

# **BIOLOGY I CP CURRICULUM**

**August 1, 2008**

## **COURSE DESCRIPTION:**

The basic aim of the Biology CP Lab course is to familiarize the students with the process and patterns of the living world. Through planned experimentation, audio visual aids, test reading, and research projects, each student will be exposed to the major principles that govern the biosphere. Considerable emphasis is placed on laboratory work and on one's ability to analyze experimental data to derive logical conclusions. Areas of study include, but are not limited to Biochemistry, Cytology, Bioenergetics, Genetics, Evolution, Ecology, Taxonomy and Microbiology.

## **CORE CURRICULUM CONTENT STANDARDS:**

**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 SYSTEMATIC OBSERVATIONS, INTERPRETING AND ANALYZING DATA, DRAWING CONCLUSIONS, AND COMMUNICATING RESULTS.**

## **CUMULATIVE PROGRESS INDICATORS:**

Building upon knowledge and skills gained in preceding grades, 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 and 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.

## **SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO: (Arrange by standard)**

\* **Lab/activities** – *Scientific Method*

Pulse Rate Hypothesis (w.s)

Peanut Activity (w.s.)

Color My World (w.s.)

**INSTRUCTIONAL STRATEGIES:**

Teacher will use of lectures, labs, activities, videos, and presentations to teach students. Teacher will guide students to begin their search for solutions to a particular problem or question by forming a hypothesis, a testable possible explanation for their observations.

**CORE CURRICULUM CONTENT STANDARDS:**

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.

**CUMULATIVE PROGRESS INDICATORS:**

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.

**SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO: (Arrange by standard)****Chapter 12 “Genetics and Inheritance”**

## 12.1 Origins of Hereditary Science

(Gregor Mendel, Mendel’s models, and Heredity Laws)

## 12.2 Mendel’s Theory

## 12.3 Modeling Mendel’s Laws

## 12.4 Beyond Mendelian Heredity

**INSTRUCTIONAL STRATEGIES:**

Teacher will use of lectures, labs, activities, videos, and presentations to teach students. Teacher will point out the reason for Gregor Mendel’s success at inheritance research and emphasize the connection between Mendel’s principles of inheritance and the mechanisms of meiosis and mitosis.

Teacher will review Mendel’s principles, and how to use them to predict outcomes of genetic crosses. Encourage students to use the process skills of predicting, inferring, and interpreting data to solve genetic problems.

Teachers will describe the different types of mutations and causes, and infer mutations

cause changes in the phenotype because of a change in the DNA or chromosomes.

**CORE CURRICULUM CONTENT STANDARDS:**

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.

**CUMULATIVE PROGRESS INDICATORS:**

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, tradeoffs, risks, benefits and environmental impact.

C. Technological Design

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

**SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO: (Arrange by standard)**

\* Computer/Internet activities

Building A Protein (CD Rom Bioquest) 1-2 periods

Developing Vaccines (CD Rom Invest.) Lab 1-2 periods

**INSTRUCTIONAL STRATEGIES:**

Teacher will use of lectures, labs, activities, videos, and presentations to teach students.

Teacher will Emphasize the importance of genetic engineering and outline the four stages.

Teacher will discuss the great successes of genetic engineering and its role in transforming agriculture.

Teacher will describe how genetic engineering has focused on its potential to aid in preventing and curing illness.

**CORE CURRICULUM CONTENT STANDARDS:**

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.

**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.

#### 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.

### **SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO: (Arrange by standard)**

#### Chapter 3 "Chemistry of Life"

##### 3.1 Matter and Substances

##### 3.2 Water and Solutions

##### 3.3 Carbon Compounds

##### 3.4 Energy and Metabolism

#### *Activities*

What Is Life? (5 characteristics)

Basic Chemistry (atoms □ forming bonds)

Molecules of Life (macromolecules)

\* Lab/activities – *Microscope*

Comparing Living and Nonliving Things (w.s.)

