VCE Biology

Implementation of VCE Study Design for 2022 – 2026

An overview of Units 1 & 2

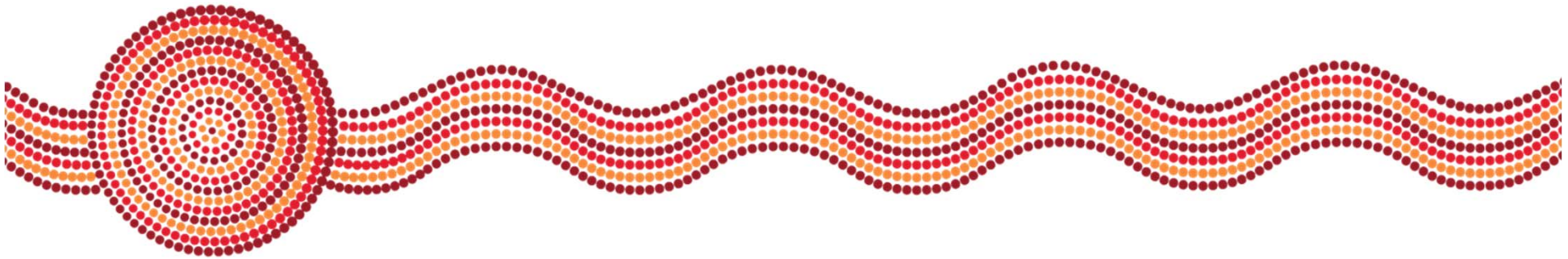
VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

VICTORIA State Government

Acknowledgment of Country

I would like to acknowledge the traditional custodians of the many lands across Victoria on which each of you are living, learning and working. For myself, I acknowledge the Dja Dja Wurrung as the traditional custodians of the land from which I am presenting today.

I would like to pay my respects to Elders past, present and emerging, for they hold the memories, traditions, culture and hopes of all Aboriginal and Torres Strait Islander peoples across the nation.

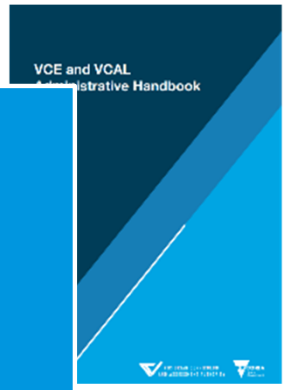


Purpose

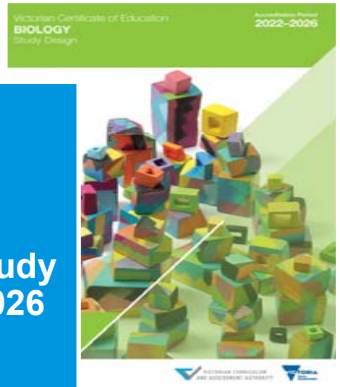
- Introduce and familiarise teachers with the revised Units 1 and 2
- Consider how key science skills, scientific methodologies and practical work link to key knowledge
- Assessment structure
- Resources

VCE Biology 2022 – 2026 resources

VCE and VCAL Administrative Handbook 2022

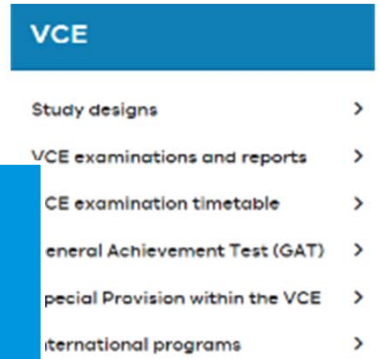


VCE Biology Study Design 2022-2026



VCE Biology Unit 1 and 2 resources

VCAA VCE webpage



Support materials

VCE Biology Units 1 & 2 2022 – 2026

Scope of study, Rationale and Aims

Cross-study specifications

- Outcomes
- Key Knowledge and Key Science Skills

Units of study

- Satisfactory completion
- Levels of achievement

Aims of VCE Biology (p. 3)

- develop knowledge and understanding of key biological models, theories, concepts and issues from the individual cell to species level
- develop knowledge and understanding of organisms, their relationship to their environment, and the consequences of biological change over time, including the impact of human endeavours on biological processes and the survival of species
-

Broad aims of VCE Sciences (p.3)

