



# BMOL3402

## Molecular Biology and Genomics

Session 1, In person-scheduled-weekday, North Ryde 2022

*School of Natural Sciences*

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## General Information

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Credit points

10

Prerequisites

130cp at 1000 level or above including BMOL2201 or CBMS201 or CBMS223

Corequisites

Co-badged status

### Unit description

Molecular biology is a central science in twenty-first century biology and biotechnology. Understanding the fundamentals of molecular biology is essential for many other fields in the life sciences, including microbiology, cell biology, immunology, and development. Molecular biology makes a significant and increasing contribution to major sectors of our society including agriculture and medicine, and is also important in environmental science and forensics. In this unit we explore topics that allow students to obtain an advanced understanding of the mechanisms of molecular biology, including those of DNA replication and recombination, prokaryotic gene expression, eukaryotic gene expression, mobile elements, the functions of the nucleus, and epigenetics. We also address topics on the rapidly changing technologies in molecular biology, including those used in genome sequencing, metagenomics, systems and synthetic biology. Practical sessions complement the lectures and provide students with hands-on experience with a range of critical laboratory skills including those required for DNA and RNA isolation, PCR and RT-PCR, cloning, and bioinformatics. Students gain experience in working with both bacterial and eukaryotic systems in the laboratory classes so that their skills and experience are valuable for a variety of positions in both industry and research.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

**ULO1:** Describe the theory behind and demonstrate competency in the use of a range of molecular biology experimental techniques, including PCR, restriction enzyme digestion, gel electrophoresis, cloning, gene editing, DNA sequencing and DNA hybridization.

**ULO2:** Describe and discuss essential molecular processes in the cell, especially as related to DNA and RNA. These molecular processes include transcription, translation, DNA replication, recombination, DNA repair, and transposition.

**ULO3:** Relate the revolutionary impact of genomics across all biological sciences.

**ULO4:** Analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.

## General Assessment Information

### Assignments

**All assignments must be submitted as soft copy on the date specified.**

**All written work must be submitted to Turnitin for plagiarism checking. Instructions will**

**be provided on iLearn.**

**Criteria and standards required for the assessment tasks will be available on iLearn.**

### **Note the standardised 5 pm submission time for assessments**

**Extensions** will only be granted under exceptional circumstances.

**Late submissions** - Late submissions will be accepted for all assessments in this unit with penalties. There will be a deduction of 10% of the total available marks made from the total awarded mark for each 24 hour period or part thereof that the submission is late (for example, 25 hours late in submission – 20% penalty). This penalty does not apply for cases in which an application for disruption of studies is made and approved.

General Faculty Policy on assessment submission deadlines and late submissions: Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure, students may apply for Special Consideration.

All other assessments must be submitted by 11 pm on their due date. Should these assessments be missed due to illness or misadventure, students should apply for Special Consideration. As late submissions are permitted as indicated in the unit guide and on iLearn a consistent penalty will be applied for late submissions as follows: 24 hours late = 10% deduction; for each day thereafter, an additional 10% per day or part thereof will be applied until five days beyond the due date. After this time, a mark of zero (0) will be given.

**Off-shore students** Off-shore students must email the convenor as soon as possible to discuss study options as this course has in person practical classes and attendance is mandatory. So this course cannot be completed off-shore.

**COVID Information and on-campus classes** On-campus teaching continues to be scheduled for Session 1, 2022. **Masks are compulsory** for all classes in indoor spaces and social distancing will be implemented wherever possible. Students will also be required to sanitise surfaces before and after use. Students are requested to minimise the risk of spreading COVID to themselves and others in accordance with the university and NSW Health guidelines: <https://www.mq.edu.au/about/coronavirus-faqs> and <https://www.nsw.gov.au/covid-19/stay-safe>.

Any further requirements or changes to units in relation to COVID will be communicated to students via iLearn.

