Medical Biochemistry
CHEM 1005
Renee LeClair, Ph.D.

I. Overview.

Medical Biochemistry is a four credit hour course designed to lay the foundation for other basic and clinical medical sciences. The goal of this course is to learn the core concepts of biochemistry that apply to human health and disease and to cite specific examples of their application. You will be able to analyze and evaluate the most common biochemistry cited in medical literature. Furthermore, these basics will facilitate further learning in biochemistry and the health sciences.

II. Instructor and Support Contact Information

Instructor: Renee LeClair, Ph.D.
Email: rleclair@une.edu
Office number: 864-455-9833
Office hours:
Tuesday 9-11 am, Thursday 1-3pm, Friday by appointment. Please feel free to call me during office hours. If I am not able to answer the phone, please leave a short message that includes your name and phone number. I will return your call as soon as I can. The best way to contact me is to use the messaging tool within the course. I check my email several times during the day; therefore, this mode of communication will result in you getting a faster response to your questions or concerns.

Student Support Specialist: Courtney Ayers
Email: cayers2@une.edu
Phone number: 207-221-4968

Technical Assistance:
If you have a problem with Blackboard or your software, please make sure that you email comdistancetechhelp@une.edu.

III. Lectures and Laboratories:

1. Lectures: This course it designed to be completed in a 16-week period, just like an on-campus Biochemistry course. This breaks down to one module per week. One week in this online course is equivalent to 3, 50-minute lectures in a traditional classroom setting. The general rule of studying for science courses is to spend 3 hours studying for every one hour that you are in class. Therefore, the suggested

study time for each module is 9 hours above and beyond the time it takes to listen to the lecture. Please refer to the schedule below for the suggested schedule of lectures. Students may complete the course in less than 16 weeks.

Each module consists of:

- Session level objectives
- Reading from Marks Medical Biochemistry
- Pre – Quiz (see below section VII for description)
- Voice over PowerPoint and associated slides
- Additional learning resources
- Module evaluation (see below section VII for description)

2. Laboratories: N/A

IV. Required materials

- Textbook: Marks Basic Medical Biochemistry: A Clinical Approach, 4th edition. Leiberman and Marks

V. Course Objectives

Upon the completion of this course the student will be able to:

1. Identify functional groups unique to proteins, nucleic acids, lipids, and carbohydrates and describe their relevance in biological systems.

2. Interpret the role and regulation of metabolism of proteins, carbohydrates, lipids, and nucleic acids in normal physiological conditions and the changes that occur in disease processes.

3. Identify and evaluate methodologies for molecular and biochemical diagnostic testing in individuals and populations.

4. Demonstrate an understanding of cellular structure, compartmentalization, trafficking, and cellular signaling

5. Explain genomic, DNA and RNA structure and the central dogma of molecular biology, including the processes of DNA replication, transcription, and translation across eukaryotes.

6. Explain how changes in genetic and environmental factors can result in the displayed genetic variation in human populations.

7. Understand how enzymes facilitate chemical reactions and the necessity of metabolic cofactors or vitamins in these reactions; relate how these may have pharmacological applications.

VI. Course Outline

The table below gives a general outline of the material. For more detailed readings please follow the Module information on Blackboard.

UNIT 1:Cellular fundamentals and applications of molecular biology		
Module 1: Biochemistry basics and enzymology		
Course Objectives: 1,7	**Chapters**	
At the end of this module the learner will: be able to illustrate the importance of key compounds in biological settings and the necessity of biological buffers. It will also provide an understanding of enzymes and their relevance in biological reactions.		**Session 1:**
	4	Water, Acids, Bases and Buffers
	6	Amino Acids in Proteins
	7	Structure-Function Relationships in Proteins
		Session 2:
	8	Enzymes as Catalysts
	9	Regulation of Enzymes
Module 2: Cellular Communication		
Course Objectives: 1,4	**Chapters**	
be able to explain how cells communicate and integrate signals resulting in a cellular or physiological change.	10	Relationship between cell biology and biochemistry
	11	Cell Signaling by Chemical Messengers
Module 3: Central Dogma - DNA structure and synthesis		
Course Objectives: 1,2,3,5,6	**Chapters**	
be able to describe the structure and synthesis of nucleotides. Students will be able to relate the phases of the cell cycle to DNA replication and repair processes.		**Session 1:**
	12	Nucleotide structure
	41	Purine and Pyrimidine Synthesis and Salvage