Units 1 and 2 Structure

Unit titles	Area of Study titles
Unit 1: How do organisms regulate their functions?	**Area of Study 1:** How do cells function? **Area of Study 2:** How do plant and animal systems function? **Area of Study 3:** How do scientific investigations develop understanding of how organisms regulate their function (relates to content in AOS 1 and/or AOS 2)
Unit 2: How does inheritance impact on diversity?	**Area of Study 1:** How is inheritance explained? **Area of Study 2:** How do inherited adaptations impact on diversity? **Area of Study 3:** How do humans use science explore and communicate contemporary bioethical issues? (relates to content in AOS 1 and/or AOS 2)

Developing a Unit 1 and 2 curriculum and assessment program

- **Each school is different:**
  - different contexts in which students operate
  - different circumstances in which schools are situated
- **Students will have different:**
  - strengths and talents
  - available resources
- **Schools have flexibility in:**
  - designing curriculum programs that meet the needs of their cohort and the context in which they are learning
  - developing assessment programs that are aligned to the *VCE Biology Study Design* and comply with VCE assessment principles.

Planning template

Provide details of the outcome, time period (Term/Week–Term/Week), key knowledge and key science skills *(from the study design)*		List and describe the learning activities that will be used to provide appropriate opportunity for students to demonstrate satisfactory achievement of the outcome (this includes practical activities, demonstrations and excursions/field work).	List and describe the assessment tasks that will be used to assess students level of achievement. Include an estimate of when each task will occur
Unit 1, Outcome 1: <insert outcome statement – see page 13 of VCE study design>			
Anticipated teaching time allocation: <insert as appropriate; e.g. Term 1 Week 1 – Term 1 Week 6>			
Key knowledge:	**Biology Units 1–4 Key science skills:**	<Consider a range of resources when developing appropriate learning activities; e.g. VCE Advice for Teachers located on the VCAA website: www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/biology/advice-for-teachers/Pages/Index.aspx – ensure that any activities directly sourced from a public resource are contextualised to your school/provider's approach>	<Select and describe as appropriate. See page 16 of the VCE study design. Include an estimate of when the task will occur>
• <Select as appropriate. See pages 13–14 of VCE study design>	• <Select as appropriate. See pages 10–11 of VCE study design>		

Whilst designed specifically for schools seeking to deliver a VCE study for the first time, the VCE Curriculum and Assessment Plans are a useful tool for all teachers in planning assessment.

Cross-study specifications (p. 7–14)

Plan for opportunities to enable students to engage with and develop:

- **Key Science Skills**
- **Scientific Investigation**
- **Critical and creative thinking**
- **Ethical understanding**
- **Individual and collaborative scientific endeavour**
- **Aboriginal and Torres Strait Islander knowledge, culture and history**

Scaffolding key science skills

- Different schools will have different ways in which they scaffold the key science skills across Units 1 and 2
- Schools should adjust the curriculum and assessment program to match their students needs
- Formative assessment is critical to understanding the prior skills that your students have entering into Unit 1 and/or Unit 2 Biology.

Key Science Skills (p.7–9)

- Contextualised for VCE Biology
- Make explicit
- Opportunities to practise
- Deploy in new contexts

VCE Biology Study Design 2022–2026
Develop aim and questions, formulate hypotheses and 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

Explicit integration of key knowledge and key science skills

Key science skills:

- **are not an ‘add on’ to the key knowledge or something to be taught as a ‘separate topic’**
- **may be explicit in key knowledge, or may be implicit, allowing flexibility for teachers to choose when/how to include in teaching and learning programs**
- **Unit 1 Area of Study 3 and Unit 2 Area of Study 3 provide students with the opportunity to apply the key science skills they have learnt across the unit - they should not be the only place students are explicitly taught key science skills**

Practical work

Central component of learning and assessment.

Includes activities such as laboratory experiments, fieldwork, simulations, modelling and other direct experiences described in the scientific investigation methodologies.

A minimum of 10 hours of class time to be devoted to student practical activities and scientific investigations across Areas of Study 1 and 2 for Units 1 and 2.

A minimum of 7 hours to be devoted to Area of Study 3 in Units 1 and 2.

Logbooks (p.10)

A logbook of practical activities is maintained for each of Units 1 and 2 for recording, authentication and assessment purposes.

