School of Biological Sciences
Te Kura Pūtaiao Koiora

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Course outline | Ngā Whakamārama 2025

BIOL337-25S1 Semester 1, 2025
Bioinformatics

0.125 EFTS 15 Points
17 Feb – 30 May 2025

Description / Whakamahuki

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, through applying these skills to biological datasets from peer-reviewed scientific publications. This paper will also explore 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 re-analyze biological datasets following published methodology and using their knowledge of bioinformatics. The emphasis is on the amalgamation of students' previous training and experience, providing students with the context and the background required to apply their skills in the real world. Skills learnt will be assessed via short computer lab reports and a final exam. BIOL337 is a required course for enrolment in BIOL338 (Bioinformatics Project).

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Goals of the Course
The focus of this course is on the critical understanding and application of published methods which are transferable to many modern bioinformatic applications.

You will apply computational methods to large-scale biological data, to generate biologically meaningful outputs, in a statistically-informed manner.

Specific skills acquired in this course will include:

- The ability to reliably reproduce published research
- The ability to adapt and apply existing bioinformatics methods to new data
- Use of advanced programming/coding across multiple programming languages (Bash, R, Shell, Git, Python) to analyse and interpret biological datasets
- Use of job schedulers used on research compute clusters
- The development and application of simulated datasets to answer questions in biology.

Through the practice and implementation of the above skillset, students will gain a strong proficiency in, and fundamental understanding of, the use, management, integration and interpretation of biological data.

Intended Learning Outcomes (Hua Akoranga) and Associated Assessment (Aromatawai)
As a student in this course, I will develop the ability to:
Learning Outcome Number 1
LO1
Demonstrate an understanding of biological data analysis across multiple programming languages, and demonstrate the ability to apply these methods to different types of biological data, to derive biologically meaningful conclusions from the data
(Assessment: written assessments and final exam)
Related Graduate Attributes and Kaupapa: Critically competent in the core academic discipline, Biculturally Competent and Confident (kaupapa 1,3,4,5,7), Employable, innovative and enterprising, Globally aware

Learning Outcome Number 2
LO2
Demonstrate an ability to edit and adapt existing bioinformatics analysis methods and pipelines to new datasets
(Assessment: written assessments)
Related Graduate Attributes and Kaupapa: Critically competent in the core academic discipline, Biculturally Competent and Confident (kaupapa 3,4,5,7), Employable, innovative and enterprising, Globally aware

Learning Outcome Number 3
LO3
Show competency in the fitting of appropriate statistical tests to data outputs from LO1
(Assessment: written assessments)
Related Graduate Attributes and Kaupapa: Critically competent in the core academic discipline, Biculturally Competent and Confident (kaupapa 3,4,5,7), Employable, innovative and enterprising

Learning Outcome Number 4
LO4
Demonstrate understanding of the characteristics and limitations of these methods
(Assessment: written assessments, final exam)
Related Graduate Attributes and Kaupapa: Critically competent in the core academic discipline, Employable, innovative and enterprising, Globally aware

Learning Outcome Number 5
LO5
Demonstrate an understanding of the importance of biological data ownership and governance, as applied to ethical, social and political issues
(Assessment: written assessments final exam)

- **Related Graduate Attributes and Kaupapa:** Critically competent in the core academic discipline, Biculturally Competent and Confident (kaupapa 3,4,5,6,7), Employable, innovative and enterprising, Globally aware

Transferable Skills / Pūkenga Ngaio

As a student in this course, I will develop the following skills:

- Synthesising information. In everyday life and in many job situations you will be required to read information from different sources, construct your own understanding and shape your own viewpoint. *In lectures and labs we will discuss recent research papers in a group environment and this will develop your abilities to identify the essential elements of research outputs - you will then use in report writing.* (Graduate Attribute 2: Employable, Innovative and Enterprising)
- Generating data. Important for research and in governmental and non-governmental organizations. *We will conduct research activities to provide both the real-world context for lectures and to develop hands-on skills in data generation, manipulation and interpretation.* (Graduate Attribute 2: Employable, Innovative and Enterprising)
- Analysing data. Important for research, as well as in a number of private-sector organizations. *This skill will be further developed when you analyse and present the data you generate in the labs.* (Graduate Attribute 2: Employable, Innovative and Enterprising)
- Writing a report on findings. Clear written communication is essential for most professional careers. *We will provide instruction on the elements of successful reports and help you identify these elements with clear marking rubrics through peer and self-assessment.* (Graduate Attribute 2: Employable, Innovative and Enterprising)

