Biological Sciences
Postgraduate

BSc(Hons), PGDipSc, MSc, PhD
Biological Sciences, Biochemistry, Biotechnology, Cellular and Molecular Biology, Ecology, Environmental Science, Microbiology
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Welcome to Biology at UC

The School of Biological Sciences is a research-focused centre covering all areas of Biology. We are one of the leading biological research schools in Australasia, and many of our staff have strong international research profiles.

Our postgraduate degrees help prepare you for a career in biology across a wide range of areas. You will find our courses exciting, challenging, and at the cutting edge. We have a large cohort of new staff, including four Rutherford Discovery Fellows, who bring new ideas and enthusiasm to the School.

Our staff are actively engaged in research, ensuring your projects are relevant and employ the latest methods. We have emerging and established strengths across a wide range of areas including Genetics, Evolution, Ecology, Biochemistry, Microbiology, Bioinformatics, Plant Science and Cell Biology.

The School of Biological Sciences has the best field station facilities in the country, a modern state-of-the-art research building, and our postgraduate courses are taught by leading national and visiting international researchers. Several of our staff have received Tertiary Teaching Excellence Awards.

This booklet is designed to help you plan your course of postgraduate study in Biology. We look forward to welcoming you into our postgraduate programme.

‘I really love the atmosphere, when I’m on campus I feel like I’m at home. Every day I appreciate how beautiful the surroundings are.’

Bonnie Humphrey
Te Āti Awa

Bachelor of Science in Biological Sciences and Psychology
Studying towards a Master of Science in Biological Sciences
Our postgraduate program is designed to build upon your basic undergraduate training and to give you recognisable practical skills in research science. Our graduates gain 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.

‘I enjoy getting outside to learn and become familiar with the environment...’

Ani had completed studies in Zoology, Māori Studies, and Marine Science before coming to UC to begin her PhD in Environmental Science.

‘I wanted to further my research skills in shellfisheries function, to understand local management, and to gain experience in contaminant research relating to estuarine and coastal systems.’

‘The Ngāi Tahu Research Centre and the School of Biology were supportive of my research scope. They are specialists in Ngāi Tahu Mahinga Kai – culturally important practices and harvest of food and habitats, and eco-toxicological research.’

As a Ngāi Tahu Research Centre student, Ani had the opportunity to do her research on an international scale. She has taken part in the First Nations’ Futures Programme at Stanford University in California, USA, which focused on developing leadership skills for work within the community.

‘This experience enriched my development as a person, an academic, and as a role model,’ she says.

Ani Kainamu (Ngāpuhi)
Studying towards a PhD in Environmental Science

‘Biochemistry has a pleasant mix of molecular biology and chemistry that lets me satisfy my curiosity...’

The chemical properties of the health-boosting enzymes found in the humble kiwifruit are the focus of Eric’s Master of Science thesis.

‘I am researching the stability and structure of various bioactive proteins and how different chemical and physical environments might affect their activity,’ he explains. ‘I have been analysing the product processing line to see if optimisation may be accessible which could increase the amount of active enzymes present in the exported product.’

Eric’s project is a collaboration with a biotechnology company with interests in the lucrative ‘neutraceuticals’ industry. Thanks to a Callaghan Innovation scholarship, he is working in the labs of UC’s Biomolecular Interaction Centre (BIC) which fosters partnerships between academic research and industry.

Eric says the real-world uses for such research make it a fascinating area to work in.

Eric Richards
Recently completed an MSc in Biological Sciences

‘I hope that my work will aid future conservation.’

Out of high school, Rachel was offered entrance into the Chemistry Honours Program at UC but didn’t want to give up biology. So in 2009, with interests in genetics, evolutionary ecology and biochemistry, she graduated with a BSc in Biological Sciences. Rachel was awarded a Scholarship from UC, and is currently working on the population genetics of the rare Banks Peninsula tree weta (Hemideina ricta).

Her study aims to determine whether this species is at risk of going extinct from hybridisation with the more common Canterbury tree weta (Hemideina femorata).

This research will also ascertain how the remaining H. ricta populations are connected across fragmented habitat.

Rachel van Heugten
Recently completed an PhD in Biological Sciences
Shelley McMurtrie
1996 BSc
2001 MSc

Sara started the ‘Falcon Ambassadors’ programme in New Zealand schools.

As a conservation biologist, Sara is interested in farming landscapes and human-wildlife conflicts and was also a founding member of the Marlborough Falcon Conservation Trust. Her PhD research at UC focused on the efficacy of reintroducing the threatened New Zealand falcon (*Falco novaeseelandiae*) into the vineyards of Marlborough, New Zealand’s largest wine region, as both a conservation scheme and as a source of natural pest control. The research combined behavioural ecology, ornithology, and conservation biology to examine the changes that occurred in the falcons themselves and in the vineyard ecosystems.

Sara has recently taken up a position at California State University, Sacramento following her role as a Post-doctoral Research Scholar at the University of California Davis where she constructed predator-prey models to determine whether barn owls are able to control rodent pests on Californian farms.

Prior to this Sara was a 2013 David H. Smith Conservation Research Post-doctoral Fellow at the University of California Davis and The Nature Conservancy.

Sara believes that outreach is one of the most rewarding parts of doing research, and views it as an important component of her commitment to conservation.

Dr Sara Kross
2012 PhD

Hugh Wilson
1971 BSc

Hugh’s dream of returning Hinewai to native bush has been his on-going passion for nearly 30 years.

Hugh is a world-renowned botanist, conservationist and cyclist.

