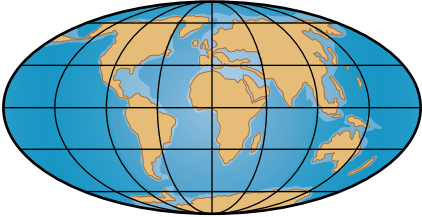
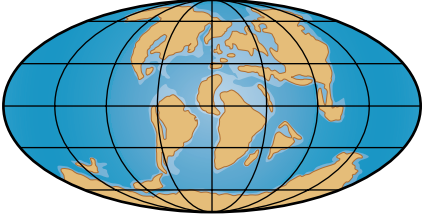
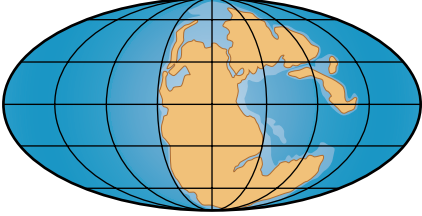





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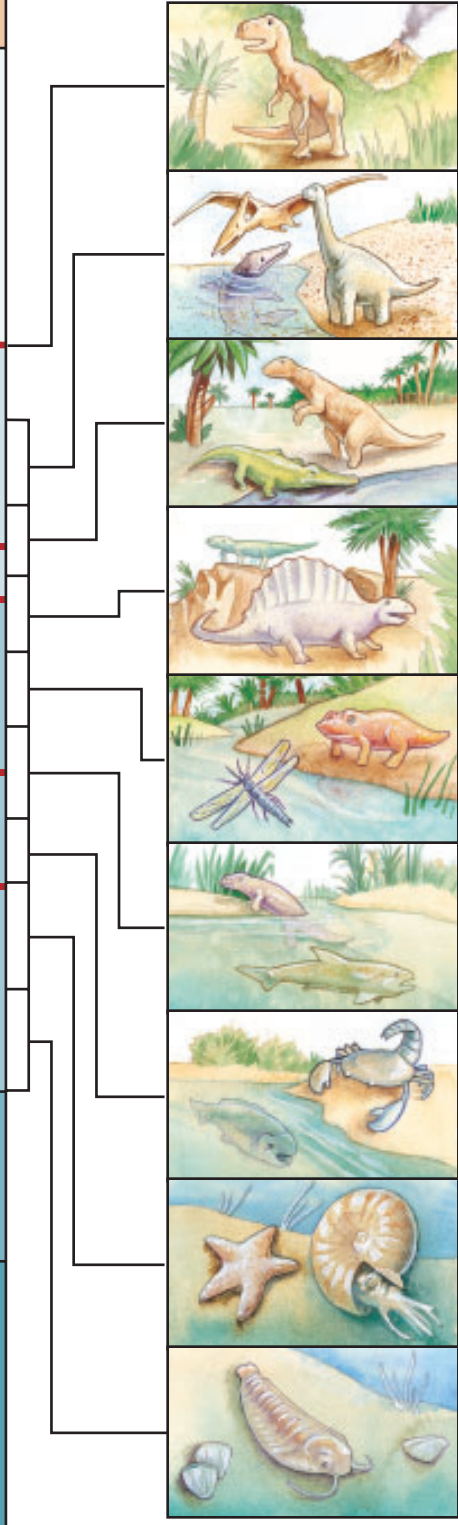
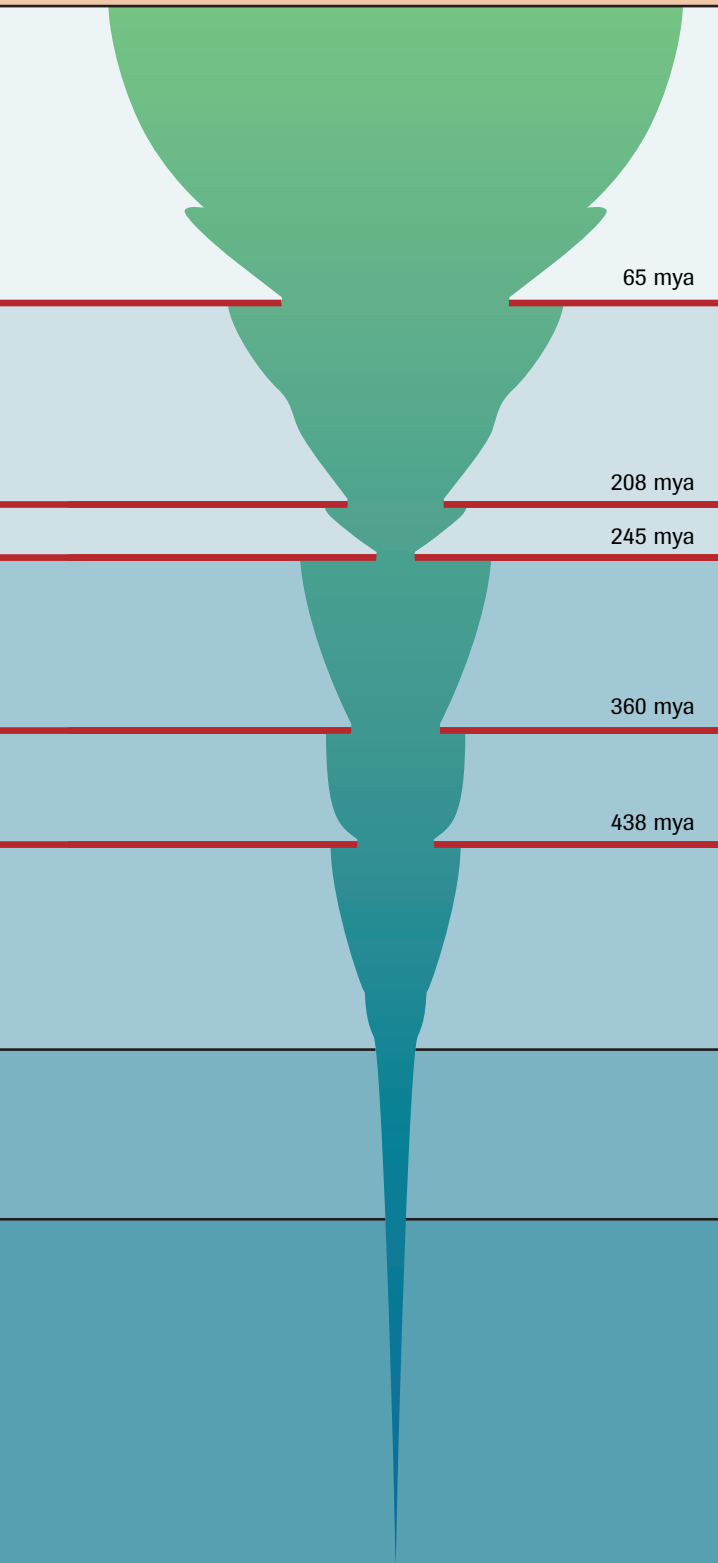


Alberta 20–30

Moving Continents		Era	Period	Epoch	Age millions of years ago (mya)	
10 mya		Cenozoic	Quaternary	Recent	0.01	
	Pleistocene			1.8		
	Tertiary		Pliocene	5		
			Miocene	24		
			Oligocene	37		
			Eocene	58		
			Paleocene	65		
65 mya		Mesozoic	Cretaceous	Late	100	
	Early			144		
	Jurassic		208			
240 mya			Triassic		245	
		Paleozoic	Permian		286	
			Carboniferous		360	
			Devonian		408	
370 mya				Silurian		438
				Ordovician		505
			Cambrian		570	
420 mya		Proterozoic	Oxygen(O ₂) abundant		2000	
					2500	
540 mya		Archean	Oldest fossils known		3500	
			Oldest dated rocks		3800	
			Approximate origin of Earth		4600	

