

MCDB S300: Biochemistry
(BIOL S300/MB&B S200)
Yale Summer Session B

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Class Meeting: MWF 9.00-11.15; 7/12/21 - 8/13/2021
Office Hours: After class, and by appointment (on Zoom)

This course will feature live class discussion. Students must attend during class time, and must have a web cam. Students will be participating in group activities, answering and asking questions, and presenting live. Technical requirements are detailed at:
<https://summer.yale.edu/academics/important-information-summer-online>

CATALOG DESCRIPTION: An introduction to the biochemistry of animals, plants, and microorganisms, emphasizing the relations of chemical principles and structure to the evolution and regulation of living systems.

Prerequisites: BIOL 101 or equivalent performance on the corresponding biological sciences placement examination; AND one term of organic chemistry.

GOALS: Students will: know the structures, chemical features and biological roles of the principal classes of biomolecules in life: amino acids, proteins, carbohydrates, DNA, RNA, and lipids, as well as the roles of these biological molecules in living cells.

-develop an understanding of the principles of chemical and enzyme kinetics, including types of enzyme inhibition in sufficient depth to identify kinetic types of inhibition from primary data.

- develop an understanding of the fundamentals of biochemical thermodynamics including the principles of chemical equilibrium and coupled reactions.

- develop an understanding of the structure of biological membranes and establish the structure-and-function relationship of membrane transport processes.

-know the key reactions of major metabolic pathways and be able to analyze their regulation: Glycolysis/Gluconeogenesis, Citric Acid Cycle, Respiratory and Photosynthetic Electron Transport, the Urea Cycle and Fatty Acid Metabolism and transport.

TEXTS: Biochemistry, 9th Edition, by Jeremy Berg, John Tymoczko, Gregory Gatto, and Lubert Stryer (W.H. Freeman and Co.). An ebook is available from the publisher, if you prefer that format. Older editions are acceptable--the text is a valuable reference for the class.

Other readings and videos will be posted online.

CLASS DYNAMICS:

1) Narrated Powerpoint video lectures will be viewed by students at home before the class session. Students will test their comprehension with online problem sets.

2) Students prepare for discussion of scientific papers by use of the Perusall tool, and collaboratively annotate a publication.

3) In-class time is devoted to answering student questions, clarifying misunderstandings, advanced problem-solving exercises, and paper discussions

ASSESSMENT:

Canvas Problem Sets: 20% Each unit will have an associated problem set posted on Canvas. Due dates are listed below and on Canvas.

Perusall paper annotation: 20% Perusall is a free online tool (<https://perusall.com/>). Students will annotate selections from the scientific literature and asynchronously respond to each other's comments and questions in context. Student reports will be the basis for in-class discussions. Perusall grades on a scale of 1-3 on the depth and quality of your annotations, with a 3 reflecting a high A. Grades will be holistically considered, and reported on Canvas for each unit.

Midterm Exam: 25% ; Administered on Canvas on 7/28/21

Cumulative Final: 35% ; Administered on Canvas on 8/13/21

Academic Integrity: Students are expected to read and understand “Appendix A” as outlined in the Yale Summer Session Handbook. A student violating the terms outline Appendix A of the Yale summer session handbook in any assignment, test, or examination in this class will receive a minimum penalty of a zero (0) for that exam, quiz or assignment, and may receive a grade of "F" for the course at the discretion of the instructors, following the procedures and policies of the YSS handbook.

All students will conform to Yale policies regarding inclusion and respect in the classroom.

Zoom session will be recorded. Students may not share these sessions or any other course materials with those not in the class, or upload or distribute them via or to any other online environment. Doing so would be a breach of the Academic Integrity Policy and, in some cases, a violation of the Family Educational Rights and Privacy Act (FERPA), a federal law governing privacy and students’ academic records.

Preliminary Schedule

Please note that below is a tentative schedule of topics that will be covered. Topics are categorized into 5 distinct units, and relevant chapter readings are indicated. **Daily details and due dates can be viewed in the unit modules on canvas.** Textbook readings and pre-recorded lectures should be viewed before class. Alterations to the schedule may be made based on the progress of the students and unforeseen circumstances. This is a general plan, schedule changes will be announced in class, via email and on Canvas.

WEEK 1:

Principles of Biochemistry (water, pH, thermodynamics (Chp. 1)
Amino Acids, Protein Structure, Protein Folding (Chp. 2)
Protein synthesis and degradation (Chp. 30, selections from Chp. 23)
Hemoglobin (Chp. 7)
Basic Concepts of Enzyme Action/Inhibitors/Drug Design (Chp. 8, 28)
Due: Problem Set 1 ; Perusall paper 1

WEEK 2:

Enzyme mechanisms (Chp. 9)
Enzyme Regulation (Chp. 10)
Nucleic acids (Chp. 4)
Replication and repair of DNA (Chp. 28)
Synthesis of RNA (Chp. 29).
Due: Problem Set 2; Perusall paper 2, 3

WEEK 3:

Carbohydrates: (Chp. 11)
Lipids, Membranes: (Chp. 12)
Membrane Channels and Pumps (Chp. 13)
Signal Transduction (Chp. 14)
Due: Problem Set 3 ; Perusall paper 4
Midterm Exam: 7/28 on Blackboard during class time ; Covers through Nucleic Acids (Chp 29).

WEEK 4:

Metabolism: Basic Concepts and Design (Chp. 15)
Glycolysis/Gluconeogenesis (Chp. 16)
Glycogen metabolism (Chp. 21)
Citric Acid Cycle (Chp. 17)
Mitochondrial Electron Transport Chain and ATP Synthesis (Chp. 18)
Photosynthesis: Light reactions (Chp. 19)
Due: Problem Set 4; Perusall paper 5,6

WEEK 5:

The Calvin Cycle/ Pentose Phosphate Pathway (Chp. 20)
Fatty Acid Degradation /Fatty Acid Synthesis / Ketone body synthesis (Chp. 22, 26)
Cholesterol synthesis and Lipid Transport (Chp. 26)
Urea Cycle (Chp. 23), key cofactors in amino acid and nucleotide metabolism
Metabolism: Integration (Chp. 27)
Due: Problem Set 5; Perusall paper 7
Final Exam: 8/13 on Blackboard during class time; Comprehensive (all topics weighted evenly)