



# MOLS8411

## Molecular Genomics Analysis and Design

Session 1, In person-scheduled-weekday, North Ryde 2024

*School of Natural Sciences*

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## General Information

### Unit convenor and teaching staff

Unit Convenor

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Credit points

10

Prerequisites

((BMOL6201 or CBMS621) or (admission to MBioBus or BMedScMBiotech)) and BMOL6432

Corequisites

Co-badged status

Unit description

This unit provides an introduction to synthetic biology and hands-on practise in the analysis of large datasets gathered when working in the broad field of biomolecular sciences.

Biomolecular sciences spans the study of individual molecular structures and biochemical reactions to also encompass the 'omics' sciences of genomics, proteomics, metabolomics and glycomics. These sciences all generate large and complex datasets that require specialised software and methods to assemble and analyse. The analyses are challenging, as they not only require a good knowledge of biochemistry, molecular biology, and cell and developmental biology, but also an understanding of limitations of both the software and the data quality. The lectures on synthetic biology start with a brief overview of the field before delving into more challenging yet exciting concepts. You will learn about current techniques and approaches used in synthetic biology and design a molecular switch using these principles. The lectures also discuss applications, limitations and future potential of synthetic biology to produce new solutions to global challenges.

## 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:

**ULO1:** Utilise and describe techniques applicable to acquiring large biomolecular datasets and the limitations of the use of these methods

**ULO2:** Design and conduct experiments to collect large biomolecular datasets using appropriate methods to assess and analyse the quality of these datasets.

**ULO3:** Report, communicate and draw new conclusions about a biomolecular system from large analytical datasets

**ULO4:** Summarise and discuss synthetic biology engineering principles using appropriate contemporary synthetic biological vocabulary

**ULO5:** Summarise current and future application spaces for synthetic biology by reviewing the latest published literature in the field

**ULO6:** 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

## General Assessment Information

### General Assessment Information

All assignments must be submitted as soft copy before the date & time specified on iLearn. Specific instructions for how to successfully complete assessments will be provided on iLearn. Criteria and standards required for the assessment tasks will be available on iLearn. For any unapproved absences, students will receive a zero mark.

Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure, students may apply for Special Consideration.

All other assessments must be submitted by 5:00 pm on their due date. Should these assessments be missed due to illness or misadventure, students should apply for Special Consideration.

### Late Assessment Submission Penalty

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation

assessment is not submitted, up until the 7<sup>th</sup> day (including weekends). After the 7<sup>th</sup> day, a grade of '0' will be awarded even if the assessment is submitted.

The submission time for all uploaded assessments is **11:55 pm**. A 1-hour grace period will be provided to students who experience a technical concern. For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for [Special Consideration](#).

### **Assessments where Late Submissions will be accepted**

In this unit, late submissions will be accepted as follows:

**Natural and Synthetic Genomics Essay, Synthetic Biology Design Project** – YES, Standard Late Penalty applies

**All Other Assessments** (Genome assembly and annotation, Practice Based task, Final Exam) - NO, unless Special Consideration is Granted

### **Requirements to Pass this Unit**

To pass this unit you must:

- Achieve a total mark equal to or greater than 50%, and
- Participate in, and undertake all hurdle activities for a minimum of 7/10 completed.

### **Hurdle Assessments**

**Practice-based task (0%)** Development of knowledge and skills requires continual practice at authentic problems in a laboratory-based setting. This unit has weekly laboratory classes and you must demonstrate your progress in developing and communicating knowledge and skills in a minimum of 7 of the 10 classes. This is a hurdle assessment meaning that failure to meet this requirement may result in a fail grade for the unit. Students are permitted up to three absences: additional absences will require approval of Special Consideration (see below).

## **Special Consideration**

The Special Consideration Policy aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment.

**Written Assessments:** If you experience circumstances or events that affect your ability to complete the written assessments in this unit on time, please inform the convenor and submit a Special Consideration request through [ask.mq.edu.au](https://ask.mq.edu.au).

**Weekly practice-based tasks:** To pass the unit you need to demonstrate ongoing development of skills and application of knowledge in 7 out of 10 of the weekly practical classes. If you miss a weekly practical class due to a serious, unavoidable and significant disruption, contact your convenor as soon as possible as you may be able to attend another class that week. If it is not possible to attend another class, you should still contact your convenor for access to class material to review in your own time.

