



# MOLS7212

## Proteomics Technologies and Applications

Session 2, Special circumstances, North Ryde 2021

*Department of Molecular Sciences*

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#### **Disclaimer**

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#### **Session 2 Learning and Teaching Update**

The decision has been made to conduct study online for the remainder of Session 2 for all units WITHOUT mandatory on-campus learning activities. Exams for Session 2 will also be online where possible to do so.

This is due to the extension of the lockdown orders and to provide certainty around arrangements for the remainder of Session 2. We hope to return to campus beyond Session 2 as soon as it is safe and appropriate to do so.

Some classes/teaching activities cannot be moved online and must be taught on campus. You should already know if you are in one of these classes/teaching activities and your unit convenor will provide you with more information via iLearn. If you want to confirm, see the list of [units with mandatory on-campus classes/teaching activities](#).

Visit the [MQ COVID-19 information page](#) for more detail.

## 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 MRes

Corequisites

Co-badged status

Co-taught with Mols8212.

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 semester break.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://students.mq.edu.au/important-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.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#"><u>Mini-Review Essay</u></a>	15%	No	Friday September 3rd 9am
<a href="#"><u>Mid-semester test</u></a>	5%	No	week 8
<a href="#"><u>Practical Report</u></a>	20%	No	Monday October 4th 9am
<a href="#"><u>Continuing assessment</u></a>	5%	No	ongoing
<a href="#"><u>Oral Tutorial Presentation</u></a>	15%	No	Various dates available
<a href="#"><u>Final Exam</u></a>	40%	No	Exam Period

### Mini-Review Essay

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

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

Due: **Friday September 3rd 9am**

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.

## 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.

## Practical Report

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

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

Due: **Monday October 4th 9am**

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.

## Continuing assessment

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

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

Due: **ongoing**

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 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.

## Oral Tutorial Presentation

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

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

Due: **Various dates available**

Weighting: **15%**

Choose one publication from a Tutorial Papers List (on a first-come first-served basis), which is found 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 presentation can be submitted as a video presentation uploaded in advance to youtube. It must include figures, graphics, text (and some footage of the presenter).

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**

Weighting: **40%**

2.5hr exam covering all practical and theoretical components of MOLS7212 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.

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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 [Learning Skills Unit](#) 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

### **MOLS7212** [Proteomics Technologies and Applications](#)

#### LECTURE, TUTORIAL and PRACTICAL TIMETABLE

Lectures: Thursdays 10:00 am - 12:00 pm July 29<sup>th</sup> - November 4<sup>th</sup>, either *9WW 102* or *online*

Tutorials/workshops: Fridays 10:00 am - 11:00 am July 30<sup>th</sup> - November 5<sup>th</sup>, either *3IR G240* or *online*

NOTE: the first scientific content lecture 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 13<sup>th</sup>- 17<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)

### **MOLS7212 Proteomics Technologies and Applications**

#### **ASSESSMENT PROCESS 2021**

#### **Mini-Review Essay (Due 9am Friday September 3<sup>rd</sup>) - 15%**

Topic for 2021: Compare and contrast the way in which proteomics studies are performed in current literature as opposed to those performed ten years ago.

- 1500 word mini-review article suitable for publication (not including abstract, keywords, 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.

### 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 preparing a presentation.
- Present your critique of the topic as a short Powerpoint seminar. Aim for 10 min talking (12 minutes max), and there will be time for questions. We may adjust that schedule depending on class numbers.
- Summarise the paper. Presented in a short form so that other students in the class can understand what was done, and how, and why.
- 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 it be presented live, either in person or by zoom, and it will also be accented 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 echo 360. It is best for both students to 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.

### **Continuing assessment: Weekly Speaker Questions - 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 of the day. This must be relevant to the topic that has been presented.

