CBMS331

Molecular and Medical Biotechnology

S2 Day 2014

Chemistry and Biomolecular Sciences

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
Helena Nevalainen
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Credit points
3

Prerequisites
CBMS215 and CBMS224

Corequisites

Co-badged status
The lectures and practicals in this unit are co-taught with CBMS880 and CBMS731 Molecular and Medical Biotechnology. The specific undergraduate learning outcomes for CBMS331 are aimed at introducing the main concepts and current practices in the areas of modern biotechnology relevant to the unit. Practical laboratory reports are an essential part of the learning providing the students an opportunity to show ability to interpret the results and practise scientific writing.

Unit description
This unit provides an overview of contemporary biotechnology, emphasising the molecular aspects of this growing field. Several examples will be provided to demonstrate how the basic molecular sciences translate into environmental and industrial applications as well as to better health and wealth. We will discuss functional genomics and proteomics, the use of surrogate hosts for protein production, and the roles of sugars on proteins and cells. Other topics include forensics, stem cells and applications of fluorescence in biotechnology. Students will carry out hands-on laboratory work applying recombinant DNA techniques, visualise organisms and molecules using confocal fluorescence microscopy, assess production capabilities of an industrially exploited fungal cell factory, and analyse the sugars on a commercially available recombinant product.

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:

• Carry out experiments following safe laboratory practices • Interpret, analyse, explain and discuss your experimental results in the class • Develop capabilities to deal with unexpected experimental findings • Gain and search for information in order to draw an informed conclusion • Gain project and time management skills to be able to plan and organise experiments and the best way of reporting on the data
• Analyse experimental results and critically evaluate own data • Think critically and independently and in an interdisciplinary manner • Extract key messages from scientific papers and paraphrase information • Ask questions relevant to the problem in hand
• Work and communicate in a team e.g. when doing laboratory work • Develop time management skills – ability to prioritise tasks, manage and achieve results on time and within constraints • Take responsibility for your own learning • Ability to work independently • Listen to others • Co-operate with other team members – exchange details, divide up work • Explain concepts, ideas, plans etc to fellow students, tutors and lecturers • Motivate team members • Respect others and conduct ethically
• Collect and record data by measurement or observation • Collect, record and present data using appropriate tools • Interpret and organise data to present a coherent argument • Search the internet for scientific literature and use relevant databases (e.g. DNA or protein sequence databases) • Judge the reliability of information sources
• Write summaries • Write a bibliography/reference list • Write scientific documents – abstract, introduction, methods, results and discussion • Orally communicate ideas • Effectively take part in arguments and debates

Assessment Tasks

Name	Weighting	Due
Final examination	45%	TBA
Practical reports	35%	19.9; 14.10 and 28.10
Primer design quiz	5%	9 September
Fluorescence quiz	5%	9 October
The Great Debate	5%	various
Continuing assessment	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** 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 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.

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Practical reports

Due: **19.9; 14.10 and 28.10**
Weighting: **35%**

These 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. 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.

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.

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- • Collect and record data by measurement or observation • Collect, record and present data using appropriate tools • Interpret and organise data to present a coherent argument • Search the internet for scientific literature and use relevant databases (e.g. DNA or protein sequence databases) • Judge the reliability of information sources
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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 a list of questions to answer. This quiz will require some literature research and must be returned by the due date (see below).

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Fluorescence quiz

Due: **9 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:

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The Great Debate

Due: **various**
Weighting: **5%**

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:

- • Work and communicate in a team e.g. when doing laboratory work • Develop time management skills – ability to prioritise tasks, manage and achieve results on time and within constraints • Take responsibility for your own learning • Ability to work independently • Listen to others • Co-operate with other team members – exchange details, divide up work • Explain concepts, ideas, plans etc to fellow students, tutors and lecturers • Motivate team members • Respect others and conduct ethically
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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.

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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, 3rd 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.

