UNSW SYDNEY

Course Outline

BIOC2101

Principles of Biochemistry (Advanced)

School of Biotechnology and Biomolecular Sciences

Faculty of Science

Term 2, 2020

Welcome Message from the Course Convenor

Welcome to BIOC2101 Principles of Biochemistry online in 2020!

I would like to extend a very warm welcome to all BIOC2101 students enrolled in this online version of the course in T2 2020. Learning and teaching in a fully online environment is new to many students and staff, but together I hope we can make this a very enjoyable and rewarding experience for everyone.

BIOC2101 introduces students to a suite of catabolic and anabolic processes and regulatory mechanisms that are essential to life. In this course, we will also study a range of experimental techniques that allow us to investigate these processes.

All lectures in the course are presented online in an asynchronous format that can be accessed any time. Each week, during at least one of the time-tabled lecture slots, there will be a 'live' review lecture conducted by the scheduled lecturer and/or course convenor (me). The purpose of this lecture is to allow for questions and discussion at the end of a lecture series, to review Term Quiz answers and feedback, or to simply spend some time catching up 'face-to-face' about any other aspect of the course. The live sessions will also be recorded and made available online for anyone who cannot attend. It is not compulsory to attend any lectures.

All online laboratory classes are conducted live via Microsoft Teams, and attendance at these weekly classes is compulsory. During three of the laboratory sessions (Weeks 4, 7, and 10), there will be a Term Quiz conducted in the first hour. More information about online laboratory class access and content will be provided in Moodle.

If you have any questions about the course at any time throughout the term, or if you just feel a little lost and would like some advice, please do not hesitate to contact me by email (a.galea@unsw.edu.au) and I will do my very best to help.

As 2020 continues to challenge and strengthen us, I have no doubt this Term will be an interesting adventure for all of us. And I encourage all of you to bring happiness, humour, and the odd COVID-19 meme to all your BIOC2101 classes, as a little bit of light-heartedness could certainly go a long way to make people smile and lift any low spirits (not that there will be any low spirits after everyone has learned the details of oxidative phosphorylation in Weeks 4-5!).

Thanks for your time in reading this and I very much look forward to seeing you in class.

All the best,

Anne

BIOC2101 Principles of Biochemistry (Advanced) – Course Outline

Contents

1. Course Information

Year of Delivery	2020
Course Code	BIOC2101
Course Name	Principles of Biochemistry (Advanced)
Academic Unit	School of Biotechnology and Biomolecular Sciences
Level of Course	2nd year undergraduate
Units of Credit	6
Delivery Mode	Fully online (including all assessments) in 2020
Grading Mode	Standard Grading
Term(s) Offered	T2
Assumed Knowledge, Prerequisites or Co-requisites	Prerequisites: BABS1201 and CHEM1011 or CHEM1031 or CHEM1051 and CHEM1021 or CHEM1041 or CHEM1061
Hours per Week	6
Number of Weeks	9 weeks
Commencement Date	Monday 1st June 2020 (Week 1)

Summary of Course Structure

Component	Hours/ week	Time	Day	Location
Online Lectures	3 hours total	All lectures posted asynchronously online for access any time. Review lectures are scheduled at the end of each lecture series and are delivered live via Teams but also recorded for those who cannot attend.		
Weekday lecture 1	1 hour	1 pm – 2 pm	Monday	Online via Moodle/MS Teams
Weekday lecture 2	1 hour	3 pm – 4 pm	Thursday	Online via Moodle/MS Teams
Weekday lecture 3	1 hour	4 pm – 5 pm	Friday	Online via Moodle/MS Teams
Online Laboratory Classes & Quizzes	1 – 3 hours	All laboratory classes conducted synchronously online via MS Teams. Attendance is compulsory.		
Laboratory – Option 1	3 hours	10 am – 1 pm	Tuesday	Online via MS Teams
Laboratory – Option 2	3 hours	2 pm – 5 pm	Tuesday	Online via MS Teams
Laboratory – Option 3	3 hours	10 am – 1 pm	Wednesday	Online via MS Teams

2. Staff Contact Details

See below for course contact details for course convenor, lecturers and technical staff.

Staff	Role	Name	Contact Details
Course Convenor		Anne Galea	a.galea@unsw.edu.au
Additional Teaching Staff	**Lecturers**	Prof Andrew Brown A/Prof Kyle Hoehn Dr Rebecca LeBard Dr Vladimir Sytnyk Dr Nirmani Wijenayake Prof Marc Wilkins	aj.brown@unsw.edu.au k.hoehn@unsw.edu.au r.lebard@unsw.edu.au v.sytnyk@unsw.edu.au b.wijenayakeg@unsw.edu.au m.wilkins@unsw.edu.au
	Technical & Laboratory Staff	Elessa Marendy (Senior Technical Officer) Gee Ling (Senior Technical Officer) Tammy Tang (Technical Officer)	e.marendy@unsw.edu.au g.ling@unsw.edu.au sihui.tang@unsw.edu.au

3. Course Details

Course Description[1]	BIOC2101 introduces modern biochemistry, covers fundamental aspects of the structure-function relationships of proteins, and an overall coverage of intermediary metabolism. Major topics covered include: the nature and function of proteins and enzymes; the metabolic working of cells, tissues and organs; the interrelationships between the pathways of carbohydrate, lipid and amino acid metabolism; the vital role of hormones in metabolic regulation; the energy-trapping mechanisms of animals; and interesting variations in the central metabolic pathways under various physiological conditions. Online laboratory work complements the lectures and introduces the principles of biochemical analysis.
Course Aims[2]	• This course aims to introduce students to modern biochemistry with an emphasis on how we, as humans, convert foods to useful energy. • This course also aims to provide a solid context for new learning material by providing clinical, medical, and everyday applications that correspond to the central themes and topics. • Practical classes are designed to reinforce the core biochemical concepts covered in lectures and introduce students to current laboratory techniques and biochemical assays.
Student Learning Outcomes[3]	By the completion of this course students should be able to: 1. Describe and contrast the functions and key features of the major metabolic pathways in humans. 2. Explain the various mechanisms that control and regulate the simultaneous functioning of anabolic and catabolic processes in the cells of living tissues. 3. Describe the integration of major metabolic pathways in the context of common human conditions, such as fasting, starvation, obesity and exercise. 4. Work safely and effectively in a modern biochemical laboratory to perform a range of biochemical assays, analytical techniques and related calculations. 5. Communicate experimental methods, outcomes and their interpretations in the format of a professional scientific report.