Note that a Special Consideration should only be applied for if you miss more than three of the

weekly practical classes.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Natural and Synthetic Genomics Essay</a>	25%	No	Week 7 (11 April)
<a href="#">Genome assembly and annotation</a>	25%	No	Week 8 (3 May)
<a href="#">Synthetic Biology Design Project</a>	25%	No	Week 13 (4 June)
<a href="#">Practice Based task</a>	0%	Yes	Week 2 - Week 12
<a href="#">Final Exam</a>	25%	No	University Exam Period

### Natural and Synthetic Genomics Essay

Assessment Type <sup>1</sup>: Essay

Indicative Time on Task <sup>2</sup>: 22 hours

Due: **Week 7 (11 April)**

Weighting: **25%**

An essay on a contemporary topic in genomics and/or synthetic biology.

On successful completion you will be able to:

- Utilise and describe techniques applicable to acquiring large biomolecular datasets and the limitations of the use of these methods
- Report, communicate and draw new conclusions about a biomolecular system from large analytical datasets
- Summarise and discuss synthetic biology engineering principles using appropriate contemporary synthetic biological vocabulary
- 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

### Genome assembly and annotation

Assessment Type <sup>1</sup>: Poster

Indicative Time on Task <sup>2</sup>: 22 hours

Due: **Week 8 (3 May)**

Weighting: **25%**

Presentation of a poster representing a genome assembly and annotation project.

On successful completion you will be able to:

- Utilise and describe techniques applicable to acquiring large biomolecular datasets and the limitations of the use of these methods
- Design and conduct experiments to collect large biomolecular datasets using appropriate methods to assess and analyse the quality of these datasets.
- Report, communicate and draw new conclusions about a biomolecular system from large analytical datasets

## Synthetic Biology Design Project

Assessment Type <sup>1</sup>: Presentation

Indicative Time on Task <sup>2</sup>: 25 hours

Due: **Week 13 (4 June)**

Weighting: **25%**

A presentation on a synthetic biology design task.

On successful completion you will be able to:

- Summarise and discuss synthetic biology engineering principles using appropriate contemporary synthetic biological vocabulary
- Summarise current and future application spaces for synthetic biology by reviewing 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

## Practice Based task

Assessment Type <sup>1</sup>: Practice-based task

Indicative Time on Task <sup>2</sup>: 0 hours

Due: **Week 2 - Week 12**

Weighting: **0%**

**This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)**

Demonstration of practical laboratory skills and knowledge of protocols, and the submission of practical tasks.

On successful completion you will be able to:

- Utilise and describe techniques applicable to acquiring large biomolecular datasets and the limitations of the use of these methods
- Design and conduct experiments to collect large biomolecular datasets using appropriate methods to assess and analyse the quality of these datasets.
- Report, communicate and draw new conclusions about a biomolecular system from large analytical datasets
- Summarise and discuss synthetic biology engineering principles using appropriate contemporary synthetic biological vocabulary
- Summarise current and future application spaces for synthetic biology by reviewing 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

## Final Exam

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 20 hours

Due: **University Exam Period**

Weighting: **25%**

An exam consisting of a series of problem solving, data interpretation and short essay questions.

On successful completion you will be able to:

- Utilise and describe techniques applicable to acquiring large biomolecular datasets and the limitations of the use of these methods
- Design and conduct experiments to collect large biomolecular datasets using appropriate methods to assess and analyse the quality of these datasets.
- Report, communicate and draw new conclusions about a biomolecular system from large analytical datasets

- Summarise and discuss synthetic biology engineering principles using appropriate contemporary synthetic biological vocabulary
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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

### Week 1 Classes

Lectures (attend in-person 1CC 216, or via zoom):

Friday: 12 pm - 1 pm

Practicals (attend in-person 14EAR 130 only)

Fridays: 2 pm - 6 pm

NO practical in Week 1; practicals start in **WEEK 2**

- Practical attendance is compulsory.
- Close-toed shoes must be worn in every practical unless instructed otherwise.
- Lab coats are NOT needed.
- We highly encourage students to bring their own computer.

### Methods of Communication

We will communicate with you via your university email and through announcements on iLearn. Queries to convenors can either be placed on the iLearn discussion board or sent to the unit convenor via the contact email on iLearn.

### COVID Information

For the latest information on the University's response to COVID-19, please refer to the Coronavirus infection page on the Macquarie website: <https://www.mq.edu.au/about/coronavirus-faqs>. Remember to check this page regularly in case the information and requirements change during semester. If there are any changes to this unit in relation to COVID, these will be communicated via iLearn.



