The prescribed learning outcomes and the suggestions for instruction, assessment, and learning resources contained within *Senior 1 Science: A Foundation for Implementation* provide teacher educators with a plan for achieving the student learning outcomes identified in *Senior 1 Science: Manitoba Curriculum Framework of Outcomes* (2000). The document is organized by clusters; Cluster 0: Overall Skills and Attitudes is followed by the four “thematic” clusters. In addition, the appendices comprise Student Learning Activities, Teacher Support Materials, and Blackline Masters. These complementary materials are designed to support, facilitate, and enhance student learning and assessment by being closely linked to the learning outcomes and the skills and attitudes.

**Guide to Reading the Specific Learning Outcomes and the Four-Column Format**

- The Prescribed Learning Outcomes identified in column one outline the intended learning to be achieved by the student by the end of the course of instruction. They include the specific learning outcomes related to the thematic cluster in addition to the learning outcomes related to Cluster 0: Overall Skills and Attitudes selected to correspond to the Suggestions for Instruction.

- Column two contains Suggestions for Instruction directly related to the achievement of the specific learning outcomes contained in the first column.

- Column three assists teachers with Suggestions for Assessment of the specific learning outcomes.

- Column four cites suggested approved Learning Resources intended to guide and support instruction, the learning process, and student assessment.

- Teacher Background information provides planning hints, special interest material, and depth of treatment on certain issues related to the learning outcomes. These are incorporated as text boxes in either column two or three.

The pages that follow provide detailed clarification on reading the four-column format.
Describe various types of asexual reproduction that occur in plant and animal species. Examples: fission, budding, sporulation, vegetative propagation, regeneration...

**Entry-Level Knowledge**
Students have studied the difference between unicellular and multicellular organisms in Grade 8, but have not examined reproduction.

**Notes for Instruction**
Most students will have some life experience with asexual reproduction. Encourage them to share their experience with the class through guided discussion or question and answer.

**Student Learning Activities**
- Collaborative Teamwork S1-0-4e
  Students use a Jigsaw or Roundtable to learn about the various types of asexual reproduction.
- Expert Groups
  Each student group investigates one form of asexual reproduction (regeneration, budding, sporulation, fission, vegetative propagation), and then shares its findings with the rest of the class. (See *Success for All Learners*, Chapter 5)
- Visual Displays S1-0-2c, 5c
  Students draw diagrams or create posters describing various types of asexual reproduction. (See Appendix 1.3)
- Journal Writing S1-0-7e
  Students reflect on ways in which the process of regeneration may be useful to humans. (See *SYSTH*, Chapter 13)
Rubrics/Checklists
Rubrics or checklists can be used for peer-, self-, or teacher-assessment.

Written Quiz/Test
Students
- identify examples of asexual reproduction based on their observations of microscope slides, pictures, or diagrams.
- describe different types of asexual reproduction.
- differentiate among alternative forms of asexual reproduction.
- explain why cutting individual starfish into pieces will increase the starfish population.

Visual Displays S1-0-2c, 5c
Students or student groups prepare visual displays of the various types of asexual reproduction. The displays may include:
- posters
- diagrams
- information technology presentations

Journals
Assess journal entries using a Journal Evaluation rubric. (See SYSTH, page 13.21)

Teacher Background
Some examples of organisms that use various methods of asexual reproduction include:
- regeneration: starfish, planaria
- budding: sponges, hydra
- sporulation: bread mould, wheat rust
- fission: amoebas, bacteria
- vegetative propagation: poplars, strawberries

Note: Reproduction refers to the processes by which a new generation of cells or multicelled individuals is produced. Sexual reproduction requires meiosis, formation of gametes, and fertilization (with the exception of parthenogenesis. Asexual reproduction refers to the production of new individuals by any mode that does not involve formation of gametes.

Suggestions for assessing specific learning outcome(s)

Suggestions for learning resources including print and information technology resources

Senior 1, Cluster 1: Reproduction

Suggested Learning Resources

Science 9
5.4 The Importance of Cell Division, p. 148
5.8 Reproduction and Cell Division, p. 159
6.5 Regeneration, p. 186
6.9 Cloning, p. 194
TSM-3 Cooperative Learning

Sciencepower 9
1.3 The Cell Cycle in Your Body, p. 24
1.4 Asexual Reproduction In Bacteria, Protists, Fungi, and Animals, p. 29
Investigation 1-D: Be a Biologist: Assess Asexual Reproduction, pp. 31–36
1.5 Asexual Reproduction In Plants, pp. 24–25
BML 1-23 Investigation 1-D: Be a Biologist: Assess Asexual Reproduction
BML 1-24 Mitosis and Cell Division in an Amoeba
BML 1-25 Asexual Reproduction Crossword

Appendices
1.3 Blackline Master Types of Asexual Reproduction
SYSTH
3.7 Cooperative Learning and Science
10.9 Building a Scientific Vocabulary
13 Writing to Learn Science

Success for All Learners
5 Flexible Grouping
5.3 Individual, Small-Group, and Whole-Class Work

References to blackline masters (BLM) and Teacher Support Materials (TSM) in print resources

Background information and/or definitions for teachers, often beyond what students are required to know; safety information
Guide to Reading

Specific Learning Outcomes

Senior 1 Science: A Foundation for Implementation

**Skills and Attitudes Outcomes**

S1-0-1a. Propose questions that could be tested experimentally.

- Entry-Level Knowledge
  - Students have not previously studied genetics and heredity but may be familiar with the inheritance of some traits such as eye colour.

- Notes for Instruction
  - Outcomes S1-1-11 and S1-1-12 can be learned together.
  - Discuss examples of human dominant and recessive traits, including:
    - *Eye Colour*: Brown = dominant, Blue = recessive
    - *Hair Shape*: Straight = dominant, Wavy = recessive
  - See Appendix 1.6 for additional traits.

- Student Learning
  - Class Discussion
    - Students will...