota, Zygomycota, Ascomycota and Basidiomycota in terms of the following:
  - Structure
  - Life cycles
- ◆ Demonstrate an understanding of the mutualistic relationship between fungi and algae in the formation of lichen.
- ◆ Demonstrate an understanding of the ecological importance of fungi.

**Homework:** Read chapter 31

## **Unit 16 – Animal Evolution**

1. Introduction to Animal Evolution
2. Invertebrates
3. Vertebrate Evolution and Diversity

### **At the end of this unit students will be able to:**

- ◆ Differentiate between the traditional view of animal diversity and phylogeny based on sequencing of SSU-rRNA.
- ◆ Demonstrate an understanding of the following divisions and how they were used to formulate the traditional view of animal diversity:
  - Parazoa-Eumetazoa dichotomy
  - Radiata-Bilateria Dichotomy
  - Acoelomate, pseudocoelomate and coelomate grades
  - Protostome-Deuterostome Dichotomy

## **Unit 16 – Animal Evolution (continued)**

- ◆ Differentiate between the different invertebrate phyla based on:
  - Locomotion
  - Structures including:
    - Body planes
    - Gastrovascular cavities
    - Body cavities
    - Cephalization

- Circulatory systems
- Body segmentation
- ◆ Demonstrate an understanding of the evolutionary significance of certain animal traits including:
  - Bilateral symmetry
  - Cephalization
  - Development of wings
  - Amniotic egg
- ◆ Demonstrate an understanding of the four anatomical features that characterizes the phylum chordate
- ◆ Differentiate between the different vertebrate phyla.
- ◆ Demonstrate an understanding of primate evolution.

**Homework:** Read chapters 32, 33 and 34

Evolution Connection Questions: Chapters 32 and 34

## **Unit 17 - Plants**

1. Plant Structure and Growth
2. Transport in Plants
3. Plant Nutrition
4. Plant Reproduction and Biotechnology
5. Plant responses to Internal and External Signals

**At the end of this unit students will be able to:**

- ◆ Differentiate between monocots and dicots with regard to embryos, leaf venation, stems, roots and flowers.
- ◆ Differentiate between a plant's basic organs in terms of structure and function.
- ◆ Differentiate between xylem and phloem in terms of structure and function.
- ◆ Demonstrate an understanding of the stomata in terms of structure, function and control.
- ◆ Identify the different types of plant cells.
- ◆ Demonstrate an understanding of the apical and lateral meristems in regard to plant growth.
- ◆ Identify the different zones that make up the plant root and the different types of tissue that make up the plant root.
- ◆ Identify the types of tissues that make up the stem of a plant.
- ◆ Demonstrate an understanding of the tissue organization of leaves.
- ◆ Show an understanding of the development of the plant body including genetic controls.
- ◆ Show an understanding of the importance of the mutualistic relationship between the plant root and mycorrhizae.
- ◆ Show an understanding of nutrients required by a plant and what the symptoms of a deficiency would be.
  - Differentiate between macronutrients and micronutrients.
- ◆ Understand the importance of soils and soil conservation.
- ◆ Show an understanding of the importance of nitrogen-fixing bacteria as a limiting factor for plant growth.
- ◆ Identify the different parts of a flower and know their function.
- ◆ Differentiate between the different types of flowers.
- ◆ Identify different types of seeds and how germination occurs.
- ◆ Determine the evolutionary significance of the development of the seed and pollen in angiosperms.
- ◆ Differentiate between the different types of asexual reproduction.

## **Unit 17 – Plants (continued)**

- ◆ Debate the social and environmental issues associated with plant biotechnology.
- ◆ Differentiate between the different hormones involved in plant growth, seed dormancy and germination.

- ◆ Demonstrate an understanding of a plant's response to light in regard to growth and flowering.

**Homework:** Read chapters 35 – 39  
Evolution Connection Questions Chapters 35 and 36

**Labs:** AP Laboratory 9: Transpiration  
Structure of flowers and seeds Lab

## **Unit 18 – Animal Structure and Function**

1. Animal Nutrition
2. Circulation and Gas Exchange
3. The Body's Defenses
4. Regulating the Internal Environment
5. Chemical Signals in Animals
6. Animal Reproduction
7. Animal Development
8. Nervous System
9. Sensory and Motor Mechanisms

