Biological Sciences
2025

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Akonga Undergraduate

UNIVERSITY OF CANTERBURY
Biological Sciences
Pūtaiao Koiora

Published August 2024, by the School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140, New Zealand.

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Tauti mai
Welcome

Biology means the study of living things. Biologists study animals, plants and microbes in many different ways and at various scales from molecules and cells to multicellular organisms, populations, and even ecosystems.

Our courses will help prepare you for a career. The opportunities for a biologist are far-reaching: be it in research, teaching, policy, or as a front-line biosecurity officer. You will find our courses exciting, challenging, and up-to-the minute as our lecturers are all actively engaged in research in the Biological Sciences. With two National Tertiary Teaching Excellence Awards and seven UC Teaching Awards in recent years, we have a proven track record in excellence in teaching. We are also host to three Rutherford Discovery Fellows. The Fellowships support New Zealand's most talented early- to mid-career researchers.

It has been suggested that the 21st Century will belong to the biologist. We now have incredibly powerful tools available to us - from the laboratory tools of the molecular biologist to the computer tools employed by those engaged in modelling the processes occurring in ecosystems.

This handbook is provided to help you plan a course of study in Biology. If you have any questions please contact us.

Welcome to Biology at UC.

Equity and Diversity

The School of Biological Sciences recognises the inherent worth of every person and group. We celebrate diversity in gender, sexuality, race, religion, culture, ability, and all other forms of diversity. We promote equity, diversity, access, and inclusion in science, and stand up against bullying, harassment and discrimination. The School is committed to realising the principles of Te Tiriti o Waitangi and acknowledges the distinct status of Māori as tangata whenua. These values are at the core of our teaching, research and outreach.

Need help? We are here for you

During your time as a student at UC, you may go through difficult periods in your life. This might come with anxiety and depression, making it challenging to focus and stay motivated on your studies. You might even start questioning your abilities and your sense of belonging at university. We would like you to know that we understand this and care about your wellbeing. It is therefore important that you reach out and get help if you need it. Your lecturers can discuss with you how we can better support you academically during difficult times. You are also very welcome to seek help from the Biology Undergraduate Advisor or the College of Science Student Advisors. The UC Student Care Team specifically supports students who are going through a rough time. Their services are free and available for all students.

UC is proud to partner with Ngāi Tūāhuriri and Ngāi Tahu to uphold the mana and aspirations of mana whenua.

Rainbow Diversity Support

Āhuatanga Ākonga
Student Profiles

Our undergraduate program is designed to develop your understanding of biological sciences through theory and practical activities. Our graduates perform diverse jobs all over the world, from remote villages to capital cities. UC is ranked in the top 3% of universities in the world. A degree from Canterbury is seen by the world as a quality degree and opens many doors.

'UC is an excellent choice as the courses offered suited my interests extremely well.'

Steve has a clear idea of what he wants to do in his career and has taken on a double degree to set himself up for it.

'My aim is to one day own a company. My BCom will help me to achieve that, and my BSc will provide the industry. New Zealand has a miniature biotechnology scene, so there is plenty of opportunity for those with the right skills to help it grow. My dream is to be involved in as many ventures as I can, specialising in clean energies and sustainability.'

Steve has long been fascinated by biology, and after deciding it was an area he wanted to work in long-term, realised he needed to study the subject at a higher level.

'I'm one of those people that will stare at pond water under the microscope for ages just to glimpse something weird swim by, or become awe-struck in a forest by the sheer scale or biological diversity around me,' he says.

'In my Science degree, the labs are definitely the best part. I have always preferred learning by discovering things practically. '

Steve Rowe

Studying towards a Bachelor of Science in Biotechnology and a Bachelor of Commerce in Strategy and Entrepreneurship

'The field trips I have been on to the Cass field station have definitely enhanced my appreciation for how wonderful the environment of New Zealand is...'

As she reaches the latter stages of her degree, Sophie says she has been inspired by her studies to make science the basis of her future.

'Every day here I learn new and exciting things about the wonderful world we live in. Ecology in particular has become my passion. The field trips I have been on to the Cass field station have definitely enhanced my appreciation for how wonderful the environment of New Zealand is, and how important it is that we look after it.'

While she was at high school, Sophie was expecting to study commerce at university, but was persuaded that her academic strength was in science. However, by choosing to study at UC, she was able to do both. 'Finding out that I could study Economics in a Bachelor of Science, I was sold!' she says. 'Doing a double major can be very full-on at times, trying to squeeze everything into three years, but it is definitely achievable.

Sophie Hale

Studying towards a Bachelor of Science in Biological Sciences and Economics

'There are many things that are constantly being discovered in the field of biochemistry...

Rudy had always wanted to have a career 'in a white lab coat working in a pristine laboratory' since he was young, which eventually lead him onto Biochemistry studies.

Originally from India, Rudy moved to New Zealand for its reputation in scenic views and kind locals.

Biochemistry ended up being his passion, because of how well it fitted into other science subjects and its relevance to the world.

With one of his favourite things about his Science degree being the opportunity to make contacts with industry experts, Rudy landed an amazing internship with a commercial medical diagnostics lab in India.

'I wish to lead a successful research group that produces meaningful results that have an impact on the lives of people who are less privileged than I am,' he says.

Rudranuj (Rudy) Bundela

Recently completed a BSc(Hons) in Biochemistry

Tāura Maruwehi Inspirational Alumni

Jamie has expertly woven together strands of Māori culture and science to achieve research excellence

Being Māori and a scientist has shaped Jamie's career and his personal journey that has included appearances on the national kapahaka stage, Māori community environmental research, governance roles in Māori business and education initiatives. In these roles he is recognised as a leader within the Māori and science communities.

On completing his studies, Jamie took up a post-doctoral fellowship at Manaaki Whenua Landcare Research where he went on to become a senior scientist with a joint appointment as a senior Māori lecturer at Lincoln University.

He now holds positions at the Bio-Protection Research Centre, Cawthron Institute and Ngā Pae o Te Māramatanga.

Jamie conducts his research within multi-disciplinary/multi-organisational programmes embedded in Māori cultural process and communities but linked strongly with end-user organisations. This approach explores mechanisms that promote mutual understanding and equality of uptake in policy and decision making with respect to environmental resource management.

Dr James Ataria
Rongomaiwahine, Ngāti Kahungunu, Ngāti Raukawa

1991 BSc
1994 MSc

Since her first year at high school Wafaa has been intrigued by biochemistry—the chemical reactions and pathways that underpin life.

After completing her BSc in 1992 she took on a number of roles, from a biochemist at a kidney transplant unit to the Director of Medical Laboratories for Al-Rusafa district, Baghdad.

In 2013 Wafaa made the big move to New Zealand to take up a PhD position, where despite the hardship of being away from her family she felt welcome and at home. She was a highly respected citizen within the School and supported inclusive activities such as the Biological Sciences International Food Festival.

Her PhD research focused on disrupting receptors involved in ovarian cancer cell growth, her findings have been published in the prestigious journal Cancer Letters.

On her return to Iraq she took on a two year assignment to the challenging role of Director of Central Public Health Laboratories (CPHL), where she had to be ready to respond, 24 hours a day, to any disease crisis within the country.

Wafaa is currently a Health Security Partners (HSP) Fellow and has recently taken up a lectureship position at the College of Medicine, Ibn Sina University.

Dr Wafaa Al-Hussainni
2018 PhD in Biochemistry

Shelley has a major role in the post-earthquake revitalisation of Christchurch rivers.

Combining her passions for quality science and clear communication, Shelley started EOS Ecology—an aquatic science and visual communication company—soon after graduating from UC. As Co-director and Principal Scientist, Shelley is responsible for strategic direction, managing the science team, maintaining quality, and undertaking research and commercial work to identify robust and practical solutions to the problems facing freshwater and estuary systems in New Zealand.

Recognised for her expertise in the impacts of urbanisation on aquatic fauna and the rehabilitation of aquatic systems, Shelley was selected as the Ecology Technical Lead for two key Anchor Projects aimed at revitalising Christchurch following the earthquakes—Te Papa Otākaro/Avon River Precinct (ARP) and the Northern/Eastern Frame. As Ecology and Design Leader for the ARP in-river works package, Shelley is also responsible for one of the largest urban waterway revitalisation programmes in New Zealand.

Shelley is a member of community groups and Chairperson of a charitable trust, and regularly donates her time and her company's resources to help the general public on ecology matters.

Shelley McMurtrie

1996 BSc
2001 MSc

Kia whakaweawe āu akoranga
Learn with real impact

The community benefits of learning

Many courses in Biological Sciences are designed to teach students in the context of the "real world". Our courses include a range of activities and outputs that benefit communities, allowing students to contribute while they learn.

Seeking answers for our communities

Courses in **Marine Biology and Ecology** (BIOL 212) and **Science, Maori and Indigenous Knowledge** (SCIM 101) interact with Kaikoura coastal communities. Students learn through field work designed to help answer specific community generated questions relating to the health and future of their marine environment. The new knowledge generated by the students is an especially important contribution after the recent earthquakes as the locals attempt to understand and adapt to the changed environment. Community engagement involves the rūnanga and both primary and secondary schools.

Developing public resources

Students of **Practical Field Botany** (BIOL 305) work together with participants from the Department of Conservation, Environment Canterbury and other organisations to document the plant species in the Cass-Craigieburn-Arthur's Pass area. They collect plant specimens for the UC herbarium and contribute their observation data and photos to public websites such as iNaturalist and the Cass Mountain Research Area Plant Checklist.

Participating in decision making

In **Molecular Genetics** (BIOL 333) students write a submission to a regulatory agency, such as the Environmental Protection Authority (EPA) or the Food Standards Australia New Zealand (FSANZ), as per a publicly notified consultation request. They review the scientific studies supplied to the agency and conduct a critique, with the option to submit this to the agency and thus also participating in the consultation process.

Kia rite ki te korara
Prepared to make a difference

Get hands-on with real-world experiences

Hands-on experiences through the investigation of real world problems and scenarios are an important way to learn at UC. The learnings from these activities and experiences add to each student's toolkit of transferable skills to be applied in their future career, and life as a scientifically literate citizen.

Real life situations

As part of **Advanced Microbiology** (BIOL 313), students write a scientific report, about a microbe that they isolate, in the format used by water monitoring officials. Laboratory classes are complemented by an open lab that allows students to individually plan and conduct experiments. The open labs allow students to develop time management skills and valuable hands-on experiences under real life situations to develop their skills. This specifically includes experimental failure and good microbiological laboratory practise.

A global view

Investigating contemporary global genetic engineering projects of plants is part of **Plant Development and Biotechnology** (BIOL 352). Students reflect on environmental and food safety issues as well as public perceptions of genetic modifications of plants. By the end of the course they are prepared to make an informed difference in contributing to public debates on genetically modified organisms (GMOs).

With a New Zealand context

The **Global Change and Biosecurity** (BIOL 377) course has a two-day research workshop in which students work in teams to assess the ability of potentially invasive species to survive in NZ, both now and with a changing climate. They then consider and model the possible impacts of that invader on a New Zealand ecosystem.

Work ready skills

Students in **Marine Ecosystems** (BIOL 384) develop hands-on sampling techniques that are used in contract work on biodiversity monitoring of near-shore marine communities, such as for the Department of Conservation. Students write reports based on industry standards, and give presentations that stress problems, avenues to solutions and results of experimental testing. The combination of species identification, structured sampling, and oral and written reporting provides good grounding for applied research and future employment.

Mātai Koiora ki UC
Biology at UC

The Biology major offered at the undergraduate level provides a broad-based introduction to Biology.

Staff and research students in the School are engaged in research in five themes of biology that are vital to humankind:

- **Biochemistry** - the chemistry of life
- **Bioinformatics** - understanding, managing and using biological data through a wide range of applications and tools.
- **Molecular/Micro Biology & Systematics** - how molecules and micro-organisms are structured, function, interact with their environment and evolve.
- **Cell & Organismal Physiology** - how the processes within cells, tissues and individuals function
- **Ecology, Evolution & Behaviour** - how organisms interact and change over time in ecosystems

We offer over 40 undergraduate courses in biology and biochemistry. They are taught by academic staff with expertise in areas of biology ranging from genetics, biochemistry and molecular biology to ecology, conservation biology and biotechnology. Biology courses also support multidisciplinary majors and degrees such as Biochemistry, Bioinformatics, Environmental Science, Antarctic Studies and Water Resource Management —Biology at UC offers something for everyone!

All our Biology majors will complete the three 100-level biology core papers: BIOL 111 Cellular Biology and Biochemistry, BIOL 112 Ecology, Evolution and Conservation and BIOL 113 Diversity of Life. In addition, Biology majors need to take STAT 101 Statistics 1 as an introduction to statistical data analysis (unless you have NCEA L3 Maths achieved with excellence) and SCIE 101 Science, Society, and Me. Finally, all students that major in biology complete BIOL 209 Introduction to Biological Data Analysis.

Having gained an introduction to the breadth of Biology in their first year, many students subsequently start to focus on a particular area. Such interests are catered for in the major thematic areas described in pages 10–17.

