Seongmin Lee

COLLEGE OF PHARMACY
THE UNIVERSITY OF TEXAS AT AUSTIN

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Pharmaceutical Biochemistry II (PHR 281N)

Schedule: Lectures, Tuesday/Thursday 2-3 p.m. in PHR 2.110
Optional: Weekly Problem-Solving Sessions, TBA

Faculty:

Dr. Kevin Dalby BME 6.202B
(471-9267) dalby@austin.utexas.edu
Dr. Seongmin Lee PHR 3.206A
(471-1785) SeongminLee@austin.utexas.edu

Teaching Assistants:

Course Texts: 1. Campbell and Farrell "Biochemistry," 8th Edition (required).

Note: Exam questions may come from assigned text readings.

Web Resources: 1.The Canvas® **web site** for this course is located at:

http://courses.utexas.edu/

On login (with your UTEID) you will see a list of Canvas® websites for your current courses. Click on *Pharmaceutical Biochemistry II* to access the site. You are strongly encouraged to visit this site for additional resources associated with the courses (electronic quizzes, powerpoint presentation, previous exams, contacting faculty by Email, electronic versions of suggested and ***required*** readings). Messages sent to you via the Canvas® Website (Email and Notifications) are **official** mechanisms for communication in this course; be sure you understand the College Email policies.

1. The **Discussion Board** for this course is also on the Canvas® website. The Discussion Board will be used for posting questions, exchanging class information, and making class announcements.
You may also contact faculty members directly via **phone** or **Email**.

Video Capture: This class is using UT's Echo360 system which records all of the audio and presentation materials (what is projected on the screen in class) for review later. To access this material, you will need to log into Canvas and click "EchoCenter" on the left side navigation menu.

Course Policies

1. Examinations:

There will be three 1-hr summary examinations throughout the semester, plus a comprehensive final administered during the Final Exam period. Exams will be given according to the following schedule:

Exam Date & Time	Location	Coverage	Faculty	Points[#]
Thursday, Feb. 23	2.110	Lecture 1-9	Dalby	100 pts
Tuesday, April 4	2.110	Lectures 10-18	Dalby/Lee	100 pts
Thursday, May 4	2.110	Lectures 19-26	Lee	100 pts
Final Exam	TBA	Lectures 1-26	Dalby, Lee	100 pts

Points for Exams 1-3 are proportional to actual lectures given, and may be adjusted accordingly.

The format for the exam is entirely the prerogative of the faculty. ***Students must arrive on time for examinations.*** All instructions and corrections will be made at the beginning of the examination period and will not be repeated. Semester exams will begin promptly at the designated hour and will be picked up after exactly 1 hr. The final examination will last three hours. Students arriving after any students have completed the exam and left the room may not be allowed to sit for the exam and may receive a score of zero.

No allowances will be made for an exam being missed, other than documented illness or emergency. The student must contact the course coordinator for confirmation ***prior to the exam***. If permission is granted to delay the exam, it is the student responsibility to complete the College Form titled "Student Request for Alternate Exam Time" for consideration and *final approval* by the Faculty member. In this event, the nature of the make-up will be at the discretion of the faculty (oral, written, increased weighting on the final, etc.). An unexcused absence from an exam may result in a grade of "zero" for that exam.

If scantron sheets are used, the grading of objective questions will be based upon the scantron sheets turned in, and *not* on answers written on the exam papers. After the exams have been graded and an item analysis performed (Measurement & Evaluation Center), questions may be discarded at the discretion of the Course Coordinator before arriving at final grades.

1.A. Return of Exams; Posting Class Scores & Keys:

All summary examinations will be returned to the students within a reasonable time after taking the exam. Following the grading of each exam, score statistics and the exam key will be posted Canvas. An announcement will be made via the listserv that the key has been posted, that grades have been posted on Canvas, and that exams are available for return.

