BIOZONE

CLASSROOM GUIDE

# VCE | BIOLOGY UNITS 3&4

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## STUDENT EDITION


Student Edition with Answers in Place ..... i-318



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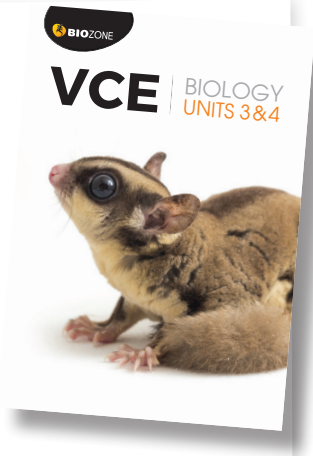
# FAQs
## ABOUT VCE BIOLOGY UNITS 3&4





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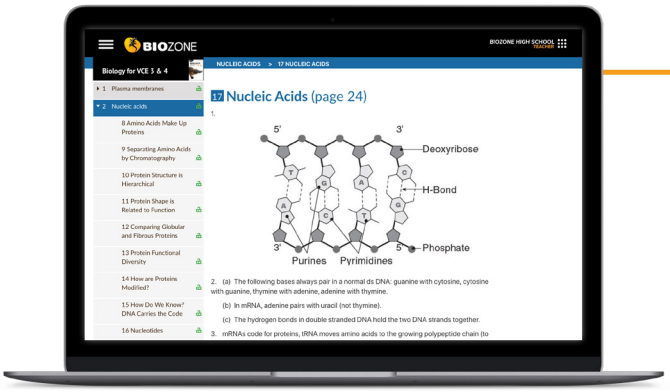
# Teacher Support Materials

*VCE Biology, Units 3&4* is supported by a suite of resources that support the main book. These additional resources provide the tools for teaching and learning remotely or in the classroom, support your students in their self-assessment tasks with online answers, and use interactivity to promote class discussion and efficient review. Some features of these supporting resources are described below and you will find further information later in this guide.




## ONLINE MODEL ANSWERS

Online Model Answers provide model answers to each of the activities, including working where appropriate (e.g. calculations).

Online Model Answers are accessible via a login that is unique to your school. Your access as a teacher means you're able to control how much and when students can view individual answers, making it easier for you to support homework and revision. Controlled access to answers promotes deeper understanding and encourages students to be self critical. The online model answers also provide an effective tool to support your students with remote learning.

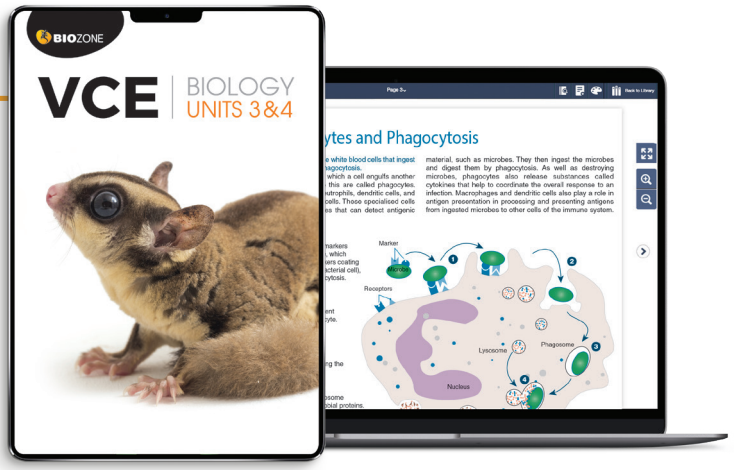
## EBOOK VERSION

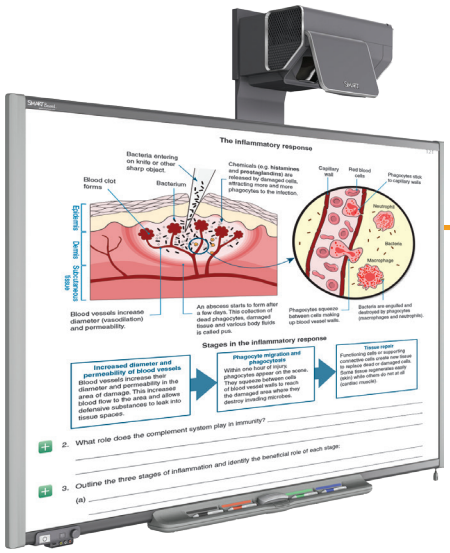
Our eBooks provide a digital replica of the printed pages.

With our eBook PLUS on a School Managed Licence, students can answer most questions online, although a small number of questions require offline responses or a download. These are mostly associated with key skills, such as plotting and graphical representations.

The eBook TEACHER'S EDITION is also available with answers in place and some additional features.

Visit: **biozone.com.au/ebooks** for more information




## DIGITAL TEACHER'S EDITION

This teacher's resource features a non-printable PDF Teacher's Edition, with a useful feature allowing you to hide and display the suggested answers. It is ideal for introducing and reviewing activities using an interactive whiteboard. The Digital Teacher's Edition includes an introductory guide to using *VCE Biology, Units3&4*in the classroom and online, as well as a long answers section. Supplied as a direct download.

## RESOURCE HUB

Be sure to visit BIOZONE's RESOURCE HUB, which is fully accessible and free of charge to you and your students. If offers a curated collection of videos, animations, 3D models, and supporting content for the activities in this book.

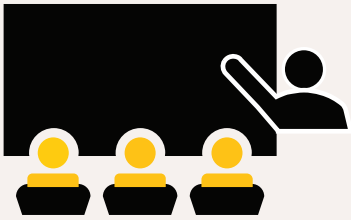
Visit: **www.BIOZONEhub.com** Your code is **VCE12-2-6375**

# Meeting Key Competencies

We want today's biology students to be self-motivated, lifelong learners, to develop a sound grasp of biological knowledge, to plan and evaluate their work, and to think critically and independently. In developing *VCE Biology*, we have put the aims and structure of the **VCE Biology Study design** (for accreditation 2021-2025) first and foremost. This title fully supports scientific investigation, critical and creative thinking, and individual and collaborative approaches to scientific endeavour. An understanding of ethical behaviours, and acknowledgement of the knowledge and cultures of Aboriginal and Torres Strait Islander peoples, are integral to this title. This guide will highlight some of strategies BIOZONE has used to meet the aims and scope of the study design.


## Lesson planning

- The structure of *VCE Biology, Units 3&4* follows the Unit-Area of Study structure specified in the **VCE Biology Study Design**. Teachers can be assured that all of the essential components of the Study Design are covered, ensuring easy and efficient lesson planning with no content gaps.
- Use the chapter introductions to assign students work for each lesson.
- Add interest to your lessons by utilising the FREE, curated resources on **BIOZONE's Resource Hub** in your planning. Resources for specific activities are identified on the Resource Hub, saving you time, and extending your range of tools. You can use these to prepare students for upcoming topics, or consolidate understanding after lessons.
- Use the contents pages to help with lesson planning too. A green bullet next to an activity in the contents pages identifies where there is a **practical investigation**. A red bullet indicates an **assessment task.** Incorporate these activities into your schedules.



## Teaching

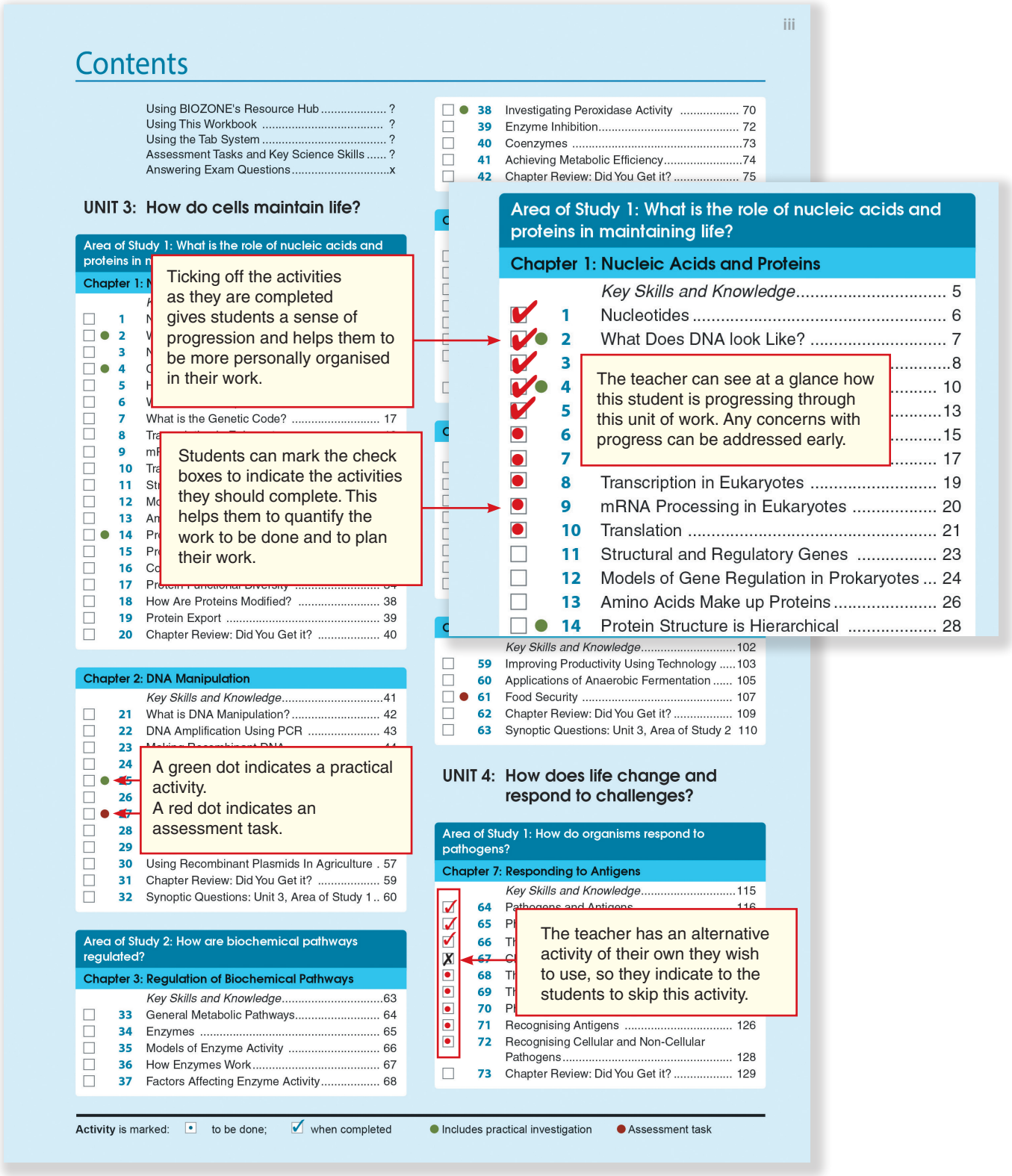
- Teach the content in the order presented in *VCE Biology, Units 3&4.* The content and skills covered in Outcomes 1 and 2 of each unit lay the foundation for tackling Outcome 3 with confidence.
- Encourage peer-to-peer learning by assigning students into groups of mixed abilities when carrying out group research projects or practical investigations.
- Activities that manipulate data using formulas may be supported by spreadsheets on **BIOZONE's Resource Hub**. You can tailor how you use the spreadsheets and students can analyse the data sets provided (including graphs) to save time.
- Extend students' scientific vocabulary by encouraging them to look up unfamiliar words in the **glossary** (Appendix 1).
- Use the **Digital Teacher's Edition** to introduce an activity and give any direction required. It can be used to review answers in class or on-line quickly and efficiently. Choose when and how you reveal the answers. To promote student discussion, reveal answers only once the students have shared their ideas. Reveal all the answers if you want the students to self mark their own work.