The presentation format of the log book is a school decision and no specific format is prescribed. Purposes may include:

- **providing a basis for further learning, for example, contributing to class discussions about demonstrations, activities or practical work**
- **reporting on an investigation or activity**
- **responding to questions in a practical worksheet or problem-solving exercise**
- **writing up an investigation as a formal report or as the basis of a scientific poster.**

Critical and creative thinking

- What opportunities to develop questions and test hypotheses?
- What scaffolding to design and undertake questions?
- What opportunities to make reasoned predictions?
- What opportunities to evaluate knowledge? To clarify concepts and ideas?
- How to consider alternatives and consequences?
- What opportunities to make evidence-based decisions?
- Where to devise real or imagined solutions and solve problems?

Ethical understanding

- What opportunities to consider the implications of their own and others' investigations?
- What opportunities to apply integrity when recording and reporting the outcomes of their investigations?
- What opportunities to apply integrity when using their own and others' data?
- What opportunities to apply an understanding of ethical approaches and concepts to reach justified positions?
- What opportunities to consider values and factors that influence responsible science-related decision making?

Individual and collective scientific endeavour

- What opportunities to manage their time effectively?
- What opportunities to work safely and make responsible decisions?
- How to scaffold opportunities for students to work with others, to actively participate and share ideas, to complete tasks and solve problems?
- How to support students to offer view points and suggestions while respecting the perspectives of others?
- How to support students to seek, value and act on feedback?

Aboriginal and Torres Strait Islander knowledge, culture and history

- **Who are the traditional custodians of your local area?**
- **What opportunities for learning about local perspectives will be included?**
- **What opportunities are there to engage with local Elders and/or Koorie organisations?**
- **What about engagement with regional, state and/or national perspectives?**
- **What resources will you access and/or use in your classroom?**

School-based Assessment

School-based assessment is an opportunity to design learning and teaching activities for a specific cohort of students, with assessment that is personalised for them.

Central to School-based Assessment is understanding that teachers know their students; and know the best ways to collect evidence in terms of their achievement.

Two forms of assessment for each outcome in Units 1 and 2:

- **Satisfactory completion of an outcome**
- **Levels of achievement**
  - school-based tasks in Units 1 and 2

Unit 1 and 2 Assessment

Underpinned by VCE Assessment Principles

All assessments at Unit 1 and 2 are school-based. Procedures for assessment of levels of achievement in Units 1 and 2 are a matter for school decision

List of selected tasks to choose from to assess students levels of achievement for Outcomes 1 and 2 in Units 1 and 2

If multiple tasks are selected for Outcome 1 and/or 2, they must be different. The same task cannot be selected more than once across Outcomes 1 and 2

Unit 1 Outcome 3: A report of a student-adapted or student-designed scientific investigation

Unit 2 Outcome 3: A response to an investigation into a bioethical issue.

Integrity and Authentication

The integrity of VCE Assessments is of a paramount concern to maintain the integrity of the VCE qualification, as such teachers and schools need to develop and implement robust authentication strategies to ensure that the student's submitted work is clearly their own.

Effective schools will build a culture of integrity and trust underpinned by teaching and learning practices of ongoing formative assessment to gather knowledge and evidence of student abilities.

Formative vs summative assessment

- How will you know where your students are ‘at’ in terms of satisfactory completion of an outcome?
- How will you identify student strengths/weaknesses in content/skills?
- How will you determine what do your students know and what can they can do?
- How will you determine what your students don’t know and what they can’t they do?
- How will you teach and assess to address any issues?
- How can feedback be provided to students about their progress in VCE studies?
- How can assessment tasks be formative as well as summative assessments?

Unit 1 – How do organisms regulate their functions?

- How to embed and integrate the Cross-study specifications?
- Which related key science skills for each outcome?
- What practical work? How much?
- Which scientific investigation methodologies?
- How will the logbook be used?
- How to structure at least 50 hours of scheduled classroom instruction?
- How to assess satisfactory completion of each outcome?
- How to assess students levels of achievement?