At the age of 5 Hugh began drawing birds and dreaming of the bush. Following school Hugh taught in Sarawak with Volunteer Service Abroad before returning to Christchurch to attend UC, where he completed degrees in both arts and science.

Hugh then conducted botanical surveys of the Aoraki Mount Cook region and then of Stewart Island / Rakiura, and then. This was followed in 1980s by a five year botanical survey of Banks Peninsula.

Since 1987 Hugh has managed Hinewai Reserve on Banks Peninsula, a privately owned nature reserve. Hugh has written and illustrated over a dozen books, including the richly illustrated Plant Life on Banks Peninsula.

He was awarded the Loder Cup in 1987 for his work with New Zealand flora, followed in 1991 by the Linnaean Society of London Bloomer Medal for his contribution to botany. He is a research fellow of the Koiata Botanical Trust and Landcare Research - Manaaki Whenua, and a director of the Banks Peninsula Track Company.

Hugh Wilson
1971 BSc

Shelley McMurtrie
1996 BSc
2001 MSc

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 estuarial 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

Inspirational Alumni
See more at www.biol.canterbury.ac.nz/inspire/
Postgraduate Degrees

At the School of Biological Sciences we offer several postgraduate degree paths:

- Bachelor of Science (Honours) – BSc(Hons)
- Postgraduate Diploma of Science – PgDipSc
- Master of Science – MSc
- Doctor of Philosophy – PhD

Applying for Postgrad studies – what to do first

1. Contact the Fourth Year Course Advisor to discuss your course of study and proposed major.
   See page 9 for a list of majors.
2. Apply to enrol online (current UC students). Students new to UC should consult the Future Students webpage: www.canterbury.ac.nz/future-students/
3. Monitor your email over summer as the Course Advisor may need to contact you.
4. Once you have been approved for entry you will receive a letter of offer and fees invoice.

More information is available on the Biological Sciences and UC postgraduate websites:
- www.canterbury.ac.nz
- www.canterbury.ac.nz/postgraduate/
- www.canterbury.ac.nz/publications/postgrad.shtml

PgDipSc

The Postgraduate Diploma of Science is a one-year program equivalent to the first year of an MSc. Students take eight 400-level courses, including BIOL411 (Research Preparation) and BIOL412 (Research Proposal), but do not carry out research. See page 11 for the list of courses we offer.

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.

Entry Requirements

Normally a B- average (GPA 4) for your 300-level science courses.

- All papers must be passed at the first attempt but if no more than one paper is failed, a pass in the year as a whole may be recommended, provided that a B- (GPA 4) is attained including the failed course. However it should be noted that normally a B- would be insufficient to allow progress from PgDipSc to MSc part II.

Things you need to know

- To transfer to MSc part II you need to obtain a B average (GPA 5) across your 400-level courses.
- If you are awarded a PgDipSc then your MSc result is determined on thesis only and you are not eligible for MSc with Honours. However, you can still be awarded an MSc with Merit/Distinction.
- Your MSc research outline forms part of the assessment of BIOL 411 and is due in late April. This brief statement tells us that you are intending on doing an MSc research project, that you have spoken to a prospective supervisor, that they have agreed to take you on as a student and that you have a provisional topic. This topic might change later.
- Your MSc Thesis Proposal forms part of the assessment for BIOL 412 and is due in late September. This is a more detailed document outlining the main aims and methods of your proposed research and contains details on what permits, equipment and funding you might need.

Both of these documents need to be signed by your potential supervisor and submitted to the School office.

Transferring from a PgDipSc to MSc part II

If you are interested in progressing into MSc part II you need to decide on a research project and complete a research outline and proposal (see below). Don’t wait until you receive your grades before organising a project and supervisor.

Things you need to know

- To transfer to MSc part II you need to obtain a B average (GPA 5) across your 400-level courses.
- If you are awarded a PgDipSc then your MSc result is determined on thesis only and you are not eligible for MSc with Honours. However, you can still be awarded an MSc with Merit/Distinction.
- Your MSc research outline forms part of the assessment of BIOL 411 and is due in late April. This brief statement tells us that you are intending on doing an MSc research project, that you have spoken to a prospective supervisor, that they have agreed to take you on as a student and that you have a provisional topic. This topic might change later.
- Your MSc Thesis Proposal forms part of the assessment for BIOL 412 and is due in late September. This is a more detailed document outlining the main aims and methods of your proposed research and contains details on what permits, equipment and funding you might need.

Both of these documents need to be signed by your potential supervisor and submitted to the School office.
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.

Entry Requirements
MSc part I: B average (GPA 5) in 200- and 300-level science courses.
MSc part II: B average (GPA 5) across your 400-level courses and an accepted research proposal.

Things you need to know
• You must enrol and pay fees in February every year of your degree.
• You must include BIOL 411 (Research Preparation) and BIOL 412 (Research Proposal) as two of your 4th year courses.
• All papers must be passed at the first attempt but if no more than one paper is failed, a pass in the year as a whole may be recommended, provided that a B- average (GPA 4) is attained including the failed course. However it should be noted that normally a B- would be insufficient to allow progress from MSc part I to MSc part II. If your grades are not sufficient for progress to MSc part II, but you have passed MSc part I, you will be awarded a PgDipSc.
• Your MSc Research Outline forms part of the assessment for BIOL 411 and is due in late April. This brief statement tells us that you are intending on doing an MSc research project, that you have spoken to a prospective supervisor, that they have agreed to take you on as a student and that you have a provisional topic. This topic might change later.
• Your MSc Thesis Proposal forms part of the assessment for BIOL 412 and is due in late September.
This is a more detailed document outlining the main aims and methods of your proposed research and contains details on what permits, equipment and funding you might need.
Both of these documents need to be signed by your potential supervisor and submitted to the School office.