Graduate Attributes Developed in this Course[4]

Science Graduate Attributes[4]	**Level of FOCUS** *1 = MINIMAL* *2 = MINOR* *3 = MAJOR*	**Activities / Assessment**
Research, inquiry and analytical thinking abilities	3	Lectures, tutorials, online laboratory experiments, online discussions, computer exercises / instruction and formative self-assessment, pre-lab quizzes, multiple choice questions, exam short answers / essay answers, solving complex problems, practical exam questions and laboratory report.
Capability and motivation for intellectual development	3	Lectures, tutorials, online laboratory experiments, online discussions, computer exercises / instruction and formative self-assessment, pre-lab quizzes, multiple choice questions, exam short answers / essay answers, solving complex problems, practical exam questions and laboratory report.
Ethical, social and professional understanding	1	Online laboratory experiments, lectures and tutorials, pre-lab quizzes, laboratory report and online laboratory safety quiz.
Communication	2	Online laboratory experiments and online discussions, exam short answers / essay answers, laboratory report.
Teamwork, collaborative and management skills	2	Online laboratory experiments and online discussions, laboratory report.
Information literacy	2	Lectures, tutorials, online resources, laboratory report.

[1] UNSW Handbook: http://www.handbook.unsw.edu.au
[2] Learning and Teaching Unit: Course Outlines
[3] Learning and Teaching Unit: Learning Outcomes
[4] Contextualised Science Graduate Attributes

Major Topics Covered	**Introduction to Metabolism** Living organisms create and maintain their essential orderliness at the expense of their environment, which they cause to become more disordered in consequence. They are essentially an 'open' chemical system existing in a steady-state condition and must therefore extract energy, generally as chemical fuel, from their surroundings. Viewed as a machine, they must obey the same thermodynamic laws applicable to purely physical phenomena. The study of bioenergetics considers these energy relationships, without which the system of complex chemical reactions unique to life processes cannot be appreciated. All life processes on this planet have utilized a single specific molecule, adenosine triphosphate (ATP), as a concentrated form of chemical energy to which outside energy sources (as food) are converted and which is then used for biosynthetic purposes to maintain low entropy, *i.e.* highly ordered system. ATP will be used as a typical example to illustrate energy relationships applicable to biochemical reactions in general. The term 'metabolism' encompasses all the chemical processes which occur within living organisms. 'Anabolism' is the sum of those processes by which structural and functional components of a cell are synthesized from simpler units. 'Catabolism' covers the processes whereby complex compounds are degraded to release energy and to provide the smaller units for the cell's synthetic processes. All living organisms break down food materials and synthesize cell components by ordered sequences of chemical reactions called metabolic pathways. These pathways are frequently common to all cells, thus both man and bacteria break down glucose to CO_2 and H_2O by essentially the same pathway. Each chemical reaction in the cell is catalysed by an enzyme. The operation of a metabolic pathway therefore depends on the properties of the individual enzymes catalysing the sequence of chemical reactions. **<u>PROTEINS AND ENZYMES</u>** **Protein Structure – Topics:** • Proteins and the central dogma of molecular biology • There are 20 amino acids encoded in DNA and used in protein synthesis • Amino acids are joined to form peptides and proteins • Proteins can form secondary structures • Protein amino acid sequence determines its 3-D structure **Enzymes and Catalysis – Topics:** • What is an enzyme? • What is a substrate? • What is catalysis? • Free energy and activation energy • Transition states in catalysis • Induced fit model of catalysis **Enzyme Kinetics – Topics:** • What is kinetics? Why study kinetics? • Enzyme reaction velocity • Test case: human foldase enzyme • The Michaelis-Menten value, KM • Implications of KM • The Michaelis-Menten equation • Lineweaver-Burk plots • The kinetically perfect enzyme • Enzyme engineering **Enzyme Inhibition and Regulation – Topics:** • Competitive and non-competitive inhibition • Kinetics of (non)competitive inhibition • Allosteric inhibition • Zymogens • Enzyme phosphorylation

CARBOHYDRATE CATABOLISM AND STORAGE

Carbohydrate catabolism I – Learning Outcomes:

- Explain what carbohydrates are
- Explain how monosaccharides are classed (number of carbons, aldose/ketose etc).
- Explain the terms stereoisomer / epimer / diastereomer
- Give an example of a disaccharide and explain the role of the glycosidic bond
- Explain what polysaccharides are and give some examples

Carbohydrate catabolism II – Overview:

- Carbohydrate digestion and transport
- Glycolysis: an energy conversion pathway for glucose
- Regulation of glycolysis
- The fate of the products of glycolysis

Glycogen – Learning Outcomes:

- Describe the general structure and function of glycogen.
- List the three key enzymes involved in glycogen breakdown and provide a brief description of their functions.
- Understand that glycogen is synthesised and degraded by different pathways.
- List the three key enzymes involved in glycogen synthesis and provide a brief description of their functions.
- Understand that the regulation of glycogen metabolism involves both allosteric control and hormonal control by covalent modification of regulatory enzymes.
- Describe the way in which glycogen breakdown and synthesis are reciprocally regulated.