Unit 1 overview

Area of Study	Approximate Time*
Area of Study 1: How do cells function?	20-23 hours, including practical work and assessment
Area of Study 2: How do plant and animal systems function?	20-23 hours, including practical work and assessment
Area of Study 3: How do scientific investigations develop understanding of how organisms regulate their function (relates to content in AOS 1 and/or AOS 2)	Minimum of 7 hours to undertake investigation and communicate findings

Unit 1 Area of Study 1

- **On completion of this outcome the student should be able to explain and compare cellular structure and functions, and analyse the cell cycle and cell growth, death and differentiation**
- **To achieve this outcome, the student will draw on key knowledge outlined in Area of Study 1 and the related key science skills in pages 7-9 of the study design.**

Notes:
- All of the Outcome should be assessed to determine an 'S' or an 'N', noting the 'cognitive level' of command terms
- Not all of an Outcome is required to be assessed to determine students' to levels of achievement

Scientific investigation methodologies (pp 9-10)

Methodology	Example
Case study	Impact of the anti-cancer drug venetoclax on apoptosis; The origin of breast cancer and the link to stem cells; Devil Facial Tumour Disease (DTFD) in Tasmanian devils
Classification and identification	Classify and identify cells as prokaryote and eukaryote; plant and animal; cancerous and non-cancerous;
Controlled experiment	Investigate the semi-permeability of an artificial membrane to differences substances including water, starch, protein and glucose; investigate the relationship between surface area and volume using agar cell diffusion
Correlational study	Are leaf stomata of plants in different environments the same?
Fieldwork	Do grasses have different types of cell walls to leaves from trees?
Literature review	How should cancer funding be allocated in Australia? What role does apoptosis play in embryo development?
Modelling	Construct models of a generalised plant and animal cell; fluid-mosaic model for the structure of a plasma membrane; mitosis and meiosis; cell cycle
Product, process or system development	Design, construct, evaluate and improve a product designed to support the regulation of body temperature in a particular animal
Simulation	View simulations that demonstrate the move of water, hydrophilic and hydrophobic substances across the plasma membrane; virtual cell tours; key stages of the cell cycle

Sample learning activities – S/N

…explain and compare cellular structure and functions…
Create a series of Venn diagrams to represent *similarities and differences* between the following: prokaryotic and eukaryotic cells; plant and animal cells; diseased and non-diseased cells.
Investigate the structure of a variety of different cell types and *record* observations (draw or photograph and label) in a logbook relating to the structure and function of cells and their organelles.
Construct models of a generalised chloroplast and mitochondrion. *Compare, contrast and discuss* their structures and functions using a venn diagram or another graphic organiser. *Link* structures to functions.
Prepare a range of wet mount slides for living plant and animal cells and produce an infographic 'Top 5 Handy Hints for Preparing Wet Slides' that include relevant images of the slides and description of processes involved
Construct a three-dimensional model to represent the fluid-mosaic model for the structure of a plasma membrane (build a membrane https://teach.genetics.utah.edu/ ; model the movement of water, hydrophilic and hydrophobic substances across the plasma membrane
Use dialysis tubing and varying solutions and concentrations of salt and sugar to *plan and conduct* an investigation into diffusion and osmosis. *Generate, collate and record* primary data. *Analyse* data to interpret results.

Sample learning activities – S/N

…analyse the cell cycle and cell growth, death and differentiation…
Draw or model images of mitosis, *identify and describe* the key stages, using biological terminology, including cytokinesis. *Map* the key stages against the cell cycle. *Compare* drawings with peers and interactive animations (www.biointeractive.com to highlight and discuss misconceptions, note the misconceptions and new learning.
Considering bacteria as an example of a prokaryotic cell, *model* binary fission as cell reproduction, using plasticine, informed by bacterial growth online video footage (www.biointeractive.com). Heating emu bush produces compounds that are bactericidal. Use the model to suggest how the emu bush compound may stop bacteria from replicating.
Create a matrix to compare the similarities and differences between mitosis in eukaryotic cells and binary fission in prokaryotic cells, *highlighting and explaining* reasoning for similarities and differences. *Compare* matrices and challenge reasoning between peers, individually or collaboratively.
Draw a simple flowchart to summarise the process of apoptosis, including malfunctions that may result in deviant cell behaviour such as cancer and the impact of the anti-cancer drug venetoclax on apoptosis (https://www.wehi.edu.au).
Investigate the effect that Devil Facial Tumour Disease (DFTD) has had on the Tasmania Devil.