MSc Part II
• Commencement date for MSc part II is 1st March. However, preliminary work can be started earlier (e.g., summer fieldwork) and so we encourage students to enrol in BIOL 401/402 (summer research courses) prior to the start of MSc part II.
• A progress report must be submitted every 6 months.
• You must complete your thesis in 12 months to be eligible to graduate with honours.
• Part-time study because of employment, family, health or other reasons may be possible but is not automatic, you need to apply to the Dean of Science.
• If you take a break between Part I & Part II and enrolment is not completed by March 1st or August 1st then a start date must be registered.
• In exceptional circumstances it may be possible to complete Parts I and II concurrently. For more information contact the 4th Year Course Advisor.

How is my grade calculated?
Your thesis will be marked by two examiners, one external to the University and one examiner from within the University. Members of your supervisory team cannot be examiners. If you completed MSc part I then your final grade is calculated on a ratio of 2:3 (coursework:thesis). Grades are calculated on your GPA.
In the School of Biological Sciences you may be eligible for an MSc with honours. Your final thesis GPA grade (i.e., including your thesis and course grades) is converted as below:

<table>
<thead>
<tr>
<th>Class</th>
<th>Letter Grade</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Class</td>
<td>A, A, A+</td>
<td>7–9</td>
</tr>
<tr>
<td>2nd Class Div 1</td>
<td>B+</td>
<td>6</td>
</tr>
<tr>
<td>2nd Class Div 2</td>
<td>B, B</td>
<td>4–5</td>
</tr>
<tr>
<td>Masters</td>
<td>C+</td>
<td>3</td>
</tr>
<tr>
<td>PGDipSc</td>
<td>&lt;2</td>
<td></td>
</tr>
</tbody>
</table>

MSc part II by thesis only
Marking is as above but your final grade is based solely on your thesis.

<table>
<thead>
<tr>
<th>Class</th>
<th>Letter Grade</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinction</td>
<td>A, A, A+</td>
<td>7–9</td>
</tr>
<tr>
<td>Merit</td>
<td>B+</td>
<td>6</td>
</tr>
</tbody>
</table>
**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 eight 400-level courses, including BIOL 411 (Research Preparation) and BIOL 412 (Research Proposal), and a research project.

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

**Entry Requirements**

B+ average (GPA 6) for 200- & 300- level science courses and an accepted research proposal

**Things you need to know**

- The research project is worth 30 points (20% of your Honours year grade).
- You must pass all your courses (including the project) on the first attempt.
- Your Honours thesis is due on November 1st. Exceptions may apply if you are taking courses outside of Biology.
- You should be contacting prospective supervisors by July or August of the year before your honours year officially starts.

**How is my grade calculated**

<table>
<thead>
<tr>
<th>Class</th>
<th>Letter Grade</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>A-, A, A+</td>
<td>7–9</td>
</tr>
<tr>
<td>2nd Div 1</td>
<td>B+</td>
<td>6</td>
</tr>
<tr>
<td>2nd Div 2</td>
<td>B-, B</td>
<td>4–5</td>
</tr>
<tr>
<td>3rd</td>
<td>C+</td>
<td>3</td>
</tr>
</tbody>
</table>

**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.

**Entry Requirement**

BSc (Hons) or MSc with a B+ average (GPA 6).

**Things you need to know**

- Entry is competitive and grades do not guarantee acceptance into the degree programme.
- UC and external doctoral scholarships are available for domestic and international students. For more information see the UC scholarships webpage: [http://www.canterbury.ac.nz/future-students/fees-and-funding/scholarships-at-uc/](http://www.canterbury.ac.nz/future-students/fees-and-funding/scholarships-at-uc/)
- You need to arrange a supervisor and decide on a research project (see Choosing a Research Topic page 13).
- A detailed research proposal must be submitted and accepted within six months of beginning your PhD. You should aim to submit your proposal well before the 6 month deadline.
- After 12 months there will be a PhD progression review where we will confirm that you are capable of undertaking a PhD, that you understand the science behind the project and that you have begun to make significant progress towards your PhD.
- You need to enrol and pay fees in February every year of your thesis.
- Progress reports are due every 6 months (usually April and October).
- Part-time candidates must normally complete their thesis within seven years.

**Research Proposal**

A research proposal is a detailed document that describes the questions your intended research project will address, how you will address them, and why answering these questions is scientifically important.

Your proposal will be assessed by our postgraduate studies committee to ensure you have a suitable project for your degree before you start your research.

Make sure you start writing your proposal well before its due date, allowing time for your supervisors to comment on one or two drafts. It is not unusual for your proposal to go back to your supervisors several times before it is polished enough to hand in to the postgraduate studies committee.

