CBMS852

Molecular Biology and Genomics

S1 Day 2015

Dept of Chemistry & Biomolecular Sciences

Contents

General Information

Unit convenor and teaching staff
Convenor
Ian Paulsen
ian.paulsen@mq.edu.au
Contact via x8152
E8A 202

Lecturer
Paul Haynes
paul.haynes@mq.edu.au

Lab Technician
Ray Duell

Credit points
4

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

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

General Assessment Information

Assignments

- **All assignments must be submitted to the appropriate assignment box for your unit.** Assignment boxes are located in the reception area of the Science Centre (Room 101), ground floor at the western end of building E7A.

The Centre is open 8.30am - 5.30pm Monday to Friday.

- **All assignments are to be submitted by midday on the date specified and must include a completed and signed coversheet stapled to the front cover.**

Problem Set

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

Requirements

- **Students are required to satisfactorily complete all components of the unit to**

pass.

Satisfactory completion of all components includes 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.

- **Attendance at the practical sessions is compulsory.**

Assessment Tasks

Name	Weighting	Due
Laboratory Reports	15%	Apr 8, Apr 15, May 27
Bioinformatic Report	10%	June 3
Mid-Semester Test	10%	Week 7
Problem Set	5%	Week 12
Final Examination	50%	University Examination Period
Essay	10%	May 6

Laboratory Reports

Due: **Apr 8, Apr 15, May 27**
Weighting: **15%**

3 lab reports, 1500 words each

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

Bioinformatic Report

Due: **June 3**
Weighting: **10%**

Report on Bioinformatic Analysis

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

Mid-Semester Test

Due: **Week 7**
Weighting: **10%**

Multiple Choice Test carried out during regularly scheduled laboratory time.

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

Problem Set

Due: **Week 12**
Weighting: **5%**

12 Question Problem Set in Prac Manual.

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

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

Essay

Due: **May 6**
Weighting: **10%**

1000 word research essay

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 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.
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Delivery and Resources

Classes There are two weekly lectures of 1 hour (C5C Collaborative Forum, 2pm Tuesday, 1pm Thursday) and a weekly practical session of 3 hours (F7B102-105, 1 – 4pm Wednesday or 9am-12pm Thursday). In weeks 10 and 11, the practical class is replaced with 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	Feb 24	1	Introduction/What is Molecular Biology/Genome Structure	Haynes
	Feb 26	2	Gene Organization/function	Haynes

2	Mar 3	3	Molecular Biology Techniques	Haynes
	Mar 5	4	Molecular Biology Techniques	Haynes
3	Mar 10	5	Molecular Cloning	Haynes
	Mar 12	6	Tools for studying Gene Activity	Haynes
4	Mar 17	7	Transcription in Prokaryotes	Paulsen
	Mar 19	8	Structure of Prokaryotic Operons	Paulsen
5	Mar 24	9	Bacterial Gene Regulation	Paulsen
	Mar 26	10	Transcription in Eukaryotes	Paulsen
6	Mar 31	11	Eukaryotic Gene Regulation	Paulsen
	Apr 2	12	Nucleosomes/Histones/Chromatin	Paulsen
			Semester break	
7	Apr 21	13	Messenger RNA splicing	Paulsen
	Apr 23	14	Mechanism of Translation	Paulsen
8	Apr 28	15	Ribosomes and transfer RNA	Paulsen
	Apr 30	16	DNA replication	Paulsen
9	May 5	17	DNA recombination	Paulsen
	May 7	18	DNA repair	Paulsen
10	May 12	19	Mobile DNA elements	Paulsen
	May 14	20	Mobile DNA elements	Paulsen
11	May 19	21	Genome Sequencing	Paulsen
	May 21	22	Genomes, Pan-Genomes and Metagenomics	Paulsen
12	May 26	23	Bioinformatics and Genome Annotation	Paulsen

	May 28	**24**	**Functional Genomics and Systems Biology**	Paulsen
13	**Jun 2**	**25**	**Revision**	Paulsen
	Jun 4	**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/

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://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 - 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.
- Students will develop hands-on expertise at conducting bioinformatic analyses of genomic data
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Assessment tasks

- Laboratory Reports
- Bioinformatic Report
- Mid-Semester Test
- Problem Set

- Final Examination
- Essay

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.
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Assessment tasks

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

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.
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- Problem Set
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- Essay

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.

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- Problem Set
- Final Examination
- Essay

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 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
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Assessment tasks

- Laboratory Reports
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- Final Examination
- Essay

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

Assessment tasks

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