You will see that there is overlap between the themes. The overlap is important – the area of molecular genetics, for example, is just as important to the study of biodiversity as it is to the study of animal or plant development!

Entry to Biology

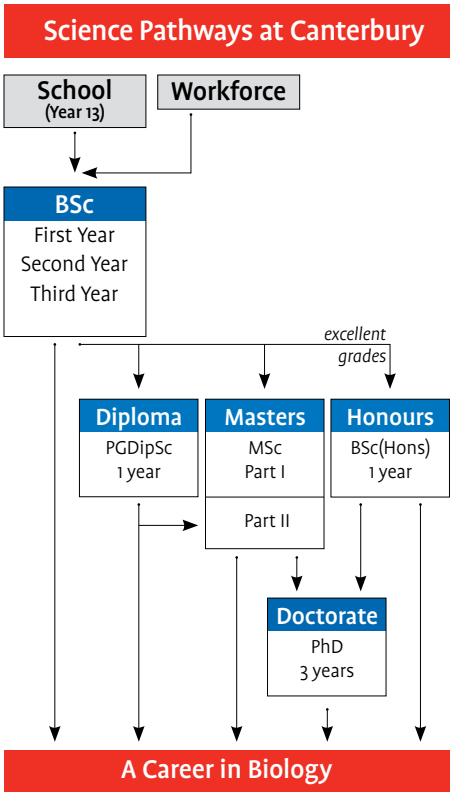
Entry into Biological Sciences is straightforward. We recommend that you take maths with statistics at Year 13. The diagram at right shows the different paths that may be followed to complete undergraduate and postgraduate studies in Biology.

Should I study Biology or Environmental Sciences?

A Bachelor of Science (BSc) degree with a major in Biological Sciences will provide you with a set of skills to take a biological approach to studying the environment, with a focus on animals, plants, and microbes. This is a good option for you if your main interest is in subjects such as ecology, biosecurity, behaviour, evolution, physiology, cell biology, conservation, botany, zoology, genetics, and microbiology.

In contrast, a Bachelor of Environmental Sciences with Honours (BEnvSci(Hons)) is a good choice if you want to learn more about how the environment is impacted by our actions. This degree is a good study pathway if you are interested in topics such as biosecurity, sustainability, natural disaster response, and global climate change.

You can also choose to study towards a BSc with a double major in Biology and Environmental Sciences to broaden your skill set. This gives you the biological knowledge and skills to contribute to addressing environmental challenges.



Accredited Biology major

The Biological Sciences major in the BSc degree has been accredited by the Royal Society of Biology (RSB) in the UK, the first in NZ to be internationally recognised in this way!

Graduates from Accredited programmes are equipped with well-rounded knowledge and skills, making them highly employable both within and beyond their chosen field.

Advantages of Accreditation:

- Academic achievement recognised
- Improved standards of learning and teaching in the biosciences
- Students can be confident about their chosen course of study
- Enhanced competitiveness of graduates in a global jobs market
- Employers assured of the level of employability skills and subject relevant bioscience skills provided by the degree
- Provides an international mark of "good practice" allowing wide ranging comparability among high performing institutions

Quality assured through international review

Biological Sciences encompasses a set of experimental subjects, which require a hands-on approach to learning. Our accredited degree incorporates learning outcomes associated with key skills in laboratory and fieldwork thereby providing a high standard of competence in graduates. Transferable graduate skills such as communication, problem solving and team working are integral to the degree. Biologists must be equipped with the skills necessary for self-learning and the ability to apply basic principles of maths, chemistry, physics and information technology to their learning and career. These are taught and assessed at all levels, providing a gradual development of ability and self-confidence in students, culminating at graduation. Students are encouraged and supported to develop their creativity, innovation and entrepreneurship.

Accredited degrees are highly regarded by employers as well as within the learning and teaching community. Accredited programmes are delivered by subject experts and produce graduates who will excel in their chosen field.

Benefits of Accreditation for students

Greater employability prospects and enhanced competitiveness in a global jobs market

The Accreditation programme establishes a profile of key skills that bioscience employers can recognise in graduates from accredited degrees. Students are able to provide tangible examples (i.e. taught, assessed and carried out in practice) of their skills (e.g.in the laboratory, team working etc.).

Professional body Accreditation of their degree

Students can be confident that the degree they are choosing is of a high standard and has been assessed and enhanced by the Accreditation process. The RSB bases Accreditation on a set of wide ranging criteria, meaning students will be aware of not only the technical skills and knowledge gained in their course, but also the transferable skills such as teamwork, communication and entrepreneurship.

Free membership/registration to the RSB

Graduates from accredited programmes are entitled to a free year of membership to the Society. This will enable access to a significant network of bioscience professionals, making it easier to stay up-to-date with biology related developments (e.g. via the free weekly bulletin of key discoveries, initiatives and policies worldwide) and provide graduates with additional recognition of their skills and experiences. This is extremely beneficial to graduates, particularly at a time when they are applying for their first employment. Membership of the Society gives students and graduates a feeling of belonging to a wide community of biologists, interested in biology for its own sake but also to contribute their knowledge and skills to help meet world challenges.

See www.rsb.org.uk for more information about the Royal Society of Biology

Whakamaheretia
Planning Your BSc in Biology

Biological Sciences Major

The Bachelor of Science, or BSc degree, is a three-year undergraduate degree requiring 360 points. The School offers undergraduate majors in Biological Sciences (BIOL) and Biochemistry (BCHM). We also offer a Bachelor of Data Science with a major in Bioinformatics. Our three core 100 level biology courses (BIOL 111, BIOL 112, BIOL 113) provide a comprehensive overview of Biology and our 200- and 300-level courses provide advanced training in specialised areas. We believe that this broad approach in curriculum delivery is of great benefit to student learning.

To major in BIOL, students must pass STAT 101, SCIE 101, BIOL 111, BIOL 112, BIOL 113 and BIOL 209. To gain a pass a student must do satisfactory practical work in laboratory classes and in field courses as well as performing satisfactorily in written tests and examinations.

Students who have not taken Chemistry to Year 13 or Scholarship level are recommended to take 15 points of CHEM (e.g. CHEM 114) before enrolling in 200 level courses.

Students who have not taken Maths (with Calculus) to Year 13 or Scholarship level should strongly consider taking 15 points of MATH (e.g. MATH 101) before enrolling in 200 level courses.

Students admitted to an Honours or Masters Degree in the Biological Sciences or Ecology majors must include BIOL 309, or an equivalent course, in their undergraduate degree. BIOL 309 is strongly recommended for ALL intending postgraduate students.

Minor in Biology

A student intending to minor in Biology needs at least 75 points in Biology, which must include at least 45 points at 200-level or above.

Choosing your first year courses

Starting your BSc in Biology is straightforward. Most students begin by taking the core biology courses during their first year at Canterbury, but students who discover an interest in biology later can also take the core courses during their second year. The three core courses are:

BIOL 111 Cellular Biology and Biochemistry
BIOL 112 Ecology, Evolution and Conservation
BIOL 113 Diversity of Life

[BIOL 111 (co-coded as BCHM 111) is required for Biochemistry majors, BIOL 112 and 113 are recommended.]

Because statistical analysis and experimental design is such a fundamental aspect of all biological research, all Biology majors are required to take STAT 101 Statistics 1 (unless you have NCEA L3 Maths achieved with excellence) and BIOL 209 Introduction to Biological Data Analysis. BSc students enrolling at UC or the first time in 2018 will need to take SCIE 101 Science, Society, and Me.

Two additional first year courses are also offered for students. These optional courses cannot be substituted for the core biology courses.

BIOL 116 Human Biology
SCIM 101 Science, Maori and Indigenous Knowledge

Choosing courses for your second and third year: Themes in Biology

In order to help you to choose your second and third year courses, Biological Sciences has designed a range of themes (see pages 10–17). They allow you to create a personalised degree that suits your interests.

The themes are informal selections of courses that we recommend taking to become proficient in your area of interest. For each, we list the core courses and some of the main complementary courses that you might be interested in.

You don't have to select a theme to major in Biology, nor do you need to take all core courses in your theme/s of interest. However, many students find it helpful to use one or more themes for selecting a coherent combination of courses.

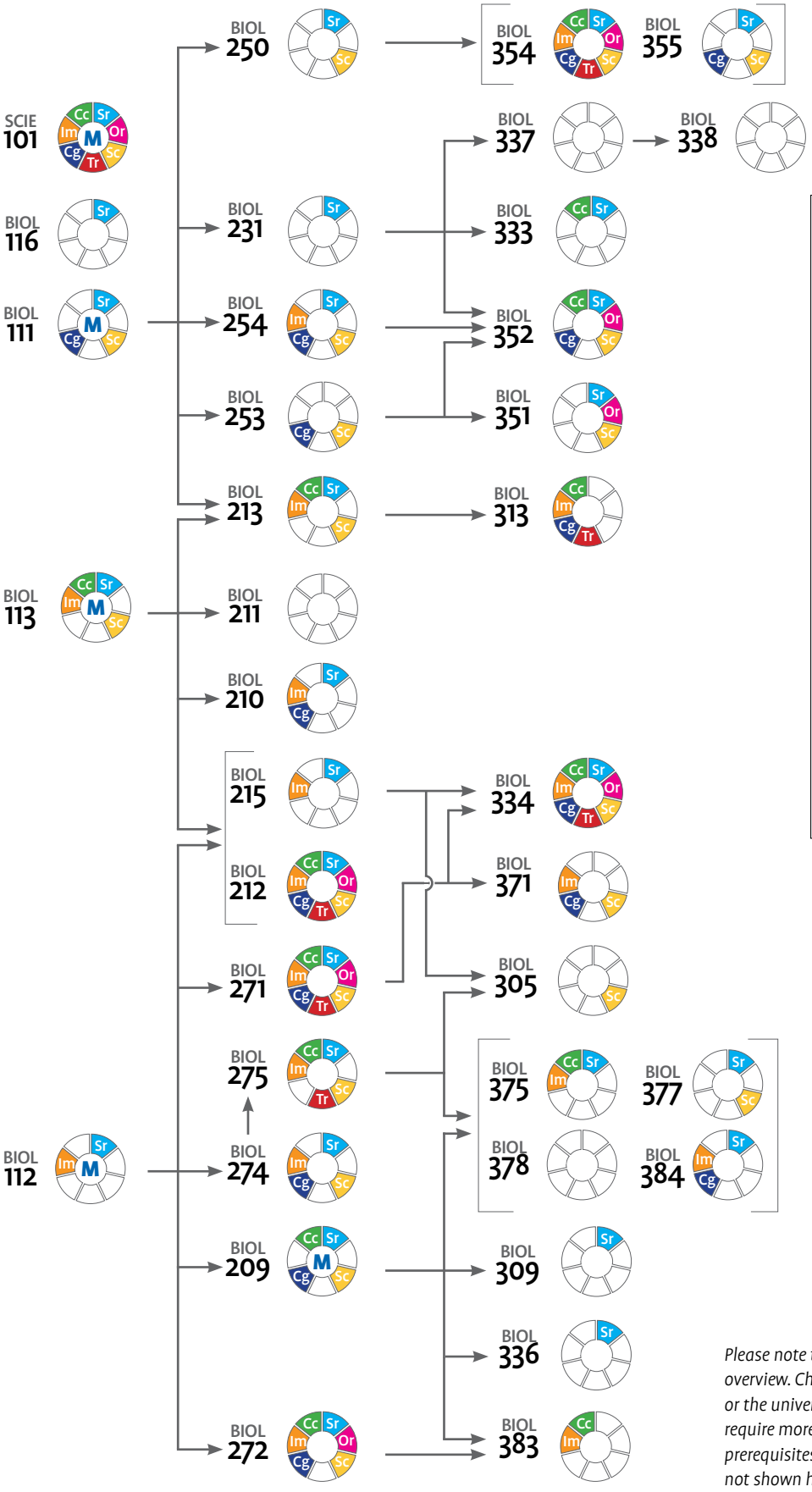
The Biochemistry theme can also be taken as a major if all core courses are taken.

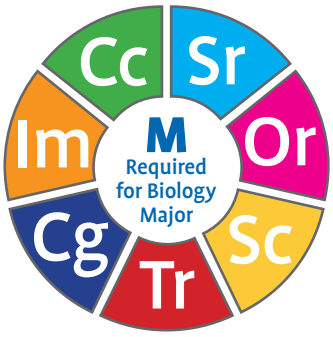
Find maths or chemistry intimidating?

Mathematics and Chemistry can seem intimidating to many - if you lack confidence in these (or haven't done them to year 13) but want to expand your background, don't worry! UC provides plenty of support. This includes introductory courses at 1st year that are specifically tailored to biologists' needs – Methods of Mathematics (MATH 101) and Foundations of Chemistry (CHEM 114). If in doubt, talk to one of our academic advisors.

Course map

Simplified overview of course pre-requisites and Bicultural Competence and Confidence (BiCC) touch points.