Gluconeogenesis – Learning Outcomes:

- Provide a broad definition of the process of gluconeogenesis.
- Appreciate that glucose can be synthesised from lactate, pyruvate, glycerol and amino acids.
- Explain the Cori Cycle.
- Describe the three enzymatic steps of glycolysis that are bypassed in gluconeogenesis.
- Name the enzymes that are NOT common to glycolysis and gluconeogenesis.
- Explain the energy requirements of gluconeogenesis.
- Explain how glycolysis and gluconeogenesis are reciprocally regulated.

BIOENERGETICS

TCA Cycle – Learning Outcomes:

- State the primary function of the TCA cycle
- Provide the net reaction of the TCA cycle
- Explain the role of NADH and $FADH_2$
- Explain why the cycle functions only in aerobic conditions
- Describe how the TCA cycle is regulated at three levels
- Discuss how cytoplasmic NADH are transported across the mitochondrial membrane and any impact this has on ATP yields

Respiratory chain – Learning Outcomes:

- Outline to function of the respiratory chain
- Describe the importance of the mitochondrial structure in reference to the respiratory chain
- Explain the pathway of electrons through the respiratory chain, from their entry points to the reduction of oxygen to water
- Describe the movements of protons across the membrane in the context of the respiratory chain and the creation of a proton gradient

Redox biochemistry – Learning Outcomes:

- Understand where reactive species are produced
- What are the major types of reactive species in the cell
- Describe the major antioxidant defence systems in place

Oxidative Phosphorylation – Learning Outcomes:

- Outline the chemiosmotic theory
- Describe the structure and function of ATP synthase
- Explain what the P/O ratio is
- Explain what an uncoupler does and provide an example
- Describe the ways in which an agent may inhibit oxidative phosphorylation
- Discuss the role reactive oxygen species play in oxidative phosphorylation
- Describe the process of oxidative phosphorylation giving reference to the mitochondrial membrane
- Calculate the number of ATP equivalents generated from a glucose molecule

PROTEIN CATABOLISM

Amino Acid Catabolism – Learning Outcomes:

- Explain the process whereby an amino group is removed form an amino acid.
- Discuss the degradation of AA in muscle during prolonged exercise and fasting.
- Describe how amino acid degradation is linked to the TCA cycle.
- Discuss the Urea cycle e.g. ATP used, where performed, where the two N in urea are from.
- Explain what is meant by the terms keto- and glucogenic amino acids and provide examples.
- Give examples of conditions where there are errors in the degradation of amino acids.

Protein digestion and turnover – Learning Outcomes:

- List the sources of amino acids for building proteins.
- Describe what is meant by the term essential amino acids.
- Describe the breakdown of dietary proteins
- Discuss the process of protein turnover
- Explain the function of ubiquitin and the proteasome

SIGNAL TRANSDUCTION IN METABOLISM

Signal Transduction – Learning Outcomes:

- Briefly describe the function of cell / organelle membranes and how proteins may be associated with them.
- Briefly explain the structures of integral membrane proteins.
- Describe the role of a receptor in signal transduction
- Describe the structure of 7TM receptors and provide an example.
- Outline the process of signal transduction.
- Describe the features and action of 7TM and protein kinase receptors, giving examples.
- Discuss the role of secondary messengers and give examples.
- Explain what can occur if there is a defect in a signal transduction pathway.

FAT METABOLISM AND STORAGE

Fat metabolism I, II, III and IV – Learning Outcomes:

- List roles of fats in the diet.
- List roles of fats in the body.
- Briefly describe the structure and function of some of the major fats in the body.
- Provide examples of fats that contain one or more fatty acids.
- Describe the general structure of a fatty acid.
- Explain the difference between saturated and unsaturated fatty acids.
- List examples of lipid-soluble vitamins and their roles/functions.
- Describe the steps involved in the digestion and absorption of fats.
- Outline the major steps that take place during the digestion of dietary lipids.
- Describe the process of lipid absorption and chylomicron formation in intestinal cells.
- Describe the general structure of a lipoprotein.
- Describe the main features of each of the different classes of lipoproteins.
- Explain the difference between exogenous and endogenous transport of lipoproteins.
- Briefly explain the difference between ‘good’ versus ‘bad’ types of cholesterol.
- Briefly explain the role of the liver in lipoprotein metabolism.
- Briefly describe the three main stages of fatty acid breakdown.
- Outline the overall stoichiometry & energy yield of fatty acid breakdown.
- Explain where, when and how ketone bodies are produced.
- Briefly describe the three main stages of fatty acid synthesis.

	• Describe the first committed step in fatty acid synthesis. • Describe the structure and function of the fatty acid synthase complex. • Outline the overall stoichiometry of palmitate synthesis. • Briefly explain why and how fatty acids can be modified. • Compare and contrast the main features of β-oxidation and fatty acid synthesis. • Briefly describe the main mechanisms of control of fatty acid metabolism. **INTEGRATION OF METABOLISM** **Hormonal control of Fuel Metabolism – Learning Outcomes:** • Discuss the role of glucose transporters and comment on the differences between the various isoforms. • Describe the structure of receptor tyrosine kinases, using the insulin receptor as an example. • Outline the role of insulin on the liver, skeletal muscle and adipose tissues in the fed state. • Outline the role of glucagon on the liver in the fasted state. • Outline the role of adrenaline on the liver, skeletal muscle and adipose tissues. **Metabolic Specialisation of Tissues – Learning Outcomes:** • Describe how different glucose transporters confer tissue-specificity • Explain how different hormones (e.g. insulin, glucagon) act on different tissues **Fuel Supply in Fasting – Learning Outcomes:** • Explain the three steps of the starved-fed cycle. • Describe the effects of glucagon, cyclic-AMP and F-2,6-bisP during fasting. • Explain the strategies employed for maintaining blood glucose levels during fasting/starvation. • Explain what happens after liver glycogen is depleted. • Describe the various effects of prolonged starvation. • Describe the overall changes in fuel metabolism during starvation - particularly with respect to requirements of the brain. **Fuel Supply in Exercise – Learning Outcomes:** • Outline the structure of muscle fibres and their requirement for energy. • Explain the difference between Type I and II muscle fibres in appearance, functional properties and metabolic profiles. • Explain the role of adenylate kinase and link this to the role of ATP/AMP as regulators of glycolysis and glycogen metabolism. • Explain the role of creatine phosphate, creatine kinase, and the fate of creatine. • Discuss how the energy sources for a sprinter, middle distance runner and marathon runner differ.
Relationship to Other Courses within the Program	BIOC2101 is a requirement for Medical Science programs. The course builds on many concepts introduced in first level courses, particularly BABS1201 Molecules, Cells and Genes. It provides the knowledge and skills required for the third level courses including BIOC3261 Human Biochemistry and BIOC3111 Molecular Biology of Proteins.