Note that in the event of a Coronavirus global pandemic:

- You will be required to submit a written question after each lecture via iLearn, which must be relevant to the topic that has been presented. Each week there will be a link to a wiki under the Introduction and timetabling section of iLearn where you get to enter a question, next to your name. The wiki will be active from 12 midday when the lecture finishes until midnight of the next day, so you have plenty of time in which to listen to the recorded lecture (if necessary) and write down a sensible question. No late submissions will be accepted. Discussion of these will form our weekly revision session prior to the next new content lecture, so if there is something you don't understand in a lecture, make sure you ask about it.

### **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 4<sup>th</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 MOLS7212
- Questions are a mix of long and short answer questions

## Unit Schedule

Lectures Thursdays 10-12pm, starting July 29<sup>th</sup>, 9WW102 or *online*

Week	Date	Lecture Title
1	<b>THURSDAY</b> July 29 <sup>th</sup>	Subject Outline, Introduction and Assessment Process, and General Introduction (1)
1	<b>FRIDAY</b> July 30 <sup>th</sup>	Mass spectrometry fundamentals (2) ( <i>in tutorial timeslot</i> )
2	August 5 <sup>th</sup>	Protein Identification from MS data (3)
3	August 12 <sup>th</sup>	2D gels and 2D DIGE (4)
4	August 19 <sup>th</sup>	Differential display and shotgun proteomics (5)
5	August 26 <sup>th</sup>	Quantitative proteomics (I) label-free (6)
6	Sept 2 <sup>nd</sup>	Quantitative proteomics (II) isotope labels (7)
7	Sept 9 <sup>th</sup>	Data dependent acquisition (DDA) and Data independent acquisition (DIA) (8)
<b>Practical: 5 Days, 13<sup>th</sup>- 17<sup>th</sup> September (<i>during semester break</i>)</b>		
8	Sept 30 <sup>th</sup>	Multiple reaction monitoring and proteomics validation (9)
9	October 7 <sup>th</sup>	Protein-Protein Interactions (10) [Public Holiday]
<b>Practical report due 9am Monday October 4<sup>th</sup></b>		

10	October 14 <sup>th</sup>	Post-translational modifications (I) Glycoproteomics (11)
11	October 21 <sup>st</sup>	Post-translational modifications (II) Phosphoproteomics (12)
12	October 28 <sup>th</sup>	Revision
13	November 4 <sup>th</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.

## MOLS7212 Proteomics Technologies and Applications

### TUTORIAL TIMETABLE

**Tutorials: Fridays 10-11am from August 2<sup>nd</sup>, 3IR G240 or online**

Week	Date
1	[note: July 30 <sup>th</sup> is used for a lecture]
2	August 6 <sup>th</sup> - MS Fundamentals
3	August 13 <sup>th</sup> - Protein ID
4	August 20 <sup>th</sup> - 2D Gels and 2D DIGE
5	August 27 <sup>th</sup> - Shotgun proteomics
6	September 3 <sup>rd</sup> - Label Free quantitation
7	September 10 <sup>th</sup> - Quantitation with labels
	<i>Semester Break - September 11<sup>th</sup> to September 26<sup>th</sup></i>
8	October 1 <sup>st</sup> – Data Independent Acquisition
9	October 8 <sup>th</sup> - Multiplexed reaction monitoring

10	October 15 <sup>th</sup> - Protein interactions
11	October 22 <sup>nd</sup> - Glycoproteomics
12	October 29 <sup>th</sup> - Phosphoproteomics
13	November 5 <sup>th</sup> - spare

Q. Why is July 30 used for a 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.

## 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](#)
- [Grade Appeal Policy](#)
- [Complaint Management 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](mailto:ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto: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](http://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 Enquiry Service

For all student enquiries, visit Student Connect at [ask.mq.edu.au](mailto:ask.mq.edu.au)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Equity 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.

## 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

- The unit has been renamed to Proteomics Technologies and Applications, to better capture what the unit is intending to convey.
- 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 2021, 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.