

Course Information / Ngā Whakamārama- 2024

BIOL231/BCHM202

FOUNDATIONS IN MOLECULAR BIOLOGY

0.125 EFTS 15 Points

First Semester

Whakamahuki / Description

We will introduce you to fundamental principles of molecular biology as they relate to inheritance and expression of phenotypes. It will focus on the “central dogma” of molecular genetics: making DNA, RNA and proteins and conclude with an introduction to gene expression.

You should expect this course to be a significant “step up” from stage 100. Prepare for this by:

- reserving more time for self study (see below);
- taking responsibility for identifying what you don’t know and using all available contact time to seek answers;
- *completing assigned readings and recorded material in advance of lecture*;
- asking questions during lecture and in the laboratory;
- self-testing by using questions in the recommended textbooks;
- participating in a study group.

Prerequisites for entry to BIOL 231 are [BIOL111](#) or [ENCH281](#). RP: [CHEM112](#) or [BCHM112](#) or [CHEM114](#).

Prerequisites for entry to BCHM 202 are P: (1) BIOL 111 or ENCH281; (2) BIOL 112 or BIOL 113 or CHEM 114 or CHEM 112.

15 pts of **chemistry is strongly recommended. If you haven’t had university level chemistry, more self-study will be necessary.**

Goal of the Course

To achieve high level competence in the biochemistry of the fundamental (‘central dogma’) reactions necessary for inheritance and which link genotype to phenotype and to understand the fundamentals of gene expression in prokaryotes and eukaryotes.

Āhuatanga Taura / Graduate Profile

This course will provide students with an opportunity to develop these UC Graduate Attributes (www.canterbury.ac.nz/study/graduate-profile/students/what-are-the-graduate-attributes/):

Graduate Profile (GP) 1. Critically competent in the core academic discipline; 2. Employable, innovative and enterprising; 3. Bi-cultural confidence and competence; 4. Engaged with the community; 5. Globally aware.

Hua Akoranga (Intended Learning Outcomes) and Aromatawai (Associated Assessment)

As a student in this course, I will:

Learning Outcome Number 1 (LO1)

apply an understanding of the enzymology of DNA replication, transcription, translation and basic gene regulatory networks (assessment tasks: problem sets and test/exam). GP1

Learning Outcome Number 2 (LO2)

understand and interpret experimental evidence (assessment task: laboratory assignments). GP1

Learning Outcome Number 3 (LO3)

perform basic calculations for chemical solution preparation and dilutions and manipulations for setting up reactions *in vitro* (assessment task: laboratory assignments, final exam). GP1

Learning Outcome Number 4 (LO4)

compare the central dogma reactions in microbes to those in other forms of life (assessment tasks: problem sets, test/exam). GP1

Learning Outcome Number 5 (LO5)

formulate hypotheses to guide my own learning process (assessment task: laboratory assignments, test/exam). GP1

Learning Outcome Number 6 (LO6)

manage my time to achieve better outcomes (assessment task: prepare a time schedule for the semester). GP2

Learning Outcome Number 7 (LO7)

achieve a higher competence in self-guided learning through participation in class (reflecting on communication in a cultural context) and completing required reading assignments (analytical, critical thinking and problem solving in diverse contexts) (assessment: test/exam). GP3:KP1

Pūkenga Ngaio / Transferable Skills Register

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

- I can express myself as a scientist. This will be important for any career in research, journalism or business where you will need to communicate science to both experts and lay readers. We will provide opportunity to build confidence in written and oral communication in tutorials. GP2/GP3:KP1
- I can competently synthesise 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/tutorials and laboratory sessions we will discuss different sources of evidence and types of experiments and how they lead to current understanding. GP2
- I can competently analyse data. Important for research, police work as well as in a number of private-sector organizations. This skill will be further developed when we assist you to analyse the data we generate in the lab. GP2
- I can confidently ask questions, and do so in a culturally appropriate way. A key skill is to identify what you don't know and have the confidence to ask for clarification. Moreover, it is important to know how to be effective in getting answers, and this often requires some knowledge of the culture of those whom you seek knowledge. It is expected that you will practice this skill during lecture/tutorial/laboratory sessions. GP5
- Competence in personal time management to ensure preparedness for tutorials and laboratories. GP2
- Ability to work to an irregular schedule. This will be developed by taking personal responsibility for noting the time and location of class activities and ensuring your ability to attend. GP2

Wātaka / Timetable

See University Website for times and rooms.