### **Problem Set**

Problems 1 - 12 will be discussed on ongoing basis during the various practical sessions.

### **Requirements**

Assessment tasks involve the practical assignments and the problem sets which are both integral components of the unit. Apart from the marks formally allocated to these components, a comprehensive understanding of them will greatly assist you in the final exam. You should

remember that the final exam covers ALL components of the unit. Participation in ALL practical sessions is required in order to complete the practical reports.

### COVID-Safe requirements

The safety of students and staff is our primary concern, and we must all work together to maintain a COVID-free campus. We ask students to note the following:

- [COVIDSafe behaviour](#) must be always practiced while on campus: wear masks, clean surfaces before/after use, maintain social distancing where possible, and follow directions of staff.
- If unwell, please do not come to campus. Email the convenor and apply for a Special Consideration. Staff have the discretion to request that students presenting COVID-19 like symptoms leave campus.
- You may return to campus if you have tested negative for COVID-19 and have not experienced COVID-19 related symptoms for the last 72 hours.
- If you have tested positive for COVID-19 and have been on campus, please inform the unit convenor and the COVIDSafe Team ([COVIDSafe@mq.edu.au](mailto:COVIDSafe@mq.edu.au)).
- For more information, please see the University's [FAQS](#) site and [NSW Health](#).

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Lab reports</a>	35%	No	Week 6, Week 8 and Week 13
<a href="#">Synthetic Biology Challenge</a>	15%	No	Week 13
<a href="#">Final Examination</a>	40%	No	TBC
<a href="#">Midsemester Test</a>	10%	No	Week 7 April 4th 2022

### Lab reports

Assessment Type <sup>1</sup>: Lab report

Indicative Time on Task <sup>2</sup>: 30 hours

Due: **Week 6, Week 8 and Week 13**

Weighting: **35%**

Three lab reports 1500 words each

On successful completion you will be able to:

- Describe the theory behind and demonstrate competency in the use of a range of molecular biology experimental techniques, including PCR, restriction enzyme digestion, gel electrophoresis, cloning, gene editing, DNA sequencing and DNA hybridization.
- Analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.

## Synthetic Biology Challenge

Assessment Type <sup>1</sup>: Qualitative analysis task

Indicative Time on Task <sup>2</sup>: 10 hours

Due: **Week 13**

Weighting: **15%**

Written report based on the design phase of synthetic biology

On successful completion you will be able to:

- Relate the revolutionary impact of genomics across all biological sciences.
- Analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.

## Final Examination

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 18 hours

Due: **TBC**

Weighting: **40%**

Final Examination held in university examination period

On successful completion you will be able to:

- Describe the theory behind and demonstrate competency in the use of a range of molecular biology experimental techniques, including PCR, restriction enzyme digestion, gel electrophoresis, cloning, gene editing, DNA sequencing and DNA hybridization.
- Describe and discuss essential molecular processes in the cell, especially as related to DNA and RNA. These molecular processes include transcription, translation, DNA replication, recombination, DNA repair, and transposition.
- Relate the revolutionary impact of genomics across all biological sciences.

## Midsemester Test

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 10 hours

Due: **Week 7 April 4th 2022**

Weighting: **10%**

Test carried out during regularly scheduled laboratory time.

On successful completion you will be able to:

- Describe the theory behind and demonstrate competency in the use of a range of molecular biology experimental techniques, including PCR, restriction enzyme digestion, gel electrophoresis, cloning, gene editing, DNA sequencing and DNA hybridization.

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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

### Classes

There are two weekly lectures of 1 hour each on **Monday 1-2pm** and **Tuesday 1-2pm** which will be held at **14 Sir Christopher Ondaatje Avenue Lecture Theatre 5 (14SCO T5)**. There is one weekly practical session of 3 hours on **Monday 10-1pm (practical groups 1 and 2) and Monday 2-5pm (practical groups 3 and 4) at 14 Eastern Road Science Labs 130 and 150**. Attendance at practical sessions is a compulsory component of this unit. Lecture recordings and graphics slides are available online through iLearn (<https://ilearn.mq.edu.au/login/MQ/>), although lecture attendance in person is highly recommended. The practical manual is also available online through iLearn.

