



# MOLS8212

## Proteomics Technologies and Applications

Session 2, In person-scheduled-weekday, North Ryde 2022

*School of Natural Sciences*

### Contents

<u>General Information</u>	2
<u>Learning Outcomes</u>	2
<u>General Assessment Information</u>	3
<u>Assessment Tasks</u>	3
<u>Delivery and Resources</u>	7
<u>Policies and Procedures</u>	16

#### Disclaimer

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## General Information

Unit convenor and teaching staff

Paul Haynes

[paul.haynes@mq.edu.au](mailto:paul.haynes@mq.edu.au)

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

### Late Assessment Submission Penalty

From 1 July 2022, Students enrolled in Session based units with written assessments will have the following university standard late penalty applied. Please see <https://students.mq.edu.au/study/assessment-exams/assessments> for more information.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written 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. Submission time for all written assessments is set at 11:55 pm. A 1-hour grace period is 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, students need to submit an application for Special Consideration.

In this unit, late submissions will be accepted for the essay and practical report, both of which are written tasks with a specified due date.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Oral Tutorial Presentation</u>	15%	No	Various dates throughout semester
<u>Final Exam</u>	40%	No	Exam period 7-25 November.

Name	Weighting	Hurdle	Due
<u>Mini-Review Essay</u>	15%	No	Friday 2nd September
<u>Mid-semester test</u>	5%	No	week 8
<u>Continuing assessment</u>	5%	No	various dates throughout semester
<u>Practical Report</u>	20%	No	Monday October 3rd

## Oral Tutorial Presentation

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

Indicative Time on Task <sup>2</sup>: 16 hours

Due: **Various dates throughout semester**

Weighting: **15%**

Choose one publication from the Tutorial 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 tutorial 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.

## Final Exam

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

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

Due: **Exam period 7-25 November.**

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.

## Mini-Review Essay

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

Indicative Time on Task <sup>2</sup>: 16 hours

Due: **Friday 2nd September**

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.

## Mid-semester test

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

Indicative Time on Task <sup>2</sup>: 3 hours

Due: **week 8**

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.

## Continuing assessment

Assessment Type <sup>1</sup>: Reflective Writing

Indicative Time on Task <sup>2</sup>: 3 hours

Due: **various dates throughout semester**

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

## Practical Report

Assessment Type <sup>1</sup>: Lab report

Indicative Time on Task <sup>2</sup>: 18 hours

Due: **Monday October 3rd**

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.

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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

### LECTURE, TUTORIAL and PRACTICAL TIMETABLE

**Lectures: Thursdays 12 noon - 2:00 pm July 28<sup>th</sup> - November 3<sup>rd</sup>, 4 Western Rd 220**

**Tutorial workshops: Fridays 11:00 am – 12 noon am July 29<sup>th</sup> - November 4<sup>th</sup>, 14SCO 263**

**NOTE: Lectures start week 1, and an introductory lecture explaining all aspects of the course will be delivered in the first tutorial timeslot.**

**Practicals: Are held in a one-week block during semester break. You must be available for all of September 12<sup>th</sup>- 16<sup>th</sup>. 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. Attendance is compulsory - if you are not able to attend the practical class all week, for any reason, please do not enrol in this unit.**

**The practical course includes differential display 2D gel electrophoresis, in-gel protein digestion, peptide spectrometry (MALDI-TOF/TOF and nanoESI-Linear ion trap), protein identification using Mascot and XTandem, shotgun proteomic analysis using SDS-PAGE protein fractionation, and label-free protein quantitation using normalized spectral abundance factors.**

**Up to date timetable information is found at [timetables.mq.edu.au](http://timetables.mq.edu.au)**

**All unit information is distributed using the unit website on ilearn, accessed via [ilearn.mq.edu.au](http://ilearn.mq.edu.au)**

**Lectures Thursdays 12-2pm, starting July 28<sup>th</sup>, 4 Western Rd 220**

Week	Date	Lecture Title
1	THURSDAY July 28 <sup>th</sup>	Mass spectrometry fundamentals (1)

