CBMS880

Molecular and Medical Biotechnology

S2 Day 2016

Dept of Chemistry & Biomolecular Sciences

Contents

General Information

Unit convenor and teaching staff
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Credit points
4

Prerequisites
Admission to MBiotech or MBiotechMCom or MRadiopharmSc or MBioBus

Corequisites

Co-badged status
CBMS331 and CBMS731

Unit description
This unit is composed of lectures, a significant hands-on laboratory component, student debate, tutorials, assignments and reports. A visit to local industry will be arranged. We will discuss examples of cutting-edge research and biotechnology-related recentThis unit explores particular areas of contemporary molecular and medical biotechnology building on students' existing knowledge and importantly, showing how science is translated to applications in health, industry and the environment. Lecture topics range from the production of recombinant biomolecules in various cell factories, applications of stem cells to joint repair, and applications of nanoparticles for diagnostics. We will look into recent technical and conceptual developments and how these relate to our personal lives, society and industry. Visiting lecturers from industry and various academic disciplines will lead discussion on their area of expertise.areas of expertise. A special task for the 800-level students is to compose an essay on ethical issues in modern biotechnology according to their own area of interest. The unit also has a significant hands-on laboratory component with tutorials and assignment tasks.

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:

At the end of this unit, the students will be able to: 1. Describe key concepts and explain the impact of biotechnology, and discuss its interdisciplinary nature and how it has affected modern society. 2. Conduct hands-on laboratory work using contemporary experimental techniques including microbial culture, DNA mediated transformation, production of recombinant proteins in fungi, confocal microscopy and glycan analysis. 3. Collect and synthesize experimental data in the form of a scientific report which conforms to a standard biotechnology journal, including the use of appropriate scientific referencing. At Masters level students are expected to go beyond 'this is what we got' to 'how can I explain and/or improve on this'. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

General Assessment Information

Practical Reports

These are major reports describing the laboratory experiments in detail with references to literature. The reports must be submitted to iLearn by the due date (see below) for checking in turnitin. In addition to the electronic copy, a hard copy is to be submitted to the Science Student Centre, temporarily located on the ground floor of the MUSE building, where a submission box will be set up. Campus maps are available at http://www.bgo.mq.edu.au/maps_campus.htm. The Centre is open from 8.30 am to 5.30 pm from Monday to Friday.

The reports should follow the format:

Introduction	(stating aims in the last paragraph)
Materials and Methods	(main points and procedures)
Results	(with tables and graphs where applicable)
Discussion	(reflecting on the results)
References	(choose one style and stick to it)
Answers to questions	(separate from other text)

Results should consist of tables, diagrams and words in between to tie them together. Presenting tables, graphs, etc. without any explanation is not acceptable. Every table, graph and diagram should be numbered and have a caption, and you should refer to them in the text by their number. Expected length for an average report is about 5-10 double spaced typewritten pages plus figures and tables. Please answer the questions after the actual report text under a heading 'Answers to questions' and number your answers. Marks allocated to each component are given in the class.

Submission

All reports and assignments must be submitted by 5.30 pm on the due date.

Late Submission

There are no written tasks worth 10% or less with a deadline. Continuing assessment will be marked unit the end of the unit.

Written tasks above 10% - No extensions will be granted. 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. This penalty does not apply for cases in which an application for disruption of studies is made and approved. In case of approved disruption of studies the student will be given an extension for the assignment(s) in negotiation with the unit convener. No submission will be accepted after solutions have been posted.

What is Required to Complete the Unit Satisfactorily

Students should attend lectures, tutorials and laboratory classes with active participation. This means that you are encouraged to ask questions during lectures, and particularly at tutorials and laboratory classes. Do not be afraid to ask questions – your classmates will probably wonder

about the same thing. There are no stupid questions, really.

The lectures and practicals link together to support the overall learning. The questions related to the practicals are formulated so that you will have the opportunity to use the information acquired in the class and provided in the lectures. You are expected to consult scientific literature for additional information and inspiration. The students will have plenty of time for hands-on laboratory work and opportunities to discuss any practical problems with the demonstrator and class mates. **It is important to keep in mind that experiments with living organisms can produce surprising results or sometimes no results at all!** If that should happen, your task would be to find reasons for the unexpected outcome(s). There are no pre-set 'correct' results to the laboratory work and it is important to learn how to continue with the experiment in the face of the unexpected. Similarly, there may be modifications or additions to the instructions printed in the practical notes provided, depending on the course the experiments may take.