Unit 1 Area of Study 2

- **On completion of this outcome the student should be able to explain and compare how cells are specialised in plants and animals, and analyse how specific systems in plants are regulated.**
- **To achieve this outcome, the student will draw on key knowledge outlined in Area of Study 2 and the related key science skills in pages 7-9 of the study design.**

Notes:
- All of the Outcome should be assessed to determine an 'S' or an 'N', noting the 'cognitive level' of command terms
- Not all of an Outcome is required to be assessed to determine students' to levels of achievement

Scientific investigation methodologies (pp 9-10)

Methodology	Example
Case study	Comparison of Australia native plants in terms of transpiration rates, stomata location and opening; Breeding drought tolerant crop plants
Classification and identification	*Investigate* how animals cells are *classified* in terms of tissues, organs and systems and how vascular plant cells are specialized and organized into tissue for specific functions
Controlled experiment	*Design, plan and conduct* an experiment to show how an environmental factor such as light intensity, temperature or humidity affects the transpiration rate of a vascular plant
Correlational study	Do young leaves have the same density and distribution of stomata as older leaves?
Fieldwork	*Identify and classify* native plants, based on structures to maintain water balance
Literature review	*What is* the incidence of type 1 diabetes in Australia compared to world-wide? *Should* Australians be able to travel overseas for organ transplants?
Modelling	Use the stimulus-response *model to show how* thermoregulation occurs in humans by the control of heat exchange and metabolic activity
Product, process or system development	*Investigate* products designed to treat Type 1 Diabetes. *Design* an imagined solution to treat type 1 diabetes.
Simulation	Use a *simulation to model* transpiration in different plants under different conditions; explore homeostatic control of body temperature and blood glucose via a virtual lab

Sample learning activities – S/N

…explain and compare how cells are specialised in plants and animals…
Use prepared slides to *examine* the cell types that make up one specific organ; *compare* similarities and differences in a jigsaw activity with other students who have investigated different organs
Use a microtome to section plant specimens for viewing under a microscope and *compare* the physiology of different species of leaves (stomata, chlorophyll distribution); *develop* hypotheses and *undertake* investigations to determine whether there is a correlation between the location of a leaf on a tree and: the number of stomata or the distribution of chlorophyll
Capture an image of a first-hand dissection of a mammalian system; *annotate* the image to name the functions of specific organs in the systems, specifically digestive, endocrine and excretory. *Identify* the system's relationship to another system, using a concept map.
Compare the epidermal cellular structures (such as stomata) from the leaves of different wheat varieties. Suggest which might be best for a low rainfall environment.
Case study: Australians looking overseas for transplants. (www.donatelife.gov.au ; www.kidney.org.au ; www.abc.net.au ; www.mja.com.au 'transplant tourism' media article, research letter and podcast). Students work in groups, with rotation of groups, to consider the viewpoints of stakeholders and current Australian laws.

Sample learning activities – S/N

…analyse how specific systems in plants are regulated…
Identify and classify native plants, based on structures to maintain water balance, using field work and field guides or online sources (www.rbg.vic.gov.au – 'towards sustainability'; www.anbg.gov.au – 'mallee plants')
Use a proscope or digital microscope to investigate any one of the following questions: What is the effect of different levels of sunlight on the rate of opening and closing, and on maximum size opening, of stomata on leaves? Do young leaves have the same density and distribution as older leaves? Are the stomates on all plants the same size, shape and distribution?
Use the stimulus-response *model* to *show* how thermoregulation occurs in humans by the control of heat exchange and metabolic activity through physiological and behavioural mechanisms
Type 1 diabetes – what are the misconceptions? (www.abc.net.au). Students select one or more misconceptions, suggesting why people might have these misconceptions. Students 'debunk' the myths using relevant biological information, create their own questions for research and communicate findings for a specific audience.
Evaluate a range of scientific and media texts (including audio) about Grave's Disease and hyperthyroidism (www.abc.net.au*;* *www.thyroidfoundation.org.au)* to provide background information to *draw* stimulus-response models and negative feedback loops and associated organ structures to demonstrate regulation of thyroid hormones.

Unit 1 Area of Study 3

(investigation related to content in Unit 1 Area of Study 1 and/or 2)

- adapt an existing scientific investigation or design their own scientific investigation to generate appropriate qualitative and/or quantitative data
- Guided inquiry OR coupled inquiry OR open inquiry approach
- Whole class: same inquiry approach and/or methodology OR different students: different inquiry approaches and/or methodologies
- May work individually or in a group to undertake their investigations BUT analysis and evaluation should be completed individually
- Teacher may choose the format to presenting their report OR students choose presentation formats (as outlined on page 23 of the study design)

Unit 2 – How does inheritance impact on diversity?