## Assessment

- Provide feedback (formative and summative) to students to update them on their progress. This can highlight areas of strength or areas needing work.
- Use formative assessment to identify areas the class needs to revisit before progressing to the next topic or unit. Methods of formative assessment include reviewing student answers on the chapter reviews, observing students carrying out practical work, or evaluating their contribution and understanding in practical work.
- Use the **Synoptic Questions** at the end of each Area of Study to assess student understanding. This could be carried out as a test in class. Alternatively, you can set them as homework or open book assessments if you wish.

# The Contents: A Planning Tool

The contents pages are not merely a list of the activities in the book. Encourage your students to use them as a planning tool for their programme of work. Students can identify the activities they are to complete and then tick them off when completed. Teachers can see at a glance how quickly the student is progressing through the assigned material.



# Introducing the Content

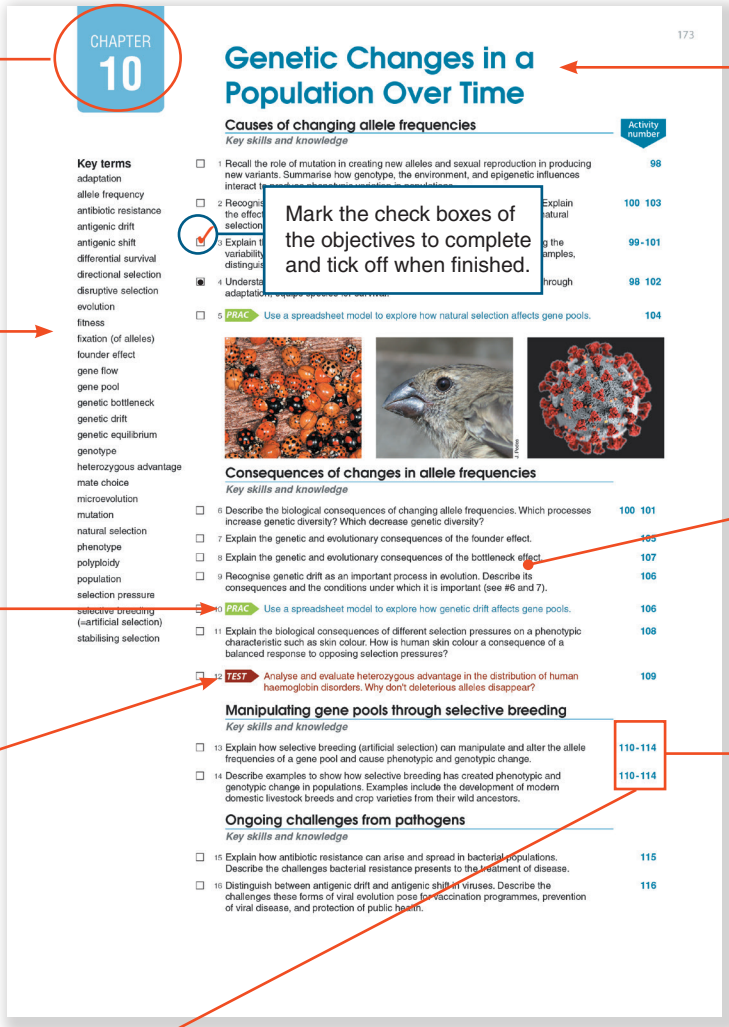
Each chapter in *VCE Biology Units 3&4* is prefaced with a one page introduction, providing students with an overview of the chapter content and organisation. Each of the numbered learning outcomes pertains to a point of key knowledge or a skill, and is matched to one or more activities. A list of key terms for the chapter is also included. The comprehensive, but accessible, list of learning outcomes encourages students to approach each topic confidently. Familiarity with the scientific terms used in each topic is implicit in this. Encourage your students to use the glossary to expand their vocabulary.

For ease of navigation, chapters are numbered sequentially throughout the book, separated by Unit and Area of Study breaks (see following pages).

Students can use the list of **key terms** to create their own glossary, or they can look them up in the glossary at the back of the book. This encourages use of the correct terms when answering questions.

Activities that cover practical skills are identified with a green bookmark and blue text.

Activities that cover an assessment for the Area of Study are indicated by a red bookmark and text.




The chapter title corresponds to the *Key Knowledge* headings under each *Outcome* for each *Area of Study*.

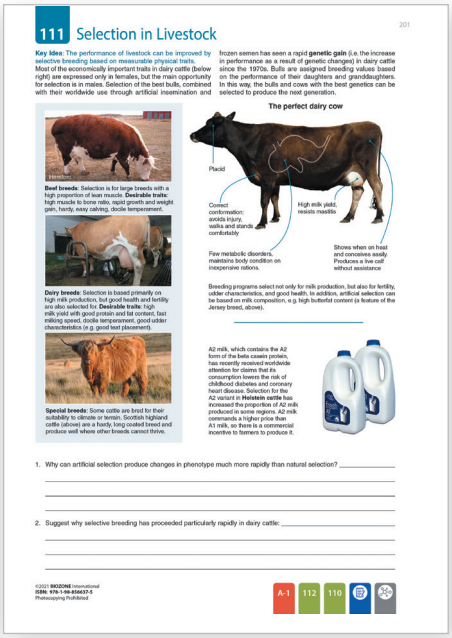
**For students**:

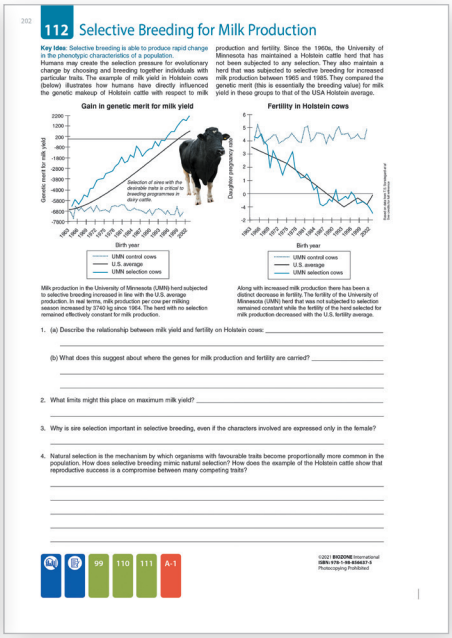
Key knowledge and skills are drawn from the study design. They are purposefully brief, with enough information to provide a framework, but not so much that students are overwhelmed.

The activities relating to these key knowledge outcomes.

Introduce the concept with a grounding activity

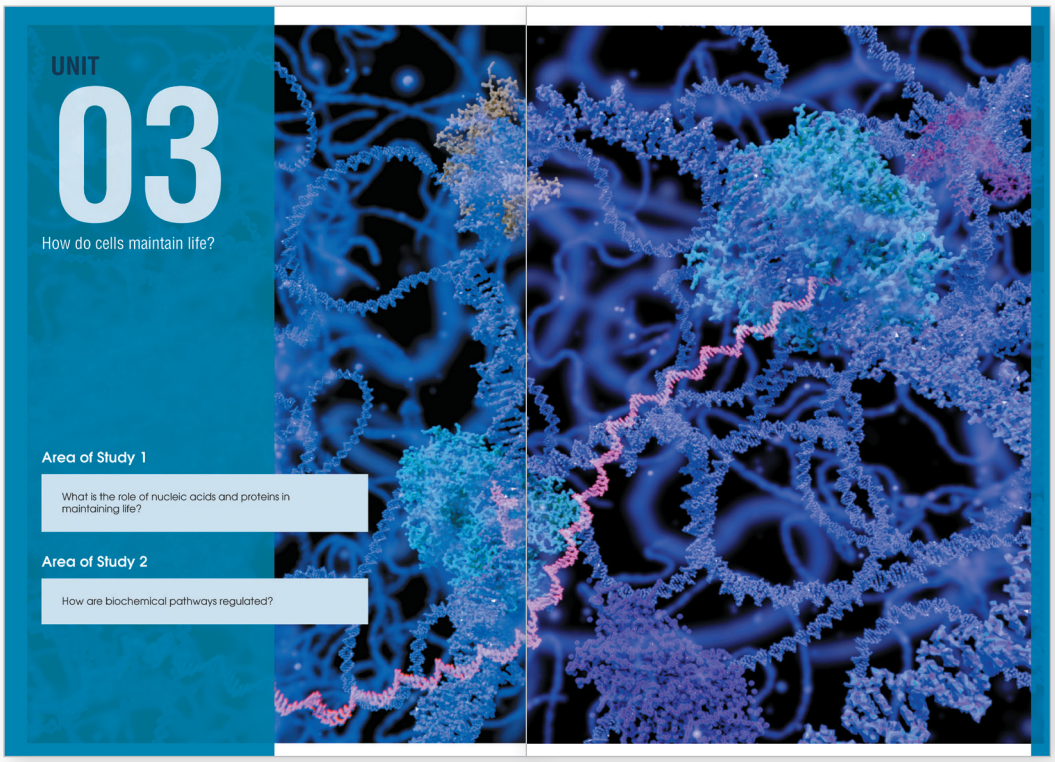
Follow with activities exploring that concept

