CBMS336

Molecular Biology and Genomics

S1 Day 2017

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
3

Prerequisites
(39cp at 100 level or above) including CBMS224

Corequisites

Co-badged status
CBMS336/836

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, 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. 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:

Students will be 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.

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 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.

Assessment Tasks

Name	Weighting	Hurdle	Due
Laboratory Reports	25%	No	Apr 12, Apr 19, May 31
Bioinformatic Report	10%	No	June 7
Mid-Semester Test	10%	No	Week 7
Problem Set	5%	No	Week 12
Final Examination	50%	No	University Examination Period

Laboratory Reports

Due: **Apr 12, Apr 19, May 31**
Weighting: **25%**

3 lab reports, 1500 words each

On successful completion you will be able to:

- Students will be 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.

Bioinformatic Report

Due: **June 7**
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.

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 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.

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 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.

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 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.

Delivery and Resources

Classes There are two weekly lectures of 1 hour (12pm Monday in E7BT5, and 3pm Wednesday in E7BT3) and a weekly practical session of 3 hours (F7B102 or F7B105, 2 - 5pm Tuesday or 10am - 1pm 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	Feb 27	1	Introduction/What is Molecular Biology/Genome Structure	Haynes
	Mar 1	2	Gene Organization/function	Haynes
2	Mar 6	3	Molecular Biology Techniques	Haynes
	Mar 8	4	Molecular Biology Techniques	Paulsen
3	Mar 13	5	Molecular Cloning	Haynes
	Mar 15	6	Tools for studying Gene Activity	Haynes
4	Mar 20	7	Transcription in Prokaryotes	Paulsen
	Mar 22	8	Structure of Prokaryotic Operons	Paulsen
5	Mar 27	9	Bacterial Gene Regulation	Paulsen
	Mar 29	10	Transcription in Eukaryotes	Paulsen
6	Apr 3	11	Eukaryotic Gene Regulation	Paulsen

	Apr 5	**12**	**Nucleosomes/Histones/Chromatin**	Paulsen
7	**Apr 10**	**13**	**Messenger RNA splicing**	Paulsen
	Apr 12	**14**	**Mechanism of Translation**	Paulsen
Semester break				
8	**May 1**	**15**	**Ribosomes and transfer RNA**	Paulsen
	May 3	**16**	**DNA replication**	Paulsen
9	**May 8**	**17**	**DNA recombination**	Paulsen
	May 10	**18**	**DNA repair**	Paulsen
10	**May 15**	**19**	**Mobile DNA elements**	Paulsen
	May 17	**20**	**Mobile DNA elements**	Paulsen
11	**May 22**	**21**	**Genome Sequencing**	Paulsen
	May 24	**22**	**Genomes, Pan-Genomes and Metagenomics**	Paulsen
12	**May 29**	**23**	**Bioinformatics and Genome Annotation**	Paulsen
	May 31	**24**	**Functional Genomics and Systems Biology**	Paulsen
13	**Jun 5**	**25**	**Synthetic Biology**	Paulsen
	Jun 7	**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_2016.html

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

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration

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://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

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcome

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

Assessment tasks

- Bioinformatic Report
- Final Examination

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Students will be 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.
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Assessment tasks

- Laboratory Reports

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

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Students will be 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.
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Assessment tasks

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

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and

systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Students will be 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.
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Assessment tasks

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

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Students will be 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.

Assessment tasks

- Laboratory Reports
- Mid-Semester Test
- Problem Set
- Final Examination

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcome

- 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

Changes since First Published

Date	Description
28/02/2017	Changes were made to General Assessment Information: 1) The following words were removed: “Students are required to satisfactorily complete all components of the unit to pass”. Assessment items are not defined hurdles, but are nevertheless integral parts of the unit, as still stated. 2) The following words were removed: “Attendance at the practical sessions is compulsory.” Instead it is specified that “Participation in ALL practical sessions is required in order to complete the practical reports.”