

**New Brunswick Department of Education**

Daily Teaching Guide  
**Biology 112/111**

June 2008



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<b>Martha McClure</b>	Learning Specialist, Educational Programs and Services, New Brunswick Department of Education, Fredericton
<b>Alison Bartlett</b>	Teacher, Riverview High School, Riverview
<b>Tim Beatty</b>	Teacher, Riverview High School, Riverview
<b>Alexis Christmas</b>	Teacher, Fredericton High School, Fredericton
<b>Paul Dunnett</b>	Teacher, Kennebecasis High School, Quispamsis
<b>Misty Gallant</b>	Teacher, Moncton High School, Moncton
<b>Anne Furlotte</b>	Teacher, Bathurst High School, Bathurst
<b>Paul Kettela</b>	Teacher, Woodstock High School, Woodstock
<b>Nancy MacKinnon</b>	Teacher, Tantramar High School, Sackville
<b>Danny MacLean</b>	Teacher, Tobique Valley High School, Plaster Rock
<b>Ken McDowell</b>	Teacher, James M. Hill Memorial High School, Miramichi
<b>Lawrence McGillivray</b>	Teacher, Moncton High School, Moncton
<b>Natalie Miller</b>	Teacher, Tantramar High School, Sackville
<b>Susan Mills</b>	Teacher, Tantramar High School, Sackville
<b>Debby Peck</b>	PhD Candidate, Science Education, University of New Brunswick, Fredericton
<b>Michael Swift</b>	Teacher, Sussex Regional High School, Sussex
<b>Christine Whalen</b>	Teacher, Moncton High School, Moncton
<b>Jill Yates-McInnis</b>	Teacher, Chipman Forest Avenue School, Chipman



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**BIOLOGY 11/12 OVERVIEW**

The Biology 11 and Biology 12 programs explore the unity and the diversity among living things. In Biology 11, students study the cell as the basic unit of life and the diversity of organisms that make up World's ecosystems. They also study some of the systems that allow multicellular organisms to maintain equilibrium as they interact with the outside environment. In Biology 12, students begin to focus on Biology at a molecular level. They study how organisms grow and pass along characteristics to future generations, and then how this impacts at the species and population level. They also pick up from grade 11 with the study of more systems that allow multicellular organisms to maintain equilibrium internally and with their environment. In both programs students investigate the impact of biology and technology on society and the impact of human activities on the natural world. A suggested sequence is presented but can be altered as preferred.

**BIOLOGY 11 Quick Start Guide**

This Quick Start Guide gives a summary of the grade 11 biology course, linking the knowledge outcomes together as part of a continuing story of human discovery of structures, functions and evolutionary trends of living organisms. As much as possible students should learn about how and when our present scientific understanding developed, and what questions we need to ask next.

Unit 1: The Cell (24 hrs.)

In this unit, students will observe the historical use of scientific method to search for the origin of organisms, the development of microscope technologies, the discovery of cells as basic units of life and the development of a cell theory. Eukaryotic cell structures and their interactive functions will be investigated in detail including a basic introduction to respiration and photosynthesis.

1. The Development of Cell Theory - describe the contributions of early scientists in discrediting the concept of spontaneous generation (abiogenesis), and in developing the modern cell theory. Describe how scientific understanding was enhanced or revised as a result of the invention of the microscope. (4 hours)
2. Microscope techniques – review and learn proper microscope techniques in preparation for a study of cells. Learn microscope parts and their function, microscope care and safety, focusing technique. Demonstrate the ability to properly display (i.e. draw) microscope images using line diagrams, and demonstrate the ability to prepare and stain a wet mount. (3 hours)
3. A Closer Look at Cells – explore, using microscopes and/or images, a variety of prokaryotic and eukaryotic cells. Identify the structures that make up eukaryotic cells and describe their functions - *nucleus, ribosomes, smooth and rough endoplasmic reticulum, Golgi apparatus, vesicles, chromosomes, lysosomes, microtubules and microfilaments, mitochondria, chloroplast, plasma membrane*. Identify ways in which plant and animal cells differ. Introduce how the cell uses proteins, carbohydrates and lipids. (7 hours)
4. Photosynthesis and Respiration - Describe the structure and functioning of *mitochondria and chloroplasts*, and develop a basic understanding of the involvement of these organelles in cell respiration and photosynthesis. (5 hours)
5. Cell Membranes - Describe the structure and function of the *plasma membrane*, including passive and active transport, endocytosis and exocytosis, semi-permeability and osmosis, the fluid mosaic model, and limits to cell size. (5 hours)

Unit 2: Biodiversity (37 hrs.)

This unit provides an overview of life's unity and diversity within the biosphere. The development of binomial nomenclature is explored as a systematic way to classify the vast diversity of living things. Students compare the structure, physiology, and life cycles of organisms between and within domains and kingdoms, and study the structural differences between phyla with reference to adaptations to the environmental niche occupied. An overview of classification can be found in Appendix 1 (Biodiversity Chart). The unit finishes with a study of the role of biodiversity in New Brunswick ecosystems, and the impact of human activities on these ecosystems.

1. Principles of taxonomy – explore the history, value and future of taxonomy, and the techniques used to classify organisms from a domain to a species level. (5 hours)
2. Characteristics of Major Groups – explore the characteristics of living things, the unique categorization of viruses, and the characteristics of each of the 6 Kingdoms. (7 hours)
  - Describe the life cycle and impact on humans, of viruses and of a selection of representative species from the Kingdoms Archaeobacteria, Eubacteria, Protista and Fungi.
3. A More Detailed Look at Plants and Animals – a more in-depth study of the Kingdoms Plantae and Animalia.
  - For plants (8 hours), study the characteristics of the Kingdom Plantae, and then representative life cycles, distinguishing characteristics, structures and reproductive strategies as evolutionary trends of four Phyla - the Mosses, Ferns, Gymnosperms and Angiosperms.
  - For animals (12 hours), study the characteristics of the Kingdom Animalia and then the distinguishing characteristics and evolutionary trends of the eight invertebrate phyla found in the animal kingdom.
    - Continue the study of the animal Kingdom towards a deeper understanding of the phyla Arthropoda and Chordata.
      - In Arthropods study the characteristics of the class Insecta and their success in exploiting a wide range of environmental niches.
      - In the Chordates, study the unifying characteristics and evolutionary trends of Fishes, Amphibians, Reptiles, Birds and Mammals.
4. Biodiversity of ecosystems – Consider the value of biodiversity in relation to the equilibrium and sustainability of ecosystems in New Brunswick. Study the province's eco-regions and their unique blend of biodiversity, climate and physical geography. Identify and discuss the impact of humans on this biodiversity. (5 hours)



Unit 3: Maintaining Dynamic Equilibrium (I) (29 hrs.)

All living things struggle to maintain an internal balance in response to the constant changing nature of the external environment. This unit investigates the role of specific systems in providing for the needs of cells of multicellular organisms to carry on living processes while maintaining homeostasis.

Homeostasis – explore the maintenance of homeostasis in terms of long-term adaptations, and lifetime responses, both in plants and in the human system. (2 hours)

Digestive and Excretory Systems – First explore the chemistry of the human body and the nutrients and energy delivered by the digestive system to each cell. Describe the structures of the human digestive system and their functions as nutrients are broken down and absorbed into the bloodstream. Describe the structure and function of the excretory system as waste is processed. Describe the requirements of a healthy diet, the results of malnutrition, and diseases of the Digestive system. (12 hours)

Circulatory and Respiratory System – Describe the structure of the human circulatory system, how gases and nutrients are delivered to cells throughout the body, and how the circulatory system helps to maintain homeostasis. Describe the mechanics of human breathing, lung structure and function, gas exchange with the bloodstream, and respiratory disorders. (8 hours)

Immune system – Describe the structure and functioning of the immune system as it defends the body from foreign organisms. Describe immune system disorders and diseases, their causes, and prevention. (7 hours)

## Instructional Planning Guide

for Prentice Hall "Biology" 2008 by Miller and Levine

Unit - Suggested Time	# hrs	Text Sections	Text pages	Suggested activities
<b>Unit 1 The Cell (24 hrs.)</b>				PH "Biology" text PHSchool.com webCode
The development of cell theory	4	1-2, 7-1	pp. 8-12, 168-172	"Writing in Science" p.171 cbe-1012/ cbp-1012 cbn-3071
Microscope techniques	3	Appendix D	pp.1070-1071	"Exploration" p.29 Lab Manual A, pp.35-40
A closer look at cells	7	7-1, 7-2, 7-4	pp.172-181 pp.190-193	"Quick Lab" p.180 "Exploration" pp. 194-195 Lab Manual A, pp.101-105 cbe-3072/ cbp-3072 cbb-3074
Photosynthesis and respiration	5	8-1, 8-2, 8-3, 9-1, 9-2	pp.200-209, 220-222, 232	"Writing in Science" p.205, 207 "Quick Lab" pp. 206, 231 "Analyzing Data" p. 213 "Design an Experiment" p.215 Lab Manual A pp.91-99 cbd-3081 cbe-3091/ cbp-3091
Cell membranes	5	7-3	pp.182-189, 241-243	"Quick Lab" p.187, p.242 "Analyzing Data" p.188 Lab manual A pp. 85-89 cbn-3073 cbe-3073/ bp-3073 cbe-3075/ cbp-3073 cbe-3076/ cbp-3076 cbd-3101

## Instructional Planning Guide

for Prentice Hall "Biology" 2008 by Miller and Levine con't

Unit - Suggested Time	# hrs	Text Sections	Text pages	Suggested activities
<b>Unit 2 Biodiversity (37 hrs.)</b>				
				<i>PH "Biology" text</i> <i>PHSchool.com webCode</i>
Principles of Taxonomy	5	18-1, 18-2 Appendix F	pp. 446-455, 1078-1083	"Writing in Science" p.450 "Quick Lab" p.453 "Thinking Visually" p.455 "Technology and Society" p.456, "Real World Lab" pp.462-263 "Field Trip" p. 1079, 1081 <b>Lab Manual A</b> p.147-152 <b>cbn-5181, cbe-5189/ cbp-5182</b>
Characteristics of Major Groups	7	1-3, 19-2, 18-3, Appendix E	pp.15-18, 457-461, 478-490, 1072-1077	"Quick Lab" p.18, p.482 "Focus on the Big Idea" p.461, 483 "Issues in Biology" p.484 "Writing in Science" p.487, 490 "Exploration" p.491 Appendix F p.1081-1083 <b>Lab Manual A</b> p.195 <b>cbn-5183, cbe-6192, cbe-6192/ cbp-6192, cbb-6195</b>
A more detailed look at plants and animals	8	Plants: 22-1, 22.2, 22-3, 22-4, 22-5, 25-2, 25-3	pp.550-572, 612-613, 639-646	"Problem Solving" p.553 "Focus on the Big Idea" p.555, 642 "Writing in Science" p.559 "Thinking Visually" p.563, 572, 646 "Quick Lab" p.565, 613, 640 "Sharpen your Skills" p.568 "Exploration" p.573 <b>Lab Manual A</b> pp. 171, 177, 183, 189, 207 <b>cbe-7222/ cbp-7222, cbn-7221, cbd-7222, cbn-7224, cbn-7223, cbe-7252/ cbp-7252, , cbb-7225, cbe-7249/ cbp-7241</b>
		Invertebrates: 29-1, 29-2 Arthropods: 28-1, 28-2, 28-3 Chordates: 30-1, 33-1, 33-2, 33-3	pp. 744-758 pp. 715-719, 725-733 pp. 766-770, 848-864	"Problem Solving" p.750 "Quick Lab" p.753, 718, 775, 861 "Thinking Visually" p.758, 856 "Design an Experiment" p.759, 211, 739, "Focus on the Big Idea" p.719, 852 "Sharpen your Skills" p.725 "Writing in Science" p.731, 733, 770, 864 "Analyzing Data" p.855 "Exploration" p.790, 865 "Issues in Biology" p. 853 <b>Lab Manual A</b> p 201, 237 <b>Lab Manual B</b> , p.181 <b>cbe-8299/ cbp-8291, cbn-8292, cbn-8281, cbn-9301, cbn-9331, cbn-9332</b> <b>cbe-9333/ cbp-9333, cbb-9333</b>
Biodiversity within ecosystems	5	6-3, 5-3, 6-1	pp.150-156, 138-149	"Quick Lab" p. 153 "Writing in Science" p.155, 149 "Focus on the Big Idea" p 156 "You and Your Community" p.143 <b>Lab Manual B</b> , pp.187-191 <b>cbn-2063, cbn-2061, cbe-2069/ cbp-2062</b>