- **Sr** A process of self-reflection on the nature of 'knowledge' and 'norms'
- **Or** The nature of contemporary Māori organisational structures, e.g. rūnanga, hapū, iwi, iwi corporations
- **Sc** Traditional and contemporary realities of Māori society, e.g. tikanga and kawa, te reo Māori
- **Tr** The Treaty of Waitangi and Aotearoa New Zealand's bicultural history
- **Cg** The process of colonisation and globalisation
- **Im** Other indigenous models of development, knowledge and behaviours
- **Cc** Application of bicultural competence and confidence in a chosen discipline and career

Please note that this diagram is intended as a simplified overview. Check the course descriptions, online course details or the university calendar for full information. Some courses require more than one pre-requisite course, have alternative prerequisites or recommended preparation courses which are not shown here.

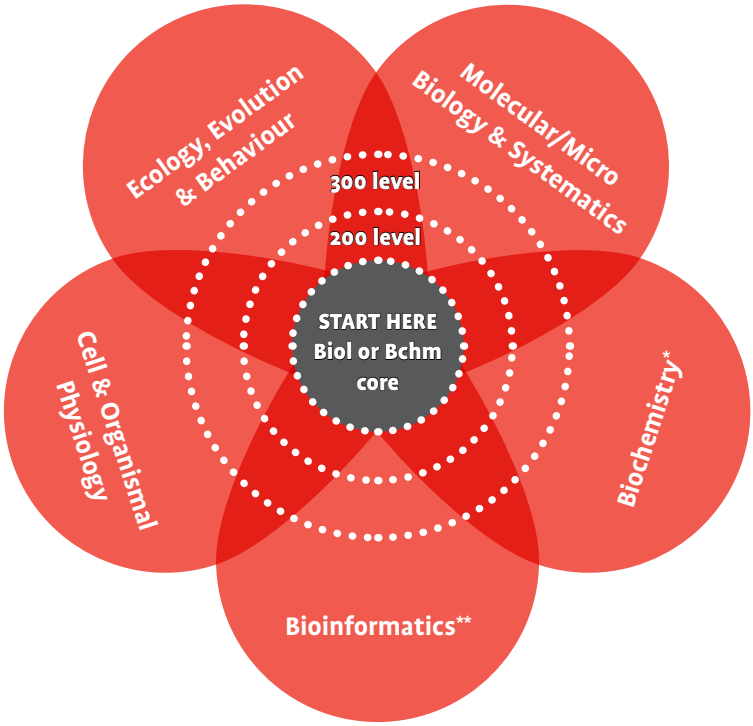
Kaupapa Mātai Koiora
Themes in Biology

An overview of undergraduate Biology and Biochemistry at UC

Our undergraduate teaching is aligned to 5 main themes in biology as shown in the diagram to the right. The themes are not isolated from each other as there is significant overlap, many of our courses cover content from multiple themes. There are also synergies with areas such as environmental science, biogeography, medical physics and waterways, to name a few.

Everyone starts with a 100 level core of biology or biochemistry along with SCIE 101. These courses provide an introduction to the themes allowing you to choose a pathway forward based on your interests.

Our pathways have been designed to align with a theme, and are supported by courses from the other themes. You can also design your own pathway to suit your interests, our advisors can help you with this.



*** Also offered as a Bachelor of Science with a Major in Biochemistry**

**** Also offered as a Bachelor of Data Science with a Major in Bioinformatics**

Bachelor of Science degree requirements

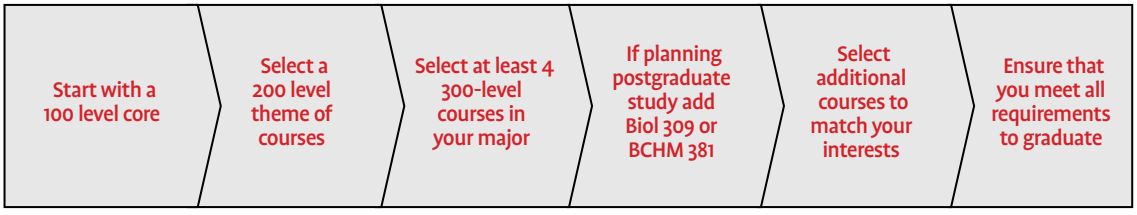
The Bachelor of Science degree requires a minimum total of 360 credit points, of which at least 255 points must be from science courses. The remaining 105 points can be from science or non-science courses. At least 225 points must be above 100-level, of which at least 90 must be at 300-level, 60 of them in a single subject (BIOL) – this is your major. Students can take more than 225 points above 100-level and some choose to do a double major by taking two science subjects through to 300-level with 60 points in each.

Checklist to a BSc major in Biology

The core requirements are, a minimum of:

- 60 points selected from BCHM 305, BCHM 306 and 300 level BIOL ..... ☐
- 90 points at 300 level ..... ☐
- 225 points at 200/300 level ..... ☐
- 255 points from science courses ..... ☐
- 360 credit points ..... ☐
- BIOL 111, BIOL 112, BIOL 113, SCIE 101, STAT 101 and BIOL 209 ..... ☐

Steps to designing your degree



The Science Student Advisor and Biology Undergraduate Advisor are available to help you plan your degree

Generalized Biological Sciences BSc degree structure

	Biology major courses			Other science courses		Courses from science or other degrees		
1	Biol 111	Biol 112	Biol 113	Stat 101	Scie 101	100 Level	100 Level	100 Level
2	200 Level	200 Level	200 Level	Biol 209	200 Level	200 Level	200 Level	100 Level
3	300 Level	300 Level	300 Level	300 Level	300 Level	300 Level	200 Level	200 Level

* Biology majors are strongly recommended to take some chemistry, such as CHEM 114.

This diagram shows the minimum requirements for a BSc degree with a major in Biology. Many students take more than 225 points above the 100 level, and most take more than 60 points in their major. Students must take BIOL 111, BIOL 112, BIOL 113, SCIE 101, STAT 101 and BIOL 209 in their degree, and BIOL 309 is strongly recommended, especially for potential postgraduate students. BIOL 309 cannot be used as part of the minimum 60 points needed at 300 level to major in Biological Sciences, but BCHM 305 and BCHM 306 can be used.

Biochemistry

Biochemistry is a major, see the UC Calendar for regulations.

Choose this theme if you are interested in topics such as:
Biotechnology, animal physiology, plant development, medical biochemistry

Biochemistry uses the techniques of chemistry, physics and molecular biology to probe the mysteries of biology at the molecular level. At UC, biochemistry courses are taught as a collaboration between the Department of Chemistry and the School of Biological Sciences. For Biochemistry students it is important to consider both biology and chemistry courses in addition to the biochemistry core when designing your degree.

Within the broad field of biochemistry, research interests at UC focus on the following key areas:

- The molecular basis for diseases
- Medical biochemistry
- The molecular basis for biological phenomena: studies of molecular biology; gene expression and control; hormones and physiological phenomena
- Enzyme inhibition and drug design
- Natural products chemistry and drug discovery
- Intermediary metabolism: studies of the integration of reactions in living cells; how cells make and use energy; biosynthesis of proteins; DNA & RNA; and cellular control mechanisms
- The nature of enzyme-catalysed reactions.
- Ultrastructure: studies of the coordination of the structure and function of cells, their organelles and their proteins.
- The structure of biopolymers: studies of the structure of proteins, DNA & RNA, cell walls, etc.
- Applied biochemistry: studies of immobilised enzymes; biochemical engineering, food biochemistry, etc.
- Free radical biochemistry.

Career paths

Biochemistry is a "central science" allowing employment across a wide range of disciplines - from chemistry to molecular biology; from medicine to food technology.

A Biochemistry major can prepare you for diverse careers including teaching and research in hospitals and medical fields, in the food and drink industries, in agriculture and in industry.

- Forensic Senior Technician - ESR
- Research Technician at e.g. Synlait Milk Ltd
- Research Technician in biochemistry at AgResearch or Plant & Food Research
- Scientific sales consultant for a pharmaceutical company
- Medical laboratory technician
- Craft Brewery Manager at a micro brewery
- Secondary school teacher
- Research technician
- Laboratory manager

Useful links

UC Careers, Internships & Employment
www.canterbury.ac.nz/careers

Careers New Zealand
www.careers.govt.nz

Biochemistry

My degree plan

Year 1 *BSc*			2			3			4 *BSc(Hons), PGDipSc, MSc part 1*	
Semester 1	**Semester 2**	**Summer**	**Semester 1**	**Semester 2**	**Summer**	**Semester 1**	**Semester 2**	**Summer**	**Semester 1**	**Semester 2**
BCHM 111	BCHM 112	*Optional*	BCHM 202	BCHM 222	*Optional*	BCHM 305	BCHM 306	*Optional*		
	SCIE 101	*Optional*	BCHM 212	BCHM 281	*Optional*	BCHM 338	BCHM 339	*Optional*		
			BCHM 253				‡			

‡ BCHM 381 if considering postgraduate study

100 level courses

BCHM 111	Cellular Biology & Biochemistry (S1)
BCHM 112	Structure and Reactivity in Chemistry and Biochemistry [1] (S2)
SCIE 101	Science, Society & Me (S2)

200 level courses

BCHM 202	Foundations of Molecular Biology (aka BIOL 231) (S1)
BCHM 212	Chemical Reactivity (S1)
BCHM 222	Biochemistry B - Metabolism; the reactions of molecules in cells (S2)
BCHM 253	Cell Biology 1 (aka BIOL 253) (S1)
BCHM 281	Practical Biochemistry (S2)

300 level courses

BCHM 305	Protein Science (S1)
BCHM 306	Biochemical Pathology (S2)
BCHM 338	Chemical Biology (S1)
BCHM 339	Bioinorganic & Bioorganic Chemistry (S2)
BCHM 381	Biochemical Techniques (S2) [2]

Notes

[1] If you have fewer than 14 credits of NCEA level 3 chemistry take CHEM 114 before starting BCHM/CHEM 112.

[2] BCHM 381 is usually required for postgraduate Biochemistry.

The Science Student Advisor and Biology Undergraduate Coordinator are available to help you plan your degree.

You may also like:

BIOL 112	Ecology, Evolution & Conservation (S2)
BIOL 113	Diversity of Life (S1)
BIOL 116	Human Biology (S2)
HLTH 110	Epidemiology (S2)
CHEM 111	Chemical Principles & Processes (S1,S2)
LAWS 101	Legal System: Legal Method & Institutions (W)
MATH 101	Methods of Mathematics (S1, S2, W)
SCIM 101	Science, Maori & Indigenous Knowledge (S2)
STAT 101	Statistics 1 (S1, S2, Su) (or MATH 101) [2]
BCHM 206	Organic Chemistry (S2)
BIOL 209	Biological Data Analysis (S1)
BIOL 210	Vertebrate Biology (S2)
BIOL 213	Microbiology (S2)
BIOL 250	Principles of Animal Physiology (S1)
BIOL 254	Principles of Plant Physiology (S2)
CHEM 211	Molecules (S1)
PSYC 206	Introductory Research Methods and Statistics (S1,Su)
PSYC 215	Introductory Cognitive and Behavioural Neuroscience (S2)
BIOL 333	Molecular Genetics (S1)
BIOL 334	Evolutionary Genetics & Genomics (S2)
BIOL 351	Cell Biology 2 (S2)
BIOL 352	Plant Development and Biotechnology (S1)
CHEM 335	Organometallic Chemistry & Catalysis (S2)
CHEM 337	Organic Synthesis (S2)
CHEM 340	Environmental Chemistry and Toxicology (S1)
PSYC 373	Neuroscience and Neurological Disorders (S1)

Bioinformatics

A new Bachelor of Data Science degree has been introduced in 2021, contact the Faculty of Science Student Advisor for further details.

Choose this degree if you are interested in topics such as:

Molecular genetics and genomics, evolutionary biology, biological databases, computer programming, mathematics, statistics.

Bioinformatics and computational biology are broad themes in biology and their definitions are changing as the field develops. These themes are seen as disruptive and are leading biological research forward in the 21st century. They centre around understanding, managing and using biological data through a wide range of applications and tools.

New biological techniques allow the generation of massive datasets, whilst the development of new computer technology enables novel approaches to analysing these data. This use of "big data" is transforming how biologists ask questions and seek answers.

Bioinformatics is seen as so important that UC recently developed a new Bachelor of Data Science. There are five majors with Bioinformatics the most relevant to students interested in biological sciences.

Through a bioinformatics major you will gain a wide variety of transferable skills. These will include programming languages, statistics as applied to biological data, familiarity with fundamental algorithms and the ability to apply these to novel problems and large biological datasets, and the ability to create pipelines tying together multiple bioinformatics and computational programs.

With big data comes big responsibility, and you will learn the importance of data security, ethics, and strategy.

These bioinformatics skills are used in many different ways, such as to analyse and interpret high-throughput molecular data to understand community composition and function. Further, one could make use of the great wealth of publicly available human genome datasets and apply novel analysis techniques to these. These skills and techniques can also be used to add to our understanding of evolutionary patterns and processes, identifying invasive species through DNA data, or study whole communities through metabarcoding approaches, or shed new light on human health and disease.

