



Department of Chemistry at

Lehman College City

University of New York

Biochemistry, CHE 446, Syllabus, Spring 2019

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Class Meetings: Tuesday and Thursday from 5:30pm to 6:50 pm, Davis Hall 337.

Office: Davis Hall 318: Tuesdays and Thursdays after lab class or Saturday starting at 12:30 pm.

The required textbook:

David L. Nelson • Michael M. Cox; Lehninger, Principles of Biochemistry, 4e, 5e, 6e, 7e-any of these editions are OK.

The Following are the recommended textbooks:

- *Biochemistry a Short Course, Second Edition, John L. Tymoczko, Jeremy M. Berg and Lubert Stryer*
- *Biochemistry – The molecular basis of life McKee and McKee 3rd or 4th Edition*
- *Lippincott's Illustrated reviews: Biochemistry Denise R. Ferrier*
- Or the following On Line resource: <http://www.ncbi.nlm.nih.gov/books/NBK21154/>

Website resources required:

http://courses.bfwpub.com/help/lehninger6e/Student/QuickStarts/lehninger6e_UserGuide.pdf

<http://www.ncbi.nlm.nih.gov/books/NBK21154/>

http://proteopedia.org/wiki/index.php/Main_Page

Other recommended Websites for Biochemistry ebooks:

Biochemistry, 2e by Reginald Garrett and Charles Grisham - Brooks Cole.

<http://www.web.virginia.edu/Heidi/home.htm>

The Structures of Life- National Institutes of Health, 2007

<http://publications.nigms.nih.gov/structlife/>

PROTEIN DATA BANK (PDB): <http://www.rcsb.org/pdb/home/home.do>;

The Structural Biology Knowledgebase: <http://sbkb.org/>

<http://www.elmhurst.edu/~chm/vchembook/5900verviewmet.html>

BRENDA: <http://www.brenda-enzymes.org/>

Course Description: This is a one-semester course in biochemistry covering all major metabolic pathways (catabolism and anabolism), integration of metabolism, DNA replication, repair and recombination, transcription and translation, gene expressions and regulation. Additional metabolic pathways specific for each organ and tissue in mammalian organisms will also be presented, including the action of hormones that regulate fuel metabolism; biochemistry of erythrocytes and other blood cells; liver metabolism; metabolism of the muscle cell at rest and during exercise; metabolism of the nervous system; extra-cellular matrix and connective tissue and blood coagulation and fibrinolysis. Most of the material is presented in formal lectures in conjunction with problem sets, ON-LINE access to different databases such as Protein Data Bank (PDB), Nucleic Acids Databank (NDB), NCBI and all metabolic pathways related databases:

Human Metabolome Database (HMD): <http://www.hmdb.ca>,

Small Molecule Pathway Database: <http://smpdb.ca>,

KEGG PATHWAY: <http://www.genome.jp/kegg/pathway.html>,

MetaCyc Metabolic Pathway Database: <https://metacyc.org/>;

International Union of Biochemistry and Molecular Biology on the Nomenclature and Classification of Enzymes by the Reactions they Catalyze.

<http://web.expasy.org/pathways/>

<http://enzyme.expasy.org/>

<http://prosite.expasy.org/>

https://cgap.nci.nih.gov/Pathways/BioCarta_Pathways

II. COURSE REQUIREMENTS AND GRADING

REQUIRED HOME WORK:

Sapling homework assessment for each work will be based on the material covered in-class.

Homework assignment will be averaged with 3 midterms and then with the final exam.

!!! The Sapling registration provides you with the ebook of Lehninger, independent than the one provided by the Bookstore at Lehman College.

How to set-up your Sapling account:

Students:

1. Go to <http://saplinglearning.com> and click on your country ("US Higher Ed" or "Canada") at the top right.

2a. If you already have a Sapling Learning account, log in and skip to step 3.

- 2b. If you have Facebook account, you can use it to quickly create a Sapling Learning account. Click the blue button with the Facebook symbol on it (just to the left of the username field). The form will auto-fill with information from your Facebook account (you may need to log into Facebook in the popup window first). Choose a password and timezone, accept the site policy agreement, and click "Create my new account". You can then skip to step 3.
- 2c. Otherwise, click the "Create an Account" link. Supply the requested information and click "Create My Account". Check your email (and spam filter) for a message from Sapling Learning and click on the link provided in that email.
3. Find your course in the list (you may need to expand the subject and term categories) and click the link.
4. If your course requires a key code, you will be prompted to enter it.
5. If your course requires payment, select a payment option and following the remaining instructions. Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments. During sign up or throughout the term, if you have any technical problems or grading issues, send an email to support@saplinglearning.com explaining the issue. The Sapling Learning support team is almost always faster and better able to resolve issues than your instructor.

