



MOLS7211

Protein Discovery and Analysis

Session 1, Weekday attendance, North Ryde 2020

Department of Molecular Sciences

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General Information

Unit convenor and teaching staff

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Credit points

10

Prerequisites

Admission to MRes

Corequisites

Co-badged status

Unit description

This unit outlines molecular principles underlying today's developments in protein science and biomedical research. As well as detailing modern separation technologies, the course addresses structural biology, protein analysis and bioinformatics. Practices common in the biotechnology and pharmaceutical industries to isolate recombinant proteins are emphasized. Analysis methods are introduced in relation to proteomics, genomics and biochemical research. Molecular properties leading to the 3D shape of proteins are detailed and contemporary structure methods outlined.

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:

ULO2: Demonstrate a chemical understanding of proteins (gene products), in vivo and in vitro

ULO1: Design appropriate procedures for isolating and handling proteins

ULO3: Utilise contemporary web tools for protein analysis

ULO4: Describe protein topology forms and architectures, and recognise how these are encoded within a primary sequence

ULO5: Extract and interpret information from literature sources concerning proteins

Assessment Tasks

Coronavirus (COVID-19) Update

Assessment details are no longer provided here as a result of changes due to the Coronavirus (COVID-19) pandemic.

Students should consult [iLearn](#) for revised unit information.

[Find out more about the Coronavirus \(COVID-19\) and potential impacts on staff and students](#)

General Assessment Information

In-class quizzes

Due: **In scheduled lectures.** Weighting: **40%**

- Four separate quizzes (30 min) will be administered during Thursday lectures throughout semester (weeks 2, 4, 10 and 12). These open-book tests will incorporate problem-solving exercises utilising lecture material covered in preceding weeks.
- If you are not able to be present for a quiz, you must submit paperwork seeking Special Consideration.

“Pet Protein” Study

Due: **Apr 3.** Weighting: **15%**

- In the Week 3 workshop, you will be allocated a specific protein of industrial/medical importance as a case-study ("Pet Protein") for the semester.
- You will analyse the sequence of your individual Pet Protein using relevant software tools.
- You will undertake a literature search to locate primary journal sources for methodological details about (i) the initial historical isolation of this protein, and (ii) its modern recombinant production for industrial or laboratory purpose.
- You will provide a chemical analysis of the separation steps of these two procedures, and present in both flow chart and text forms.
- The full submission requirements for this report, and its marking rubric will be provided on iLearn.

Protein Production Practical Report

Due: **May 1** Weighting: 15%

- Following your designated 2-day mid-semester laboratory experience, you will submit an individual written report (via Turnitin) outlining the experimental data gathered by your group, and your own discussion and analysis of the findings.
- Separate sections are required for "Aims", "Methods", "Results and Discussion" and "References". A discipline-appropriate citation style must be utilised for your reference listing, or your report will be returned unmarked.

Molecular graphics

Due: **May 8** Weighting: 10%

- This activity is done in pairs, with a single joint report submitted from the session. This will incorporate a copy of the worksheet summarising observations as completed on the day.
- The submission will additionally incorporate an opening preamble (1-2 pp), outlining the background work leading to the 3D coordinates utilised for your viewing and structural analysis.

"Pet Protein" seminar & model

Due: **Week 12 or 13, as advised.** Weighting: **20%**

This is a continuation of the Pet Protein case study. You will transmit your understanding of your Pet Protein to fellow students via presentation (10 min, 10%), and your own constructed three-dimensional protein model (10%) .

- Locate the coordinate file in the Protein Data Bank (www.rcsb.org/pdb/) and pertinent paper.
- Outline the method(s) used to derive its structure.
- Outline the fold features and spatial organisation of the molecule, and highlight structural features that relate to its function.
- Construct a model (hint: wire, tape, kitchen utensils...) that clearly shows the three-dimensional shape of this protein.
- If your protein is particularly large, with two or more distinct domains, only select one of

these for your model.

Delivery and Resources

Coronavirus (COVID-19) Update

Any references to on-campus delivery below may no longer be relevant due to COVID-19.

Please check here for updated delivery information: https://ask.mq.edu.au/account/pub/display/unit_status

Delivery and Resources

Teaching Staff:

- See iLEARN for details

Classes:

- **Lectures** will be twice weekly: Wednesday (3 pm) and Thursday (4 pm) in [14 Sir Christopher Ondaatje Ave - 100 Theatre](#)
- The course syllabus is defined by the subject material presented in all lectures, including guest lectures and practicals, much of which is beyond standard textbooks.
- From week 1, **tutorials** run Thursday (2 pm) in 131 (9WW) and Friday (1 pm) in 14 Eastern Road 263 (14SCO). These are structured as problem-solving workshops to build your understanding. You are expected to attend *one* of the two sessions.