Labs: See University Website for times and rooms.

Students are expected to prepare in advance for laboratory sessions and some laboratory assessments are due prior to the laboratory.

Kairuruku Akoranga / Course Co-ordinator

Prof. Jack Heinemann

534 Biology

jack.heinemann@canterbury.ac.nz

Pūkenga / Teachers

Jack Heinemann	Room 534 SBS jack.heinemann@canterbury.ac.nz
Grant Pearce	Grant.pearce@canterbury.ac.nz
Thomas Evans	thomas.evans@canterbury.ac.nz

Any queries concerning the course should be directed to the course co-ordinator. He will attempt to answer all queries quickly. **Please try to answer questions about scheduled events by referring to this course outline and use an email to the course coordinator about such business as a last resort. If your question can be answered using this handout, you may not receive a reply by email.** Queries concerning specific lecturers should be discussed with the

lecturer concerned. If that is not possible or comfortable for you, then see the Course Coordinator or Head of School (Prof. Elissa Cameron).

The lecturers are always interested to hear from you what would make your learning experience more rewarding. So please make contact as early in the course as problems or insights occur. Note that we expect students to diligently monitor their email and Learn/Ako for course announcements. Attendance at lectures is expected and relevant announcements made there may not be repeated elsewhere.

Assessment / Aromatawai

There may be penalties for late submission of work or absence from laboratories and tests. See the “Rules and regulations...” document attached at the end of this course handout. The material covered in both lectures and practical laboratories is assessed.

Attendance at labs is compulsory (unless you have a medical certificate). To gain a pass in this course a student must achieve a mark of 50% overall plus achieve an average of at least 40% in the combined items Laboratory and Tutorial and at least 40% in the combined items Course Tests and Final Exam. The laboratory practical covers 6 weeks, 1 day/week. Certain fundamental skills must be demonstrated in order to receive a passing mark in the laboratory. Students repeating this course may be exempt from labs with the approval of the course co-ordinator.

BIOL231/BCHM202		
Type	Value (%)	Due Dates
Laboratory:	32.5*	
attendance	mandatory	as per your timetable
Laboratory preparation		
flowsheets + lab data	7.5	see Learn / Ako pages
flowsheet short answer questions	5	see Learn / Ako pages
numeracy quizzes (level 3) (pass/fail)	5	see Learn pages
laboratory test	15	see Learn / Ako pages
Tutorial	10*	see Learn / Ako pages
Course test I: ‘prerequisite’ test in Workshops (up to two 2 hour sessions) See Learn for details	10†	as per your timetable
Course test II: ‘Mid term’ test (one 2 hour session)	22.5†	as per your timetable
Final Exam	25†	as per your timetable
Total	100	

*Will count toward your in-course assessment. Combined score of these items must achieve $\geq 40\%$ to pass.

† Combined score of these items must achieve $\geq 40\%$ to pass.

See Learn / Ako for details.

Course test II is 200 level material.

