



CBMS223

Biochemistry

S1 Day 2014

Chemistry and Biomolecular Sciences

Contents

<u>General Information</u>	2
<u>Learning Outcomes</u>	2
<u>Assessment Tasks</u>	3
<u>Delivery and Resources</u>	8
<u>Unit Schedule</u>	10
<u>Learning and Teaching Activities</u>	11
<u>Policies and Procedures</u>	11
<u>Graduate Capabilities</u>	13
<u>Penalties for late submission</u>	26
<u>Textbook</u>	26
<u>Unit Website</u>	27

Disclaimer

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

General Information

Unit convenor and teaching staff

Unit Convenor

Shoba Ranganathan

shoba.ranganathan@mq.edu.au

Contact via shoba.ranganathan@mq.edu.au

F7B 121

meeting confirmed by email

Credit points

3

Prerequisites

(BIOL115 and CBMS103) or admission to GCertBiotech or GDipChiroSc or PGQual(Chiro)

Corequisites

Co-badged status

Unit description

This unit provides an essential background of biochemistry for the modern life scientist, building on fundamentals of organic and biological chemistry and general biology. Lecture topics include structure of biological macromolecules, enzymatic control of biological reactions, principal pathways of intermediary metabolism, flow of energy within cells, and lipid and amino acid metabolism. The unit emphasises the interpretation of quantitative data and the experimental basis for our current ideas and developments in biochemistry. Laboratory practical sessions will alternate with tutorials covering lecture and practical topics.

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:

Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.

Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of

important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.

Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.

Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.

An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.

How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.

How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;

Metabolic pathway mapping: have a detailed knowledge of the interactions between different metabolic pathways.

How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.

Tracking enzyme reactions: apply analytical techniques to determine the molecular composition of reaction products and determine the thermodynamic parameters of enzyme reactions.

Data analysis: how to sort, graph and analyze experimental results.

Assessment Tasks

Name	Weighting	Due
<u>Assignment</u>	5%	on iLearn
<u>In-Semester Test</u>	15%	on iLearn
<u>Practicals</u>	15%	on iLearn
<u>Tutorials</u>	5%	on iLearn
<u>Mid-year Examination</u>	60%	on iLearn

Assignment

Due: **on iLearn**

Weighting: **5%**

The **assignment** will provide early feedback on the understanding of protein structure (Lectures 1-4) and provide you an opportunity to use computer-based tools to explore and analyse the 3D nature of functional proteins.

The assignment should be completed by answering an **online quiz** on iLearn.

On successful completion you will be able to:

- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.
- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;

In-Semester Test

Due: **on iLearn**

Weighting: **15%**

The **in-semester test** (multi-choice format) will cover lecture materials (Lectures 1-10) and give you an idea of the types of questions that will be asked in the mid-year examination.

The test will be held in a number of locations in lieu of the scheduled CBMS223 lecture: details will be posted on iLearn.

This is a closed book test and you may use a non-programmable scientific calculator (with no text retrieval capability). Pl. bring a 2B pencil(s) and an eraser for the test. Your bags and mobile phones will need to be placed at the front of the test venue.

On successful completion you will be able to:

- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.
- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;

Practicals

Due: **on iLearn**

Weighting: **15%**

The practical exercises will provide you the opportunity to apply experimental techniques, collate relevant experimental results and analyse them.

The pre-lab quizzes are designed to prepare for the practicals and should be answered online at iLearn, prior to attending the scheduled laboratory practical session.

Completed practical files are due on iLearn 1 week after the date of the lab.

Lab schedules as well as lab report submission dates will be posted on iLearn.

Satisfactory completion of the practical component is essential for passing the unit.

On successful completion you will be able to:

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Discipline-specific knowledge: a basic understanding of key biochemical processes and

their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.

- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- Metabolic pathway mapping: have a detailed knowledge of the interactions between different metabolic pathways.
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.
- Tracking enzyme reactions: apply analytical techniques to determine the molecular composition of reaction products and determine the thermodynamic parameters of enzyme reactions.
- Data analysis: how to sort, graph and analyze experimental results.

Tutorials

Due: **on iLearn**

Weighting: **5%**

Tutorials provide an opportunity to work out problems and questions complementing lectures and practicals.

Tutorial PDFs should be printed from iLearn and Part A answered before coming to the tutorial class.