### Required and Recommended Texts

The course syllabus is defined by all of the subject material presented in lectures and practicals, much of which is beyond standard textbooks. The prescribed text for this unit is Molecular Biology Fifth edition by Robert F Weaver. Available from the Co-op bookshop. The following

texts may also be useful and are available in the library:

GenesIX by Benjamin Lewin

Mobile Genetic Elements by Sherratt

Molecular Cloning: A Laboratory Manual by Maniatis, Fritsch and Sambrook

An Introduction to Genetic Engineering by Des Nicholl.

## Technology Requirements

Within this Unit, you will be introduced to web-based search engines that are commonly used in molecular biology. Our expectation is that you will be able to readily access the internet and have a computer available to you for web browsing and preparation of your laboratory reports. Handwritten reports will not be accepted. Your laboratory reports will be submitted and circulated via the online Turnitin program on iLearn, for which access instructions will be given at submission time. Your practical reports will require you to carry out minor computational tasks, for which a calculator and access to basic statistical tools will be required. We place a large emphasis on correct referencing style in all your reports, and use of the program EndNote is encouraged, but not essential.

## Unit Schedule

Week	Date	Lecture	Title	Lecturer
1	Feb 21	1	Introduction/What is Molecular Biology/Genome Structure	Haynes
	Feb 22	2	Gene Organization/function	Haynes
2	Feb 28	3	Molecular Biology Techniques	Haynes
	Mar 1	4	Molecular Biology Techniques	Haynes
3	Mar 7	5	Molecular Cloning	Haynes
	Mar 8	6	Tools for studying Gene Activity	Haynes
4	Mar 14	7	Transcription in Prokaryotes	Paulsen
	Mar 15	8	Structure of Prokaryotic Operons	Paulsen
5	Mar 21	9	Bacterial Gene Regulation	Paulsen
	Mar 22	10	Transcription in Eukaryotes	Paulsen



6	Mar 28	11	Eukaryotic Gene Regulation	Paulsen
	Mar 29	12	Nucleosomes/Histones/Chromatin	Paulsen
7	Apr 4	13	Messenger RNA splicing	Paulsen
	Apr 5	14	Mechanism of Translation	Paulsen
SEMESTER BREAK				
8	Apr 26	15	Ribosomes and transfer RNA	Paulsen
9	May 2	16	DNA replication	Paulsen
	May 3	17	DNA recombination	Paulsen
10	May 9	18	DNA Repair	Paulsen
	May 10	19	Mobile DNA elements #1	Paulsen
11	May 16	20	Mobile DNA elements #2	Paulsen
	May 17	21	Genome Sequencing	Paulsen
12	May 23	22	Genomes, Pan-Genomes and Metagenomics	Paulsen
	May 24	23	Bioinformatics and Genome Annotation	Paulsen
13	May 30	24	Functional Genomics and Systems Biology	Paulsen
	May 31	25	Synthetic Biology	Paulsen

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)

- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies](https://students.mq.edu.au/support/study/policies) (<https://students.mq.edu.au/support/study/policies>). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central](https://policies.mq.edu.au) (<https://policies.mq.edu.au>) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## The Writing Centre

[The Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)

- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)
- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual assault
- [Social support including information about finances, tenancy and legal issues](#)

## Student Enquiries

Got a question? Ask us via [AskMQ](#), or contact [Service Connect](#).

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

## Changes from Previous Offering

The Bioinformatic Project is now run as a Synthetic Biology Design Challenge (see iLearn and the Prac Manual for details). It now runs from week 2 to week 13 in prac classes, rather than being in a discrete period (weeks 9-11) as previous.