4. Rationale and Strategies Underpinning the Course

Teaching Strategies	Course content is initially presented in lectures. Key concepts from the lectures are incorporated into online laboratory sessions, where students also learn about laboratory techniques and safe workplace skills. Students are provided with avenues for revision, practice, and discussion of the course content through large group or online independent tutorials on each major content area.
Rationale for learning and teaching in this course	Lectures are used in the course to introduce and introduce new concepts and elaborate on intermediary metabolism and its regulation. Online laboratory sessions are designed to complement the lecture material in addition to teaching professional technical skills and safe and efficient work practices. Tutorials (large group and online independent) are used to reinforce concepts presented in the lectures through problem solving, and to encourage further enquiry. Both online laboratories and tutorials aim to promote effective communication, discussion and teamwork. The integration of these main teaching areas of the course are in accordance with the UNSW Guidelines on Learning that inform Teaching. Specifically: • Effective learning is supported when students are actively engaged in the learning process. • Effective learning is supported by a climate of inquiry where students feel appropriately challenged and activities are linked to research and scholarship. • Activities that are interesting and challenging, but which also create opportunities for students to have fun, can enhance the learning experience. • Learning is more effective when students' prior experience and knowledge are recognised and built on. • Students become more engaged in the learning process if they can see the relevance of their studies to professional, disciplinary and/or personal contexts. • If dialogue is encouraged between students and teachers and among students (in and out of class), thus creating a community of learners, student motivation and engagement can be increased. • Students learn in different ways and their learning can be better supported by the use of multiple teaching methods and modes of instruction (visual, auditory, kinaesthetic, and read/write). • Clearly articulated expectations, goals, learning outcomes, and course requirements increase student motivation and improve learning. • When students are encouraged to take responsibility for their own learning, they are more likely to develop higher order thinking skills such as analysis, synthesis, and evaluation. • Graduate attributes – the qualities and skills the university hopes its students will develop as a result of their university studies – are most effectively acquired in a disciplinary context. • Learning cooperatively with peers - rather than in an individualistic or competitive way - may help students to develop interpersonal, professional, and cognitive skills to a higher level. • Effective learning is facilitated by assessment practices and other student learning activities that are designed to support the achievement of desired learning outcomes. • Meaningful and timely feedback to students improves learning.

5. Course Schedule T2 2020

Some of this information is available on the Online Handbook[5] and the UNSW Timetable[6].

Week	Begins	Monday 1-2 pm Lecture Online Asynchronous via Moodle or *MS Teams	Practicals & Term Tests Tue 10-1pm, Tue 2-5pm or Wed 10-1pm Online Synchronous via MS Teams	Thursday 3-4 pm Lecture Online Asynchronous via Moodle or *MS Teams	Friday 4-5 pm Lecture Online Asynchronous via Moodle or *MS Teams
Week 1	01 June	**Lecture 1**: Course Introduction - AMG*	**Lab 1**: Biochemical Calculations and Skills	**Lecture 2**: Proteins - MW	**Lecture 3**: Enzymes - MW
Week 2	08 June	**Lecture 4**: Enzyme Kinetics - MW	**Lab 2**: Spectrophotometry	**Lecture 5**: Enzyme Regulation - MW*	**Lecture 6**: Carbohydrates - VS
Week 3	15 June	**Lecture 7**: Glycolysis - VS	**Lab 3**: Enzymes	**Lecture 8**: Regulation of glycolysis - VS*	**Lecture 9**: TCA Cycle - RLB
Week 4	22 June	**Lecture 10**: Oxidative phosphorylation 1 - RLB	**TERM QUIZ 1**	**Lecture 11**: Oxidative phosphorylation 2 - AMG*	**Lecture 12**: Oxidative phosphorylation 3 - AMG
Week 5	29 June	**Lecture 13**: Oxidative phosphorylation 4 - AMG*	**Lab 4**: Glycolysis	**Lecture 14**: Gluconeogenesis - NW	**Lecture 15**: Glycogen - NW*
Week 6	06 July	**FLEXIBILITY WEEK**			
Week 7	13 July	**Lecture 16**: Fats 1 - AB	**TERM QUIZ 2** / **Lab 5**: Oxygen Electrode	**Lecture 17**: Fats 2 - AB*	**Lecture 18**: Fats 3 - AB
Week 8	20 July	**Lecture 19**: Fats 4 - AB*	**Lab 6**: Separation Techniques	**Lecture 20**: Protein Catabolism - RLB	**Lecture 22**: Urea cycle - RLB*
Week 9	27 July	**Lecture 23**: Hormones - AMG	**Lab 7**: Glucose Tolerance Test	**Lecture 24**: Metabolic Specialisation of Tissues - KH*	**Lecture 25**: Exercise - RLB
Week 10	03 August	**Lecture 26**: Fasting - KH	**TERM QUIZ 3**	**Lecture 27**: Integration of Metabolism - KH*	**Lecture 28**: Concluding Lecture - AMG*

Lecturers: AMG = Dr Anne Galea, MW = Prof Marc Wilkins, VS = Vladimir Sytnyk, RLB = Dr Rebecca LeBard, NW = Dr Nirmani Wijenayake, AB = Prof Andrew Brown, KH = A/Prof Kyle Hoehn.