## Instructional Planning Guide

for Prentice Hall "Biology" 2008 by Miller and Levine con't

Unit - Suggested Time	# hrs	Text Sections	Text pages	Suggested activities
<b>Unit 3 Maintaining Dynamic Equilibrium (29 hrs.)</b>				PH "Biology" text PHSchool.com webCode
Homeostasis	2	35-1	pp.890-896	"Thinking Visually" p.896
Digestive system	5	2-3, , 38-1	pp.44-53, 970-977	"Design an Experiment" pp.990
				"Quick Lab" p.982 Lab Manual B, pp.243-246 <b>cbe-1024, cbe-0381 (American)</b>
	7	2-4, 38-2, 38-3	pp.49-55, 978-984, 985-989	"Analyzing Data" p.51 "Design an Experiment" pp.54
Circulatory and Respiratory system	8	37-1, 37-3, 40-3	pp.942-955 pp.956-963, 1044	"Inquiry Activity" p.942 "Writing in Science" p.949, 950 "Analyzing data" p.954 "Quick Lab" p.960 "Design an experiment" pp.964 <b>Lab manual A p.261</b> <b>Lab Manual B, pp.239</b> <b>cbe-0373, cbe-0371</b>
Immune system	7	40-1, 40-2, 40-3	pp.1030-1047	"Real World Lab" p. 1055 <b>Lab Manual B, pp. 253-56</b>

### The Four Column Spread

This curriculum document is intended as a guide to the required topics and skills to be covered in the New Brunswick Biology 11 course.

Column one identifies all learning outcomes for Biology 112/111. Following each outcome is a bracketed list of numbers which refers back to the “**Pan-Canadian Specific Curriculum Outcomes**” at the beginning of each unit.

In Column one, “**NB Prescribed Outcomes**” are required for all students. Those outcomes identified under “**Biology III**” are required extensions of the course material for all those taking the level 1 course option. This enriched curriculum should take the form of increased depth of understanding and greater development of investigative techniques rather than an increase in factual knowledge. If chosen, those outcomes identified as “**Optional**” should only be undertaken after completing the other outcomes.

In Column two, “**Elaborations**”, are meant to clarify the level of detail and approach to take with reference to each of the prescribed outcomes. “**Teaching Suggestions**” are optional and intended to illustrate by example the approach one could take in teaching the outcomes.

In Column three, “**Tasks for Instruction and Assessment**”, presents further suggestions for instruction and assessment to use and should be considered optional.

Column four, “**Notes**”, provides references to the prescribed text and supporting resources specific to each topic. **PHBiology** refers to the 2008 edition of Prentice Hall “Biology” by Miller and Levine. Codes listed (e.g. **cbp-1012**) refer to on-line links to resources accessible at <http://phschool.com/> **Laboratory manuals A and B** refer to the ancillary resources for Prentice Hall “Biology”.

In addition to the resources linked to the prescribed text teachers should refer often to the NB Government Education Portal at <https://portal.nbed.nb.ca/> for current internet links and shared teacher resources sorted by specific topic.

These resources should be considered a starting point - teachers are encouraged to add other resources as appropriate.

# BIOLOGY 11

## *UNIT 1 - The Cell*

### **Introduction**

The word “biology” is one that can be defined simply as the study of life. However, the study of biology is far from simple, and is as complex and diverse as living things are complex and diverse. Living things are much more than physical machines or a mere set of chemical reactions. They are composed of individual units called cells. Cells are considered to be the basic unit of structure and function displaying the characteristics of life. During this unit, the historical development of the cell theory and the role of the microscope in the advancement of biological knowledge will be discussed. Students will gain an appreciation for the complexity of life at the cellular level of organization and the delicacy of interactions between components at this level as they study cell structures and their functions.

### **Curriculum Focus**

In its consideration of the cell as the fundamental unit of life, the focus of this unit is placed within the area of **scientific inquiry**. This involves primarily an emphasis on **observation and inquiry**. Sections within this unit ask students to consider structures, processes and interactions within cells and to gain familiarity with basic laboratory techniques.

### **Curriculum Links**

This preliminary discussion of cells builds upon clusters of information that have preceded it in the student’s earlier study of the science curriculum. Characteristics and needs of living things and their dependence on the environment are first introduced in a general format in Grade 1. This base is built upon with the discussion of the interaction of plants with the environment in Grade 3. Students in Grade 6 begin to become familiar with the use of magnifying tools to observe micro-organisms. By the end of the Grade 8 level, students have been introduced to plant and animal cells as living systems exhibiting the characteristics of life. In addition, structural and functional relationships between cells, tissues, organs and body systems and their relationship to the functioning of the human organism as a whole have been investigated. In grade 9 students look more closely at the nucleus and the genetic material involved in reproduction.

## Unit 1- The Cell

### Pan-Canadian Specific Curriculum Outcomes

#### STSE

##### Nature of Science & Technology

**114-1** Explain how a paradigm shift can change scientific world views.

**114-2** Explain the role of evidence, theories, and paradigms in the development of scientific knowledge.

**114-9** Explain the importance of communicating the results of a scientific or technological endeavour, using appropriate language and conventions.

**115-5** Analyze who and how a particular technology was developed and improved over time.

**116-2** Analyze and describe examples where scientific understanding was enhanced or revised as a result of the invention of a technology.

**116-6** Describe and evaluate the design of technological solutions and the way they function, using scientific principles.

#### SKILLS

##### Initiating & Planning

**212-7** Formulate operational definitions of major variables.

##### Performing and Recording

**213-2** Carry out procedures controlling the major variables and adapting or extending procedures where required.

**213-3** Use instruments effectively and accurately for collecting data.

**213-5** Compile and organize data, using appropriate formats and data treatments to facilitate interpretation of the data.

**213-8** Select and use apparatus and materials safely.

##### Analyzing & Interpreting

**214-1** Describe and apply classification systems and nomenclatures used in the sciences.

**214-3** Compile and display evidence and information, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots

**214-11** Provide a statement that addresses the problem or answers the question investigated in light of the link between data and the conclusion.

##### Communication & Teamwork

**215-6** Work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise.

#### KNOWLEDGE

**314-5** Explain the Cell theory

**314-6** Describe cell organelles visible with the light and electron microscopes.

**314-7** Compare and contrast different types of prokaryotic and eukaryotic cells.

**314-8** Describe how organelles manage various cell processes such as ingestion, digestion, transportation, and excretion.

**314-9** Compare and contrast matter and energy transformations associated with the processes of photosynthesis and aerobic respiration.

## The Development of Cell Theory

(4 hours)

### *NB Prescribed Outcomes*

*It is expected that students will:*

- Describe the contribution of early scientists in discrediting the concept of spontaneous generation (abiogenesis) in favour of biogenesis. (114-1, 114-2, 114-9)
- Describe the contribution of early scientists in development of the cell theory and have a good understanding of the cell theory. (314-5, 116-2)
- Analyze and describe how scientific understanding was enhanced or revised as a result of invention of the microscope. (116-2)

### *Biology III*

- Research and discuss examples of abiogenesis versus biogenesis in which the bias of the investigators affected outcomes.

### **Elaborations**

An historical approach to the development of the concept of biogenesis illustrates the development and functioning of scientific thought and techniques, as students study the contributions of scientists such as Redi, Spallanzani, and Pasteur to the establishment of biogenesis.

The concept of spontaneous generation arose from faulty observations and a lack of experimental control. Through the use of controlled experiments biogenesis was supported and spontaneous generation discredited. This should be used as an opportunity to develop students' understanding of science skills, including the importance of controlled experiments.

Early cell biologists such as Robert Hooke, Anton van Leeuwenhoek, Schleiden, Schwann, and Virchow were instrumental in the discovery of cells as the basic unit of living organisms, and in the development of the cell theory.

Students should be able to link the advances of microscope technology to the development of cell theory, structure and functioning. This provides a good example of how scientific understanding has been advanced as a result of technological advances. Various microscopes should be compared with reference to terms of illumination, magnification, field of view dynamics and specimen preparation.

### **Optional**

Opportunity exists here to link biology with physics, with a study of the basic technology of the electron microscope.



## *The Development of Cell Theory con't*

### **Suggestions for Instruction and/or Assessment**

#### **Presentation** (114-1, 114-2)

*Provide your students with a list of individuals who have contributed historically to the development of the cell theory.*

Collect information on the researcher assigned to you or your group and prepare a brief oral presentation to be given to the class. On the index cards provided outline in point form the individual's name, the time frame in which he or she worked, and their main contributions to the development of the cell theory. Presentations will be made in chronological order and the index cards affixed to a time line at the front of the class to chronicle the development of this theory.

### **Notes**

***PH Biology*** pp. 8-12, 168-172  
*"Writing in Science" p.171*

**cbe-1012/ cbp-1012, cbn-3071**

***Check NB Government Portal for current links and shared resources***  
<https://portal.nbed.nb.ca/>

## Microscope Techniques

(3 hours)

### NB Prescribed Outcomes

*It is expected that students will:*

- Demonstrate effective and accurate use of the light microscope including:
  - Parts and their function
  - General care
  - Focusing technique
  - Field of view calculation
  - Safety concerns (213-3, 213-8)
- Demonstrate the ability to prepare a wet mount of a specimen, including staining techniques. (213-3)
- Demonstrate the ability to display accurately, through line diagrams, information compiled through the use of the microscope. (213-5, 214-3)

### Elaborations

In preparation for use of the microscope throughout their biology studies, students should review terminology and general care and safety of the microscope, and then be given ample time to explore the practical use of the microscope working with a variety of materials. This section must be done as a hands-on lab activity.

Students should become comfortable with specimen preparation, including wet-mount and staining techniques, focusing techniques, and effective presentation of their observations to others. Diagrams of the specimens viewed should include field of view and magnification, should accurately show what they have seen, and should follow correct protocol for biological drawings.

### Optional

Should both a compound microscope and dissecting (stereo) microscope be available, it is a useful exercise to compare views of various specimens, as a way to bridge the abstract nature of the microscopic, with the common daily visual experience.

### Teaching suggestion

The students can begin working with familiar objects (e.g. a printed letter such as “e” or “f” to illustrate inversion properties of the microscope), and work up to easily viewed objects (e.g. commercially prepared slides selected by the teacher or teacher prepared slides), and then to a variety of objects they select and prepare themselves for which the compound microscope may or may not be the appropriate tool (thinly vs. thickly sliced specimens, plant material, pond water, various foods, sand etc.).

## *Microscope Techniques con't*

### **Tasks for Instruction and/or Assessment**

*This section involves an emphasis on hands on laboratory experiences.*

#### Observation (214-3)

Now that we have completed our discussion on parts of the microscope, their purposes, safety features, and the focusing techniques, you will be assessed on your understanding through a demonstration. To demonstrate your competency, you will be observed as you prepare a wet mount of the material provided and will be expected to answer questions in an interview fashion.

#### Pencil & Paper (214-3)

Draw a line diagram of the specimen provided and label it properly.  
*Assessment of diagram will be based on completion of task, clarity and accuracy.*

#### Performance (214-3)

Prepare and stain a wet mount slide. A visual scan of your product will allow an assessment of your slide preparation and focusing techniques

#### Laboratory Activities (213-5, 213-8)

Following the procedures demonstrated and outlined on your lab sheet, use the microtome to prepare a section of the specimen provided. Fix and stain your specimen appropriately and view under the microscope.