Attendance to practicals is compulsory.

Assessment Tasks

Name	Weighting	Due
Practical report 1	11%	16-09-2106
Practical report 2	11%	24-10-2016
Practical report 3	11%	07-11-2016
Primer design task	11%	Due: 12-09-2016
The Great Debate	3%	Week 11 or 12
Continuing assessment	3%	Weekly
Hot topic essay	11%	10-10-2016
Final examination	39%	November 2016

Practical report 1

Due: **16-09-2106**
Weighting: **11%**

Written report on practical 1, composed on the results from practical work over five weeks and marked over **the mid-semester break** will provide early feedback on the developing skills in report writing and extracting relevant information from various paper and electronic sources. The report provides an indication of the student's ability to interpret, analyse and explain experimental results. Related approaches have been discussed in lectures 1-14. There are two additional questions for the students to answer and explore as part of the report.

On successful completion you will be able to:

- At the end of this unit, the students will be able to: 1. Describe key concepts and explain the impact of biotechnology, and discuss its interdisciplinary nature and how it has affected modern society. 2. Conduct hands-on laboratory work using contemporary experimental techniques including microbial culture, DNA mediated transformation, production of recombinant proteins in fungi, confocal microscopy and glycan analysis. 3. Collect and synthesize experimental data in the form of a scientific report which conforms to a standard biotechnology journal, including the use of appropriate scientific referencing. At Masters level students are expected to go beyond ‘this is what we got’ to ‘how can I explain and/or improve on this’. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Practical report 2

Due: **24-10-2016**
Weighting: **11%**

Written report on practical 2 including notes on the Fluorescence quiz (added as an appendix). The students have received feedback on their first report and thus should take the advice on board when compiling report 2. This report involves presenting image material and discussing the observations in detail. Also, the students are requested to answer two questions presented in the fluorescence tutorial and provide one page executive summary linking together practicals 1 and 2, as part of the report.

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literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Practical report 3

Due: **07-11-2016**
Weighting: **11%**

Written report on practical 3. The report concerns detailed analysis using results obtained in the class. There are two additional questions for the students to answer and explore as part of the report.

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- At the end of this unit, the students will be able to: 1. Describe key concepts and explain the impact of biotechnology, and discuss its interdisciplinary nature and how it has affected modern society. 2. Conduct hands-on laboratory work using contemporary experimental techniques including microbial culture, DNA mediated transformation, production of recombinant proteins in fungi, confocal microscopy and glycan analysis. 3. Collect and synthesize experimental data in the form of a scientific report which conforms to a standard biotechnology journal, including the use of appropriate scientific referencing. At Masters level students are expected to go beyond ‘this is what we got’ to ‘how can I explain and/or improve on this’. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Primer design task

Due: **Due: 12-09-2016**
Weighting: **11%**

The task measures the ability to design oligonucleotide primers for DNA amplification which is one of the most essential skills in molecular biology. During the tutorial, you will be given a brief, material to work with and specific questions to answer. This assignment will be completed at home and requires some independent literature/web research. Submission on iLearn.

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The Great Debate

Due: **Week 11 or 12**
Weighting: **3%**

The students will be divided into groups of 3-5 people (depending on the total student number) who will be given a topic in the area of biotechnology (drawn out of a hat) which they either have to defend or oppose. The topics will be chosen from those suggested by the students and teaching staff. The groups will know their topic in the previous week so that they can plan ahead their debating strategy. Each debate, chaired by the course convener, will last for 10-20 minutes followed by questions from the audience. The audience will participate in the assessment by voting for the winning team after each debate. This is a good opportunity to practice ethical voting, *i.e.* voting based on a successful argument and not *e.g.* because you are good buddies with some individuals in one of the debating teams. There will be no individual marks but the collective mark goes to everyone in the group.