The assessment is based on tutorial quiz questions, which will cover the associated practicals and are answered as online quizzes on iLearn.

Satisfactory completion of the tutorial component is essential for passing the unit.

On successful completion you will be able to:

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.
- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- Metabolic pathway mapping: have a detailed knowledge of the interactions between different metabolic pathways.
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.
- Data analysis: how to sort, graph and analyze experimental results.

Mid-year Examination

Due: **on iLearn**

Weighting: **60%**

The mid-year examination will comprise a combination of multiple-choice questions, short answers and an essay question, to assess your overall understanding of the subject.

The format of the exam and the exact will be posted on iLearn.

Satisfactory performance in the exam is mandatory for passing the unit.

On successful completion you will be able to:

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.
- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- Metabolic pathway mapping: have a detailed knowledge of the interactions between different metabolic pathways.

Delivery and Resources

CLASSES

Timetable: Please check www.timetables.mq.edu.au for the official timetable of the unit.

Additional rooms for the in-semester test: will be listed on iLearn, at least two weeks before the test, with the students allocated to each test venue.

Lectures will be delivered as scheduled with eCHO recording available through iLearn. Additional learning materials (notes, animations, movies) and revision materials provide by the textbook publisher are also available from iLearn.

Laboratory Work: labs. alternate with tutorials and each group of max. 16 students will be allocated a tutor. Lab/tutorial schedules of each group will be posted on iLearn.

Laboratory sessions are scheduled in the timetable. You will undertake experiments at the bench (wet-labs) in **E7A 130** (the lab with the yellow door) - please bring your **lab. coat** and **wear covered shoes**. Safety glasses will be provided in the lab.

Before commencing a new experiment, you are **required to complete the prelab quiz**. All questions are to be answered online at iLearn, upto one hour before the commencement of the lab. A delay in starting the experimental work due to poor pre-lab preparation may have a detrimental effect on your ability to perform the laboratory work satisfactorily. You should attempt the pre-lab exercises well in advance of each practical class. You are advised to read each experiment carefully.

Students unable to attend laboratory classes due to illness or misadventure (as defined in the Handbook of Undergraduate Studies) and who are unable to catch up in another session must provide formal documentary evidence to the University as soon as possible after the absence. For one such justified absence students will receive the average mark from the sessions that they did attend. For any unjustified absences, students will receive a zero mark and may be liable to compulsory withdrawal from the unit. You will need to submit a "Special consideration form", information on which is given below. It may be possible to rearrange your schedule if sufficient advance notice is given and if there is lab space available on another lab day. If the absence is anticipatable, such as for religious observance days and the like, it is your responsibility to discuss this with your lecturer **in advance of** the absence.

Some practical work will be undertaken before the corresponding material has been covered in lectures. The notes have been written with this in mind and some allowance will be made in the marking of reports.

Lab Report Submission Date: Reports must be uploaded to iLearn within one week after the completion of the lab. **Penalties for late submission** are provided in a separate section.

TEXTBOOK USED

Please see the **Textbook** section for details.

TECHNOLOGY USED

PDF viewer: To view notes on all the lecture topics, quizzes, tutorial answers and past questions, on the unit web site, you will require the free software, Adobe Acrobat Reader to be installed on your computer. Acrobat Reader can be downloaded from the Adobe website <http://get.adobe.com/uk/reader/>. If you are using the computers in the library, then Acrobat has already been installed.

IT and internet: General use computers are provided by the University, but it would be advantageous to have your own computer and internet access.

E-mail: You are also expected to access your **Macquarie University student email account** regularly to get the latest information on the unit. If you do not use this account regularly, please set up automatic forwarding to your preferred email address.

Calculators: Hand-held calculators will be occasionally used in tutorials and practicals, for tests and in the final examination. Note that text-retrieval or programmable calculators are not permitted during the tests or the mid-year examination. Calculators on smart phones will also not be allowed.

CHANGES SINCE 2013

1. **Prac notes:** We now have electronic or paperless lab documents (Word and excel files) for noting observations down during the prac sessions and generating the graphs required. **Completed files will be uploaded to iLearn.**

Unit Schedule

The unit will cover three basic areas of biochemistry: the exact lecture schedule is on iLearn.

