Course Outline

Code: MLS211
Title: Medical Biochemistry

School of: Health & Sport Science
Teaching Session: Semester 2
Year: 2019
Course Coordinator: Dr Mark Holmes Tel: 5430 2844 Email: mholmes@usc.edu.au
Course Moderator: Dr Fraser Russell Tel: 5459 4665 Email: frussell@usc.edu.au

Please go to the USC website for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?

1.1 Description
Medical biochemistry is the area of general pathology that performs analyses on human specimens such as blood plasma and serum, urine, cerebrospinal fluid, serous fluids and tissue biopsies. The course describes common tests used to assist with the diagnosis and treatment of human diseases. On completion of this course, you will be able to demonstrate and evaluate current knowledge in the basic principles and practices of the medical biochemistry laboratory, including disorders of amino acid and carbohydrate metabolism, dyslipidaemias, and routine chemistries for major organ system functions.

1.2 Course topics
Basic principles and practices in the medical biochemistry laboratory
Human specimen collection for diagnostic testing in clinical chemistry
Critical correlations and analytical procedures in medical biochemistry
Biochemistry of disorders of carbohydrate, lipid, amino acid and protein metabolism
Common analytes/biomarkers used to assess human organ system functions, including diagnosis of renal, gastrointestinal, cardiac and liver function
Analytical techniques in medical biochemistry, including spectrophotometry, electrophoresis, ion-selective electrodes, blood pH and gas analysis, and immunoassay
Evaluation of analytical data and scientific writing skills
Critical review of scientific literature

2. What level is this course?
200 level Developing - Applying broad and/or deep knowledge and skills to new contexts. May require pre-requisites and introductory level knowledge/skills. Normally undertaken in the 2nd or 3rd year of an undergraduate program

3. What is the unit value of this course?
12 units
4. **How does this course contribute to my learning?**

<table>
<thead>
<tr>
<th>Specific Learning Outcomes</th>
<th>Assessment Tasks</th>
<th>Graduate Qualities or Professional Standards mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>On successful completion of this course you should be able to:</td>
<td>You will be assessed on the learning outcome in task/s:</td>
<td>Completing these tasks successfully will contribute to you becoming:</td>
</tr>
<tr>
<td>Critically analyse and evaluate concepts in medical biochemistry that are relevant to</td>
<td>Task 1. Case-Based Learning Portfolio</td>
<td>Creative and critical thinkers.</td>
</tr>
<tr>
<td>the pathology services industry.</td>
<td>Task 3. Final exam</td>
<td></td>
</tr>
<tr>
<td>Capably and confidently demonstrate skills and competencies in medical biochemistry</td>
<td>Task 2. Competency-Based Practical Exercises Booklet</td>
<td>Empowered</td>
</tr>
<tr>
<td>required to enter the pathology services industry.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicate scientifically in the form of individual reports.</td>
<td>Task 1. Case-Based Learning Portfolio</td>
<td>Empowered</td>
</tr>
<tr>
<td>Task 2: Competency-Based Practical Exercises Booklet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demonstrate current knowledge of the medical biochemistry discipline of laboratory</td>
<td>Task 1. Case-Based Learning Portfolio</td>
<td>Knowledgeable</td>
</tr>
<tr>
<td>medicine</td>
<td>Task 3. Final exam</td>
<td></td>
</tr>
</tbody>
</table>

5. **Am I eligible to enrol in this course?**

Refer to the [USC Glossary of terms](https://www.usc.edu.au/glossary) for definitions of "pre-requisites, co-requisites and anti-requisites".

5.1 **Enrolment restrictions**

Nil

5.2 **Pre-requisites**

LFS251 Biochemistry

5.3 **Co-requisites**

Nil

5.4 **Anti-requisites**

Nil

5.5 **Specific assumed prior knowledge and skills (where applicable)**

It is recommended that students have prior knowledge and skills in chemistry, biochemistry and human physiology.

6. **How am I going to be assessed?**

6.1 **Grading scale**

Standard – High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL)

6.2 **Details of early feedback on progress**

You will complete a Review Quiz in Week 4 as part of Task 1: Case-Based Learning Portfolio that will provide you with early feedback on how you are engaging with the MLS211 course materials being covered in the weekly lecture modules and case-based learning tutorials. In addition, your MLS211 course coordinator will be providing you with feedback from Week 1 on how well you are completing the pre-lab and laboratory exercises as you start working on the Task 2: Competency-Based Practical Exercises Booklet.
### Assessment Task 1: Case-Based Learning Portfolio (30%)

**Goal:** In this assessment task, you will be able to demonstrate, apply and evaluate your theoretical knowledge associated with the biochemistry of basic principles and practices in medical biochemistry through the instructional method of case-based learning.

**Product:** Review quizzes and a clinical case study.

**Format:** The case-based learning portfolio will include:

- **Task 1a. Review Quiz 1:** 5% - Individual - Week 4
- **Task 1b. Review Quiz 2:** 5% - Individual - Week 6
- **Task 1c. Review Quiz 3:** 5% - Individual - Week 8
- **Task 1d. Clinical Case Study:** 10% - Individual or Pair - Week 10
- **Task 1e. Review Quiz 4:** 5% - Individual - Week 13

Please refer to the MLS211 Assessment folder in Blackboard for specific details for task description, format and submission instructions.

