



# COGS3020

## Computational Neuroscience

Session 1, In person-scheduled-weekday, North Ryde 2022

*School of Psychological Sciences*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

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Bianca De Wit

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Credit points

10

Prerequisites

130cp including ((COGS1000 or COGS100) or (BIOL2230 or BIOL257) or (MEDI2300 or MEDI204)) and (COGS2020 or (STAT2170 or STAT270))

Corequisites

Co-badged status

Unit description

Computational modelling is increasingly important for understanding brain function at the single neuron, circuit, and network levels. This unit provides students with a rigorous introduction to the exciting field of computational neuroscience including topics such as the mathematical description of neurons, simple neural networks, statistical inference, reinforcement learning, and decision making. Students will learn the Python programming language and use it to explore some of the most influential models in computational neuroscience to deepen their understanding of the relationship between the brain, behaviour, and neural computation.

## 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:** Demonstrate advanced knowledge of key computational models in neuroscience.

**ULO2:** Simulate and analyse models of individual neurons and brain circuits.

**ULO3:** Fit computational models to experimental data to find best fitting parameters.

**ULO4:** Compare different computational models using statistical model comparison techniques.

## General Assessment Information

### Late Penalty

Late submissions will receive a 5% per day penalty including weekends and public holidays, unless an extension has been granted through special consideration. No late submissions will be accepted more than 5 days after the submission deadline, unless special consideration has been granted. No further submissions will be accepted after the marked assignments are returned and feedback is released to students. Please note that it is the student's responsibility to notify the University of a disruption to their studies and that requests for extensions for assignments must be made via the University's Ask MQ System (as outlined in the [Special Consideration Policy](#)).

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Mid-term exam</a>	30%	No	Mid semester
<a href="#">Weekly online quizzes</a>	10%	No	Approximately weekly
<a href="#">Weekly problem sets</a>	30%	No	Approximately weekly
<a href="#">Final exam</a>	30%	No	Final exam period

### Mid-term exam

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

Indicative Time on Task <sup>2</sup>: 15 hours

Due: **Mid semester**

Weighting: **30%**

1-hour mid-term exam

On successful completion you will be able to:

- Demonstrate advanced knowledge of key computational models in neuroscience.
- Simulate and analyse models of individual neurons and brain circuits.
- Fit computational models to experimental data to find best fitting parameters.
- Compare different computational models using statistical model comparison techniques.

### Weekly online quizzes

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 10 hours

Due: **Approximately weekly**

Weighting: **10%**

10 short online multiple choice quizzes designed to provide routine assessment and feedback. Graded on credit/no-credit basis. The 2 lowest quizzes (missed or marked non-credit) may be dropped without penalty.

On successful completion you will be able to:

- Demonstrate advanced knowledge of key computational models in neuroscience.
- Simulate and analyse models of individual neurons and brain circuits.
- Fit computational models to experimental data to find best fitting parameters.
- Compare different computational models using statistical model comparison techniques.

## Weekly problem sets

Assessment Type <sup>1</sup>: Problem set

Indicative Time on Task <sup>2</sup>: 40 hours

Due: **Approximately weekly**

Weighting: **30%**

10 problem sets

On successful completion you will be able to:

- Demonstrate advanced knowledge of key computational models in neuroscience.
- Simulate and analyse models of individual neurons and brain circuits.
- Fit computational models to experimental data to find best fitting parameters.
- Compare different computational models using statistical model comparison techniques.

## Final exam

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

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

Due: **Final exam period**

Weighting: **30%**

2-hour exam conducted during the examination period.

On successful completion you will be able to:

- Demonstrate advanced knowledge of key computational models in neuroscience.
  - Simulate and analyse models of individual neurons and brain circuits.
  - Fit computational models to experimental data to find best fitting parameters.
  - Compare different computational models using statistical model comparison techniques.
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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

### Delivery

Lectures are 2-hour sessions held once per week, starting in Week 1. Lectures run from 9:00 AM - 11:00 AM Wednesdays and will be delivered in-person at 12 Second Way - Room 301.

### Readings

Reading sources for this course are the weekly lecture notes and published papers from the computational neuroscience literature. The lecture notes will be made available via the course iLearn page, and additional readings will be linked in the lecture notes.

### iLearn

Through iLearn you will be able to access the lecture recordings (Echo360), readings, and feedback and marks for the assessment tasks. You are also required to submit all assignments via iLearn, using the Turnitin submission tool. You will need access to the internet to access iLearn.

### Mid-term exam

There will be a mid-term exam which will assess all material covered in lectures, weekly problem sets, and tutorial sessions up to the point at which the exam is given. The exam will be given during the first half of that weeks lecture. You will have 1 hour from the time the exam is made available to turn it in through the course iLearn page. If you are unable to take the mid-semester exam at the specified time, you must advise the Student Centre via [ask.mq.edu.au](mailto:ask.mq.edu.au) and must also apply for Special Consideration through [ask.mq.edu.au](mailto:ask.mq.edu.au) and submit appropriate supporting documents. It should be noted that Macquarie University Policy states: "Pre-booked holidays will not routinely be considered unavoidable absences or commitments by the University". Students deemed eligible for a late mid-semester exam will be notified via email

about the time and location of the exam.

### **Final exam**

There will be a final exam which will assess all material covered in lectures, weekly problem sets, and tutorial sessions up to the point at which the exam is given, including material that appeared on the mid-term exam. The time and location for this exam will be timetabled centrally and announced later in the semester. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations ([http://students.mq.edu.au/student\\_admin/exams/](http://students.mq.edu.au/student_admin/exams/)). The only exception to taking the final exam at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for special consideration due to disruption to studies. Information about unavoidable disruption and the special consideration process is available at: <http://students.mq.edu.au/study/my-study-program/special-consideration>. If a Supplementary Examination is granted as a result of the Special Consideration process, the examination will be scheduled after the conclusion of the official examination period. The format of a supplementary examination is at the unit convenor's discretion and is subject to change from the original final examination. If a Supplementary Exam has been granted, it is the student's responsibility to ensure they sit the Supplementary Exam on the specified date. You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, which is the final day of the official examination period.

## **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 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.