Delivery: All lectures can be accessed asynchronously online in Moodle. *Asterisked lecture times are review sessions that will be delivered live via MS Teams by lecturer and/or course convenor.

Term Quizzes: Term Quiz 1 examines Lectures 2-8, Term Quiz 2 examines Lectures 9-15, Term Quiz 3 examines Lectures 16-22. Lab work and Lectures 23-28 are examined in the Final Exam.

[5] UNSW Virtual Handbook: http://www.handbook.unsw.edu.au
[6] UNSW Timetable: http://www.timetable.unsw.edu.au/

6. Assessment Tasks & Feedback

Task	Knowledge & abilities assessed	Assessment format and/or criteria	%	Date	Feedback		
					WHO	WHEN	HOW
Formative Quiz	OPTIONAL: Covers all content from lectures 1-8 (inclusive). Aims to help students understand the type and depth of content that is covered and assessed in the course.	Online formats (e.g. multiple choice, true or false, drag-and-drop, correct order). Accessed via Moodle. Can be conducted anywhere and anytime after quiz opens.	-	Can be completed any time	Convenor	Immediately	Online (Moodle)
Laboratory Report Assignment	Students prepare a written laboratory report based on experimental results provided. This assignment is worth 20% and consists of 3 parts: 1) Calibration Assessment (3%) 2) Report Submission (12%) 3) Peer Review of Reports (5%)	Full details on report format and criteria are provided online in Moodle. All 3 parts are conducted online in Moodle.	**3**	**Calibration DUE**: 11:59pm Fri 19th June (**Week 3**)	Convenor	Within 2 days	Online (Moodle)
			12	**Report DUE**: 11:59pm Fri 3rd July (**Week 5**)	Convenor	Within 10 working days	
			5	**Peer Reviews DUE**: 11:59pm Fri 24th July (**Week 8**)	Peers and Convenor	Within 10 working days	
Term Quiz 1	Covers all content from lectures 2-8, inclusive.	1-hour duration. Multiple choice & short answer formats. Conducted via Moodle Quiz in first hour of Week 4 lab.	**12**	**Week 4 Lab Time** (10am Tue, 2pm Tue or 10am Wed)	Convenor	Within 10 working days	Online (Moodle)
Term Quiz 2	Covers all content from lectures 9-15, inclusive.	1-hour duration. Multiple choice & short answer formats. Conducted via Moodle Quiz in first hour of Week 4 lab.	**12**	**Week 7 Lab Time** (10am Tue, 2pm Tue or 10am Wed)	Convenor	Within 10 working days	Online (Moodle)
Term Quiz 3	Covers all content from lectures 6-22, inclusive.	1-hour duration. Multiple choice & short answer formats. Conducted via Moodle Quiz in first hour of Week 4 lab.	**12**	**Week 10 Lab Time** (10am Tue, 2pm Tue or 10am Wed)	Convenor	Within 10 working days	Online (Moodle)
Final Theory Exam	Covers all laboratory class content and all content from lectures 23-28, inclusive.	Multiple choice questions, essay, and short response questions.	**44**	See final examination timetable			
		TOTAL:	**100**				

7. Additional Resources and Support

Text Book	**Biochemistry 9th edition**, WH Freeman and Company, 2019. JM Berg, JL Tymoczko, GJ Gatto, and L Stryer Availability: UNSW bookshop, UNSW library: Open Reserve/High use collection
Course Manual	All BIOC2101 course information including course outline, assessment schedule and practical information is available via Moodle.
Recommended Internet Sites	All students enrolled in BIOC2101 automatically have access to the course Moodle site https://moodle.telt.unsw.edu.au/. This site will be used to distribute course notes and information and should be checked at regular intervals. Specifically, the Moodle site will be used to provide: • Important course announcements • Assessment marks • Practical notes • Lecture handouts and recordings • Information about examination arrangements • Further assessment information resulting from special consideration • Self-directed learning resources There are also many computer exercises and teaching aids available to students enrolled in BIOC2101 Principles of Biochemistry (Advanced). Links to the textbook companion websites (if available) and additional online animations and revision tutorial can be found on the course Moodle site.
Study Spaces	If/when UNSW begins welcoming students back to campus in Term 2, there are student common areas for study or relaxation on the ground floor of the Biological Sciences Building E26 and in the UNSW Library.

8. Required Equipment, Training and Enabling Skills

Equipment Required	To complete BIOC2101 online, students will need: • A computer equipped with Microsoft Teams and an internet browser • For assistance with online learning, please see the UNSW 'Transitioning to Online Learning' website: https://www.covid19studyonline.unsw.edu.au/
Enabling Skills Training Required to Complete this Course	Students should aim to complete the BABS Health and Safety Quiz (online) by the end of Week 10; It is also recommended that students complete individual pre-laboratory quizzes prior to each practical class.

9. Course Evaluation and Development

MyExperience	Students can provide feedback on the course via online myExperience surveys, as instructed, in the final week of term. The latest information on how student feedback has been used to update and improve the course can be found on the Moodle site for the course.