Weeks 1-4: Proteins and Enzymes Protein structure and enzyme function including basic Michaelis-Menton type enzyme kinetics.

- Structure and properties of amino acids found in proteins including some “non standard” amino acids, and chirality of amino acids.
- Definition and properties of a peptide bond
- Definition of primary, secondary, tertiary and quaternary structure of proteins, including protein structural domains
- Protein analysis, including stability, protein folding and denaturation, protein purification, sequencing methods such as Edman degradation and MS-MS, chromatography, solubility, spectroscopic properties, protein structure determination methods and gel electrophoresis.
- Models of enzyme activity, including catalytic site and enzyme mechanisms, enzyme classification, enzyme inhibition and review of thermodynamics and chemical equilibria.

Weeks 4-8: Intermediary metabolism Principles of metabolism and how cell structure may influence metabolism within cells is covered as an overview before examining specific pathways.

- Types of metabolic strategies that organisms utilize: chemolithotroph, photoautotroph, photoheterotroph and heterotroph
- The link between catabolism and biosynthesis: reducing equivalents, coupling reactions for thermodynamic favourability, carbon and nitrogen sources and other nutrients.
- Compartmentalization of enzymes and pathways
- Membrane structure
- Regulation of metabolic pathways: Intra- and inter- cellular signals i.e. hormones.
- Clustering of enzyme activities
- Glycolysis and gluconeogenesis: the key regulatory steps, enzyme mechanisms and

compartmentalization of parts of the gluconeogenesis pathway in mammals.

- Tricarboxylic acid cycle in mitochondria: catalytic and synthetic roles
- Glyoxalate cycle
- Pentose phosphate pathway
- Electron transport chain and oxidative phosphorylation

Weeks 9-13: Biosynthesis and utilization of biomolecules How biomolecules are made and recycled within the cell.

- Fatty acid synthesis and degradation
- Nitrogen metabolism
- Amino acid synthesis and breakdown
- Nucleotide synthesis and catabolism
- The role of vitamins and coenzymes in the functioning of the cell and diseases caused by deficiencies in these essential molecules.

Learning and Teaching Activities

Practicals

Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.

Tutorials

Tutorials provide an opportunity to work out problems and questions complementing lecture and practical materials. The tutorial quiz questions will cover also the associated practicals.

Lectures

The lectures provide an overview of each topic/concept. The student is encouraged to follow up with textbook reading as well as additional reading materials provided on iLearn. Wherever possible, animations and movies are also provided on iLearn along with revision quizzes from the textbook.

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy 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/support/student_conduct/

If you have missed **an assessable task** (assignment, in-semester test, practical or tutorial), please check if you are eligible for Special Consideration from:

<http://ask.mq.edu.au>

If yes, please complete the online form and submit required documentation (medical certificate, etc.) to the Science Centre, **within 5 working days of the absence.**

If you have missed **the mid-year exam**, please check if you are eligible for Special Consideration from:

<http://ask.mq.edu.au>

If yes, please complete the online form and submit required documentation (medical certificate, etc.) to the Science Centre, **within 5 working days of the absence.** If approved, you will then be considered for the the Supplementary exam, scheduled after the examination period.

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 improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)

- [Ask a Learning Adviser](#)

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

IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use Policy](#). The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.
- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.

- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.
- Tracking enzyme reactions: apply analytical techniques to determine the molecular composition of reaction products and determine the thermodynamic parameters of enzyme reactions.
- Data analysis: how to sort, graph and analyze experimental results.

Assessment tasks

- In-Semester Test
- Practicals
- Tutorials
- Mid-year Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.
- Tutorials provide an opportunity to work out problems and questions complementing lecture and practical materials. The tutorial quiz questions will cover also the associated practicals.
- The lectures provide an overview of each topic/concept. The student is encouraged to follow up with textbook reading as well as additional reading materials provided on iLearn. Wherever possible, animations and movies are also provided on iLearn along with revision quizzes from the textbook.

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships

with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcomes

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.
- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- Metabolic pathway mapping: have a detailed knowledge of the interactions between different metabolic pathways.
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.
- Tracking enzyme reactions: apply analytical techniques to determine the molecular composition of reaction products and determine the thermodynamic parameters of enzyme reactions.
- Data analysis: how to sort, graph and analyze experimental results.