		Session 2
	13	DNA Synthesis
Module 4: Central Dogma - Transcription and Translation		
Course Objectives: 1,5	**Chapters**	
to describe the flow of genetic information from DNA to the level of protein synthesis.	14	Transcription
	15	Translation
Module 5: Gene regulation and diagnostic evaluation		
Course Objectives: 1,3,6	**Chapters**	
be able to integrate information from previous modules and illustrate how cells sense and regulate gene expression. The learner will also be able to understand how to evaluate these changes at a molecular level using cutting edge molecular technologies.		**Session 1:**
	16	Regulation of Gene expression
		Session 2:
	17	Use of Recombinant DNA Techniques in Medicine
Module 6: Amino acids as specialized products		
Course Objectives: 1,6,7	**Chapters**	
be able to evaluate how defects in amino acid metabolism are inherited and how accumulation of intermediary metabolites can be used to clinically diagnose these disorders.	39	Synthesis and degradation of amino acids
	40	Tetrahydrofolate, Vitamin B12, and S-Adenosylmethionine
UNIT 2: Generation of Energy and Carbohydrate Metabolism		
Module 7: Generation of energy		
Course Objectives:2,7	**Chapters**	
be able to relate the free energy of a reaction with its directionality. The learner will also be able to describe the relevance and generation of ATP within the cell.	19	Cellular Bioenergetics
	21	Oxidation phosphorylation
Module 8: Carbohydrate Metabolism		

Course Objectives: 1,2	Chapters	
be able to summarize carbohydrate, fat and amino acid metabolism and the interrelationship of various tissues. Specifically, the learner will assess the metabolic fate of carbohydrates following digestion.		**Session 1:**
	26	Basic concepts in the regulation of Fuel metabolism by insulin, glucagon and other hormones.
		Session 2:
	27	Digestion, absorption and transport of carbohydrates
	22	Generation of ATP from Glucose: Glycolysis
	28	Formation and Degradation of Glycogen
Module 9: TCA cycle		
Course Objectives: 1,2	**Chapters**	
be able to describe the role and regulation of the TCA cycle in generating reducing equivalents and substrates for intermediary metabolism.	20	Tricarboxyilic Acid Cycle
Module 10: Alternative glucose metabolism and the RBC		
Course Objectives: 1,2	**Chapters:**	
be able to discuss alternative pathways for glucose metabolism; specifically glucose metabolism within the red blood cell and the necessity of NADPH.		**Session 1:**
	29	Pathways of Sugar metabolism: Pentose Phosphate Pathway, Fructose
		Session 2:
	44	The Biochemistry of Erythrocytes and other blood cells
UNIT 3: Lipid metabolism and integrated metabolism		
Module 11: Digestion, circulation and synthesis of lipids		
Course Objectives: 1,2	**Chapters**	
be able to illustrate how lipids are digested, transported to the periphery and synthesized. The learner will also assess how		**Session 1:**