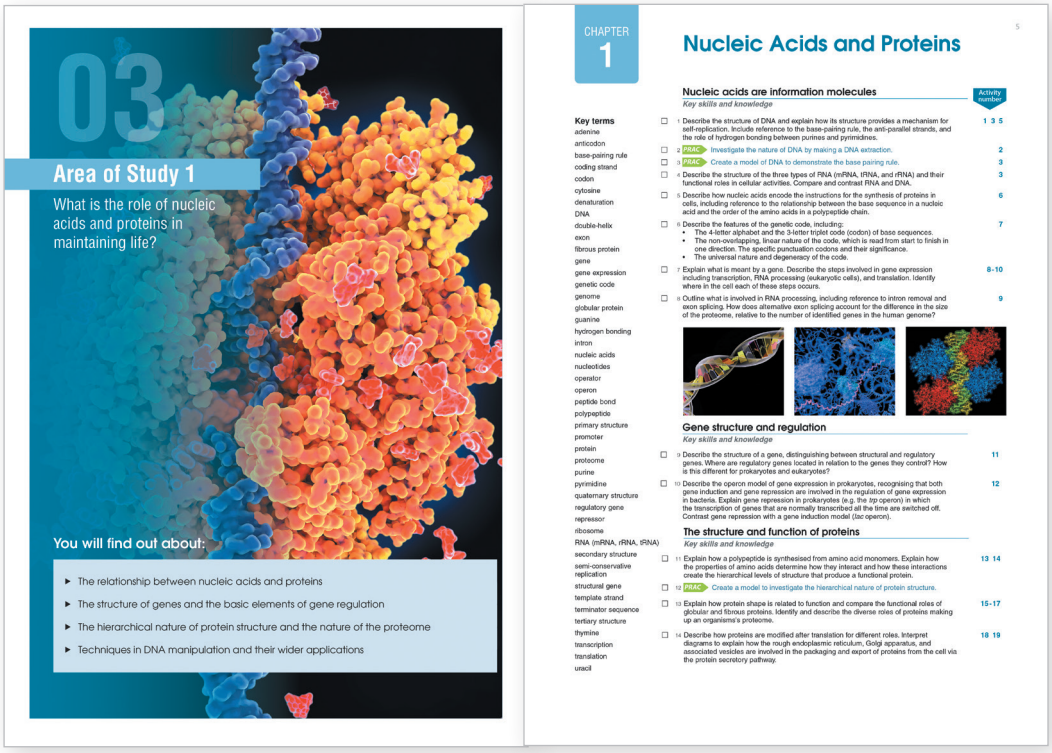



# Finding Your Way Around

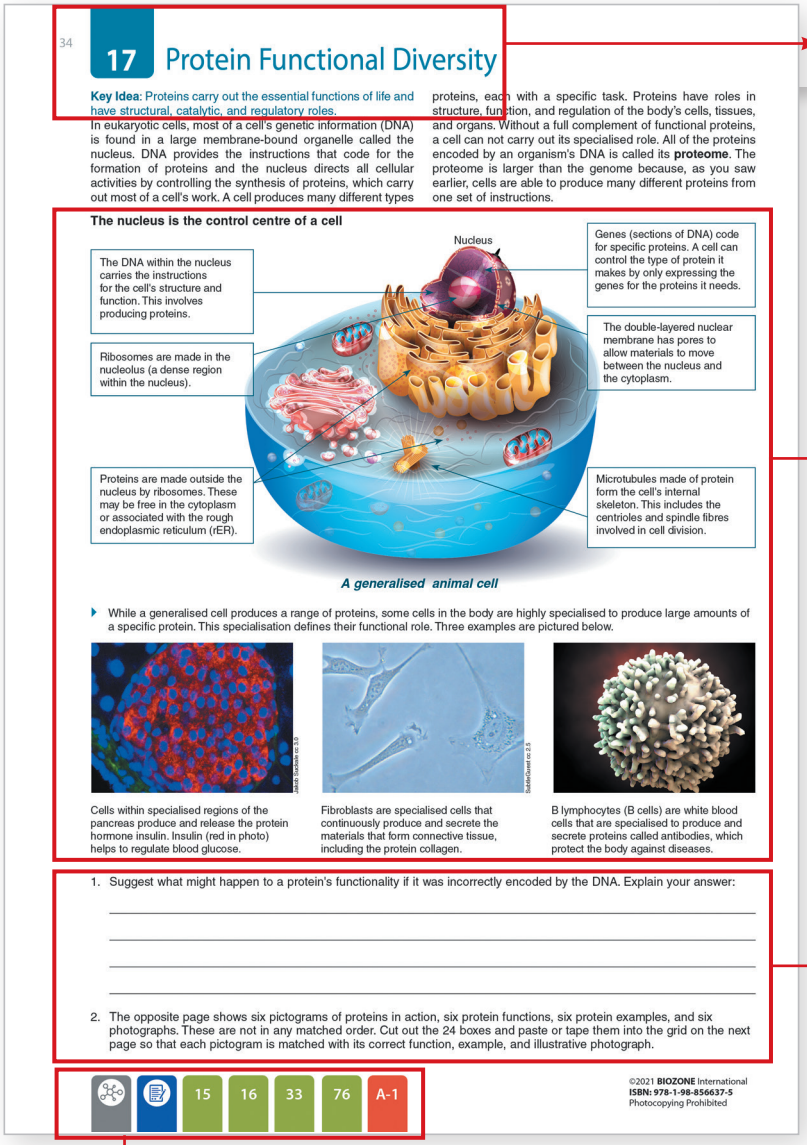
The content of the *VCE Biology Units 3&4* is organised into 14 chapters, numbered sequentially and nested within their Unit and Area of Study (below). Each chapter begins with an introduction and most conclude with a student's self-test of understanding and vocabulary. Inviting, concept-based activities make up the bulk of each chapter, with each activity focussing on the student developing an understanding of a concept, applying that understanding to another scenario, and/or developing an essential skill, such as graphing or data analysis. The tabs for each activity identify the nature of the activity, and identify related material and external supporting resources. These features are explained further on the opposite page.




The two *Unit* breaks divide the book into two halves, providing students with a clear indication of where they are in the course. Each unit break summarises the topics to be covered in each *Area of Study*, so students have a clear idea of what is coming up.




The *Area of Study* breaks demarcate each group of related topics within the Study Design. Each one provides a short list of what the student will find out about in that section, which helps to prepare them for the upcoming content. An *Area of Study* may include anything from one to three chapters (*Key Knowledge* areas).



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# 17 Protein Functional Diversity

**Key Idea:** Proteins carry out the essential functions of life and have structural, catalytic, and regulatory roles.

In eukaryotic cells, most of a cell's genetic information (DNA) is found in a large membrane-bound organelle called the nucleus. DNA provides the instructions that code for the formation of proteins and the nucleus directs all cellular activities by controlling the synthesis of proteins, which carry out most of a cell's work. A cell produces many different types proteins, each with a specific task. Proteins have roles in structure, function, and regulation of the body's cells, tissues, and organs. Without a full complement of functional proteins, a cell can not carry out its specialised role. All of the proteins encoded by an organism's DNA is called its **proteome**. The proteome is larger than the genome because, as you saw earlier, cells are able to produce many different proteins from one set of instructions.

**The nucleus is the control centre of a cell**



*A generalised animal cell*

While a generalised cell produces a range of proteins, some cells in the body are highly specialised to produce large amounts of a specific protein. This specialisation defines their functional role. Three examples are pictured below.



Cells within specialised regions of the pancreas produce and release the protein hormone insulin. Insulin (red in photo) helps to regulate blood glucose.

Fibroblasts are specialised cells that continuously produce and secrete the materials that form connective tissue, including the protein collagen.

B lymphocytes (B cells) are white blood cells that are specialised to produce and secrete proteins called antibodies, which protect the body against diseases.

1. Suggest what might happen to a protein's functionality if it was incorrectly encoded by the DNA. Explain your answer:

2. The opposite page shows six pictograms of proteins in action, six protein functions, six protein examples, and six photographs. These are not in any matched order. Cut out the 24 boxes and paste or tape them into the grid on the next page so that each pictogram is matched with its correct function, example, and illustrative photograph.

15 16 33 76 A-1


**ISBN: 978-1-98-856637-5**


**Key Idea**: Proteins carry out the essential functions of life and have structural, catalytic, and regulatory roles.

The **key idea** provides a focus for each activity. It summarises the focus of the activity and provides a clear take-home message for the student.

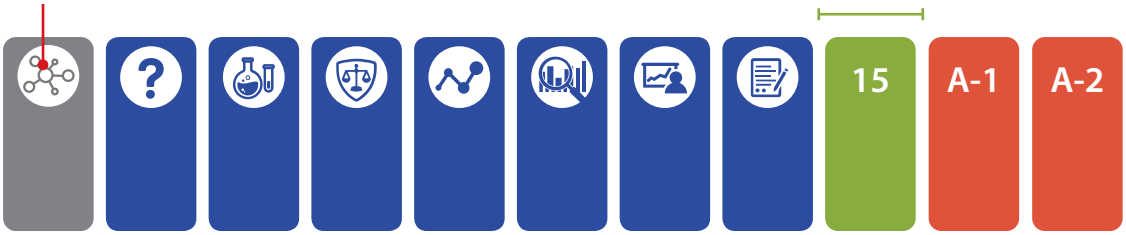
Annotated diagrams, sometimes including photo panels, explain the content of the page, providing the information necessary to complete the activity.

Understanding of content is tested through questions, data handling, analysis, prediction, or summary. Students are often required to apply their understanding to a new scenario or make connections to related content. Students must interact with the information on the page in order to complete the activity. It is this interaction that provides the valuable learning experience, reinforcing and explaining the key idea. Students are frequently asked to work in small groups to discuss ideas and formulate responses.

Related or supporting content is identified through the **colour-coded tab system** (below).