Range of Global Diversity
(Marine and Terrestrial)

Mass Extinction —



- 65 mya**
extinction of large reptiles
mammal radiation begins
angiosperm plants dominate
- 135–180 mya**
birds appear
reptiles rule land, air, and sea
mammals appear
angiosperm plants appear
- 180–225 mya**
cycad-like and conifer trees
dominate
mammal-like reptiles appear
early dinosaurs appear
- 225–280 mya**
reptiles radiate
coniferous trees radiate and
modernize
- 280–345 mya**
reptiles appear
amphibians and insects radiate
coniferous trees appear
- 345–395 mya**
amphibians appear
trees and forests appear
insects appear
first bony fish appear
land plants radiate
- 395–435 mya**
land plants appear
arthropods invade land
jawed fish appear
armoured fish dominate
- 435–500 mya**
vertebrates appear
armored jawless fish appear
shell-bearing marine
invertebrates dominate
- 500–570 mya**
shell-bearing animals appear
marine invertebrates radiate

Biology

Alberta 20–30

Authors

Dr. Bob Ritter

Edmonton Catholic Separate School District No. 7

K.L. Burley

Red Deer Public School District No.104

Douglas Fraser

District School Board Ontario North East

Contributing Writers

Lorraine Lastiwka

Science Consultant, Edmonton School District No.7

Jennifer Halia MacLean

(Formerly) Holy Trinity High School, Edmonton Catholic Separate School District No.7





Biology Alberta 20–30

Authors

Dr. Bob Ritter
K.L. Burley
Douglas Fraser

Contributing Writers

Lorraine Lastiwka
Jennifer Halia MacLean

Director of Publishing

Beverley Buxton

**General Manager, Mathematics,
Science, and Technology**

Lenore Brooks

Publisher, Science

John Yip-Chuck

**Executive Managing Editor,
Development**

Cheryl Turner

Managing Editors, Development

Susan Ball
Lois Beauchamp

Product Manager

Paul Masson

Program Manager

Jackie Dulson

Educational Publishing Consultant

Trudy Rising

Developmental Editors

Barbara Booth
Kelly Davis
Jackie Dulson
Jenna Dunlop
Barb Every
Christy Hayhoe
Louise MacKenzie
Lisa McManus
Tom Shields
Rosemary Tanner

Editorial Assistants

Jacque Busby
Christina D'Alimonte
Aisha Hammah
Alisa Yampolsky

**Executive Director, Content and
Media Production**

Renate McCloy

**Director, Content and Media
Production**

Linh Vu

Senior Content Production Editors

Deborah Lonergan
Lisa McManus
Sue Selby

Content Production Editor

Cheryl Tiongson

Copy Editor

Susan Till

Proofreaders

Christine Hobberlin
Wendy Thomas

Indexer

Noeline Bridge

Production Manager

Cathy Deak

Production Coordinators

Sharon Latta Paterson
Helen Locsin
Kathrine Pummell

Design Director

Ken Phipps

Art Management

Suzanne Peden

Illustrators

AMID Studios
ArtPlus Ltd.
Greg Banning
Andrew Breithaupt
Steven Corrigan
Deborah Crowle
Kyle Gell Design
Imagineering
Irma Ikonen
Dave Mazierski
Bart Vallecoccia
Jane Whitney