**Grade Point Average (GPA)**

GPAs are rated as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>GPA</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>9</td>
<td>89.5+</td>
</tr>
<tr>
<td>A</td>
<td>8</td>
<td>84.5–89.4</td>
</tr>
<tr>
<td>A-</td>
<td>7</td>
<td>79.5–84.4</td>
</tr>
<tr>
<td>B+</td>
<td>6</td>
<td>74.5–79.4</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>69.5–74.4</td>
</tr>
<tr>
<td>B-</td>
<td>4</td>
<td>64.5–69.4</td>
</tr>
<tr>
<td>C+</td>
<td>3</td>
<td>59.5–64.4</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>54.5–59.4</td>
</tr>
<tr>
<td>C-</td>
<td>1</td>
<td>49.5–54.4</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
<td>39.5–49.4</td>
</tr>
<tr>
<td>E</td>
<td>-1</td>
<td>&lt;39.5</td>
</tr>
</tbody>
</table>
Postgraduate study in Biological Sciences is organised into a number of subject majors and you should identify one of these (and discuss your choice with the Fourth-Year Advisor) before you enrol. If you are studying for a BSc (Hons), PG DipSc or MSc you will need to take eight courses in your first year, including the compulsory courses BIOL 411 (Research Preparation) and BIOL 412 (Research Proposal).

Some majors are quite flexible with regard to course choice, while others have distinct requirements and these are listed below. Prerequisites (P) are also shown.

Short descriptions of the courses are given on page 11, full details are on our website.

To ensure you have an appropriate combination of courses you should discuss your choices with the Fourth Year Advisor.

<table>
<thead>
<tr>
<th>Undergraduate Pathway</th>
<th>Postgraduate Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Science Background</td>
<td>Biological Sciences or Environmental Science</td>
</tr>
<tr>
<td>Animal Behaviour</td>
<td>Ecology or Biological Sciences</td>
</tr>
<tr>
<td>Animal Physiology</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>Biotechnology or Cellular &amp; Molecular Biology or Microbiology</td>
</tr>
<tr>
<td>Biosecurity</td>
<td>Biological Sciences or Ecology</td>
</tr>
<tr>
<td>Cell Biology</td>
<td>Cellular &amp; Molecular Biology</td>
</tr>
<tr>
<td>Ecology</td>
<td>Ecology</td>
</tr>
<tr>
<td>Environmental Science</td>
<td>Environmental Science</td>
</tr>
<tr>
<td>Evolutionary Biology</td>
<td>Biological Sciences or Ecology</td>
</tr>
<tr>
<td>Genetics</td>
<td>Cellular &amp; Molecular Biology or Biological Sciences</td>
</tr>
<tr>
<td>Marine Biology</td>
<td>Biological Sciences or Ecology</td>
</tr>
<tr>
<td>Microbiology</td>
<td>Microbiology</td>
</tr>
<tr>
<td>Plant Biology</td>
<td>Biotechnology or Biological Sciences or Ecology</td>
</tr>
</tbody>
</table>

‘Studying in Christchurch, we are right on the doorstep of some of New Zealand’s most amazing wilderness.’

Steve Pohe
Ngāti Hine
Studying towards a PhD in Ecology
Biochemistry
UC offers a full programme of biochemistry, integrated into the Department of Chemistry and the School of Biological Sciences.
Courses totalling at least 1.0 EFTS as approved by the Director of Biochemistry. Students need to include either BIOL411 and BIOL412 or CHEM421, plus 90 points from BCHM 455 (BCHM455), BCHM 456 (BCHM456), BCHM 457 (BCHM457), BCHM462 (BCHM462), BCHM 461 (BCHM461), BCHM 460 (BCHM 460), BCHM 459 (BCHM 459), BCHM 420, and CHEM 422. Other suitable courses include: BCHM 407–409, BIOL 429–463, BIOL 481, BIOL 496.
P: 90 points in 300-level courses: 75 points from BCHM 301 (BIOL 331), BCHM 302 (CHEM 320) and BCHM 381; and additional points from CHEM 321, CHEM 322, CHEM 324, CHEM 362, CHEM 381, BIOL 313, BIOL 320, BIOL 333, BIOL 335, BIOL 351 or BIOL 352.

Biological Sciences
This is a broad major designed for students wishing to focus on any aspect of biological sciences or on projects which are interdisciplinary or span more than one sub-discipline in biology. It provides students with a suitable pathway for broad, interdisciplinary careers in biology, and fits well with the School of Biological Sciences’ philosophy of embracing modern trends in scientific endeavour.

Courses totalling at least 1.0 EFTS including BIOL 411 and BIOL 412. At least 0.5 EFTS are to be selected from other BIOL 400-level courses. The remaining courses may be selected with the approval of the School of Biological Sciences Fourth Year Coordinator.
P: (i) 60 points from 300-level BIOL courses (ii) BIOL 309 or equivalent (e.g. GEOG 309 or STAT 201 or STAT 202 or STAT 319).

Biotechnology
This is an applied subject major encompassing work on plants and their uses in biotechnology. Courses totalling at least 120 points including BIOL 411, BIOL 412 and BIOL 496. At least 45 points are to be selected from BIOL 429, BIOL 455–457 (BCHM 455–457), BIOL 459–463 (BCHM 459–462). The remaining courses may be selected with the approval of the School of Biological Sciences Fourth Year Coordinator.
P: At least 60 points from BCHM 301, BIOL 313, BIOL 331, BIOL 333, BIOL 334, BIOL 335, BIOL 351, BIOL 352 or appropriate advanced level courses in biochemistry and the molecular biosciences.
Note: students are normally expected to have taken BIOL 309.

Cellular and Molecular Biology
Cellular and Molecular Biology and Genetics are strongly represented at UC. This area overlaps with other majors such as Biochemistry, Microbiology, Physiology, and increasingly, Ecology and Environmental Science.

Courses totalling at least 1.0 EFTS including BIOL 411 and BIOL 412. At least 0.25 EFTS to be selected from BIOL 455–463 (BCHM 455–462) and BIOL 496. The remaining courses may be selected with the approval of the School of Biological Sciences Fourth Year Coordinator.
P: Three courses from BCHM 301, BIOL 313, BIOL 330, BIOL 333, BIOL 335, BIOL 331, BIOL 351, BIOL 352.
Note: students are normally expected to have taken BIOL 309.