The Compound Microscope (w.s.)

Life In A Drop of Pond Water Lab (w.s.)

\* Computer/Internet activities

Internet Assignment – branches of biology (w.s.)

### **INSTRUCTIONAL STRATEGIES:**

Teacher will use of lectures, labs, activities, videos, and presentations to teach students.

Teacher will guide students to compile a list of characteristics that distinguish living from nonliving.

Teacher will emphasize to students that a basic knowledge of chemistry is important to understand chemical reactions that are vital to life.

Teacher will guide students to understand the structure and function of various organic compounds.

## Chapter 1 “Biology and You”

- 1.1 The Nature of Science  
(Characteristics of scientific thinking and role of ethics and universal law)
- 1.2 Scientific Method  
(Stages common to all scientific research-  
Malaria, Mosquitoes, \* Power Point West Niles Virus)
- 1.3 Tools and Techniques  
(Introduces the tools and techniques scientist use –  
measurement systems)
- 1.4 What is Biology? (Characteristics of all living things)
- \* **Lab/activities** – *Scientific Method*
  - Pulse Rate Hypothesis (w.s.)
  - Peanut Activity (w.s.)
  - Color My World (w.s.)
  - Writing a Laboratory Report (w.s.)
  - Comparing Living and Nonliving Things (Focus Activity chp2)
  - The Compound Microscope (Investigation 1-1)
  - Life In A Drop of Pond Water Lab (pg.42-43)
- \* **Computer/Internet activities**
  - Interpreting Data – graphs (CD Rom Explorations)
  - Internet Assignment – branches of biology (w.s.)

## Chapter 2 “Applications of Biology”

- 2.1 Health in the 21<sup>st</sup> Century  
(biology’s role in improving health)
- 2.2 Biology, Technology, and Society  
(relationship between Biology and Technology)
- 2.3 Biology and the Environment  
(effects of Biology on the Environment)
- \* **Lab/activities** – *Microscope*
  - Feeding Yeast

## Chapter 3 “Chemistry of Life”

- 3.1 Matter and Substances (atoms → forming bonds)
- 3.2 Water and Solutions (water)
- 3.3 Carbon Compounds (macromolecules)
- 3.4 Energy and Metabolism  
(chemical reactions provide energy, enzymes role in  
reactions)
- \* **Lab/activities** – *Cell Structure*
  - Water Day Activities
    - water on wax paper
    - Penny Challenge
  - Enzymes – cracker tasting
  - Digestion Reaction using saliva

A Study of Biochemical Reactions – Liver Lab (w.s.)

**\* Computer/Internet activities**

Enzyme-Controlled Reactions (CD Rom Invest.) Lab 1-2 periods

**Chapter 4 “Ecosystems”**

4.1 What is an Ecosystem? (biotic and abiotic factors of ecosystems)

4.2 Energy Flow in Ecosystems (producers, consumers, flow of energy)

4.3 Cycling of Matter (cycles of water, carbon, nitrogen)

**\* Lab/activities –**

Ecosystem food webs

Ecosystem Terrariums

**Chapter 5 “Populations and Communities”**

5.1 Populations (population growth and characteristics)

5.2 Interactions in Communities

(predator-prey interactions / symbiotic relationships)

5.3 Shaping Communities (species niche)

**\* Lab/activities –**

Yeast Population Growth

**Chapter 6 “The Environment”**

6.1 An Interconnected Planet

(humans and environmental connections)

6.2 Environmental Issues

(identifies causes and effects of pollution)

6.3 Environmental Solutions

(strategies for reducing pollution and solving environmental problems)

**\* Lab/activities –**

Effects of Acid Rain on Seeds pg.140-141

**Chapter 7 “Cell Structure”**

7.1 Introduction to Cells (cell theory)

7.2 Inside Eukaryotic Cell

(structure and function of eukaryotic cells)

7.3 From Cell to Organism (cellular organization, single cell to multicellular organisms)

**\* Lab/activities – *Cell Structure***

Diffusion Through A Membrane (w.s.)