1	<b>FRIDAY</b> July 29 <sup>th</sup>	Introductory Lecture - Subject Outline, assessment processes, and other important information ( <i>in tutorial timeslot</i> )
2	August 4 <sup>th</sup>	Protein Identification from MS data (2)
3	August 11 <sup>th</sup>	2D gels and 2D DIGE (3)
4	August 18 <sup>th</sup>	Differential display and shotgun proteomics (4)
5	August 25 <sup>th</sup>	Quantitative proteomics (I) label-free (5)
6	Sept 1 <sup>st</sup>	Quantitative proteomics (II) isotope labels (6)
7	Sept 8 <sup>th</sup>	Data dependent acquisition (DDA) and Data independent acquisition (DIA) (7)
<b>Practical: 5 Days, 12<sup>th</sup>- 16<sup>th</sup> September (during semester break)</b>		
8	Sept 29 <sup>th</sup>	Multiple reaction monitoring and proteomics validation (8)
<b>Practical report due Monday October 3<sup>rd</sup></b>		
9	October 6 <sup>th</sup>	Protein-Protein Interactions (9)
10	October 13 <sup>th</sup>	Post-translational modifications (I) Glycoproteomics (10)
11	October 20 <sup>th</sup>	Post-translational modifications (II) Phosphoproteomics (11)
12	October 27 <sup>th</sup>	Revision (12)
13	November 3 <sup>rd</sup>	Spare

All written work must be submitted through iLearn Turnitin. In addition, hardcopies may be required, to be confirmed. Lectures and tutorials will both be recorded and made available via echo 360.

## MOLS8212 Proteomics Technologies and Applications

### TUTORIAL TIMETABLE

**Tutorials: Fridays 11am-12 from August 1<sup>st</sup>, 14SCO 263**

Week	Date
1	[note: July 29 <sup>th</sup> is used for an introductory lecture]
2	August 5 <sup>th</sup> - MS Fundamentals
3	August 12 <sup>th</sup> - Protein ID
4	August 19 <sup>th</sup> - 2D Gels and 2D DIGE
5	August 26 <sup>th</sup> - Shotgun proteomics
6	September 2 <sup>nd</sup> - Label Free quantitation
7	September 9 <sup>th</sup> - Quantitation with labels
	<i>Semester Break - September 10<sup>th</sup> to September 25<sup>th</sup></i>
8	September 30 <sup>th</sup> – Data Independent Acquisition
9	October 7 <sup>th</sup> - Multiplexed reaction monitoring
10	October 14 <sup>th</sup> - Protein interactions
11	October 21 <sup>st</sup> - Glycoproteomics
12	October 28 <sup>th</sup> - Phosphoproteomics
13	November 4 <sup>th</sup> - spare

Q. Why is July 29<sup>th</sup> used for an introductory lecture?

A. If we had a tutorial session on that day, the students presenting their research papers would have less than a week to prepare. If we start tutorials 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.

## **MOLS8212 Proteomics Technologies and Applications**

### **ASSESSMENT PROCESS 2022**

#### **Mini-Review Essay (Due Friday September 2<sup>nd</sup>) - 15%**

Topic for 2022: Compare and contrast the way in which proteomics studies are performed in current literature as opposed to those performed ten years ago.

- 1200-1500 word mini-review article suitable for publication (not including titles, affiliations, abstract, keywords, acknowledgements, 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. Hint: go to Pubmed and search for “Journal of Proteomics AND review”.
- You can choose to focus on a particular biological subject area if you wish, but you must make that clear to the reader.