1.B. Post-Exam Remarks and Reconsideration Requests:

If there is a disagreement over the answer to a specific question, the student should present his/her exam plus a written explanation (with appropriate documentation) to the instructor within 72 hours of the listserv announcement of the posting of exam results & key as described above. Documentation may include statements from textbooks, handouts, packets, or current scientific reprints; lecture notes are *not* authoritative documentation. The explanation must be clear, rational, and concise. (This policy does not apply to addition or other grading errors).

1.C Final Exam Re-Examination Policy: The re-examination policy for this course will follow the General Information Catalog (GIC) policy for the University, which reads as follows: "Only a student who has a grade average of at least a C on all class work and lab work submitted before the final exam may request a temporary delay of the final course grade because he or she failed the final examination, which is the examination given during the final exam period as printed in the official examination schedule. If the petition is denied by the instructor (i.e., course coordinator), the student's final course grade will remain as originally determined. If the petition is granted by the instructor (i.e., course coordinator), the grade on the reexamination will be **substituted** for the grade on the original exam in determining the student's final course grade, provided the student earns at least a C on the reexamination. **If the grade on the reexamination is less than a C, a final course grade of F must be recorded.**"

2. On-Line Exams

Throughout the semester you may be assigned exam questions to be completed on Canvas. These are "open book" exams, but must be completed individually.

3. Course Grading:

There will be a total of 400 points for the course: 300 points (75 %) for in-class exams, quizzes, and on-line exams, and 100 points (25 %) for the final exam. The final letter grade assignments will be based on the following scale:

A = 100%-93%
A- = 92%-90%
B+ = 89%-87%
B = 86%-83%
B- = 82%-80%
C+ = 79%-77%
C = 76%-73%
C- = 72%-70%
D+ = 69%-67%
D = 66%-65%
F = Below 65%

This scale may be curved more leniently in the final analysis of grades at the discretion of the instructors.

4. Academic Dishonesty:

The "Statement on Scholastic Dishonesty of the College of Pharmacy" reads as follows: "Pharmacy practitioners enjoy a special trust and authority based upon the profession's commitment to a code of ethical behavior in its management of client affairs. The inculcation of a sense of responsible professional behavior is a critical component of professional education, and high standards of ethical conduct are expected of pharmacy students. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including failure of the course involved and dismissal from the college and/or the University. Since dishonesty harms the individual, fellow students, and the integrity of the University and the College of pharmacy, policies of scholastic dishonesty will be strictly enforced in this class".

Students are expected to work independently on all examinations and on all laboratory write-ups (unless specifically instructed otherwise). Any student caught cheating will be given a "zero" on the assignment (minimum). Any student suspected of dishonesty will be reported to the Dean of the College of Pharmacy and to the Dean of Students, as per University regulations. Students are expected to have read and understood the current issue of the General Information Catalog published by the Registrar's Office for information about procedures and about what constitutes scholastic dishonesty. Students are also expected to be familiar with and abide by the College Honor Code, and will be expected to sign the Honors Statement at the end of each examination.

5. Students with Disabilities

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. All University rules concerning accommodations must be followed, including the student arranging for special accommodations *prior* to *each* examination. In the absence of such *prearrangement*, the student will be expected to take the exam with the rest of the class at the regularly scheduled exam time. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TTY.

6. Campus Carry

Students should familiarize themselves with the information provided by the University regarding the implementation of "Campus Carry" legislation. You will find an information sheet specifically for students (as well as sheets for parents, visitors, faculty, and staff) at http://campuscarry.utexas.edu/info-sheets."

Schedule of Pharmaceutical Biochemistry (PHR 281N)

