

HONORS BIOLOGY CURRICULUM - AUGUST 2008

COURSE DESCRIPTION: (The course description sets the parameters, scope and sequence for the course:

The purpose of this course is to provide students with advanced exploratory experiences and activities in the fundamental concepts of the biological sciences. This course includes a study of but is not limited to, ecology, population biology, biochemistry, cells, DNA and RNA, cell reproduction, genetics and heredity. This is a laboratory-based course, with emphasis on the scientific method, problem solving and data analysis. Students will be expected to complete independent research projects.

CORE CURRICULUM CONTENT STANDARDS: (Quoted from state document)

STANDARD 5.1 (Scientific Processes) All students will develop problem-solving, decision-making and inquiry skills, reflected by formulating usable questions and hypotheses; planning experiments, conducting systemic observations, interpreting and analyzing data, drawing conclusions, and communicating results.

STANDARD 5.2 (Science and Society) All students will develop an understanding of how people of various cultures have contributed to the advancement of science and technology, and how major discoveries and events have advanced science and technology.

STANDARD 5.3 (Mathematical Applications) All students will integrate mathematics as a tool for problem solving in science, and as a means of expressing and/or modeling scientific theories.

STANDARD 5.4 (Nature and Process of Technology) All students will understand the interrelationships between science and technology and develop a conceptual understanding of the nature and process of technology.

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.

STANDARD 5.6 (Chemistry) All students will gain an understanding of the structure and behavior of matter.

STANDARD 5.7 (Environmental Studies) All students will develop an understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.

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

CUMULATIVE PROGRESS INDICATORS: (Quoted from state document)

5.1 (Scientific Processes)

By the end of Grade 12, students will:

A. Habits of Mind

1. When making decisions, evaluate conclusions, weigh evidence, and recognize that arguments may not have equal merit.
2. Assess the risks and benefits associated with alternative solutions.
3. Engage in collaboration, peer review, and accurate reporting of findings.
4. Explore cases that demonstrate the interdisciplinary nature of the scientific enterprise.

B. Inquiry of Problem Solving

1. Select and use appropriate instrumentation to design and conduct investigations.
2. Show that experimental results can lead to new questions and further investigations.

C. Safety

1. Understand, evaluate and practice safe procedures for conducting science investigations.

5.2 (Science and Society)

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

A. Cultural Contributions

1. Recognize the role of the scientific community in response to changing social and political conditions and how scientific and technological achievement effect historical events.

B. Historical Perspectives

1. Examine the lives and contributions of important scientists who effected major breakthroughs in our understanding of the natural and designed world.
2. Discuss significant technological achievements in which science had played an important part as well as technological advances that have contributed directly to the advancement of scientific knowledge.
3. Describe the historical origin of important scientific developments such as atomic theory, genetics, plate tectonics, etc., showing how scientific theories develop, are tested, and can be replaced or modified in light of new information and improved investigative techniques.

5.3 (Mathematical Applications)

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

A. Numerical Operations

1. Reinforce indicators from previous grade level.

B. Geometry and Measurement

1. When performing mathematical operations with measured quantities, express the answer to reflect the degree of precision and accuracy of the input data.

C. Data Analysis and Probability

1. Construct and interpret graphs of data to represent inverse and non-linear relationships and statistical distribution.

5.4 (Nature and Process of Technology)

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

A. Science and Technology

1. Know that scientific inquiry is driven by the desire to understand the natural world and seeks to answer questions that may or may not directly influence humans, while technology is driven by the need to meet human needs and solve human problems.

B. Nature of technology

1. Assess the impacts of introducing a new technology in terms of alternative solutions, costs, trade offs, risks, benefits and environmental impact.

C. Technological Design

1. Plan, develop, and implement a proposal to solve an authentic technological problem.

STANDARD 5.5 (Characteristics of Life)

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.

3. Describe how plants produce substances high in energy content that become the primary source of energy for life.

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.