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 presented material.** 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 are required to 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 all 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. 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. 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.

Instructions for the laboratory experiments can be downloaded from iLearn

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 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 CBMS331 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.

Unit Schedule

CBMS331 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) Tue 5.8

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) Tue 2.9
10. Cell cultures and transgenic animals (HN) Fri 5.9
11. What about transgenic plants (HN) Tue 9.9
12. The art of making a biotech product on a large scale (HN) Fri 12.9

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)	Fri	10.10

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)	Fri	31.10
23.	Application of proteomics to cancer research (MM)	Tue	4.11

Nanobiotechnology

24.	A quick peak into nanotechnology (HN)	Fri	7.11
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)

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

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

DB- Ms Debra Birch, MQ, Biological Sciences (debra.birch@mq.edu.au)

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

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

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

BH- Dr Ben Herbert, Regeneus Ltd (benjamin.herbert@mq.edu.au)

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

JD- A/Prof Jin Dayong, MQ CBMS (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 chromatography-mass spectrometry and interpretation of data
Wed	15.10.	

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.

Learning and Teaching Activities

Lectures

There are 26 lectures in the unit

Laboratory practicals

There are three hands-on practicals that are required to be reported in writing

Quizzes

Two quizzes that are introduced in the class but that will require study at home

Great debate

Two student groups will debate against each other

Continuing assessment

Continuing assessment concerns answering 20 questions on the content of the lectures on line

Unit web site blog

Voluntary blogging on topics related to biotechnology

Policies and Procedures

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

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

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

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

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

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

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

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://informatics.mq.edu.au/help/.

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

Graduate Capabilities

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

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Assessment tasks

- Final examination
- Practical reports
- Primer design quiz
- Fluorescence quiz
- The Great Debate

Learning and teaching activities

- There are three hands-on practicals that are required to be reported in writing
- Two quizzes that are introduced in the class but that will require study at home

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they

participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

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- Continuing assessment

Learning and teaching activities

- There are 26 lectures in the unit
- There are three hands-on practicals that are required to be reported in writing
- Two quizzes that are introduced in the class but that will require study at home
- Two student groups will debate against each other
- Continuing assessment concerns answering 20 questions on the content of the lectures on line

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:

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- Two quizzes that are introduced in the class but that will require study at home
- Two student groups will debate against each other

- Continuing assessment concerns answering 20 questions on the content of the lectures on line
- Voluntary blogging on topics related to biotechnology

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

- • Carry out experiments following safe laboratory practices • Interpret, analyse, explain and discuss your experimental results in the class • Develop capabilities to deal with unexpected experimental findings • Gain and search for information in order to draw an informed conclusion • Gain project and time management skills to be able to plan and organise experiments and the best way of reporting on the data
- • Analyse experimental results and critically evaluate own data • Think critically and independently and in an interdisciplinary manner • Extract key messages from scientific papers and paraphrase information • Ask questions relevant to the problem in hand
- • Work and communicate in a team e.g. when doing laboratory work • Develop time management skills – ability to prioritise tasks, manage and achieve results on time and within constraints • Take responsibility for your own learning • Ability to work independently • Listen to others • Co-operate with other team members – exchange details, divide up work • Explain concepts, ideas, plans etc to fellow students, tutors and lecturers • Motivate team members • Respect others and conduct ethically
- • Collect and record data by measurement or observation • Collect, record and present data using appropriate tools • Interpret and organise data to present a coherent argument • Search the internet for scientific literature and use relevant databases (e.g. DNA or protein sequence databases) • Judge the reliability of information sources
- • Write summaries • Write a bibliography/reference list • Write scientific documents – abstract, introduction, methods, results and discussion • Orally communicate ideas • Effectively take part in arguments and debates

Assessment tasks

- Final examination
- Practical reports

- Primer design quiz
- Fluorescence quiz
- The Great Debate

Learning and teaching activities

- There are 26 lectures in the unit
- There are three hands-on practicals that are required to be reported in writing
- Two quizzes that are introduced in the class but that will require study at home
- Two student groups will debate against each other