Lecture	Date	Topic(s)
1	Jan 19	Cholesterol metabolism (1) (*Dalby)*
2	Jan 24	Cholesterol metabolism (2) (*Dalby)*
3	Jan 26	Cholesterol metabolism (3) (*Dalby)*
4	Jan 31	Plasma Lipoproteins (1) (*Dalby)*
5	Feb 2	Plasma Lipoproteins (2) *(Dalby)*
6	Feb 7	Plasma Lipoproteins (3) *(Dalby)*
7	Feb 9	Protein metabolism (1) *(Dalby)*
8	Feb 14	Protein metabolism (2) *(Dalby)*
9	Feb 16	Protein metabolism (3) *(Dalby)*
10	Feb 21	Revision for exam *(Dalby)*
Exam 1 on Feb 23 Covering Lectures 1- 9 *(Dalby)*		
11	Feb 28	Protein metabolism (4) *(Dalby)*
12	March 2	Protein metabolism (5) *(Dalby)*
13	March 7	Review (*Dalby*)
14	March 9	Nucleotide metabolism (1) (*Lee*)
Spring Break March 13-17		
15	March 21	Nucleotide metabolism (2) (*Lee*)
16	March 23	Nucleic Acids - Structure (1) (*Lee*)
17	March 28	Nucleic Acids - Structure (2) (*Lee*)
18	March 30	DNA Replication (1) (*Lee*)
Exam 2 on April 4 Covering Lectures 10-17 (*Dalby/Lee*)		
19	April 6	DNA Replication (2) (*Lee*)
20	April 11	DNA Replication (3) (*Lee*)
21	April 13	Transcription (1) *(Lee)*
22	April 18	Transcription (2) *(Lee)*
23	April 20	DNA damage, mutagenesis and cancer (1) (*Lee*)
24	April 25	DNA damage, mutagenesis and cancer (2) (*Lee*)
25	April 27	DNA-targeting anticancer drugs (1) (*Lee*)
26	May 2	DNA-targeting anticancer drugs (2) (*Lee*)
Exam 3 on May 4 Covering Lectures 18-26 (Lee)		

* These lectures may be replaced with in- or out-of-class activities.

Learning Objectives
Pharmaceutical Biochemistry
(PHR 281N)

Learning Objectives to Dr. Dalby's Section:

Reading Material (Selected from the chapters below)
Chapter 3: Amino Acids and Peptides (mainly for review)
Chapter 8: Lipids and Proteins Are Associated in Biological Membranes
Chapter 12: Protein Synthesis: Translation of Genetic Message
Chapter 21: Lipid Metabolism
Chapter 23: The Metabolism of Nitrogen

Review Material
At the end of this course and after reviewing the reading and review material you should be able to:

1. Cholesterol Metabolism
Describe the properties of cholesterol
Describe the *essential* elements of cholesterol synthesis
Describe the *essential* elements of cholesterol regulation
Describe the mode of action of the statins
Describe the essential elements of the synthesis of bile salts and their physical properties
Describe the enterohepatic circulation
Describe the essential elements of hypercholesteroemia
Describe the essential elements of cholelithiasis

2. Steroids
Provide a brief overview of steroid synthesis mechanism and metabolism

3. Plasma Lipoproteins
Describe the physical properties, composition and structures of the plasma lipoproteins
Describe the function of key apolipoproteins
Outline the metabolism of Chylomicrons
Outline the metabolism of Very Low Density Lipoproteins
Outline the production of LDL from VLDL
Outline the metabolism of Low-density Lipoproteins
Describe the role of endocytosed cholesterol on cellular cholesterol homeostasis
Describe the metabolism of high-density lipoproteins and their role in cholesterol homeostasis
Define hyperchylomicronemia

4. Amino Acids as a Nitrogen Source
List the essential and nonessential amino acids
Describe how body and dietary proteins are utilized to assimilate amino acids
List the proteolytic enzymes involved in protein digestion
Explain the specificity and mechanism of activation of the proteolytic enzymes
Correlate some clinical problems with abnormal protein digestion and amino acid absorption
Define nitrogen Balance
Describe Hartnup Disorder, Cystinuria, Cystic Fibrosis and Kwashiorkor

5. Ammonia
Describe the properties of ammonia

Describe the biosynthesis of ammonia
Describe how ammonia is converted into amino acids
Describe the roles of glutamate dehydrogenase and glutamine synthase
Describe transamination reactions
Define the mechanism of pyridoxal phosphate (PLP) in transamination reactions
Describe the role of glutamate in urea production
Describe the conversion of ammonia from glutamate and glutamine
List sources of ammonia
Describe hyperammonemia
Describe the pathophysiology of hyperammonemia and the neurotoxicity associated with ammonia