Use the micro slide viewer to observe the slides provided. This is a way to view samples that cannot be viewed under a light microscope. Answer the assigned questions.

### **Notes**

**PH Biology** pp.1070-1071  
*"Exploration"* p.29

**Lab Manual A**, pp. 35-40

**Check NB Government Portal for current links and shared resources**  
<https://portal.nbed.nb.ca/>

## A Closer Look at Cells

(7 hours)

### NB Prescribed Outcomes

It is expected that students will:

- Examine and compare the structure of prokaryotic and eukaryotic cells. (213-3, 214-1, 314-6, 314-7)
- Describe the differences between plant and animal cells. (214-1, 314-8)
- Describe eukaryotic cellular structures and the ways in which they manage various cell processes. Include: *nucleus, nucleolus, nuclear membrane, ribosomes, smooth and rough endoplasmic reticulum, Golgi apparatus, vesicles, chromosomes, lysosomes, microtubules and microfilaments, vacuoles, mitochondria, centrioles, chloroplasts, cell membranes and cell walls.* (314-6, 314-8)
- Examine and compare images of cell structure generated by both the light and electron microscopes. (115-5, 116-6, 314-6)

### Elaborations

Skills in slide preparation and staining developed in the previous section should be used to view a variety of prokaryotic and eukaryotic cells. Examples could include: prokaryotic cells such as cyanobacteria, or *lactobacillus* in yogurt, and eukaryotic cells such as chloroplasts in spinach, leucoplasts in unripe banana, nucleus in yeast, nucleus, vacuole and cell wall in onion epithelium. They should recognize both the similarities and distinguishing characteristics of prokaryotic and eukaryotic cells, while at the same time recognizing the range of cell types within a given group.

Students should view a variety of plant and animal cells under the microscope, and use diagrams, models, or charts to illustrate and distinguish the structures of plant and animal cells. As when comparing prokaryotic and eukaryotic cells, students need to identify both the similarities and differences between plant and animal cells.

Micrographs produced by both transmission electron microscopes and scanning electron microscopes should be available for student examination. These will illustrate details of some cell structures that cannot be distinguished by students in a laboratory setting. Textbooks and websites are a good source of these.

### Optional

Students could research the discovery of the structure and functions of cell organelles to answer questions such as: Who discovered the organelle and when? How was the function of the organelle discovered? Did the initial understanding change over time, and if so, how?

During the progression of Biology 11 & 12, it is appropriate to make students aware of the career opportunities that exist in various areas of this science (e.g. cytology or the study of cells as a component of laboratory technology).

### Biology 111 Teaching Suggestion

As a classroom activity students can work on their own or in a group to act out “a day in the life of the cell”.

## A Closer Look at Cells con't

### Tasks for Instruction and/or Assessment

#### **Homework Assignment** (114-2, 115-5, 116-2, 314-6, 314-8)

Research the history of the discovery of the structure and functions of a cell organelle – either review printouts from the internet or text resources that the teacher has provided, or search on the internet yourself. Bring the printout to school prepared to share 3 or 4 key points with the class.

Questions to consider: Who discovered the organelle and when? How was the function of the organelle discovered? Did the initial understanding change over time, and if so, how?

#### **Project** (213-8, 214-3)

Create a model of a plant or animal cell and its structures using the parameters provided for you. *Assessment will be based on the accuracy and completeness of model.*

#### **Paper & Pencil** (215-6, 314-6, 314-7)

Individually or in groups of two, choose one of the following sets and prepare a chart to summarize the differences: Plant vs. animal cells

- Eukaryotic vs. prokaryotic cells
- Light microscope vs. scanning electron microscope
- Light microscope vs. transmission electron microscope
- Scanning electron microscope vs. transmission electron microscope

#### **Laboratory Activities** (213-2, 213-5, 213-8, 214-3, 214-11, 215-6)

##### *Design and Implementation*

Working in a group, research some aspect of plant and animal cells.

Possible topics might include:

- Comparing the sizes or structures of cells from a variety of species
- Compare how the structure differs between cells from different areas of a plant.

Present your plan for approval. Your plan should include how you intend to organize yourselves, collect your data and control and measure the variables. You will be assessed on your understanding of the topic you are researching, the logic and practicality of your research plan, your experimental techniques, and your creativity in choosing a topic and designing the investigation.

##### *Presentation*

When the investigations have been completed, you can present your findings to the class. You should be able to explain the rationale behind your experiment and be able to answer questions on the data collected. You should also consider if there were any ways that your experimental design could have been improved, and what questions and further investigations might arise from your work.

### Notes

#### **PH Biology**

pp.172-181, .190-193

“Quick Lab” p.180

“Exploration” pp. 194

**Lab Manual A**, pp.101-105

**cbe-3072/ cbp-3072**

**cbb-3074**

*Check NB Government Portal for current links and shared resources*

<https://portal.nbed.nb.ca/>

## Photosynthesis and Respiration

(5 hours)

### NB Prescribed Outcomes

*It is expected that students will:*

- Describe the structure of mitochondria, and chloroplasts. (314-6)
- Compare and contrast the basic matter and energy transformations associated with the processes of photosynthesis and aerobic respiration. (314-9)
- Demonstrate that photosynthesis and aerobic respiration are complementary processes. (314-9)

### Biology 111

- Design and perform experiments to investigate photosynthesis and respiration (213-2, 213-3, 213-5, 214-3, 215-6)

**OR**

- Explain the importance of the processes of photosynthesis and aerobic respiration to human enterprises. (116-6, 214-3, 214-11, 314-9)

### Elaborations

In the previous section students will have identified mitochondria as present in all cells, and chloroplasts as present only in plant cells and some protists.

As the cell and structure of mitochondria is studied, students should identify the sites of glycolysis, Krebs cycle and electron transport as part of respiration. Students should gain a basic understanding of cellular respiration as the breakdown of stored chemical energy (glucose) into easily released chemical energy (ATP) which can then be used to power cell activities such as movement and the building of molecules. Oxygen is necessary for respiration, and carbon dioxide, water, and heat are released as by-products.



As the structure of chloroplasts is studied, links should be made to its function as the site of photosynthesis. Students should gain a basic understanding of photosynthesis as the conversion of solar energy into stored chemical energy (glucose), which is then available to be broken down through respiration to power cell activities. Carbon dioxide and water are necessary for photosynthesis, and oxygen and water are released as by-products.



### Biology 111 Elaborations

Students should begin to investigate respiration and photosynthesis at a biochemical level (Krebs cycle, glycolysis, fermentation and light and dark reactions associated with plants) always keeping sight of the context of these reactions.

*Choose one of the following:*

Laboratory experiments can be designed and performed by students to investigate photosynthesis and respiration. Results should be recorded and could then be presented to the class as a poster or oral presentation.

**OR**

An analysis of the role of photosynthesis as the biological basis of the primary industries of agriculture, forestry and the fisheries would be appropriate. This may lead to discussion or research into how the pressures of human population have impacted the natural balance between photosynthesis and respiration through burning of fossil fuels, deforestation, depletion of ocean resources, and the input of synthetic fertilizers.

## Photosynthesis and Respiration con't

### Tasks for Instruction and/or Assessment

#### **Paper & Pencil** (212-7, 213-2, 214-3, 214-11, 314-9)

Prepare a demonstration to illustrate the consumption of CO<sub>2</sub> or production of O<sub>2</sub> by a water plant found in a local pond/stream or pet store or to monitor the production of O<sub>2</sub> bubbles vs. light intensity. Record your observations and an explanation for them in scientific terms.

### *Biology III Tasks for Instruction and Assessment*

Choose one of the following projects:

#### **Project 1 - laboratory Activities**

(212-7, 213-2, 213-5, 214-3, 214-11, 215-6, 314-9)

*Development and implementation of experiment*

As a group choose a topic to investigate. Possibilities might include:

- Production of starch by the leaves of plants.
- Starch production within variegated leaves (*Coleus*).
- Variety of pigments found in the leaves of plants.
- Colour (wavelength) of light that is most useful for photosynthesis in geranium leaves.
- Respiration in germinating plant seeds compared to boiled seeds.
- Production of heat as a by-product of respiration in living organisms.

Discuss within your group plans for your experimental design and how you intend to proceed, measure variables and record data. You must illustrate understanding of the task at hand, development of a hypothesis and a workable plan, clarity of thought and logical creativity. As you carry out your experiment you will be assessed as to whether you followed your design, used correct techniques, worked safely, and made necessary changes if needed during the experiment.

Based on this experiment, design a follow up experiment to answer a question that arose from this experiment. You will be evaluated for completeness, originality and logical thought.

#### *Presentation*

When the experiments have been completed, you will present your data and conclusions to the class. Be prepared to explain your experimental design and why you made certain decisions during the planning and implementation.

**Project 2 - presentation** (114-9, 116-6) Using print or electronic resources, research some of the effects that human manipulation has had upon the natural balance of the processes of photosynthesis and respiration within the environment. Suggested concepts for presentation and subsequent discussion could include:

- Selective breeding of crop plants to increase productivity.
- Addition of fertilizer nutrients to water systems
- Deforestation of old growth forests.
- Dependence of global population on consumption of fossil fuels.
- Dependence on tropical deforestation to support the production of meat

Present your findings in a report format or point form.

### Notes

*PH Biology* pp.200-209, 220-222, 232

"Writing in Science" p.205, 207

"Quick Lab" pp. 206, 231

"Analyzing Data" p.213,

"Design an Experiment" p.215

*Lab Manual A* pp.91-99

**cbd-3081**

cbe-3091/ cbp-3091

*Check NB Government Portal for current links and shared resources*  
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## Cell Membranes

(5 hours)

### NB Prescribed Outcomes

It is expected that students will:

- Explain how materials are able to move into and out of cells through a selectively permeable membrane.  
Include:
  - *fluid mosaic model*
  - *passive transport – osmosis, diffusion and facilitated diffusion*
  - *active transport – molecular transport, endo- and exocytosis* (314-8)
- Describe the effects of osmosis on cells with and without cell walls. (314-8)
- Carry out procedures to investigate the relationship between membrane surface area and cell size and summarize your findings. (212-7, 213-2, 214-11, 215-6)

### Elaborations

Passive transport includes osmosis, diffusion, and facilitated diffusion. Students should explore the relationship between some familiar situations and osmosis and diffusion (hypertonic, hypotonic and isotonic solutions).

Active transport includes molecular transport, endocytosis, and exocytosis. Students should be clear of the mechanics of each of these processes and the important ways that active transport differs from passive transport.

Students should investigate the relationship between surface area and volume and explain why this would limit the size of cells.

### Teaching suggestions

Passive transport can be demonstrated in the classroom by setting up and/or having students set up and observe concentration gradients across membranes – both artificial (dialysis tubing) and natural (animal or plant cells). Examples include food preservation with sugar or salt, the adverse effect of too much fertilizer on plants, the reason that vegetables are sprayed with water at local grocery stores, and the use of intravenous fluids in medical situations, and the reason why you shouldn't drink sea water.

The relationship between surface area and volume can be modelled with dye absorption experiments. It can also be investigated mathematically using the chart below.

### Surface to Volume Relationship in Cell Growth

Radius of Sphere	Surface Area $4\pi r^2$	Volume $4/3\pi r^3$	Surface/ Volume Ratio
1			
2			
3			
4			
5			

### Biology 111 Teaching suggestion

Students can be asked to design an experiment which further explores osmosis and diffusion.



## Cell Membranes con't

### Tasks for Instruction and/or Assessment

#### **Paper & Pencil** (314-8)

Observe the demonstrations prepared on osmosis and/or diffusion and explain in scientific terms the observations you make based upon your understanding of these concepts.

Investigate one of these everyday situations related to osmosis and diffusion (hypertonic, hypotonic and isotonic solutions) individually or in groups. You may also select an original scenario, upon approval by teacher. Record your findings, and be prepared to present them to the class.