these processes are hormonally regulated.	32	Digestion and transport of Dietary Lipids
		Session 2:
	33	Synthesis of Fatty acids, Triacylglycerols and Major Membrane Lipids
Module 12: Cholesterol synthesis and lipoprotein metabolism		
Course Objectives: 1,2	**Chapters**	
be able to interpret the circulation of both dietary and endogenous cholesterol as well as determine how this impacts de novo cholesterol synthesis. The learner will also determine the interrelationship VLDL and HDL metabolism	34	Cholesterol absorption, synthesis and metabolism
Module 13: Maintenance of blood glucose		
Course Objectives: 1,2	**Chapters**	
be able to describe the necessity and hormonal regulation of gluconeogenesis and the maintenance of blood glucose.		**Session 1:**
	31	Gluconeogenesis and Maintenance of Blood Glucose
	33	Synthesis of Fatty acids, Triacylglycerols and Major Membrane Lipids
		Session 2:
	25	Metabolism of Ethanol
UNIT 4: Hormonal control of metabolism and metabolic acidosis		
Module 14: Protein digestion and the urea cycle		
Course Objectives: 1, 2,3,6	**Chapters**	
to be able to asses the amino acid pool within the body and determine the relative flux thru the urea cycle based on protein catabolism.	37	Protein Digestion and Amino Acid Absorption
	38	Fate of Amino Acid Nitrogen: Urea cycle
Module 15: Fasted state and Metabolic Acidosis		
Course Objectives: 1, 2,3,6	**Chapters**	
be able to determine metabolic adaptations that occur during the fasting state and to confidently revisit the integration of	3	Fasting

intermediary metabolism within the liver, brain, kidney, skeletal muscle and adipose.	36	Integration of carbohydrate and Lipid metabolism
	42	Interrelationships of Amino acids with other tissues
Module 16: Additional hormones that impact metabolism		
Course Objectives: 2,3	**Chapters**	
be able to integrate the actions of alternative hormones on the discussed metabolic pathways to facilitate integration of metabolism across tissues.	43	Actions of Hormones that Regulate Fuel Metabolism

VII. Examination and Grading Information.

Students will have the opportunity to assess their knowledge with both formative and summative evaluations. Each module consists of both a Pre-module quiz (formative), and a post Module evaluation (summative). Each unit has an associated summative exam; exams after Units 2 and Units 4 are cumulative and proctored.

Description of Assessments:

Pre-module Quiz:
To evaluate your preparedness for the Module there are Pre-module quizzes linked for each session. You can take these quizzes multiple times and are a good resource for the Unit exams and Module evaluations. These quizzes *do not* contribute to your final grade.

Module Evaluations:
All modules have an end of module evaluation. These many be in the form of a multiple choice quiz or a 'Madlib' which is a fill-in the blank exercise. These quizzes are timed, non-proctored and are *closed notebook and closed notes*. The quizzes will be taken online through the course Blackboard site. Doing well on the quizzes will help prepare you for the timed-proctored exams.

Unit Exams:
There will be a total of 4 exams in the course, one after each of the 4 Units. Exams after Units 1 and 3 will be taken through Blackboard and are not cumulative. Exams after Units 2 and 4 are cumulative and will be taken using Proctor U (see below for instructions).

Units 1 and 3 exams:
Each exam will consist of 30 multiple choice questions that cover all of the material in the respective unit, these will be taken on Blackboard similar to a Module evaluation and are closed notes, closed book. You will have up to 1.5 hours to complete these exams.

Units 2 and 4 exams:
Each exam will consist of 50 multiple choice questions that cover all of the material from the

respective unit, as well as up to 10% of material from previous units. These exams will be taken using one of the outlined proctoring procedures below. These are closed book and closed notes exams. You will not have access to any material saved on your or any other computer. No access to the internet or other communication devices is allowed during these exams.

Retaking a Unit 2 or Unit 4 exam:
You will have the option of retaking either the Unit 2 or Unit 4 exam if requested. You will be responsible for rescheduling the exam with Proctor U and the cost of the proctoring. Your final grade for the assessment will be the average of the two scores. We strongly encourage students who score below 50% on the Unit 2 exam to retake this assessment, as this background is fundamental to the other two Units.

Final Grade:
The course grade will be determined using the weighted averages of each of the assessments outlined above.

Module Evaluations 20%
Unit 1 and 3 Exams 20%
Unit 2 and 4 Exams 60%

Exam Procedures:
Students can either take their final proctored exam online using Proctor U or at the campus of the University of New England.

Proctored Examinations.