EXAMS:

For this class there will be 3 mid-session assessments and a final exam that will contain both multiple choice and longer questions. The final grade will be established as follows:

Mid Term Exam 1	15%
Mid Term Exam 2	15%
Mid Term Exam 3	15%
Sapling Homework	20%
Final exam (has questions from midterm 1-3 and new material)	20%
Term Paper	15%
Due date: May 25th 2018	

The subject of the term paper will be posted on Blackboard during the first week of classes. No make-up exams will be given.

CHE 446 course objectives:

After successfully completing Biochemistry II (CHE 446) the student should be able to:

1. Comprehend fundamental concepts of biochemical energetics and metabolic pathways with a focus on the interactive nature of biological systems.
2. Explain how the metabolism of glucose leads ultimately to the generation of large quantities of ATP.
3. Describe how fats, nucleotides and amino acids are metabolized, and explain how they can be used for fuel.
4. Describe the structure of DNA, and explain how it carries genetic information in its base sequence.
5. Describe DNA replication.
6. Describe RNA and protein synthesis.

7. Explain how protein synthesis can be controlled at the level of transcription and translation.
8. Summarize what is currently known about the biochemical basis of cancer.
9. Explain the molecular signaling pathways.
10. Explain the molecular biology of cell division and development, cell motility and immune defense.

Key Topics

Weeks 1-4: Review of major metabolic pathways and organic chemistry mechanisms of biochemical reactions (handouts on blackboard).

Chapters 13, 14, 15: Cellular regulation of metabolism, bioenergetics and glucose metabolism: glycolysis, gluconeogenesis, glycogen breakdown and synthesis; pentose-phosphate pathway.

Review: biological membranes and signal transduction pathways (from Chem 444).

Week 4: Midterm I (1 hour 15 min hours exam) (chapters 13-15 and selected topics from biological membranes and signal transduction pathways).

Weeks 5-8:

Citric acid (TCA) cycle: Chap. 16: emphasis will be on the organic chemical transformations, and the molecular mechanisms of enzymes regulation: chemical modifications and allosteric control; anaplerotic reactions of TCA.

Lipid catabolism and biosynthesis Chap. 17 and 21: fatty acids ketone bodies and triacylglycerols (TAG) metabolism of phospholipids, glycosphingolipids and eicosanoid metabolism; cholesterol, lipoprotein and steroid metabolism.

Week 8: Midterm II (1 hour 15 min hours exam) (chapters 16, 17 and 21)

Weeks 9-10:

Introduction to "Nitrogen Metabolism. Amino Acids Metabolism: Catabolism and Biosynthesis. Chap. 18: emphasis will be on the organic chemical transformations, structure-function of the enzymes involved and their molecular mechanisms of regulation: chemical modifications and allosteric control.

Electron Transport Chain (ETC) and oxidative phosphorylation: Chap. 19: emphasis will be on structure-function of the proteins involved in the ETC and ATP synthesis, chemiosmotic theory and respiratory control of the oxidative phosphorylation; thermodynamic of the electron transport reactions and ATP synthesis by F₁F_o ATP synthase.

Weeks 11-12:

Nitrogen Assimilation, Biosynthetic Use, and Excretion & Introduction to "Nucleotides Metabolism".

Purines and Pyrimidines Metabolism: Chap. 22.

Integration of Metabolism: Metabolic Effects of Insulin and Glucagon: Integration of Metabolism:

Vitamins: The feed and fast cycle. Chap. 23.

Week 12: Midterm III (1 hour 15 min hours exam) (chapters 18,19,22 and 23). No questions from chapter 20.

Weeks 13-14:

Gene and Chromosomes and the replication and transcription: DNA metabolism: Chap. 24, 25:***selected topics and subchapters.***

Translation, Protein Synthesis and Degradation (Protein turn-over): Chap.26, 27. ***selected topics and subchapters.***

Regulation of Gene Expression and Cancer Biology: Biotechnology and Human Diseases:

Chap. 28. ***selected topics and subchapters.***

Final Exam: 3 hour exam: Chapters 24-28 (selected subchapters when indicated) and selected questions from midterms 1-3.

Grading: Each student is required to take three one-hour &15 min examinations and one three hour final exam in addition to completing the term paper and the Sapling homework.

Grade Assignments:

100%-92% = A; 91.9%-85% =A-; 84.9%-78% = B+; 77.9%-73% = B; 72.9%-69% = B-

68.9%-63% = C+; 62.9%-58% = C; 57.9%-52% =C-; 51.9%-45% = D; Below 45% = F