**Grey hub tabs** indicate the activity is supported on the Resource Hub. See page v for details.

**Green tabs** make connections to related activities elsewhere in the book




**Blue** tabs indicate the activity covers the following **key skills** (L → R):

- Develop aims and questions, formulate hypotheses, make predictions
- Plan and conduct investigations
- Comply with safety and ethical guidelines
- Generate, collate, and record data
- Analyse and evaluate data and investigation methods
- Construct evidence-based arguments and draw conclusions
- Analyse, evaluate and communicate scientific ideas

**Red** tabs indicate appendices (L → R):

- A-1: Glossary
- A-2: Equipment list

*See pages 311-315*

# Practical Investigations

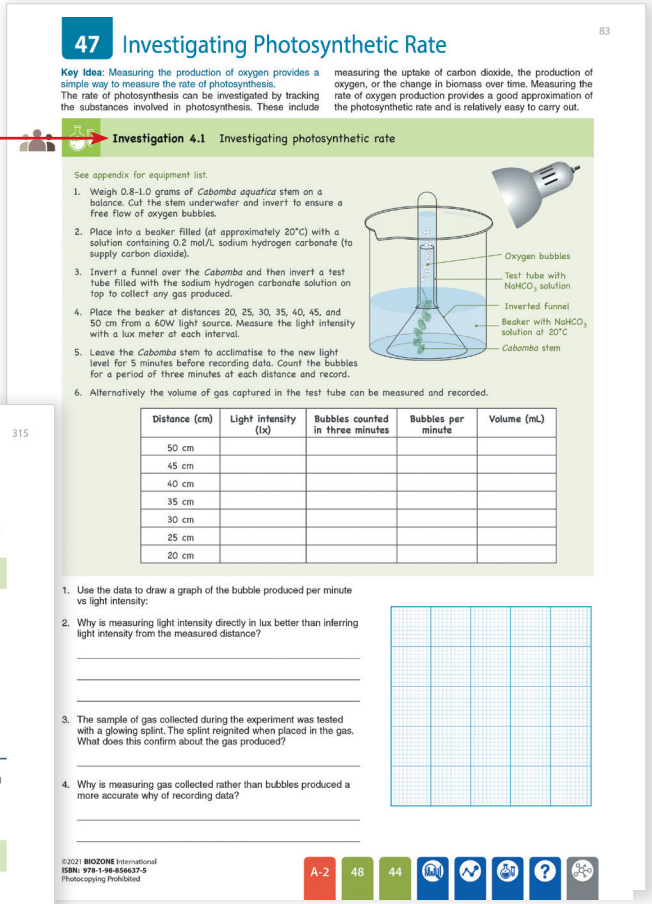
- One of the best ways to engage students is through hands on activity. Numerous opportunities for practical work are presented throughout this book. These practical investigations are opportunities for students to develop competency in scientific procedures and to practise the *Key Science Skills* by applying them in practical situations.

The investigations provide an opportunity for collaborative work and will stimulate discussion and the sharing of ideas. Collaboration through paired practical work provides an excellent opportunity for students to interact in meaningful ways to extend their scientific vocabulary and improve communication skills.

The investigations have been designed using everyday materials and equipment easily found in most high school laboratories. No special kits are required. Where possible we have provided "typical" results.

Each investigation is clearly numbered (sequentially through the chapter).

- Ensure your students read through the procedure fully *before beginning* the investigation.
- Highlight any hazardous or important steps, and make sure the students follow your directions.



47 Investigating Photosynthetic Rate

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**Key Idea:** Measuring the production of oxygen provides a simple way to measure the rate of photosynthesis.
The rate of photosynthesis can be investigated by tracking the substances involved in photosynthesis. These include measuring the uptake of carbon dioxide, the production of oxygen, or the change in biomass over time. Measuring the rate of oxygen production provides a good approximation of the photosynthetic rate and is relatively easy to carry out.

**Investigation 4.1** Investigating photosynthetic rate

See appendix for equipment list.

1. Weigh 0.8–1.0 grams of *Cabomba aquatica* stem on a balance. Cut the stem underwater and invert to ensure a free flow of oxygen bubbles.
2. Place into a beaker filled (at approximately 20°C) with a solution containing 0.2 mol/L sodium hydrogen carbonate (to supply carbon dioxide).
3. Invert a funnel over the *Cabomba* and then invert a test tube filled with the sodium hydrogen carbonate solution on top to collect any gas produced.
4. Place the beaker at distances 20, 25, 30, 35, 40, 45, and 50 cm from a 60W light source. Measure the light intensity with a lux meter at each interval.
5. Leave the *Cabomba* stem to acclimatise to the new light level for 5 minutes before recording data. Count the bubbles for a period of three minutes at each distance and record.
6. Alternatively the volume of gas captured in the test tube can be measured and recorded.

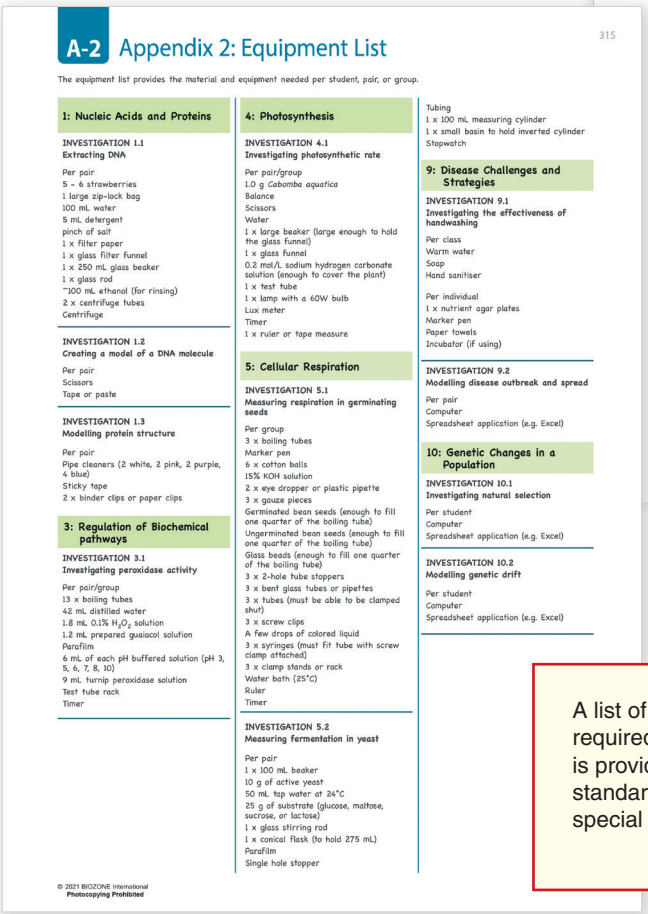
Oxygen bubbles
Test tube with $NaHCO_3$ solution
Inverted funnel
Beaker with $NaHCO_3$ solution at 20°C
*Cabomba* stem

| Distance (cm) | Light intensity (lx) | Bubbles counted in three minutes | Bubbles per minute | Volume (mL) |
|---|---|---|---|---|
| 50 cm | | | | |
| 45 cm | | | | |
| 40 cm | | | | |
| 35 cm | | | | |
| 30 cm | | | | |
| 25 cm | | | | |
| 20 cm | | | | |

1. Use the data to draw a graph of the bubble produced per minute vs light intensity:
2. Why is measuring light intensity directly in lux better than inferring light intensity from the measured distance?
3. The sample of gas collected during the experiment was tested with a glowing splint. The splint reignited when placed in the gas. What does this confirm about the gas produced?
4. Why is measuring gas collected rather than bubbles produced a more accurate why of recording data?







A-2 Appendix 2: Equipment List

315

The equipment list provides the material and equipment needed per student, pair, or group.

**1: Nucleic Acids and Proteins**

INVESTIGATION 1.1
**Extracting DNA**
Per pair
5 – 6 strawberries
1 large zip-lock bag
100 mL water
5 mL detergent
pinch of salt
1 x filter paper
1 x glass filter funnel
1 x 250 mL glass beaker
1 x glass rod
~100 mL ethanol (for rinsing)
2 x centrifuge tubes
Centrifuge

INVESTIGATION 1.2
**Creating a model of a DNA molecule**
Per pair
Scissors
Tape or paste

INVESTIGATION 1.3
**Modelling protein structure**
Per pair
Pipe cleaners (2 white, 2 pink, 2 purple, 4 blue)
Sticky tape
2 x binder clips or paper clips

**3: Regulation of Biochemical pathways**

INVESTIGATION 3.1
**Investigating peroxidase activity**
Per pair/group
13 x boiling tubes
42 mL distilled water
1.8 mL 0.1% $H_2O_2$ solution
1.2 mL prepared guaiacol solution
Parafilm
6 mL of each pH buffered solution (pH 3, 5, 6, 7, 8, 10)
9 mL turnip peroxidase solution
Test tube rack
Timer

**4: Photosynthesis**

INVESTIGATION 4.1
**Investigating photosynthetic rate**
Per pair/group
1.0 g *Cabomba aquatica*
Balance
Scissors
Water
1 x large beaker (large enough to hold the glass funnel)
1 x glass funnel
0.2 mol/L sodium hydrogen carbonate solution (enough to cover the plant)
1 x test tube
1 x lamp with a 60W bulb
Lux meter
Timer
1 x ruler or tape measure

**5: Cellular Respiration**

INVESTIGATION 5.1
**Measuring respiration in germinating seeds**
Per group
3 x boiling tubes
Marker pen
6 x cotton balls
15% KOH solution
2 x eye dropper or plastic pipette
3 x gauze pieces
Germinated bean seeds (enough to fill one quarter of the boiling tube)
Ungerminated bean seeds (enough to fill one quarter of the boiling tube)
Glass beads (enough to fill one quarter of the boiling tube)
3 x 2-hole tube stoppers
3 x bent glass tubes or pipettes
3 x tubes (must be able to be clamped shut)
3 x screw clips
A few drops of colored liquid
3 x syringes (must fit tube with screw clamp attached)
3 x clamp stands or rack
Water bath (25°C)
Ruler
Timer

INVESTIGATION 5.2
**Measuring fermentation in yeast**
Per pair
1 x 100 mL beaker
10 g of active yeast
50 mL tap water at 24°C
25 g of substrate (glucose, maltose, sucrose, or lactose)
1 x glass stirring rod
1 x conical flask (to hold 275 mL)
Parafilm
Single hole stopper
Tubing
1 x 100 mL measuring cylinder
1 x small basin to hold inverted cylinder
Stopwatch

**9: Disease Challenges and Strategies**

INVESTIGATION 9.1
**Investigating the effectiveness of handwashing**
Per class
Warm water
Soap
Hand sanitiser
Per individual
1 x nutrient agar plates
Marker pen
Paper towels
Incubator (if using)

INVESTIGATION 9.2
**Modelling disease outbreak and spread**
Per pair
Computer
Spreadsheet application (e.g. Excel)

**10: Genetic Changes in a Population**

INVESTIGATION 10.1
**Investigating natural selection**
Per student
Computer
Spreadsheet application (e.g. Excel)

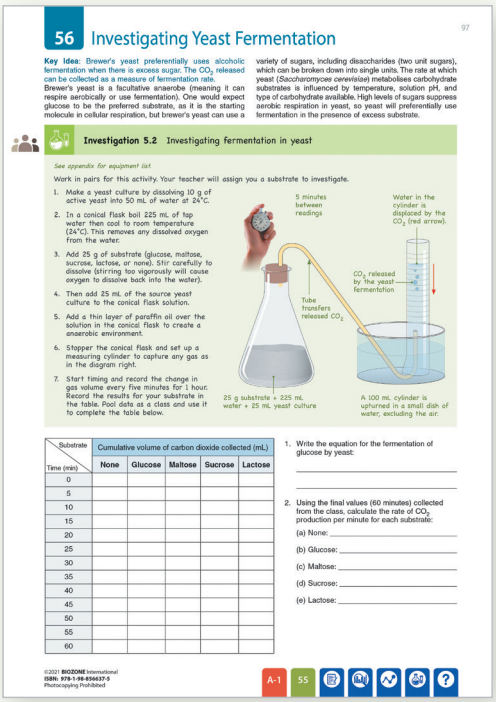
INVESTIGATION 10.2
**Modelling genetic drift**
Per student
Computer
Spreadsheet application (e.g. Excel)



A list of the equipment and reagents required for each investigation is provided in appendix 2. Only standard equipment is used (no special kits are required).

