Chemistry 562
Intermediary Metabolism
Spring 2017

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Course time: 11:00-11:50 a.m., Mon. & Wed., GMCS 314

Office hours: 12:00-1:00 p.m. Monday; 8:30-10:00 a.m. Tuesday, OR
Call or e-mail to make an appointment, OR
Drop by my office or lab (CSL 325)

D. Voet, J. Voet & C.W. Pratt (John Wiley & Sons, Inc.)
Note: You may also use the old Third Edition (2008)

The course:

Prerequisites- General Biochemistry (Chem 560) OR Biochemistry, Cell & Molecular Biology I (Chem 365)

Course description-This is one of three upper division biochemistry lecture courses, with Chem 563 (Nucleic Acid Function and Protein Synthesis) and Chem 564 (Receptor Biochemistry and Protein Modification), that complete an advanced undergraduate education in biochemistry. Metabolism refers to the complete set of chemical reactions that sustain life. Metabolism begins with the extraction of energy from environmental sources such as sunlight and reduced organic compounds and its conversion to more useful chemical forms such as ATP and the reductive potential of NADH and NADPH. It also encompasses all of the synthetic processes required to build up and maintain a cell (anabolism) as well as the breakdown of complex cellular structures into simpler biomolecules (catabolism). The entire process is highly regulated. Therefore, metabolism resides at the interface between organic chemistry, physical chemistry (thermodynamics and energy transfer), and enzymology. The goal of this course is to provide advanced students of biochemistry with a detailed understanding of the fundamental biochemistry that supports all living things. Students with an interest in pharmaceuticals and medicine will gain an understanding of the biochemical processes that underly metabolic diseases.
Expected student learning objectives-
Each student who successfully completes this course will be able to:

(i) show familiarity with the global concepts of metabolism and its regulation, homeostasis, and organ specialization
(ii) express in chemical detail the core metabolic pathways of glycolysis, the citric acid cycle, and electron transport/oxidative phosphorylation;
(iii) describe in chemical detail the light and dark reactions of photosynthesis;
(iv) detail the anabolic and catabolic processes that regulate the synthesis and breakdown of fatty acids

Please note-To be successful in this course, you must develop a working familiarity with a vast amount of material. Be prepared to dedicate sufficient time each week to stay current with your reading and studying. You will need to read an average of 15-30 pages of text each week. However, not all of the chapters will be covered in their entirety. Please consult the “Reading” column in the lecture schedule on pages 3 and 4 of this syllabus to identify chapter pages from which exam material will be taken.

Resources available to students-The text is the primary resource for this course. Lectures will closely follow the sequence and organization of the textbook. A short list of “lecture goals” will be highlighted at the beginning of each lecture. The purpose of outlining the lecture goals is to aid students in studying for exams. The slides used in lectures will be posted to the Blackboard site at least 24 hours prior to lecture. This is to aid students in note taking and reinforce the lecture goals during study. Make good use of office hours to ask questions about material you find confusing before you encounter it on your exam.

Homework-There will be nine graded homework assignments. These will be posted regularly to the Blackboard site. The purpose of these problem sets is to help students think critically about the material and prepare for exams. You are encouraged to work together in groups and it is also highly recommended that students bring questions that arise while working on these problems to office hours.

Exams and grading-There will be nine homework assignments, two mid-term exams, and a cumulative final. The point distribution is as follows:

Homework assignments 1-9 (you are encouraged to work together in groups) 10 points each plus 10 points for turning in all nine assignments, 100 points total

Mid-term exams 1 and 2 (50 min) 100 points each, 200 points total

Final exam (120 min) 150 points—the final exam is cumulative.

Total 450 points
## SCHEDULE

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic (Lecture number)</th>
<th>Reading</th>
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<tbody>
<tr>
<td>Jan 18</td>
<td>Introduction&lt;br&gt;Overview of metabolism (1)</td>
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<tr>
<td>Jan 23</td>
<td>“High-energy” compounds (2)</td>
<td>Ch. 14 (436-456)</td>
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<td>Jan 25</td>
<td>Oxidation-reduction reactions (3)</td>
<td>Ch. 14 (456-461)</td>
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<td>Jan 30</td>
<td>Experimental approaches to the study of metabolism (4)</td>
<td>Ch. 14 (462-468)</td>
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<td><strong>Homework #1 due</strong></td>
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<tr>
<td>Feb 1</td>
<td>The reactions of glycolysis: Phase I (5)</td>
<td>Ch. 15 (472-482)</td>
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<td>Feb 6</td>
<td>The reactions of glycolysis: Phase II (6)</td>
<td>Ch. 15 (483-491)</td>
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<td><strong>Homework #2 due</strong></td>
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<td>Feb 8</td>
<td>Glycolysis: fermentation and regulation (7)</td>
<td>Ch. 15 (491-501)</td>
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<td>Feb 13</td>
<td>Metabolism of alternative hexoses&lt;br&gt;The pentose-phosphate pathway (8)</td>
<td>Ch. 15 (502-513)</td>
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<td>Feb 15</td>
<td>Catch up/Review&lt;br&gt;<strong>Homework #3 due</strong></td>
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<td>Feb 20</td>
<td><strong>Exam 1 (Lectures 1-8)</strong></td>
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<td>Feb 22</td>
<td>Breakdown and synthesis of glycogen (9)</td>
<td>Ch. 16 (517-530)</td>
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<td>Feb 27</td>
<td>Regulation of glycogen metabolism (10)</td>
<td>Ch. 16 (530-538)</td>
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<td>Mar 1</td>
<td>Gluconeogenesis (11)</td>
<td>Ch. 16 (538-545)</td>
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<td>Mar 6</td>
<td>Generation of Acetyl-CoA (12)&lt;br&gt;<strong>Homework #4 due</strong></td>
<td>Ch. 17 (551-560)</td>
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<td>Mar 8</td>
<td>The citric acid cycle (13)</td>
<td>Ch. 17 (560-568)</td>
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<tr>
<td>Mar 13</td>
<td>Regulation of the citric acid cycle (14)&lt;br&gt;<strong>Homework #5 due</strong></td>
<td>Ch. 17 (568-574)</td>
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Mar 15  Mitochondria and electron transport (15)   Ch. 18 (581-603)
Mar 20  Oxidative phosphorylation (16)   Ch. 18 (603-614)
Mar 22  Exam 2 (Lectures 9-14)
       Homework #6 due
Mar 27  NO CLASS — SPRING RECESS
Mar 29  NO CLASS — SPRING RECESS
Apr  3  Photosynthesis: chloroplasts and prokaryotic photosystems (17)   Ch. 19 (623-628)
Apr  5  Photosynthesis: the light reactions (18)   Ch. 19 (628-643)
Apr 10  Photosynthesis: the dark reactions (19)
       Homework #7 due
Apr 12  Lipid digestion, absorption, and transport (20)   Ch. 20 (657-664)
Apr 17  Fatty acid oxidation (21)
       Homework #8 due
Apr 19  Fatty acid biosynthesis (22)   Ch. 20 (680-691)
Apr 24  Protein degradation (23)   Ch. 21 (712-718)
Apr 26  Amino acid deamination
       The urea cycle (24)
       Homework #9 due
May  1  Organ specialization (25)   Ch. 22 (791-799)
May  3  Catch up/Review
May  8  Final exam (Lectures 1-25)
       10:30 a.m. - 12:30 p.m.
       GMCS 314