10. Administration Matters

Expectations of Students	**ATTENDANCE:** In T2 2020, **compulsory attendance is only required for your weekly laboratory classes and all examinations (Term Quizzes and Final Exam)**. If you miss a laboratory class or examination due to illness or misadventure, you must apply for Special Consideration with appropriate supporting documentation within 3 days. If you miss more than one laboratory class without adequate supporting documentation, you may not be eligible for passing the course. Attendance at weekly 'live' review lectures (conducted via MS Teams) is recommended but not compulsory, as these sessions will also be recorded and available for asynchronous viewing. **PRE-LAB QUIZZES:** Students are encouraged to complete a pre-lab quiz prior to each weekly laboratory class. Pre-lab quizzes can be accessed via Moodle. Although the completion of pre-lab quizzes is not compulsory, it is highly recommended because it will help you to prepare for and get the most out of each online laboratory class. Pre-lab quizzes will also help you prepare for the laboratory component of your Final Exam. **ILLNESS AND MISADVENTURE:** The following procedures are designed to ensure that you are not penalised for absences for which there was an appropriate reason. If you are not fit to attend a **BIOC2101 online laboratory class throughout Weeks 1 to 10 of Term**, please email the course convenor (a.galea@unsw.edu.au) with supporting documentation within 5 working days of the absence. (Do not apply for Special Consideration for laboratory class absences). If you are not fit to sit a **BIOC2101 Term Quiz (Weeks 4, 7 and 10) or the Final Exam**, you must apply for Special Consideration following the guidelines provided on the following page or in Moodle prior to the start of the quiz/exam or within 24 hours of the quiz/exam. If you are unable to submit any component of the **BIOC2101 Laboratory Report** by the scheduled deadlines, you must email the Course Convenor AND apply for Special Consideration following the guidelines provided on the following page or in Moodle. **PLEASE NOTE that due to the automated online nature of the peer review component of the report assignment, failure to submit a component on time may result in the need for you to complete an alternative assignment.**

	SATISFACTORY LABORATORY PERFORMANCE: A pass in BIOC2101 is conditional upon a satisfactory performance in the laboratory program. This consists of: (i) attendance at all online laboratory classes (unless illness/misadventure is documented). (ii) completion of all scientific report assignment components. (iii) participation in online laboratory class discussions and completion of scheduled weekly online laboratory activities.
Assignment Submissions	All components of the BIOC2101 Laboratory Report assignment will be submitted online via Moodle.
Occupational Health and Safety[7]	Prior to commencing the practical component of the course, students are typically required to complete and pass a BABS Health and Safety Quiz (accessed via Moodle). Since T2 2020 students will not be conducting laboratory experiments in a scientific laboratory, this requirement is not directly applicable. However, to achieve all practical learning outcomes in the course, students are still required to complete the Health and Safety Quiz by the end of the Term. This will also ensure that students are adequately prepared for future face-to-face laboratory classes. Each online laboratory class will still include an Undergraduate Risk Assessment Guide for the School of Biotechnology and Biological Sciences. This addresses the hazards and risks you may encounter if you were conducting the experiments in a laboratory. To work with these correctly and safely, you will need to follow the safe work practices provided in the manual or by academic or technical staff involved in the course. Additional information on Health and Safety at UNSW can be found at: http://www.HS.unsw.edu.au/

[7] UNSW HS Home page

Assessment Procedures **UNSW Assessment Policy**[8]	**SPECIAL CONSIDERATION AND FURTHER ASSESSMENT TERM 2 2020** Students who believe that their performance, either during the term or in the end of term exams, may have been affected by illness or other circumstances may apply for special consideration. Applications can be made for mid-term assessment tasks and final examinations. You must submit the application prior to the start of the relevant exam, or before a piece of assessment is due, except where illness or misadventure prevent you from doing so. If you become unwell on the day of the exam or fall sick during an exam, you must provide evidence dated within 24 hours of the exam, with your application. You must obtain and attach Third Party documentation before submitting the application. Failure to do so may result in the application being rejected. UNSW has a fit to sit/submit rule which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so. Further information on special consideration can be found at https://student.unsw.edu.au/specialconsideration. **HOW TO APPLY FOR SPECIAL CONSIDERATION** **The application must be made through Online Services in myUNSW (My Student Profile tab > My Student Services > Online Services > Special Consideration).** Students will be contacted via *their official university email* as to the outcome of their application. It is the responsibility of all students to regularly consult their official student email accounts and myUNSW to ascertain whether they have been granted further assessment. **SUPPLEMENTARY EXAMINATIONS** Supplementary examinations may be given to those students who were absent from mid-term or final exams due to illness or misadventure. Only students who submit a compliant Special Consideration application (as per the above instructions) may be eligible for a supplementary examination. Students will be notified via the online special consideration system and their official UNSW email account as to the outcome of their application. Supplementary **mid-term examinations** will be managed internally by your course convenor and held during term. Supplementary **final examinations** will be managed externally by UNSW Exams Branch and held during the official BABS Supplementary Final Examination period. The BABS Supplementary Final Exam period for Term 2, 2020 is: **Monday 7th September to Friday 11th September 2020** **Supplementary Final Exams will be offered during this period ONLY. Failure to sit for the appropriate exam that you have been offered may result in an overall failure for the course. Further assessment will NOT be offered on any alternative dates.**