#### **Group Oral Tutorial Presentation – Various Dates - 15%**

- You will work in groups of two, so identify a partner as soon as possible.
- Choose one publication from the Tutorial Papers List (on a first-come first-served basis), which is found on a wiki on the iLearn site.
- The papers are to be presented on the date indicated, because they are sorted by subject material. There is a small number of general interest papers at the end of the list which can be presented on any date you wish to choose.
- A maximum of two group presentations will be scheduled for each week. If you put your name down on a particular date as the third group, you will miss out on presenting, so you will have wasted your time.
- Both students must take part in presenting, and share the workload.
- An essential part of this task is organising yourselves so that everyone in the class has a

time scheduled to present their work. A wiki will be set up in iLearn, and you will be able to put your name down. The papers are grouped by subject so that they follow the weekly lecture content fairly closely, to help reinforce your learning. Hence, a paper on a specific topic will be listed on a given date and can only be presented on that date.

- The exception to this is the general interest papers which can be presented on any date you wish to choose. If you choose to present one of the general interest papers, it is **your job** to copy and paste that information into the correct date on the wiki so that everyone knows what is going on.
- It is important to be proactive about this scheduling task, because the unit convenor will not be involved. If there are three or four group names down to present on one week, you need to talk among yourselves and fix the problem. Please be aware that we frequently have issues with students putting their name down and then withdrawing from the unit. That means timeslots go by unused and then there is not enough time for other students to present. Again, it is the responsibility of all students involved to make sure that we get two presentations each week.
- Present your critique of the topic as a short Powerpoint seminar. Aim for 10 min talking (12 minutes absolute max), and there will be time for questions And discussions. We may adjust that schedule depending on class numbers.
- Summarise the paper. Present it in a short form so that other students in the class can understand what was done, and how, and why.
- You are not required to present every figure and table from the paper, you need to summarise and present what is important to get the point across.
- 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.
- **Participation in all other group's topic presentations contributes to your final mark - if you turn up and ask questions, you will get a better mark. Since this constitutes a continuing assessment component, marks will not be finalised and released until the last presentation has been completed at the end of the semester.**
- The research tutorial presentation can be presented live, or it can also be presented as a video presentation uploaded in advance to youtube. Pre-recorded videos 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. Tutorial presentations will be recorded and made available via iLearn.

**Continuing assessment: Weekly Speaker Questions - 5%**

- You will be given a few minutes at the end of each lecture so that you can write down and submit a question concerning the lecture of the day. This must be relevant to the topic that has been presented.

**Mid-semester test – week 8 - 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, date to be confirmed.

**Practical Report (Due Monday October 3<sup>rd</sup>) - 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.

**Final Exam (2.5 hrs, date and time to be advised) - 40%**

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

**Late Assessment Submission Penalty**

From 1 July 2022, Students enrolled in Session based units with written assessments will have the following university standard late penalty applied. Please see <https://students.mq.edu.au/study/assessment-exams/assessments> for more information.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written 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. Submission time for all written assessments is set at 11:55 pm. A 1-hour grace period is 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, students need to submit an application for Special Consideration.

In this unit, late submissions will be accepted for the essay and practical report, both of which are written tasks with a specified due date.

## **TUTORIAL TOPICS**

## **EVALUATION CRITERIA**

Your tutorial presentation (approximately 10-12min presentation plus question time, depending on student numbers) will be assessed using the following criteria.

1. Content – is your presentation accurate and easy to understand, and evidence of sound knowledge of the overall subject area
2. Evidence of comprehension of techniques used
3. Evidence of literature research beyond the set text
4. Fluency and presentation, including use of visual, and ability to maintain group attention
5. Inclusion of key advances in the area
6. Demonstration of critical scientific thinking
7. Assessment of any relevant ethical and social issues
8. Summing up with a peer-review recommendation: do you think this work should have been published or not? Why?
9. Handling of questions
10. Participation in other student's tutorial presentations i.e. pay attention and ask intelligent questions

## 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.
- What is changed? The unit is updated every year with revised lecture content and numerous new tutorial research papers.
- What is changed? The unit has been renamed to Proteomics Technologies and Applications, to better capture what the unit is intending to convey.
- What is changed? The research tutorial presentation will 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.
- For 2022, revised and refreshed lecture content based on feedback from the previous year, and updated tutorial paper list. The revised lecture content and numerous new tutorial research papers reflect the rapidly changing state of the field.

## 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](https://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.