This degree major supports other areas of biology, including Systematics, Molecular Biology, Evolution, Ecology, Microbiology, Conservation and Taxonomy.

Career paths

A graduate with a bioinformatics background would often work as part of a research team. They may perform tasks such as rearranging data into formats that allow for accurate use, developing tools to visualise complex data, collaborating with investigators to develop and perform statistical analyses and/or developing novel bioinformatic analysis pipelines, and use a range of statistical software and various database structures to analyse and store data.

Graduates in bioinformatics may take up careers such as:

- Graduate Analyst for The Northern Regional Alliance, Auckland
- Research Leader in Data Analytics – Scion
- Bioinformatics Analyst, Dana-Farber Cancer Institute
- Data Management Officer, University of New South Wales, Sydney
- Bioinformatics coordinator for Genomics Aotearoa
- Biostatistician for Novotech
- Bioinformatician - Single Cell & Computational Genomics, Garvan Institute of Medical Research, Sydney
- National Research Partnerships Manager at Australian Genome Research Facility Ltd, Melbourne

Useful links

UC Careers, Internships & Employment
www.canterbury.ac.nz/careers

Careers New Zealand
www.careers.govt.nz

Bachelor of Data Science with a Bioinformatics Major

You can also design a BSc majoring in Biology with a focus on bioinformatics, computational biology or data science - contact a student advisor for support to plan your degree.

My degree plan

Year 1 *BSc*			2			3			4 *BSc(Hons), PGDipSc, MSc part 1*	
Semester 1	**Semester 2**	**Summer**	**Semester 1**	**Semester 2**	**Summer**	**Semester 1**	**Semester 2**	**Summer**	**Semester 1**	**Semester 2**
BIOL 111	BIOL 112	*Optional*	BIOL 231	BIOL 215	*Optional*	BIOL 333	BIOL 334	*Optional*		
COSC 121	DATA 101	*Optional*	COSC 262	DATA 201	*Optional*	BIOL 337	BIOL 338	*Optional*		
MATH 102	COSC 122		DATA 203	PHIL 240		DATA 301				
	SCIE 101		BIOL 271	STAT 202*		STAT 315*	DATA 303			

100 level courses

BIOL 111	Cellular Biology & Biochemistry (S1)
BIOL 112	Ecology, Evolution & Conservation (S2)
COSC 121	Introduction to Computer Programming (S1, S2)
COSC 122	Introduction to Computer Science (S2, Su)
MATH 102	Mathematics 1A (S1, S2)
DATA 101	Introduction to Data Science (S2)
SCIE 101	Science, Society & Me (S2)

200 level courses

BIOL 215	Exploring Biodiversity: Principles and Methods of Systematics
Biol 231	Foundations in Molecular Biology
BIOL 271	Evolution
DATA 201	Data Wrangling (S2)
DATA 203	Data Science Multivariable Methods (S1)
STAT 202	Regression Modelling (S2) (* or STAT 201 Applied Statistics (S1) or BIOL 209 Biological Data Analysis (S1))
COSC 262	Algorithms (S1)
PHIL 240	Bioethics: Life, Death, and Medicine (S2)

300 level courses

BIOL 333	Molecular Genetics
BIOL 334	Evolutionary Genetics and Genomics
BIOL 337	Bioinformatics *(New in 2025)*
BIOL 338	Bioinformatics Project
DATA 301	Big Data Computing and Systems (S1)
DATA 303	Computational Data Methods (S2)
STAT 315	Multivariate Statistical Methods and Applications (S1) (* or STAT 318 Data Mining (S1, S2))

Notes

The Science Student Advisor and Biology Undergraduate Coordinator are available to help you plan your degree.

You may also like:

BIOL courses - ensure your choices give you the prerequisites to proceed to the next level

SCIM 101	Science, Maori & Indigenous Knowledge (S2)
BIOL 113	Diversity of Life (S1)
SENG 201	Software Engineering I (S1)
STAT 318	Data Mining (S1)

The Bachelor of Data Science requires a minimum total of 360 points:

195 points of compulsory Data Science core courses

165 points of courses towards your major.

At least 225 points must be from courses above 100-level, with at least 105 points at 300-level.

Each major has specific course requirements, but all consist of a minimum 165 points, with at least 45 points at 200-level or above and at least 60 points at 300-level.

Molecular/Micro Biology & Systematics

Choose this theme if you are interested in topics such as:
Microbiology, biotechnology, bioinformatics, molecular biology, genomics, biodiversity, drug development, plant biology, biosecurity, ancient DNA, taxonomy, phylogenetics

Genetics is at the heart of the Molecular/Micro Biology and Systematics theme. It is the science of heredity. It has a history of less than 150 years, yet the most significant discovery, the double helix, celebrated its 50th birthday in 2003. The completion of the human genome project, followed by a proliferation of genome projects on endemic and endangered species has promised to challenge the creativity of future scientists. Genetics provides a platform for the development of new drugs to combat diseases, methodology for the conservation of endangered species and understanding evolutionary patterns and processes. Furthermore, it helps us to understand who we are and what we are, enhance our biosecurity and even catch criminals. Genetics is a rapidly advancing field that creates challenges and opportunities for society. Our graduates and staff also work in civil society organisations and for government agencies providing expertise to maximise the benefits of genetic technologies while minimising risk.

Molecular Biology is the field of biology that studies the structure and function of genes at a molecular level. The study of chromosomes and gene expression of an organism can give insight into heredity, genetic variation, and mutations.

Microbiology is the study of organisms such as algae, fungi, bacteria and viruses that cannot be seen with the naked eye. These micro-organisms are abundant and diverse, and they affect humans in both negative and positive ways. Some micro-organisms cause diseases in humans, other animals, or agricultural crops, and are therefore of significance to our biosecurity. Others can be used to benefit humans, such as microbes that can be used to kill insect pests (bio-control) and those that destroy harmful chemicals such as pesticides (bio-remediation). Other microbes are simply essential to the maintenance of all life, such as those that generate oxygen and other critical elements.

Systematics aims to describe and classify biological diversity and to understand its origins. It encompasses the description, identification, nomenclature, and classification of organisms (taxonomy) and the reconstruction of their evolutionary history (phylogenetics). Knowing the identity and evolutionary relationships of organisms is crucial to any biological study, and Systematics therefore unifies all of biology. Molecular methods in genetics have revolutionised systematics during recent decades leading to a far deeper understanding of how species are related and the processes that underlie biodiversity.

Career Opportunities

The broad and transferable skills gained from following this pathway open up many career options, many of which may include some component of laboratory work such as culturing micro-organisms, sequencing DNA, identifying species.

Graduates who specialise in Molecular/Micro Biology and Systematics may take up careers like:

- Craft Brewery Manager at a micro brewery
- Technical Compliance Officer for a food safety company
- Genetic Services Specialist at PIC
- Laboratory Technician - Microbiology at Hill Laboratories
- Technician - Pathogens at AsureQuality Ltd
- Laboratory manager
- Secondary school teacher
- Medical laboratory technician at Canterbury Health
- Biotechnology technician
- Assistant Cereal Breeder with the Cereal Research and Development team at PGG Wrightson Seeds
- Entry level Fisheries Modeller - NIWA

Useful links

UC Careers, Internships & Employment
www.canterbury.ac.nz/careers

Careers New Zealand
www.careers.govt.nz

Molecular/Micro Biology & Systematics

My degree plan

Year 1 *BSc*			2			3			4 *BSc(Hons), PGDipSc, MSc part 1*	
Semester 1	Semester 2	Summer	Semester 1	Semester 2	Summer	Semester 1	Semester 2	Summer	Semester 1	Semester 2
BIOL 111	BIOL 112	*Optional* *	BIOL 209	BIOL 213	*Optional*		‡	*Optional*		
BIOL 113	SCIE 101	*Optional*	BIOL 231	BIOL 215	*Optional*			*Optional*		
*	*									

* STAT 101 should be taken during first year

‡ BIOL 309 if considering postgraduate study

100 level courses

BIOL 111	Cellular Biology & Biochemistry (S1)
BIOL 112	Ecology, Evolution & Conservation (S2)
BIOL 113	Diversity of Life (S1)
SCIE 101	Science, Society & Me (S2)
STAT 101	Statistics 1 (S1, S2, Su)

200 level courses

BIOL 209	Biological Data Analysis (S1)
BIOL 213	Microbiology (S2)
BIOL 215	Exploring Biodiversity: Principles and Methods of Systematics (S2)
BIOL 231	Foundations in Molecular Biology (S1)

300 level courses

BIOL 309	Experimental Design & Data Analysis for Biologists (S2) [1]

At least 4 courses selected from:

BIOL 305	Practical Field Botany (Su)
BIOL 313	Advanced Microbiology (S2)
BIOL 333	Molecular Genetics (S1)
BIOL 334	Evolutionary Genetics & Genomics (S2)
BIOL 352	Plant Development & Biotechnology (S1)

Notes

[1] BIOL 309 is usually required for postgraduate Biology.

The Science Student Advisor and Biology Undergraduate Coordinator are available to help you plan your degree.

You may also like:

BCHM 112	Structure & Reactivity in Chemistry & Biochemistry (S2)
CHEM 114	Foundations of Chemistry (S1)
LAWS 101	Legal System: Legal Method & Institutions (W)
HLTH 106	Te Wero - Maori Health Issues & Opportunities (S1)
HLTH 111	Global Health (S1)
SCIM 101	Science, Maori & Indigenous Knowledge (S2)
BCHM 222	Biochemistry B - Metabolism; the Reactions of Molecules in Cells (S2)
BCHM 281	Practical Biochemistry (S2)
BIOL 211	Insect Biology (S2, offered even years)
BIOL 250	Principles of Animal Physiology (S1)
BIOL 254	Principles of Plant Physiology (S2)
BIOL 271	Evolution (S1)
BIOS 201	Issues in New Zealand Biosecurity (S2)
BCHM 305	Protein Science (S1)
BCHM 306	Biochemical Pathology (S2)
BCHM 381	Biochemical Techniques (S2)
BIOL 352	Plant Development & Biotechnology (S1)
BIOL 354	Animal Ecophysiology (S2)
BIOL 355	Neurons, Hormones & Behaviour (S1)
BIOL 371	Evolutionary Ecology (S1)

Cell & Organismal Physiology

Choose this theme if you are interested in topics such as:
Biotechnology, animal physiology, ecophysiology, plant development, biochemistry, genetics

Cellular and organismal physiology focuses on the normal vital processes of organisms. This theme is directed at understanding biochemical, biophysical, molecular, and genetic states of normal functioning at the subcellular, cellular, or whole-organism level.

Many of the recent advances in biology have focused on cellular and molecular processes, and these will always be a need to be related back to the function of the whole organism.

Within this theme a broad range of areas of focus are possible. Cell and organismal physiology in many ways links biochemistry with behaviour, and there is a large amount of overlap with our other themes.

The lines between areas of focus often are blurred and students interested in this area may want to develop backgrounds in ecology and evolution, genetics and developmental biology, or cellular and molecular biology in order to supplement their background in basic cell and organismal biology.

Cell biology is the science of the living cell. Cell theory, developed in the 1800s, states that all organisms are composed of one or more cells, that cells are the smallest living units of all living organisms, and that cells arise only by division of a previously existing cell. Recent decades have seen stunning advances in the study of cell biology as a range of different imaging, biochemical and molecular techniques have been used to investigate how cells work, and how cells interact with other cells.

Animal physiology is the study of the physical and chemical processes that occur within animals—in other words, how animals work. Animal physiology is concerned with such topics as gas exchange, blood and circulation, osmoregulation, digestion, nervous and muscle systems and endocrinology.

Biotechnology is of national and international importance. It can be defined as fundamental research contributing knowledge about biochemical, molecular, ecological and evolutionary processes; research underpinning biodiversity and biosecurity management in New Zealand; and research directed towards technology development with dual economic and environmental outcomes. Consequently, biotechnology research has key roles to play in helping us characterise New Zealand's indigenous genetic heritage through bio-systematics, to protect New Zealand's indigenous genetic heritage through the provision of tools to identify biosecurity threats, and, through research, to help counter the environmental impacts of farming in areas such as agricultural methane emissions and nitrogen fixers in pastures.

Biotechnology goes beyond genetic modification and includes a range of laboratory based tissue culture and breeding techniques such as the use of somatic hybridisation.

Plants are central to the maintenance of life on Earth and for the basis of agricultural production. Plant biology is a very broad discipline that covers the study of the structure, function and evolution and diversity of plants. Plant biologists study processes at the cellular and whole organism level, and address questions on how plants respond to the environment and other organisms. Others study the evolutionary history of the huge diversity of plant species. The study of plant biology can be undertaken in the lab or in the field, and is central to agricultural production and ecosystem function.

Career Opportunities

The broad and transferable skills gained from following this pathway open up many career options, many of which may include some component of laboratory work such as preparing assays, screening bio-active compounds or microscopy.