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'how can I explain and/or improve on this'. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Continuing assessment

Due: **Weekly**
Weighting: **3%**

Continuing assessment involves providing a brief answer to a weekly question appearing on iLearn each Friday by 5 pm. The question concerns a topic discussed either on the Mon or Fri lecture. You are expected to attend lectures/listen to the lecture recordings and submit a brief answer to the question on iLearn. Your answers must be in by the following Wed 5 pm. There will be 12 questions overall. The mark will be calculated according to the number of questions answered. Answering all questions will give you the full 3%. This exercise is voluntary; however, it is great practice for the final exam.

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Hot topic essay

Due: **10-10-2016**
Weighting: **11%**

This essay will be written in the "Times magazine style", *i.e*. to a broader audience. The topics

that will be around whatever is 'hot'; in the biotech area, will be announced before the mid-semester break. You can take a strong standing on the topic you are writing about in order to engage the reader and prove the value of your point of view. Expected length of the paper is about 5-10 double spaced typewritten pages. Use illustrations and references if applicable. The essay will be submitted to turnitin.

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Final examination

Due: **November 2016**
Weighting: **39%**

The final course examination will be 3 hours plus 10 min reading time. The examination will cover all sections of the unit including tutorials and practicals and consists of short answers, problem solving tasks and essay questions. In their answers the students are encouraged to practise critical thinking and expand on ideas rather than just listing facts and figures with no discussion. Dot point-style answering is not allowed. You do not need a calculator in the examination.

On successful completion you will be able to:

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Collect and synthesize experimental data in the form of a scientific report which conforms to a standard biotechnology journal, including the use of appropriate scientific referencing. At Masters level students are expected to go beyond 'this is what we got' to 'how can I explain and/or improve on this'. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Delivery and Resources

Technology Used

Access to the Internet is necessary. General use computers are provided by the University, but it would be advantageous to have your own computer/laptop with internet access.

All calculations during practicals can be carried out using a smart phone. Laboratory reports can be produced using standard Microsoft Office software.

Classes

Timetable: Please check http://www.timetables.mq.edu.au/ for the official timetable of the unit.

Lectures: There are two one-hour lectures per week, Mon at 10-11 am in W5C320 and Fri from 10-11 am in E6A102. The material presented in the lectures is examinable. Please note that there is no text book coverage for a fair amount of the presented material. Therefore, regular attendance to the lectures and careful listening of the recordings is highly recommended. Lecture topics and dates can be found on the unit webpage on iLearn (CBMS880 http://ilearn.mq.edu.au). Lectures will be delivered as scheduled with eCHO recording available through iLearn.

Lecture graphics will be uploaded on CBMS880 iLearn (http://ilearn.mq.edu.au) the day before each lecture. The site also provides you with lecture recordings, videos and images generated in the practicals. Announcements will be used to communicate information from the unit convener.

Laboratory work: Please note that **laboratory sessions commence in Week 2**; Practical topics and the timetable are available on iLearn. The 4-hour practical sessions will be offered on Tue afternoon from 2-6 pm (Group 1) or Wed morning 9 am-1 pm (Group 2) in E7B349-50. Each student should enrol in **one** of these sessions and stay within that group throughout the entire semester. Practical laboratory sessions are compulsory and a medical certificate or other relevant documentation will be required for any absences. It should be noted that missing any practical will make the reporting very difficult since some of the practicals continue over several weeks and plenty of data will be generated every week. Should a student miss a practical for a valid or unavoidable reason, he or she should consult the working pair and other class mates for results and other information generated during the missed session in order to be able to produce a report. The student can also join the other weekly prac class as a temporary guest and then return to his or her allocated class.

Laboratory procedures: This course will involve laboratory work with microorganisms, DNA samples, proteins and sugars. The experimental techniques feature molecular biology, microbial cultivation, fluorescent microscopy, biochemical analyses and mass spectrometry. Note that there are safety requirements concerning the use of these techniques. All students are required to adhere to the guidelines for safe laboratory conduct provided on iLearn.

Instructions for the laboratory experiments and quizzes can be downloaded from iLearn. Instructions for the laboratory experiments can be downloaded from iLearn. It is essential that you bring the notes with you to each class. Additional material may be provided in the class.

The Great Debate: Attendance to the debate is compulsory. The debate will be carried out in the CBMS Tea room at the time slot allocated for the laboratory class (*i.e*. 2-6 pm on Tue or 9 am-1 pm on Wed).