Graduate Profile / Āhuatanga Tāura

Critically competent	Employable, innovative and enterprising	Biculturally competent and confident	Engaged with the community	Globally aware
X	X	X		X

Timetable

http://www.canterbury.ac.nz/theuni/timetable/

Lectures/labs / Akoranga

There will be a total of 36 contact hours in this course, consisting of lectures and labs. Due to the practical nature of this course, there will be 24 x 1.5hr sessions, where each session starts with a short lecture with the remaining time used for hands-on activities. Each session will be a mix of instruction, question time, and practical application of the content. This format has been devised to allow for in-depth group discussions on analysis methods, and to facilitate peer-assisted learning. Topics covered in this course will include:

- Biological data sovereignty, ownership and governance, as applied to cultural, ethical, social and political issues
- Models used for the quantitative analysis of differential abundance
- Whole genome sequencing, assembly, annotation and analysis (de novo/shotgun and reference-aligned, bacterial genome)
- Transcriptomics/RNA sequencing/differential gene expression analysis (human, animal or bacterial)
- DNA methylation/post-translational modification analysis (human, animal)
- Concepts and techniques of network analyses

Datasets will focus on integrating information and analyses across multiple environments and platforms. Datasets used in this course will be from medical/health, ecological, microbiological, conservation, phylogenetic and evolution projects, to highlight breadth of applicability of knowledge.

Our teaching philosophy is that students need to be actively engaged in learning – it is important that you do more than simply turn up to class and receive instruction from us. You will be given clear instructions on what preparation is expected before each class – please come to class prepared to make best use of the time. [Students should note that in the Science Faculty that the average student is responsible for 10 hours of study per credit point – this equates to approximately 3 hours of additional study for each hour of class contact at the 300-level].

Assessment / Aromatawai

5 written assessments	15% each = 75%
Final exam - 2 hrs	25%

Note that the course will be subject to the Biology policy on late submission of work (see below).

What is expected in assessments?
The expectations for assessment items relate to the learning outcomes above. A marking schedule will be given in advance for the written assessments, however, a general marking rubric is as follows:

A to A+ : Evidence that the student has developed an individual conception of the subject from wide reading and reflection. This individual understanding will likely be applied to a novel situation.

B+ to A- : Evidence of strategic reading from a few sources, and the ability to present lecture content in the student's own words.

C to B: Reproduction of lecture content following the structure used by the lecturer.

D to C- : Reproduction of some lecture content without clear structure.

E : Confusion of content or no meaningful content presented beyond knowledge of what would be expected at the start of the course.

Textbooks
There is no required text. During the course, you will be directed to various online resources and to primary scientific papers. This allows us to include in this course the most current scientific knowledge available, and to provide greater breadth than would be found in a single textbook. **To do well in final exam you must show evidence that you have read and understood this material.**

Class material on Learn (Ako) & use of *Turnitin*
Resources used or referred to in lectures will be available on-line on the course link in Learn.
Please also note that we will be requesting that you submit written work in electronic form (for both grading and assessment of originality using "*Turnitin*"). Instructions will be given on how you do this via Learn.

Prerequisites
[BIOL231 or BIOL215 or BIOL271] AND [STAT201 or STAT202 or BIOL209]

RULES, REGULATIONS, AND WHAT TO DO WHEN THINGS GO WRONG
[updated March 2023]

If in doubt: ASK! The course coordinator is happy to answer questions. All staff involved in the course are available for advice on specific issues.

What do I do if I have to miss a test/exam or if my performance was impaired?

