

COURSE OUTLINE

NAME OF COURSE: BIOLOGY

COURSE NUMBER: SCI 201

WRITTEN / REVISED: SEPTEMBER, 2011

LEVEL OF COURSE: HONORS

NUMBER OF CREDITS: SIX (6)

PREREQUISITES: HONORS SCREENING

GRADE LEVELS OFFERED TO: 9-10

COURSE DESCRIPTION:

This program is designed for the serious, college bound student who demonstrates significant science ability. The recommended student should be tracking toward a career in the Sciences. The format of the program should foster a college-like atmosphere. Great emphasis will be placed on independent work.

COURSE OBJECTIVES:

When this Biology course has been completed successfully, students should be able to:

1. Demonstrate the ability to set reasonable goals.
2. Demonstrate the responsibility for carrying out self-set goals.
3. Demonstrate cooperation by working constructively with other students.
4. Demonstrate cooperation with the instructor by using time constructively and with purpose, relative to course oriented goals.
5. Demonstrate cooperation with the instructor by performing requested special program oriented tasks.
6. Demonstrate independence by exploring all possible avenues in the solution of problems with the minimum of help.
7. Demonstrate independence and scholastic growth by using resources available efficiently.

CORE CURRICULUM CONTENT STANDARDS ADDRESSED:

5.1 - Scientific Practices

5.2 - Physical Science

5.3 - Life Science

SPECIFIC BEHAVIORAL OBJECTIVES / PROFICIENCIES AND TIME LINES:

Unit 1 – Biology: Exploring Life

Time = 8 Days

Goal: The student will gain an understanding of the fundamental philosophy of Biology as a science and the many levels of organization of the natural world.

Objectives:

1. Describe the levels of biological organization from molecules to the biosphere.
2. Compare the flow of chemical nutrients and the flow of energy in a n ecosystem.
3. Explain how cells function as the structural and functional units of life.
4. Define the principle of emergent properties and describe and example of it.
5. Explain how DNA encodes a cell's information.
6. List seven properties that are common to all life.
7. Compare the tree domains of life.
8. Describe the process and products of natural selection, explaining why individuals cannot evolve.
9. Compare discovery science and hypothesis-based science.
10. Define a hypothesis and compare inductive with deductive reasoning.
11. Describe the structure of a controlled experiment and give an example.
12. Compare the goals of science and technology.
13. Explain how evolution impacts the lives of all humans.

Unit 2 - The Chemical Foundations for Cells

Time = 11 days

Goal: Establish the basic concepts of chemistry for biology.

Objectives:

1. Review the basic structure of atoms, ions, molecules and the function of subatomic particles.
2. Explore the role of electron distribution in the formation of ionic and covalent bonds.
3. Know the various types of chemical bonds, the circumstances under which each forms, and the relative strengths of each type.
4. Understand the essential chemistry of water and its important properties for life.
5. Understand the relationship of acids bases and salts.

Unit 3 – Carbon Compounds in Cells

Time = 10 days

Goal: The student will gain an understanding of how carbon is essential for life.

Objectives:

1. Understand how small molecules can be assembled into large macromolecules by condensation (dehydration) synthesis and also split via hydrolysis, monomers and polymers.
2. Review Carbon's unique role in the chemistry of life and the functional groups.
3. Consider the structure, characteristics, properties and role of the important organic molecules: carbohydrates, lipids, proteins and nucleic acids.

Unit 4 – Chapter 21 Nutrition and Digestion **Time = 10 days**

Goal: Students will gain an understanding of the role of the digestive system

Objectives:

1. Students will be able to name, identify, and describe the roles and functions of each organ in the digestive system.
2. Label the organs of the digestive system.
3. Describe the diseases and health issues related to the digestive system.
4. Describe the four classes of essential nutrients.
5. Define the essential minerals and explain why each is important in our diet.
6. Explain how diet can influence the risks of cardiovascular disease and cancer.

Unit 5 – Chapter 4 A Tour of the Cell **Time = 10 days**

Goal: The student an understanding of cell structure and function

Objectives:

1. Define and understand the cell theory and briefly describe the discoveries that led to its development.
2. Understand the essential structure and function of the cell membrane.
3. Contrast the basic features of prokaryotic and eukaryotic cells.
4. Consider the structure and function of the organelles and compare and contrast plant and animal design.