Assessment tasks

- Assignment

- In-Semester Test
- Practicals
- Tutorials
- Mid-year Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.
- Tutorials provide an opportunity to work out problems and questions complementing lecture and practical materials. The tutorial quiz questions will cover also the associated practicals.
- The lectures provide an overview of each topic/concept. The student is encouraged to follow up with textbook reading as well as additional reading materials provided on iLearn. Wherever possible, animations and movies are also provided on iLearn along with revision quizzes from the textbook.

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as

post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.

- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- Metabolic pathway mapping: have a detailed knowledge of the interactions between different metabolic pathways.
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.
- Tracking enzyme reactions: apply analytical techniques to determine the molecular composition of reaction products and determine the thermodynamic parameters of enzyme reactions.
- Data analysis: how to sort, graph and analyze experimental results.

Assessment tasks

- Assignment
- In-Semester Test
- Practicals
- Tutorials
- Mid-year Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.
- Tutorials provide an opportunity to work out problems and questions complementing

lecture and practical materials. The tutorial quiz questions will cover also the associated practicals.

- The lectures provide an overview of each topic/concept. The student is encouraged to follow up with textbook reading as well as additional reading materials provided on iLearn. Wherever possible, animations and movies are also provided on iLearn along with revision quizzes from the textbook.

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- Metabolic pathway mapping: have a detailed knowledge of the interactions between different metabolic pathways.
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.
- Tracking enzyme reactions: apply analytical techniques to determine the molecular composition of reaction products and determine the thermodynamic parameters of enzyme reactions.

- Data analysis: how to sort, graph and analyze experimental results.

Assessment tasks

- Assignment
- In-Semester Test
- Practicals
- Tutorials
- Mid-year Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.
- Tutorials provide an opportunity to work out problems and questions complementing lecture and practical materials. The tutorial quiz questions will cover also the associated practicals.
- The lectures provide an overview of each topic/concept. The student is encouraged to follow up with textbook reading as well as additional reading materials provided on iLearn. Wherever possible, animations and movies are also provided on iLearn along with revision quizzes from the textbook.

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and

quantitatively the factors affecting sugar metabolism in energy production.

- How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- Metabolic pathway mapping: have a detailed knowledge of the interactions between different metabolic pathways.
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.
- Tracking enzyme reactions: apply analytical techniques to determine the molecular composition of reaction products and determine the thermodynamic parameters of enzyme reactions.
- Data analysis: how to sort, graph and analyze experimental results.

Assessment tasks

- Assignment
- Practicals
- Tutorials
- Mid-year Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.
- Tutorials provide an opportunity to work out problems and questions complementing lecture and practical materials. The tutorial quiz questions will cover also the associated practicals.

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Overall biochemical understanding: overview of the structure and function of the most

important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.

- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- Metabolic pathway mapping: have a detailed knowledge of the interactions between different metabolic pathways.
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.

Assessment tasks

- Assignment
- Practicals
- Tutorials
- Mid-year Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.
- Tutorials provide an opportunity to work out problems and questions complementing lecture and practical materials. The tutorial quiz questions will cover also the associated

practicals.

- The lectures provide an overview of each topic/concept. The student is encouraged to follow up with textbook reading as well as additional reading materials provided on iLearn. Wherever possible, animations and movies are also provided on iLearn along with revision quizzes from the textbook.

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.
- Ability to define key concepts: biochemistry and what biochemists know; the thermodynamic principles of enzyme catalysis; the major biological systems involved in metabolism and energy production pathways in the living cell.
- Understanding of the protein structure-function paradigm: describe qualitatively and quantitatively the relationship between structure and function of proteins.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How other essential biomolecules are made and broken down: describe qualitatively how lipids, nucleic acids and amino acids are made and turned over.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- Tracking enzyme reactions: apply analytical techniques to determine the molecular

composition of reaction products and determine the thermodynamic parameters of enzyme reactions.

Assessment tasks

- Assignment
- In-Semester Test
- Practicals
- Tutorials
- Mid-year Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.
- Tutorials provide an opportunity to work out problems and questions complementing lecture and practical materials. The tutorial quiz questions will cover also the associated practicals.
- The lectures provide an overview of each topic/concept. The student is encouraged to follow up with textbook reading as well as additional reading materials provided on iLearn. Wherever possible, animations and movies are also provided on iLearn along with revision quizzes from the textbook.