## Unit Schedule

Week	Lecture	Date	Day	Time	Lecturer	Class Title	Week	Num.	Date	Day	Time	Demonstrators	Pract
1	1	23/ Feb	FRI	12PM-1PM	Paul Jaschke	Unit introduction and History of Genome Sequencing Projects	1	-	23/ Feb	FRI	2PM-6PM	-	NON
2	2	01/ Mar	FRI	12PM-1PM	Paul Jaschke	Storing and Comparing Sequences	2	1	01/ Mar	FRI	2PM-6PM	P Jaschke	WS1. Geno Brows Annot and B - DAY
3	3	08/ Mar	FRI	12PM-1PM	Paul Jaschke	Genome Sequencing Technologies I	3	2	08/ Mar	FRI	2PM-6PM	P Jaschke	WS1. Geno Brows Annot and B - DAY
4	4	15/ Mar	FRI	12PM-1PM	Paul Jaschke	Genome Sequencing Technologies II	4	3	15/ Mar	FRI	2PM-6PM	P Jaschke/R Sood	WS2. Geno Sequ Assem and Analy DAY
4	-	15/ Mar	FRI	-	-	CENSUS DATE	4	-	15/ Mar		-	-	CENS DATE
5	5	22/ Mar	FRI	12PM-1PM	Paul Jaschke	Genome Assembly	5	4	22/ Mar	FRI	2PM-6PM	P Jaschke/R Sood	WS2. Geno Sequ Assem and Analy DAY
6		29/ Mar	FRI	-	-	Good Friday (no class)	6	-	29/ Mar	FRI	-	-	Good (no cl
7	6	05/ Apr	FRI	12PM-1PM	Paul Jaschke	Shotgun Metagenomics	7	5	05/ Apr	FRI	2PM-6PM	P Jaschke/R Sood	WS2. Geno Sequ Assem and Analy DAY

8	7	12/ Apr	FRI	12PM-1PM	Paul Jaschke	Genome Annotation	8	6	12/ Apr	FRI	2PM-6PM	P Jaschke/R Sood	WS2. Geno Sequ Asser and Analy DAY
-	-	19/ Apr	-	-	-	SEMESTER BREAK WEEK 1	-	-	19/ Apr	-	-	-	SEME BREA WEEK
-	-	26/ Apr	-	-	-	SEMESTER BREAK WEEK 2	-	-	26/ Apr	-	-	-	SEME BREA WEEK
9	8	03/ May	FRI	12PM-1PM	Paul Jaschke	Applications and Ethics of Genomics	9	7	03/ May	FRI	2PM-6PM	P Jaschke/R Sood	WS2. Geno Sequ Asser and Analy DAY
10	9	10/ May	FRI	12PM-1PM	Paul Jaschke	Synthetic Biology: Understanding How Life Works	10	8	10/ May	FRI	2PM-6PM	Cain/Jaschke/ Walker	WS3. Synth Biolog Design and B Gene Devic
11	10	17/ May	FRI	12PM-1PM	Alescia Cullen	Intro to synthetic biology	11	9	17/ May	FRI	2PM-6PM	Cain/Jaschke/ Walker	WS3. Synth Biolog Design and B Gene Devic
12	11	24/ May	FRI	12PM-1PM	Briardo Llorente	Design in Synthetic Biology	12	-	24/ May	FRI	2PM-6PM	-	No Work
13	12	31/ May	FRI	12PM-1PM	Hugh Goold	How to build a synthetic genome	13	10	31/ May	FRI	2PM-6PM	Cain/Jaschke/ Walker	WS3. Synth Biolog Design and B Gene Devic

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au). 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](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

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

To find other policies relating to Teaching and Learning, visit [Policy Central](https://policies.mq.edu.au) (<https://policies.mq.edu.au>) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) 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](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

## Student Support

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

## The Writing Centre

[The Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)

- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)
- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual assault
- [Social support including information about finances, tenancy and legal issues](#)
- [Student Advocacy](#) provides independent advice on MQ policies, procedures, and processes

## Student Enquiries

Got a question? Ask us via [AskMQ](#), or contact [Service Connect](#).

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](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.

## Changes from Previous Offering

We value student feedback to be able to continually improve the way we offer our units. As such we encourage students to provide constructive feedback via student surveys, to the teaching staff directly, or via the FSE Student Experience & Feedback link in the iLearn page.

**Natural and Synthetic Genomics Essay:** the assessment will be changed from the last offering

**Synthetic Biology Design Project:** this assessment will be changed from the last offering.

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Unit information based on version 2024.01R of the [Handbook](#)