Interior Design

Kyle Gell
Allan Moon

Cover Design

Johanna Liburd

Cover Image

Sarah Spencer/Shutterstock

Compositors

Zenaida Diores
Nelson Gonzalez

Photo/Permissions Researcher

Karen Becker

Printer

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Reviewers and Advisors

Teacher Reviewers

Peggy Au

Winston Churchill High School,
Lethbridge School District No.51

Barry Hertz

St. Mary's High School, Calgary
Roman Catholic Separate School
District No. 1

Shannon Mitchell

Lindsay Thurber Composite High
School, Red Deer Public School
District No.104

Narsh Ramrattan

Peace River High School, Peace River
School Division No.10

Sandy Shields

Winston Churchill High School,
Lethbridge School District No.51

Tim Trentham

Hunting Hills High School, Red Deer
Public School District No. 104

Aboriginal Education Reviewers and Consultants

Leith Campbell

Edmonton Catholic Separate School
District No. 7

Dean Cunningham

Consultant, Edmonton

Accuracy Reviewers

Dr. Keith M. Bagnall

Professor, Division of Anatomy,
University of Alberta

Dr. Ralph Cartar

Associate Professor, Department of
Biological Sciences, University of
Calgary

Dr. Steve Harvey

Professor, Department of Physiology,
University of Alberta

Dr. Robin E. Owen

Instructor, Department of Chemical,
Biological & Environmental Science,
Mount Royal College

Dr. Michael Pollock

Instructor, Department of Chemical,
Biological & Environmental Science,
Mount Royal College

Assessment Reviewers

Jayni Caldwell

Foothills Composite High School,
Foothills School Division No. 38

Kelly Dunn

Bishop Grandin High School, Calgary
Roman Catholic Separate School
District No. 1

Barry Hertz

St. Mary's High School, Calgary
Roman Catholic Separate School
District No. 1

Mary McDougall

Secondary Science Consultant, Calgary
Roman Catholic Separate School
District No. 1

David Milne-Ives

Strathcona-Tweedsmuir School,
Private

Audio Clip Writer

Pat Adams

Strathcona-Tweedsmuir School,
Private

Careers Consultant

Art Bauer

Science Coordinator, Living Waters
Catholic Regional Division No. 42

Investigations Reviewers

Greg Voigt

Archbishop Oscar Romero, Edmonton
Catholic Separate School District No.7

T.J. Sadler

Harry Ainlay School, Edmonton
School District No.7

Literacy Reviewers

Mary McDougall

(Formerly) Secondary Science
Consultant, Calgary Roman Catholic
Separate School District No. 1

Janice Ritter

St. Francis High School, Calgary
Roman Catholic Separate School
District No. 1

Safety Reviewer

Art Bauer

Science Coordinator, Living Waters
Catholic Regional Division No. 42

Web Quest Writer

Dr. Norma Nocente

Associate Professor, Faculty of
Education, University of Alberta

Technology Reviewers and Consultants

Pat Adams

Strathcona-Tweedsmuir School,
Private

Dan Braun

Kingsville District High School,
Greater Essex County District School
Board

William Konrad

Boreal-Northwest

Dr. Norma Nocente

Associate Professor, Faculty of
Education, University of Alberta

T.J. Sadler

Harry Ainlay School, Edmonton
School District No.7

International Baccalaureate Advisors

K.L. Burley

Red Deer Public School District
No.104

David Milne-Ives

Strathcona-Tweedsmuir School,
Private

Dr. Bob Ritter

Assistant Superintendent, Edmonton
Catholic Separate School District No. 7

David Rose

John G. Diefenbaker High School,
Calgary School District No.19

Field Test Schools

Alberta Education Field Test Schools

Battle River Regional Division No.31: Camrose Composite High School

Calgary Roman Catholic Separate School District No.1: Bishop Grandin High School

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East Central Alberta Catholic Separate Schools Regional Division No.16: St. Jerome's School

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Edmonton School District No.7: Amiskwaciy Academy, J. Percy Page School, McNally School

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Red Deer Public School District No.104: Hunting Hills High School

Rocky View School District No.41: Bert Church High School, Bow Valley High School

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Your Guide to this Textbook

Each unit begins with a two-page set of questions: **Are You Ready?** These questions will help you assess which concepts you should review before you begin the unit.




▶ **Unit 20 C** **ARE YOU READY?**
Photosynthesis and Cellular Respiration

These questions will help you find out what you already know, and what you need to review, before you continue with this unit.

