

SECTION 3:

DOCUMENT ORGANIZATION

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DOCUMENT ORGANIZATION

Document Organization and Format

The suggestions for instruction and assessment contained within *Grade 12 Biology: A Foundation for Implementation* provide teachers with strategies for assisting students in achieving the general and specific learning outcomes identified for this curriculum. The instructional and assessment suggestions offer teachers a range of strategies from which to select appropriate directions with students. Although they are not prescriptive, the strategies presented can be considered starting points from which teachers can include their own initiatives, style, and effective techniques to foster learning.

The topic-related appendices (found at the end of each unit) and the general appendices (found at the end of this document) provide additional information on student learning activities, teacher support materials related to instruction and assessment, and a variety of assessment rubrics. These complementary resources are closely linked to the specific learning outcomes and to the skills and attitudes outcomes, and are designed to support, facilitate, and enhance student learning.

At-a-glance listings of the general learning outcomes, skills and attitudes outcomes, and specific learning outcomes for Grade 12 Biology are provided in Appendix 11.

Guide to Reading the Learning Outcomes and the Document Format

The specific learning outcomes identified for Grade 12 Biology are organized according to five units:

- Unit 1: Understanding Biological Inheritance
- Unit 2: Mechanisms of Inheritance
- Unit 3: Evolutionary Theory and Biodiversity
- Unit 4: Organizing Biodiversity
- Unit 5: Conservation of Biodiversity

The suggested strategies for implementing the curriculum outcomes within each biology unit include the following components:

- **Specific Learning Outcomes (SLOs):** The SLOs, identified at the top of each page within the units, outline the intended learning to be achieved by the student by the end of the course. They include the SLOs related to the particular biology topic, in addition to the learning outcomes related to Cluster 0: Skills and Attitudes, selected to correspond to the Suggestions for Instruction.
- **General Learning Outcome (GLO) Connections:** The GLOs, found in Appendix 11, provide links across the entire scope of the Kindergarten to Grade 12 continuum of learning in science. These GLOs provide connections to the Five Foundations for Scientific Literacy that guide all Manitoba science curricula in all science discipline areas.

- **Suggestions for Instruction:** The instructional strategies relate directly to the achievement of the identified SLOs. In each unit, SLOs may be grouped into related topics.
- **Entry-Level Knowledge:** Students will have prior knowledge in relation to some learning outcomes. Identification of students' entry-level knowledge, where included, links teachers to key areas of the science curriculum from previous years, providing information about where students should be in relation to the present learning outcomes.
- **Background Information:** These notes provide teachers with content background (often beyond what the students are required to know) related to the identified learning outcomes.
- **Teacher Notes:** These notes, incorporated throughout the document, provide teachers with planning hints, cautions, and information on the depth of treatment of certain issues related to the identified learning outcomes.
- **Activate:** By activating students' prior knowledge of a topic, teachers can recognize gaps and misconceptions in students' knowledge and adjust instruction appropriately; stimulate students' curiosity and initiate the inquiry process; and help students relate new information, skills, and strategies to what they already know and can do. Suggested activating strategies are provided for all groupings of SLOs.
- **Acquire/Apply:** These instructional strategies are designed to assist students in processing, integrating, and consolidating their learning. The examples of teacher-facilitated acquiring and applying strategies presented in this document are designed to be student-centred, engaging the learner directly in some contextual way. The skills linked to the suggested acquiring and applying strategies are provided as well.
- **Culminating Tasks:** These tasks (identified by the CT graphic shown on the left) are designed to integrate several learning outcomes and skills and attitudes outcomes of a unit into one major assignment. A culminating task is suggested in each unit of the course.
- **Suggestions for Assessment:** These suggestions offer strategies for assessing students' achievement of the SLOs. They are identified by the graphic shown on the left.
- **Resource Links:** The links to websites suggested within the units are intended to provide additional resources to support student learning. They include the websites listed on the following pages.



Note: These websites were accessed on May 5, 2011 (unless specified otherwise). Any websites referenced in this document are subject to change. If the sites become inactive, please use a search engine to locate the online resources.