[8] UNSW Assessment Policy

Equity and Diversity	Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course Convenor prior to (or at the commencement of) their course. Such students may also contact Disability Services https://student.unsw.edu.au/disability for more information on the types of support they can provide (Disability Services Ph: 9385 4734, Email: disabilities@unsw.edu.au). Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made on time and in full.
	SCHOOL OF BABS DIVERSITY AND INCLUSION VALUES In an ideal world, science would be objective. However, the reality is much of science is subjective and is historically built on a small subset of voices. In BABS we will make an effort to expose students to literature from a diverse group of scientists, despite limits still existing on this diversity. We acknowledge that it is possible that there may be some biases in the material due to the lens with which it was written, and the School welcomes feedback to improve the diversity of the course materials. There are challenges inherent in communicating between people from other cultures, but BABS staff will strive to ensure their passion for science is appreciated through different eyes. We have a genuine desire to experience new cultures, expand our own horizons, and transcend any barriers that interacting with diverse groups could impose. The School is acutely aware of the importance of diversity and inclusion in all aspects of life and BABS academics strive to uphold these values as educators. The School of BABS is dedicated to creating a positive, inclusive educational environment that embraces diversity in all forms and rejects any form of hostile workplace, discrimination, or bullying. We have a clear statement of behavioral expectations (as well as definitions of discrimination, (sexual) harassment and bullying, which can be found here: https://student.unsw.edu.au/harassment. On this website, students can also find resources and contacts for reporting issues. In addition, the Science Equity, Diversity and Inclusion Working Group of the Faculty of Science have recently launched a set of Classroom Inclusivity Guidelines that all staff and students are striving to work under. They can be found here: https://www.science.unsw.edu.au/our-faculty/classroom-inclusivity-guidelines Beyond the University protocols, **it is our goal in BABS to create a learning environment for our students that supports a diversity of thoughts, perspectives and experiences, and Honours student identities** (including race, gender, class, sexuality, religion, ability). To help accomplish this, BABS staff will endeavour to use student's chosen name and pronouns, adapt as we learn about diverse perspectives and identities, and action any concerns raised as a result of any EDI-related student experiences. In addition those students who have a disability that requires some adjustment in their teaching or learning environment (e.g. access requirements, assessment arrangements) are encouraged to discuss their study needs with the course Convenor and with the Equitable Learning Service https://student.unsw.edu.au/els). Finally, the School recognises the added challenges faced by students during the coronavirus outbreak, in particular those related to teaching and learning remotely while public health is managed. Specific details on how this course will be managed are given throughout this manual and will be highlighted further in the first lecture, but please be assured the School of BABS will strive to minimise stress to students while still endeavouring to deliver a high-quality teaching experience.

Student Complaint Procedure[9]	School Contact	Faculty Contact	University Contact
	Mr John Wilson Student Office, Room G06, Ground Floor, Biological Sciences Building D26 j.e.wilson@unsw.edu.au Ph: 9385 1748	**Dr Gavin Edwards** Associate Dean (Undergraduate Programs) g.edwards@unsw.edu.au Ph: 9385 4652	**Student Conduct and Appeals** Officer Telephone: 02 9385 8515, email: studentcomplaints@unsw.edu.au University Counselling and Psychological Services[10] Ph: 9385 5418

[9] UNSW Student Complaint Procedure
[10] University Counselling and Psychological Services

11. UNSW Academic Honesty and Plagiarism

Academic misconduct may apply to any work or document related to assessment that is submitted to the School of Biotechnology and Biomolecular Sciences; this includes quizzes, the marked practical, laboratory workbooks, and examinations. All work must represent a student's own individual efforts. Copying or paraphrasing another person's work and using another student's experimental results are all examples of academic misconduct.

What is Plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one's own.

*Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle

† Adapted with kind permission from the University of Melbourne

12. Practical Information

LABORATORY CLASS REQUIREMENTS

In Term 2, 2020, due to the Coronavirus pandemic, face-to-face practical sessions in teaching laboratories have been replaced by online laboratory classes. The online sessions have been designed to help students achieve most of the original learning outcomes, and therefore it is still compulsory for students to satisfy all requirements of the laboratory component to pass the course.

To satisfy all requirements of the laboratory component, students must:

- Attend all weekly online laboratory classes
- Participate in all online laboratory class discussions and activities
- Complete all tasks assigned in all online laboratory classes
- Complete all components of the Laboratory Report assignment
- Attempt the laboratory component of the final exam

NEW ONLINE LABORATORY CLASS FORMAT

In T2 2020, online laboratory classes will be conducted in Microsoft Teams as follows:

1) Each weekly lab session will typically start with a 10-20-minute Introductory Talk by the course convenor in a designated channel within MS Teams.
2) Students will then be instructed to work on a task or series of tasks within a separate MS Teams channel that has been created for their Tutor Group. Group discussions with your classmates are encouraged to help you complete the tasks in this part of the class.
3) Your Tutor will then join you to facilitate a discussion of the completed tasks, with a focus on ensuring you achieve all learning outcomes for that class.
4) In Weeks 4, 7, and 10 of Term, you will sit a 1-hour Term Quiz (worth 12%) that is scheduled in the first hour of your usual laboratory class. In Week 4 only, there will be an online laboratory class scheduled 30 minutes after the completion of your Term Quiz. More details about this lab session and the Term Quizzes will be posted in Moodle.

ONLINE LABORATORY CLASS INSTRUCTIONS

Detailed instructions for accessing all online laboratory classes and introductory talks in MS Teams are available in the '**BIOC2101 Online Learning Guide**' which is available and continually updated in Moodle.

Before each weekly laboratory class, it is highly recommended that you read through the associated laboratory notes that are available in Moodle. You are also encouraged to attempt the Pre-Lab Quizzes (accessed via Moodle) prior to each online lab class and/or afterwards for study purposes. While these Pre-Lab Quizzes were designed to cover key concepts in the original face-to-face lab classes, they still cover many of the important learning outcomes in this year's classes.

Students are also required to complete the **BABS Online Health and Safety Quiz** (accessed via Moodle) by the end of Week 10 of Term. This ensures that you achieve course learning outcomes associated with working safely in a laboratory and prepare you for experimental work in future classes and research.

The information provided on pages 21 to 23 below is for student reference only. It covers fundamental teaching laboratory safe working practices and procedures and may be used as a reference for completing the BABS Online Health and Safety Quiz in Moodle.

GENERAL LABORATORY SAFETY

Biochemical laboratories contain chemicals and equipment that are potentially dangerous when misused or handled carelessly. Consequently, safe experimental procedures and responsible conduct in the laboratory are essential at all times. The regulations governing conduct in the laboratory have been set down by the NSW Environmentally Hazardous Chemical Regulation 2008, NSW WHS Regulation 2011, NSW Work-cover Publications, Work-safe National Codes of Practice and Guidance Notes and Australian Standards AS:2243 series Safety in Laboratories. These policies and standards apply to all university staff and students.