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.

STANDARD 5.6 (Chemistry)

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

A. Structure and Properties of Matter

1. Know that atoms are made of a positive nucleus surrounded by negative electrons and that the nucleus is composed of protons and neutrons, each almost 2,000 times more massive than an electron.
2. Know that the number of protons in the nucleus defines the element.
3. Know that an atom's electron configuration determines how the atom can interact with other atoms.
4. Explain that atoms form bonds (ionic and covalent) with other atoms by transferring or sharing electrons.
5. Explain how the Periodic Table of Elements reflects the relationship between the properties of elements and their atomic structure.

B. Chemical Reactions

1. Explain that the rate of reactions among atoms and molecules depends on how often they encounter one another and that the rate is affected by nature of reactants, concentration, pressure, temperature, and the presence of a catalyst.
2. Show that some changes in chemical bonds require a net input or net release of energy.

STANDARD 5.7 (Environmental Studies)

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

A. Cultural Contributions

1. Recognize the role of the scientific community in responding to changing social and political conditions and how scientific and technological achievement effect historical events.

B. Historical Perspectives

1. Examine the lives and contributions of important scientists who effected major breakthroughs in our understanding of the natural and designed world.
2. Discuss significant technological achievements in which science has played an important part as well as technological advances that have contributed directly to the advancement of scientific knowledge.
3. Describe the historical origin of important scientific developments such as atomic theory, genetics, plate tectonics, etc., showing how scientific theories develop, are tested, and can be replaced or modified in light of new information and improved investigative techniques.

STANDARD 8.1 (Technology Literacy)

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 THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO: (Arranged by standard)

STANDARD 5.1 (Scientific Processes)

Lab Manual – Investigation 2-1 “Can Scientific Methods Be Used To Solve a Problem?”pp. 5-8.

Minilab, SE,(student edition) p.30

Biolab, SE., p.32

Lab Manual- “Using SI Units.” Pp. 9-12.

CD-ROM INVESTGATION: Developing Vaccines

STANDARD 5.2 (Science and Society)

Students will read the information presented to them in the text and perform research on the following Science and Society issues:

ISSUES:

Saving the Everglades - pp. 74

Evolution: Evaluating the Evidence - pp.426
Bioengineered Food – pp.586
Should we let fires burn? – pp.620
Too Many Starfish? – pp.790
Zoos: Preserves of Breeding Grounds? – pp.844
What Price Beauty? – pp.887
Megavitamins – pp.963

STANDARD 5.3 (Mathematical Applications)

~ Students will utilize the following websites to complete assignments:

www.pbs.org/teachersource/math/high_algebra.shtml

www.tc.cornell.edu/Services/Edu/MathSciGateway/Math.asp

~ MATH ACTIVITIES:

*How many are there? pp. 126

*Energy from Cellular Respiration. pp. 251

*A Solution from Ratios pp. 290

*The Mathematics of Evolution. Pp. 438

*Making and Using Graphs. Pp. SH12

STANDARD 5.4 (Nature and Process of Technology)

~ Technology and Society: Keeping the Balance pp. 1108

~ Students will utilize the following websites to complete independent projects:

www.nap.edu/issues/

www.teach-nology.com/teachers/lesson_plans/science.com

Group Project – Students will work in teams of three to plan, develop and implement a proposal to solve an authentic technological problem.

