MOLS8212

Proteomics Technologies and Applications

Session 2, In person-scheduled-weekday, North Ryde 2024

School of Natural Sciences

Contents

General Information

Unit convenor and teaching staff
Paul Haynes
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Credit points
10

Prerequisites
Admission to GradDipBiotech or GradCertLabAQMgt or GradDipLabAQMgt or MBiotech or MBioBus or MLabAQMgt or MRadiopharmSc or MSc or MScInnovationChemBiomolecularSc and (BMOL6201 or CBMS621 or BMOL6432)

Corequisites

Co-badged status
Mols7212

Unit description
Proteomics is the study of protein expression in living systems, considered in a functional context. This allows us to better understand how protein networks become dysfunctional, which in turn enables the manipulation of protein functions and cellular phenotypes through environmental or genetic intervention, or the use of drug treatment. This unit covers the principles and applications of proteomic techniques, and assumes basic knowledge of protein electrophoresis and mass spectrometry. Topics include: a detailed study of advanced techniques, instrumentation and protein identification software in mass spectrometry; two-dimensional differential gel electrophoresis; label-free and isotope-labelling quantitation in proteomics; application of different types of peptide- and protein-based shotgun proteomics approaches; multiplexed reaction monitoring: data independent acquisition; and characterisation of protein post-translational modifications including phosphorylation and glycosylation. Students must attend a compulsory one week laboratory session during the session break.

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: Process scientific data and prepare written work in formats suitable for

publication in peer-reviewed scientific journals.

ULO2: Communicate to their peers a summary of a recent publication in a contemporary area of proteomics, and produce their own peer-review of that publication.

ULO3: Develop skills in critical thinking and analysis, and written and oral presentation of scientific information

ULO4: Extract and summarise from the scientific literature information required to develop a research plan within a relevant area of proteomics.

ULO5: Describe the basis of technologies used in proteomics, and exhibit sound knowledge of how to apply proteomics techniques to answer biological questions.

ULO6: Explain the chemical, biochemical and biophysical processes involved in proteomics, and demonstrate proficiency in a range of practical proteomics techniques.

General Assessment Information

Requirements to Pass this Unit

To pass this unit you must:

- Attempt all assessments, and
- Achieve a total mark equal to or greater than 50%,

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 7th day (including weekends). After the 7th 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.

Assessments where Late Submissions will be accepted

This applies to all submitted assessments.

Special Consideration

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.

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. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through ask.mq.edu.au.

Assessment Tasks

Name	Weighting	Hurdle	Due
Practical Report	20%	No	Tuesday October 8th
Mini-Review Essay	15%	No	Friday 6th September 2024
Continuing assessment	5%	No	weekly
Mid-semester test	5%	No	week 9
Final Exam	40%	No	Exam period.
Oral Workshop Presentation	15%	No	Various dates available throughout the semester.

Practical Report

Assessment Type [1]: Lab report
Indicative Time on Task [2]: 18 hours
Due: **Tuesday October 8th**
Weighting: **20%**

You must present your work in the format of a manuscript suitable for publication in Journal of Proteomics. This will be discussed in detail during the practical session.

On successful completion you will be able to:

- Process scientific data and prepare written work in formats suitable for publication in peer-reviewed scientific journals.
- Develop skills in critical thinking and analysis, and written and oral presentation of scientific information
- Extract and summarise from the scientific literature information required to develop a research plan within a relevant area of proteomics.
- Describe the basis of technologies used in proteomics, and exhibit sound knowledge of how to apply proteomics techniques to answer biological questions.
- Explain the chemical, biochemical and biophysical processes involved in proteomics, and demonstrate proficiency in a range of practical proteomics techniques.

Mini-Review Essay

Assessment Type [1]: Essay
Indicative Time on Task [2]: 16 hours
Due: **Friday 6th September 2024**
Weighting: **15%**

Topic: Compare and contrast the way in which proteomics studies are performed in current literature as opposed to those performed ten years ago. 2000 word mini-review article suitable for publication (not including references, diagrams, tables or figures, all of which are encouraged) Must conform to the Instructions for Authors for a review article submitted to “Journal of Proteomics”. Look up the Journal of Proteomics instructions and follow them. Make sure you read some review articles in the journal before you start writing, because that will give you a good template to work from.

