



# CBMS731

## Molecular and Medical Biotechnology

S2 Day 2014

*Chemistry and Biomolecular Sciences*

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#### Disclaimer

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

Unit convenor and teaching staff

Unit Convenor

Helena Nevalainen

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Credit points

4

Prerequisites

Admission to MRes

Corequisites

Co-badged status

The lectures and practicals in this unit are co-taught with CBMS331 and CBMS880. The specific postgraduate learning outcomes for CBMS731 are aimed at gaining an understanding of scientific literature and current practices in the relevant fields of modern biotechnology. The ability to communicate science to a broader audience is especially addressed. Students are required to research the questions presented in the practical manual in depth, and make this additional inquiry evident in the answers. The practical laboratory reports are expected to show aptitude to interpret the results, i.e. the ability and curiosity to move beyond 'what was done' to explaining 'what does it mean'.

Unit description

The unit is composed of lectures, a significant hands-on laboratory component, student seminars, debates, tutorials, assignments and readings. A visit to local industry will be arranged. We will discuss examples of cutting-edge research and recent developments in molecular and medical biotechnology 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. A special feature for the 700-level students is an assignment related to science communication.

## 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:

The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications. Literature provides an excellent sounding board for your own research. It is important to see the similarities and parallels your work has to the published literature. It is relatively easier to produce results than to work out what they actually mean. Published literature will be a very good sounding board for this. Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion. There is always something to learn- be curious and ask questions- not everything has been discovered yet!

## Assessment Tasks

Name	Weighting	Due
<a href="#"><u>Final examination</u></a>	45%	TBA
<a href="#"><u>Practical reports</u></a>	30%	19.9; 14.10 and 28.10
<a href="#"><u>The Great Debate</u></a>	4%	VARIOUS
<a href="#"><u>Seminar and Press release</u></a>	6%	11 or 12.11
<a href="#"><u>Primer design quiz</u></a>	5%	9 September
<a href="#"><u>Fluorescence quiz</u></a>	5%	7 October
<a href="#"><u>Continuing assessment</u></a>	5%	end of semester

### Final examination

Due: **TBA**

Weighting: **45%**

The final course examination will be 3 hours plus 10 min reading time. The examination will cover **all sections of the unit** and consist of short answers, problem solving tasks and essay questions. In their answers the students are encouraged to practise critical thinking and expanding on ideas rather than just listing facts and figures with no discussion. Dot point-style

answering is not allowed. Take a calculator to the examination.

On successful completion you will be able to:

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications.
- It is relatively easier to produce results than to work out what they actually mean. Published literature will be a very good sounding board for this.
- Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion.
- There is always something to learn- be curious and ask questions- not everything has been discovered yet!

## Practical reports

Due: **19.9; 14.10 and 28.10**

Weighting: **30%**

These three reports are major reports describing the laboratory experiments in detail with references to literature. The reports must be submitted to iLearn for checking in turnitin by the due date (see below).

***The three separate reports (P1, 2 and 3) 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. Length of each report differs depending on the duration of the practical. About 10 double spaced typewritten pages plus figures and tables is not unusual. Please answer the questions after the actual report text under a heading 'Answers to questions' and number your answers.

Practicals 1 and 2 are interconnected and the students are requested to provide **one page** executive summary linking them together. The summary will be handed in together with the detailed report on Practical 2.

On successful completion you will be able to:

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications.
- Literature provides an excellent sounding board for your own research. It is important to see the similarities and parallels your work has to the published literature.
- It is relatively easier to produce results than to work out what they actually mean. Published literature will be a very good sounding board for this.
- There is always something to learn- be curious and ask questions- not everything has been discovered yet!

## The Great Debate

Due: **VARIOUS**

Weighting: **4%**

For this Debate, 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 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 practise 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.

On successful completion you will be able to:

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in

biotechnology which is a multidisciplinary approach to science and its applications.

- Literature provides and excellent sounding board for your own research. It is important to see the similarities and parallels your work has to the published literature.
- Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion.