### **At the end of this unit students will be able to:**

- ◆ Differentiate between the different types of tissues in terms of their structure and function.
- ◆ Understand the importance of negative and positive feedback loops in the homeostasis of an organism.
- ◆ Differentiate between endotherms and ectotherms in regard to metabolic strategies.
- ◆ Differentiate between the different types of feeding strategies.
- ◆ Differentiate between ingestion, digestion, absorption and elimination.
- ◆ Differentiate between intracellular and extracellular digestion.
- ◆ Show an understanding of the human digestive process including the organs and enzymes involved.
- ◆ Differentiate between open and closed circulatory systems.
- ◆ Differentiate between the generalized circulatory systems of vertebrates.
- ◆ Show an understanding of mammalian cardiovascular system in terms of structure and electrical control.
- ◆ Differentiate between arteries, veins and capillaries in terms of their structure and function.
- ◆ Show an understanding of what blood pressure is a measure of.
- ◆ Show an understanding of how exchange between the capillaries and interstitial fluid occurs.
- ◆ Differentiate between the different cellular elements that constitute the blood
- ◆ Differentiate between the different types of respiratory surfaces (gills and lungs) and determine the advantages and disadvantages of each.
- ◆ Understand how the countercurrent exchange system of a fish maximizes the oxygen transfer from the water to the blood.
- ◆ Understand the structure and function of the mammalian lung.
- ◆ Differentiate between non-specific and specific defense mechanisms.
- ◆ Differentiate between the different types of cells involved in defending an organism from invading pathogens.
- ◆ Show an understanding of how disorders of the immune system can lead to disease.
- ◆ Understand how countercurrent exchange systems are involved in the regulation of body temperature.
- ◆ Differentiate between different types of topography and the advantages to the organism.
- ◆ Differentiate between different types of an animal's nitrogenous waste and how they are correlated to their habitat.
- ◆ Show an understanding of the kidney in terms of its structure and its function in osmoregulation.
- ◆ Differentiate between major vertebrate endocrine glands, their hormones, function and what regulates them.
- ◆ Differentiate between the different reproductive strategies found among animals.

## **Unit 18 – Animal Structure and Function (continued)**

- ◆ Differentiate between the male and female mammalian reproductive systems in terms of their function structure.
  - Demonstrate knowledge of spermatogenesis and oogenesis
  - Understand the hormonal control of the male and female reproductive systems.
- ◆ Show an understanding of embryonic development in animals.
- ◆ Cleavage, gastrulation, organogenesis
- ◆ Organs and tissues derived from the three embryonic germ layers
- ◆ Determine the evolutionary significance of the shelled egg and uterus of placental mammals.
- ◆ Understand the importance of cytoplasmic determinants and cell-to-cell induction in embryonic development.
- ◆ Understand the genetic control involved in embryonic development.
- ◆ Demonstrate an understanding of the structure of a vertebrate neuron, how impulses are transmitted along a neuron and between neurons.
- ◆ Differentiate between the central nervous system and the peripheral nervous system.
- ◆ Differentiate between the different neurotransmitters and their function within the body.
- ◆ Distinguish between the different types of nervous systems found in different organisms.
- ◆ Understand the evolutionary significance of cephalization.
- ◆ Show an understanding of the vertebrate nervous system including brain structure and the interaction of the sympathetic and parasympathetic divisions of the autonomic nervous system.
- ◆ Understand how sensory receptors transmit information from the environment to the nervous system.
- ◆ Differentiate between hydrostatic skeleton, exoskeleton and endoskeletons in terms of their structure and function.
- ◆ Differentiate between the different types of joints found in the human skeleton in terms of their structure.
- ◆ Understand the relationship between muscular and skeleton systems.
- ◆ Understand the interaction between myosin-actin filaments in muscle contraction.

**Homework:** Chapters 40 – 49

Evolution Connection Questions chapter 42, 46, 47 and 49

**Labs:** Laboratory 10: Physiology of the Circulatory System

Laboratory 11: Animal Behavior

## **Unit 19 - Ecology**

1. Introduction to Ecology and the Biosphere
2. Population Ecology
3. Community Ecology
4. Ecosystems
5. Conservation Biology

**At the end of this unit students will be able to:**

- ◆ Demonstrate an understanding of how geographic, biotic and abiotic factors affect the distribution of organisms.
- ◆ Differentiate between the different types of biomes found on the earth.
- ◆ Understand the genetic and environmental factors that may shape a behavior.
  - Understand the evolutionary significance of mating behaviors.
  - Debate the pros and cons of altruistic behavior
- ◆ Differentiate between the different types of learning seen in animal populations.
- ◆ Differentiate between density and dispersion of a population.
- ◆ Interpret life tables, reproductive tables and survivorship curves.
- ◆ Differentiate between semelparity and iteroparity and the environmental conditions that would favor one over the other.

- ◆ Differentiate between r-selected and k-selected species.
- ◆ Demonstrate an understanding of the relationship between negative feedback and population growth.

### **Unit 19 – Ecology (continued)**

- ◆ Demonstrate an understanding of how improved medicine and agricultural methods have allowed the human population to grow exponentially.
- ◆ Differentiate between the rivet and redundancy models of community ecology.
- ◆ Show an understanding of how population size may be controlled by intraspecific and/or interspecific competition.
- ◆ Show how energy is transferred between organisms in a community.
- ◆ Understand the importance and a keystone species in a food chain.
- ◆ Differentiate between primary and secondary succession.
- ◆ Understand the relationship between an ecosystem's energy budget and primary productivity.
- ◆ Understand the importance of the water cycle, carbon cycle, nitrogen cycle and phosphorous cycle in transferring nutrients through ecosystems.
- ◆ Understand the human impact on ecosystems and the biosphere in terms of.
  - Loss of biodiversity
  - Habitat destruction
  - Changes in climate cycles
  - Affect of introduced species

**Homework:** Read chapters 50 – 55  
 Journal article on Florida Scrub Jays (altruism)  
 Evolution Connection Question – Chapter 52, 54 and 55

**Labs:** Laboratory 12: Dissolved Oxygen and Primary Productivity