Ecology
Our Ecology major is designed for students wishing to focus on any combination of ecology, behaviour or evolutionary biology with an emphasis on field research.

Courses totalling at least 1.0 EFTS including BIOL 411 and BIOL 412. Additional courses are to be selected, with the approval of the School of Biological Sciences Fourth Year Coordinator, from BIOL 420, BIOL 423–429, BIOL438, ENVR 410, ENVR 411, and FORE 416.
P: (i) 60 points from BIOL 370–384; and (ii) BIOL 309 or BIOL 301 or equivalent (e.g. GEOG 309 or PSYC 206).

Environmental Science
Environmental Science is a multidisciplinary major encompassing many departments across the campus. Its aim is to equip students with an understanding of environmental science, its application and use as a management tool. Students planning on completing a research project based in the School of Biological Sciences must include BIOL411 and BIOL412 in their 4th year courses.
P: 90 points in appropriate 300-level courses in Science, Engineering and Forestry approved by the Environmental Sciences Coordinator.

Microbiology
This is a broad major, covering bacteria, archaea, eukaryotic microbes and viruses, and environmental, evolutionary and molecular microbiology.

Part 1: Courses totalling at least 1.0 EFTS including BIOL 411, BIOL 412, BIOL455 / BCHM 455 and BIOL 456 / BCHM 456. At least 0.25 EFTS are to be selected from BIOL 457 / BCHM 457, BIOL 459 / BCHM 459, BIOL 460 / BCHM 460, BIOL 463 and BIOL 496. Additional courses may be selected with the approval of the School of Biological Sciences Fourth Year Coordinator.
P: (1) BIOL 331, and (2) one course selected from BIOL 331, BCHM 301, BIOL 330, BIOL 333, BIOL 335.

Note: students are normally expected to have taken BIOL 309.
Course Descriptions

For full details of our courses contact our course coordinators.
All courses listed below are 15 points each.
Note: If too few students enrol in a course it may not be run.

**Semester 1**

**BIOL 411**

**Research Preparation**

Coordinator: Dr Elissa Cameron

The general aim of the course is to prepare postgraduate students to engage in research – it has been designed for BSc(Hons), MSc PtI and PGDipSci students as a compulsory component of the 4th year postgraduate experience. It will comprise a series of modules in contemporary research methodology in the biological sciences, such as research and professional scientific communication skills (including written, visual and oral communication); self-directed inquiry and problem solving skills; critical analysis and research design and planning; scientific career development. The skills developed in this course will serve students progressing to research projects (through BIOL 412 and MSc PtI) and those students who decide to pursue other careers.

Recommended preparatory course(s): none.

**BIOL 425**

**Freshwater Ecology**

Coordinator: Prof Angus McIntosh

The aim of this course is to give students an understanding of current issues in freshwater ecology with particular reference to ecological theory, and the application of research to management and conservation issues in New Zealand. An additional goal is to equip students with the skills needed by professionals working in freshwater-related areas of research, consultancy, and management.

Recommended preparatory course(s): BIOL 375.

**BIOL 427**

**Global Change Biology**

Coordinator: Prof Matthew Turnbull

This course will address selected major issues concerning the role of biological processes in the Earth System and the impact on these of human activities (global change). Discussion will include carbon and nutrient cycling in terrestrial and marine ecosystems, the impacts of past and future climate change on biota, the significance of biodiversity loss on ecosystem processes and strategies to mitigate climate change.

Recommended preparatory course(s): More than one of BIOL 214, BIOL 252, BIOL 374, BIOL 377, BIOL 378 or BIOL 384.

**BIOL 428**

**Marine Biology and Ecology**

Coordinator: Prof Islay Marsden

This course focuses on current issues in marine biology and ecology. It includes critical assessment of experimental approaches, ecological and physiological processes affecting the structure of marine communities and the application of research to current issues.

Recommended preparatory course(s): BIOL 270 or BIOL 250.

**BIOL 429**

**Conservation Genetics**

Coordinator: Dr Tammy Steeves

This course addresses contemporary issues in conservation genetics including the genetic consequences of small population size, the genetic consequences of hybridisation and introgression, the role of genetics in species recovery, and the genetic management of captive and wild populations in collaboration with diverse end-users.

Recommended preparatory course(s): BIOL 330 or BIOL 332 or BIOL 334.

**BIOL 438**

**Behaviour**

Coordinator: Prof Jim Briskie

Current topics in the study of animal behaviour with an emphasis on empirical tests of theoretical issues. Topics vary from year to year but include sexual selection, foraging strategies, parental care and parasitism, problem solving and animal cognition.

**BIOL 455 / BCHM 455**

**Applied and Molecular Microbiology**

Coordinator: Prof Jack Heinemann

This course emphasises the study and use of microbes in multiple contexts, including for industrial microbiology, medicine, environment and genomics. The course can cover all kinds of microbes both cellular and viral. The course is structured to have a large hands-on practical component covering topics in molecular microbiology.

Recommended preparatory course(s): at least one of BIOL 313, BIOL 333, BCHM 301 / BIOL 331. In S1. In addition, one from the following is highly recommended: BIOL 313 or BIOL 333 (or equivalent, as determined by course coordinator).