- How to embed and integrate the Cross-study specifications?
- Which relevant key science skills for each outcome?
- What practical work? How much?
- Which scientific investigation methodologies?
- How will the logbook be used?
- How to structure at least 50 hours of scheduled classroom instruction?
- How to assess satisfactory completion of each outcome?
- How to assess students levels of achievement?

Unit 2 overview

Area of Study	Approximate Time
Area of Study 1: How is inheritance explained?	20-23 hours, including practical work and assessment
Area of Study 2: How do inherited adaptations impact on diversity?	20-23 hours, including practical work and assessment
Area of Study 3: How do humans use science to explore and communicate contemporary bioethical issues? (relates to content in AOS 1 and/or AOS 2)	Minimum of 7 hours to undertake investigation and communicate findings

Unit 2 Area of Study 1

- **On completion of this outcome the student should be able to explain and compare chromosomes, genomes, genotypes and phenotypes, and analyse and predict patterns of inheritance.**
- **To achieve this outcome, the student will draw on key knowledge outlined in Area of Study 1 and the related key science skills in pages 7-9 of the study design.**

Notes:

- All of the Outcome should be assessed to determine an 'S' or an 'N', noting the 'cognitive level' of command terms
- Not all of an Outcome is required to be assessed to determine students' to levels of achievement

Scientific investigation methodologies (pp 9-10)

Methodology	Example
Case study	Investigate the inheritance of pigment production in barley; Construct a pedigree chart using the student's family history for the inheritance of a particular genetic characteristic
Classification and identification	Classify and identify chromosomes based on length, centromere positions and other structures; identify autosomes and sex chromosomes; identify homologous chromosomes
Controlled experiment	Investigate the genetic outcomes for monohybrid crosses in particular plants
Correlational study	How do environmental factors influence phenotype?
Fieldwork	Conduct a survey investigating the views of school, family and local community members on gene therapy and cloning
Literature review	Should genetic screening be recommended to all prospective parents?
Modelling	Create analogies to represent the relationship between genes, alleles and a genome. Create models of homologous chromosomes and construct a karyotype from the models.
Product, process or system development	Is there a better way to represent inheritance than using a pedigree chart?
Simulation	Use computer simulations to investigate patterns of inheritance, for example in *Drosophila*

Sample learning activities – S/N

…explain and compare chromosomes, genomes, genotypes and phenotypes…
Design an infographic, or similar, to outline the sequencing of the human genome and *show* the relationship between a genome, the nature and location of genes and their alleles
Create *models* of homologous chromosomes and gene loci. *Construct* a karyotype of the chromosome models.
Create analogies to represent the relationship between genes, alleles and a genome.
Respond to a series of genetic problems that involve interpretation and use of genetic language, the allocation of symbols to genotypes and the definition of phenotypes as dominant or recessive
Use computer simulations to *investigate* patterns of inheritance, for example in *Drosophila*
Compare karyotypes between different organisms in terms of size and number of chromosomes.
Conduct an investigation on the inheritance of the pigment production in barley that has alternative alleles for pigmentation (green and dominant) or no pigmentation (white and recessive)
Use a *problem-based learning approach* to discuss the following case in *Nature* Journal in January 1979 to propose credible explanatory mechanisms: A woman with blood type AB blood gave birth to a child with blood type O; a second type O child was born six years later (Human chimaera detectable only by investigation of her progeny' by Mayr, Pausch and Schnedl, *Nature 277*:210-211)

Sample learning activities – S/N

…analyse and predict patterns of inheritance…
Consider a genetic disease and *model* the behaviour of a pair of chromosomes during meiosis and annotate key features. *Simulate* meiosis using an interactive animation to produces new assortments of alleles that give rise to variations in offspring phenotypes.
Fragile X Syndrome is a common genetic condition (www.fragilex.org.au). How does genetic carrier screening identify Fragile X? *Model* karyotypes with Fragile X and non-Fragile X in both males and females. *Pose* questions to identify: chromosome abnormalities within the karyotype, chromosome variability in males and females (size and number), autosomes, sex chromosomes, homologous chromosomes, genes, alleles and genome.
Could genetic carrier screening be recommended to all prospective parents? (www.abc.net.au) *Connect* the diseases referred to in the article to patterns of inheritance, including autosomal and sex-linked inheritance, expression of dominant and recessive phenotypes and predicting genetic outcomes for a monohybrid cross. *Explain* why, using pedigree charts and symbols. *Apply* understanding to local online *simulations* investigating patterns of inheritance (www.newbyte.com) *Propose* plausible recommendations to the issue of genetic carrier screening, based on genetic knowledge and ethical understandings.