Resource Links

- Agriculture in the Classroom. "DNA Extraction Lab Protocol." Rev. 11 Apr. 2011. Multimedia Educational Resource for Learning and Online Teaching (MERLOT). <www.merlot.org/merlot/viewMaterial.htm?id=423595>.
- Alberta Riparian Habitat Management Society – Cows and Fish. *Biodiversity and Riparian Areas: Life in the Green Zone*. Lethbridge, AB: Cows and Fish, Feb. 2002. Available on the Cows and Fish website at <www.cowsandfish.org/pdfs/biodiversity.pdf>.
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- Assiniboine Park Zoo. "Conservation Corner." *Programs: Education and Experience*. <www.zoosociety.com/programs/conservation-corner.php>.
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- British Broadcasting Corporation (BBC). *BBC Motion Gallery*. <www.bbcmotiongallery.com/>.
- Canadian Association of Genetic Counsellors. Home Page. <www.cagc-accg.ca/>.
- Canadian Fossil Discovery Centre. Home Page. <www.discoverfossils.com/>.
- Canadian Hemophilia Society. Home Page. <www.hemophilia.ca/>.
- Canadian Museum of Nature. *The GEEE! in Genome*. <www.nature.ca/genome/index_e.cfm>.
- The Canadian Society for Mucopolysaccharide and Related Diseases Inc. Home Page. <www.mpssociety.ca/>.
- Canadian Water Resources Association (CWRA). *Project WET*. <www.cwra.org/branches/ProjectWet/>.
- Canadian Wildlife Federation (CWF). Home Page. <www.cwf-fcf.org/>.

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<www.cwf-fcf.org/en/educate/ed_resources/for-educators/>.
- Canadian Wildlife Service and Canadian Wildlife Federation. *Hinterland Who’s Who*.
<www.hww.ca/>.
- Canon Envirothon. Home Page. <www.envirothon.org/>.
- Carnegie Institution for Science. “Sickle Cell Anemia.”
<http://carnegiescience.edu/first_light_case/horn/lessons/sickle.html>.
- Cold Spring Harbor Laboratory’s DNA Learning Center. *DNA from the Beginning*.
<www.dnafb.org/>.
- . *DNA Interactive*. <www.dnai.org/>.
- . Home Page. <www.dnalc.org/>.
- . *Lab Center at DNALC*. <<http://labcenter.dnalc.org/dnalc.html>>.
- . *Online Education Websites*. <www.dnalc.org/websites/>.
- . *Your Genes, Your Health*. <www.ygyh.org/>.
- The Complete Work of Charles Darwin Online. Home Page.
<www.darwin-online.org.uk/>.
- Council for Biotechnology Information. *Canada: English*. <www.whybiotech.ca/>.
- CropLife Canada. *Biotechnology*. <www.croplife.ca/web/english/biotechnology/>.
- Crop Protection Institute of Canada. *Plant Biotechnology: A Secondary School Teacher’s Resource Manual*. CropLife Canada.
<www.croplife.ca/english/pdf/CPI_Biotech_Manual.pdf>.
- Cystic Fibrosis Canada. Home Page. <www.cysticfibrosis.ca/>.
- Encyclopedia of Life. Home Page. <www.eol.org/>.
- Environment Canada. “Education and Awareness.” Canadian Biodiversity Information Network. <www.cbin.ec.gc.ca/education/>.
- . *EnviroZine*. <www.ec.gc.ca/envirozine/>.
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- Genetic Science Learning Center. "DNA Extraction Virtual Lab." *Learn.Genetics*. <http://learn.genetics.utah.edu/content/labs/extraction/>.
- . "How to Extract DNA from Anything Living." *Learn.Genetics*. <http://learn.genetics.utah.edu/content/labs/extraction/howto/>.
- . *Learn.Genetics*. <http://learn.genetics.utah.edu/>.
- . "What Are Genetic Disorders?" *Learn.Genetics*. <http://learn.genetics.utah.edu/content/disorders/whataregd/>.
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<<http://sciencecases.lib.buffalo.edu/cs/collection/>>.
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- National Park Service. "Wolves of Yellowstone." *Yellowstone National Park*.
<www.nps.gov/yell/naturescience/wolves.htm>.
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- . "An Origin of Species." *Evolution*.
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- University of Massachusetts Boston. *Virtual Genetics Lab*. <<http://intro.bio.umb.edu/vgl/>>.
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- World Wildlife Fund – Canada. Home Page. <www.wwf.ca/>.

Sample Two-Page Layout

The following clarification on reading the document format is based on a sample two-page layout from *Grade 12 Biology: A Foundation for Implementation*.

Indicates the biology topic.

Specific learning outcome (SLO) statements define what students are expected to achieve by the end of Grade 12 Biology.

GRADE 12 BIOLOGY • *Unit 1: Understanding Biological Inheritance*

AUTOSOMAL INHERITANCE

SLO: B12-1-04

SPECIFIC LEARNING OUTCOME

B12-1-04: Use Punnett squares to solve a variety of autosomal inheritance problems, and justify the results using appropriate terminology. (GLOs: D1, E1)

Include: monohybrid cross, dihybrid cross, testcross, P generation, F₁ generation, F₂ generation, phenotypic ratio, genotypic ratio, dominant alleles, recessive alleles, purebred, hybrid, and carrier

SUGGESTIONS FOR INSTRUCTION

ENTRY-LEVEL KNOWLEDGE

Students observed, collected, and analyzed data of single-trait inheritance in Grade 9 Science. At that time, students were introduced to Punnett squares and solved single-trait inheritance problems.