**BIOL 460 / BCHM 460**

**Molecular Biology**

Coordinator: Dr Pieter Pelser

Molecular biology comprises a suite of tools and approaches for understanding the structure and function of DNA, RNA and proteins. The primary goal of this course is to assist the development of scholars with advanced technical skills in molecular biology, who can then use these tools to infer evolutionary and functional relationships.

Recommended preparatory course(s): Any of BIOL 333, BIOL 334, BCHM 301 / BIOL 331, BIOL 335.

**BIOL 461 / BCHM 461**

**Protein Science**

Coordinator: Dr Grant Pearce

The general aim of the course is to introduce students to some of the different techniques used in protein science, and how these are applied to contemporary protein issues. Students will master methods used for studying proteins. They will also be able to use and understand primary scientific publications, and have the ability to independently plan, carry out and critically evaluate experiments. Proteins play an essential role in life, acting as catalysts to speed up chemical reactions, scaffolds that determine cell shape, or signalling molecules that regulate development and responses. In this course we will take an in depth look at the structure and
function of proteins, with an emphasis on how understanding the fundamental biochemistry of proteins opens up exciting areas of research. We will explore the methodology used in studying enzymes and the ability to analyse and critically interpret experimental data. The aim is to build a sound understanding of contemporary protein science and an ability to think critically about the current research literature in the field. We will cover a range of issues including protein purification, folding, and aggregation; and the structure, function and evolution of proteins. Recommended preparatory course(s): BIOL 331 / BCHM 301.

BIOL 463  
**Cell Biology**  
Coordinator: Assoc Prof Ashley Garrill

A critical examination of recent advances in cell biology with emphasis on cell signalling, the cytoskeleton, cell junctions and the nucleus. The focus ranges from fundamental cellular and molecular biology to consideration of cellular mechanisms within the context of physiological or pathological processes. During the course our aim is to encourage and provide advice and feedback to enable you to develop skills in written and oral communication, and in the efficient acquisition of scientific information. The course will involve group discussion, presentation of scientific papers, and preparation and critique of a review article.

Recommended preparatory course(s): BIOL 351 or BIOL 331 / BCHM 301.

**Semester 2**

### BIOL 412  
**Research Proposal**

**Coordinator:** Prof Matthew Turnbull

The general aim of the course is to prepare postgraduate students to engage in research through the development of a detailed research proposal – it has been designed for BSc (Hons), MSc Ptl and PGDipSci students as a compulsory component of the 4th year postgraduate experience. It comprises a series of modules in contemporary research methodology and proposal preparation and time to engage with potential supervisors to discuss project ideas. The skills and perspectives developed in this course will serve students progressing to research projects (in BSc Hons and MSc Ptl) and those students who decide to pursue other careers.

Recommended preparatory course(s): BIOL 411. For those students who begin 4th year in the middle of the year, BIOL 411 and BIOL 412 must be completed in Semester 1 of the following year.

### BIOL 420  
**Terrestrial Ecology**

**Coordinator:** Prof Dave Kelly

This course covers current advances in terrestrial ecology with a focus on population and species ecology. It covers species interactions, such as herbivory, pollination, seed dispersal, and epidemics. Examples concentrate on interactions among vascular plants (trees and shrubs), vertebrate and invertebrate animals, and pathogens, and interactions of those species with the physical environment.

Recommended preparatory course(s): BIOL 351 or BIOL 331 / BCHM 301.

### BIOL 423  
**Evolutionary Ecology**

**Coordinator:** Assoc Prof Hazel Chapman

This course is at the interface of ecology and evolution. It focuses on interactions within and among species and how these interactions affect the evolution of populations and through that, ecological processes. It explores how a combination of molecular, experimental and ecological approaches can be used to investigate how such interactions influence the distribution and abundance of organisms. Key themes include natural selection and adaptation, phenotypic plasticity/epigenetics, breeding systems, mutualisms and coevolutionary dynamics. It will be useful for those with interest in conservation, biodiversity, invasion biology and global change.

Recommended preparatory course(s): BIOL 377, BIOL 378 or BIOL 371.

### BIOL 424  
**Community Ecology**

**Coordinator:** Prof Jason Tylianakis

The aim of this course is to investigate fundamental aspects of community ecology— the study of interactions between two or more species and their consequences. The course will be of value to anyone interested in biodiversity, global environmental change, and ecological theory. Major themes include food web ecology, metacommunities, determinants of community structure, community assembly, species interactions in diverse assemblages, and threats to biodiversity. Given the strong conceptual basis of the course material, we will often present topics via a mix of both theoretical (modelling) and empirical research when possible. Although a strong background in mathematics isn’t required, we do expect that you will make an earnest effort to dissect equations and models and be able to explain what they show in plain English.

Recommended preparatory course(s): BIOL 377, BIOL 378 or BIOL 375.

### BIOL 426  
**Conservation Biology**

**Coordinator:** Prof Dave Kelly

This course covers aspects of biology that are useful in applied conservation situations. In other words, how can ecologists help to preserve biodiversity? Topics covered include: what is rarity; extinction rates past and present; limiting factors in endangered species management; adaptive management of NZ species; reserve design in theory and practice; conservation and climate change. This course complements BIOL429 which looks at conservation genetics.

Recommended preparatory course(s): BIOL 374, BIOL 375, BIOL 377, BIOL 378, BIOL 379 or BIOL 384.
BIOL 456 / BCHM 456
Evolution and Dynamics of Biological Interactions
Coordinator: Prof Jack Heinemann
This course is on the evolution and dynamics of biological interactions with an emphasis on molecular plant-microbial interactions. It will teach skills in molecular systematics and microbial evolution, and use an eco-evolutionary approach to understanding the development of pathological or beneficial consortia with a plant centre. Students will apply these skills and knowledge to develop their understanding of the evolution of interactions between plants, microbes and the environment at the levels of molecules, organisms and species.
Recommended preparatory course(s): at least one of BIOL 333, BIOL 313, BIOL 334, BIOL 335, and/or BCHM 301 (BIOL 333). However, the course will accommodate other backgrounds.