**Criteria:** You will be assessed on your ability to:
- demonstrate and apply knowledge of the basic principles and practices of medical biochemistry; the biochemistry of metabolic syndrome (disorders of carbohydrates and lipids); disorders of amino acid and protein metabolism; enzymes used in clinical diagnosis; and the biochemical assessment of renal, cardiac, gastrointestinal and liver function.
- use evidence-based reasoning to provide correct answers to the review quiz questions (individually) and a clinical case study (individually or as a pair).
Assessment Task 2: Competency-Based Practical Exercises Booklet (30%)

Goal: In this assessment task, you will demonstrate your developing skills and competencies in practical medical biochemistry and analyse and evaluate your practical knowledge gained by communicating in the format of a Competency-Based Practical Exercises Booklet.

Product: Competency-Based Practical Exercises booklet.

Format: For Task 2, you will complete pre-laboratory (pre-lab) and laboratory exercises in a Competency-Based Practical Exercises Booklet during semester as you undertake Practicals 1 to 6. The booklet will detail the experimental results you achieve, showing all necessary calculations, and having interpretation of the results obtained during each practical. Your Competency-Based Practical Exercises Booklet will be submitted after Practical 3 in Week 5 for initial assessment and feedback, and again after Practical 6 in Week 11 for final assessment. Completion of your pre-lab exercises will be checked by your course tutors at each practical class during the semester.

Criteria: You will be assessed on your ability to:
- adhere to the correct format and presentation (e.g. structure, spelling, grammar, referencing, written expression) required to complete the booklet.
- interpret the individual and class findings obtained during Practicals 1 to 6.
- relate the practical findings to peer-reviewed articles and professional internet sites in the medical biochemistry literature.

Assessment Task 3: End-of-Semester Exam (40%)

Goal: In this assessment task, you will be able to demonstrate, apply and evaluate your theoretical and practical knowledge associated with the biochemistry of enzymes used in clinical diagnosis; assessment of renal, cardiac, gastrointestinal, and liver function; body water and electrolyte homeostasis; and blood gases, pH and buffers.

Product: You will need to complete a two (2) hour (<1000 words) exam.

Format: The exam will consist of multiple-choice and short-answer questions based on the material covered in the online lectures, case-based learning tutorials and practical classes held during weeks 7 to 13 of the semester.

Criteria: You will be assessed on your ability to:
- demonstrate and apply knowledge of the principles and concepts of medical biochemistry;
- analyse information and explain essential elements of the theories which underpin the concepts in medical biochemistry covered during the course;
- solve problems based on theoretical material and information covered in online lecture modules, case-based learning tutorials and practicals;
- use evidence-based reasoning to provide complete and correct answers to the multiple-choice and short-answer questions.

7. What are the course activities?

7.1 Directed study hours

The directed study hours listed here are a portion of the workload for this course. A 12-unit course will have a total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Directed study hours may vary by location. Student workload is calculated at 12.5 learning hours per one unit.

<table>
<thead>
<tr>
<th>Location: Specific Campus(es) or online:</th>
<th>Directed study hours for location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>USC Sunshine Coast</td>
<td>Pre-recorded online lecture modules</td>
</tr>
<tr>
<td></td>
<td>Tutorials (2-hours per week, commencing in week 1)</td>
</tr>
<tr>
<td></td>
<td>Practicals (3-hours each fortnight, commencing in week 1)</td>
</tr>
</tbody>
</table>
### 7.2 Course content