Graduates who specialise in Cell and Organismal Physiology may take up careers like:

- Research Technician in Genetics AgResearch
- Research Technician at Synlait Milk Ltd
- Seed Production Technician at AgResearch
- Forensic Senior Technician - ESR
- Plant development and breeding at a crop seed supplier
- Research technician at a university
- Scientific sales consultant for a pharmaceutical company
- Bio-imaging specialist
- Animal caretaker at a wildlife park
- Technical Laboratory Assistant at Scion

Useful links

UC Careers, Internships & Employment
www.canterbury.ac.nz/careers

Careers New Zealand
www.careers.govt.nz

Cell & Organismal Physiology

My degree plan

Year 1 *BSc*

Semester 1	Semester 2	Summer
BIOL 111	BIOL 112	*Optional* *
BIOL 113	SCIE 101	*Optional*
*	*	

2

Semester 1	Semester 2	Summer
BIOL 209		*Optional*
BIOL 231		*Optional*
BIOL 253		

3

Semester 1	Semester 2	Summer
	BIOL 351	*Optional*
	‡	*Optional*

4 *BSc(Hons), PGDipSc, MSc part 1*

Semester 1	Semester 2

* one of these must be STAT 101

‡ BIOL 309 if considering postgraduate study

100 level courses

BIOL 111	Cellular Biology & Biochemistry (S1)
BIOL 112	Ecology, Evolution & Conservation (S2)
BIOL 113	Diversity of Life (S1)
SCIE 101	Science, Society & Me (S2)
STAT 101	Statistics 1 (S1, S2, Su)

200 level courses

BIOL 209	Biological Data Analysis (S1)
BIOL 231	Foundations in Molecular Biology (S1)
BIOL 253	Cell Biology (S1)

At least 1 course selected from:

BIOL 213	Microbiology (S2)
BIOL 250	Principles of Animal Physiology (S1)
BIOL 254	Principles of Plant Physiology (S2)

300 level courses

BIOL 309	Experimental Design and Data Analysis for Biologists (S2) [1]
BIOL 351	Cell Biology 2 (S2)

At least 3 courses selected from:

BIOL 313	Advanced Microbiology (S2)
BIOL 333	Molecular Genetics (S1)
BIOL 352	Plant Development & Biotechnology (S1)
BIOL 354	Animal Ecophysiology (S2)
BIOL 355	Neurons, Hormones & Behaviour (S1)

Notes

[1] BIOL 309 is usually required for postgraduate Biology.

The Science Student Advisor and Biology Undergraduate Coordinator are available to help you plan your degree.

You may also like:

BCHM 112	Structure & Reactivity in Chemistry & Biochemistry (S2)
BIOL 116	Human Biology (S2)
CHEM 114	Foundations of Chemistry (S1)
LAWS 101	Legal System: Legal Method & Institutions (W)
HLTH 106	Te Wero - Maori Health Issues & Opportunities (S1)
HLTH 110	Epidemiology (S2)
MATH 101	Methods of Mathematics (S1, S2, W)
PSYC 105	Introductory Psychology - Brain, Behaviour and Cognition (S1, Su)
SCIM 101	Science, Maori & Indigenous Knowledge (S2)
BCHM 222	Biochemistry B - Metabolism; the Reactions of Molecules in Cells (S2)
BCHM 281	Practical Biochemistry (S2)
BIOL 210	Vertebrate Biology (S2)
BIOL 271	Evolution (S1)
BIOL 274	Principles of Ecology (S1)
BIOL 275	Field Ecology (S1)
BCHM 305	Protein Science (S1)
BCHM 306	Biochemical Pathology (S2)
BCHM 381	Biochemical Techniques (S2)
BIOL 333	Molecular Genetics (S1)
BIOL 334	Evolutionary Genetics & Genomics (S2)
PSYC 373	Neuroscience and Neurological Disorders (S1)

Ecology, Evolution & Behaviour

Choose this theme if you are interested in topics such as:

Conservation biology, genetics & genomics, biosecurity, terrestrial/marine/freshwater biology and ecology, animal behaviour, environmental sciences, computational biology, bioinformatics

Students of the Behaviour, Ecology, and Evolution theme study a broad diversity of organisms and ecosystems, and employ a wide range of methods in studies of both basic and applied questions. Courses are highly integrative and often include both laboratory and field-based components. Our staff have significant strengths in areas such as animal behaviour, ecosystem ecology, conservation biology and evolution.

Ecology is the study of organisms and how they relate to their environment. Evolution is a closely related area of study that focuses on how species change to adapt to their local surroundings and, more broadly, the processes that shape biodiversity. Animal behaviour is the study of the "how" and "why" of what animals do.

Ecology is an increasingly important field, as we struggle to protect plants and animals from growing human impacts. Amongst others, ecologists and evolutionists try to understand the threats to our endangered native organisms such as kiwi, kakapo and rare plants. They also try to predict or mitigate the effects of exotic pests such as possums and old man's beard.

Water is an important natural resource necessary for the survival of all ecosystems. From the glaciers of South Westland and braided rivers of Canterbury to the deep marine canyon off Kaikoura, New Zealand has an abundance of fresh and marine water systems.

Freshwater and marine ecology focus on the understanding of the ecology of rivers, lakes, wetlands, coastlines and oceans. Focussing on ecological concepts but also applying water science, it includes the study of water chemistry, plant/algae, invertebrate and fish diversity and communities. With increasing land use pressures and climate change there is a need to better understand these water systems to support management decisions regarding usage, conservation and rehabilitation.

Humans probably always have been fascinated by the behaviour of animals. Studies of animal behaviour can range from addressing questions about how animals communicate and how neural mechanisms control behaviour, to questions about why animals are altruistic to family members, why some animals look after their offspring while others do not, or why species differ in their mating systems. By studying animal behaviour through a scientific framework, we can understand the reasons for the rich behavioural repertoire seen across the animal kingdom and, in the process, perhaps learn something about our own sometimes perplexing behaviour. Understanding the behaviour of animals in nature also is becoming increasingly important in conservation biology programmes to ensure that they survive and reproduce. There is a large amount of overlap between Animal Behaviour and the Cell and Organismal Physiology theme.

Evolution complements Ecology in areas such as conservation biology, how species respond to climate change, the spread of introduced plant and animals, and predicting the potential spread of GMOs. Evolution complements Behaviour in explaining topics such as sexual selection and social behaviour. An understanding of evolution is also fundamental to the designing of effective drugs and predicting the spread of new diseases such as Zika virus. Tools and technologies of evolutionary biology underpin all the biological sciences, including in fields such as molecular biology, cell biology, ecology, biodiversity and behaviour. The common theme is the study of how species change and adapt to their local environment.

Career Opportunities

The broad and transferable skills gained from studying this theme open up many career options, many of which include some component of outdoor work such as monitoring, sampling and managing of species, as well as laboratory work and computational analyses.

Graduates who specialise in Ecology, Evolution and Behaviour may take up careers like:

- District conservation officer for the Department of Conservation
- Monitoring of ecological values along streams, rivers and estuary for the a city council
- Field technician in Landcare Research's programme to help meet Kyoto agreements on global warming
- Operating an aquaculture facility for a Marlborough Sounds seafood company
- Biosecurity officer for MAF involved in predicting and managing the spread of introduced organisms
- Border control officer at an international air or sea port.
- Scientist for AgResearch working in biocontrol
- Regional council water quality scientist

- Fisheries officer for the Ministry of Primary Industries (MPI)
- Policy analyst for a government agency
- Laboratory technician at Cawthron Institute
- Environmental education officer
- Environmental and compliance consultant
- Biodiversity Advisor
- Scientist such as an ecologist, evolutionary biologist, environmental scientist.

Useful links

UC Careers, Internships & Employment
www.canterbury.ac.nz/careers

Careers New Zealand
www.careers.govt.nz

Ecology, Evolution & Behaviour

My degree plan

Year 1 *BSc*

Semester 1	Semester 2	Summer
BIOL 111	BIOL 112	*Optional* *
BIOL 113	SCIE 101	*Optional*
*	*	

* one of these must be STAT 101

2

Semester 1	Semester 2	Summer
BIOL 274	BIOL 272	*Optional*
BIOL 275		*Optional*
BIOL 271		
BIOL 209		

3

Semester 1	Semester 2	Summer
	‡	*Optional*
		Optional

‡ BIOL 309 if considering postgraduate study

4 *BSc(Hons), PGDipSc, MSc part 1*

Semester 1	Semester 2

100 level courses

BIOL 111	Cellular Biology & Biochemistry (S1)
BIOL 112	Ecology, Evolution & Conservation (S2)
BIOL 113	Diversity of Life (S1)
SCIE 101	Science, Society & Me (S2)
STAT 101	Statistics 1 (S1, S2, Su)

200 level courses

BIOL 209	Biological Data Analysis (S1)
BIOL 271	Evolution (S1)
BIOL 272	Principles of Animal Behaviour (S2)
BIOL 274	Principles of Ecology (S1)
BIOL 275	Field Ecology (S1)

300 level courses

BIOL 309	Experimental Design & Data Analysis for Biologists (S2) [1]

At least 4 courses selected from:

BIOL 305	Practical Field Botany (Su)
BIOL 332	Genetics, Evolution and Ecology of Invasive Species (S2)
BIOL 334	Evolutionary Genetics & Genomics (S2)
BIOL 336	Ecological & Evolutionary Models (S1)
BIOL 354	Animal Ecophysiology (S2)
BIOL 355	Neurons, Hormones & Behaviour (S1)
BIOL 371	Evolutionary Ecology (S1)
BIOL 375	Freshwater Ecosystems (S2)
BIOL 377	Global Change and Biosecurity (S1)
BIOL 378	Population Ecology & Conservation (S1)
BIOL 383	Behavioural Ecology (S1)
BIOL 384	Marine Ecosystems (S2)

Notes

[1] BIOL 309 is usually required for postgraduate Biology.

The Science Student Advisor and Biology Undergraduate Coordinator are available to help you plan your degree.

You may also like:

ENVR 101	Introduction to Environmental Science (S1)
GEOG 106	Global Environmental Change (S2)
GEOL 101	Building Planet Earth: Fundamentals of Earth Science (S1)
GEOL 102	Environmental Earth System Science (S2)
FORE 111	Trees, Forests & the Enviroment (S1)
MATH 101	Methods of Mathematics (S1, S2, W)
PSYC 105	Introductory Psychology - Brain, Behaviour & Cognition (S1, Su)
SCIM 101	Science, Maori & Indigenous Knowledge (S2)
ANTA 201	Antarctica & Global Change (S1)
BIOL 211	Insect Biology (S2, offered even years)
BIOL 212	Marine Biology & Ecology (S1)
BIOL 215	Exploring Biodiversity: Principles and Methods of Systematics (S2)
BIOL 250	Principles of Animal Physiology (S1)
BIOL 254	Principles of Plant Physiology (S2)
GEOG 201	Environmental Processes: Principles & Applications (S1)
GEOG 205	Introduction to Geographic Information Systems & Science (S1)
MGMT 230	Business, Society & the Environment (S1, S2)
WATR 201	Freshwater Resources (S2)
WATR 203	Freshwater Science Field Skills (Su)
BIOL 355	Neurons, Hormones & Behaviour (S1)
WATR 301	Water Resource Management (S1)

Akoranga Mātai Koiora
Biology Courses

See www.canterbury.ac.nz/study/getting-started/about-our-qualifications for full details of each course.

Key

P: Pre-requisite
C: Co-requisite
RP: Recommended Preparation
R: Restrictions
EQ: Equivalent Course

BIOL 111

Cellular Biology and Biochemistry

Semester 1 15 points

A foundation course that will introduce you to the basic processes of cellular biology. The cell is considered the basic unit of life because every organism whether animal, plant, or micro-organism consists of cells or is itself a single cell. As such the structure and function of the cell impacts on all other levels of life including organisms, ecosystems and the biosphere. For this reason it is essential for all biologists to understand the fundamentals of cell biology. In this course you will learn the basic concepts of cell function and how these are related to cell structure, which is in turn dependent on molecular structure and biochemical interactions between molecules.

R: ENCH 281 and BCHM 111

EQ: BCHM 111

BIOL 112

Ecology, Evolution and Conservation

Semester 2 15 points

In this course you will learn the basics of evolution, ecology and conservation biology. You will see how evolution underpins both ecology and conservation and discover how these areas of biology impact every-day life. The first part of the course has an evolution focus and we will look at both genes (micro) and species (macro) evolution. We'll explore human diseases, drug resistance and invasive species. We'll also understand how fossils have contributed to our understanding of life on Earth today. The second term has a focus on ecology and conservation, with lots of examples demonstrating how New Zealand science is saving our unique ecosystems.

BIOL 113

Diversity of Life

Semester 1 15 points

This course provides an overview of the vast diversity of life on Earth. You will hear about the evolution, structure, function and importance of animals, plants and microbes. The first part of the course focuses on the diversity, reproduction and structure of bacteria, protists and fungi. The second part focuses on plants whilst the third part examines animals and includes discussion of locomotion, respiration, circulation, nervous and endocrine systems. Hands-on investigation of a variety of organisms in laboratory classes is an important part of the course.

