

**Fall 2015:** MCB C100A / Chem C130 ***Biophysical Chemistry: The Molecules of Life***  
Instructors: John Kuriyan and David Savage  
Lecture Schedule and Course Outline

Textbook for the course:

**"The Molecules of Life"** by Kuriyan, Konforti & Wemmer (Garland Publishing)

**Updated 10/05/15 - DFS.**

Changes include update to lecture schedule and splitting of PS8 into PS8A and PS8B.

|    | Date                    | Lecturer | Topic   | Textbook Reading                                  |
|----|-------------------------|----------|---|---|
| 1  | August 27, Thursday     | JK-1     | The genetic code. Introduction to protein and DNA structure. Qualitative description of intermolecular forces.  | Chapter 1   |
| 2  | September 1, Tuesday    | JK-2     | Principles of protein structure. How secondary structures form. Structural motifs of soluble proteins. Lipids and membrane proteins. Domain architecture of proteins. | Chapter 4<br><br><b>Problem Set PS 1 due, 9/3</b> |
| 3  | September 3, Thursday   | JK-3     |   |   |
| 4  | September 8, Tuesday    | JK-4     | Continue protein structure. Sequence-structure comparisons. Diversity in protein structure.   | Chapter 4   |
| 5  | September 10, Thursday  | JK-5     | BLOSUM matrix and evolution of proteins   | Chapter 5<br><b>PS 2 due</b>                      |
| 6  | September 15, Tuesday   | DS-1     | Principles of nucleic acid structure. Various forms of the double helix. Base pairing. RNA folds. Introduction to carbohydrates.                                      | Chapter 2<br>Chapter 3<br><br><b>PS 3 due</b>     |
| 7  | September 17, Thursday  | DS-2     |   |   |
| 8  | September 22, Tuesday   | JK-6     | Purification of biological molecules. Start discussion of energy.   | Chapter 6.  |
| -  | September 23, Wednesday | -        | <b>MIDTERM 1 (evening)<br/>7 - 9 PM in 1 Pimentel</b>   | <b>PS 4 due at start of exam. 9/23</b>            |
| 9  | September 24, Thursday  | JK-7     | Energy. The first law of thermodynamics.  | Chapter 6   |
| 10 | September 29 Tuesday    | JK-8     | Heat capacity. Introduction to the Boltzmann Distribution. Molecular Energy function  | Chapter 6   |
| 11 | October 1 Thursday      | JK-9     | Entropy. Calculation of multiplicity of coin tosses. Entropy is the logarithm of the multiplicity. The second law of thermodynamics.                                  | Chapter 7   |
| 12 | October 6, Tuesday      | JK-10    | Energy Levels and Entropy.  | Chapter 8   |

|    | Date                   | Lecturer | Topic  | Textbook Reading                            |
|----|------------------------|----------|--|---|
| 13 | October 8, Thursday    | JK-11    | More on the Boltzmann Distribution. Temperature and heat flow.                                 | <b>PS 5 due</b>                             |
| 14 | October 13, Tuesday    | JK-12    | Free Energy, predicting spontaneous reactions, relationship to work                            | Chapter 9<br>Section A,B                    |
| 15 | October 15, Thursday   | DS-3     | Free Energy and Chemical Potential, concentration dependence, equilibrium                      | Chapter 9C<br>Chapter 10<br><b>PS 6 Due</b> |
| 16 | October 20, Tuesday    | DS-4     | Equilibria, temperature dependence, acid/base equilibria                                       | Chapter 10                                  |
| ** | October 21, Wednesday  | -        | <b>MIDTERM 2 (evening)</b><br>7 - 9 PM in 1 Pimentel   | <b>PS 7 due at start of exam. 10/21</b>     |
| 17 | October 22, Thursday   | DS-5     | Equilibria and protein folding, continued.   | Chapter 10                                  |
| 18 | October 27, Tuesday    | DS-6     | Chemical Kinetics, rate laws, time dependence of concentrations                                | Chapter 15                                  |
| 19 | October 29, Thursday   | DS-7     | Chemical Kinetics, complex mechanisms, factors determining rates, activation energy, catalysis | Chapter 15<br><b>PS 8A Due</b>              |
| 20 | November 3, Tuesday    | JK-13    | Ligand Binding, importance in drug-target interactions   | Chapter 12                                  |
| 21 | November 5, Thursday   | JK-14    | Allostery  | Chapter 14<br><b>PS 8B Due</b>              |
| 22 | November 10, Tuesday   | DS-8     | Enzyme Kinetics, the Michaelis Menten model  | Chapter 16                                  |
| 23 | November 12, Thursday  | DS-9     | Enzyme kinetics, continued.  |   |
| 24 | November 17, Tuesday   | DS-10    | Enzyme mechanisms, cooperativity, inhibition   | Chapter 16                                  |
| ** | November 18, Wednesday | -        | <b>MIDTERM 3 (evening)</b><br>7 - 9 PM in 1 Pimentel   | <b>PS 9 Due at start of exam 11/18</b>      |

|         | Date                     | Lecturer     | Topic   | Textbook Reading               |
|---------|--------------------------|--------------|---|--------------------------------|
| 25      | November 19,<br>Thursday | DS-11        | Oxidation-reduction reactions,<br>electrochemical measurements    | Chapter 11                     |
| 26      | November 24,<br>Tuesday  | DS-12        | Concentration gradients, membrane<br>potentials and free energy   | Chapter 11                     |
| -       | November 27              | --           | Thanksgiving break  |                                |
| 27      | December 1,<br>Tuesday   | DS-13        | Membrane and Gradients Continued /<br>Fidelity of DNA replication | Chapter 11<br>Chapter 19       |
| 28      | December 3,<br>Thursday  | DS-14        | Fidelity of DNA replication                                       | Chapter 19<br><b>PS 10 Due</b> |
| **<br>* | December 15,<br>Tuesday  | 8 - 11<br>AM | <b>FINAL EXAMINATION<br/>(comprehensive); location TBA</b>        | full course<br>reading         |