<table>
<thead>
<tr>
<th>Week # / Module #</th>
<th>What key concepts/content will I learn?</th>
</tr>
</thead>
</table>
| **1**             | Introduction to medical biochemistry and human specimen collection  
• Overview of the MLS211 course, including teaching staff, online lecture modules, tutorial and practical classes, prescribed textbook, useful websites, and assessment tasks.  
• Human specimen collection and handling. Revising important concepts. |
| **2**             | Principles and practice in medical biochemistry  
• Introduction to the clinical biochemistry section of a pathology laboratory.  
• Overview of instrumentation in medical biochemistry.  
• The importance of standards and controls for laboratory analysis.  
• Analytical performance parameters and decision limits.  
• Reference ranges for diagnostic tests in clinical biochemistry.  
• Quality assurance and quality control in the laboratory.  
• Basic laboratory statistics in medical biochemistry. |
| **3**             | Metabolic syndrome (Part A): Disorders of carbohydrate metabolism  
• Overview of metabolic syndrome.  
• Biochemistry of carbohydrates.  
• Diagnostic criteria for prediabetes and diabetes.  
• Glucose tolerance tests.  
• Other carbohydrate-related analytes.  
• Clinical testing for blood glucose. |
| **4**             | Metabolic syndrome (Part B): Biochemistry of the blood lipids and lipoproteins  
• Review of lipid biochemistry.  
• Lipoprotein structure and function (chylomicrons, VLDLs, LDLs, HDLs and Lpa). |
| **5**             | Metabolic Syndrome (Part C): Blood serum lipid profiles and assessment of cardiovascular disease risk  
• Dyslipidaemias and atherosclerosis.  
• Methodologies used to measure blood lipids and lipoproteins.  
• Assessment of cardiovascular disease risk using blood lipid testing. |
| **6**             | Disorders of amino acid and protein metabolism  
• Basic amino acid and protein chemistry.  
• Aminoacidopathies.  
• Total protein abnormalities.  
• Protein methodologies.  
• Serum protein electrophoresis. |
| **7**             | Enzymes of clinical significance  
• Revision on enzyme biochemistry, including kinetics, classification and isoenzymes.  
• Clinically important enzymes for cardiac, liver, biliary tract, digestive and pancreatic diagnosis (including common laboratory methodologies). |
| **8**             | Assessment of renal function  
• Analytes associated with renal function (nonprotein nitrogen, urea, creatinine, uric acid).  
• Measurements of renal clearance.  
• Screening for renal disease (α₂-microglobulin, microalbuminaemia). |
| **9**             | Assessment of cardiac function  
• Classification of cardiac diseases.  
• Considerations for selecting cardiac biomarkers.  
• Troponins, creatine kinase isoenzymes, myoglobin, lactate dehydrogenase isoenzymes, C-reactive protein, oxidized LDL and Lpa. |
10. **Assessment of gastrointestinal function**
- Overview of the functions of the gastrointestinal tract.
- Gastrointestinal regulatory peptides.
- Laboratory assessment of disorders of the gastrointestinal tract.

11. **Assessment of liver function**
- The liver and bilirubin metabolism.
- Common disorders of the liver.
- Jaundice (prehepatic, intrahepatic and posthepatic).
- Liver function tests.
- Testing hepatic enzymes in blood serum.

**Note:** There won’t be a MLS211 tutorial class in Week 11 due to the Queen’s birthday public holiday on Monday 7 June. The online lecture modules for assessment of liver function will be available for viewing. Case-based learning for this topic will be independent learning.

12. **Body water and electrolyte homeostasis**
- Body fluid composition.
- Osmolarity and osmolality.
- Regulation of water and electrolytes.
- Electrolyte analysis – sodium, potassium and chloride measurements.
- Anion gap.

**Note:** There won’t be a MLS211 tutorial class in Week 12 on Monday 14 October. The online lecture modules for body water and electrolyte homeostasis will be available for viewing. Case-based learning for this topic will be covered during the Week 13 tutorial.

13. **Blood gases, pH and buffer systems**
- Acid-base balance – role of lungs and kidneys
- The bicarbonate buffering system
- Acidosis and alkalosis
- Blood gas analysers
- Measurement of oxygen saturation, pH, PO₂ and PCO₂

Please note course content is subject to variation.

8. **What resources do I need to undertake this course?**

Please note that course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Blackboard site. Please log in as soon as possible.

8.1 **Prescribed text(s)**

Please note that you need to have regular access to the resource(s) listed below as they are required:

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Title</th>
<th>Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>RL Sunheimer &amp; L Graves</td>
<td>2018</td>
<td>Clinical Laboratory Chemistry (2nd edn)</td>
<td>Pearson Education, USA</td>
</tr>
</tbody>
</table>

8.2 **Specific requirements**

You will be expected to purchase the MLS211 Course Practical Manual and Competency-Based Practical Exercises Booklet from USC Mail and Print Services (MaPS). In addition, you will be required to bring along a laboratory coat, safety glasses and closed non-slip footwear to the course practical classes.

9. **Risk management**

Risk assessments have been performed for all practical classes and a low level of health and safety risk exists. Some risks concerns may include equipment, instruments, and tools; as well as manual handling items within the
laboratory. It is your responsibility to research and understand the risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the online induction training for students.

10. What administrative information is relevant to this course?

10.1 Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.

10.2 Assessment: Additional requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

a) The final mark is in the percentage range 47% to 49.4%
b) The course is graded using the Standard Grading scale
c) You have not failed an assessment task in the course due to academic misconduct

10.3 Assessment: Submission penalties

Late submission of assessment tasks will be penalised at the following maximum rate:

- 5% (of the assessment task’s identified value) per day for the first two days from the date identified as the due date for the assessment task.
- 10% (of the assessment task’s identified value) for the third day
- 20% (of the assessment task’s identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task.
- A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.

To request an extension, you must contact your Course Coordinator and supply the required documentation to negotiate an outcome.

10.4 Study help

In the first instance, you should contact your tutor, then the Course Coordinator. Additional assistance is provided to all students through Academic Skills Advisers. To book an appointment or find a drop-in session go to [Student Hub](#).

Contact Student Central for further assistance: +61 7 5430 2890 or [studentcentral@usc.edu.au](mailto:studentcentral@usc.edu.au)

10.5 Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:
Course Outline: MLS211  Medical Biochemistry

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website:
http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.6 General Enquiries
In person:
- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC South Bank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **USC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **USC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **USC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890
Email: studentcentral@usc.edu.au