- Food preservation
- Wilting of plants
- Effects of too much fertilizer on plants
- Why IV's must contain isotonic solutions
- Difficulties that must be dealt with as fish (salmon) move from fresh to salt water or vice versa

#### **Laboratory Activities** (213-2, 213-5, 213-8, 214-3, 214-11, 215-6, 314-8)

Perform the experiment assigned to investigate the relationship between cell surface area and cell size, and complete the evaluation requirement as indicated.

*A variety of potential experimental methods exist. Students may be asked to turn in a laboratory write-up, answer questions based on the relationships seen through the laboratory work, or to discuss additional potential difficulties that cells may experience as they increase in size.*

### **Biology 111 Tasks for Instruction and/or Assessment**

#### **Laboratory Activities** (213-2, 213-5, 213-8, 214-3, 214-11, 215-6, 314-8)

Propose a hypothesis and then design and carry out a controlled experiment to determine whether surrounding a model cell with particular molecules will result in net movement of water by osmosis or in diffusion of the molecules themselves. Dialysis tubing can be used to simulate the plasma membrane.

*Based on this lab experience, students could suggest and/or design an experiment that would help to answer a question that arose from their work. This could be evaluated for completeness, originality and logical thought processes.*

### Notes

*PH Biology pp.182-189, pp.241-243*

*“Quick Lab” p.187, .242  
“Analyzing Data” p.188*

*Lab manual A pp. 85-89*

**cbn-3073  
cbe-3073/ bp-3073  
cbe-3075/ cbp-3073  
cbe-3076/ cbp-3076  
cbd-3101**

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# BIOLOGY 11

## *UNIT 2 - Biodiversity*

### **Introduction**

Approximately one and one-half million types of organisms are known today, with more constantly being identified. The opinions of scientists range anywhere from the possibility of ten to thirty million as being the total number of species actually in existence. Dealing with a system as large and widespread as this requires a taxonomic organizational structure to allow scientists and students to investigate the types and characteristics of these living things. This unit introduces Linnaeus' modern classification system as a basis for this study.

Organisms exhibit a huge range of diversity, yet maintain a number of basic things in common. An appreciation for this paradigm is encouraged as students are given the opportunity to experience the array of organisms within a logical survey of the taxonomic categories of life, and investigate their anatomy, physiology and life cycles. A survey of the world's organisms would not be complete without a study of the significance of biodiversity in sustaining the world's ecosystems, and the anthropological effects on this biodiversity. Through research into current issues, students are encouraged to explore the relationship between humans and the ecosystems which support all life.

### **Curriculum Focus**

This unit on biodiversity contains an emphasis on **scientific inquiry** and **observation**. There are ample opportunities for students to sample and gain an appreciation for the diversity and complexity of life on earth through their investigation of the classification of these living things.

### **Curriculum Links**

Students begin looking at different examples of living things, and how we depend on our environment in Grade 1. Life cycles of familiar animals and the environments that support them are compared in Grade 2 with the life cycles of plants introduced in Grade 3. The major focus in Grade 4 is on habitats and community including the identification of regional and local habitats and how the removal of plant or animal populations would affect the remainder of the community. Within Grade 6 the concept and importance of classification systems and the diversity of living things are discussed. At this level students compare characteristics of common mammals, birds, reptiles, fishes and arthropods. In Grade 7 diversity of life and their interactions within ecosystems is discussed, and students are introduced to biotic and abiotic factors, the flow of energy within an ecosystem, and ecological succession. In Grade 10 students take a more in-depth look at the sustainability and the dynamics of ecosystems as matter is cycled and natural populations are kept in equilibrium in relation to the availability of resources, and some of the many factors that can disrupt sustainability

## Unit 2 – Biodiversity

### Pan-Canadian Specific Curriculum Outcomes

#### STSE (Science, Technology, Society and Environment)

##### Nature of Science & Technology.

**114-5** Describe the importance of peer review in the development of scientific knowledge.

**115-7** Explain how scientific knowledge evolves as new evidence comes to light and as laws and theories are tested and subsequently restricted, revised, or replaced.

##### Relationships between Science & Technology

**116-2** Analyse and describe examples where scientific understanding was enhanced or revised as a result of the invention of a technology.

**116-7** Analyse natural and technological systems to interpret and explain their structure and dynamics.

##### Social & Environmental Contexts of Science & Technology.

**118-6** Construct arguments to support a decision or judgment, using examples and evidence while recognizing various perspectives.

#### SKILLS

##### Initiating & Planning

**212-1** Identify questions to investigate that arise from practical problems and issues and then determine ways to investigate them.

**212-6** Design an experiment and identify specific variables.

##### Performing & Recording

**213-6** Use library and electronic research tools to collect information on a given topic.

**213-8** Select and use apparatus and materials safely.

##### Analysing & Interpreting

**214-1** Describe and apply classification systems and nomenclatures used in the sciences.

**214-2** Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.

**214-3** Compile and display evidence and information, by hand or computer in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots.

**214-5** Interpret patterns and trends in data, and infer or calculate linear and nonlinear relationships among variables.

**214-8** Evaluate the relevance, reliability, and adequacy of data and data collection methods.

**214-9** Identify and apply criteria, including the presence of bias, for evaluating evidence and sources of information.

**214-10** identify and explain sources of error and uncertainty in measurement and express results in a form that acknowledges the degree of uncertainty.

**214-15** propose alternative solutions to a given practical problem, identify the potential strengths and weaknesses of each, and select one as the basis for a plan.

**214-17** Identify new questions or problems that arise from what was learned.

##### Communication & Teamwork

**214-4** identify a line of best fit on a scatter plot and interpolate or extrapolate based on the line of best fit.

**215-1** Communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others.

**215-2** Select and use appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate ideas, plans, and results.

**215-3** Synthesize information from multiple sources or from complex and lengthy texts and make inferences based on this information.

#### KNOWLEDGE Outcomes

Con't next page....

## KNOWLEDGE

**313-1** Analyze and explain the life cycle of a representative organism from each kingdom, as well as of a representative virus.

**316-4** Outline evidence and arguments pertaining to the origin, development, and diversity of living organisms on Earth.

**316-5** Use organisms found in a local or regional ecosystem to demonstrate an understanding of fundamental principles of taxonomy.

**316-6** Describe the anatomy and physiology of a representative organism from each kingdom, as well as from a representative virus.

**317-1** Explain how different plant and animal systems, including the vascular and nervous systems, help maintain homeostasis.

**317-8** Explain how behaviours such as tropisms, instinct, and learned behaviour help maintain homeostasis.

**318-6** Explain how biodiversity of an ecosystem contributes to its sustainability.

**318-7** Compare Canadian biomes in terms of climate, vegetation, physical geography, and location.

**318-10** Evaluate Earth's carrying capacity, considering human population growth and its demands on natural resources.

**331-6** Analyze the impact of external factors on an ecosystem

## Principles of Taxonomy

(5 hours)

### NB Prescribed Outcomes

*It is expected that students will:*

- Use organisms found in a local or regional ecosystem to demonstrate an understanding of the fundamental principles of taxonomy. (212-1, 316-5)
- Identify limitations inherent to any classification system. (214-2, 214-17)
- Understand the concept of binomial nomenclature as developed by Linnaeus and understand its advantages for the scientific community. (214-2)
- List, in order, levels of classification (taxa) based on increasingly narrower categories, using the species as the base identification level. (214-1)
- Explain how scientific classification systems are changing as new evidence concerning living things is being discovered. (114-5, 115-7, 116-2)

### Biology 111

- Research modern techniques used for classification. (116-2, 213-6, 215-1)

### Elaborations

This section provides a structural framework for the subsequent study of living things. Students should be given the opportunity to explore a variety of ordering and classification systems using organisms with which they are familiar, and from local or regional ecosystems.

The differences that arise as each group of students develop their own classification systems should become a springboard for discussions and further investigations regarding limitations inherent in any classification system. Students should develop a clear understanding of the concept of characteristics as similarities which are relevant in classification systems.

As students explore the ways in which organisms are classified, they should examine naming systems. They will be familiar with common names for some species but should realize the inadequacies and language problems associated with this method of identification. This will highlight the usefulness of a common international naming system and will prepare for a discussion on the Linnaean system of taxonomy using binomial nomenclature. They should learn how the Linnaean system first developed, and how it is used today.

The seven major categories of Linnaeus' classification system (*kingdom to species*) should be introduced. Students should gain an understanding that each taxon involves varying degrees of similarities and differences amongst the organisms that are found in it. It should be pointed out that superclass, suborder sometimes exist, adding additional layers of complexity to this system.

Students should learn to use a dichotomous key which will help increase their understanding of the importance of observations and other complexities of taxonomy. It is also a practical skill which can be extended outside the classroom.

### Teaching Suggestions

Keys are commercially available, and/or students could design their own key, which could then subsequently be used by others in the class to identify specific items or organisms.

### Biology 111

Students should be given an opportunity to explore newer techniques involved in the classification of organisms (e.g. cladistics, DNA/RNA comparisons, molecular clocks, radioactive dating, structural information, embryology, cellular structure or behaviour) and compare these techniques with the methods utilized by early scientists such as Aristotle or Linnaeus.

*Principles of Taxonomy con't*

**Tasks for Instruction and/or Assessment**

**Laboratory Activities** (214-2, 316-5)

Visit a locally accessible ecosystem and observe its organisms. Develop your own grouping system for what you observe. You will be asked for the rationale of your system of biological organization. *Assessment may be based on their thoroughness, logical thinking and explanations given for their techniques. A broad variety of methods of grouping may be evident.*

**Investigation & Presentation** (316-5)

Select one of the organisms you observed and investigate its classification utilizing Linnaeus' system. Be prepared to share this classification with other class members in a visual format.

*Assessment can be based upon thoroughness and completeness.*

*Teacher should ensure that a wide variety of organisms are included.*

**Research & Presentation** (115-7, 116-2, 213-6, 215-1)

Present the results of your research on modern classification techniques to the class. Use any appropriate format (oral, poster, computer presentation).

*This may best be used as an enrichment activity.*

**Notes**

***PH Biology*** pp.446-455, 1078-1083

*“Writing in Science”* p.450

*“Quick Lab”* p.453

*“Thinking Visually”* p.455

*“Technology and Society”*

p.456,

*“Real World Lab”* pp.462-263

*“Field Trip”* p. 1079, 1081

***Lab Manual A*** p.147-152

**cbn-5183, cbe-6192, cbe-6192/  
cbp-6192, cbb-6195**

***Check NB Government Portal for current links and shared resources***  
<https://portal.nbed.nb.ca/>

## Characteristics of Major Groups

(7 hours)

### NB Prescribed Outcomes

It is expected that students will:

- Develop a list of characteristics shared by living things. (118-6)
- Identify the general characteristics that distinguish the members of each recognized kingdom. (313-1, 316-6)
- Demonstrate an understanding that the recognized kingdoms of living things represent a diversity of organisms exhibiting extensive variety in terms of form and function. (316-6)
- Analyze and explain the major features of a virus and its reproductive cycle. (313-1, 316-6)

### Elaborations

*This discussion is intended as an overview to introduce students to the vast array of living organisms in the world, and how they relate to one another.*

Students should recognize that although groups of living things are distinct in many ways, there are a number of characteristics that are shared and increase their chances of survival.

Students should identify the general characteristics that distinguish the members of Domains (Bacteria, Archaea & Eukarya) and Kingdoms. Students should be introduced to enough examples from each Kingdom (Eubacteria, Archaeobacteria, Protists, Fungi, Plants, Animals) to recognize that even within Kingdoms organisms show wide diversity in form and function.

Examples should be selected from each kingdom and used to illustrate the major features of that Kingdom including: symmetry, cell and body structure, locomotion, nutrition, circulation, respiration, excretion and reproduction. Students should identify a variety of organisms and determine those characteristics which distinguish the kingdom to which they belong.

Students should explore the placement of viruses with reference to characteristics of living things, and the general structure and reproductive cycle of a virus (e.g. T4 virus). The impact of viruses and bacteria on human health will be further explored in the study of the human immune system in Unit 3.