Feedback

For details on feedback, please see the Learn pages. In general, your instructors routinely use a variety of means to communicate back to you regarding your progress. Feedback is not something that you only get after you complete an assignment. The most powerful feedback we provide you with is during contact hours. If you are able to participate during class activities drawing reasonably from the assistance of instructors, then you have feedback that you are making satisfactory progress. If you struggle or must disengage during class activities, this is feedback that you are making unsatisfactory progress. Specialist feedback is provided during tutorials IN ADVANCE of assessed work. The post-assessment grade is a second form of feedback. Disappointment with that grade should further inform how you approach the next tutorial. Pre-test/laboratory practice exercises, which you complete voluntarily, provide feedback to you IN ADVANCE of your scheduled contact hours. Failure to complete these is feedback that your preparation may be unsatisfactory. Your instructors are also very willing to meet with you personally to discuss questions on an individual basis. Your instructors use evidence-based pedagogy and do not believe that issuing “answers” or class statistics after an assignment or test constitutes effective or productive feedback.

1. Summary of course contents

<u>Topics</u>	<u>Proportion of non-lab contact hours</u>
Central dogma reactions through translation	60
Gene expression regulation	40

Course Textbooks

Molecular Biology Principles of Genome Function 3rd Ed. by Craig *et al.*

This text is the best for BIOL231 and BIOL333.

OR

Lehninger Principles of Biochemistry 6th Ed.

This text is the best for BCHM202 and other biochemistry courses.

Note that Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. *Molecular Biology of the Gene*, 7th Edition, and Prescott's *Microbiology* 9th Ed (Wiley, Sherwood and Woolverton), are also useful and were historically used this course. If you are a biochemistry or microbiology student and not planning to take more genetics courses, then you may wish to buy only the core text for your programme. Some material will be taken from Snyder and Champness **Molecular Genetics of Bacteria**, 3rd Ed.

Reading and study

Readings are assigned by individual lecturers. *Students should note that in the Science Faculty the average student is expected use approximately 3.2 hours of additional study for each contact hour (i.e., lectures and labs) at the 200-level. In other words, readings and self-study opportunities cannot be repeated in lecture.* Allow 108 hours of good self-study for this course. It is your responsibility to make the best use of contact time, such as spare time during the laboratory, to achieve an understanding of the material. (Leaving the lab early is a lost opportunity.)

Lab Manuals are compulsory but are provided.

To purchase approved safety glasses or lab coats go to <https://www.canterbury.ac.nz/science/shop/>

The collection point for purchases is inside the southern entry to the Ernest Rutherford Building, Monday to Friday between the hours 8.30 – 10.00 am and 1.30 – 3.00 pm for the first two weeks of the semester.

Disposable gloves are available in the laboratory for those who might need them.

LEARN / AKO

This course is supported by Learn / Ako. You will find electronic copies of lecture notes and other material distributed solely by this method. The course is attempting to be as environmentally friendly as possible, so you will receive a minimum of “paper” handouts.

Help with writing

Your work may well benefit if it's seen by a learning advisor at the Learning Skills Centre prior to submission. Early in the writing phase is best: that's when learning advisors can address the critical issues of clarity, structure and organisation. They also offer tips on referencing, grammar, punctuation, and good written style.

COURSE CONTENTS

Some lecture material is recorded. Where this occurs, the content may not be repeated during lecture time.

Introduction to Central Dogma Reactions

What are the reactions? What will be learned in this course?

DNA Reactions

Replication of DNA

Evidence of semiconservative replication; DNA polymerization at replication fork; genetic and biochemical analysis of DNA replication. Initiation, elongation and fidelity of DNA replication; error correction and repair functions.

Recombination and repair

Holliday junctions and mutation.

RNA reactions

Transcription; promoters to codons. Evidence for the code. RNAs: an account of various types of RNAs, their structures and functions.

Protein synthesis

Translation: the second code (aminoacyl-tRNA synthetases); structure and function of ribosomes, initiation, elongation and termination of a polypeptide chain; activation of amino acids for peptide bond formation.

Models of gene expression regulation

Operon models illustrating induction, repression and attenuation; gene switch models such as the λ lytic/lysogeny decision; eukaryotic models such as yeast mating type.

RULES, REGULATIONS, AND WHAT TO DO WHEN THINGS GO WRONG

[updated January 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.

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

Marked assignments 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. **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 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.

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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