A range of different types of practical activities have been included in the book (these are outlined below). Practical investigations are identified in the contents with a green circle, and in the chapter introduction with a green prac tab. In addition, chapter 14 has been designed to help students with the outcome 3 task of designing or adapting a lab or field-based investigation related to cellular processes and/or biological change and continuity over time. The chapter covers:

- Ethical considerations and safety
- Recording results in a log book
- Analysing and interpreting data
- Designing a practical investigation
- Presenting findings

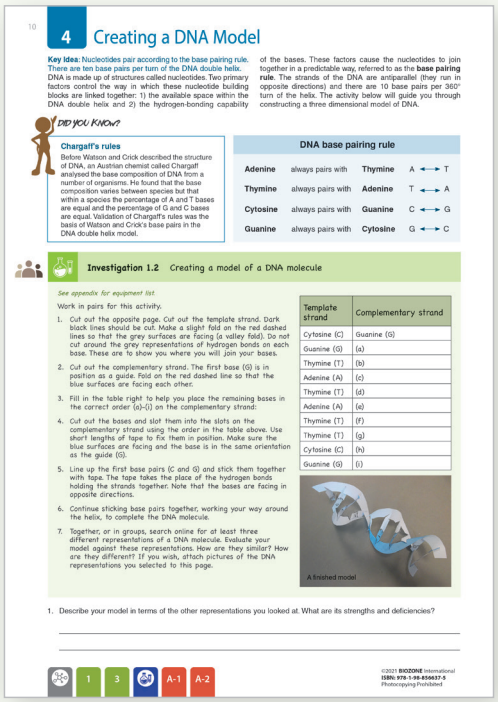


56 Investigating Yeast Fermentation

Key idea: Brewer's yeast preferentially uses alcoholic fermentation when there is excess sugar. The $CO_2$ released can be collected as a measure of fermentation rate.

Investigation 5.2 Investigating fermentation in yeast

*Experiments and investigations*

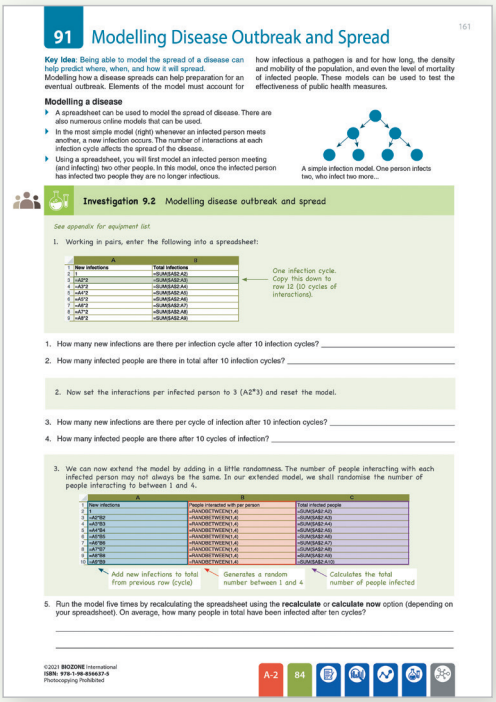


4 Creating a DNA Model

Key idea: Nucleotides pair according to the base pairing rule. There are ten base pairs per turn of the DNA double helix.

Investigation 1.2 Creating a model of a DNA molecule

*Paper practicals*

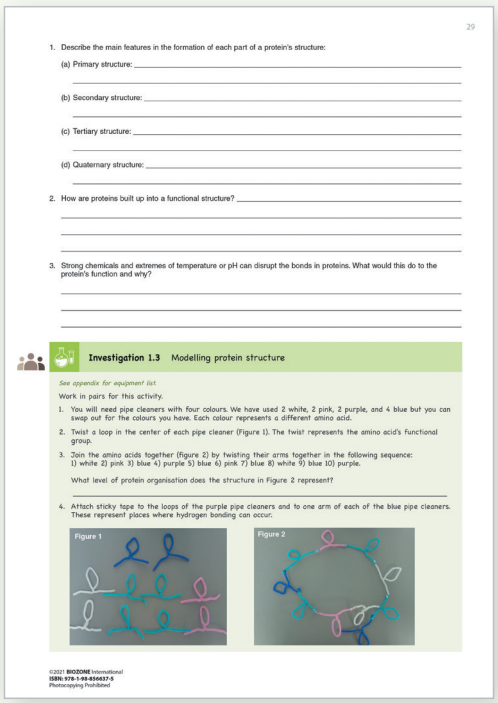


91 Modelling Disease Outbreak and Spread

Key idea: Being able to model the spread of a disease can help predict where, when, and how it will spread.

Investigation 9.2 Modelling disease outbreak and spread

*Spreadsheets and computational models*



1. Describe the main features in the formation of each part of a protein's structure:

Investigation 1.3 Modelling protein structure

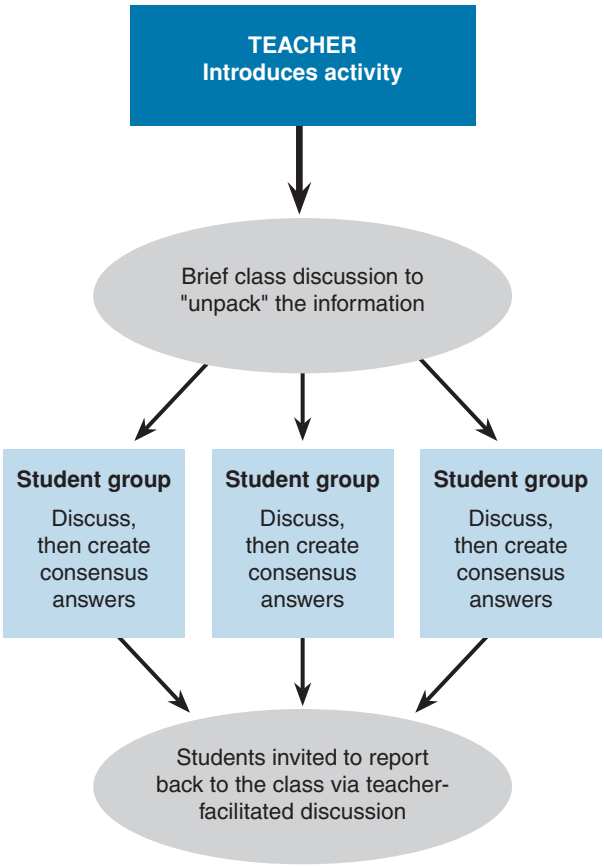
*Physical models*

# Teaching Strategies for Classroom Use

Achieving effective differentiated instruction in classes is a teaching challenge. Students naturally have mixed abilities, varying backgrounds in the subject, and different language skills. Used effectively, BIOZONE's student books and supporting resources can make teaching a mixed ability class easier. Here, we suggest some approaches for differentiated instruction.

## MAKING A START

Regardless of which activity you might be attempting in class, a short introduction to the task by the teacher is a useful orientation for all students. For collaborative work, the teacher can then divide the class into appropriate groups, each with a balance of able and less able students. Depending on the activity, the class may regroup at the end of the lesson for discussion.




## Using collaboration to maximise learning outcomes

- The structure of *VCE Biology Units 3&4* allows for a flexible approach to unpacking the content with your students.
- The content can be delivered in a way to support collaboration, where students work in small groups to share ideas and information to answer and gain a better understanding of a topic, or design a solution to a problem.
- By working together to ask questions and evaluate each other's ideas, students maximise their own and each other's learning opportunities. They are exposed to ideas and perspectives they may not have come up with on their own.
- Collaboration, listening to others, and voicing their own ideas is valuable for supporting English language learners and developing their English and scientific vocabularies.
- Use a short, informal collaborative learning session to get students to exchange ideas about the answer to a question. Alternatively, collaboration may take a more formal role that lasts for a longer period of time (e.g. assign groups to work together for a practical activity, to research an extension question, or design a solution to a problem).

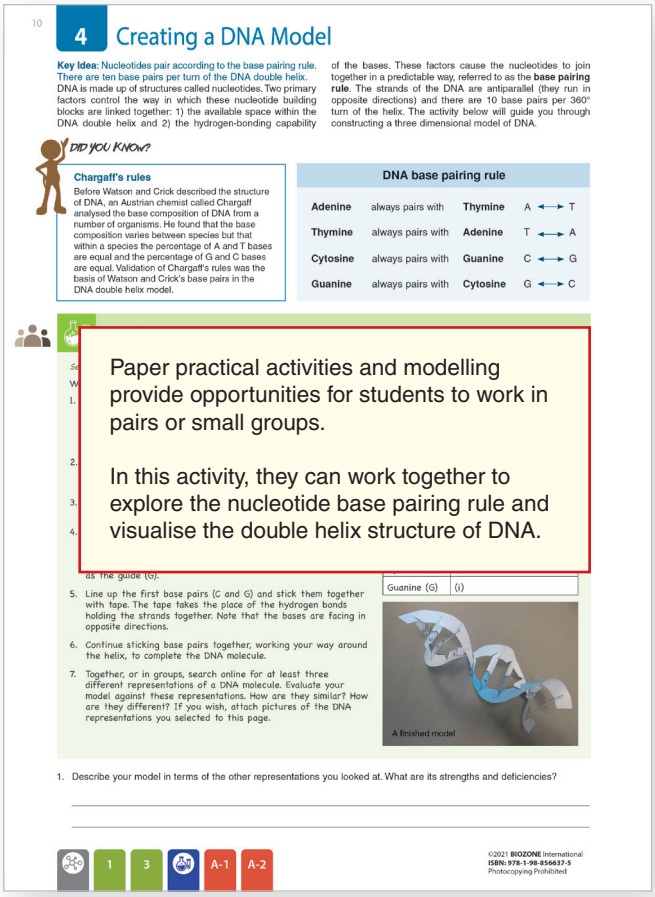
The teacher introduces the topic. They provide structure to the session by providing background information and setting up discussion points and clear objectives. Collaboration is emphasised to encourage participation from the entire group. If necessary, students in a group can be assigned specific tasks.