### Teaching suggestions

An effort should be made to use organisms that are easily available and/or indigenous to the local area and could include: *Lactobacillus* in yogurt, pond water organisms, yeast, mushrooms, mosses, flowers, grasshoppers, earthworm, starfish, perch, frogs, and pigs.

A variety of techniques including wet mounts, prepared slides, classification sets, models, specimens, dissections, computer simulations, etc. provide hands-on activities to reinforce student learning.

### Biology 111 Elaborations

Students should explore replication pathways for other viruses e.g. HIV, herpes simplex.



## Characteristics of Major Groups con't

### Tasks for Instruction and/or Assessment

#### **Laboratory Activities** (215-1, 316-6, 313-1)

Observe the organisms provided as samples of members of each kingdom. Be sure to follow the directions specified for the use of the classification set, living or preserved specimens, dissections, computer simulation, or microscopy involving wet mounts or prepared slides.

*Assessment can be accomplished in a laboratory format through the completion of proper lab diagrams or assignment questions.*

#### **Laboratory activities** (316-6, 213-8, 214-1, 214-3)

Labs may include making yogurt (beneficial bacteria), a protist survey, growth and reproduction of fungus, plant embryonic development, and plant and flower structure.

A microscope lab could compare worms including parasitic and free living organisms such as sheep liver fluke, planarian, trichina worm, tapeworm, and round worm.

Dissection labs could include squid, earthworm, grasshopper, sea star and frog, illustrating a range of body forms.

#### **Presentation** (213-6, 215-1, 313-1, 316-6)

Select, with your teacher's guidance, a member of one of the Kingdoms that were discussed. Investigate, using library or electronic research the anatomy, physiology and life cycle of this organism and present the information on this organism to the rest of the class in the form of a model and/or poster and a brief oral report. Be sure to include any new or surprising pieces of information you may collect, and indicate where this organism might be found.

*Teachers should ensure that there are a good variety of organisms selected within the class. Assessment should to be based on thoroughness and accuracy of visual and oral presentation.*

### Notes

*PH Biology pp.15-18, 457-461, 478-483, 1072-1077*

*"Quick Lab" p.18, p.482*

*"Focus on the Big Idea" p.461, 483*

*"Issues in Biology" p.484*

*"Writing in Science" p.487, 490*

*"Exploration" p.491*

*Appendix F p.1081-1083*

*Lab Manual A p.195*

**cbn-5183, cbe-6192, cbe-6192/ cbp-6192, cbb-6195**

*Check NB Government Portal for current links and shared resources*  
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## A More Detailed Look at Plants

(8 hours)

### NB Prescribed Outcomes

It is expected that students will:

- Describe the differences that exist between the major groups of plants (bryophytes, ferns, gymnosperms, angiosperms). (313-1, 316-4, 316-5, 316-6)
- Describe the structure and function of a flower, and compare the structure of monocot and dicot seeds. (316-4, 316-6)
- Dissect, compare and identify a variety of plant phyla. (316-4, 316-6)
- Dissect a variety of flower types and identify structures. (316-4, 316-6)
- Explain how plants maintain homeostasis with reference to tropisms and adaptations to harsh climates. (317-8)

### Biology 111

- Students should design and carry out experiments on plant tropisms.
- Investigate the role played by plant hormones such as cytokinins, auxins and gibberellins.

### Elaborations

*The intention of this section is to survey a selection of plant phyla, with a focus on adaptations to a variety of environments.*

For plants, the focus should be on four phyla – Bryophyta (mosses), Pterophyta (ferns), Coniferophyta (gymnosperms) and Anthophyta (angiosperms) - and the characteristics which distinguish them as different taxonomic groups.

Characteristics and life cycles should be studied with reference to being progressively less dependent on immersion in water. With this focus, students should study vascular systems, physical barriers to water loss (e.g. cuticle, stomata), and reproductive cycles and strategies, including the structure and functioning of flowers, seeds, and fruits.

Connections should be made between the adaptability of Angiosperms and its status as the most diverse plant group.

Plants also respond to changes in their environment during their lifetime and between generations as adaptations to their environment.

Students should investigate aspects of plant tropisms and adaptations that allow plants respond to their changing environment and maintain homeostasis. In some cases plant adaptations permit survival in extreme environments or weather conditions e.g extreme cold or heat, extreme wet or dry environments, in fresh or salt water (refer to Unit 1, and the effect of hypo and hypertonic solutions on cells) or on high energy tidal shores.

### Teaching Suggestions

A discussion of angiosperms as the most diverse plant group could include the mention of: the assistance from animals and wind in pollination, the presence of structures in plants specific to attracting certain animal pollinators which the plants supply with food, the way seeds are protected by unique structures, and the function of fruits in seed dispersal.

### Biology 111 Teaching Suggestions

Students can explore the unique physiological processes of C4 plants and CAM plants pertaining to their adaptations to climate e.g. cacti, pineapple, sedums.

## A More Detailed Look at Plants con't

### Tasks for Instruction and/or Assessment

#### **Laboratory activities** (316-6, 213-8, 214-1, 214-3)

Plant dissection labs could include a look at the structures of a variety of plant types from mosses to ferns to gymnosperms and angiosperms, a comparison of vascular and non-vascular structures, a comparison of reproductive structures - flower and/or seed types, female and male gymnosperm cones, and pollen grains. For many of these structures students will need to use their microscope skills.

#### **Presentation** (116-7, 215-2, 317-1, 317-8)

Select a plant that survives in what may be considered an inhospitable environment or simply an environment very different from the local one, and investigate the homeostatic mechanisms it utilizes to ensure its survival and reproduction. Present your conclusions to the class, and/or prepare a poster or model of the organism labeled in such a manner to illustrate the homeostatic mechanisms involved.

#### **Presentation** (215-2, 317-8)

Research and select a type of tropism of interest to you. Include details of the tropism, its advantages, and evolution. Be prepared to make a brief presentation to the class on your selection.

### **Biology 111**

#### **Laboratory Activities** (116-7, 212-6, 213-5, 214-9, 214-10, 214-15, 215-2, 215-4, 317-1, 317-8)

##### Experimental Design

Within your group, develop a research question and design an appropriate experiment to investigate it. Suggested topics may include:

- Tropisms (thigmo-, hydro-, gravi-, chemo-, phototropism)
- Transpiration and how it affects temperature and water loss
- The effect of growth hormones on plants
- The effect of flooding or salt water on root cells
- Adaptations of plants to extreme conditions

##### Carrying out the Experiment

You will be assessed on how well you follow the design, use correct and safe techniques, and if necessary how you redesign your experiment.

##### Presentation

Following the completion of your experiment, you will be required to compile and organize your data in a clear and concise format, and discuss as a group what conclusions can be made. Be prepared to present your data and conclusions to the class, and to explain why your group made certain decisions in planning and conducting your experiment.

As a group, summarize the experiment in a written lab report, including sections for an introduction, purpose and hypothesis, results and data, and discussion (see Appendix 2).

### Notes

Appendix 1 – Biodiversity Chart at the end of this document.

#### **PH Biology**

*Plants:* pp.550-572, pp. 612-613, 639-646, **633-638**

“Problem Solving” p.553

“Focus on the Big Idea” p.555, 642

“Writing in Science” p.559

“Thinking Visually” p.563, 572, 646

“Quick Lab” p.565, 613, 640

“Sharpen your Skills” p.568

“Exploration” p.573

“Real World Lab” p.648

**cbe-7222/ cbp-7222, cbn-7221, cbd-7222, cbn-7224, cbn-7223, cbe-7252/ cbp-7252, , cbb-7225, cbe-7249/ cbp-7241**

#### **Lab Manual A**

p.171, .177, 183, 189, 207

**Check NB Government Portal for current links and shared resources**  
<https://portal.nbed.nb.ca/>

## A More Detailed Look at Animals

(12 hours)

### NB Prescribed Outcomes

It is expected that students will:

- Describe the differences that exist between the invertebrate phyla with respect to symmetry, body cavity, reproduction and digestion. (316-4, 316-5, 316-6)
- Describe characteristics that have contributed to the success of arthropods in a wide variety of environments.
- Describe the differences and similarities that exist between the classes of chordates. (116-7, 214-1, 316-5, 316-6, 317-1)

### Elaborations

*The intention of this section is to survey a selection of animal phyla, with a focus on adaptations to a variety of environments.*

*While progressing through the various phyla of the animal kingdom the development of the digestive, excretory, circulatory, and respiratory systems of representative organisms should be highlighted. This should be linked back to Unit 1 and the requirements of each cell for nutrition, excretion, and oxygen. This will also support the study of the human systems in Unit 3, and the study of evolutionary theory and human systems in grade 12 Biology.*

For both invertebrates and chordates, students should be given an opportunity to trace the evolutionary development of various systems and characteristics, and how development of various systems has allowed exploitation of other habitats. By identifying the ancestors which may or may not still be found, they can explore the evidence that supports various lineages. (e.g Tiktaalik fossil found in Ellesmere Island, Canada).

Selected phyla of invertebrates should be examined to illustrate evolutionary trends and the differences in symmetry, body cavity, circulation, respiration, digestion, and reproduction, and embryonic development (protostome / deuterostome).

Students should focus on arthropods and on insects in particular, as the biologically most varied and numerous class of animals.

General characteristics and developmental trends of various representative systems should be explored in non-vertebrate chordates, and in the vertebrates - fishes, amphibians, reptiles, birds and mammals.

In this section students should be given an opportunity to view live and/or preserved specimens, and should carry out one or two dissections, and understand the role that dissections play in scientific inquiry.

## *A More Detailed Look at Animals con't*

### **Tasks for Instruction and/or Assessment**

#### **Laboratory activities** (316-6, 213-8, 214-1, 214-3)

Animal dissection labs could include the squid, earthworm, grasshopper, and frog, giving attention to various systems and how, for a given species, these reflect the environment for which that species is adapted.

### **Notes**

*Appendix 1 – Biodiversity Chart* This chart found at the end of this document.

#### **PH Biology**

pp. 744-758, 715-719, 725-733, 766-770, 848-864

*“Problem Solving”* p.750

*“Quick Lab”* p.753, 718, 775, 861

*“Thinking Visually”* p.758, 856

*“Design an Experiment”* p.759, 211, 739,

*“Focus on the Big Idea”* p.719, 852

*“Sharpen your Skills”* p.725

*“Writing in Science”* p.731, 733, 770, 864

*“Analyzing Data”* p.855

*“Exploration”* p.790, 865

*“Issues in Biology”* p. 853

#### **Lab Manual A**

p.201, 237

#### **Lab manual B**

p..181

cbe-8299/ cbp-8291, cbn-8292, cbn-8281,  
cbn-9301, cbn-9331, cbn-9332, cbe-9333/  
cbp-9333, cbb-9333

*Check NB Government Portal for  
current links and shared resources*  
<https://portal.nbed.nb.ca/>

## Biodiversity within Ecosystems

(5 hours)

### NB Prescribed Outcomes

*It is expected that students will:*

- Explain how biodiversity of New Brunswick ecosystems is related to their sustainability. (318-6)
- Compare New Brunswick eco-regions in terms of biodiversity, climate, physical geography, and location. (318-7)
- Analyze the impact of human behaviour, and human population growth on biodiversity and ecosystems. (331-6, 318-10)

### Elaborations

*Throughout this unit students have been exploring the range of species in our ecosystems. The intention of this section is take this study of biodiversity to a deeper level – to investigate why biodiversity is important, how it is threatened, and what steps we can take to maintain or restore it.*

As students explore the importance of biodiversity, it will be important to realize that issues around biodiversity and ecosystem sustainability affect, not just people in the tropics or in developing countries, but all of us, including citizens of New Brunswick.

Students should identify the unique species, climate and geology of New Brunswick's ecosystems. They should recognize the diversity and interdependence of organisms within each ecosystem and the how they contribute to maintaining dynamic equilibrium.

