



CBMS794

Research Topic: Synthetic Biology

S1 Day 2018

Dept of Chemistry & Biomolecular Sciences

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General Information

Unit convenor and teaching staff

Unit Convenor

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

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Credit points

4

Prerequisites

Admission to MRes

Corequisites

Co-badged status

Unit description

This unit will build on fundamental concepts in molecular biology and bioengineering to explore themes in the emerging field of synthetic biology. This unit 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://www.mq.edu.au/study/calendar-of-dates>

Learning Outcomes

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

- Summarise 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.).
- Summarise 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.
- Productively work in a group on a scientific project
- Synthesize diverse primary synthetic biology literature sources and present in an accessible way suitable for a general audience

Assessment Tasks

Name	Weighting	Hurdle	Due
<u>SynBio Company Assessment</u>	15%	No	Week 3
<u>Paper presentation/discussion</u>	15%	No	Week 4-6
<u>SynBio Ethics Essay</u>	20%	No	Week 7
<u>Gene refactoring</u>	15%	No	Week 9

Name	Weighting	Hurdle	Due
Research Report	15%	No	Week 12
Digital Media Presentation	20%	No	Week 13

SynBio Company Assessment

Due: **Week 3**

Weighting: **15%**

Presentation describing one company in the synthetic biology space.

On successful completion you will be able to:

- Summarise 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.
- Synthesize diverse primary synthetic biology literature sources and present in an accessible way suitable for a general audience

Paper presentation/discussion

Due: **Week 4-6**

Weighting: **15%**

Lead presentation of primary synthetic biology literature and participate in discussion of other student's presentations.

On successful completion you will be able to:

- Summarise 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.).
- Productively work in a group on a scientific project
- Synthesize diverse primary synthetic biology literature sources and present in an accessible way suitable for a general audience

SynBio Ethics Essay

Due: **Week 7**

Weighting: **20%**

An essay on the ethics of synthetic biology.

On successful completion you will be able to:

- Summarise 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.
- Synthesize diverse primary synthetic biology literature sources and present in an accessible way suitable for a general audience

Gene refactoring

Due: **Week 9**

Weighting: **15%**

A report of the results of computationally refactoring genes.

On successful completion you will be able to:

- Productively work in a group on a scientific project

Research Report

Due: **Week 12**

Weighting: **15%**

A research report on a topic in synthetic biology.

On successful completion you will be able to:

- Summarise 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.).
- Summarise current and future application spaces for synthetic biology and have a sound knowledge of the latest published literature in the field.
- Synthesize diverse primary synthetic biology literature sources and present in an accessible way suitable for a general audience

Digital Media Presentation

Due: **Week 13**

Weighting: **20%**

Digital media presentation of new tool/approach in synthetic biology.

On successful completion you will be able to:

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

Delivery and Resources

Class Times:

This Session 1 unit comprises a 4-hour block each week. Please consult the iLearn site for updated timetable. 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>

There is a hardcopy of the book in the Macquarie Library. It is **NOT** recommended that you purchase this text.

Other required learning material (e.g. journal articles, book chapters) will be made available on **iLearn** as this unit progresses.

Unit Schedule

Tentative schedule subject to change with appropriate notice

Week 1-3: P Jaschke

Introduction – What is Synthetic Biology?

Week 4-6: I Paulsen

Minimal Cells and Synthetic Life

Week 7: R Willows

Parts, Devices and Systems - a more detailed look

*** Easter Break ***

Week 8-9: R Willows

Parts, Devices and Systems - a more detailed look

Week 10: J Hallinan

Modelling Synthetic Biology Systems

Week 11: P Jaschke

Gene Circuits

Week 12: B Mabbutt

Nano Construction with Proteins

Week 13: P Jaschke

Unit wrap up and digital media presentations

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Undergraduate students seeking more policy resources can visit the [Student Policy Gateway \(https://students.mq.edu.au/support/study/student-policy-gateway\)](https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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](#).

**** 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 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 outcomes

- 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.
- Productively work in a group on a scientific project
- Synthesize diverse primary synthetic biology literature sources and present in an accessible way suitable for a general audience

Assessment tasks

- SynBio Ethics Essay
- Gene refactoring
- Research Report

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

- Summarise 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.).
- Summarise current and future application spaces for synthetic biology and have a sound knowledge of the latest published literature in the field.
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- Productively work in a group on a scientific project

- Synthesize diverse primary synthetic biology literature sources and present in an accessible way suitable for a general audience

Assessment tasks

- SynBio Company Assessment
- Paper presentation/discussion
- SynBio Ethics Essay
- Gene refactoring
- Research Report
- Digital Media Presentation

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

- Summarise 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.).
- Summarise current and future application spaces for synthetic biology and have a sound knowledge of the latest published literature in the field.
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Assessment tasks

- SynBio Company Assessment
- Paper presentation/discussion
- SynBio Ethics Essay
- Gene refactoring
- Research Report
- Digital Media Presentation

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

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

Assessment tasks

- SynBio Company Assessment
- Gene refactoring
- Research Report
- Digital Media Presentation

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

- Summarise 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.).
- Summarise 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.
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Assessment tasks

- SynBio Company Assessment
- Paper presentation/discussion
- SynBio Ethics Essay
- Research Report

- Digital Media Presentation

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

- 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.
- Productively work in a group on a scientific project
- Synthesize diverse primary synthetic biology literature sources and present in an accessible way suitable for a general audience

Assessment tasks

- Paper presentation/discussion
- SynBio Ethics Essay

Changes from Previous Offering

There will be the following changes made from the 2016 offering:

- No final exam
- Creation of one additional assessment task, the research report, and a rebalancing of other assessment task weights.
- Additional lecture from Dr. Jennifer Hallinan (Biological Sciences)