## Seminar and Press release

Due: **11 or 12.11**

Weighting: **6%**

You are given a task to introduce and explain a product made by biotechnology, currently on the market, to a wider non-specialist audience in a seminar presentation. You will also prepare a snappy A4 Press release to go with the product. The convener will reveal the products you will work with two weeks before the seminar.

On successful completion you will be able to:

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications.
- Literature provides and excellent sounding board for your own research. It is important to see the similarities and parallels your work has to the published literature.

## Primer design quiz

Due: **9 September**

Weighting: **5%**

The ability to design oligonucleotide primers for DNA amplification is one of the most essential skills in molecular biology. Your brief is to design primers for the isolation of a specific gene. You will be given material to work with and specific questions to answer. This quiz will require some literature research and must be returned by the due date (see below).

On successful completion you will be able to:

- It is relatively easier to produce results than to work out what they actually mean. Published literature will be a very good sounding board for this.

## Fluorescence quiz

Due: **7 October**

Weighting: **5%**

This quiz will feature questions addressing matters discussed in the lectures and a tutorial conducted during Practical 2. You are expected to find and record most of the answers to these questions during the time allocated to the tutorial. The completed paper must be returned by the due date (see below).

On successful completion you will be able to:

- It is relatively easier to produce results than to work out what they actually mean.  
Published literature will be a very good sounding board for this.

## Continuing assessment

Due: **end of semester**

Weighting: **5%**

A continuing assessment that involves providing a brief answer to 20 questions (from the total of 26 lectures) is set up on iLearn. You are expected to listen to each of these lectures and submit a brief answer to a particular question arising from the lecture, posted on iLearn by the convener by 5 pm on the day of the lecture. Your answers to each week's lectures must be in by the following Mon 5 pm. Best answers will be displayed on iLearn.

On successful completion you will be able to:

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications.
- Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion.
- There is always something to learn- be curious and ask questions- not everything has been discovered yet!

## Delivery and Resources

## **REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS**

Biotechnology draws from different disciplines and technologies. The recommended textbook will give you a good introduction to these areas and provide further reading and websites for more in depth studies. There are also good questions at the end of each chapter to test your learning.

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

The book is available at the University Bookshop. Please note that while the book provides 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.

There are also many web resources, but material placed on the web is not necessarily checked for accuracy, so be careful when using it.

**The Practical manual** containing 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.

## **TECHNOLOGY USED**

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

It would be helpful to have a (scientific) calculator to carry out various calculations during practicals. They are also needed when preparing reports and in the final examination. Text-retrieval calculators are not allowed in the final examination. Laboratory reports and essays 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:** The material presented in the lectures is examinable. **Please note that there is no text book coverage for a fair amount of the material presented.** Therefore, regular attendance to the lectures and careful listening of the recordings is highly recommended. Lecture topics and dates can be found at the end of this guide. Lectures will be recorded and made available on iLearn. A continuing assessment that involves providing a brief answer to 20 questions (from the total of 26 lectures) is set up on iLearn.

**Tutorials and Industry exposure:** Attendance at the tutorials and the Industry exposure is compulsory, a medical certificate or other relevant documentation will be required for any absences. Previously announced locations for these activities may change so stay tuned. Tutorial material, which forms part of the material submitted for assessment and/or examination, will be distributed at the beginning of the class.

**Laboratory work:** Laboratory sessions commence in **Week 2**; Practical topics and the timetable are listed at the back of this guide. 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.

**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 must adhere to the guidelines for safe laboratory conduct as detailed below.

1. Study the practical notes so that you understand the experimental procedures. Reading the notes beforehand is highly recommended and will speed up your work.
2. **Wear a decent laboratory coat and safety glasses** at all times within the laboratory area. Preferably bring your own.
3. Tie back long hair before starting laboratory work.
4. Do not wear open-toe shoes in the laboratory.