Students should compare biodiversity in New Brunswick and elsewhere by reviewing the many threats that are often driven by human population pressures and/or lack of knowledge or the will to prevent losses. Threats to biodiversity include habitat loss, introduced species, overexploitation, disruption of ecosystems, and the isolation of small population.

### Teaching Suggestions

Discussions of values of intact functioning ecosystems might include support of human health and populations as a source of food, medicine, clothing, energy, shelter, and reserves for the future, maintenance of water quality, flood and drought control, healthy soil, climate moderation, pollution absorption, and waste processing.

*Biodiversity within Ecosystems con't***Tasks for Instruction and/or Assessment****Paper & Pencil**

Select one of the New Brunswick protected natural areas, and research the biodiversity which makes it unique from the perspective of its biotic and abiotic features and the rare or at risk species that are found within that ecosystem. Discuss the reasons for maintaining protected natural areas, the different levels of protection, and what values are considered when managing these areas. Present as a poster, essay, or an electronic presentation.

**Laboratory Activities** (116-7, 214-5, 214-8, 318-7)

Select an appropriate local area to use for a scientific field study. Collect, tabulate and graph data as instructed on the biotic elements (plant and animal species) and selected abiotic factors (air/soil temperature, wind velocity, precipitation amounts, humidity, chemical analysis of soil/water) evident in your field study area. Collect both qualitative and quantitative data as it is appropriate.

Include a discussion on the relevance, reliability and adequacy of your data and data collection techniques.

*Assess students based on completeness and the accuracy of information and the selection of a method for data presentation.*

**Paper & Pencil** (215-3, 318-7)

Research and prepare a class presentation on a New Brunswick ecoregion using electronic and library research skills. Prepare a handout for class members to facilitate their recording of the pertinent features of your ecoregion during your presentation. Be sure to include information on climate, vegetation, geography and location, and any other features that make your ecoregion interesting and distinct.

*Assessment can be twofold – including the information presented by the individuals or groups and on the efficiency with which class members complete the distributed chart.*

**Notes**

***PH Biology*** pp.150-156, 138-149

*“Quick Lab”* p. 153

*“Writing in Science”* p.155, 149

*“Focus on the Big Idea”* p 156

*“You and Your Community”* p.143

***Lab Manual B***, pp.187-191

cbn-2063, cbn-2061, cbe-2069/ cbp-2062

*Check NB Government Portal for current links and shared resources*  
<https://portal.nbed.nb.ca/>

# BIOLOGY 11

## *UNIT 3 – Maintaining Dynamic Equilibrium I*

### **Introduction**

Cells, tissues, organs, organ systems and ultimately organisms must maintain a biological balance despite changing external conditions. Homeostasis is the state of internal balance on which existence depends. It represents a dynamic equilibrium displaying constant interactions and checks and balances both within organisms, between organisms and with their environment. There are a variety of systems within living things responsible for the maintenance of this delicate balance and this unit will identify and introduce the role of those plant and animal systems including the circulatory, respiratory, digestive, excretory and immune systems. The vital links that exist between them will be investigated.

### **Curriculum Focus**

This unit has its primary focus within the area of decision-making (STSE) as social and environmental issues are considered. This STSE component contributes to the development of scientific literacy and a sense of global citizenship. In addition, there are numerous opportunities for problem-solving and scientific inquiry incorporated into the discussion of the circulatory, respiratory, digestive, excretory and immune systems.

### **Curriculum Links**

Biology students have studied the components of body systems at a number of different levels. Students in Grade 2 are introduced to the importance of maintaining a healthy lifestyle. When they reach the level of Grade 5 they begin to discuss the role of specific body systems in growth and reproduction. The major components of the structure and functions of the digestive, excretory, respiratory, circulatory and nervous systems are introduced. The contributions of the skeletal, muscular and nervous system to movement are also integrated into their study. In addition, body defenses against infection and nutritional requirements to promote health are discussed. When students reach the level of Grade 8, they begin to consider the basic factors that effect the functioning and efficiency of the human respiratory, circulatory, digestive, excretory and nervous systems and are encouraged to discover and describe examples of the interdependence of various systems of the human body. These provide a good introduction to the role of systems in the maintenance of homeostasis discussed in more detail here. A cross-curricular link exists between the life sciences and physical sciences in the discussion of dynamic equilibrium incorporated into APEF Chemistry and Physics.



## Unit 3 – Maintaining Dynamic Equilibrium 1

### Pan- Canadian Specific Curriculum Outcomes

#### STSE (Science, Technology, Society and Environment)

##### Nature of Science & Technology.

**114-4** Identify various constraints that result in tradeoffs during the development and improvements of technologies.

**115-5** Analyse why and how a particular technology was developed and improved over time.

##### Relationships between Science & Technology

**116-4** Analyse and describe examples where technologies were developed based on scientific understanding.

**116-7** Analyse natural and technological systems to interpret and explain their structure and dynamics.

##### Social & Environmental Contexts of Science & Technology.

**117-2** Analyse society's influence on scientific and technological endeavours.

**117-4** Debate the merits of funding specific scientific or technological endeavours and not others.

**118-6** Construct arguments to support a decision or judgment, using examples and evidence while recognizing various perspectives.

**118-8** Distinguish between questions that can be answered by science and those that cannot, and between problems that can be solved by technology and those that cannot.

**118-9** propose a course of action on social issues related to science and technology, taking into account human and environmental needs.

**118-10** Propose courses of action on social issues related to science and technology, taking into account an array of perspectives, including that of sustainability.

#### SKILLS

##### Initiating and Planning

**212-6** Design an experiment and identify specific variables.

##### Performing & Recording

**213-5** Compile and organize data, using appropriate formats and data treatments to facilitate interpretation of the data.

**213-9** Demonstrate a knowledge of WHMIS standards by selecting and applying proper techniques for handling and disposing of lab materials.

##### Analysing & Interpreting

**214-9** Identify and apply criteria, including the presence of bias, for evaluating evidence and sources of information.

**214-10** Identify and explain sources of error and uncertainty in measurement and express results in a form that acknowledges the degree of uncertainty.

**214-15** Propose alternative solutions to a given practical problem, identify the potential strengths and weaknesses of each, and select one as the basis for a plan.

##### Communication & Teamwork

**215-2** Select and use appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate ideas, plans, and results.

**215-4** Identify multiple perspectives that influence a science-related decision or issue.

#### KNOWLEDGE

**314-1** Identify chemical elements and compounds that are commonly found in living systems.

**314-2** Identify the role of some compounds, such as water and glucose, commonly found in living systems.

**314-3** Identify and describe the structure and function of important biochemical compounds, including carbohydrates, proteins and lipids.

**317-1** Explain how different plant and animal systems, including the vascular and nervous systems, help maintain homeostasis.

**317-3** Explain the importance of nutrition and fitness to the maintenance of homeostasis.

**317-4** Identify, in general terms the impact of viral, bacterial, genetic and environmental diseases on the homeostasis of an organism.

**317-6** Predict the impact of environmental factors such as allergens on homeostasis within an organism.

**317-8** Explain how behaviours such as tropisms, instinct, and learned behaviour help to maintain homeostasis.

## Homeostasis

(2 hours)

### *NB Prescribed Outcomes*

*It is expected that students will:*

- Explain what is meant by the concept of homeostasis and its critical nature to living things. (317-1, 317-8)
- Using humans as an example, explore ways that behaviours and systems respond to changes in the external environment. (317-1, 317-6, 317-8)

### **Elaborations**

*In this section, students should be given the opportunity to study a variety of factors that affect the homeostasis of an organism. Through this, they will begin to appreciate the complexity of mechanisms involved in the maintenance of homeostasis.*

Students should be able to explain, with examples, the concept of homeostasis in general terms.

Students should consider this topic with reference to human systems. Discussions with and among students should include various scenarios in which a person's external environment or behaviour modifies the internal environment, and in response the body activates feed-back mechanisms that result in regaining homeostasis.

### **Teaching Suggestions**

In the study of homeostasis in Human systems examples could include:  
**Body temperature** - what is the response to raised body temperature (on a hot day or when exercising for example) or lowered body temperature?  
**Water and salt levels** - what is the response to loss of water and salt through excessive sweating?  
**Muscle use** - what is the response to aerobic exercise such as running?

## *Homeostasis con't*

### **Tasks for Instruction and/or Assessment**

#### **Paper & Pencil** (317-1, 317-3, 317-6, 317-8)

Consider what happens to your body when you are frightened. Prepare a concept map to illustrate the interaction between the reactions produced and the body systems involved in the maintenance of homeostasis.

### **Notes**

***PH Biology*** pp.890-896

*“Thinking Visually”* p.896

*Check NB Government Portal  
for current links and shared  
resources*

<https://portal.nbed.nb.ca/>

## Digestive system – the chemistry of nutrition

(5 hours)

### NB Prescribed Outcomes

*It is expected that students will:*

- Identify and describe the structure and function of carbohydrates, protein, lipids and nucleic acids and where they are found in living organisms. (314-1, 314-2, 314-3)
- Explain the importance of nutrition and fitness to the maintenance of homeostasis. (317-3)
- Describe eating and digestive disorders and their effect on the homeostasis of the system and the organism as a whole. (116-7, 317-1, 317-3, 317-4)

### Elaborations

Students should describe the basic structure of carbohydrates, lipids, proteins and nucleic acids, and how, through digestive processes these can be broken down to smaller molecules such as glucose, fatty acids, and amino acids.

Discussion of these molecules should include their role in energy release, growth, repair, and communication between cells. Links should be made to cell structure and functioning, and respiration in Unit 1 – the breakdown of glucose in respiration, the protein and lipid structure of cell membranes, burning of fats and protein when carbohydrates are not available.

Students should investigate the presence and energy value of carbohydrates, lipids and proteins, in a variety of the foods that are commonly consumed.

A laboratory exercise should be provided to determine either:

- The presence of carbohydrates, lipids and proteins in various foods
- OR The calorimetric content of various foods.

Students should recognize the importance of good nutrition and fitness to homeostasis and good health. Besides carbohydrates, lipids and proteins, the importance of other nutrients such as water, vitamins and minerals should be emphasized, in the maintenance of homeostasis. The consequences of nutrient imbalances and deficiencies should also be explored. Links should be made to Canada's food guide.

Students should describe the eating disorders bulimia and anorexia, and digestive disorders such as ulcers, gall stones, ileitis, colitis, cancer, Crohn's disease, celiac disease, and the ways to diagnose, treat or cure these problems.

### Teaching Suggestions

Students should research, and prepare a report or presentation on the issue of whether society and public health care should be held responsible for the cost of treatment of health problems caused primarily by correctable lifestyles?

*Digestive system – the chemistry of nutrition con't***Tasks for Instruction and/or Assessment****Presentations** (317-1)

*Extend an invitation to community resources such as physicians, organizations (Ileitis and Colitis Association, Canadian Liver Association) or sufferers of eating disorders (anorexia nervosa) to speak to the class.*

Research and prepare questions related to the topic being presented by the guest speaker. Working in groups, these questions should be reviewed and revised, and questions selected to be asked during the presentation. Following this presentation, you may be asked to prepare a brief summary of it, or of the answer to your question.

*Assessment may be based on a student summary of the guest's talk or answers provided to one of their questions.*

**Laboratory Activities** (213-5, 214-10, 215-2, 317-1)

Perform a lab activity to:

- detect the presence within food of organic substances such as carbohydrates, lipids and proteins
- determine the energy value in found in carbohydrate or lipid food materials.

Record and display data comparing food categories.

**Paper and Pencil**

Student food journals over a period of time can be used to see how the guide relates at a personal level.

**Research Topics and Presentations** (117-2, 118-8, 118-10, 215-4)

- Research and evaluate how nutritional deficiencies caused by fad diets (e.g. high protein, high carbohydrate, low fat) starvation diets, or eating disorders e.g. bulimia and anorexia nervosa) can adversely affect the equilibrium of other body systems.
- Many individuals routinely consume various vitamins, minerals and herbal supplements in their search for a healthy lifestyle. Research and investigate the origins of and the claims made by manufacturers of these herbal medicines (e.g., Echinacea, St. John's Wort, Gingko biloba, garlic, etc.) and any scientific basis or data that exists for these assumptions.
- Surgical approaches to deal with the problems of obesity, and their potential health effects.
- Dietary restrictions such as lactose or gluten intolerance - investigate its prevalence, causes, and methods employed to control the symptoms.