Unit 6 – Ecology **Time = 10 Days**

Goal: The students will gain an understanding of the basic ecological concepts

Objectives:

Part A – Chapter 34

1. The students will learn the language associated with the study of population ecology.
2. Understand the factors that affect population density, distribution, and change.
3. Understand the significance and use of life tables; interpret survivorship curves.
4. Know the impacts of the growth of human populations.
5. Tell which factors have encouraged growth in some cultures and limited growth in others.
6. Describe the relationship between food web, food chain, trophic levels, ecological pyramids, and energy trophic levels.
7. Understand how organisms interact with their environment at several levels.
8. Determine the physical and chemical factors that influence life in the biosphere.
9. Understand how regional climate influences the distribution of terrestrial biomes.

Part B – Chapter 36

1. Determine why populations change over time.
2. Explain why density and dispersion patterns are important population variables.
3. Describe how an ecological footprint is a measure of resource consumption.
4. Discuss the positive aspects and the negative aspects of predation on prey populations

Part C – Chapter 37

Objectives:

1. Describe the relationship between a food chain and food web.
2. Trace the flow of energy (trophic levels) through living systems.
3. Describe how one ecological pyramid distributes energy and how energy is transferred and lost.
4. Describe how climatic change has altered conditions on Earth, ie greenhouse effect
5. Describe how human activities (hunting) has reduced biodiversity
6. Identify conservation efforts to protect threatened and endangered species and methods used to help maintain balance within an ecosystem.
7. Describe the role of the ozone layer and conservation efforts to protect it.

Unit 7 – Tracing Evolutionary History

Time = 12 Days

Goal: The students will gain an understanding of how organisms are classified and their role in the environment.

Objectives:

Part A – Chapter 15 (section 15.16-15.17):

1. Describe the early classification system proposed by Linnaeus.
2. Explain how organisms are grouped today based on evolution decent, phylogeny, molecular level.
3. Name and characterize each of the major kingdoms and domains.
4. Conduct lab activities to demonstrate an understanding of the concepts and the application of the dichotomous key.

Part B – Chapter 16 The Origin and Evolution of Microbial Life

Goal: The students will gain an understanding of prokaryotes.

Objectives:

1. Give examples of positive and negative impacts of bacteria.
2. Describe typical external barriers that organisms present to invading organisms.
3. Describe the principal types of bacteria.
4. Describe the unique features of bacterial processes and how they cause disease.

Part C – Chapter 10 Molecular Biology of the Gene- Sections 10.17 – 10.21

Goal: The students will gain an understanding to how a virus replicates and cause disease.

Objectives:

1. Compare the lytic and lysogenic reproductive cycles of a virus.
2. Compare the structures and reproductive cycles of an enveloped RNA virus and a herpes virus.
3. Describe three processes that contribute to the emergence of viral disease.
4. Explain how AIDS virus enters a host cell and reproduces.
5. Describe the structure of viroids and prions and explain how they cause disease.

Unit 8 – Chapter 24 The Immune System

Time = 4 Days

Goal: The students will gain an understanding of how our three lines of defense defend against microorganisms.

Objectives:

1. List and describe the three levels of defense against microorganisms.
2. Describe the role of antibodies.
3. Describe how immunotherapy, vaccines, and drug therapy have helped to improve health.
4. Describe how malfunction or failure of the immune system can cause disease.
5. Explain why allergies occur and what causes anaphylactic shock.

Unit 9—The Working Cell

Time = 10 days

Goal: The student will develop an understanding of the concepts of Diffusion, Osmosis, Water Regulation, Chemical Reactions, Enzymes and Digestion.

Objectives:

1. Know two laws that govern the way energy is transferred from one substance to another.
2. Know the forces that cause water and solutes to move across membranes passively.
3. Understand which types of substances move by simple diffusion and which by facilitated diffusion.
4. Know the mechanisms by which substances are moved across membranes against a concentration gradient.
5. Provide an example of a metabolic pathway and explain how they are regulated.
6. Define, identify the characteristics of, and explain the action and regulation of enzymes.
7. Explain how a molecule can “carry” energy.

