CBMS794

Research Topic: Synthetic Biology

S1 Day 2016

Dept of Chemistry & Biomolecular Sciences

Contents

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 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://www.mq.edu.au/study/calendar-of-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
Short reports/activities	30%	Weeks 3, 6, 10
Digital Media Presentation	20%	Week 13
Exam	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 PJ (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.
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Delivery and Resources

Class Times:

This Session 1 unit comprises a 3-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.eblib.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

Week 1-3: P Jaschke

Introduction – What is Synthetic Biology?

Week 4-6: I Paulsen

Minimal Cells and Synthetic Life

*** Easter Break ***

Week 7-10: R Willows

Parts, Devices and Systems - a more detailed look

Modelling Synthetic Biology Systems

Week 11: B Mabbutt

Nano Construction with Proteins

Week 12-13: P Jaschke

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

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

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

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

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

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

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

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

Student Code of Conduct

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

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

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

Assessment tasks

- Essay
- Short reports/activities

- Exam

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

- 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.).
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Assessment tasks

- Essay
- Short reports/activities
- Digital Media Presentation
- Exam

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

- 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.).
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Assessment tasks

- Essay
- Short reports/activities
- Digital Media Presentation
- Exam

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

- 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.

Assessment tasks

- Short reports/activities
- Digital Media Presentation
- Exam

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

- 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.).
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Assessment tasks

- Essay
- Short reports/activities
- Digital Media Presentation
- Exam

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 outcome

- 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.

Assessment task

- Essay