Relationship b/t Diffusion and Cell Size – Agar cubes (w.s.)

Comparing plant and animal cells Lab (w.s.)

**\* Computer/Internet activities**

Parts of a Cell (CD Rom Explorations) +1 period

**\* Project – “Constructing A Cell”**

To be used as test grade

## **Chapter 8 “Cells and Their Environment”**

- 8.1 Cell Membrane (cell membrane and homeostasis)
- 8.2 Cell Transport (how substances move across membrane)
- 8.3 Cell Communication

### **\* Lab/activities –**

- Potato Osmosis
- Egg Osmosis
- Dialysis Tubing Lab (w.s)
- Surface Area to Volume Ratios (cube lab)

## **Chapter 9 “Photosynthesis and Cellular Respiration”**

- 9.1 Energy in Living Systems (ATP)
- 9.2 Photosynthesis
  
- 9.3 Cellular Respiration (turning sugar into ATP)

### **\* Lab/activities –**

- Cooperative learning - Photosynthesis
- Enzymes – cracker tasting
- Digestion Reaction using saliva
- How Does Temperature Affect the Rate of Photosynthesis Lab
- A Study of Biochemical Reactions – Liver Lab (w.s.)
- Chromatography Lab – Separation of Leaf Pigments (w.s.)

### **\* Computer/Internet activities**

- Photosynthesis – cell questions sheet  
(<http://ampere.scale.uiuc.edu/~m-lexa/cell/cell.html>)
- Enzyme-Controlled Reactions (CD Rom Invest.) Lab 1-2 periods

## **Chapter 10 “Cell Growth and Division”**

- 10.1 Cell Reproduction (chromosomes)
- 10.2 Mitosis (cell division)
- 10.3 Regulation (regulating the cell cycle)

### **\* Lab/activities –**

- Onion Root Mitosis

### **\* Computer/Internet activities**

- Phases of Mitosis (CD Rom Explorations) <1 period
- Cell Reproduction (CD Rom Invest.) Lab 1-2 periods

## **Chapter 11 “Meiosis and Sexual Reproduction”**

- 11.1 Reproduction (sexual and asexual)
- 11.2 Meiosis
- 11.3 Multicellular Life Cycles (diploid and haploid numbers)

### **\* Lab/activities –**

- Meiosis Model

## **Chapter 12 “Mendel and Heredity”**

- 12.1 Origins of Hereditary Science (Mendel’s Peas)
- 12.2 Mendel’s Theory (phenotype, genotype)

12.3 Modeling Mendel's Laws (Punnett square problems)  
12.4 Beyond Mendelian Heredity

**\* Lab/activities –**

Interpreting Pedigree  
Genetic Problems sheet  
Genetics and Inheritance  
Insect Karyotyping  
Mendel and Meiosis (Mendel's Laws of Heredity – w.s.)

**\* Internet Assignment**

Genetic Diseases – “Just What Is A Genetic Disease?”  
(<http://raven.umnh.utah.edu/review/disease/index.html>)

**Chapter 13 “DNA, RNA, and Proteins”**

13.1 The Structure of DNA  
13.2 Replication of DNA  
13.3 RNA and Gene Expression

**\* Lab/activities –**

Strawberry DNA extraction  
DNA Nucleotide cut out

**\* Computer/Internet activities**

Building A Protein (CD Rom Bioquest) 1-2 periods

**Chapter 16 “Evolutionary Theory”**

16.1 Developing a Theory (evolution)  
16.2 Applying Darwin's Ideas (natural selection)  
16.3 Beyond Darwinian Theory (speciation)

**\* Lab/activities –**

Natural Selection Simulation

**EVALUATION/ASSESSMENT OF STUDENTS:**

50% Tests  
30% Lab Reports  
10% Quizzes  
10% Homework

**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  
Holt, 2008