Biochemistry III CHEM 3813
Nucleic Acids

[Spring 2015]

Instructor Dr. Michael Swanson
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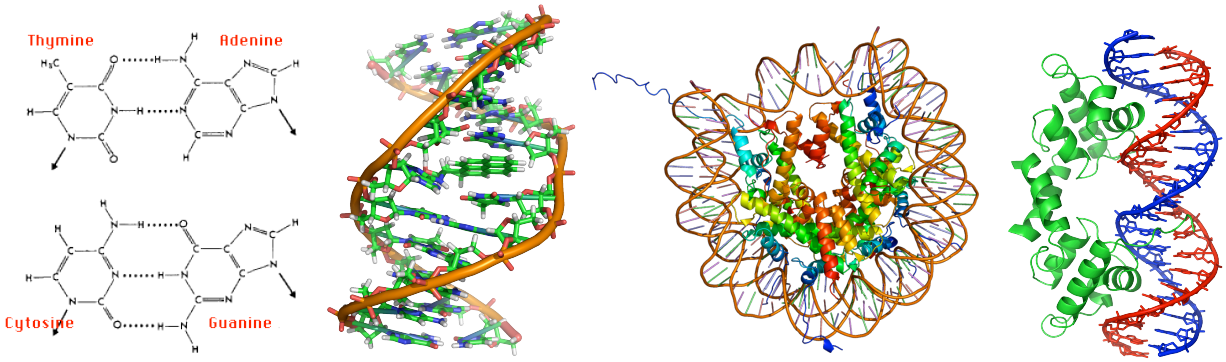
Class Lectures: MWF 8:00 – 8:50a; Boettcher 102
Office Hours: Before and after class by appointment (MWF: 7:30-8:00a and 9:00-9:30a)



When you eat an apple, how do your cells know how to digest the sugars that you eat? The information for this process, and all other cellular processes, are stored in your genetic code. The genetic code is made up of long polymers of nucleic acids. Nucleic acids are used by cells to store information (DNA) or to translate this information into the molecular machinery needed by the cell (RNA→ Proteins). In this class we will investigate the structures of nucleic acids and how they can be used to store information. We will study how information is replicated when cells multiply and how information can be turned into working proteins that are required for the cell to function. Near the end of the quarter, we will discuss how the expression of genes is controlled by the cell as well as the emerging field of epigenetics.

COURSE OBJECTIVES

Some of the important concepts we will be covering in this class:

- Chemical Structures of Nucleic Acids
- Modern DNA Technologies
- The Central Dogma of Molecular Biology
  - DNA Replication
  - DNA Transcription
  - RNA Translation
- Gene Regulation
- Introduction to Epigenetics

REQUIRED COURSE ITEMS

Textbook: Lehninger Principles of Biochemistry, 6th (5th or 4th) Edition, Nelson and Cox, Freeman and Company, 2008

Calculator: An inexpensive calculator that has the capabilities for square roots, logarithms, and (exponential) scientific notation operations. The calculator will be used for homework, quizzes, and exams.

READING. Assigned reading is listed in the tentative lecture schedule below. Reading should be completed prior to class. Important concepts from readings will be highlighted during lectures.

HOMEWORK. Practicing problems is very helpful in the mastery of chemical/biochemical concepts. Therefore, homework problems will be assigned throughout the quarter. Problems will be assigned primarily from the end of chapter questions in the text. These homework problems are voluntary and will not be graded**.** An initial list of homework problems is given below.

EXAMS. There will be two (2) one-hour exams given during the quarter and a two-hour, cumulative final exam. Dates for these exams are posted below on the lecture schedule. **NO MAKE-UP EXAMS WILL BE ACCEPTED**. There is one exception to this policy. If you will be out of town for a University sanctioned function (e.g., athletic team or music group), you are responsible for making arrangements with Dr. Swanson at least one week in advance to complete the exam prior to the scheduled date.

GRADES. Final grades will be determined according to relative positions and overall class performance. There will be a maximum of 550 points (600 for graduate students) for the course:

Component	Points
Hour Exams (150 points each)	300
Final Exam	200
Total Points	**500**

LECTURE AND TESTING ACCOMODATIONS. Every effort will be made, in complete confindence, to accommodate students diagnosed with a learning disability. Any student requiring these accommodations should inform Dr. Swanson the first week of class. For further information, please see DU's Disability Services' website at http://www.du.edu/disability/dsp/index.html.

ACADEMIC DISHONESTY. Collaborative learning and teamwork are very important parts of science but cheating of any kind will not be tolerated. **Copying on exams (as *well as any behavior that could be interpreted as copying*) will result in no credit being given on the exam.** Repeated offences will result in failure of the course and possible expulsion from the University. Please refer to the University's honor code: http://www.du.edu/ccs/honorcode.html.

TENATIVE LECTURE SCHEDULE (EXAMS, SPECIAL TOPICS, IN-CLASS ACTIVITIES)

DATE	TOPIC	READING
WEEK 1 – NUCLEOTIDES AND NUCLEIC ACID STRUCTURE		
Mar 21	Class Introduction	
23	Snow Day	
25	Nucleic Acid Structure	8.1, 8.2

WEEK 2 – DNA-BASED INFORMATION TECHNOLOGIES

28	Nucleic Acid Chemistry	8.3, 8.4
30	Genes and Gene Products	9.1
Apr 1	DNA-Based Technologies	9.2

WEEK 3 – GENES AND CHROMOSOMES

4	Genomics	9.3
6	Chromosomal Elements	24.1
8	DNA Super Coils	24.2

WEEK 4 - DNA METABOLISM

11	Chromosomal Structure	24.3
13	**EXAM 1**	
15	DNA Replication	25.1

WEEK 5 – DNA METABOLISM CONTINUED

18	DNA Replication –Continued-	
20	DNA Repair	25.2
22	DNA Recombination	25.3

WEEK 6 – RNA METABOLISM

25	Transcription	26.1
27	Transcription –Continued-	
29	RNA Processing	26.2

WEEK 7 – PROTEIN METABOLISM

May 2	Reverse Transcription	26.3
4	The Genetic Code	27.1
6	Degenerate Codons and Wobble	

WEEK 8 – PROTEIN METABOLISM CONTINUED

9	Ribosome Structure and Amino Acid Activation	27.2
11	Translation: Initiation, Elongation and Termination	
13	Protein Targeting and Degradation	27.3

WEEK 9 – REGULATION OF GENE EXPRESSION

16	**EXAM 2**	
18	Principles of Gene Regulation	28.1
20	The Lac Operon and Protein-DNA Interactions	

WEEK 10 – SPECIAL TOPICS/OVERFLOW

23	Eukaryotic Gene Regulation	28.2
25	Eukaryotic Gene Regulation –Continued-	28.3
27	**Special Topics / Overflow**	
28	**FINAL EXAM**: **8AM to 9:50AM** (Cumulative)	

HOMEWORK

CHAPTER	**PROBLEM NUMBERS***
8	1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 14, 16, 17, 18
9	1 a-g, 3, 4, 5, 7, 8, 10, 12, optional: 14, 15
24	1, 2, 4, 5, 6, 8, 9, 11, 13, 16
25	1, 2, 3, 5, 6, 8, 9, 10, 11, 13, 16
26	1, 2, 3, 4, 5, 6, 7, 9, 11, 13
27	1, 2, 3, 4, 5, 8, 9a-d, 11, 12, 13, 14, 15, 16, 17, 18
28	2, 3, 6, 7, 10, 11, 12, 13, 14

***Problem numbers are from 6th edition of the text.