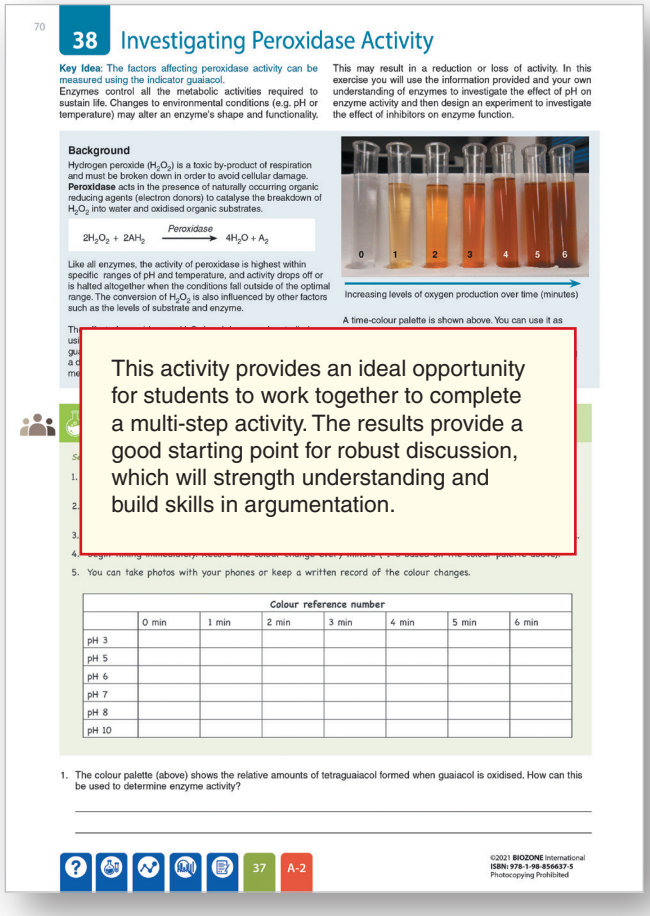
Students work in small groups so everyone's contribution is heard. They collaborate, share ideas, and engage in discourse. The emphasis is on discussing questions and formulating a consensus answer, not just sharing ideas.

At the end of the session, students report back on their findings. Each student should have enough knowledge to report back on the group's findings. Reporting consists primarily of providing answers to questions, but may involve presenting a report, model, or slide show, or contributing to a debate.

## Peer to peer support

- **Peer-to-peer learning** is emphasised throughout the book, and is particularly valuable for more challenging activities in which the content is more complex or the questions require students to draw on several areas of their knowledge to solve a problem.
- **Practical activities, investigations** and **group research projects** are an ideal vehicle for peer-to-peer learning. Students can work together to review and discuss their results, ask and answer questions, and describe phenomena.



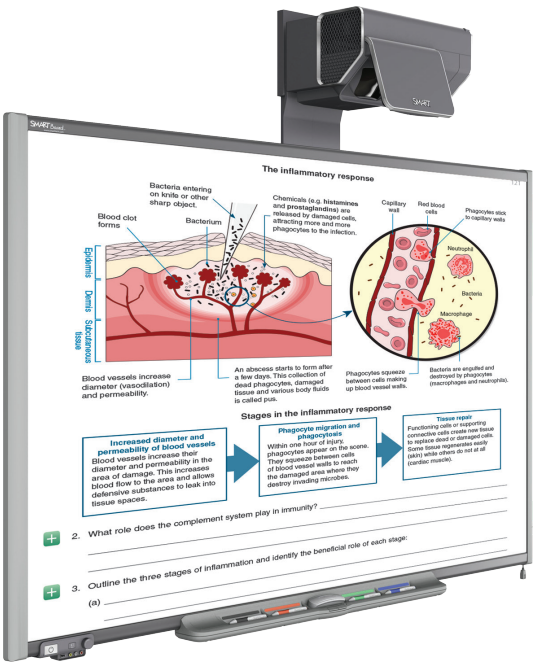

## Collaboration and discovery

- BIOZONE's *VCE Biology Units 3&4* allows for collaboration and discovery. By working together and sharing ideas, students are exposed to different perspectives and levels of knowledge about biological concepts.
- BIOZONE's *VCE Biology Units 3&4* builds student understanding by providing a range of activities. These include getting students to think about and share what they already know and then build on this knowledge by exploring and explaining phenomena.


**Student A** is capable. He helps to lead the discussion and records the discussion in a structured way.

**Students B and C** are also capable but less willing to lead discussion they will add ideas to the discussion but need a little direction from A to do so.

**Student D** is less able but gains ideas and understanding from the discussion of students A, B, and C. She may add to the discussion as she gains confidence in the material being studied.

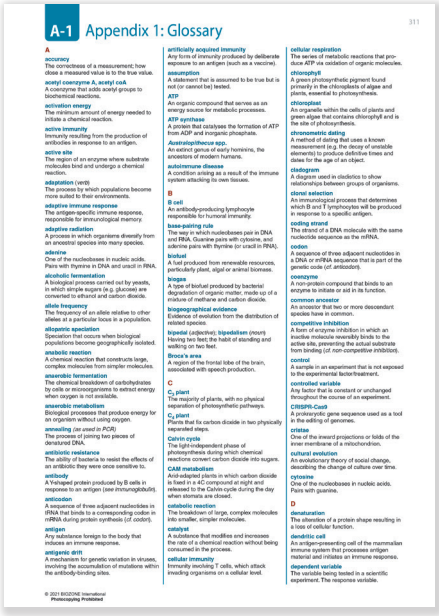



## Interactive revision of tasks in class

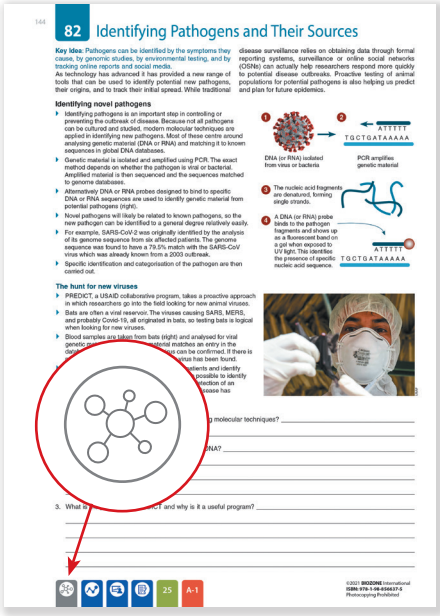
- The **Digital Teacher's Edition** provides a digital rights managed (DRM) version of the student book as PDF files. It features useful HIDE/SHOW answers, which can be used to review activities in class using a data projector or interactive whiteboard (left).
- Students benefit from the feedback in class, where questions can be addressed, and teachers benefit by having students self-mark their work and receive helpful feedback on their responses.
- This approach is particularly suited to activities with questions requiring a discussion, as students will be able to clarify some aspects of their responses. Stronger students can benefit by contributing to the explanatory feedback and class discussion.

# Differentiated Learning

Tools for differentiated instruction within *VCE Biology Units 3&4* help teachers to support students all skill levels. BIOZONE's collaborative approach to science inquiry encourages students to share their ideas and knowledge with their peers while reinforcing their own understanding. There are several ways to use *VCE Biology Units 3&4* in a differentiated classroom:

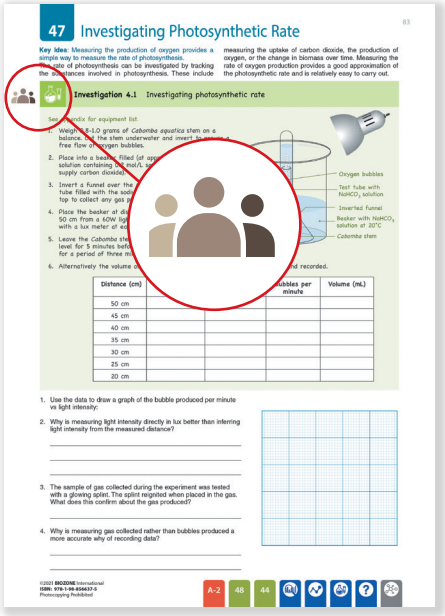



Encourage students to use the glossary (Appendix 1) when they come across a new word or a word whose definition they are unsure of. This will build their scientific literacy and knowledge of key terms.




**BIOZONE's Resource Hub** provides curated content to support the activities in the book. Videos, animations, simulations, and 3D models support students of all abilities, while some resources (interactive spreadsheets, fact sheets, and reference papers) may be used as part of group work or extension.

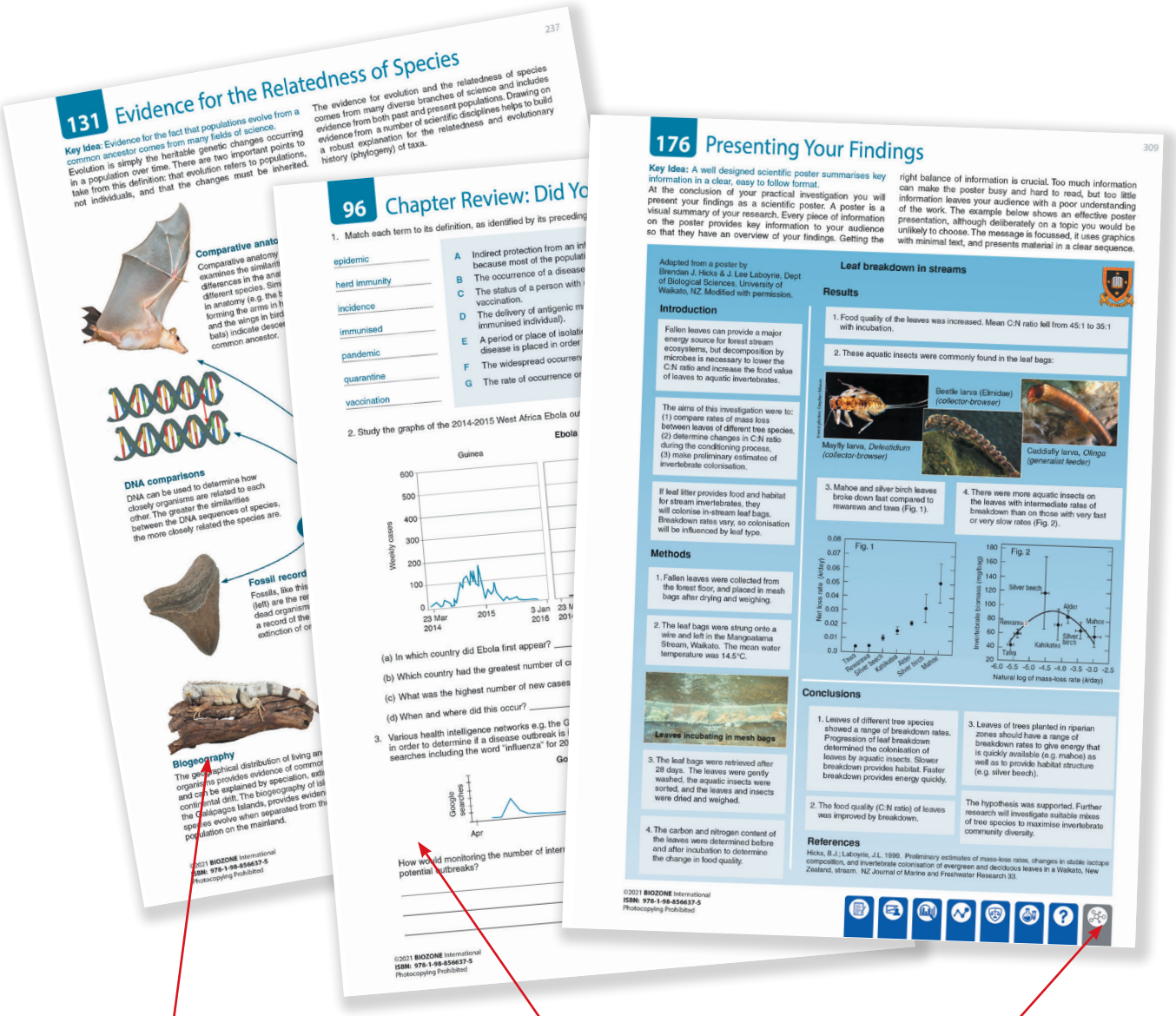
A grey hub tab at the bottom of the page indicates the activity has online support.