Unit 2 Area of Study 2

- **On completion of this outcome the student should be able to analyse advantages and disadvantages of reproductive strategies, and evaluate how adaptations and interdependencies enhance survival of species within an ecosystem.**
- **To achieve this outcome, the student will draw on key knowledge outlined in Area of Study 2 and the related key science skills in pages 7-9 of the study design.**

Notes:

- All of the Outcome should be assessed to determine an 'S' or an 'N', noting the 'cognitive level' of command terms
- Not all of an Outcome is required to be assessed to determine students' to levels of achievement

Scientific investigation methodologies (pp 9-10)

Methodology	Example
Case study	Adaptations of plants and animals of the Mallee Shrublands; Case Study: Treecreepers of the Wombat; Plight of the bumble bee (Ecoeye: Sustainable solutions Episode 5)
Classification and identification	Discuss what determines the classification of a 'weed' and examine how the adaptations of *Echium plantagineum* allows it to survive in a wide range of environments
Controlled experiment	Plan and conduct an investigation to vegetative propagate a native plant using a cutting
Correlational study	Observe the reproductive strategies of different species from a seasonal perspective.
Fieldwork	Investigate the variation in size of pollen grains in different species of flowering plants; suggest the adaptive advantages of identified differences
Literature review	How do mosses and algae survive in a wide range of environments?
Modelling	Model the motion of seeds as an adaptation for survival
Product, process or system development	Design a product to support the artificial pollination of an insect-pollinated and wind-pollinated flower.
Simulation	Simulate how an adaptation such as colour for camoflague against predation enhances survival of organisms by undertaking a timed 'hunt the red ribbon' activity using 5 cm lengths of red and green ribbon on (a) red and (b) green backgrounds

Sample learning activities – S/N

…analyse advantages and disadvantages of reproductive strategies…
Dissect and *examine* the reproductive structures of an insect-pollinated and a wind-pollinated flower and *explain* how each is adapted for pollination
The Bynoe's gecko can reproduce both asexually and sexually. *Predict* how this may be possible, *research* how this is possible, *explain* how this occurs and *distinguish* the biological advantages and disadvantages, including genetic diversity of offspring, *communicating* ideas in a meaningful way.
Investigate the advantages and disadvantages of seeds as a reproductive strategy and explore the role of seed banks in terms of maintaining genetic diversity.
Plan and conduct an investigation to vegetative propagate a native plant using a cutting (www.rbg.vic.gov.au - towards sustainability). Outline the biological advantages and disadvantages of asexual reproduction and why this is considered asexual reproduction.
Clone your pet dog? (https://cosmosmagazine.com). Students work in groups, with rotation of groups, to consider the viewpoints of stakeholders. Select one or more ethical approaches and concepts (pages 16 and 17) to explore the issue of cloning pets. Students consider *their own position and suggested course of action,* based on the collated class data, discussion and scientific evidence, reasoning and reflection.

Sample learning activities – S/N

…evaluate how adaptations and interdependencies enhance survival of species within an ecosystem…
Investigate the variation in size of pollen grains in different species of flowering plants; *suggest* the adaptive advantages of identified differences
Investigate the motion of fallen seeds; *explain* how motion as an adaptation is related to survival of the species
Research and *explain* the theory behind 'companion planting'; *investigate* and *report* on the veracity of companion planting claims, for example planting tomatoes and basil together to repel flies
Discuss what determines the classification of a plant as a 'weed': *use the case study* of *Echium plantagineum* which is generally known as 'Paterson's curse' but in South Australia is called 'Salvation Jane' to explain how the adaptations of *Echium plantagineum* allow it to survive in a wide range of environments.
Investigate the diverse range of ecosystems across Victoria, *considering* the adaptations that species in each environment have to enable them to survive, the keystone species and predators that help to maintain balance and the interdependencies between species within each ecosystem. Useful resources: VBA Go (environment.vic.gov.au),