You can review prerequisite concepts and skills on the Nelson Web site and in the Appendices. The **Appendices** are useful resources for your reference throughout the course.

Each chapter begins with **Starting Points** questions, helping you assess what you already know about the concepts for that chapter. Continue to consider these as you go through the chapter.

Throughout the chapters are activities that have one of the following icons on the left-hand side of their banner. Icons indicate the curriculum emphasis to which the activity relates.

Icon	Curriculum emphasis of activity
	Nature of Science
	Science and Technology
	Social and Environmental Contexts

Investigations are labs in which you will make predictions, form hypotheses, gather and record evidence, then analyze, evaluate, and communicate your results. **Report Checklists** in Investigations show you the parts of lab reports you will need to complete.

INVESTIGATION 6.1 **Report Checklist**

Separating Plant Pigments from Leaves

Plants produce thousands of different chemical compounds,

<input checked="" type="checkbox"/> Purpose	<input type="checkbox"/> Design	<input checked="" type="checkbox"/> Analysis
<input checked="" type="checkbox"/> Problem	<input type="checkbox"/> Materials	<input checked="" type="checkbox"/> Evaluation
<input type="checkbox"/> Hypothesis	<input type="checkbox"/> Procedure	<input type="checkbox"/> Synthesis
<input checked="" type="checkbox"/> Prediction	<input checked="" type="checkbox"/> Evidence	

You will see an **Investigation Introduction** at the point in the chapter where you will most likely perform each Investigation.

INVESTIGATION 6.1 Introduction **Report Checklist**

Separating Plant Pigments from Leaves

Look at **Figure 5** with unaided eyes and determine its colour. Now look at the figure with a magnifying glass. What colours do you see? The spring and summer leaves of deciduous trees appear green in colour. Do green leaves contain only green pigments, or is there a mixture of pigments with the green

<input type="checkbox"/> Purpose	<input type="checkbox"/> Design	<input checked="" type="checkbox"/> Analysis
<input type="checkbox"/> Problem	<input type="checkbox"/> Materials	<input checked="" type="checkbox"/> Evaluation
<input type="checkbox"/> Hypothesis	<input type="checkbox"/> Procedure	<input type="checkbox"/> Synthesis
<input type="checkbox"/> Prediction	<input checked="" type="checkbox"/> Evidence	

A **Case Study** provides you with information or data, and then guides you in analyzing, decision making, or problem solving by a series of questions.

Case Study

Using Satellite and Airborne Technology to Monitor Photosynthesis and Productivity.

Clear cutting has been practised for decades in Whitecourt, Alberta. Recently however, an increasing demand for wood has accelerated this cutting and placed added stress on the land base (**Figure 8**). In addition to harvesting for the forestry

In an **Explore an Issue** feature, you have the opportunity to define, research, analyze, and report on issues affecting our planet. The **Issue Checklist** shows you the parts of the decision-making process you will need to complete.

EXPLORE an issue **Issue Checklist**

Harnessing Light Energy

By utilizing sunlight, plants produce food through What are the

<input checked="" type="checkbox"/> Issue	<input type="checkbox"/> Design	<input checked="" type="checkbox"/> Analysis
<input checked="" type="checkbox"/> Resolution	<input checked="" type="checkbox"/> Evidence	<input checked="" type="checkbox"/> Evaluation

Sample Exercises guide you step-by-step through a solution.

▶ **SAMPLE exercise 2**

For the cross shown in **Figure 3**, what is the probability that an offspring will have a phenotype of wrinkled seeds? Express the answer as a percent.

Solution
 Since the allele for wrinkled seeds, *r*, is recessive, only offspring with a genotype *rr* will have wrinkled seeds. From the Punnett square, 1 of every 4 offspring are expected to have this genotype, so the probability that an offspring will have

You will have many opportunities throughout each unit for practice and review. **Practice** questions are found after all Sample Exercises and at other points throughout the chapter, and will help you to assess your understanding as you work.