BIOL 457 / BCHM 457
Macromolecular Evolution & Engineering
Coordinator: Assoc Prof Ren Dobson
In this course we will examine how (and why) nature has evolved its repertoire of biological macromolecules (DNA, RNA, and proteins) to perform the functions of life. The last 50 years has seen an explosion in our knowledge of how these macromolecules function. Importantly, we are now able to design and build our own macromolecules for bespoke purposes, for example enzymes to access to new synthetic methods, proteins as biosensors, and the design and engineering of new biosynthetic pathways in cells to produce biofuels. Thus, in parallel to learning how nature has evolved its macromolecule repertoire, we will also explore how we design new macromolecules; that is, synthetic biology.
Recommended preparatory course(s): BIOL 331/ BCHM 301 and/or BIOL 461 / BCHM 461, which is designed to be a compatible course run in S1. In addition, one from the following is highly recommended: BIOL 313 or BIOL 333 (or equivalent, as determined by course coordinator).

BIOL 459 / BCHM 459
Genomics
Coordinator: Dr Amy Osborne
Genomics is an integrally important part of biology. Through the sequencing, characterisation, and study of DNA, it is now possible to decode the complete genetic complement of any organism. Genome science is revolutionising almost all fields of biological enquiry. In this course we will look at the genomic technologies that are transforming biology, the biological and evolutionary insights arising from genome research, and the process of genome sequencing, from start to finish. You will learn about genome sequencing, annotation and the analysis of genomes using experimental and bioinformatics tools.
Recommended preparatory course(s): Any of BIOL 333, 333, 334, 335 or 300-level BCHM.

BIOL 462 / BCHM 462
Medical Biochemistry
Coordinator: Assoc Prof Steven Gieseg
This course will examine broad topics of medical interest where biochemical techniques have been used to examine the basis of human pathological process. The topics may include cholesterol accumulation and cell death in cardiovascular disease, immune treatment of cancer and the effect of exercise on the human body. The course will examine and critically evaluate the research literature and evaluation of competing theories on the mechanism of selected disease pathologies. Participants will critically assess selected research publications and present the work in a series of seminars on each topic for discussion.
Recommended preparatory course(s): BIOL 331/ BCHM 301 or BIOL 351 or BIOL 463.

BIOL 481
Environmental Animal Physiology
Coordinator: Prof Bill Davison
Physiological adaptations that allow animal life to survive in diverse environments. The course will look at the strengths and weaknesses of the comparative approach and its relationship to phylogeny. Topics that may be addressed include osmoregulatory physiology and water balance, thermoregulation, metabolic rates, exercise and cardiovascular physiology.
Recommended preparatory course(s): BIOL 354.
Choosing a Research Topic

Research is a central part of the postgraduate experience. It can be very rewarding, but also requires good time management skills and a high level of engagement.

If you are planning to enrol in BSc (Hons), MSc or PhD, your degree will involve a significant research component. The following tips are designed to help you get started on choosing a research topic and supervisor.

**Tip # 1 - Start looking early**
Choosing a topic requires careful thought, so begin the process as soon as you can. Bear in mind, supervisors can only take on a finite number of students so if you want to work with a particular person, approach them early.

**BSc (Hons)**
You should be thinking about your research project in July or August, the year before your course officially starts. Your enrolment into BSc (Hons) will not be approved until you have advised the 4th year Course Advisor of your research project and supervisor. Most students doing field work will need to have finalised plans before the start of the field season in November, and may need to start their field work over the summer before 4th year officially starts.

**MSc**
Research is a major part of your degree so you should spend as much time thinking about your research interests as you do thinking about which 400-level courses to take.
Most students begin preliminary research in October/November, and will routinely enrol in BIOL 401 and/or BIOL 402 the summer before starting MSc part II, especially if they are working in the field.
There are a variety of scholarships available for MSc Part II, so ensure that you browse the University scholarships page throughout the year.

**PhD**
Find a research topic that is of interest to you and a supervisor well in advance of scholarship application due dates. Scholarships are highly competitive so make sure you begin the application process several months in advance of the due dates so that you are able to apply.

**Tip # 2 - Pick an area of genuine interest to you**
Research comes with highs and lows and requires high motivation to get through the tough times. The secret to success is to work in an area where you really want to know the answer to the research questions you pose. If you are only mildly curious about the topic, it will be tough to get through the more challenging parts and see the thesis through to completion.
We don’t recommend taking on a project that doesn’t sound interesting to you just because an academic is offering you a spot in their lab.

**Tip # 3 - Look for a good match between supervisor and topic**
The most important action that you can take is to approach staff members who have interests that overlap your own. All staff members welcome such approaches, either face to face, or via email.
Academic staff members often have research ideas that can be developed into proposals by students, so it is a good idea to ask them what they are currently working on. Alternatively, research projects may develop from discussions with staff around a research topic of mutual interest: don’t be afraid to take your ideas to them.
Bear in mind that topics staff lecture on may not necessarily reflect their core research interests – have a look at their recent publications, and find out more about their current research.
Research projects are not guaranteed and you may be competing with your fellow students for available topics and your choice of supervisor. Academics receive more expressions of interest for research than they have space in their labs so to give yourself the best chance read up on the research area and go prepared to discuss possible projects in detail.
The number one mantra for anyone wishing to pursue a career in research is “Publish or Perish”, so ensure you chose a lab that is actively publishing in good journals.
It is also worth talking to postgraduate students from the lab you wish to join – they will be able to give you a sense of what the research is like, and what the academic is like to work with.