In Biological Sciences, we require a satisfactory level of achievement in both the theoretical aspects of the discipline and in practical activities. **This means you must attend all class activities (labs, tutorials, fieldtrips)** and submit all items of assessment unless you have a very good reason not to (e.g. medical reasons) and if this has been approved by your course coordinator.

If you feel that **illness, injury, bereavement or other extenuating circumstances beyond your control** prevented you from completing a **test/exam** worth 10% or more of the total course assessment, or if these circumstances affected your performance in such assessments, you should apply for Special Consideration. Applications for Special Consideration should be submitted via the Special Consideration website http://www.canterbury.ac.nz/study/special-consideration/ *within five working days* of the assessment or its due date. You should also notify the course coordinator. If you apply for Special Consideration because of medical reasons, you should visit a doctor within a reasonable timeframe (application form available on the website above or from the Student Health Centre).

The Special Consideration provisions are intended to assist students who have covered the work of a course but have been prevented by illness or other critical circumstances from demonstrating their mastery of the material or skills at the time of a text/exam – **they do not excuse you from doing the test/exam** within a reasonable time agreed with the course coordinator.

What do I do if I have to miss a quiz or assignment or if I need an extension?
You cannot apply for Special Consideration if you miss an assessment that is not a test/exam, such as a quiz, lab report, essay, literature review or other assignment, or if the test/exam is worth less than 10% or more of the total course assessment. If this happens or if you need an extension because of **illness, injury, bereavement or other extenuating circumstances beyond your control**, please contact the course coordinator and arrange an alternate activity and/or submission date. You should also do this if you have to miss a laboratory, tutorial or field trip.

What are other valid reasons to miss an assessment or mandatory course activity?
The Special Considerations policy (https://www.canterbury.ac.nz/about/governance/ucpolicy/student/special-consideration-procedures-and-guidelines/) outlines only a few kinds of activities that UC considers valid reasons for missing an assessment or mandatory course activity other than those outlined above. These include **involvement in international or national representative sport or cultural groups.** Holiday trips, birthday parties, weddings, work-related commitments etc. are not given special status in this University policy. Please contact your course coordinator to ask for an alternate activity and/or submission date if you are eligible.

Special Consideration for late discontinuation of a course
Students prevented by **extenuating circumstances** from completing the course after the final date for withdrawing, may apply for Special Consideration for late discontinuation of the course. Applications must be submitted via http://www.canterbury.ac.nz/study/special-consideration/ no later than five working days after the examination period has finished.

Academic Integrity
It is the responsibility of each student to be familiar with the definitions, policies and procedures concerning academic misconduct/dishonest behaviour. Instances of academic misconduct will be dealt with in a serious and appropriate manner. Students should refer to:
https://www.canterbury.ac.nz/about/ako/academic-quality/academic-integrity/

Plagiarism
It is essential that you are aware that plagiarism is considered a very serious offence by the academic community, the University and the School of Biological Sciences. Plagiarism is defined as taking content from another work or author and presenting it, without attribution, as if it is your own work. Content here includes text (sentences or major parts of sentences), display items (graphs and tables), and overall structure (the detailed sequence of ideas). Plagiarism includes:

- re-use of previous assignments (even if each individual sentence has been rephrased to say the same thing in different words, if the overall structure is re-used).
- copying of another student's work (with or without their consent).
- the unreferenced use of published material or material from the internet, e.g. cutting and pasting of paragraphs or pages into an essay.
- the generation of text using artificial intelligence technology without disclosure and when it is not intended to be part of an assignment.

For most pieces of in-term assessment you will be given information concerning the use of direct and indirect quotes from previously published work. If you have any doubt about the appropriate use of published material, please speak with an academic staff member. If you are unsure what plagiarism is, seek advice.

It is a School policy that courses will likely that you submit work electronically for subsequent analysis of originality using *Turnitin*. Students agree that by taking courses in BIOL, assessments may be submitted to Turnitin.com for textual similarity review. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Terms and Conditions of Use as posted on the Turnitin.com site.