STANDARD 5.5 (Characteristics of Life)

Laboratory Manual- “Chloroplast Pigment Analysis”, pp.57-60

Thinking Lab- “How Does Photosynthesis vary with light intensity?”, pp.244

Biolab- “Design your Own Experiment.” Pp. 246

Laboratory Manual-“How Does Concentration of Sugar Affect Fermentation?”pp.61-62

Laboratory Manual –“Observation of Meiosis.” Pp.73-74

Lab: Dihybrid Crosses

CD-ROM INVESTIGATION: Sex-linked Traits

STANDARD 5.6 (Chemistry)

Laboratory Manual- “Test for Organic Compounds” pp. 39-42

Laboratory Manual-“What is the Action of Diastase?”pp. 43-46

Critical Thinking – Sugars and Isomers,pp.7

Biolab-“Design your Own Experiment” pp. 182

CD-ROM INVESTIGATION: Enzyme-Controlled Reactions

STANDARD 5.7 (Environmental Studies)

Laboratory Manual- “Physical Factors of the Soil.”pp.13-14

Laboratory Manual-“Lesson of the Kaibab.” Pp.15-18

Minilab-“Measuring water loss in plants.”pp.57

CD-ROM –Investigations: Population Biology, Assessing Water Quality

CD-ROM Explorations: Pyramid of Energy, Classifying Pines, and Pollination

CD- ROM- Bioquests: Antarctic Food Web

STANDARD 8.1 (Technology Literacy)

Internet Applications: Research examples of the Scientific Method

Internet Applications: Report on Scientist

CD-ROM: Pasteur’s Experiment

CD-ROM: The Scientific Method

Internet Connection: Glencoe link

CD-ROM: Bioquests

CD-ROM: Explorations

CD-ROM: Investigations

CD-ROM: Presentation Inquiry

CD-ROM: Quiz/Assessment

Internet Applications: Cell Research Power point Project

Internet Applications: Endangered Species – Independent Project

Internet Applications: Global Warming/

Internet Applications: “An Inconvenient Truth”

INSTRUCTIONAL STRATEGIES:

Standard 5.1 (Scientific Processes)

~The teacher will explain the steps used in scientific methods.

~The teacher will describe the differences between quantitative and qualitative research,

Standard 5.2 (Science and Society)

~The teacher will present students with examples of contributions of scientists who affected major breakthroughs in our world.

~The teacher will describe the historical origin of important scientific breakthroughs.

~The teacher will explain how scientific theories are developed, tested and implemented.

Standard 5.3(Mathematical Applications)

~The teacher will demonstrate to students the importance of applying mathematical operations to scientific situations.

~The teacher will present students with examples of graphs to represent inverse and nonlinear relationships.

Standard 5.4 (Nature and Process of Technology)

~The teacher will explain to students how technology is driven by the need to meet human needs and solve human problems.

~The teacher will describe how to plan, develop and implement a proposal to solve an

authentic, technological problem.

Standard 5.5 (Characteristics of Life)

- ~The teacher will explain how plants convert light energy to chemical energy.
- ~The teacher will explain how the theory of natural selection accounts for extinction as well as an increase in the proportion of individuals with advantageous characteristics.

Standard 5.6 (Chemistry)

- ~The teacher will describe the important components of an atom.
- ~The teacher will explain how changes in chemical bonds require a net input or net release of energy.

Standard 5.7 (Environmental Studies)

- ~The teacher will present the meaning of ecology as well as the roles of biotic and abiotic factors within ecosystems.
- ~The teacher will discuss the ways in which organisms obtain energy and how it is transferred from organism to organism.
- ~The teacher will describe how human activities impacts upon the cycling of matter and the flow of energy through ecosystems.

Standard 8.1 (Technological Literacy)

- ~The teacher will provide students with the opportunity to utilize the computers and therefore the internet and any other additional technological devices to complete research, solve problems and organize information.
- ~The teacher will encourage students to create and manipulate information through the utilization of technological devices to solve problems and identify solutions.
- ~The teacher will present students with the opportunity to evaluate and critique software for accuracy, relevance and appropriateness.

EVALUATION/ASSESSMENT OF STUDENTS:

Students will be evaluated/assessed on the following criteria:

- Laboratory reports
- Tests
- Quizzes
- Independent Projects

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 (see attached).

RESOURCES/BIBLIOGRAPHY:

BIOLOGY: The Dynamics of Life - Glencoe

