



CBMS836

Molecular Biology and Genomics

S1 Day 2018

Dept of Chemistry & Biomolecular Sciences

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Disclaimer

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General Information

Unit convenor and teaching staff

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Credit points

4

Prerequisites

Admission to MBiotech or MBiotechMCom or MRadiopharmSc or MSc or MBioBus or MMarScMgt or GradDipConsBiol

Corequisites

Co-badged status

CBMS336/836

Unit description

Molecular biology is a central science in twenty-first century biology and biotechnology. 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, gene expression and regulation, and mobile elements. We also address topics on the rapidly changing technologies in molecular biology, including those used in genome sequencing, metagenomics and microarray analysis. 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.

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:

Students 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, site-directed mutagenesis, DNA sequencing and DNA hybridization.

Students will be able to 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.

Students will be able to relate the revolutionary impact of genomics across all biological sciences.

Students will be able to analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.

Students will be able to analyse and interpret genomic data utilising bioinformatic techniques.

Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

General Assessment Information

Assignments

- **All assignments must be submitted in hard copy to the FSE Student Centre by midday on the date specified and must include a completed and signed coversheet stapled to the front cover.**
- **In addition, 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.**

Extensions will only be granted under exceptional circumstances.

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.

Problem Set

Problems 1 - 12 should be done in time for marking and discussion during the practical session of the **Week 12**.

Requirements

Assessment tasks include 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.

Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Laboratory Reports</u>	15%	No	TBA
<u>Bioinformatic Report</u>	10%	No	TBA
<u>Mid-Semester Test</u>	10%	No	Week 7 (April 30th - May 4th)
<u>Essay</u>	10%	No	TBA
<u>Problem Set</u>	5%	No	Week 12 (June 4th - June 8th)
<u>Final Examination</u>	50%	No	University Examination Period

Laboratory Reports

Due: **TBA**

Weighting: **15%**

3 lab reports, 1500 words each

On successful completion you will be able to:

- Students 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, site-directed mutagenesis, DNA sequencing and DNA hybridization.

- Students will be able to analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.
- Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

Bioinformatic Report

Due: **TBA**

Weighting: **10%**

Report on Bioinformatic Analysis

On successful completion you will be able to:

- Students will be able to relate the revolutionary impact of genomics across all biological sciences.
- Students will be able to analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.
- Students will be able to analyse and interpret genomic data utilising bioinformatic techniques.
- Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

Mid-Semester Test

Due: **Week 7 (April 30th - May 4th)**

Weighting: **10%**

Multiple Choice Test carried out during regularly scheduled laboratory time.

On successful completion you will be able to:

- Students 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, site-directed mutagenesis, DNA sequencing and DNA hybridization.
- Students will be able to 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.
- Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

Essay

Due: **TBA**

Weighting: **10%**

1000 word research essay

On successful completion you will be able to:

- Students will be able to 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.
- Students will be able to relate the revolutionary impact of genomics across all biological sciences.
- Students will be able to analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.
- Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

Problem Set

Due: **Week 12 (June 4th - June 8th)**

Weighting: **5%**

12 Question Problem Set in Prac Manual.

On successful completion you will be able to:

- Students 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, site-directed mutagenesis, DNA sequencing and DNA hybridization.
- Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

Final Examination

Due: **University Examination Period**

Weighting: **50%**

2 essays, 20 short answer questions

On successful completion you will be able to:

- Students 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, site-directed mutagenesis, DNA sequencing and DNA hybridization.

- Students will be able to 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.
- Students will be able to relate the revolutionary impact of genomics across all biological sciences.
- Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

