

CURRICULUM LINKS FOR ENVIRONMENTAL SCIENCE INVESTIGATOR PROGRAMS: HUMAN GENETICS AND DNA

Contents

Introduction:	2
Program Description	3
Grade 8 Science and Technology	4
Grade 10 Science.....	4
Grade 11 Science.....	5
Biology (University and College Preparation)	5
Grade 12 Science.....	5
Biology.....	5
Science (University/College Preparation) (2008).....	6

ST. LAWRENCE RIVER INSTITUTE



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Introduction:

The River Institute offers a variety of programs for intermediate and high school groups:

- Aquatic Invertebrates
- Fish Ecology
- Human Genetics and DNA
- Water Quality and its Importance
- Nature Hike (at Cooper Marsh)
- The Marsh Ecosystem (at Cooper Marsh)

All programs are appropriate for grades 7 through 12 and connect to certain Ontario Ministry of Education Curriculum goals. This document is aimed to provide teachers with an idea of which curriculum goals will be covered by the following program: Human Genetics and DNA. Curriculum links to other programs are listed in separate documents.

On the next page is a description of the Human Genetics and DNA program, followed by an account of which curriculum components are covered for each grade. Overall Expectations are listed (as put forth by the Ministry of Education). Teachers can expect that most of the Overall Expectations for the particular strand or course listed will be touched, as well as additional curriculum topics (listed in the “additional curriculum topics” section). Program content may vary depending on weather, current research projects or staff specializations. As such, the curriculum links may also vary within each program.

The following curriculum guides were used to produce this document:

The Ontario Curriculum: Grades 1-8 Science and Technology – 2007

The Ontario Curriculum: Grades 9 and 10 Science – 2008

The Ontario Curriculum: Grades 11 and 12 Science – 2008

Program Description

Using a sample of their own DNA (cheek swab), students will perform PCR (Polymerase Chain Reaction) reactions using DNA “probes” to augment specific genomic sequences. They will then visualize their results using gel electrophoresis. This hands-on exercise will help students develop laboratory technical skills as well as understand the genetic diversity of all living things.

Grade 8 Science and Technology

Understanding Life Systems: Cells

Overall Expectations

By the end of Grade 8, the student will:

- Assess the impact of cell biology on individuals, society, and the environment;
- Investigate functions and process of plant and animal cells;
- Demonstrate an understanding of the basic structure and function of plant and animal cells and cell processes

Additional curriculum topics:

- Cells (they are the basis of life, they are organized into tissues, tissues are organized into organs, organs into organ systems and organ systems into organisms)
- The various parts of the cell (organelle, membrane, etc.)
- How to use microscopes correctly.

Grade 10 Science

B. Biology (Academic and Applied)

Overall Expectations

By the end of the course, students will:

B1. Evaluate the importance of medical and other technological developments related to systems biology, and analyse their societal and ethical implications;

B2. Investigate cell division, cell specialization, organs, and systems in animals and plants, using research and inquiry skills, including various laboratory techniques;

B3. Demonstrate an understanding of the hierarchical organization of cells, from tissues, to organs, to systems in animals and plants.

Additional curriculum topics:

- Ethical considerations of DNA screening for genetic diseases
- Key terms: differentiation, regeneration, etc.
- Rate of cell division in cancer cells
- Scientific Investigation Skills and Career Exploration

Grade 11 Science

Biology (University and College Preparation)

B. Cellular biology (College)

Overall Expectations

By the end of the course, students will:


- B1. evaluate the impact of environmental factors and medical technologies on certain cellular processes that occur in the human body;
- B2. investigate the structures and functions of cells, and the factors that influence cellular activity, using appropriate laboratory equipment and techniques;
- B3. demonstrate an understanding of the basic processes of cellular biology.

D. Genetic Processes (University), Genetics (College)

Overall Expectations

By the end of the course, students will:

- D1. evaluate the importance of some recent contributions to our knowledge of genetic processes, and analyse social and ethical implications of genetic and genomic research;
- D2. investigate genetic processes, including those that occur during meiosis, and analyse data to solve basic genetics problems involving monohybrid and dihybrid crosses;
- D3. demonstrate an understanding of concepts, processes, and technologies related to the transmission of hereditary characteristics.

 Additional curriculum topics:

- Scientific Investigation Skills and Career Exploration

Grade 12 Science

Biology

D. Molecular Genetics

Overall Expectations

By the end of the course, students will:

D1. analyse some of the social, ethical, and legal issues associated with genetic research and biotechnology;

D2. investigate, through laboratory activities, the structures of cell components and their roles in processes that occur within the cell;

D3. demonstrate an understanding of concepts related to molecular genetics, and how genetic modification is applied in industry and agriculture.

 Additional curriculum topics:

- DNA contains all the genetic information for any living organism and proteins control a wide variety of cellular processes
- Scientific Investigation Skills and Career Exploration

Science (University/College Preparation)

B. Medical Technologies

Overall Expectations

By the end of the course, students will:

B1. assess the impact of medical technologies and therapies, both conventional and alternative, used to diagnose and treat human health conditions;

B2. investigate the uses of, and analyse the information provided by, a variety of medical technologies;

B3. demonstrate an understanding of the function and use of a variety of medical technologies and the information they provide about the human body.

F. Biotechnology


Overall Expectations

By the end of the course, students will:

F1. analyse a variety of social, ethical, and legal issues related to applications of biotechnology in the health, agricultural, or environmental sector;

F2. investigate various techniques used in biotechnology and how they are applied in the food industry and the health and agricultural sectors;

F3. demonstrate an understanding of biological processes related to biotechnology and of applications of biotechnology in the health, agricultural, and environmental sectors.

 Additional curriculum topics:

- Scientific Investigation Skills and Career Exploration