6. Urea cycle
Describe the Urea Cycle
Describe mechanisms of short-term regulation of the Urea Cycle
Describe the role of carbamoyl phosphate synthetase I (CPSI)
Describe mechanisms of long-term regulation of the Urea Cycle
Describe Urea Cycle defects (UCDs)

7. Metabolism, biosynthesis and uses of amino acids
Provide a metabolic classification of amino acids
Outline how amino acids are metabolized
Describe the glucose/alanine cycle in muscle
Discuss Lysine
Describe Phenylketonuria, Alcaptonuria, Histidemia and Maple Syrup Syndrome
Outline the biosynthesis of nonessential amino acids
Describe the diagnostic value of transaminases
Describe a treatment for Leukemia
Describe the synthesis of Histamine, Serotonin, Catecholamines, Acetylcholine, GABA and Thyroxine (T_4)

Learning Objectives to Dr. Lee's Section:

Reading Material (Selected from the chapters below)
Chapter 9: Nucleic Acids
Chapter 10: DNA Replication
Chapter 11: Transcription

Upon successful completion of this portion of the course, students should be able to:

1. Nucleic Acid Structures
*Define bases, nucleosides, nucleotides, DNA, and RNA
*Draw the structures of: A/T/C/G/5-MeC/ribose/2'-deoxyribose/G:C and A:T base pairings
*Outline the nature of the DNA double helix
*Explain the concept of base complementarities
*Explain Watson-Crick and Hoogsteen base parings
*Describe various double helical DNA structures
*Describe forces stabilizing nucleic acid structures
*Discuss the denaturation and annealing of DNA
*Explain how supercoiling takes place in eukaryotic DNA
*Explain the function of topoisomerases
*Describe the mechanism of action of camptothecin, a topoisomerase inhibitor

2. Nucleotide Metabolism
*Define the de novo pathways and the salvage pathways
*Describe de novo synthesis of purine ribonucleotides

*Describe the purine salvage pathway
*Describe biosynthesis of pyrimidine ribonucleotides
*Describe the formation of deoxyribonucleotides
*Describe the function of ribonucleotide reductase
*Outline the nucleotide degradation
*Describe biosynthesis of nucleotide coenzymes
*Describe the catalytic mechanism of thymidylate synthase
*Explain the mechanism of action of 5-FU

3. DNA replication
*Outline fundamental rules of DNA replication
*Describe the role of DNA polymerases in DNA synthesis
*Discuss how DNA replication proceeds accurately
*List and describe the functions of proteins required in DNA replication
*Describe the mechanism of DNA ligase reaction
*Describe the role of hemi-methylation in DNA replication

4. DNA Repair
*Discuss the types of DNA damage
*List DNA damaging agents
*Discuss why DNA damages can cause mutations
*Describe the fates of oxidative, alkylative, and deaminative DNA damages
*Describe base-excision repair
*Describe nucleotide-excision repair
*Describe direct repair
*Describe mismatch repair
*Outline the role of DNA glycosylases, endonucleases, ligases, and polymerases in DNA repair

5. Transcription and Its Regulation
*How do transcription and DNA synthesis differ? How are they the same?
*What descriptors are used to refer to the DNA strand that is copied in transcription? The other DNA strand?
*How are transcribed regions of DNA recognized in prokaryotes? In eukaryotes?
*What is the function of the sigma factor in prokaryote RNA polymerase? What carries out the corresponding function in eukaryotes?
*What sub-unit of the prokaryote RNA polymerase is targeted by rifamicin and analogs?
*What distinguishes constitutive and regulated gene expression?
*What is an operon? Be able to sketch out the *lac* operon and describe how it functions.
*What are transcriptional repressors and activators?
*How does Transcription terminate in prokaryotes? In eukaryotes?
*What structural features allow regulatory proteins to recognize DNA? To recognize each other?
*How does the organization of eukaryotic DNA affect the way it is transcribed?
*How do DNA and histone modifications regulate transcription?