Tutorials: Tutorials (codon optimisation, primer design and fluorescence) are run during practical sessions, thus attendance is compulsory. Previously announced locations for these activities may change so stay tuned (please consult iLearn). Tutorial material, which forms part of the material submitted for assessment and/or examination, will be made available on iLearn.

Required Materials and/or Recommended Readings

Biotechnology draws from different disciplines and technologies. The recommended textbooks will give you a good general introduction to (Thieman and Palladino) or deeper knowledge on (Clark and Pazdernik) these areas and provide further reading as well as useful websites for more in depth studies. The books also provide good questions at the end of each chapter to test your learning.

Textbooks:

William J. Thieman and Michael A. Palladino (2012): Introduction to Biotechnology, 3rd edition. Pearson Benjamin-Cummings Publishing Company, San Francisco CA.

David P. Clark and Nanette J. Pazdernik (2016): Biotechnology, 2nd edition. Elsevier, China. This book also provides an online study guide available with the textbook.

The books is available at the University Bookshop. Please note that while the books provide an anchor for the studies, plenty of **additional and examinable information** will be provided in the lectures.

Almost every issue of the mainstream biotechnology journals will contain scientific papers related to the lecture material. Journals such as ‘Biotechnology’ and ‘Trends in Biotechnology’ are subscribed by the MQ Library and a good amount of the relevant journals are accessible through electronic databases such as PubMed (http://www.ncbi.nlm.nih.gov/pubmed/). Please take some time to browse through the journals for papers that you may find interesting. Getting familiar with the format in which scientific papers are presented will be of great help in your own report writing.

In the Laboratory:

You are required to wear a decent labcoat and safety glasses whenever in the lab. Preferably bring your own. It is recommended that you carry a marking pen (permanent), spatula, scissors and tweezers (and phone).

You will be required to keep **a laboratory book** in which the details, results and conclusions of experiments will be recorded. The best format is an A4 ruled notebook that opens flat. This book is to be used in the practicals and notes should allow you to repeat the experiment. Tablets and laptops may be used for note-taking. You are required to write three formal reports on the practical work, which will be a lot less painful experience with good notes in hand.

Unit Website

The official CBMS880 website is: **ilearn.mq.edu.au**

You will be asked for a username and password. Your username is your student number. If you have trouble logging in, please follow the help instructions given on the web page before contacting your lecturer academic staff. You may also contact the

Help Desk:

Phone: 9850-HELP (4357)

Freecall: 1800 063 191

Email: http://help.mq.edu.au/

Unit Schedule

CBMS880 Molecular and Medical Biotechnology, lecture topics 2016

Two one-hour lectures per week, on Mon at 10-11 am in W5C320 and Fri from 10-11 am in E6A102

The many faces of biotechnology- the big picture

1. Course introduction - contribution of biotechnology to modern life (HN)-1.8

Molecular biotechnology:

Molecular aspects of biotechnology revisited

2. The toolbox for genetic engineering-making a recombinant protein (HN)-5.8
3. Genetic engineering- power tools and considerations (HN)-8.8
4. Biotechnology pipeline- linking the ‘omics’ (HN)-12.8
5. Protein secretion and quality control (HN)-15.8
5. Protein secretion, the way out (HN)-19.8
7. Modern approaches into protein engineering (AS)-22.8
8. Basic concepts in synthetic biology (LB)-26.8

Making recombinant products

9. Microbes as cell factories (HN)-29.8
10. Cell cultures and transgenic animals (HN)-2.9
11. What about transgenic plants (HN)-5.9
12. The art of making a biotech product on a large scale (HN)-9.9

Fluorescence in biotechnology

13. Fluorescence instrumentation and applications in biotechnology (LP)-12.9
14. Super resolution microscopy (DD)-16.9

BREAK 19.9. – 3.10.

Medical biotechnology:

15. Flow cytometry as a tool in biotechnology (MO)-7.10

Sweet biotechnology

16. Basic aspects of protein glycosylation (NP)-10.10
17. Biological functions of protein glycosylation (NP)-14.10

Drugs, bugs and thugs

18. DNA as evidence in forensic science (HN)-17.20
19. The promise of biopharmaceuticals (HN)-21.10
20. Bioinformatics and combinatorial chemistry in drug design (SR-24.10)

Stem cells and cancer biotechnology

21. Quick guide to stem cells and their applications (HN)-28.10
22. Cancer and biotechnology (MM)-31.10

Nanobiotechnology

23. Sneak peak into nanotechnology (HN)-4.11

24. Application of nanoparticles in cancer diagnostics (AC)-7.11

25. Course summary (HN)-11.11

Please note that there may be changes to the visiting lecturers; these changes will be announced on iLearn Announcements.