**Tip # 4 - Relationships matter**
Once you have teamed up with a supervisor you will have regular meetings and will work together to evolve your project and develop approaches to tackle your research. Your supervisor and committee are there to help, don’t be afraid to ask questions and seek advice from them.

It’s a competitive process. It is up to you to give yourself the best chance of getting where you want to be! Yinon Dolev, studying towards a PhD in Biological Sciences
Research Facilities

The School of Biological Sciences has modern, well-equipped research laboratories. Our new, purpose built, research building Pūtaiao koiora has 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 the High Performance Computing facility which operates multiple supercomputers.
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 exits at Hari Hari, Westport and Mount John. Our extensive global collaborations also allow access to field sites around the world.

Edward Percival Field Station, Kaikoura
With panoramic views of sea and mountains, the field station has residential and laboratory facilities and is an ideal location for field studies of native birds, rocky shore ecosystems, and marine animal behaviour. The George Knox Research Laboratory includes a large general research laboratory, library, computer facilities, workroom, tank rooms and controlled temperature rooms, as well as a large covered working area suitable for algal culture and maintaining live animals.

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.

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.
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.

The Centre seeks to develop the intellectual capacity to mitigate negative human impacts on essential ecosystem services, and maximise the sustainable provision of multiple services.

Enduring solutions to the problems caused by human impacts must be multidisciplinary and cut across biological scales, from molecules to landscapes to the entire planet.

By educating tomorrow’s trans-disciplinary, solutions-focussed scientists and policy-makers, we will effect lasting, positive impact on NZ’s natural environment for future generations.

INBI actively collaborates with civil society and industry organisations around the world. We work on special projects with governments and the United Nations Environment Programme. We will assist you in building an international career.

Centre for Integrated Research in Biosafety (INBI)
INBI is a multi-disciplinary centre devoted to career-minded researchers in the biological, physical and social sciences, philosophy, law, engineering and cultural studies. The primary mission of the centre is to produce graduates and professionals equipped to contribute to the global demand for research and expertise in bringing forth safe and effective biotechnologies.

The Centre for Integrated Research in Biosafety (INBI)
INBI is a multi-disciplinary centre devoted to career-minded researchers in the biological, physical and social sciences, philosophy, law, engineering and cultural studies. The primary mission of the centre is to produce graduates and professionals equipped to contribute to the global demand for research and expertise in bringing forth safe and effective biotechnologies.

Currently, our research focus is on the effects of agricultural chemicals on microbes and how to integrate science-informed research into public policy and communication.

Centre of Excellence in Aquaculture and Marine Ecology (CEAME)
CEAME is a joint marine research centre that provides students an opportunity to engage with University staff and scientists from the National Institute of Water and Atmospheric Research (NIWA). The objectives of CEAME are to promote and enhance excellence in aquaculture and marine ecological research, to attract the best students nationally and internationally.

Projects within CEAME include a broad range of disciplines such as mathematics and engineering, theoretical and conceptual issues of marine science, sustainability of cultured fisheries, and genetics based research.
Scholarships and prizes
The University of Canterbury awards a number of postgraduate scholarships and prizes each year in order to help postgraduates conduct MSc or PhD research. Information about these can be obtained from the Scholarships Office: [www.canterbury.ac.nz/future-students/fees-and-funding/scholarships-at-uc/](http://www.canterbury.ac.nz/future-students/fees-and-funding/scholarships-at-uc/)

Note that the closing date for many awards is mid October each year.

Financial support for MSc and PhD students can sometimes be obtained from sources outside the University, including government agency contracts and not-for-profit organisations. You can discuss this possibility with your supervisor or the Head of School.

Laboratory Demonstrating
MSc and PhD students are strongly encouraged to demonstrate and instruct in undergraduate laboratory classes for which they receive payment. Details are released prior to the start of each semester.

International Students
If you are contemplating undertaking a postgraduate degree in biological sciences at UC, your first port of call is the International Office: [www.canterbury.ac.nz/international](http://www.canterbury.ac.nz/international)

Here you can find details about enrolment, the University, scholarship opportunities and fees.

**Canterbury Doctoral and Masters Scholarships** are open to overseas students, but cover tuition fees only at the New Zealand student rate. All PhD students pay tuition fees at the NZ rate, but MSc students pay international fees.

Many countries offer scholarships for students wishing to undertake postgraduate studies overseas. Check with your current University for information on funding opportunities.

Student Representation
**Postgraduate Student Committee (Biology)**
To ensure the quality of your experience with us is as good as possible, the School runs a postgraduate student committee with representatives from among the fourth-year, MSc and PhD students, a postdoctoral scientist and a member of academic staff. The committee reports back to students regarding important decisions in the School, and ensures student issues are heard at staff meetings.


**Postgraduate Students’ Association (PGSA)**
UCSA also has a postgraduate student association which ensures representation of postgraduates within the wider university community.

[www.ucpgsa.org](http://www.ucpgsa.org)

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Studying towards a PhD in Cellular and Molecular Biology

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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.

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Student Advisor, College of Science

The Student Advisor is available to provide accurate and timely academic advice and assistance on course options and/or degree programmes in science subjects.

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University of Canterbury Contact Centre

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

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