BIOL 116

Human Biology

Semester 2 15 points

Human Biology is an introductory course that looks at the biology of Homo sapiens from a number of different viewpoints including the actions of individual cells and even individual molecules. The course is not only for the students who want to pursue Health Science studies but also for anyone who is interested in learning about aspects of human biology and health. The broad lecture themes include basic anatomy of the organs, nutrition, genetics, immune response, and human body / microorganism interface. Labs in the course have been designed to assist the learning of these broad lecture themes.

SCIM 101

Science, Maori and Indigenous Knowledge

Semester 2 15 points

This is an integrated multi-disciplinary course between the School of Maori and Indigenous Studies and the College of Science, studying Maori and other indigenous peoples knowledge and its relevance to today's western science.

R: MAOR 172

EQ: MAOR 172

BIOL 209

Biological Data Analysis

Semester 1 15 points

This course develops skills required by students and scientists in all branches of biology. It covers the scientific method, experimental design, development and testing of hypotheses, and fundamentals of probability. Then we cover essential statistical methods for biology including t-tests, chi-square, regression, and

Analysis of Variance. There is a strong hands-on component in computer-based labs. The course prepares students for running their own tests in projects and assignments, and interpreting tests

presented in the scientific and popular literature. This course is required for all students in Biology.

P: STAT 101 or 15 points of 100 level MATH

BIOL 210

Vertebrate Biology

Semester 2 15 points

This course deals with the biology and evolution of the phylum Chordata and in particular the subphylum Vertebrata, animals with backbones. The course gives an overview of the phylum highlighting form and function and gives information on evolutionary relationships.

P: BIOL 113

BIOL 211

Insect Biology

Offered in even years, next offered in 2024

Semester 2 15 points

The biology of insects and other non-marine arthropods, with emphasis on environmental relationships and management.

P: BIOL 113

BIOL 212

Marine Biology and Ecology

Semester 1 15 points

An introduction to the ecology and biology of the marine environment. Including description and analysis of marine communities and the biodiversity, ecology and behaviour of marine organisms. Includes a field trip.

P: BIOL 112 and BIOL 113

BIOL 213

Microbiology

Semester 2 15 points

The Mātai koiora moroiti | Microbiology course provides a broad overview on microbial physiology, microbial activity and the roles microorganisms play from the molecular to the global scale. It is intended for students with a broad interest in microbiology, mycology, biodiversity, and microbial ecology. You will learn about microbial genetics, metabolism and physiology, diversity, host-microbe and microbe-ecosystem interactions.

The laboratory component of this course emphasises practical microbiology skills such as microscopy, aseptic technique, experimental design and planning, and methods for controlling microbial growth. The course also includes a field trip as part of the laboratory.

The course interfaces with BIOL 231 / BCHM 202 and is an essential preparation for BIOL 313.

P: BIOL 111 or BIOL 113

RP: BIOL 231 or BCHM 202

BIOL 215

Exploring Biodiversity: Principles and Methods of Systematics

Semester 2 15 points

This course takes a broad view of the ways biological diversity can be described and classified, and its origins understood. Systematics is the scientific discipline that encompasses the description, identification, nomenclature, and classification of organisms (Taxonomy) and the reconstruction of their macro-evolutionary history (Phylogenetics). Knowing the identity and evolutionary relationships of organisms is crucial to any biological study, but functional classifications are also important. This course is an introduction to the methodology and principles of systematics across all forms of biodiversity (bacteria, plants, fungi, protists, and animals), from morphological to next-generation DNA-based approaches and including functional methods.

P: Biol 112 or Biol 113

RP: BIOL 111

BIOL 231

Foundations in Molecular Biology

Semester 1 15 points

Molecular biology is the science of how genes work. This understanding underpins the sciences of biochemistry, bioinformatics, evolution, systematics and ecology by both providing tools that are used by these sciences and by explaining how organisms produce the characteristics observed by these other sciences. This course goes will take you from familiarity with the concepts of DNA replication, transcription and translation to a foundation understanding of these reactions in living cells seen through gene regulation. It is intended for anyone who wants to begin to understand how genetics relates to life and seeks skills related to working at the molecular scale. The course is a foundation to further work that involves understanding patterns in DNA, structure and function of proteins, or developing new biotechnologies.

P: BIOL 111 (=BCHM 111) or ENCH 281

RP: CHEM 112 or BCHM 112 or CHEM 114

R: BCHM 202, ENCH 480

EQ: BCHM 202, ENCH 480

BIOL 250

Principles of Animal Physiology

Semester 1 15 points

This is a broad-based, elementary course in animal physiology providing an introduction to the principal physiological systems in animals, how they operate and how they are regulated. Topics include gas exchange, blood and circulation, osmoregulation and excretion, digestion, nervous and muscle systems, immunology, and endocrinology. The treatment is comparative although human and mammalian physiology receives greatest emphasis. Selected examples from lower vertebrates and invertebrates are used to illustrate physiological principles.

P: BIOL 111 (=BCHM 111) or ENCH 281

BIOL 253

Cell Biology 1

Semester 1 15 points

The course will cover membrane structure, membrane transport of small molecules and the electrical properties of membranes, intracellular compartments and protein sorting, intracellular vesicle transport, aspects of the cytoskeleton, the cell cycle and apoptosis. These topics will give the students a comprehensive grounding in cells as single entities. This will prepare students for an updated 3rd year cell biology course that will consider cells in their social context i.e. how they interact with other cells.

P: BIOL 111 (=BCHM 111) or ENCH 281

RP: 15 points of Chemistry at 100 level

R: BCHM 253

EQ: BCHM 253

BIOL 254

Principles of Plant Physiology

Semester 2 15 points

This course provides an introduction to the principles of plant development, including the basic anatomy of higher plants, and how they grow and reproduce. There will be a broad overview of the processes associated with the transport of water and mineral nutrients in plants, and the responses of plants to external stimuli and adverse growth conditions. In this course, the students have the opportunity to participate in trying a few practical basic plant science skills which would be useful to the study of plant ecology, plant-microorganism interactions, agriculture, horticulture and forestry. The students will appreciate the relevance of plant physiology principles to developments in agriculture and biotechnology.

P: BIOL 111 (=BCHM 111) or ENCH 281

BIOL 271

Evolution

Semester 1 15 points

This course provides an introduction to evolution including the patterns and processes of evolution, the evolution of life history traits, mechanisms of evolution, adaptation, speciation and extinction. It uses a partial Team Based Learning (TBL) approach in which most internal assessment is completed in structured, permanent learning teams: two lectures per week are traditional "we talk, you listen" sessions but every third lecture is a TBL session, and all tutorial sessions follow a similar "you talk, we guide" approach. The course is intended for anyone interested in gaining an understanding of evolutionary theory and its role in our understanding of questions such as where species have come from, why are there so many different species, and the importance of evolution in everyday life.

P: BIOL 112

BIOL 272

Principles of Animal Behaviour

Semester 2 15 points

Using a mix of traditional lectures, selected case studies, and fieldwork, this course aims to provide a broad understanding of the adaptive significance of behaviour: how animals interact with each other and with their environment. We explore the neural and hormonal basis of behaviour, as well as core subjects, like why and how animals communicate or have sex. This course is suited to anyone who may have wondered if animals can be dishonest, and if so, whether they are 'actively lying', and thus self-aware?

P: BIOL 112 or PSYC 105

BIOL 274

Principles of Ecology

Semester 1 15 points

This course provides a fundamental grounding in the main concepts in and applications of ecology, the study of relationships between organisms and their environment. The most important concepts in population, community, landscape and ecosystem ecology are covered. These are considered using examples from across marine, freshwater, forest, grassland, urban and production ecosystems, and with particular reference to the factors controlling the distribution of plants, animals and microbes in Aotearoa New Zealand, and their differences to other countries.

Overall, this course provides a thorough overview for those wanting to compliment other environmental knowledge. It can be combined with BIOL 275 Field Ecology to provide a comprehensive platform for those wanting to undertake more advanced ecological study.

P: BIOL 112

BIOL 275

Field Ecology

Semester 1 15 points

This course provides a fundamental grounding in the practical skills used in ecology, the study of relationships between organisms and their environment. It is designed to add to the co-requisite course BIOL 274 Principles of Ecology if students want to advance to 300-level ecology courses. There is a particular emphasis on the problems and issues affecting natural systems, and how ecological knowledge can be applied to achieve solutions. The focus of the course is a four-day field trip to the UC Cass field station near Arthur's Pass National Park. Combined with laboratory sessions prior to cultivate basic skills, the field course allows students to develop expertise in field experimental design and sampling, data analysis and interpretation, as well as providing practical experience in some wonderful high country environments. We will also recognise taonga species and consider appropriate Māori protocols (tikanga) for sampling in the field and the need for consultation.

To undertake all aspects of the course, students will need to have a reasonable level of fitness that allows them to travel over untracked forest and grassland, and have footwear and clothing that allows them to undertake field work safely in a mountain environment.

C: BIOL 274

WATR 203

Freshwater Science Field Skills

Summer (Nov – Dec) 15 points

A field and laboratory course which focuses on practical skills in identifying and measuring physical freshwater habitats, aquatic plants, invertebrates and fish and in analysing water chemistry.

P: A freshwater-related course of study or appropriate freshwater-related work experience subject to approval by the Head of the School of Biological Sciences.

BIOL 305

Practical Field Botany

Summer (Jan) 15 points

During eight consecutive days in summer, this intensive field course at the Cass field station in the Southern Alps prepares you for careers in field biology, ecology, conservation and taxonomy. You will learn how to document, identify, collect and preserve plants. BIOL 305 complements other courses in the Ecology, Evolution & Behaviour theme and also provides a base for further training in plant taxonomy. The course uses examples from the montane and alpine flora of Canterbury, but most acquired skills will be transferable to other regions and other groups of organisms. BIOL 305 is an inverted classroom course in which you learn by doing instead of listening. It is unique in attracting undergraduate students as well as members from the workforce (e.g., DoC and regional council staff) and plant enthusiasts.

This is a residential summer course at Cass field station running 17–25 January 2023.

P: BIOL 215 or BIOL 273 or BIOL 274 and BIOL 275 or approval by the Head of the School of Biological Sciences.

BIOL 309

Experimental Design & Data Analysis for Biologists

Semester 2 15 points

This course provides a detailed understanding of how the interpretation and analysis of data depends on the way the data were collected. It covers various aspects of experimental design, a variety of statistical methods to analyse data, basic programming in R, and places a heavy

emphasis on interpreting the results of analysis. It is intended for anyone who would like to know more about designing robust research, analysing datasets of various kinds, or who wishes to better identify the misleading use of statistics in the media or in research. The experimental design component is particularly suited for anyone who plans to do postgraduate research in any theme of biological sciences, or who would like to pursue a career in any field where it is useful to identify patterns in data.

This course is available as an online distance course.

P: BIOL 209 or appropriate statistical background as determined by the Head of School.

BIOL 313
Advanced Microbiology

Semester 2 15 points

This course builds on BIOL 213 and explores microbial ecology, advanced food and agricultural microbiology, disease and pathogenesis. The course emphasises bacteria and fungi, with other microbes also considered. Both fundamental and applied microbiology will be covered. The practical component of the course consists of isolating and characterising novel microbial strains, using both molecular and traditional approaches.

P: BIOL 213

RP: BIOL 253

BIOL 333
Molecular Genetics

Semester 1 15 points

This course provides a detailed understanding of the relationship between genes and phenotypes. The course assists you in transitioning from an intermediate knowledge of the core reactions involved in DNA replication, transcription, translation and gene regulation to an appreciation of the molecular diversity of living things. This diversity is at the root of the unexpected ways that organisms behave, why medicines work or fail, why biotechnologies succeed, are safe, or fail or cause harm. This course places an emphasis on the skills for discovery, rewards curiosity, and guides you to greater levels of competence in criticism and preparing for work.

P: BIOL 231 (=BCHM 202)

RP: BIOL 213

BIOL 334
Evolutionary Genetics and Genomics

Semester 2 15 points

This course provides an advanced understanding of mechanisms of evolutionary genetics and genomics, including applications to human health and conservation biology. Specific topics include epigenetics, evolution and development (evo-devo), genomic interactions with the environment, as well as, the genetic and genomic consequences of small population size, intra- and interspecific hybridization and the resolution of taxonomic uncertainties. Te Tiriti o Waitangi (The Treaty of Waitangi) is embedded in the course, and students will learn about the cultural considerations associated with the generation, storage, access and use of genetic/genomic data for research. This course is intended for anyone with an interest in both fundamental and applied research, or who wishes to gain bioinformatic experience working with large genetic and genomic data sets. It is also particularly well suited for anyone who plans to pursue a career in genetics or genomics that is responsive to the needs and aspirations of indigenous communities.

P: BIOL 215 and BIOL 271

BIOL 336
Ecological and Evolutionary Models

Semester 1 15 points

The general aim of the course is to introduce you to the major concepts in developing theoretical biological models. This is achieved by examining key ecological and evolutionary models. The central focus is on understanding, creating, and analysing basic biological models. We will highlight the importance of theoretical modelling to the fields of ecology and evolution and help you develop key computational and mathematical skills.