On successful completion you will be able to:

- Process scientific data and prepare written work in formats suitable for publication in peer-reviewed scientific journals.
- Develop skills in critical thinking and analysis, and written and oral presentation of scientific information
- Extract and summarise from the scientific literature information required to develop a research plan within a relevant area of proteomics.
- Describe the basis of technologies used in proteomics, and exhibit sound knowledge of how to apply proteomics techniques to answer biological questions.
- Explain the chemical, biochemical and biophysical processes involved in proteomics, and demonstrate proficiency in a range of practical proteomics techniques.

Continuing assessment

Assessment Type [1]: Reflective Writing
Indicative Time on Task [2]: 3 hours
Due: **weekly**
Weighting: **5%**

You will be given 5 minutes at the end of each lecture in which you are required to write down and submit a question concerning the lecture for the day. This must be relevant to the topic that has been presented.

On successful completion you will be able to:

- Develop skills in critical thinking and analysis, and written and oral presentation of scientific information

Mid-semester test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 3 hours
Due: **week 9**
Weighting: **5%**

This will typically be a short quiz aimed at helping students assess their areas of strength and weakness prior to the final exam. It will be held after the midsemester break.

On successful completion you will be able to:

- Develop skills in critical thinking and analysis, and written and oral presentation of scientific information
- Describe the basis of technologies used in proteomics, and exhibit sound knowledge of how to apply proteomics techniques to answer biological questions.
- Explain the chemical, biochemical and biophysical processes involved in proteomics, and demonstrate proficiency in a range of practical proteomics techniques.

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 22 hours
Due: **Exam period.**
Weighting: **40%**

2.5hr exam covering all practical and theoretical components of MOLS8212. Questions are a mix of long and short answer questions

On successful completion you will be able to:

- Develop skills in critical thinking and analysis, and written and oral presentation of scientific information
- Describe the basis of technologies used in proteomics, and exhibit sound knowledge of

how to apply proteomics techniques to answer biological questions.
- Explain the chemical, biochemical and biophysical processes involved in proteomics, and demonstrate proficiency in a range of practical proteomics techniques.

Oral Workshop Presentation

Assessment Type [1]: Presentation
Indicative Time on Task [2]: 16 hours
Due: **Various dates available throughout the semester.**
Weighting: **15%**

Choose one publication from the Workshop Papers List (on a first-come first-served basis), which is found on a wiki on the iLearn site. Present your critique of the topic as a short Powerpoint seminar. Aim for 10-12 min talking (15 minutes max), and there will be time for questions. We may adjust that schedule depending on class numbers. Participation in all other group's topics contributes to your final mark Perform your own peer-review of your chosen paper - tell us whether you think this paper should have been published and why. Look up other relevant literature so you can discuss your chosen paper in context rather than in isolation. The research workshop presentation will now be accepted as a video presentation uploaded in advance to youtube. It must include figures, graphics, text (and some footage of the presenter). You can either record straight to video camera, or use software such as iMovie or Windows Movie Maker.

On successful completion you will be able to:
- Communicate to their peers a summary of a recent publication in a contemporary area of proteomics, and produce their own peer-review of that publication.
- Develop skills in critical thinking and analysis, and written and oral presentation of scientific information
- Extract and summarise from the scientific literature information required to develop a research plan within a relevant area of proteomics.
- Describe the basis of technologies used in proteomics, and exhibit sound knowledge of how to apply proteomics techniques to answer biological questions.

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[1] 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.

[2] 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

LECTURE, WORKSHOP and PRACTICAL TIMETABLE

Lectures: **Wednesdays 1pm – 3pm July 24th - October 30th, *01CC 203***

Workshops: **Fridays 12 noon – 1pm July 26th - November 1st, *01CC 106***

NOTE: Lectures are two hours duration and start week 1, and will include the first scientific content lecture (Wednesday July 24th) followed by the introductory lecture explaining all aspects of the course – which is only one hour long – followed in the first workshop timeslot (Friday July 26th).

Practicals: Are held in a one-week block during semester break. You must be available for all of September 16th- 20th. Practical classes run about 6+ hours per day, between 9am – 5 pm. This is the equivalent of 3+ hours per week for the whole semester, we just do it all at once.