Lecturers:

HN- Prof Helena Nevalainen, MQ CBMS (helena.nevalainen@mq.edu.au)

LB- Dr Louise Brown, MQ CBMS (louise.brown@mq.edu.au)

AS- Dr Anwar Sunna, MQ CBMS (anwar.sunna@mq.edu.au)

LP- Dr Lindsay Parker, MQ, Biological Sciences (lindsay.parker@mq.edu.au)

DD- Dr Danitza Denkova, MQ, ARC Centre of Excellence for Nanoscale BioPhotonics (CNBP)

MO- Dr Martin Ostrowski, MQ, CBMS (martin.ostrowski@mq.edu.au)

SR- Prof Shoba Ranganathan, MQ CBMS (shoba.ranganathan@els.mq.edu.au)

NP- Prof Nicolle Packer, MQ CBMS (nicki.packer@mq.edu.au)

MM- A/Prof Mark Molloy, MQ CBMS and APAF (mark.molloy@proteome.org)

AC- Dr Andrew Care, MQ CBMS (andrew.care@mq.edu.au)

Attendance to the lectures is not compulsory but is strongly encouraged. Some lectures will be supported by video material also made available on iLearn.

Practical sessions

The 4 hour practical sessions will be offered on Tue afternoon from 2-6 pm in E7B349-50 (Group 1) or Wed morning 9 am-1 pm in E7B350 (Group 2). Each student should enrol in **one** of these sessions and stay within that group throughout the entire semester. Please note that **practicals and tutorials are compulsory** and you will need a Doctor's certificate or other relevant documentation to justify an absence.

Practicals:

1. Genetic transformation of the filamentous fungus *Trichoderma reesei*

2. Fluorescent labelling of fungal cell membranes and cellular localisation of the recombinant DsRed 1 protein.

3. Analysis of N-linked glycans on native human lactoferrin glycoprotein isolated from human and bovine milk

Practical 1 **Genetic transformation of the filamentous fungus *Trichoderma reesei***

Tue 9.8. Plate conidia for bombardment

Wed 10.8. Coat microparticles with DNA and shoot

Tue 16.8. Count transformants and restreak on PDA-HygB plates

Wed 17.8. Streak transformant conidia for DNA isolation

Codon optimisation tutorial CBMS Tea room F7B322

Tue 23.8. Isolate chromosomal DNA from transformants for PCR

Wed 24.8. Design primers for PCR to check the transformants

Tue 30.9. Check the quality of chromosomal DNA

Wed 31.9. Run PCR on transformants

Primer design quiz handed out and discussed in the class

Tue 6.9. Check PCR products by agarose gel electrophoresis and take

Wed 7.9. photographs

Wrapping up Practical 1

Practical 2 **Fluorescent labelling of fungal cell membranes and cellular localisation of the DsRed1 protein**

Tue 13.9. Staining of the DsRed-expressing transformants and the

Wed 14.9. non-transformant with an ER specific dye

Inspection of specimens using confocal microscopy

Fluorescence quiz and tutorial E7B 346

Executive summary tutorial CBMS Tea room F7B322

No prac on 4 or 5 Oct

Practical 3. Analysis of N-linked glycans on the native lactoferrin glycoprotein isolated from human and bovine milk

Tue	11.10.	Sample preparation of native and recombinant lactoferrin
Wed	12.10.	Release of oligosaccharides by enzyme treatment

Wrapping up Practical 2

Tue	18.10.	Purification and analysis of oligosaccharides by liquid
Wed	19.10.	chromatography-mass spectrometry and interpretation of data

Wrapping up Practical 3

Tue	25.10.	**The Great Debate I,** CBMS Tea room F7B320
Wed	26.10.	

Tue	1.11.	**The Great Debate II** CBMS Tea room F7B320
Wed	2.11.	

For CBMS731 only:		**Seminar presentations** E7B 346
Tue	8.11. **or**	TBA

Wed 9.11.