P: BIOL 209 or 15 Points of 200-level COSC or DATA or EMATH or ENCE or PHYS or MATH or STAT.

RP: BIOL 271 or BIOL 274

BIOL 337

Bioinformatics

Semester 1 15 points

The general aim of this course is to discuss major concepts in the bioinformatic analysis, application, handling and management of large-scale biological data, and apply these bioinformatics methods to real-world issues. The central focus will be on bringing together previously developed skills in programming, computing and data wrangling, and evaluating how these skills apply to biological datasets. This paper will also discuss the cultural, political, social and legal issues regarding data ownership, use and governance. The course will consist of regular lectures and computer labs, where students will be able to explore biological datasets using their knowledge of bioinformatics. The emphasis is on the amalgamation of students' previous two years of training and experience, providing students with the context and the background required to apply their skills in the real world.

P: BIOL 231 and DATA 201 and [STAT 201, STAT 202 or BIOL 209]

BIOL 338

Bioinformatics Project

Semester 2 30 points

This course will develop your ability to undertake research in bioinformatics. Drawing on existing datasets, you will design and complete a research project. The aim is for most projects to be based on real-world problems with data provided in collaboration with a research partner. The training, practice and critical evaluation of the research will be carried out in groups, and you will communicate your research findings using spoken, statistical and written skills. The course consists of regular lectures/tutorials and project group meetings, supported by web-based resources. It concludes with a public conference, where you will present your findings. The emphasis is on students working together to solve real-world bioinformatic problems using skills that are transferable to the workplace.

P: BIOL 337

BIOL 351

Cell Biology 2

Semester 2 15 points

This course examines the relationships between molecular structure and organelle and cell function. It focuses on structure, physiology, biochemistry and molecular biology of cells.

P: BIOL 253 (=BCHM 253)

BIOL 352

Plant Development and Biotechnology

Semester 1 15 points

This course highlights how a knowledge of plant development is necessary to drive new applications of plant biotechnology.

Topics covered include the applications of tissue culture and genetic engineering of plants; examination of issues associated with the potential use of genetically modified plants; research advances and applied aspects of plant hormone biology, secondary metabolism, cell wall biology and disease resistance. The laboratories will provide skills used in plant biotechnology research.

P: BIOL 254 or BIOL 253 (=BCHM 253) or BIOL 231 (=BCHM 202)

BIOL 354

Animal Ecophysiology

Semester 2 15 points

This course is designed to help you understand the physiological mechanisms that enable animals to withstand environmental challenges posed by nature and humans. It includes examinations of the adaptations that permit survival of animals in the diverse range of environments they inhabit, and enable them to survive environmental fluctuation. Aspects of human impacts on the environment and their consequences for the animals therein are also addressed (e.g. pollutants, climate change). The approach is comparative, drawing on both vertebrate and invertebrate examples. A major emphasis of the course is on practical learning, with laboratories that provide hands-on experience with a number of physiological techniques, in a diverse group of animals, exposed to a wide range of environmental variables.

P: BIOL 250

BIOL 355

Neurons, Hormones and Behaviour

Semester 1 15 points

Largely through the use of case studies, this course will cover how, and why, nervous systems communicate. Sensory systems imaginable and unimaginable to us will be explored, as well as how learning physically happens. It will also cover the general principles of communication via the endocrine system, hormonal control of basic behaviours, such as feeding, social behaviour and pair bonding. These subjects will be taught with a strong emphasis on their adaptive value to the animal. This course is suited to anyone interested in how different animal minds work, and how these interface with the environment through the sensory and endocrine systems.

P: BIOL 250

RP: BIOL 272

BIOL 371

Evolutionary Ecology

Semester 1 15 points

Evolutionary ecology is the branch of ecology that considers how organisms have evolved to become adapted to their physical environment and interact with members of their own and other species. It has a focus on real time, rapid evolution and thus is particularly relevant to applied problems in human health, agriculture and conservation. In this course we examine selective pressures imposed by the environment and evolutionary response to these pressures. We also explore the reverse- how evolutionary processes affect evolutionary traits- and the feedback loops that ensue. Unifying ideas in this course are evolution within ecological timeframes and evolutionary mechanisms leading to the evolution of new species.

P: BIOL 271

BIOL 375

Freshwater Ecosystems

Semester 2 15 points

This course provides a thorough grounding in the ecology of freshwater ecosystems, including lakes, wetlands and rivers. It covers the most important concepts that underpin our understanding of these systems. Given the imperilled plight of fresh waters around the world, there is also a heavy emphasis on practical applications for solving current problems. A highlight of the course is field work at the University's Cass field station. This field work hones practical skills in association with quantitative state-of-the-environment monitoring and team-based project work. Laboratory sessions prior to the field trip develop basic physical and chemical sampling procedures, as well as macro-invertebrate identification. They are complemented by fish sampling and investigation of the wide range of aquatic systems in the Canterbury High Country around. By combining this practical expertise with detailed knowledge of how freshwater ecosystems work and of the main approaches to managing them, students will be well placed for a diverse range of careers connected to freshwater ecosystems and the resources they provide.

P: BIOL 209, BIOL 274 and BIOL 275

BIOL 377

Global Change and Biosecurity

Semester 1 15 points

A discussion of major concepts in community and ecosystems ecology in the context of anthropogenic changes to the environment and pressure from invasive exotic species. Note: fieldwork is required.

P: BIOL 209 and BIOL 274

BIOL 378

Population Ecology and Conservation

Semester 1 15 points

This course covers advanced concepts in population ecology, particularly those most relevant to the New Zealand region and to the conservation of the New Zealand biota. We cover topics including life histories, species interactions (mutualisms and predation), population modelling, and biological aspects of species conservation. There is a focus on New Zealand's terrestrial forests, birds and mammals (both native and exotic). The course has a strong practical emphasis, with field methods and species identification skills developed through a 3-day residential field trip to Kaikōura and a project write-up based on that, all of which develop skills you would need for work in this area after graduation. The field trip is also a lot of fun in a beautiful patch of native forest.

P: BIOL 209, BIOL 274 and BIOL 275

BIOL 383

Behavioural Ecology

Semester 1 15 points

The development and adaptive significance of behaviour with emphasis on the relationship between ecology and behaviour.

P: BIOL 272 and BIOL 209
RP: BIOL 271

BIOL 384

Marine Ecosystems

Semester 2 15 points

This course advances the concepts of how marine species interact with each other and the environment to form functional populations and communities. The oceans cover 71% of earth's surface and span estuaries, near-shore rocky reefs, deep water benthic communities, and the surface and deeper waters of the open ocean. They are interconnected through ocean currents, tides and an increasingly changing physical environment. This course uses a mixed platform of lectures, tutorials, computer labs and field-based exercises to understand current issues and processes affecting marine ecosystems, with New Zealand and worldwide examples. Students are taught hands-on field sampling techniques for monitoring biodiversity in near-shore marine benthic communities, and give oral presentations and written reports that stress problems, avenues to solutions and results of experimental testing. This course is intended for those interested in a deeper understanding of how marine ecosystems function, and the natural and human-induced changes affecting them. It is particularly useful for those who wish to have a good grounding for applied research and future employment, and who intend to pursue careers involving biodiversity, monitoring, report-writing and oral presentations.

P: BIOL 209, BIOL 221 and BIOL 274

R: BIOL 374

RP: BIOL 212

Key

P: Pre-requisites
RP: Recommended Preparation
R: Restrictions
EQ: Equivalent Course

Akoranga Mātai matū koiora
Biochemistry Courses

BCHM 111 (co-coded as BIOL 111)
Cellular Biology and Biochemistry

Semester 1 15 points

A foundation course that will introduce you to the basic processes of cellular biology. The cell is considered the basic unit of life because every organism whether animal, plant, or micro-organism consists of cells or is itself a single cell. As such the structure and function of the cell impacts on all other levels of life including organisms, ecosystems and the biosphere. For this reason it is essential for all biologists to understand the fundamentals of cell biology. In this course you will learn the basic concepts of cell function and how these are related to cell structure, which is in turn dependent on molecular structure and biochemical interactions between molecules.

R: ENCH 281 and BIOL 111

EQ: BIOL 111

BCHM 112 (co-coded as CHEM 112)
Structure and Reactivity in Chemistry and Biochemistry

Semester 2 15 points

Structure, isomerism, stereochemistry, synthesis, and reaction mechanisms in organic chemistry; transition metal chemistry and electrochemistry.

P: (1) NCEA: at least 14 credits NCEA Level 3 Chemistry, or (2) CIE: at least D grade in CIE AL Chemistry or A grade in CIE ASL Chemistry, or (3) IB: at least Grade 4 in IB HL Chemistry or Grade 6 in IB SL Chemistry, or (4) CHEM 114, or at least B Grade in BRDG 022.

R: CHEM 112

EQ: CHEM 112

BCHM 202 (co-coded as BIOL 231)
Foundations of Molecular Biology

Semester 1 15 points

Molecular biology is the science of how genes work. This understanding underpins the sciences of biochemistry, bioinformatics, evolution, systematics and ecology by both providing tools that are used by these sciences and by explaining how organisms produce the characteristics observed by these other sciences. This course goes will take you from familiarity with the concepts of DNA replication, transcription and translation to a foundation understanding of these reactions in living cells seen through gene regulation. It is intended for anyone who wants to begin to understand how genetics relates to life and seeks skills related to working at the molecular scale. The course is a foundation to further work that involves understanding patterns in DNA, structure and function of proteins, or developing new biotechnologies.

P: BCHM 111 (=BIOL 111) or ENCH 281

RP: CHEM 112 (=BCHM 112) or CHEM 114

R: BIOL 231, ENCH 480

EQ: BIOL 231, ENCH 480

BCHM 206
Organic Chemistry

Semester 2 15 points

The organic chemistry of π-bonded systems; alkenes, alkynes and aromatic compounds. The organic chemistry of carbonyl compounds: aldehydes/ketones and carboxylic acid derivatives; their reactivity, inter-conversions and use for C-C bond forming reactions. An introduction to ring compounds; the special properties of cyclic molecules and how strain affects their reactivity. An introduction to bioorganic chemistry; carbohydrates and the mechanisms of some important enzyme catalysed processes, including the biosynthesis of polyketides and some amino acids.

P: BCHM 212 (=CHEM 212)

R: CHEM 242

EQ: CHEM 242

BCHM 212
Chemical Reactivity

Semester 1 15 points

Structures and properties of organic and biological molecules; application of kinetics and thermodynamics to organic and biochemical reactions; substitution and elimination chemistry; bioinorganic chemistry and electrochemistry.

P: CHEM 112 or ENCH 241

R: CHEM 212

EQ: CHEM 212

BCHM 222
Biochemistry B - Metabolism; the reactions of molecules in cells

Semester 2 15 points

General principles of metabolism, particularly how the pathways are controlled in response to the changing needs within the cell. These general principles will be illustrated by an in-depth look at particular metabolic pathways, especially glycolysis and the Krebs' cycle. Bioenergetics: membranes and energy transduction, the chemiosmotic theory, oxidative phosphorylation and photosynthesis.

P: BCHM 221 or BCHM 253 (=BIOL 253)
R: BCHM 201, ENCH 323

BCHM 253 (co-coded as BIOL 253)
Cell Biology 1

Semester 1 15 points

The course will cover membrane structure, membrane transport of small molecules and the electrical properties of membranes, intracellular compartments and protein sorting, intracellular vesicle transport, aspects of the cytoskeleton, the cell cycle and apoptosis. These topics will give the students a comprehensive grounding in cells as single entities. This will prepare students for an updated 3rd year cell biology course that will consider cells in their social context i.e. how they interact with other cells.

P: BIOL 111 (=BCHM 111) or ENCH 281

RP: 15 pts of CHEM at 100 level

R: BIOL 253

EQ: BIOL 253

BCHM 281
Practical Biochemistry

Semester 2 15 points

Experimental biochemistry, synthetic organic and inorganic chemistry with an emphasis on preparation, separation, isolation, and characterisation techniques that are used in chemistry and biochemistry. Safety and library elements will be integrated into the course, biochemistry and chemistry options will be available.

P: BCHM 112 (=BCHM 112) or CHEM 111 or CHEM 114

R: CHEM 281

BCHM 305
Protein Science

Semester 1 15 points

This course is designed to help you to understand how different proteins function and how biochemists seek to investigate protein structure and function. The course aims to introduce you to modern biochemical ideas and research, and will include a substantial amount of reading from the biochemical literature, as well as from your standard textbook.

P: BCHM 253 (=BIOL 253) and BCHM 222

RP: BCHM 202 (=BIOL 231) and BCHM 206 (=CHEM 242)

BCHM 306

Biochemical Pathology

Semester 2 15 points

This course is designed to help you to understand the biochemistry underpinning disease (e.g. cancer), how diseases are diagnosed using biochemical markers (e.g. heart disease), mechanisms of cell and organ toxicity, and how toxic molecules can be used to our benefit (e.g. in cancer chemotherapy).