Section 4.11 Students are responsible for:

- Complying with the requirements of this policy, legislation and Australian Standards
- Following directions given to them by the person supervising their work
- Co-operating in the performance of risk assessments
- Participating in induction and training programs
- Reading MSDS's for substances to be handled prior to doing experiments

Failure to comply will result in expulsion from the laboratory class.

PPE[1] REQUIREMENTS IN THE LABORATORY

- **Students must purchase a laboratory coat and wear it when in the laboratory.** It should be removed when leaving the lab *e.g.* on visits to the computer lab or toilets. Lab coats should not be left on benches or stools but hung on the coat hooks that are provided at the back of the laboratory.
- **Safety glasses** MUST be worn during ALL practical procedures.
- **Disposable plastic gloves will be provided for certain manipulations. These should be discarded after use or if torn.** All gloves should be removed from your hands by first holding the gloves at the wrist and pulling to turn them inside out before they are discarded into one of the 'solids waste' containers on top of bench.
- **Never** throw gloves or any other laboratory material into the domestic bins.
- **Never** use gloved hands to open doors etc. Either ask someone to open the door for you or remove one glove temporarily. **Always** remove gloves before leaving the lab.
- **Suitable foot protection (fully closed shoes made from non-absorbent materials) must be worn.** Students with bare feet, thongs, exposed shoes or strappy sandals will not be allowed into the working area.

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[1] PPE – Personal Protection Equipment

SAFETY RULES IN THE LABORATORY

- Eating, drinking and smoking are forbidden in the laboratory.
- Students with long hair must tie it back.
- Laboratory coats, safety glasses and appropriate footwear (NO thongs or open-toed shoes) must be worn at ALL times.
- All work with toxic, corrosive or flammable (etc.) chemicals must be conducted in a fume cupboard where possible.

ALL INJURIES OR ACCIDENTS WITH CHEMICALS MUST BE REPORTED IMMEDIATELY… Either to your demonstrator or to a member of the technical staff.

RISK ASSESSMENTS

For your own protection and that of those with whom you will be working, you should read, before each week's experiment is started, the notes and instructions on the Risk Assessment Sheet preceding each experiment and take note of any hazards in the procedures to be used for that laboratory session.

Risk Assessments have been carried out on all practicals to highlight the potential for possible risks to the users. These cover chemical, biological and physical hazards. This is to ensure that the proper precautions are taken during all laboratory procedures.

As strong acids, alkalis and other toxic substances are used in some procedures, the relevant safety instructions will be included at the appropriate places in the manual. Such dangerous materials must be manipulated with great care and if any comes into contact with skin or clothing, wash the affected areas with water **immediately**, seek assistance and any antidote that may be applied.

Poisonous solutions will be provided in dispensers; these should be operated gently and carefully because careless use can cause breakage or a spray of the reagent. Automatic pipettes will be provided where possible.

EMERGENCY PROCEDURES

- In the event of a fire or other serious emergency, the building may be evacuated. When the alarm has been activated, a “get ready to evacuate” siren will sound. You should immediately cease work and secure your workplace (*e.g.* cap solutions, turn off Bunsen burners). The second stage is the “evacuate the building” call. You should immediately make your way to the nearest exit unless another exit is designated by staff. **Follow directions from the staff and evacuation wardens and gather at Gate 9 in front of the Chancellery Building** (Gate 9 is on High Street near the John Clancy Auditorium). You should wait there until you have been checked off by your demonstrator.
- Emergency eye wash stations and Safety showers are installed at the back of the lab. Seek staff help immediately. If you get something in your eye, you must wash your eyes for at least 20 minutes.
- For procedures to clean up spills, seek staff help immediately.
- Special antidotes (if using cyanide) are located near the Prep Room windows. Seek staff help immediately.
- **If you are in doubt about any safety matter, please consult a member of staff.**

Internet sites/references:

National Occupational Health & Safety Commission: http://www.nohsc.gov.au./hazsubs/index.htm

NSW Work-cover site: http://www.workcover.nsw.gov.au/links.html

SAFETY IN HANDLING LABORATORY CHEMICALS

PIPETTING

Essentially all hazardous solutions (acids, alkalis, toxic solutions etc.) that are needed in the practical class will be provided in dispensers which will be set to deliver the correct volume.

For all other pipetting, pipetting aids such as Gilson Pipetmans or Eppendorfs will be provided for use during classes. These should be returned to the appropriate stands in class immediately after use.

BROKEN GLASSWARE AND OTHER SHARP OBJECTS

Should any breakage of glassware occur, the fragments must be swept up immediately and placed in the special bins provided for glass. These bins are located at the front of each laboratory and are clearly marked "BROKEN GLASS ONLY". Other sharp objects e.g. needles or razor blades should be placed in the yellow “Sharps” Bins located on each benchtop. Broken glass or other sharp objects MUST NOT be placed in the waste-paper bins or in any other bins, under any circumstances.

DISPOSAL OF “CLINICAL” WASTE

Special labeled enamel or plastic containers are available on each laboratory bench for the disposal of gloves, gels, tips, microcentrifuge tubes, and any other used disposable plastic ware or Glad-Wrap. **Never, ever put this material in the normal domestic waste bins**.

DISPOSAL OF CHEMICAL (LIQUID) WASTE

According to the Environmental Policy of the University no chemical waste may be disposed of down the laboratory sinks.

All chemical residues must be placed in the appropriate waste containers which will be provided in the laboratory. Solvent, aqueous, biological wastes and some chemicals may have separate waste containers which are usually located in the fume cupboards. For disposal details, always check your practical manual, the instructions written on the waste disposal containers in the lab or ask your demonstrator.