Note that the dates of the above activities are interchangeable. All practicals and the Great Debate are compulsory to all students.

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

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.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 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://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 outcome

- At the end of this unit, the students will be able to: 1. Describe key concepts and explain the impact of biotechnology, and discuss its interdisciplinary nature and how it has affected modern society. 2. Conduct hands-on laboratory work using contemporary experimental techniques including microbial culture, DNA mediated transformation, production of recombinant proteins in fungi, confocal microscopy and glycan analysis. 3. Collect and synthesize experimental data in the form of a scientific report which conforms to a standard biotechnology journal, including the use of appropriate scientific referencing. At Masters level students are expected to go beyond ‘this is what we got’ to ‘how can I explain and/or improve on this’. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6.

Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Assessment tasks

- Practical report 1
- Practical report 2
- Practical report 3
- Primer design task
- The Great Debate
- Continuing assessment
- Hot topic essay
- 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 outcome

- At the end of this unit, the students will be able to: 1. Describe key concepts and explain the impact of biotechnology, and discuss its interdisciplinary nature and how it has affected modern society. 2. Conduct hands-on laboratory work using contemporary experimental techniques including microbial culture, DNA mediated transformation, production of recombinant proteins in fungi, confocal microscopy and glycan analysis. 3. Collect and synthesize experimental data in the form of a scientific report which conforms to a standard biotechnology journal, including the use of appropriate scientific referencing. At Masters level students are expected to go beyond ‘this is what we got’ to ‘how can I explain and/or improve on this’. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Assessment tasks

- Practical report 1

- Practical report 2
- Practical report 3
- Primer design task
- The Great Debate
- Continuing assessment
- Hot topic essay
- 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 outcome

- At the end of this unit, the students will be able to: 1. Describe key concepts and explain the impact of biotechnology, and discuss its interdisciplinary nature and how it has affected modern society. 2. Conduct hands-on laboratory work using contemporary experimental techniques including microbial culture, DNA mediated transformation, production of recombinant proteins in fungi, confocal microscopy and glycan analysis. 3. Collect and synthesize experimental data in the form of a scientific report which conforms to a standard biotechnology journal, including the use of appropriate scientific referencing. At Masters level students are expected to go beyond ‘this is what we got’ to ‘how can I explain and/or improve on this’. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Assessment tasks

- Practical report 1
- Practical report 2
- Practical report 3
- 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 outcome

- At the end of this unit, the students will be able to: 1. Describe key concepts and explain the impact of biotechnology, and discuss its interdisciplinary nature and how it has affected modern society. 2. Conduct hands-on laboratory work using contemporary experimental techniques including microbial culture, DNA mediated transformation, production of recombinant proteins in fungi, confocal microscopy and glycan analysis. 3. Collect and synthesize experimental data in the form of a scientific report which conforms to a standard biotechnology journal, including the use of appropriate scientific referencing. At Masters level students are expected to go beyond ‘this is what we got’ to ‘how can I explain and/or improve on this’. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Assessment tasks

- Practical report 1
- Practical report 2
- Practical report 3
- 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 outcome

- At the end of this unit, the students will be able to: 1. Describe key concepts and explain

the impact of biotechnology, and discuss its interdisciplinary nature and how it has affected modern society. 2. Conduct hands-on laboratory work using contemporary experimental techniques including microbial culture, DNA mediated transformation, production of recombinant proteins in fungi, confocal microscopy and glycan analysis. 3. Collect and synthesize experimental data in the form of a scientific report which conforms to a standard biotechnology journal, including the use of appropriate scientific referencing. At Masters level students are expected to go beyond 'this is what we got' to 'how can I explain and/or improve on this'. 4. Work in a group as well as well as an individual. 5. Pursue individual topics of biotechnology by consulting relevant scientific literature and write a news and views type essay on a selected topic in biotechnology. 6. Document and demonstrate the biotechnology skills relevant for employment in industry or progressing into higher degree studies. 7. Discuss the ethical aspects related to recombinant DNA technology.

Assessment tasks

- Practical report 1
- Practical report 2
- Practical report 3
- Primer design task
- The Great Debate
- Continuing assessment
- Hot topic essay
- 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:

Assessment tasks

- The Great Debate
- Hot topic essay
- Final examination