A group symbol indicates where students can work together. Group work provides opportunities for student collaboration and peer-to-peer support to explore the principles and concepts they are engaged with in their course. Working in groups, students can experience the benefits of collaboration in the scientific process of discovery. By speaking and listening, they develop and extend their communication skills and scientific vocabulary.

# Choosing Activities for Home Study

Many of the book's activities are ideal for homework or as vehicles for a quick formative assessment. End of chapter review activities are ideal as homework. They provide a way to review a topic that has recently been completed, while at the same time facilitating consolidation by presenting the material in a slightly different way. The information for review activities can be found within the chapter, although stronger students may not need to refer back to source material to complete the set work. Generally, homework activities should revise completed topics or provide a basic entry-level introduction.




Introductory activities can be useful to set the scene for a chapter or concept. Use this activity as an overview into the different lines of evidence scientists use to show relatedness between species. Subsequent activities will go into more detail about each point.

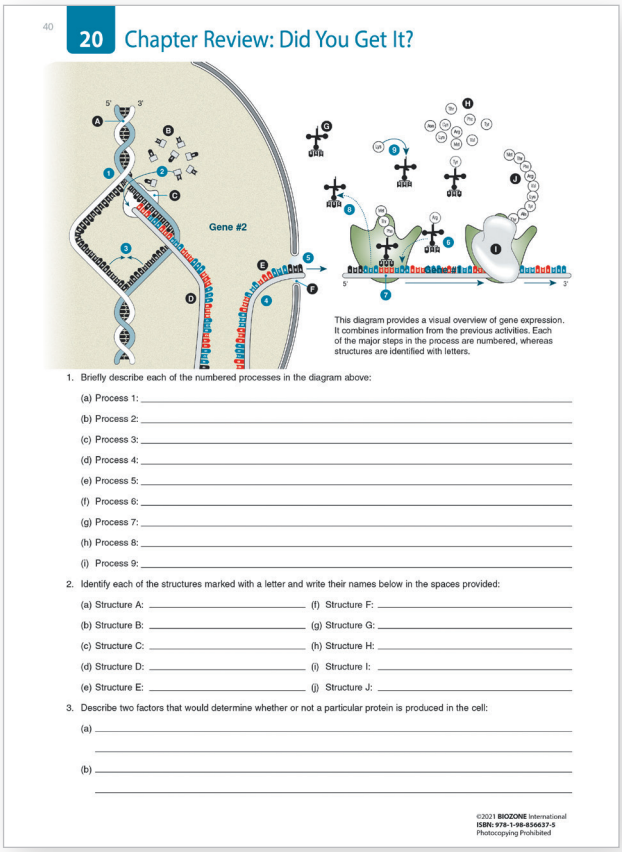
Review activities are ideal as homework because they involve a self-test of the student's own understanding of completed work. In this activity, students apply their understanding of biodiversity and ecological interdependencies to complete the activity. Such activities allow the teacher to address any misconceptions before formal assessment.

Most students will have access to the internet. Sometimes a homework activity might involve the student reviewing the resources on **BIOZONE's Resource Hub** for the next day's activity. Here, reviewing the resources on the Hub can help students plan how to present the results for Outcome 3.

# Formative and Summative Assessments

BIOZONE's *VCE Biology Units 3&4* provides many opportunities to assess your students' progress as they work through the course. The *Contents* check-box list provides a list of activities completed, and the students' own self-tests in the review activities at the end of each chapter provide opportunity to address any misconceptions or lack of understanding. A summary of formative and summative assessments is provided in the table below. You may also choose to assess practical work as you move through the course.

| UNIT 3: How do cells maintain life? | | | | | |
|---|---|---|---|---|---|
| AREA OF STUDY 1<br>What is the role of nucleic acids and proteins in maintain life? | | AREA OF STUDY 2<br>How are biochemical pathways regulated? | | | |
| CHAPTER 1<br>Nucleic Acids and Proteins | CHAPTER 2<br>DNA Manipulation | CHAPTER 3<br>Regulation of Biochemical Pathways | CHAPTER 4<br>Photosynthesis | CHAPTER 5<br>Cellular Respiration | CHAPTER 6<br>Applications of Biochemical Pathways |
| FORMATIVE<br>Activity 20.<br>Chapter Review | FORMATIVE<br>Activity 31.<br>Chapter Review<br><br>SUMMATIVE<br>Activity 27.<br>Assessment task:<br>Area of Study 1<br>*Case study analysis*<br><br>Activity 32.<br>Synoptic Questions | FORMATIVE<br>Activity 42.<br>Chapter Review | FORMATIVE<br>Activity 50.<br>Chapter Review | FORMATIVE<br>Activity 58.<br>Chapter Review | FORMATIVE<br>Activity 62.<br>Chapter Review<br><br>SUMMATIVE<br>Activity 61.<br>Assessment task: Area of Study 2<br>*Analysis and evaluation of a contemporary bioethical issue*<br><br>Activity 63.<br>Synoptic Questions |



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20 Chapter Review: Did You Get It?

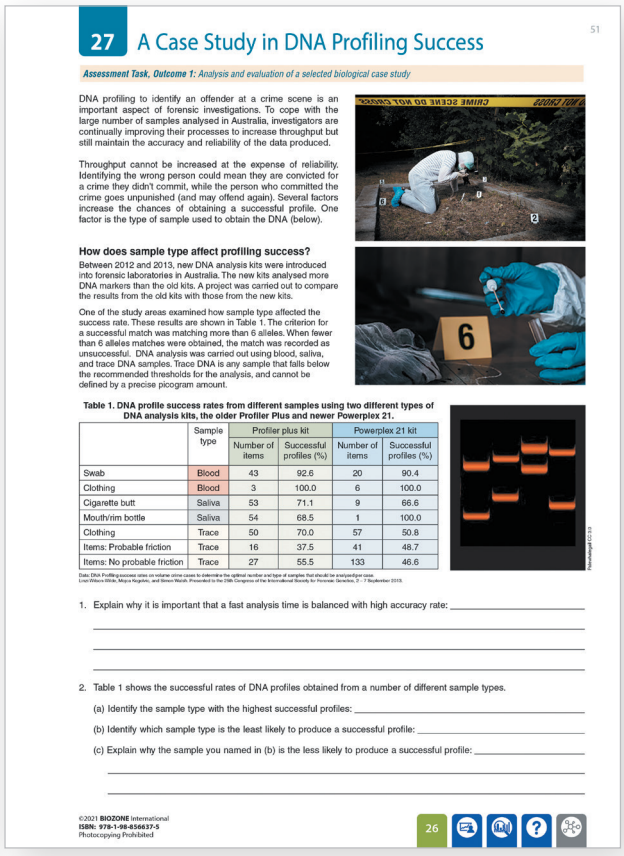


This diagram provides a visual overview of gene expression. It combines information from the previous activities. Each of the major steps in the process are numbered, whereas structures are identified with letters.

1. Briefly describe each of the numbered processes in the diagram above:
   (a) Process 1: _____
   (b) Process 2: _____
   (c) Process 3: _____
   (d) Process 4: _____
   (e) Process 5: _____
   (f) Process 6: _____
   (g) Process 7: _____
   (h) Process 8: _____
   (i) Process 9: _____
2. Identify each of the structures marked with a letter and write their names below in the spaces provided:
   (a) Structure A: _____ (f) Structure F: _____
   (b) Structure B: _____ (g) Structure G: _____
   (c) Structure C: _____ (h) Structure H: _____
   (d) Structure D: _____ (i) Structure I: _____
   (e) Structure E: _____ (j) Structure J: _____
3. Describe two factors that would determine whether or not a particular protein is produced in the cell:
   (a) _____
   (b) _____



**End of chapter reviews**



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27 A Case Study in DNA Profiling Success

***Assessment Task, Outcome 1:*** *Analysis and evaluation of a selected biological case study*

DNA profiling to identify an offender at a crime scene is an important aspect of forensic investigations. To cope with the large number of samples analysed in Australia, investigators are continually improving their processes to increase throughput but still maintain the accuracy and reliability of the data produced.

Throughput cannot be increased at the expense of reliability. Identifying the wrong person could mean they are convicted for a crime they didn't commit, while the person who committed the crime goes unpunished (and may offend again). Several factors increase the chances of obtaining a successful profile. One factor is the type of sample used to obtain the DNA (below).

**How does sample type affect profiling success?**

Between 2012 and 2013, new DNA analysis kits were introduced into forensic laboratories in Australia. The new kits analysed more DNA markers than the old kits. A project was carried out to compare the results from the old kits with those from the new kits.

One of the study areas examined how sample type affected the success rate. These results are shown in Table 1. The criterion for a successful match was matching more than 6 alleles. When fewer than 6 alleles matches were obtained, the match was recorded as unsuccessful. DNA analysis was carried out using blood, saliva, and trace DNA samples. Trace DNA is any sample that falls below the recommended thresholds for the analysis, and cannot be defined by a precise picogram amount.