**Notes**

***PH Biology*** pp.44-48, 970-977

*"Design an Experiment"* pp.990

*"Quick Lab"* p.982

***Lab Manual B*** pp.243-246

*"Analyzing Data"* p.977

*"Exploration"* p.1025

**cbe-1024, cbe-0381**

*Check NB Government Portal for current links and shared resources*

<https://portal.nbed.nb.ca/>

## Digestive System – the process of digestion and excretion

(7 hours)

### NB Prescribed Outcomes

*It is expected that students will:*

- Describe the structures, purpose and functioning of the digestive system. (116-7, 317-1)
- Identify the major glands of digestion, their secretions and their role in the digestive process. (116-7, 317-1)
- Describe the main structures of the human urinary system, including the kidney, ureter, bladder, urethra and nephrons. (116-7, 317-1)
- Explain the role of the kidney as an excretory organ in removing metabolic wastes from the body and excreting them to the environment, and the impact of kidney failure. (114-4, 115-5, 116-7, 213-5, 317-1)
- Perform an experiment to investigate the effect of specified variables on the effectiveness of an enzyme. (212-6, 213-5, 213-9)

### Biology 111

- Design an experiment to investigate the effect of specified variables on the effectiveness of an enzyme. (212-6, 213-5, 213-9)
- Describe the internal structure of the kidney and explain the function of a nephron. (116-7, 317-1)

### Elaborations

Students should be provided with the opportunity to study the principal features and action of the human digestive tract, including the mucous lining, villi, sphincters and peristalsis activities and to trace the pathway of food through the digestive system using models, computer simulations and/or dissections of mammals.

Students should identify the main glands of digestion, including salivary glands, stomach, liver, pancreas and the small intestine, and their secretions including mucus, acids or bases, and enzymes, and describe the role of each of these secretions in the digestion of carbohydrates, lipids and proteins. Students should be able to define and give examples of mechanical and chemical digestion as food moves through the digestive system.

Students should recognize the kidney's structure as including the cortex, medulla and pelvis, and should be able to describe the filtration and re-absorption functions of the nephron. Students should be provided with the opportunity to observe and identify the principal features of the human urinary system using drawings, photographs, models, computer simulations and/or performing dissections.

Students should recognize the critical role that the excretory system plays in maintaining homeostasis with respect to water, salt and metabolite concentrations within the blood.

Students should explore the impacts of kidney failure that may result from a variety of conditions and can lead to many deleterious effects including abnormal concentrations of salt and water, altered pH and general deterioration of homeostasis.

Students should perform laboratory activities to investigate the efficacy of various digestive enzymes on animal and/or plant tissue under a variety of concentrations, pH levels, and temperatures.

### Teaching Suggestions

Students could perform experiments to investigate simulated urine composition, perform data analysis and summarize the role of the kidney in homeostatic regulation of pH, water and ionic substances.

### Biology 111 Elaborations

Students should take an active part in designing and reporting on laboratory experiments investigating enzyme action.

Students should describe the structure of the nephron and recognize its role as the working unit of the kidney.

### Biology 111 Teaching Suggestions

Students could research work done at the University of Alberta to investigate islets of Langerhans transplants as a potential cure for Diabetes.

## Digestive System – the process of digestion and excretion con't

### Tasks for Instruction and/or Assessment

#### **Laboratory Activities** (212-6, 213-5, 214-10, 215-2, 317-1)

Perform the available lab activities that illustrate some aspects of the digestive system.

- Tests for the action of digestive enzymes on animal or plant tissue.
- Dissection of available specimens to observe the systems of digestion.

Design an experiment to investigate the relative effectiveness of commercially advertised antacid products.

#### **Presentations** (117-4, 317-1)

*Expose students to experts of excretory pathologies by using community resources such as physicians, organizations (Kidney Foundation), sufferers of these disorders, dialysis patients, and transplant recipients.*

Research and prepare questions related to the topic being presented by the guest speaker. Working in groups, these questions should be reviewed and revised, and questions selected to be asked during the presentation. Following this presentation, you may be asked to prepare a brief summary of it, or of the answer to your question.

*Assessment may be based on a student summary of the guest's talk or answers provided to one of their questions.*

### **Biology 111**

#### **Laboratory Activities** (212-6, 213-5, 214-10, 215-2, 317-1)

Design an experiment to determine the optimal temperature, pH, or concentration for the activity of a given enzyme and submit it for approval. Carry out the experiment with a final report in mind that you will have to hand in, in which the following sections will need to be included –introduction with a hypothesis, material and methods, data and results, discussion and conclusions.

Perform the lab activities provided to illustrate some aspects of the excretory system. These may include:

- Microscopic examination of a kidney cortex.
- Investigations using simulated urine.
- Dissection of available specimens to observe the systems of excretion.
- Observation of the contractile vacuole in Paramecium.

*Assessment would depend on the nature and depth of the activities selected.*

*Enrichment may be provided by allowing students the opportunity to design their own investigations from questions that these activities may generate.*

#### **Presentations** (114-4, 115-5, 116-4, 117-2, 117-4, 118-8, 118-10)

You will be assigned to a group and given directions to research a topic in preparation for a debate. The format of this debate will require you to display the results of your research and “argue” against other stakeholders concerning issues such as:

- Selection procedure for organ transplant recipients.
- Ethics of the sale of human organs (developing countries).
- Ethics of organ transplants across species.

*Assessment may be based on the participation of selected students, preparation of the argument, thoroughness of the research and/or a written summary.*

### Notes

*PH Biology pp. 49-55, 978-984, 985-989*

*“Analyzing Data” p.51*

*“Design an Experiment” pp.54*

*Check NB Government Portal for current links and shared resources*  
<https://portal.nbed.nb.ca/>

## Circulatory and Respiratory System

(8 hours)

### NB Prescribed Outcomes

It is expected that students will:

- Explain the function of the human circulatory and respiratory systems and how they interact. (116-7, 317-1)
- Trace the flow of blood through the heart, describe the pulmonary and systemic pathways, and follow the flow through the complete cycle. (116-7, 317-1)
- Describe the structure and function of an artery, a vein and a capillary. (116-7, 317-1)
- Identify and explain the role of leucocytes, erythrocytes, platelets, and plasma. (116-7, 317-1)
- Investigate the structures and mechanics of respiratory system. (116-7, 212-6, 215-2, 213-5, 317-1)
- Design and carry out an experiment to investigate blood pressure, respiratory function or cardiac output under various conditions. (212-6, 213-5, 214-9, 214-10, 215-2, 317-3)
- Describe disorders linked to the circulatory system and/or the respiratory system and their effect on the homeostasis of the system and the organism as a whole. (317-1, 317-3, 317-4, 317-6)

### Biology 111

- Describe adaptive features that provide for efficient gas exchange in humans (116-7, 317-1)

### Biology 111 Optional

- Predict the impact of environmental factors such as allergens on homeostasis within an organism. (317-6)

### Elaborations

Students should explain how the circulatory system both delivers materials and disposes of cellular wastes, and helps maintain equilibrium by transporting gases, heat, energy and matter.

Students should be given the opportunity to observe and identify the structures of the circulatory and respiratory systems through drawings, photographs, use of models, computer simulations and/or doing dissections.

Students should be able to track the pathways of blood through the circulatory system and relate this to the transport of gases (O<sub>2</sub> and CO<sub>2</sub>) through the respiratory system. A study of the heart should include identifying the relationship between heart mechanics and the sounds of a heartbeat, making note of the Foramen ovale between the right and left atrium during birth, and gaining an appreciation of how the direction of blood flow is controlled.

Students should identify differences in the physical structure of an artery, vein and capillary, and should be able to relate each structure to their functions in the circulation of blood.

The specific pathologies of the circulatory system created by circulatory disorders (hypertension and atherosclerosis, varicose veins, heart murmur, aneurysm, blood clots, and leukemia), and/or by respiratory disorders (lung cancer, asthma, and pneumonia) could be discussed or researched along with the capability of technology to diagnose, treat or cure the problem.

Students may research, assess and debate the effect that lifestyle choices play in the development of these disorders and the importance of promoting good nutrition, physical fitness, control of stress levels and good health in general.

### Teaching Suggestions

Students may construct a model to illustrate the functioning of the diaphragm in respiration. A popular design involves the use of a bell jar, balloons to represent lungs and a membrane for the diaphragm.

### Biology 111

#### Elaborations

Students should describe the structures of the respiratory system that increase gas exchange including: *cilia, mucous membranes, large surface area of alveoli, cartilaginous rings in airway, epiglottis.*

### Biology 111 Optional - Elaboration and Teaching suggestions

Environmental factors that can impact on respiratory disorders such as asthma, bronchitis, or emphysema may include cigarette smoke, allergens (dust, mold, food), petrochemical fumes, smog and perfumes.

Students can investigate air quality indices, what they measure and the units used, and obtain local records of these over time which can then be graphed, or presented in tabular form. Students can hypothesize reasons for varying air quality indices correlation with weather, environmental events) and the effects on an individual with respiratory difficulties when these indices are high



## Circulatory and Respiratory System con't

### Tasks for Instruction and/or Assessment

#### Laboratory Activities (212-6, 213-5, 214-9, 214-10, 215-2, 317-1)

1) Design and/or perform experiments on the circulatory and respiratory system investigating:

- a student's own blood pressure (systolic and diastolic) and posture, or exercise
- lung volume and vital capacity using a spirometer\*
- breathing rates at different times of rest or activity.
- carbon dioxide content of exhaled air.
- respiration, blood pressure or pulse rate of students, and smoking or fitness level
- respiration of asthmatics before and after using an inhaler
- respiration, blood pressure, or pulse rate with gender or weight

\*A device called a spirometer- used by patients recovering from surgery – can be used to measure lung capacity. Information on operating a spirometer, or ways to build a homemade spirometer can be found on the internet.

2) Perform lab activities such as:

- Microscopic examination of components of the blood and the structure of blood vessels.
- Measurement of blood pressure and heart rates.
- Dissection of available specimens to observe the heart and circulatory systems or to observe respiratory systems.
- Measurement of carbon dioxide concentration in inhaled or exhaled air.
- Development of a model illustrating the effect of the diaphragm.

Assessment would depend on the nature and depth of the activities selected. Many of these activities involve collection of data that can be tabulated and graphed.

**Teachers should ensure that students are aware that interpretation of statistical data from small sample sizes may not reflect the true nature of the general population.**

#### Presentations (114-4, 115-5, 116-4, 117-2, 117-4, 118-8, 118-10, 215-4)

In debate format display the results of research and “argue” against other stakeholders concerning:

- Should smoking be allowed in public places?
- Should tobacco companies be permitted to sponsor sporting events?
- Should tobacco advertising be permitted?
- In some provinces, young people cannot purchase cigarettes until the age of 19, yet it is not illegal to smoke at a younger age. Is this hypocritical?
- Should schools provide their students with a smoking area?

Sectors of society that will be considered may include lung cancer victims, executives from tobacco companies, students, smokers, clean air activists.

Assess the participation of selected students, preparation of the argument and thoroughness of the research.

#### Presentations (117-4, 317-1)

Expose students to experts in circulatory pathologies by using community resources such as physicians, organizations (Heart and Stroke Foundation), sufferers of these disorders or transplant recipients.

Research and prepare questions related to the topic being presented by the guest speaker.

Working in groups, these questions should be reviewed and revised, and questions selected to be asked during the presentation. Following this presentation, you may be asked to prepare a brief summary of it, or of the answer to your question.

Assessment may be based on a student summary of the guest's answers to one of their questions.