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

- • Carry out experiments following safe laboratory practices • Interpret, analyse, explain and discuss your experimental results in the class • Develop capabilities to deal with unexpected experimental findings • Gain and search for information in order to draw an informed conclusion • Gain project and time management skills to be able to plan and organise experiments and the best way of reporting on the data
- • Analyse experimental results and critically evaluate own data • Think critically and independently and in an interdisciplinary manner • Extract key messages from scientific papers and paraphrase information • Ask questions relevant to the problem in hand
- • Collect and record data by measurement or observation • Collect, record and present data using appropriate tools • Interpret and organise data to present a coherent argument • Search the internet for scientific literature and use relevant databases (e.g. DNA or protein sequence databases) • Judge the reliability of information sources

Assessment tasks

- Final examination
- Practical reports
- Primer design quiz
- Fluorescence quiz

Learning and teaching activities

- There are three hands-on practicals that are required to be reported in writing
- Two quizzes that are introduced in the class but that will require study at home

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 outcomes

- • Analyse experimental results and critically evaluate own data • Think critically and independently and in an interdisciplinary manner • Extract key messages from scientific papers and paraphrase information • Ask questions relevant to the problem in hand
- • Collect and record data by measurement or observation • Collect, record and present data using appropriate tools • Interpret and organise data to present a coherent argument • Search the internet for scientific literature and use relevant databases (e.g. DNA or protein sequence databases) • Judge the reliability of information sources
- • Write summaries • Write a bibliography/reference list • Write scientific documents – abstract, introduction, methods, results and discussion • Orally communicate ideas • Effectively take part in arguments and debates

Assessment tasks

- Practical reports
- Fluorescence quiz
- The Great Debate

Learning and teaching activities

- There are three hands-on practicals that are required to be reported in writing
- Two student groups will debate against each other

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 outcomes

- • Carry out experiments following safe laboratory practices • Interpret, analyse, explain and discuss your experimental results in the class • Develop capabilities to deal with unexpected experimental findings • Gain and search for information in order to draw an informed conclusion • Gain project and time management skills to be able to plan and organise experiments and the best way of reporting on the data
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- • Write summaries • Write a bibliography/reference list • Write scientific documents – abstract, introduction, methods, results and discussion • Orally communicate ideas • Effectively take part in arguments and debates

Assessment tasks

- Final examination
- Practical reports
- Primer design quiz
- Fluorescence quiz
- The Great Debate
- Continuing assessment

Learning and teaching activities

- There are three hands-on practicals that are required to be reported in writing
- Two quizzes that are introduced in the class but that will require study at home
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- Voluntary blogging on topics related to biotechnology

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcome

- • Carry out experiments following safe laboratory practices • Interpret, analyse, explain and discuss your experimental results in the class • Develop capabilities to deal with unexpected experimental findings • Gain and search for information in order to draw an informed conclusion • Gain project and time management skills to be able to plan and organise experiments and the best way of reporting on the data

Assessment tasks

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- The Great Debate
- Continuing assessment

Learning and teaching activities

- There are 26 lectures in the unit
- Two student groups will debate against each other
- Continuing assessment concerns answering 20 questions on the content of the lectures on line

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcome

- • Carry out experiments following safe laboratory practices • Interpret, analyse, explain and discuss your experimental results in the class • Develop capabilities to deal with unexpected experimental findings • Gain and search for information in order to draw an informed conclusion • Gain project and time management skills to be able to plan and organise experiments and the best way of reporting on the data

Assessment tasks

- Final examination
- The Great Debate
- Continuing assessment

Learning and teaching activities

- There are 26 lectures in the unit
- There are three hands-on practicals that are required to be reported in writing
- Two student groups will debate against each other
- Continuing assessment concerns answering 20 questions on the content of the lectures on line

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.