Delivery and Resources

Classes There are two weekly lectures of 1 hour each on Friday (**10 am - 11 am Friday** in 14 Sir Christopher Ondaatje Ave - **E7B T5 Theatre**, and **12 noon - 1 pm Friday** in 14 Sir Christopher Ondaatje Ave - **E7B T5 Theatre**) and a weekly practical session of 3 hours (14 Eastern Road **E8A labs 130 and 150, 10 am - 1 pm or 2 pm - 5 pm Wednesday**). In weeks 9 to 11, the practical class includes a bioinformatic workshop in the same location. Attendance at practical sessions (and bioinformatic workshop) 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, 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	Mar 2	1	Introduction/What is Molecular Biology/Genome Structure	Haynes
	Mar 2	2	Gene Organization/function	Haynes
2	Mar 9	3	Molecular Biology Techniques	Haynes
	Mar 9	4	Molecular Biology Techniques	Paulsen
3	Mar 16	5	Molecular Cloning	Haynes
	Mar 16	6	Tools for studying Gene Activity	Haynes
4	Mar 23	7	Transcription in Prokaryotes	Paulsen
	Mar 23	8	Structure of Prokaryotic Operons	Paulsen
5	Apr 6	9	Bacterial Gene Regulation	Paulsen
	Apr 6	10	Transcription in Eukaryotes	Paulsen
6	Apr 13	11	Eukaryotic Gene Regulation	Paulsen
	Apr 13	12	Nucleosomes/Histones/Chromatin	Paulsen
SEMESTER BREAK				
7	May 4	13	Messenger RNA splicing	Paulsen
	May 4	14	Mechanism of Translation	Paulsen
8	May 11	15	Ribosomes and transfer RNA	Paulsen
	May 11	16	DNA replication	Paulsen
9	May 18	17	DNA recombination	Paulsen
	May 18	18	DNA repair	Paulsen
10	May 25	19	Mobile DNA elements	Paulsen
	May 25	20	Mobile DNA elements	Paulsen

11	June 1	21	Genome Sequencing	Paulsen
	June 1	22	Genomes, Pan-Genomes and Metagenomics	Paulsen
12	June 8	23	Bioinformatics and Genome Annotation	Paulsen
	June 8	24	Functional Genomics and Systems Biology	Paulsen
13	Jun 15	25	Synthetic Biology	Paulsen
	Jun 15	26	Revision	Paulsen

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>). 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](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)

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

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>).

Student Code of Conduct

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

Results

Results shown in *iLearn*, 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](#).

Student Support

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

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit 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.

Graduate Capabilities

PG - Capable of Professional and Personal Judgment and Initiative

Our postgraduates will demonstrate a high standard of discernment and common sense in their professional and personal judgment. They will have the ability to make informed choices and decisions that reflect both the nature of their professional work and their personal perspectives.

This graduate capability is supported by:

Learning outcomes

- Students 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, site-directed mutagenesis, DNA sequencing and DNA hybridization.
- Students will be able to 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.
- Students will be able to relate the revolutionary impact of genomics across all biological sciences.
- Students will be able to analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.

Assessment tasks

- Laboratory Reports
- Bioinformatic Report
- Mid-Semester Test
- Essay
- Problem Set
- Final Examination

PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

Learning outcomes

- Students 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, site-directed mutagenesis, DNA sequencing and DNA hybridization.
- Students will be able to 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.
- Students will be able to relate the revolutionary impact of genomics across all biological sciences.

- Students will be able to analyse and interpret genomic data utilising bioinformatic techniques.

Assessment tasks

- Laboratory Reports
- Bioinformatic Report
- Mid-Semester Test
- Essay
- Problem Set
- Final Examination

PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

Learning outcomes

- Students 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, site-directed mutagenesis, DNA sequencing and DNA hybridization.
- Students will be able to 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.
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- Students will be able to analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.
- Students will be able to analyse and interpret genomic data utilising bioinformatic techniques.
- Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

Assessment tasks

- Laboratory Reports

- Bioinformatic Report
- Mid-Semester Test
- Essay
- Problem Set
- Final Examination

PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcomes

- Students 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, site-directed mutagenesis, DNA sequencing and DNA hybridization.
- Students will be able to 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.
- Students will be able to relate the revolutionary impact of genomics across all biological sciences.

Assessment tasks

- Laboratory Reports
- Bioinformatic Report
- Mid-Semester Test
- Essay
- Problem Set
- Final Examination

PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

Learning outcomes

- Students will be able to analyse and interpret experimental data and present this in a structured report utilising appropriate scientific referencing.
- Students will be able to analyse and interpret genomic data utilising bioinformatic techniques.
- Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

Assessment tasks

- Laboratory Reports
- Bioinformatic Report
- Mid-Semester Test
- Essay
- Problem Set
- Final Examination

PG - Engaged and Responsible, Active and Ethical Citizens

Our postgraduates will be ethically aware and capable of confident transformative action in relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues

This graduate capability is supported by:

Learning outcome

- Students will be able to analyse and critique experimental data and current scientific literature and present this in written and oral format.

Assessment tasks

- Laboratory Reports
- Bioinformatic Report
- Mid-Semester Test
- Essay
- Problem Set
- Final Examination