Unit 10 – How Cells Harvest Chemical Energy

Time = 8 days

Goal: The student will gain an understanding of the processes of fermentation / respiration.

Objectives:

1. Understand what kinds of molecules can serve as food molecules.
2. Know the relationship of food molecules to glucose and thus to glycolysis.
3. Understand the fundamental differences between glycolysis and fermentation and glycolysis followed by aerobic respiration.
4. Know the factors that determine whether an organism will carry on fermentation or aerobic respiration.
5. Know the raw materials and products of each of these processes: glycolysis, fermentation, the Krebs cycle, and electron transport phosphorylation.
6. Describe how fats and proteins can be used as alternative fuels.

Unit 11- Photosynthesis: Using Light to Make Food

Time = 7 days

Goal: The student will gain a functional understanding of the process of Photosynthesis.

Objectives:

1. Understanding the main pathways by which energy from the sun or from specific
2. chemical reactions enter and return back into the environment.

3. Know the steps of the light-dependent and light-independent reactions including raw materials and products.
4. Explain how autotrophs use the intermediates as well as the products of
5. photosynthesis in their metabolism.
6. Compare and contrast the process of chemosynthesis to photosynthesis.
7. Describe the role of chloroplasts and explain its relationship in converting light energy to produce food.
8. Determine how photosynthesis moderates global warming.

Unit 12 – Chapter 8 Cellular Reproduction and Genetics Time = 10 days

Goal: The student will gain a fundamental understanding of the activities of cell division, mitosis and how it relates to meiosis.

Objectives:

1. Understanding the factors that cause cells to reproduce.
2. Understand what is meant by *cell cycle* and explain where mitosis fits into the cell cycle.
3. Be able to describe each phase of mitosis and cytokinesis.
4. Describe what causes uncontrolled cell division and cancer.
5. Compare and contrast asexual and sexual reproduction at the cellular level.
6. Understand the effect that meiosis has on chromosome number
7. Describe the events that occur in each meiotic phase.
8. Compare and contrast mitosis and meiosis.
9. Explain chromosomal aberrations and how they relate to human genetic disorders.
10. Explore the effects of nondisjunction and establish the concept of karyotypes.
11. Explore the aspects of chromosomal mutations.

Unit 13-- Chapter 9 Patterns of Inheritance Time = 17 days

Goal: The student will gain an understanding of classical genetics.

Objectives:

1. Know Mendel's principles of dominance, segregation and independent assortment.
2. Understand how to solve genetics problems that involve monohybrid/dihybrid crosses.
3. Probability in genetics.
4. Understand the variations that can occur in observable patterns of inheritance.
5. Multiple Alleles -- pleiotropy -- multiple factors -- epistasis.
6. Explain chromosomal aberrations and how they relate to human genetic disorders.
7. Know the chromosomal basis of inheritance and relate this to Mendel's Genetics.
8. Explore the history of chromosomal inheritance with focus on the work of Morgan et al.
9. Explore the influence of Sex Linkage.

Unit 14 – Chapter 10 Molecular Biology of the Gene Time = 8 days

Goal: The student will master the structure design and function of DNA and RNA.

Objectives:

Chapter 10

1. Understand the history behind the discovery of the structure and function of DNA.
2. Understand the intricate sub-structure of DNA and RNA.
3. Understand how DNA is replicated and repaired
4. Correlate the structure of DNA and RNA to function: Transcription and Translation.
5. Explain the regulation of Gene Function.
6. Understand the nature of mutation, types of mutation, and their role in genetic variation i.e. Cancer.

Unit 15— Chapter 12 DNA Technology and Genomics Time = 6 days

Goal: The student will gain a full understanding of recombinant DNA and its application to their everyday life.