TEACHER NOTE

Students often ask where the F in F₁ and F₂ come from, and why they are not called the C (child) and G (grandchild) generations. Explain that the F comes from the Latin word *filial*, which refers to offspring or children.

ACTIVATE

Turn to Your Neighbour

Pose the following genetics problem to students:

- Short hair is dominant over long hair in dogs. Two dogs, one short-haired and one long-haired, produce a litter of eight pups. Predict the appearance of the offspring and explain how you arrived at your prediction.

Students turn to their neighbours to discuss their prediction.

ACQUIRE/APPLY

Problem-Solving Approaches—Class Discussion (S1, G1)

Discuss with students their approaches/steps to solving the problem posed in Turn to Your Neighbour. As the discussion progresses, review with students the conventions used in solving genetics problems. For example, the dominant gene is written first in the heterozygous condition (i.e., Ss, not sS).

Suggestion for Assessment

Use the Thumbs strategy – thumbs up (I get it), thumbs down (I don't get it), thumbs sideways (I'm not sure I get it) – to check students' understanding. This strategy can be used as a quick formative assessment to adjust the pace of instruction.

12 – Understanding Biological Inheritance

The first alpha-numeric code indicates course (Grade 12 Biology); second digit indicates topic number; and third digit(s) indicate(s) specific learning outcome number.

Suggestions for student learning experiences relate directly to the attainment of the specific learning outcome(s).

Include: Indicates a mandatory component of the specific learning outcome, or a defined set of limitations.

Examples: Provide ideas of what could be included (non-mandatory). (This specific learning outcome does not contain this component.)

Teacher notes provide teachers with background information, definitions, planning hints, special-interest material, and information on depth of treatment of certain issues. Safety information and cautions are included.

Skills and attitudes learning outcomes define expectations across all topics in Grade 12 Biology.

GRADE 12 BIOLOGY • Unit 1: Understanding Biological Inheritance

SKILLS AND ATTITUDES OUTCOMES

B12-0-U1: Use appropriate strategies and skills to develop an understanding of biological concepts. (GLO: D1)

Examples: use concept maps, sort and predict frames, concept frames . . .

B12-0-U2: Demonstrate an in-depth understanding of biological concepts. (GLO: D1)

Examples: use accurate scientific vocabulary, explain concept to someone else, make generalizations, compare/contrast, identify patterns, apply knowledge to new situations/contexts, draw inferences, create analogies, develop creative presentations . . .

B12-0-P1: Demonstrate confidence in ability to carry out investigations. (GLOs: C2, C5)

B12-0-S1: Use appropriate scientific problem-solving or inquiry strategies when answering a question or solving a problem. (GLOs: C2, C3)

B12-0-S2: Demonstrate work habits that ensure personal safety, the safety of others, and consideration of the environment. (GLOs: B3, B5, C1, C2)

B12-0-S3: Record, organize, and display data and observations using an appropriate format. (GLOs: C2, C5)

B12-0-S4: Evaluate the relevance, reliability, and adequacy of data and data-collection methods. (GLOs: C2, C4, C5, C8)

Include: discrepancies in data and sources of error

B12-0-S5: Analyze data and/or observations in order to explain the results of an investigation, and identify implications of these findings. (GLOs: C2, C4, C5, C8)

B12-0-I4: Communicate information in a variety of forms appropriate to the audience, purpose, and context. (GLOs: C5, C6)

B12-0-G1: Collaborate with others to achieve group goals and responsibilities. (GLOs: C2, C4, C7)

B12-0-G2: Elicit, clarify, and respond to questions, ideas, and diverse points of view in discussions. (GLOs: C2, C4, C7)

B12-0-G3: Evaluate individual and group processes used. (GLOs: C2, C4, C7)

Building Vocabulary (U1)

Introduce new vocabulary to students as required. The use of a variety of strategies (e.g., Three-Point Approach, Sort and Predict, Word Clusters) can aid students in developing both conceptual and contextual knowledge of the vocabulary of genetics. For more information on building a scientific vocabulary and for think-sheet frames, refer to *SYSTH* (Chapter 10).

Resource Link

- The National Science Digital Library. Home Page. <<http://nsdl.org/>>. The collections of genetics resources for teachers on this website include lesson plans, videos, interactives, and articles.



Suggestion for Assessment

Review students' think-sheet frames to ensure accuracy. As this learning activity is intended as a formative assessment to check students' understanding, no mark is required.

Code refers to skills and attitudes learning outcome(s).

Resource links indicate the titles, authors, and page references (or URLs) where SLO-related content is treated within the various learning resources.

Suggested strategies relate directly to assessing student achievement of the specific learning outcome(s). Suggestions for assessment are identified by the graphic shown on the left.

NOTES