Unit 2 Area of Study 3

- bioethical issue related to content in Unit 1 Areas of Study 1 and/or 2

- Teachers may support the class to identify and choose a bioethical issue that all students will explore OR allow students to choose and explore different bioethical issues
- Contemporary bioethical issues are those that are current or have arisen and/or been reported in the last calendar
- Students may be scaffolded to identify the ethical concepts and approaches to bioethics that are relevant to the selected issue OR be assessed on their ability to demonstrate these skills
- Student may work individually or in a group to identify and analyse the selected bioethical issue, however the selection and justification of a response to the bioethical issue should be completed individually

Identifying bioethical issues

- An ethical issue arises in situations where there are competing ways to respond to a situation and the best course of action is not always clear
- An ethical issue becomes an ethical dilemma when is not possible to act in a way that does not contravene a value or ethical principle, presenting us with a decision about which approach or principle to prioritise over another

Contemporary science contexts

- **Victoria is a nucleus of biological research**
- **Research is made accessible and communicated to the public via a range of methods including government and research organisation websites, Facebook, Instagram, Twitter and podcasts.**
- **Contemporary biological research and expert commentary can also be access through popular science publications such as Cosmos, New Scientist, Nature, Scientific American, ABC Science, Australian Science, Nature Briefing, ScienceAlert and Science Daily**
- **Search "*biology organisations Australia*" to select those relevant to your curriculum and assessment program, or "*citizen science, Victoria, biology*" to locate local opportunities available.**

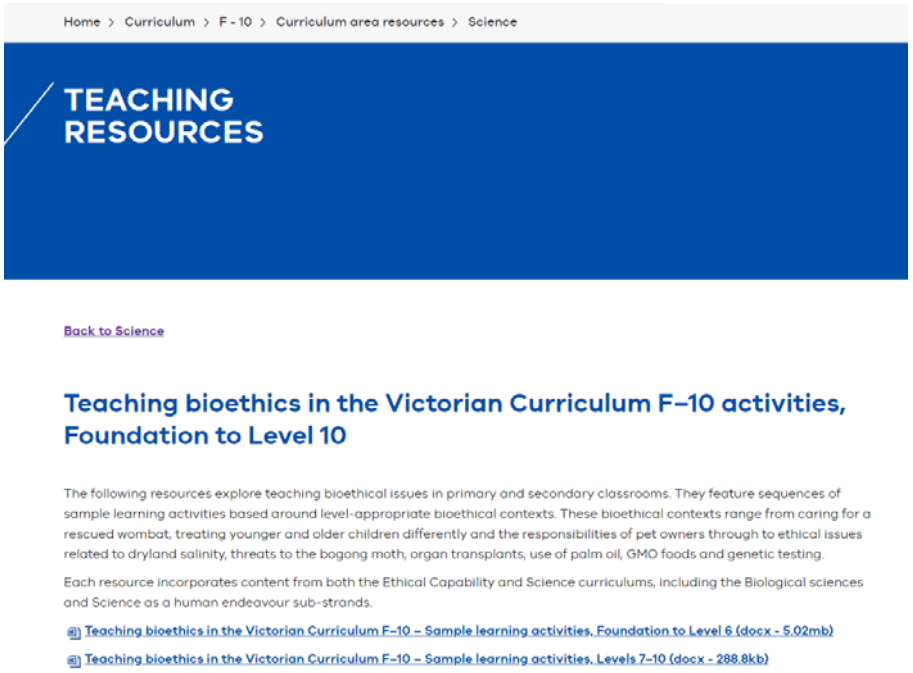
VCE resources

- Administrative information for School-based Assessment
- VCAA Bulletin and Notices to schools
- School calendar and assessment policy
- The school teaching and learning program

F – 10 Bioethics Resources

Sample learning activities that incorporate ethical considerations and concepts into ‘bioethics’ learning activities based on biological sciences content from the Victorian Curriculum F – 10.

Levels 9 and 10 resources contain activities that focus on approaches to bioethics and ethical concepts that are also included in VCE Biology.



Making visible Aboriginal Perspectives

In 2020, partnering with key stakeholders, the VCAA ran a series of webinars titled **'Making Visible: Aboriginal perspectives in the Victorian Curriculum F – 10'**

7-10 webinars provided an overview of Aboriginal perspectives across the Victorian Curriculum F – 10 as well as making visible Aboriginal perspectives in the **Aboriginal Languages curriculum, The Arts, Humanities and STEM**.

Recordings of webinars are available **on the VCAA website.**

Contact

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