



CBMS794

Research Topic: Synthetic Biology

S1 Day 2014

Chemistry and Biomolecular Sciences

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General Information

Unit convenor and teaching staff

Unit Convenor

Louise Brown

louise.brown@mq.edu.au

Contact via louise.brown@mq.edu.au

Building F7B Room 335

Tuesday to Friday (9am to 4pm) by appointment

Instructor

Bridget Mabbutt

bridget.mabbutt@mq.edu.au

Contact via bridget.mabbutt@mq.edu.au

Instructor

Ian Paulsen

ian.paulsen@mq.edu.au

Contact via ian.paulsen@mq.edu.au

Instructor

Robert Willows

robert.willows@mq.edu.au

Contact via robert.willows@mq.edu.au

Credit points

4

Prerequisites

Admission to MRes

Corequisites

Co-badged status

Unit description

This unit will build on fundamental concepts in molecular biology and bio-engineering to explore themes in the emerging field of synthetic biology. This course will provide students with the conceptual framework of systematic molecular design in order to build new componentry and biological systems. The unit will be taught extensively through the primary literature and will provide students with hands on experience in cutting edge tools required to design and synthesize biological parts. Exemplars of current applications including generation of biofuels, microbial synthesis of pharmaceuticals, and design of biosensors to detect infection and environmental waste will be examined. This unit will also focus on the ethical, legal and societal issues surrounding synthetic biology.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://students.mq.edu.au/important-dates>

Learning Outcomes

On successful completion of this unit, you will be able to:

Describe and discuss engineering principles and the relationship to synthetic biology.

Gain familiarity with a common vocabulary useful for synthetic biology (e.g. standard part, chassis, switches, oscillators, etc.).

Understand what essential functions are necessary for a bacterial cell to self-propagate.

Analyse and apply an abstraction hierarchy to design and build biological systems with a specified functionality.

Have knowledge and direct experience with several state-of-the art computational approaches (computational design, modelling and simulation software packages) to enable the efficient design and manufacture of complex biological systems.

Appreciate current and future application spaces for synthetic biology and have a sound knowledge of the latest published literature in the field.

Define the culture, safety practices, and organisational community of the synthetic biology field to evaluate how emerging and future synthetic biology technologies may benefit and/or potentially endanger humanity and the natural environment.

Develop and demonstrate intellectual, communication and problem solving skills.

Assessment Tasks

Name	Weighting	Due
Essay	20%	Week 7

Name	Weighting	Due
<u>Short reports/activities</u>	30%	Weeks 3, 6, 10
<u>Digital Media Presentation</u>	20%	Week 13
<u>Exam</u>	30%	Exam Period

Essay

Due: **Week 7**

Weighting: **20%**

Essay topic to be distributed in week 2

On successful completion you will be able to:

- Appreciate current and future application spaces for synthetic biology and have a sound knowledge of the latest published literature in the field.
- Define the culture, safety practices, and organisational community of the synthetic biology field to evaluate how emerging and future synthetic biology technologies may benefit and/or potentially endanger humanity and the natural environment.
- Develop and demonstrate intellectual, communication and problem solving skills.

Short reports/activities

Due: **Weeks 3, 6, 10**

Weighting: **30%**

Short report/activity from each of three sections given by LB (weeks 1-3), IP (weeks 4-6) and RW (weeks 7-10)

On successful completion you will be able to:

- Describe and discuss engineering principles and the relationship to synthetic biology. Gain familiarity with a common vocabulary useful for synthetic biology (e.g. standard part, chassis, switches, oscillators, etc.).
- Understand what essential functions are necessary for a bacterial cell to self-propagate.
- Analyse and apply an abstraction hierarchy to design and build biological systems with a specified functionality.
- Have knowledge and direct experience with several state-of-the art computational approaches (computational design, modelling and simulation software packages) to enable the efficient design and manufacture of complex biological systems.
- Appreciate current and future application spaces for synthetic biology and have a sound

knowledge of the latest published literature in the field.

- Develop and demonstrate intellectual, communication and problem solving skills.

Digital Media Presentation

Due: **Week 13**

Weighting: **20%**

online digital media presentation of new tool/approach - linked in with workshop from week 2/3

On successful completion you will be able to:

- Describe and discuss engineering principles and the relationship to synthetic biology. Gain familiarity with a common vocabulary useful for synthetic biology (e.g. standard part, chassis, switches, oscillators, etc.).
- Analyse and apply an abstraction hierarchy to design and build biological systems with a specified functionality.
- Develop and demonstrate intellectual, communication and problem solving skills.

Exam

Due: **Exam Period**

Weighting: **30%**

2 hr, 8 short answer/problem based questions

On successful completion you will be able to:

- Describe and discuss engineering principles and the relationship to synthetic biology. Gain familiarity with a common vocabulary useful for synthetic biology (e.g. standard part, chassis, switches, oscillators, etc.).
- Understand what essential functions are necessary for a bacterial cell to self-propagate.
- Analyse and apply an abstraction hierarchy to design and build biological systems with a specified functionality.
- Have knowledge and direct experience with several state-of-the art computational approaches (computational design, modelling and simulation software packages) to enable the efficient design and manufacture of complex biological systems.
- Appreciate current and future application spaces for synthetic biology and have a sound knowledge of the latest published literature in the field.
- Define the culture, safety practices, and organisational community of the synthetic biology field to evaluate how emerging and future synthetic biology technologies may benefit and/or potentially endanger humanity and the natural environment.

- Develop and demonstrate intellectual, communication and problem solving skills.

Delivery and Resources

Class Times:

This Session 1 unit comprises a 3-hour block each week. This will be on Tuesdays from 2-5pm in W5C 234 (Location likely to change), starting 4th March. This unit will be taught as tutorials that encompass both lectures and hands-on experiences/workshop activities (e.g. discussion of relevant papers from literature; software workshops etc). Tutorials will NOT be recorded and attendance is compulsory.

Unit Text:

The following text is recommended to help with your learning in this unit.

“Synthetic Biology : Tools and Applications” (2013) Huimin Zhao.

The ebook can be downloaded from the library using this link: <http://mqu.ebib.com.au/patron/FullRecord.aspx?p=1160900>

The hardcopy of the text is available for \$176.95 from the coop bookshop. It is **NOT** recommended that you purchase this text.

Other required learning material (eg journal articles) will be made available on **ilearn** as this unit progresses.

This is a NEW unit for 2014.

Unit Schedule

Week 1-3: L Brown

Introduction – what is synthetic biology

Unit introduction

Review of common techniques

The Societal impacts of synthetic biology

DIY Bio

Week 4-6: I Paulsen

Minimal Cells and Synthetic Life

Week 7-10: R Willows

Parts, Devices and Systems - a more detailed look

Modelling Synthetic Biology Systems

Week 11: B Mabbutt

Rational Protein Design

Week 12-13: L Brown

Applications of Designed Biological Systems

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/

**** IMPORTANT** Late submission of assessment tasks:**

No extensions will be granted. Late tasks will be accepted up to 72 hours after the submission deadline. There will be a deduction of 20% of the total available marks made from the total awarded mark for each 24 hour period or part thereof that the submission is late (for example, 25 hours late in submission – 40% penalty). This penalty does not apply for cases in which an application for special consideration is made and approved.

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 Enquiry Service

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

Equity 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.

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.