5. No eating, drinking, smoking, listening to music, chatting on a mobile phone, surfing the net for fun or applying makeup is allowed in the laboratory.
6. No children, friends or spouses are allowed in the laboratory.
7. Wash your hands and disinfect your work space before commencing work and repeat this after finishing the experiments.
8. Dispose of all microbiological waste in the autoclave bags and place sharps (needles, scalpels etc.) in the sharps container. How to dispose of other materials is instructed by the tutor.
- 9. Report ALL accidents and spills immediately.**
10. If you don't know, ASK! We love to explain.
11. Treat all chemicals and reagents with respect and read the labels. Also label your plates, test tubes etc.
12. You will need full concentration in the lab, so do not drink alcohol or use other substances that may interfere with your ability to carry out experiments safely in the classes.

It is recommended that you carry a marking pen (permanent), spatula, scissors and tweezers and a calculator. Perform the experiments in an orderly fashion and clean up afterwards.

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. You are also expected to write three formal reports on the practical work, which will be a lot less painful experience with good notes in hand. In addition to handing in a hard copy of the reports, all practical reports must be submitted to turnitin available at the unit iLearn site. Submission dates are found on p. 10. Using an iPad, tablet or any other electronic device for making lab notes is not recommended.

**Practical manual** containing instructions for the laboratory experiments can be downloaded from iLearn.

**The Great Debate and Science Communication seminars:** Attendance to both is compulsory. The debate and the seminars will be carried out in F7B346 at the time slot allocated for a laboratory class (*i.e.* 2-6 pm on Tue or 9 am- 1 pm on Wed).

#### **UNIT WEB PAGE**

Lecture graphics will be uploaded on CBMS731 iLearn (<http://ilearn.mq.edu.au>) the daybefore

each lecture. The site also provides you with lecture recordings, videos and pictures generated in the practicals.

We will have a **General discussion forum** with a standing invitation to the students to suggest topics for the Great Debate and “**What’s on your mind**’ where students can leave messages and post videos and images related to biotechnology, for further discussion amongst fellow students. We will also set up a small reference library. **Announcements** will be used to communicate information from the unit convener.

Follow the instructions on the page to log in. If you have trouble logging in, please contact the academic staff, who may then refer you to the University Library Information technology help desk: Phone: 9850-HELP (4357); Freecall: 1800 063 191; Email One Help at [ilearn.help@mq.edu.au](mailto:ilearn.help@mq.edu.au).

## Unit Schedule

### CBMS731 Molecular and Medical Biotechnology, lecture topics 2014

Two one-hour lectures per week, on Tue at 12-1 pm and Fri from 1 -2 pm in E6A102

#### The many faces of biotechnology- the big picture

- |   |     |
|---|-----|
| 1. Course introduction - contribution of biotechnology to modern life (HN)<br>5.8 | Tue |
|---|-----|

#### Molecular aspects of biotechnology revisited

- |   |     |      |
|---|-----|------|
| 1. The toolbox for genetic engineering- making a recombinant protein (HN) | Fri | 8.8  |
| 2. Genetic engineering- power tools and considerations (HN)               | Tue | 12.8 |
| 3. Biotechnology pipeline- linking the ‘omics’ (HN)                       | Fri | 15.8 |
| 4. Protein secretion and quality control (HN)                             | Tue | 19.8 |
| 5. Protein secretion, the way out (HN)                                    | Fri | 22.8 |
| 7. Basic concepts in Synthetic biology (LB)                               | Tue | 26.8 |
| 8. Modern approaches into protein engineering (AS)                        | Fri | 29.8 |

#### Making recombinant products

- |   |     |
|---|-----|
| 9. Microbes as cell factories (HN)<br>2.9 | Tue |
|---|-----|

- |   |     |
|---|-----|
| 10. Cell cultures and transgenic animals (HN)<br>5.9                  | Fri |
| 11. What about transgenic plants (HN)<br>9.9                          | Tue |
| 12. The art of making a biotech product on a large scale (HN)<br>12.9 | Fri |