Laboratory Sessions:

A Protein Purification Practical is scheduled in the first week of mid-semester break.

*All students are required to attend practicals scheduled for two designated days within the week of **Apr 14th-17th** (Tue - Fri).*

- Throughout the semester, each student will attend **4 workshops** (designated Practical_1 in the University timetable), on either Wednesday or Thursday, scheduled across selected weeks of semester. You will attend according to dates and time allocated to your laboratory group.
- You will be allocated a workshop group (group 1, 2, 3 or 4) by the Unit convenor and communicated via the iLearn interface. You are not permitted to change groups during semester. Each of you need to attend for 2 hr sessions.
- Please carefully check the location of each activity, as classes start

promptly. **Latecomers will be excluded from class.**

- Participation is compulsory on the allocated days of class. If you are absent through illness, medical certificates are required. Please consult with the Unit Convenor to ensure all laboratory and project work is completed.

Required and Recommended texts

- **The textbook to which you are expected to have access is: “Physical Biochemistry: Principles and Applications”, David Sheehan, John Wiley (2nd ed, 2002).**
- Strongly recommended **reference texts** are included in course information on iLearn.

Web resources

The Unit will run as an online unit within iLearn (<http://learn.mq.edu.au>).

Within this course, you will be introduced to search engines and graphics software commonly used in protein science. It is an expectation that you will become familiar with the following sites :

- www.uniprot.org/
- www.expasy.org/proteomics
- www.ncbi.nlm.nih.gov/pubmed
- www.rcsb.org/pdb

Technology Requirements

- You will require internet access and a computer available for accessing the iLearn site, web browsing, preparation of your reports and presentations (Word and PowerPoint software).
- Your project and laboratory reports will be electronically submitted via the online Turnitin program within the iLearn portal.
- Your practical reports will require you to carry out minor arithmetical tasks, for which a calculator and access to basic statistical software will be required.
- We place a strong emphasis on correct referencing style in all your reports. Use of the program EndNote is encouraged.
- Your model-building assessment task can be carried out with very simple materials; it is

not an expectation that expensive art supplies need be purchased.

Unit Schedule

Coronavirus (COVID-19) Update

The unit schedule/topics and any references to on-campus delivery below may no longer be relevant due to COVID-19. Please consult [iLearn](#) for latest details, and check here for updated delivery information: https://ask.mq.edu.au/account/pub/display/unit_status

Lecture topics and Practical schedule

1 - 3	PROTEIN ENGINEERING
4 & 5	ISOLATING PROTEINS
6 - 9	SEPARATION OF PROTEINS
10 & 11	MASS SPECTROMETRY & GLYCOMICS
12 - 15	PROTEIN FOLDS AND DOMAINS
16	MEMBRANE PROTEINS
17-21	TERTIARY STRUCTURE DETERMINATION
22-24	HOW PROTEINS FOLD IN SOLUTION
25 & 26	BIOINFORMATICS

Teaching week	Date	Workshop theme	Report due	Student group
Week 3	Mar 11 or 12	Searching the primary literature	4pm Fri Apr 3	<u>Mar 11</u> 4-6 pm, group 1 6-8 pm, group 2 <u>Mar 12:</u> 9-11 am, group 3 11-1pm, group 4

Mid-semester break	Apr 14-17	Protein production practical	4pm Fri May 1	whole days, 9-4pm Apr 14-15 groups 1&2 Apr 16-17 groups 3&4
Week 8	Apr 29 or 30	Molecular graphics	4pm Fri May 8	<u>Apr 29</u> 4-6 pm, group 1 6-8 pm, group 2 <u>Apr 30</u> 9-11 am, group 3 11-1pm, group 4
Week 10	May 6 or 7	At the movies: Crystallography	May 6 or 7 (in class)	May 6: 4-6 pm, groups 1&2 May 7: 11-1pm, groups 3&4
Week 12	May 27 or 28	Presentations: Pet protein structure	in class	May 27: 4-7 pm, group 1 May 28: 10-1 pm, group 3
Week 13	Jun 3 or 4	Presentations: Pet protein structure	in class	Jun 3: 4-7 pm, group 2 Jun 4: 10-1pm, group 4

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.*)

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/p) (<https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/p>

[olicy-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 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 or if you are a Global MBA student contact globalmba.support@mq.edu.au

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 help you improve your marks and take control of your study.

- [Getting help with your assignment](#)
- [Workshops](#)
- [StudyWise](#)
- [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

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

If you are a Global MBA student contact globalmba.support@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.

Changes from Previous Offering

- Four quizzes (not five) scheduled across semester, each worth 10%, to efficiently assess key themes of this course.
- On-screen work and wrap-up reports from Molecular Graphics workshop to be completed in pairs, to jointly create most effective screen images on the day.