P: BCHM 253 (=BIOL 253) and BCHM 222, and 15 points from BCHM 206 (=CHEM 242), BCHM 212 (=CHEM 212)

R: BCHM 301, BCHM 302

RP: BCHM 202 (=BIOL 231)

BCHM 338

Chemical Biology and Protein Chemistry

Semester 1 15 points

This course covers important concepts in chemical biology: the application of chemical techniques, tools, analyses, and synthetic chemicals, to the study and manipulation of the molecular processes taking place within cells.

P: BCHM 212 (=CHEM 212)

R: CHEM 325

BCHM 339

Bioinorganic and Bioorganic Chemistry

Semester 2 15 points

This course covers the chemical principles underlying selected important biological processes. The topics covered will be: bio-inorganic chemistry and electrochemistry; metal ions in biology & toxicology; case-studies in contemporary bio-organic chemistry.

P: BCHM 212 (=CHEM 212)

R: CHEM 325

BCHM 381

Biochemical Techniques

Semester 2 15 points

Biochemical experiments and analysis such as transport kinetics, DNA sequence analysis and manipulation, lipid isolation and characterisation. Safety, bioethical and library elements will be integrated into the coursework.

P: BCHM 281 (=CHEM 281)

Key

P: Pre-requisite
C: Co-requisite
RP: Recommended Preparation
R: Restrictions
EQ: Equivalent Course

Paenga Kura School Facilities

The School of Biological Sciences has modern, well-equipped research laboratories. We have state of the art facilities to allow us to conduct research across a wide range of biological fields.

Ecology laboratories are equipped to measure environmental parameters at the macro and micro levels. They include seawater, Antarctic and freshwater aquaria, as well as environmental chambers with controlled light and temperature. A large microscopy facility is also available for sorting and identifying organisms.

Animal physiological laboratories contain research equipment for neurophysiology, ion and water regulatory physiology, cardiac, respiratory and exercise physiology.

Molecular genetics and molecular biology research laboratories are fully equipped for DNA, RNA and protein analysis, recombinant DNA techniques, real-time PCR and microinjection of macromolecules into cells. We also house the Canterbury Sequencing Facility and Ancient DNA laboratory.

We have a microscopy facility which includes a confocal microscope.

An extensive plant herbarium and insect collection are housed in specialist facilities.

Plant physiology laboratories have research equipment for transgenic plant production, including comprehensive plant growth rooms and greenhouse facilities.

Biochemistry and biotechnology labs house advanced tools for the study of macro-molecular structure and enzyme function.

Microbiology laboratories have equipment to study the genetics, physiology and biochemistry of a diverse range of microbes.

The School has a computational cluster for high performance applications such as bioinformatics and ecological modelling. Researchers can also access time central UC high performance computing facilities.

The modern Biological Sciences facilities.

Undergraduate laboratory classes are in the modern Ernest Rutherford science centre and adjacent West building.

Hannah McKercher (LLB, BSC(Hons)) undertook a PhD in protein biochemistry and was co-supervised by staff at AgReserarch, Lincoln, where she had access to additional specialist equipment.

Whaitua Field Stations

Research activities are greatly assisted by field stations located around the South Island and around the world. The most widely used South Island stations are at Cass and Kaikoura, but additional stations exist at Westport and Mount John in Tekapo. Our extensive global collaborations also allow access to field sites around the world.

Students of BIOL 305 stay at the UC Cass field station and learn practical field taxonomy skills in the surrounding area.

Cass Field Station, Mid Canterbury

Situated at Cass, 105 km west of Christchurch in the mountains of the Waimakariri Basin, the field station has a research laboratory and associated residential facilities for hardy terrestrial and freshwater field workers. The Cass area comprises a wide range of environments – montane grasslands, scrub, riverbed, scree, beech forest, swamp, bog, lake, stream and alpine habitats. Close by, Arthurs Pass and the Craigieburn Range also provide accessible areas from alpine habitats to lowland and montane mixed podocarp-broadleaved forest of Westland.

Kaikōura

A research base is maintained within Kaikōura township to allow students and staff easy access to a range of habitats, from the rocky coastline to the bush clad hillsides. This site is used extensively by researchers conducting marine studies and also bird behaviour researchers.

Mount John, Tekapo

Researchers have access to accommodation facilities at the UC Mount John Observatory in Tekapo. From this location they can conduct research across the Mackenzie Basin. Currently there is a focus on kakī (black stilts), the robust grasshopper and a range of invasive plant species.

Scott Base, Antarctica

In collaboration with Gateway Antarctica, Biological Science staff and students make regular summer visits to the Antarctic to work on mosses, lichens, microbes including algae, soils, fish, birds and seals. These studies can be extended at the University using environment controlled rooms in the Biological Sciences research building.

Ngel Nyaki, Nigeria

This field station is situated on the Mambilla Plateau in Eastern Nigeria, adjacent to the montane forest reserve of Ngel Nyaki. It is available for use by staff and students from UC as well as Nigerian and International Universities. Associate Professor Hazel Chapman leads the Nigerian Montane Forest Project, which is closely associated with this research facility. There are 15 full time research assistants based at the facility allowing for extensive data collection. Find out more at www.canterbury.ac.nz/afromontane/

Rangahau Research

Our internationally recognised School of Biological Sciences is a vibrant research environment with diverse capabilities. We have modern computational facilities and equipment in purpose-built laboratories, including an analytical ultra centrifuge, confocal microscope, and Nuclear Magnetic Resonance (NMR) spectroscopy, while the Cass mountain research field station provides space for ecological and physiological research in real world settings.

Our knowledgeable, friendly and supportive staff have extensive local and international connections and welcome contact from potential students and collaborators.

Our research strengths

While our research topics are broad and varied, we have three areas where we have significant depth and skill. These areas do not have solid boundaries and there is a significant overlap amongst our research staff, with many aligned to multiple areas.

The ecological landscape – from individuals to ecosystems

This ecology focused strength investigates variables such as disturbance, dispersal and climate change across species and landscapes, from local to global, individuals to populations. By understanding the dynamics and drivers of these complex systems we can develop models to help us predict changes and their implications. We have a strong focus on Aotearoa New Zealand but are also research active globally, from volcanoes in Antarctica to montane forests in Africa.

Species diversity and conservation

The isolated islands of Aotearoa New Zealand allowed many species to evolve unique traits and diversity to take advantage of the predator-free habitat. With the hundreds of species introduced since human settlement there is a race to conserve our many endangered species. From analysing genomes to studying behaviour, our local research has relevance to small, isolated and threatened populations all across the planet. This strength has significant synergies with our ecological focused strength – the biological landscape.

Biological structure and activity

From bacteria to humans, cells are made up of millions of molecules such as proteins and sugars. By identifying and characterising these molecules and biomarkers we can better understand how biochemical processes such as metabolism and oxidation lead to growth and repair, or how the loss of regulation can also lead to diseases such as cancer. These molecules and processes can also be harnessed for the development of commercial products such as in the agritech sector to grow new food sources, or in meditech to diagnose disease or develop new treatments.

Biomolecular Interaction Centre

Biomolecular Interaction Centre (BIC)

The Biomolecular Interaction Centre (BIC) is a multi-disciplinary centre dedicated to the study of molecular interactions critical to biological function. Understanding biomolecular interactions is central to a range of fundamental sciences, new treatments for disease, and a wide range of highly functional products.

The Centre was founded in 2007 at the University of Canterbury and includes researchers from the Colleges of Science and Engineering and partners with several New Zealand CRIs, Universities and Callaghan Innovation. In 2010, BIC received a multi-million dollar investment from the University of Canterbury to become one of two new premier research institutes on campus.

BIC has 7 Principal Investigators and more than 30 Partner, Associate and Affiliated Investigators. These investigators are supported by 7 Postdoctoral Fellows and more than 30 Postgraduate students researching biomolecular interactions. The biomolecular flagship projects include investigating protein and peptide surface coatings, protein as building blocks and enzyme evolution and design. Together BIC supports a dynamic research environment for both staff and students.

Tāura Postgraduate

Postgraduate degrees taken by students include a Bachelor of Science (Honours), a Postgraduate Diploma, a Master of Science, or a Doctor of Philosophy.

Any student who wishes to enrol for a research degree should contact an academic staff member of the School for further information and advice. Also visit our website (www.canterbury.ac.nz/science/biology) or contact us for a copy of the *Biological Sciences Postgraduate Handbook*.

An interdisciplinary course, Environmental Science, is also offered at postgraduate level by Biological Sciences and the School of Earth and Environment. Details can be obtained from www.canterbury.ac.nz/study/academic-study/subjects/environmental-science or the Environmental Science Coordinator, earthandenvironment@canterbury.ac.nz.

400-level Biology Courses

Full descriptions on our website

BIOL 411 Research Preparation
BIOL 412 Research Proposal
BIOL 420 Terrestrial Ecology
BIOL 423 Evolutionary Ecology
BIOL 424 Community Ecology
BIOL 425 Freshwater Ecology
BIOL 426 Conservation Biology
BIOL 427 Global Change Biology
BIOL 428 Marine Biology and Ecology
BIOL 429 Conservation Genetics
BIOL 438 Behaviour
BIOL 455 Applied and Molecular Microbiology
BIOL 456 Dynamics of Microbial Interactions
BIOL 457 Macromolecular Evolution & Engineering
BIOL 459 Genomics
BIOL 460 Molecular Biology
BIOL 461 Protein Science
BIOL 462 Medical Biochemistry
BIOL 463 Cell Biology
BIOL 481 Environmental Animal Physiology
BIOL 496 Plant Developmental Biology and Biotechnology

BSc (Hons)

Honours is an intensive one-year programme designed for high achieving students seeking to fast-track to a PhD.

Honours students must take four 400-level courses and a research project.

We recommend this option only for students with an A- average (GPA 7) or higher at 300-level.

PgDipSc

The Postgraduate Diploma of Science is a one-year program equivalent to the first year of an MSc. Students take four 400-level courses, but do not carry out research. *See left column for the list of courses we offer, full course details are on our website.*

The PgDipSc is a great option if you are unsure whether you want to commit to an MSc or if you want to extend your theoretical grounding in biology prior to entering the workforce.

It is common for students enrolled in a PgDipSc to transfer to MSc part II providing they achieve a B average or better in their 400-level courses.

MSc

A Master of Science degree comprises one year of coursework (part I) and a 12 month research project (part II).

The MSc degree provides a solid grounding in the scientific process and provides sought after research skills applicable to a wide range of careers. This degree is also arguably the best route into a PhD because you gain more in-depth research experience than is possible during an Honours degree.

PhD

The PhD at UC is a research degree that typically requires three, but no more than four years of study. It is the highest academic qualification available at the University. Completing a doctorate is a mark of academic achievement and requires self-discipline and commitment.

A PhD prepares you for an academic or research career and the skills you gain are increasingly sought after in the international job market.

Whakapā mai
Contact Information

Please contact us if you have further questions regarding our courses or research, questions for individual staff members can be sent via email using the format firstname.surname@canterbury.ac.nz.

Head of School

Prof Elissa Cameron

Enquiries

Phone: +64 3 369-5200

E-mail: biology@canterbury.ac.nz

Web: ***www.canterbury.ac.nz/science/biology***

Biology Undergraduate Coordinator

Our coordinator can offer advice and help you plan your biology degree

Prof Ashley Garrill
ashley.garrill@canterbury.ac.nz

Biology Postgraduate Coordinators

If you have questions about how to proceed beyond undergraduate onto further degrees and diplomas contact our postgraduate coordinators

Fourth-Year Coordinator
Dr Sara Kross
sara.kross@canterbury.ac.nz

MSc Part 2 Coordinator
Dr Tadeu Siqueira
tadeu.siqueira@canterbury.ac.nz

PhD Coordinator
Prof Hazel Chapman
hazel.chapman@canterbury.ac.nz

Student advisors for future students

Staff in the Future Students Office provide advice to future students who are new to university study, and looking to start the first year of their first degree. They can assist with information on degrees, scholarships, accommodation, and other aspects of university life.
www.canterbury.ac.nz/study/getting-started/future-students-office

New Students

Te Pātaka, the Student Services Hub

Visit the Puaka-James Hight building to get advice and support from your Kaitoko (first year student advisor) at Te Pātaka.
www.canterbury.ac.nz/life/support-and-wellbeing/uc-support-services/student-services-hub

Student Advisors, Faculty of Science

The Science Student Advisors are available to provide accurate and timely academic advice and assistance on course options and/or degree programmes in science subjects.
scienceugadvice@canterbury.ac.nz

University of Canterbury Contact Centre

For more information about study options or an enrolment pack get in touch with the Contact Centre on:

Freephone: 0800 VARSITY (0800 827 748) in NZ

Or phone: +64 3 369 3999

Email: enrol@canterbury.ac.nz

Web: ***www.canterbury.ac.nz***

The School of Biological Sciences is housed in the Julius von Haast building with teaching laboratories in the adjacent Ernest Rutherford and West buildings.

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