▶ **Practice**

1. A student working with *Drosophila* makes the following cross:
 E^1E^2 (wild-type eye colour) \times E^2E^4 (apricot eye colour)














What will be the phenotypic ratio of the offspring?

You can review and demonstrate your understanding of the concepts and skills in each section using the **Summaries** and **Section Questions**.


The **Chapter Summary** lists the outcomes that you should have mastered as you worked through the chapter, as well as equations and key terms. There is also a box of questions—**Make a Summary**—to help you consolidate your understanding of the concepts addressed.


The **Chapter Reviews** and **Unit Reviews** give you practice in answering questions similar to those on the Alberta Diploma Exam. **Appendix A5** provides diploma exam tips and **Appendix D** contains numerical answers and short answers for questions throughout your textbook.

Other icons throughout the textbook will direct you to features to aid you in your learning.

Icon	Explanation	Icon	Explanation
	<ul style="list-style-type: none"> an invitation to go to the Nelson Web site for research, additional information, or to reach an activity 		<p>Caution</p> <ul style="list-style-type: none"> a warning of particular safety concerns
	<p>Starting Points</p> <ul style="list-style-type: none"> questions for you to check your knowledge of upcoming concepts, and to revisit at the end of the chapter to assess your learning 		<p>Explorations and Mini Investigations</p> <ul style="list-style-type: none"> brief activities that introduce new concepts or skills and help you to explore concepts being discussed
	<p>Lab Exercise</p> <ul style="list-style-type: none"> data from an experiment for you to analyze and/or evaluate 		<p>Extension</p> <ul style="list-style-type: none"> reading material or an activity related to concepts or skills beyond the Alberta Biology 20-30 curriculum
	<p>Career Connection</p> <ul style="list-style-type: none"> online information about a science-related career 		<p>Chemistry Connection</p> <ul style="list-style-type: none"> online information about a related topic in your chemistry course
	<p>Audio</p> <ul style="list-style-type: none"> an audio file on the Student CD and the Nelson Web site that may be a walk-through of a Sample Exercise, an Extension, or pronunciation of Key Terms 		<p>Web Activity</p> <ul style="list-style-type: none"> activities on the Nelson Web site that are an integral part of your Biology textbook <ul style="list-style-type: none"> – Web Quests (investigations in which you gather, analyze, and use online information); – Case Studies (activities that provide information and then ask you to analyze it and draw conclusions); – Simulations (interactive online activities or investigations); and – Canadian Achievers (explorations of science-related careers of exceptional Canadians)
	<p>Video</p> <ul style="list-style-type: none"> a video or animation on the Nelson Web site that demonstrates a technique or illustrates a concept 		
	<p>Diploma Exam numerical response style questions</p>		
	<p>Diploma Exam written response style questions</p>		

Preparation for Alberta Diploma Exams

We hope that your interest in science will grow and deepen as you work through your Biology course with the aid of this textbook. As your knowledge, skills, and attitudes develop, you will also be working toward the Biology Diploma Exam. This resource has been developed to help you achieve your best on the Alberta Biology 30 Diploma Exam. **Appendix A5** provides specific tips on writing the exam. Part 1 of the Chapter and Unit Reviews contain multiple choice and numerical response questions like you will find on the Diploma Exam. The numerical response questions are marked with this icon . Your teacher can provide you with additional questions we have provided to her/him. The Case Studies provide practice in answering closed-response written ques-

tions based on a scenario. In completing an Explore an Issue, you will develop skills for answering open-response written questions on the Diploma Exam. Here you will find and read information about a science-related issue and then formulate and communicate your ideas, supported by your research. You will apply these skills to the written-response (Part 2) questions in the Chapter Reviews and Unit Reviews, and in the **additional Diploma Exam-style Review Questions** on the Nelson Web site. These questions are longer scenario-based questions, sometimes using published articles. In the Chapter and Unit Review, this icon  indicates a question that is in the format of a Diploma Exam written-response question.