**Table 1. DNA profile success rates from different samples using two different types of DNA analysis kits, the older Profiler Plus and newer Powerplex 21.**

| | Sample type | Profiler plus kit | | Powerplex 21 kit | |
|---|---|---|---|---|---|
| | | Number of items | Successful profiles (%) | Number of items | Successful profiles (%) |
| Swab | Blood | 43 | 92.6 | 20 | 90.4 |
| Clothing | Blood | 3 | 100.0 | 6 | 100.0 |
| Cigarette butt | Saliva | 53 | 71.1 | 9 | 66.6 |
| Mouth/rim bottle | Saliva | 54 | 68.5 | 1 | 100.0 |
| Clothing | Trace | 50 | 70.0 | 57 | 50.8 |
| Items: Probable friction | Trace | 16 | 37.5 | 41 | 48.7 |
| Items: No probable friction | Trace | 27 | 55.5 | 133 | 46.6 |

1. Explain why it is important that a fast analysis time is balanced with high accuracy rate: _____
2. Table 1 shows the successful rates of DNA profiles obtained from a number of different sample types.
   (a) Identify the sample type with the highest successful profiles: _____
   (b) Identify which sample type is the least likely to produce a successful profile: _____
   (c) Explain why the sample you named in (b) is the less likely to produce a successful profile: _____



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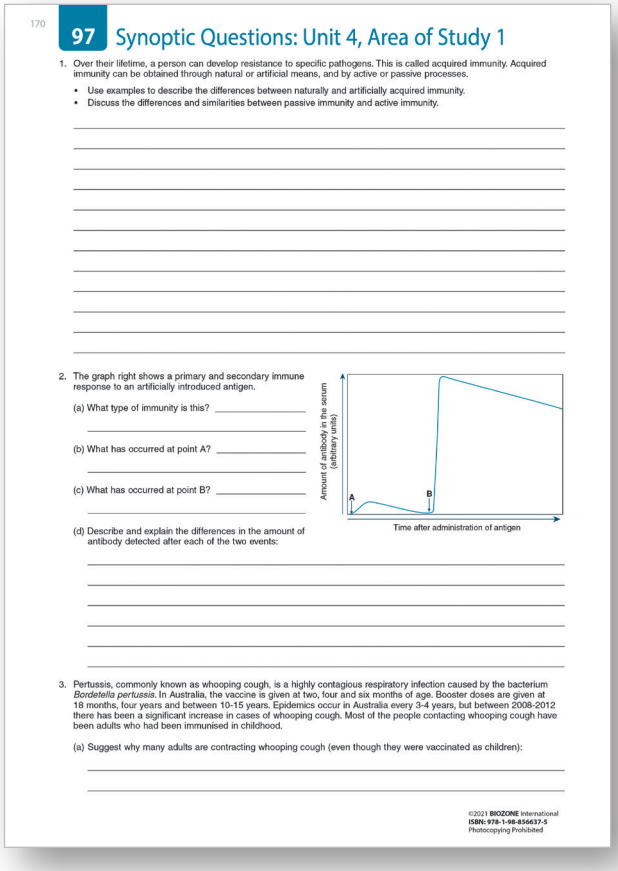
**Area of Study Assessment Task: Case Study analysis**

| UNIT 4: How does life change and respond to challenges? | | | | | | | |
|---|---|---|---|---|---|---|---|
| AREA OF STUDY 1<br>How do organisms respond to pathogens? | | | AREA OF STUDY 2<br>How are species related over time? | | | | AREA OF STUDY 3 |
| CHAPTER 7<br>Responding to Pathogens | CHAPTER 8<br>Acquiring Immunity | CHAPTER 9<br>Disease Challenges and Strategies | CHAPTER 10<br>Genetic Changes in a Population Over Time | CHAPTER 11<br>Changes in Species Over Time | CHAPTER 12<br>Determining Species Relatedness | CHAPTER 13<br>Human Change Over Time | CHAPTER 14<br>Investigating Cellular Processes or Biological Change |
| FORMATIVE<br>Activity 73.<br>Chapter Review | FORMATIVE<br>Activity 79.<br>Chapter Review | FORMATIVE<br>Activity 96.<br>Chapter Review<br><br>SUMMATIVE<br>Activity 86.<br>Assessment task: Area of Study 1<br>*Data analysis of generated primary/ secondary data*<br><br>SUMMATIVE<br>Activity 97.<br>Synoptic Questions | FORMATIVE<br>Activity 117.<br>Chapter Review<br><br>SUMMATIVE<br>Activity 109.<br>Assessment task: Area of Study 2<br>*Case study analysis* | FORMATIVE<br>Activity 130.<br>Chapter Review | FORMATIVE<br>Activity 144.<br>Chapter Review | FORMATIVE<br>Activity 170.<br>Chapter Review<br><br>Activity 171.<br>Synoptic Questions | ASSESSMENT<br>Design and conduct a scientific investigation<br><br>Supported with Activity 175.<br>Designing a Practical Investigation |



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**97** Synoptic Questions: Unit 4, Area of Study 1

1. Over their lifetime, a person can develop resistance to specific pathogens. This is called acquired immunity. Acquired immunity can be obtained through natural or artificial means, and by active or passive processes.
   - Use examples to describe the differences between naturally and artificially acquired immunity.
   - Discuss the differences and similarities between passive immunity and active immunity.

2. The graph right shows a primary and secondary immune response to an artificially introduced antigen.
   (a) What type of immunity is this?
   (b) What has occurred at point A?
   (c) What has occurred at point B?
   (d) Describe and explain the differences in the amount of antibody detected after each of the two events:



3. Pertussis, commonly known as whooping cough, is a highly contagious respiratory infection caused by the bacterium *Bordetella pertussis*. In Australia, the vaccine is given at two, four and six months of age. Booster doses are given at 18 months, four years and between 10-15 years. Epidemics occur in Australia every 3-4 years, but between 2008-2012 there has been a significant increase in cases of whooping cough. Most of the people contacting whooping cough have been adults who had been immunised in childhood.
   (a) Suggest why many adults are contracting whooping cough (even though they were vaccinated as children):


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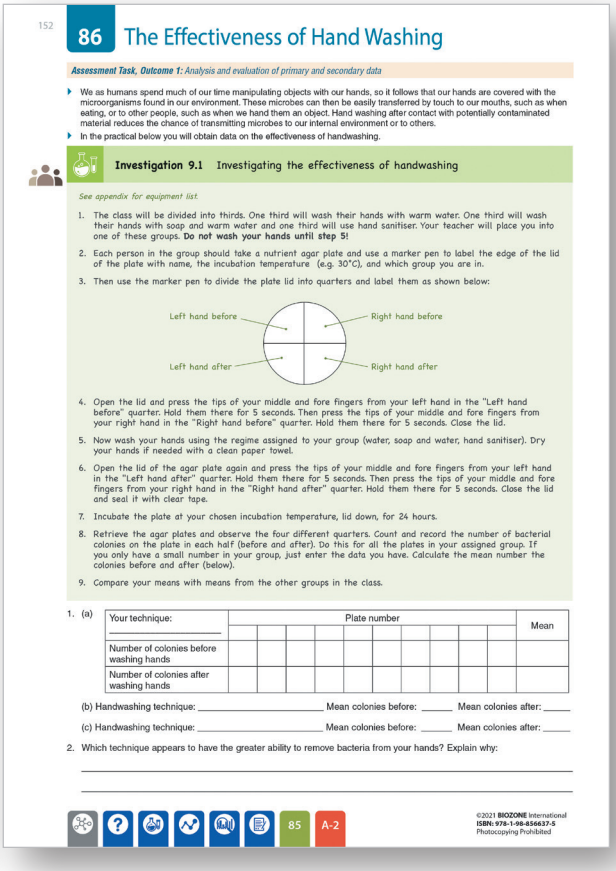
**End of Area of Study synoptic assessments**



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**86** The Effectiveness of Hand Washing

***Assessment Task, Outcome 1:*** *Analysis and evaluation of primary and secondary data*

- We as humans spend much of our time manipulating objects with our hands, so it follows that our hands are covered with the microorganisms found in our environment. These microbes can then be easily transferred by touch to our mouths, such as when eating, or to other people, such as when we hand them an object. Hand washing after contact with potentially contaminated material reduces the chance of transmitting microbes to our internal environment or to others.
- In the practical below you will obtain data on the effectiveness of handwashing.

**Investigation 9.1** Investigating the effectiveness of handwashing

*See appendix for equipment list.*

1. The class will be divided into thirds. One third will wash their hands with warm water. One third will wash their hands with soap and warm water and one third will use hand sanitiser. Your teacher will place you into one of these groups. **Do not wash your hands until step 5!**
2. Each person in the group should take a nutrient agar plate and use a marker pen to label the edge of the lid of the plate with name, the incubation temperature (e.g. 30°C), and which group you are in.
3. Then use the marker pen to divide the plate lid into quarters and label them as shown below:



4. Open the lid and press the tips of your middle and fore fingers from your left hand in the "Left hand before" quarter. Hold them there for 5 seconds. Then press the tips of your middle and fore fingers from your right hand in the "Right hand before" quarter. Hold them there for 5 seconds. Close the lid.
5. Now wash your hands using the regime assigned to your group (water, soap and water, hand sanitiser). Dry your hands if needed with a clean paper towel.
6. Open the lid of the agar plate again and press the tips of your middle and fore fingers from your left hand in the "Left hand after" quarter. Hold them there for 5 seconds. Then press the tips of your middle and fore fingers from your right hand in the "Right hand after" quarter. Hold them there for 5 seconds. Close the lid and seal it with clear tape.
7. Incubate the plate at your chosen incubation temperature, lid down, for 24 hours.
8. Retrieve the agar plates and observe the four different quarters. Count and record the number of bacterial colonies on the plate in each half (before and after). Do this for all the plates in your assigned group. If you only have a small number in your group, just enter the data you have. Calculate the mean number the colonies before and after (below).
9. Compare your means with means from the other groups in the class.

1. (a)

| Your technique: _____ | Plate number | | | | | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of colonies before washing hands | | | | | | | | | | | |
| Number of colonies after washing hands | | | | | | | | | | | |

(b) Handwashing technique: _____ Mean colonies before: _____ Mean colonies after: _____
(c) Handwashing technique: _____ Mean colonies before: _____ Mean colonies after: _____

2. Which technique appears to have the greater ability to remove bacteria from your hands? Explain why:




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**Area of Study Assessment Task: Data analysis**

# The Digital Teacher's Edition

The *Digital Teacher's Edition* is a DRM product, sold separately, and aimed primarily at extending the pedagogical tools at a teacher's disposal. Many of the features of this resource have been developed in response to requests from teachers themselves.