### Notes

**PH Biology** pp.942-955, 956-965, 1044

“Writing in Science” p.949, 950

“Analyzing data” p.954

“Quick Lab” p.960

“Design an experiment” p.964

**Lab manual A** p.261

**Lab manual B** p. 239

**cbe-0373, cbe-0371**

Check NB Government Portal for current links and shared resources  
<https://portal.nbed.nb.ca/>

## Immune System

(7 hours)

### NB Prescribed Outcomes

*It is expected that students will:*

- In general, explain how the immune system recognizes and destroys antigens that penetrate the first line of defense. (116-7, 317-1, 317-4, 317-6)
- Compare the mechanisms of various forms of acquired immunity. (314-3, 317-1)
- Explain the meaning of the terms allergen and antibody and their role in an allergic reaction. (317-4, 317-6)
- Describe various autoimmune diseases, their causes, and possible treatments. (317-4)
- Explore the political and economic issues around the worldwide AIDS epidemic. (118-6, 118-9)

### Elaborations

*Students should be aware that a properly functioning immune system is essential for health and well being and recognize the consequences that result when the immune system does not function properly.*

A study of the immune system should include non-specific first line defenses (such as skin, sweat and stomach acids), and further defenses including the inflammatory response, phagocytes, T cells, B cells and antibody production.

Students should explore and compare the ways in which immunity is acquired, both in passive (e.g. breast milk) and active (e.g. exposure, vaccines) ways.

Students should be aware of the sequence of the general physiological events (or symptoms) that result in an allergic reaction, and the role of histamines in causing this reaction. Students should be able to describe how allergic responses affect the maintenance of homeostasis within an organism.

The general definition of an autoimmune disease should be established and then the specifics of various diseases explored – this should include Type 1 diabetes, rheumatoid arthritis, myasthenia gravis, and multiple sclerosis, and acquired immune deficiency syndrome (AIDS), combined immune deficiency.

Students should explore the reason for the emergent of viral infections worldwide especially relating to animal vectors (SARS, avian flu) .

Students should explore the issues surrounding the World AIDS epidemic through research, a debate or class discussion and/or a written opinion piece.

### Teaching suggestions

A visual display (chart or sketch) of the role of each of these factors in the body's defense system may help students grasp the basics of these concepts. This discussion may be expanded to include the role of the lymphatic system within the immune response.

Students could investigate:

- how vaccines make use of the immune system in order to be effective
- the requirements, interest and financial resources of society to support the prevention of the spread of HIV, *Staphylococcus*, smallpox
- the claim that herbal supplements such as *Echinacea* boost the immune system.
- a comparison between respiratory allergies such as hay fever and food allergies, how and why some allergies are severe enough to be life threatening
- the use and effectiveness of over the counter antihistamine, decongestants and allergy shots to control allergies.

## *Immune System con't*

### **Tasks for Instruction and/or Assessment**

**Presentations** (115-5, 116-4, 116-7, 317-1, 317-4, 317-6)  
Investigate the natural response of the body to a bacterial infection or a viral disease such as a cold or the flu and present your findings to the class (*this can be linked to the study of viruses and bacteria in the biodiversity unit*).

Investigate the mechanism of transplant rejection or a selected autoimmune disease (rheumatoid arthritis, myasthenia gravis, multiple sclerosis, rheumatic fever, systemic lupus erythematosus ('lupus'), thyroiditis) and how this results in the symptoms of the disorder. Present your findings to the class.

*Assessment will be based on thoroughness and accuracy of information. Instead of a presentation results could be passed in for written assessment.*

### **Laboratory Activities** (212-6, 317-1, 317-6)

Suggest a hypothesis and design an experiment to investigate one of the following, or a topic of your choice to be submitted for approval.

- Investigate the antimicrobial nature of substances such as mouthwash and extracts from a variety of plants (garlic, ginger, aloe).
- Compare the effectiveness of soaps or other cleaning products labeled anti-bacterial with those of the same brand that are not labeled as such.

### **Present your results** (213-5, 214-9, 214-10, 215-2, 317-1, 317-6)

Compile and organize your data using appropriate formats (numeric tables, graphs) and present your data and conclusions in class. Be prepared to explain why you made certain decisions in planning and conducting the experiments.

### **Performance** (213-5, 214-9, 214-10, 215-2, 317-1, 317-6)

*Once the experiments have been designed and the design approved, students can be assessed on how well they follow the design, use correct and safe techniques, and troubleshoot as required.*

### **Paper & Pencil**

(213-5, 214-9, 214-10, 214-15, 215-2, 317-1, 317-6)

Prepare and conduct a survey of the prevalence and variety of allergies within the school population and the remedies used to alleviate symptoms. Tabulate data and prepare it in an appropriate format for a bulletin board display for the school population.

*Assessment would be based on the survey questions, the sampling technique, and the effective presentation of the results.*

### **Presentations** (215-4, 317-1, 317-3)

Select an herbal supplement or vitamin and investigate its effect on the functioning of the immune system. Prepare a poster for display. Be sure to include both natural and synthetic sources of these products.

### **Notes**

*PH Biology pp.1030-1047*

*“Real World Lab” p.1055*

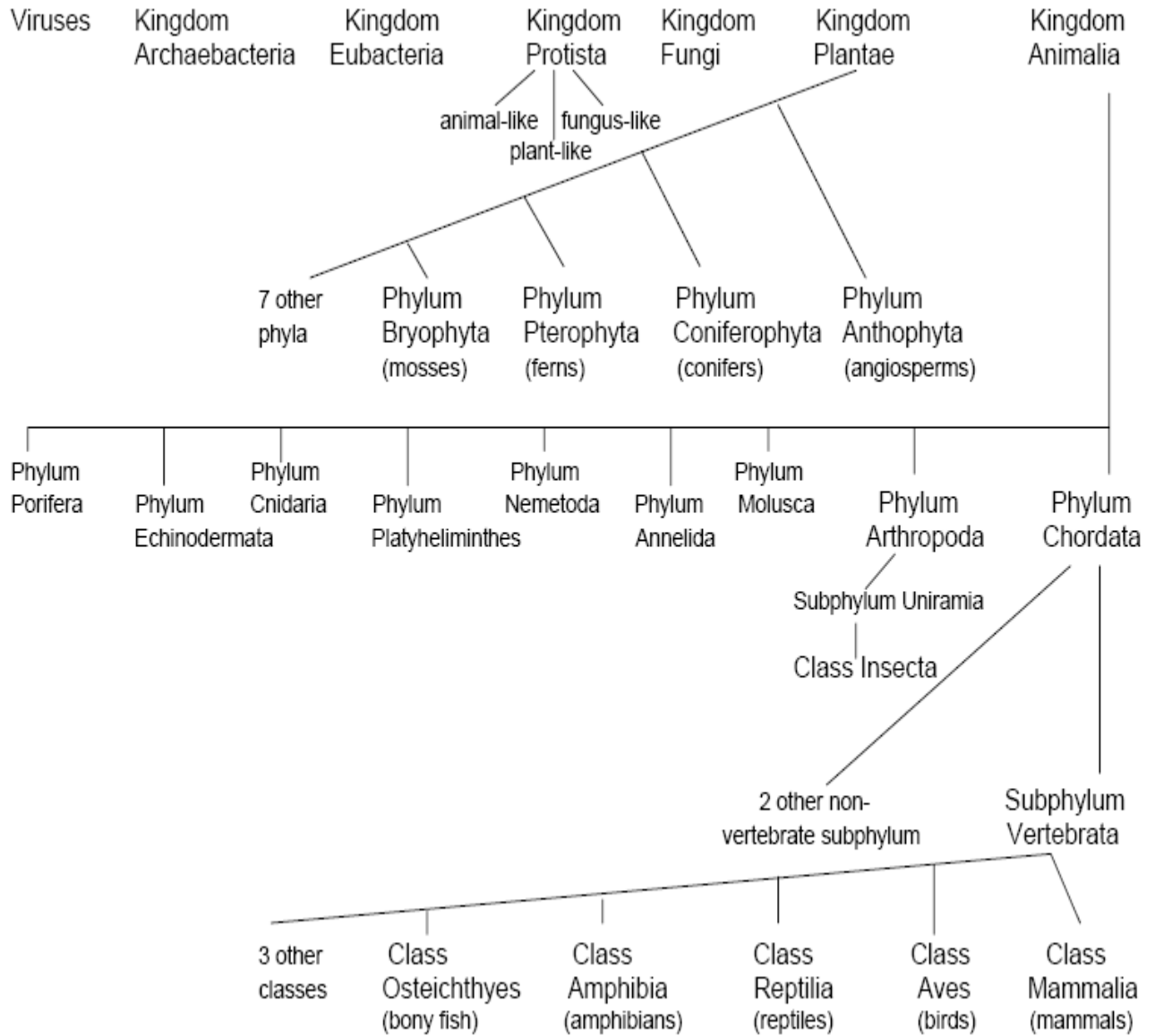
*Lab Manual B, pp. 253-56*

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Appendix A - Biodiversity Chart





## Appendix B - Formal Laboratory Write-up

A laboratory report should communicate, as clearly and concisely as possible (in third person, past tense), the purpose of the experiment, what was done, what the results were and what they mean. From the laboratory report a reader should be able to repeat the experiment or procedure and get similar results. The report should be as short and simple as possible to accomplish these ends.

The format suggested below is one way to accomplish the objectives given above. However, another format may be preferred or may be more appropriate for certain experiments. Your grade on the reports will depend on completeness, scientific accuracy and insight, organization, and writing skills.

### **Title Page or Heading**

This should include a title which describes the lab, your and your partner's name, the class section, teacher and date.

### **Abstract**

This is a brief summary of the lab. It should state the purpose of the experiment, the techniques used, the results, and the conclusions. (4-7 sentences)

### **Introduction**

The introduction will begin with the background context for the experiment, or what is known prior to the experiment. This could include how it is related to the work done in class, and any outside research you have done in preparation for the lab. This will be followed by a brief description of the ideas behind and the purpose of the experiment, and the hypothesis you will be testing. (2-5 paragraphs)

### **Materials and Methods**

This section will describe the equipment and materials you used and what you did, clearly and detailed enough so that others will be able to repeat the experiment without any outside help.

List the apparatus in paragraph format (i.e. scissors, burner stand, 2 clamps etc.). A diagram will be needed if the apparatus is set up in a specific way for the lab. If a diagram is needed, it should be done on unlined paper, and titled, labeled and placed as an appendix at the end of the report.

Describe the procedures you followed to get your results. Include details on controls, variables measured, and how and at what time intervals measurements were taken. Think of your reader as another student who has not done the experiment. You should demonstrate clearly that you know and understand what you did and can articulate it simply.

### **Data & Results**

In this section you will summarize but will not interpret the data collected - raw data should be placed in an appendix. Data should be summarized, statistically analyzed, and presented in a concise format such as a table, graph or chart, clearly labeled with titles, legends and scale. If questions on the lab are assigned they can also be included in this section.

### **Discussion and Conclusions**

In this section you will interpret and discuss the significance of the results and explain how your results either support or refute your hypothesis. Discuss ways in which your results might be useful, and possible directions for future research.

State possible explanations for unexpected results, and draw conclusions based on the results. If problems were encountered during the course of the experiment, how might they be rectified in the future? Are there any other things that could be done to make this a better experiment or to more specifically address the initial question posed? Are there any better techniques available that would allow one to more accurately generate data? Is there more than one way to explain the results? Your results may support your initial hypothesis, but there may be more than one conclusion that could be drawn from your results.

### **Remarks** (optional)

Critique the experiment as presented. Could the lab be done in a better way? Do you have some other or original method for obtaining the same results? Your suggestions are encouraged!

### **References** (optional)

If you referred to anything you read, it should be listed in this section.

*e.g. Articles from Journals:*

Marmur, J. 1961. A procedure for the isolation of deoxyribonucleic acid from microorganisms. *J. Mol. Biol.* 3:208-218.

*e.g. Articles in Books:*

Rose and D.W. Tempest (ed.), *Advances in Microbial Physiology*, Vol. 16. Academic Press, London and New York.