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Discipline-specific knowledge: a basic understanding of key biochemical processes and

their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.

- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.
- Tracking enzyme reactions: apply analytical techniques to determine the molecular composition of reaction products and determine the thermodynamic parameters of enzyme reactions.
- Data analysis: how to sort, graph and analyze experimental results.

Assessment tasks

- In-Semester Test
- Practicals
- Tutorials

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.
- Tutorials provide an opportunity to work out problems and questions complementing lecture and practical materials. The tutorial quiz questions will cover also the associated practicals.
- The lectures provide an overview of each topic/concept. The student is encouraged to follow up with textbook reading as well as additional reading materials provided on iLearn. Wherever possible, animations and movies are also provided on iLearn along with revision quizzes from the textbook.

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and

country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Overall biochemical understanding: overview of the structure and function of the most important macromolecules in the living cell, integrating them into biochemical pathways, representing essential sets of regulated reactions, involved in cell growth and survival.
- Discipline-specific knowledge: a basic understanding of key biochemical processes and their control; a basis for the mechanisms involved in the synthesis and breakdown of important biomolecules, for growth and energy; basic laboratory skills necessary for research in biochemistry; an appreciation of biochemistry and the chemical aspects of biological systems; and a biochemical foundation for advanced units of study as well as post-graduate research in biochemistry and professional studies in the health and biomolecular sciences.
- An insight into how sugar is our main energy source: describe qualitatively and quantitatively the factors affecting sugar metabolism in energy production.
- How mutations cause diseases: understand the reasons for protein mutations leading to malfunction and diseases;
- How to identify and separate biomolecules: design experiments to characterise, quantify and separate biomolecules.
- Tracking enzyme reactions: apply analytical techniques to determine the molecular composition of reaction products and determine the thermodynamic parameters of enzyme reactions.
- Data analysis: how to sort, graph and analyze experimental results.

Assessment tasks

- In-Semester Test
- Practicals
- Tutorials

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.

- Tutorials provide an opportunity to work out problems and questions complementing lecture and practical materials. The tutorial quiz questions will cover also the associated practicals.
- The lectures provide an overview of each topic/concept. The student is encouraged to follow up with textbook reading as well as additional reading materials provided on iLearn. Wherever possible, animations and movies are also provided on iLearn along with revision quizzes from the textbook.

Penalties for late submission

1. Students are to submit their **completed Assignment** on or before the due date.

- Late assignments will receive a **10% per day penalty** and will not be marked if more than 1 week late. Extensions will only be given under extenuating circumstances (see [Special Considerations policy](#)), by the unit coordinator BEFORE the due date.

2. The completed **Practical Reports** are to be uploaded to iLearn within one week of the scheduled lab. for grading.

- Late submissions will receive a **10% per day penalty** and will not be marked if more than 1 week late. Extensions will only be given in extenuating circumstances, by the unit coordinator either by email BEFORE the due date, or by completing the Special Consideration request at ask.mq.edu.au with documentary evidence, within 5 working days of the scheduled deadline.

Textbook

Prescribed text:

- “**BIOCHEMISTRY**” 5th Edition: Garret and Grisham: Brooks/Cole, 2013, 2009, bundled with the Students Solutions Manual or
- “**BIOCHEMISTRY**” 5th Edition: Garret and Grisham: Brooks/Cole, 2013, 2009, with the the Students Solutions Manual as option

Recommended texts:

- “**BIOCHEMISTRY**” 3rd or 4th edition: Voet and Voet: Wiley Publishers 2003/2004
- for Grad Cert Biotech and PG Qual Chiro students lacking Organic Chemistry background: “**ORGANIC CHEMISTRY**” 9th Edition, Solomons and Fryhle, Wiley, 2008.

Copies of the prescribed text are available in the library in the main and reserve sections.

Unit Website

The official CBMS223 website is:

ilearn.mq.edu.au

You will be asked for a username and password. Your username is your student number.

If you have trouble logging in, please follow the help instructions given on the web page before contacting your lecturer academic staff. You may also contact the Help Desk:

Phone: 9850-HELP (4357)

Freecall: 1800 063 191

Email: <http://help.mq.edu.au/>