



CBMS852

Molecular Biology and Genomics

S1 Day 2014

Chemistry and Biomolecular Sciences

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General Information

Unit convenor and teaching staff

Unit Convenor

Ian Paulsen

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Contact via ian.paulsen@mq.edu.au

Credit points

4

Prerequisites

Admission to MBiotech or MBiotechMCom or MRadiopharmSc or MSc

Corequisites

Co-badged status

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 proficient in the theory and practice 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 have a thorough understanding of 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 have an understanding of the revolutionary impact of genomics across all biological sciences.

Students will also display evidence of good report-writing skills including appropriate scientific referencing.

Students will develop hands-on expertise at conducting bioinformatic analyses of genomic data.

Students will develop skills in critical thinking and analysis, and written and oral presentation of scientific information

Assessment Tasks

Name	Weighting	Due
<u>Laboratory Reports</u>	20%	April 16; Apr 23; May 28
<u>Problem Set</u>	5%	June 4/5
<u>Final Examination</u>	45%	University Examination Period
<u>Mid Semester Test</u>	10%	Apr 30/May 1
<u>Bioinformatics Report</u>	10%	June 4
<u>Essay</u>	10%	14 May

Laboratory Reports

Due: **April 16; Apr 23; May 28**

Weighting: **20%**

On successful completion you will be able to:

- Students will be proficient in the theory and practice 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 have a thorough understanding of 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 also display evidence of good report-writing skills including appropriate scientific referencing.

- Students will develop skills in critical thinking and analysis, and written and oral presentation of scientific information

Problem Set

Due: **June 4/5**

Weighting: **5%**

On successful completion you will be able to:

- Students will be proficient in the theory and practice 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 have a thorough understanding of 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 develop skills in critical thinking and analysis, and written and oral presentation of scientific information

Final Examination

Due: **University Examination Period**

Weighting: **45%**

On successful completion you will be able to:

- Students will be proficient in the theory and practice 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 have a thorough understanding of 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 have an understanding of the revolutionary impact of genomics across all biological sciences.
- Students will also display evidence of good report-writing skills including appropriate scientific referencing.
- Students will develop hands-on expertise at conducting bioinformatic analyses of genomic data.
- Students will develop skills in critical thinking and analysis, and written and oral

presentation of scientific information

Mid Semester Test

Due: **Apr 30/May 1**

Weighting: **10%**

On successful completion you will be able to:

- Students will have a thorough understanding of 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.

Bioinformatics Report

Due: **June 4**

Weighting: **10%**

On successful completion you will be able to:

- Students will have an understanding of the revolutionary impact of genomics across all biological sciences.
- Students will also display evidence of good report-writing skills including appropriate scientific referencing.
- Students will develop hands-on expertise at conducting bioinformatic analyses of genomic data.

Essay

Due: **14 May**

Weighting: **10%**

On successful completion you will be able to:

- Students will have a thorough understanding of 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 also display evidence of good report-writing skills including appropriate scientific referencing.
- Students will develop skills in critical thinking and analysis, and written and oral presentation of scientific information

Delivery and Resources

Classes

There are two weekly lectures of 1 hour (W5C320, 11am Wednesday; E7B100, 3 pm Thursday) and a weekly practical session of 3 hours (E7B349-350, 1 – 4pm Wednesday or 9am-12pm Thursday). In weeks 10 and 11, the practical class is replaced with a bioinformatic workshop. 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

The Lactose Operon by Beckwith and Zipser

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.

What has changed?

The scope of the prac reports and bioinformatics report has been reduced.

Unit Schedule

Unit guide CBMS852 Molecular Biology and Genomics

Date	Lecture	Title	Lecturer
Mar 5	1	Introduction/What is Molecular Biology/Genome Structure	Haynes
Mar 6	2	Gene Organization/function	Haynes
Mar 12	3	Molecular Biology Techniques	Haynes
Mar 13	4	Molecular Biology Techniques	Haynes
Mar 19	5	Molecular Cloning	Haynes
Mar 20	6	Tools for studying Gene Activity	Haynes
Mar 26	7	Transcription in Prokaryotes	Paulsen
Mar 27	8	Structure of Prokaryotic Operons	Paulsen
Apr 2	9	Bacterial Gene Regulation	Paulsen
Apr 3	10	Transcription in Eukaryotes	Paulsen
Apr 9	11	Eukaryotic Gene Regulation	Paulsen
Apr 10	12	Nucleosomes/Histones/Chromatin	Paulsen
		Semester break	
Apr 30	13	Messenger RNA splicing	Paulsen
May 1	14	Mechanism of Translation	Paulsen
May 7	15	Ribosomes and transfer RNA	Paulsen
May 8	16	DNA replication	Paulsen
May 14	17	DNA recombination	Paulsen
May 15	18	DNA repair	Paulsen
May 21	19	Mobile DNA elements	Paulsen
May 22	20	Mobile DNA elements	Paulsen

May 28	21	Genome Sequencing	Paulsen
May 29	22	Genomes, Pan-Genomes and Metagenomics	Paulsen
Jun 4	23	Bioinformatics and Genome Annotation	Paulsen
Jun 5	24	Functional Genomics and Systems Biology	Paulsen
Jun 11	25	Revision	Paulsen
Jun 12	26	Revision	Paulsen

Policies and Procedures

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

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of 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/support/student_conduct/

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://informatics.mq.edu.au/help/>.

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

Graduate Capabilities

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 proficient in the theory and practice 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 have a thorough understanding of 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 have an understanding of the revolutionary impact of genomics across all biological sciences.
- Students will develop hands-on expertise at conducting bioinformatic analyses of genomic data.

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 proficient in the theory and practice 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 have a thorough understanding of 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 have an understanding of the revolutionary impact of genomics across all biological sciences.
- Students will develop hands-on expertise at conducting bioinformatic analyses of genomic data.
- Students will develop skills in critical thinking and analysis, and written and oral presentation of scientific information

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 proficient in the theory and practice 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 have a thorough understanding of 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 develop skills in critical thinking and analysis, and written and oral presentation of scientific information

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 proficient in the theory and practice 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 have a thorough understanding of 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 also display evidence of good report-writing skills including appropriate scientific referencing.

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 proficient in the theory and practice of a range of molecular biology experimental techniques, including PCR, restriction enzyme digestion, gel electrophoresis, cloning, site-directed mutagenesis, DNA sequencing and DNA hybridization.

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