The University of New England has contracted with ProctorU (proctoru.com) to provide students with the most convenient online exam proctoring system. This system provides a simple, no cost to the student, secure, online proctor for all exams and allows the student to take all of the exams at home and on their own schedule.

Upon enrollment into the course, each student will register with ProctorU and establish a login name and password. This will give you access to all of ProctorU's services. When ready, students will schedule their exams with ProctorU **one week** prior to taking that exam. Upon the exam day and hour, students will log in to proctor U and click on "exams".
Following the procedures outlined at ProctorU's web site, the student will log in to Blackboard; open the appropriate exam and the proctor will then allow student access to that exam.
Students will need to plan on, and schedule through ProctorU, a total of 1.5 consecutive hours for each of the 4 module exams - one hour for each Module lecture exam and 30 min for each Module laboratory exam, both done in the same 1.5 hour time block. You need not schedule all of the exams at once, but each one must be scheduled at least one week in advance of the actual exam date.

System Requirements for Use of ProctorU:

- PC: Windows XP, Windows Vista or Windows 7 with 256 MB of RAM or higher
- Mac: Mac OS10 or higher
- A web cam with 640x480 video pixel resolution
- Headphones or working speakers connected to the computer
- A microphone connected to the computer (we recommend having a web cam that has a built in microphone)
- A high speed internet connection (NO DIAL-up). We recommend connecting your computer directly to your router with an Ethernet cable for any proctored exams, specially the practical exams.
- A web browser with Adobe Flash Player installed. (Google Chrome recommended for ProctorU website)
- Authority to allow remote access to your computer and screen by one of our proctors

Written Proctored Exam: Students may take the exam at the University of New England College of Osteopathic Medicine's Campus. The exam is offered the first Saturday of every month. If the first Saturday of the month is a holiday, the exam will take place on the second Saturday of the month. Please contact us for information at comdistance@une.edu.

Grading Scale

88% -100% = A
82% - 87% =B+
78% - 81% = B
72 %– 77% = C+
68% - 77% = C
60% - 67% = D
Below 60% = F

VIII. Course Length

Note the following:

A schedule of lectures and assignments is included in this syllabus. This is, however a self-paced course and you can complete the course in less time.
1. Courses in CDE program are equivalent to one-semester courses designed to be completed in 16 weeks
2. Enrollment in the course begins the day your section opens, which is listed in the Academic Calendar, found on the CDE Webpage.
3. Students for whom a grade has not been posted by week 14 will be flagged by the administrative staff.

IX. Learning Disabilities.

Any student with a documented learning disability needing academic adjustments or accommodations is requested to notify the professor prior to or during the first week of being in the course. All discussions will remain confidential. All students with a documented learning disability will need to provide all necessary documentation before special accommodations will

be granted. Accommodations will be granted for the midterm and final exams only, as the quizzes are not timed.

To request accommodations at the University of New England, please contact:
Jaime L. Flaig, M.Ed
Coordinator of Disability Services
Phone: (207) 221-4418
Fax: (207) 523-1919
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Email: jflaig@une.edu

X. Withdraw Policies.

To withdraw from a course, please e-mail UNERegistrar@une.edu with your intentions to withdraw and include the course subject and number (Example: ANAT 1005). This action will result in a W grade for the course. You must declare your intention to withdraw before completing all of the graded assessments.

Refund Policy:
- 100% refund prior to the official start of the course.
- 40% refund within the first week of the official course start date.
- No refund after the first week of the official course start date.

For further information concerning refunds, please see
http://www.une.edu/businessoffice/refunds.cfm.

XI. Transcripts.

Due to the Family Privacy Act, the student may only request official transcripts. This may be done online by going to the University of New England Registrar website and following the directions on the page. The URL is: http://www.une.edu/registrar/upload/transcript.pdf. Fill in and sign the request and either mail or fax it to the University Campus address on the form.

To view your unofficial UNE student transcript:
- Log into uonline at http://uonline.une.edu
- Select Student Services
- Select Student Records
- Select Academic Transcript