### Fluorescence in biotechnology

- |   |     |      |
|---|-----|------|
| 13. Fluorescence instrumentation and applications in biotechnology (DB) | Tue | 16.9 |
| 14. Flow cytometry as a tool in biotechnology (MO)                      | Fri | 19.9 |

### BREAK 20.9. – 6.10.

### Sweet biotechnology

- |   |     |      |
|---|-----|------|
| 15. Basic aspects of protein glycosylation (NP)                 | Tue | 7.10 |
| 16. Biological functions of protein glycosylation (NP)<br>10.10 | Fri |      |

### Medical biotechnology

- |  |     |       |
|--|-----|-------|
| 17. DNA as evidence in forensic science (HN)                       | Tue | 14.10 |
| 18. The promise of biopharmaceuticals (HN)                         | Fri | 17.10 |
| 19. Bioinformatics and combinatorial chemistry in drug design (SR) | Tue | 21.10 |
| 20. Basics of stem cells (BH)                                      | Fri | 24.10 |
| 21. Application of stem cell technology to joint repair (BH)       | Tue | 28.10 |
| 22. Medical biotechnology and bioengineering (MM)<br>0             | Fri | 31.1  |
| 23. Application of proteomics to cancer research (MM)              | Tue | 4.11  |

### Nanobiotechnology

- |   |     |       |
|---|-----|-------|
| 24. A quick peak into nanotechnology (HN)<br>7.11 | Fri |       |
| 25. Development of nanoparticles (JD)             | Tue | 11.11 |
| 26. Course summary (HN)                           | Fri | 14.11 |

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](mailto:helena.nevalainen@mq.edu.au))
- LB- Dr Louise Brown, MQ CBMS ([louise.brown@mq.edu.au](mailto:louise.brown@mq.edu.au))
- AS- Dr Anwar Sunna, MQ CBMS ([anwar.sunna@mq.edu.au](mailto:anwar.sunna@mq.edu.au))
- DB- Ms Debra Birch, MQ, Biological Sciences ([debra.birch@mq.edu.au](mailto:debra.birch@mq.edu.au))
- MO- Dr Martin Ostrowski, MQ, CBMS ([martin.ostrowski@mq.edu.au](mailto:martin.ostrowski@mq.edu.au))
- NP- Prof Nicolle Packer, MQ CBMS ([nicki.packer@mq.edu.au](mailto:nicki.packer@mq.edu.au))
- SR- Prof Shoba Ranganathan, MQ CBMS ([shoba.ranganathan@els.mq.edu.au](mailto:shoba.ranganathan@els.mq.edu.au))
- BH- Dr Ben Herbert, Regeneus Ltd ([benjamin.herbert@mq.edu.au](mailto:benjamin.herbert@mq.edu.au))
- MM- A/Prof Mark Molloy, MQ CBMS and APAF ([mark.molloy@proteome.org](mailto:mark.molloy@proteome.org))
- JD- A/Prof Jin Dayong, MQ CBMS ([jin.dayong@mq.edu.au](mailto:jin.dayong@mq.edu.au))

### 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*

1. Fluorescent labelling of fungal cell membranes and cellular localisation of the recombinant DsRed 1 protein
2. 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	12.8.	Plate conidia for bombardment
Wed	13.8.	Coat microparticles with DNA and shoot
Tue	19.8.	Count transformants and restreak on PDA-HygB plates
Wed	20.8.	Streak transformant conidia for DNA isolation

**Codon optimisation tutorial**

Tue	26.8.	Isolate chromosomal DNA from transformants for PCR
Wed	27.8.	Design primers for PCR to check the transformants
Tue	2.9.	Check the quality of chromosomal DNA
Wed	3.9.	Run PCR on transformants

**Primer design quiz** handed out and discussed in the class

Tue	9.9.	Check PCR products by agarose gel electrophoresis and take
Wed	10.9.	photographs