Objectives:

Chapter 12

1. Explain the types of genetic experiments that nature has been performing for billions of years.
2. Understand what plasmids are and how they may be used to insert new genes into recombinant DNA molecules.
3. Know how DNA can be cleaned, spliced, cloned, and sequenced.
 1. Be aware of several limits and possibilities for future research in genetic engineering.
 2. Explain the role of HGP.
 3. Explain the advances in gene therapy.
7. Consider the future and ethical considerations from genetic engineering

Unit 16 – How Populations Evolve Time = 10 days

Goal: The students will trace and understand the development of evolutionary thought.

Objectives:

Part A – Chapter 16

1. Understand early beliefs and the significant contributions made by individuals such as Aristotle, Cuvier, Lamarck and Darwin/Wallace et al.
2. Understand that individuals do not evolve (species) population's do.
3. Understand the concepts of Allele Frequencies and Hardy-Weinberg and ultimately Natural Selection with consideration given to Directional, Stabilizing, Disruptive Selection, Genetic Drift, Bottlenecks and the Founder Effect.
4. Know how mutations, gene flow, genetic drift, and natural selection can change allele frequencies.
5. Describe the selection mechanisms that help shape populations.
6. Consider in detail the evidence of Fossils, Comparative Morphology and Morphological Divergence (Biogeography) and Comparative Biochemistry.
7. Be able to cite what biologists generally accept as evidence that supports evolution.

Unit 17 – Nervous System

Time = 10 days

Goal: The students will obtain a working knowledge of how the Nervous System is structured and how it functions.

Objectives:

1. Understand how the Nervous System receives input, interprets it and sends out commands.
2. Describe how a neuron functions.
3. Describe how a neuron communicates at a synapse.
4. Identify the structure and function of the Nervous System.
5. Identify the structure and functions of the human brain.

MATERIALS / RESOURCES:

Biology - Concepts and Connections by Campbell – 6th Edition, 2009

A. STUDENT PROGRESS:

The evaluation of student progress will be made on the following criteria:

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|------------------------|-------|
| 1. Unit Tests/ Quizzes | ~40 % |
| 2. Laboratory Reports | ~40 % |
| 3. Independent Work | ~20 % |

B. PERIODIC EVALUATION OF OBJECTIVES AND GUIDE:

Next evaluation due June 2014

C. SPECIAL COURSE POLICIES:

As explained in the initial meetings of class, the final project is imperative. Failure to hand in a project will result in a permanent incomplete.

D. SUPPLEMENTARY READINGS AND INSTRUCTORS BIBLIOGRAPHY:

Biology – Concepts and Applications – Cecil Starr. 5th edition.

E. DATE MID-TERM / FINAL REVISED

1. Mid-term – January 2011
2. Final – June 2011

High Point Regional High School's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and address the elimination of discrimination by narrowing the achievement gap, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectionate or sexual orientation, gender, religion, disability or socioeconomic status.

Curriculum Scope & Sequence

Content Area	High School Science	Course Title/Grade Level	Biology Honors – Grade 9-10
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General Overview and Pacing

	Topic/Unit Name	Suggested Pacing (Days)
Topic/Unit 1	Ch 1 – Exploring Life	8
Topic/Unit 2	Ch 2 - The Chemical Foundations for Cells	11
Topic/Unit 3	Ch 3 - Carbon Compounds in Cells	10
Topic/Unit 4	Ch 21 - Nutrition and Digestion	10
Topic/Unit 5	Ch 4 - A Tour of the Cell	7
Topic/Unit 6	Ch 15,16,10 – Tracing Evolutionary History	15
Topic/Unit 7	Ch 24 - Immune System	3
Topic/Unit 8	Ch 5 - The Working Cell	10
Topic/Unit 9	Ch 6 – How Cells Harvest Chemical Energy	8
Topic/Unit 10	Ch 7 – Photosynthesis: Using Light to Make Food	7
Topic/Unit 11	Ch 34,36,37 - Ecology	17
Topic/Unit 12	Ch 8 – Cellular Reproduction and Genetics	10
Topic/Unit 13	Ch 9 – Observable Patterns of Inheritance	17
Topic/Unit 14	Ch 10 - Molecular Biology of the Gene	8
Topic/Unit 15	Ch 12 – DNA Technology and Genomics	6
Topic/Unit 16	Ch 13 - Evolution	10
Topic/Unit 17	Ch 28 – Nervous System	10