Where do I hand in assignments and then collect them once marked?
All assignments should be submitted as directed by the course coordinator. Typically, this will be electronically via Learn for on-line grading and for analysis in *Turnitin*. If a hard copy is requested, assignments should be placed in the designated collection boxes in the foyer of the 2nd floor of the School of Biological Sciences (Julius von Haast building, at the top of the stairs). All assignments must be accompanied by a cover sheet signed by you stating that the submitted work is not plagiarised. Cover sheets are available on top of the collection boxes, or you can download one from the Biology website (http://www.canterbury.ac.nz/media/documents/science-documents/assignment-coversheet.pdf).

Marked assignments will be returned through Learn or, if in hard copy, can be collected from the School of Biological Sciences reception, unless directed otherwise by the course coordinator. Teaching staff will endeavour to return work as soon as possible, and should contact you if there are likely to be any delays that will prevent return within the maximum 4-week timeframe.

What if I can't get it finished in time?
Reports and assignments should be handed in on time. Extensions may be granted if you have a valid reason (see above). **If you require an extension, you should request one from the course coordinator** (or the lecturer responsible for marking the work), with as much notice as possible. Please do this BEFORE the deadline for the assignment. **If you have been given an extension and you have been asked to submit a hard-copy of your work, you should hand the work DIRECTLY to the course coordinator** (do not put it in the drop box as it may not be cleared after the due date).
If an extension has not been granted:

- work handed in within 1 hour of the deadline: penalty of up to 5 percentage points of the mark for the assignment (e.g., a mark of 75% might be reduced to 70%).
- work handed in 1 – 24 hours after the deadline: penalty of 10 percentage points of the mark for the assignment (e.g., a mark of 75% is reduced to 65%).
- work handed in 1 – 7 days after the deadline: penalty of 15 percentage points of the mark for the assignment (e.g., a mark of 75% is reduced to 60%).
- work handed in more than 7 days after the deadline will not be marked or earn credit.

What if I have written more than the word or page limit?
If there is a word limit on an assignment, it is usually there to stop you doing too much work and to encourage you to write succinctly. You can be up to 10% over without too much worry, but if the length increases beyond that your mark may suffer due to failure to follow the requirements. If you find yourself way over the word limit talk to the lecturer concerned about how to get your assignment to an acceptable length. Unless specifically advised that there is flexibility, you must adhere to the word limit indicated.

What if I fail part of the course?
In Biological Sciences, we require a satisfactory level of achievement in both the theoretical aspects of the discipline and in practical activities. This means you must attend all class activities and submit all items of assessment unless you have a very good reason not to (e.g. medical reasons). **A student must attain an average score of at least 40% for in-course assessments (e.g. assignments, reports, quizzes) and an average score of at least 40% in the exam and/or tests, AND score at least 50% overall for the course, to be awarded a passing grade. See the course outlines for clarification of the assessment items included in each category and ask the coordinator if you are still unsure.**

What's the best way to give feedback?
We welcome constructive feedback at all times – help us to make this a valuable course for you. We endeavour to remain approachable at all times. If you would rather give feedback anonymously, please use the online course survey or talk to lab demonstrators, or your class rep (who will all report back to the staff-student liaison committee that includes a representative from each of the undergraduate classes). Class representatives will be selected from each class at the start of course.

What's the best way to complain?
If you feel you have not been fairly treated during this course, please raise the issue with the lecturer or course coordinator in the first instance. Other avenues include your class rep., who can raise issues anonymously, or the UCSA education coordinator.

- **Grading**

A+	90% or above
A	85 – 90
A-	80 – 84
B+	75 – 79
B	70 – 74
B-	65 – 69
C+	60 – 64
C	55 – 59
C-	50 – 54

A restricted pass (R) **may** be awarded to those who are close to a pass (i.e. an overall score of 48-49.9%) AND who have achieved at least a 40% overall score in both in-course assessment and tests/exams. If an R grade is awarded you gain credit for the course but **cannot continue into papers that require this course as a pre-requisite**. NB. The R grade is only available at 100 and 200 level - it cannot be awarded for third year papers.

Failing grades: D 40-49 E 0–39