**Wrapping up Practical 1**

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

Tue	16.9.	Staining of the DsRed-expressing transformants and the
Wed	17.9.	non-transformant with an ER specific dye

Inspection of specimens using confocal microscopy

**Fluorescence quiz and tutorial**

**Executive summary tutorial**

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

Tue	7.10.	Sample preparation of native and recombinant lactoferrin
Wed	8.10.	Release of oligosaccharides by enzyme treatment

***Wrapping up Practical 2***

Tue	14.10.	Purification and analysis of oligosaccharides by liquid
Wed	15.10.	chromatography-mass spectrometry and interpretation of data

***Wrapping up Practical 3***

Tue 21.10. **The Great Debate I**, CBMS Tea room

Wed 22.10.

Tue 28.10. **The Great Debate II**, CBMS Tea room

Wed 29.10.

Tue 4.11. or **Industry exposure**, CBMS Tea room

Wed 5.11.

**Note that the dates of the above activities are interchangeable**

**For CBMS731 only** (audience welcome):

Tue 11.11. **Seminar presentations, E7B 346**  
Wed 12.11.

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

All practicals, the industry exposure and the Great Debate are compulsory to all students; the student can be failed for non-attendance.

## 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](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](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](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/](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

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications.
- Literature provides an excellent sounding board for your own research. It is important to

see the similarities and parallels your work has to the published literature.

- Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion.
- There is always something to learn- be curious and ask questions- not everything has been discovered yet!

## **Assessment tasks**

- Final examination
- Seminar and Press release
- Primer design quiz
- Fluorescence quiz
- Continuing assessment

## **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**

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications.
- Literature provides and excellent sounding board for your own research. It is important to see the similarities and parallels your work has to the published literature.
- It is relatively easier to produce results than to work out what they actually mean. Published literature will be a very good sounding board for this.
- Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion.
- There is always something to learn- be curious and ask questions- not everything has

been discovered yet!

## Assessment tasks

- Final examination
- Practical reports
- The Great Debate
- Seminar and Press release
- Continuing assessment

## 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

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications.
- It is relatively easier to produce results than to work out what they actually mean. Published literature will be a very good sounding board for this.
- Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion.
- There is always something to learn- be curious and ask questions- not everything has been discovered yet!

## Assessment tasks

- Practical reports
- Primer design quiz
- Fluorescence quiz

## 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**

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications.
- Literature provides and excellent sounding board for your own research. It is important to see the similarities and parallels your work has to the published literature.
- Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion.

## **Assessment tasks**

- Final examination
- Practical reports
- The Great Debate
- Seminar and Press release
- Primer design quiz
- Fluorescence quiz
- Continuing assessment

## **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 outcomes**

- Literature provides and excellent sounding board for your own research. It is important to see the similarities and parallels your work has to the published literature.
- Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills

in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion.

## **Assessment tasks**

- Practical reports
- The Great Debate
- Seminar and Press release
- Continuing assessment

## **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**

- The ability to understand the scientific language and the scientific concepts provide the key to conduct and interpret research papers. This is especially important in biotechnology which is a multidisciplinary approach to science and its applications.
- Literature provides an excellent sounding board for your own research. It is important to see the similarities and parallels your work has to the published literature.
- It is relatively easier to produce results than to work out what they actually mean. Published literature will be a very good sounding board for this.
- Biotechnology is a multifaceted and rapidly developing area sometimes full of controversies. While scientists can discuss matters using scientific language and concepts, the common audience cannot participate in this discussion due to lacking skills in scientific expressions. This often creates misunderstandings. Education of the general public is essential to avoid mismessages and provide an opportunity to broad discussion.

## **Assessment tasks**

- Final examination
- Practical reports
- The Great Debate
- Seminar and Press release
- Primer design quiz
- Fluorescence quiz

## Changes from Previous Offering

Some material has been modified in the theory and laboratory components. Lectures have been updated and new lectures brought in. The lecture timetable has changed.