The practical course includes differential display SDS-PAGE protein electrophoresis, in-gel protein digestion, peptide mass spectrometry (nanoESI- Q Exactive orbitrap), peptide to spectrum matching using programs such as MaxQuant and MSFragger, shotgun proteomic analysis using SDS-PAGE protein fractionation, and differential protein quantitation.

Up to date timetable information is found at publish.mq.edu.au

All unit information is distributed using the unit website on ilearn, accessed via ilearn.mq.edu.au

All written work must be submitted through iLearn Turnitin. Lectures and workshops will both be recorded and made available via echo 360.

For 2024, we will have no in-person classes in week 5 (commencing august 19th) and week 10 (commencing October 7th) of semester. Please read the lecture and workshop schedule very carefully.

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

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LECTURE, WORKSHOP and PRACTICAL TIMETABLE

Lectures: **Wednesdays 1pm – 3pm July 24th - October 30th, *01CC 203***

Workshops: **Fridays 12 noon – 1pm July 26th - November 1st, *01CC 106***

Lectures Wednesdays 1-3pm, starting July 24th, 01CC 203

Week	Date	Lecture Title
1	**Wednesday** July 24th	Mass spectrometry fundamentals (1)
1	**Friday** July 26th	Introductory Lecture - Subject Outline, assessment processes, and other important information (***in workshop timeslot***)
2	July 31st	Protein Identification from MS data (2)
3	August 7th	2D gels and 2D DIGE (3)
4	August 14th	Differential display and shotgun proteomics (4)
5	August 21st	No lecture, PH absent
6	August 28th	Quantitative proteomics (I) label-free (5)
7	Sept 4th	Quantitative proteomics (II) isotope labels (6)

8	Sept 11th	Data dependent acquisition (DDA) and Data independent acquisition (DIA) (7)
Practical: 5 Days, 16th- 20th September (*during semester break*)		
9	Oct 2nd	Multiple reaction monitoring and proteomics validation (8)
Practical report due Tues October 8th		
10	October 9th	– No lecture, PH absent –
11	October 16th	Protein-Protein Interactions (9)
12	October 23rd	Post-translational modifications (I) Glycoproteomics (10)
13	October 30th	Post-translational modifications (II) Phosphoproteomics (11)

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WORKSHOP TIMETABLE

Workshops: Fridays 12 noon - 1:00 pm from August 5th, 01CC 106

Week	Date	
1	*July 26th – no workshop, but we have an …*	*… introductory lecture*
2	August 2nd	MS Fundamentals
3	August 9th	Protein ID
4	August 16th	2D Gels and 2D DIGE
5	August 23rd	*No workshop, PH absent*

6	August 30th	Shotgun proteomics
7	September 6th	Label Free quantitation
8	September 13th	Quantitation with labels
	Semester Break - September 14th to September 29th	
9	October 4th	Data Independent Acquisition
10	October 11th	*No workshop, PH absent*
11	October 18th	Multiplexed reaction monitoring
12	October 25th	Protein interactions
13	November 1st	Glyco- and Phospho-proteomics

Q. Why is July 26th used for an introductory lecture?

A. If we had a workshop session on that day, the students presenting their research papers would have less than a week to prepare. If we start workshops in week two, then the first students will have two weeks to prepare, which is sufficient time to allow them to do a good job.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (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). 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) 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 or if you are a Global MBA student contact 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/.

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

Updated lectures, updated list of papers for research presentations, and redesigned practical class experiments.

Other important items

- We do not work from a textbook, instead we focus on current scientific literature.

- Additional reading material is also included at the end of most lectures. It is your job to look it up.

- The practical class is 5 days long and runs during semester break, so make plans now to be available for a week long practical class during that time.

- Technologies used and required. Lecture notes will be made available on the unit website in iLearn. Notes will be made available a few days in advance of the lecture whenever possible, and it is your responsibility to bring your own copy to lectures.

- Technologies used and required. All of the important information during semester will be communicated to you via the unit website on iLearn. It is your responsibility to check it regularly for announcements and other information.

- Technologies used and required. Students will need to have access to a computer and printer, and be able to use Word, Excel, Powerpoint, and a reference manager program such as EndNote.

Unit information based on version 2024.03 of the Handbook