

Physical Chemistry of Nucleic Acids
CHM5503 (Fall, 2010)
Syllabus, August 2010

Instructor: Dr.Fenfei Leng, Department of Chemistry and Biochemistry

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Lecture: Monday and Wednesday, 11:00 am-12:15 pm

Classroom: GC275A

Prereq: CHM 4304 or permission of the instructor. Attendance at all lectures and exam is required.

Reference books: *Nucleic Acids: Structures, Properties, and Functions* by Bloomfield, Crothers, and Tinoco (ISBN 0-935702-49-0), *Understanding DNA* by Chris R. Calladine, Horace Drew, Ben Luisi, and Andrew Travers, *DNA Topology* by Andrew D. Bates and Anthony Maxwell, and literatures.

Course Description: CHM 5503 is a core course for graduate students in the Department of Chemistry and Biochemistry. The course will introduce the structures and functions of nucleic acids, thermodynamics, ligand-DNA interactions, DNA topology, and more.

Office hours: Friday (4:00 to 5:00 pm).

Examinations and Grading: There will be one presentation (20%), one proposal (20%), and one comprehensive final exam (30%) toward your final grade. Your attendance at classes and homework (30%) will also contribute to your final grade. If you have questions regarding the grade, please see me immediately.

The instructor's expectations for students during the semester: The students will be responsible for all materials covered in lectures and assigned in the books. The students are expected to read the appropriate materials in the text before each class. The key to success is hard work.

Learning Outcomes: The overall goal of this course is for students to understand the basic principles and properties of nucleic acids. To this end, the following major learning outcomes shall apply:

1. Students will be able to understand structure and function of nucleic acids.
2. Students are expected to understand basic concepts of thermodynamics and conformation changes of nucleic acids.
3. Students will have a basic understanding of ligand-DNA interactions and DNA topology.
4. Students will learn how to write a research proposal.

Tentative lecture and examination schedule:

Presentations (various times)

Proposal due (December 1, 2010)

Comprehensive final exam (November 15, 2010)

Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly to demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.

Tentative Schedule

August 23 (M): Introduction and DNA structures
August 25 (W): DNA structures and conformation
August 30 (M): DNA conformation
September 1 (W): DNA conformation
September 6 (M): Labor Day, no class;
September 8 (W): DNA size, shape, and bending
September 13 (M): Proposal writing: central hypothesis and specific aims
September 15 (W): DNA size, shape, and bending
September 20 (M): DNA supercoiling
September 22 (W): DNA supercoiling
September 27 (M): DNA supercoiling and DNA topoisomerases
September 29 (W): proposal writing: experimental design and writing the section of Background and Significance
October 4 (M): DNA topoisomerases
October 6 (W): Water-DNA interaction
October 11 (M): Water- and ion-DNA interaction
October 13 (W): Drug-DNA interaction
October 18 (M): Drug-DNA interaction
October 20 (W): Drug-DNA interaction
October 25 (M): Protein-DNA interaction
October 27 (W): Protein-DNA interaction
November 1 (M): Protein-DNA interaction
November 3 (W): Chemical and enzymatic methods on nucleic acids
November 8 (M): Chemical and enzymatic methods on nucleic acids
November 10 (W): Review
November 15 (M): comprehensive examination
November 17 (W): Presentation 1
November 22 (M): presentation 2
November 24 (W): presentation 3
November 29 (M): presentation 4
December 1 (W): presentation 5

Proposals and Presentations of Nucleic Acids Class (CHM5503)

Fall Semester, 2010

1. Objectives

The objectives of the proposal writing of this class are: 1. to teach the graduate student how to develop and write a research proposal, 2. engage students in thorough and critical reading of literature papers in the chosen topics of nucleic acids, 3. to initiate the development of presentation skills.

2. The format

The instructor has prepared a list of topics for the proposal writing practice. The students will choose one topic for writing the proposal. After decided the topic, the students will write a five page proposal including a central hypothesis and specific aims (two to three specific aims are recommended). The students will also prepare a PowerPoint presentation to defend their proposal. The following are important dates for the proposal writing:

September 13, decide the topic for the proposal writing;

September 29, finish formulating the central hypothesis and writing the specific aims;

October 18, finishing writing the experimental design;

November 3, finishing writing the section of Background Significance; also finish the whole proposal;

November 10, finishing the preparation of the PowerPoint presentation based on your proposal.

3. Topics for your research proposals for the nucleic acids class:

1. Capillary electrophoresis to study DNA supercoiling;
2. Thermodynamics and kinetics of DNA supercoiling;
3. SELEX studies of lactose repressor and CRP;
4. Design and synthesis of minor groove binding ligands to inhibit HMGA2-DNA interactions or Zinc finger binding proteins-DNA interactions;
5. Atomic force microscope, magnetic tweezer, and optical tweezer to study DNA supercoiling;
6. New techniques to study protein-supercoiled DNA interactions for the sequence specific DNA binding proteins such as lactose repressor and gal repressor;
7. Crystal and NMR structural studies of HMGA2-DNA complexes;
8. The DNA superhelical domains: the role of the DNA binding proteins;
9. The role of the mammalian high mobility group protein AT hook 1 or 2 on the DNA repair

Your own topics related to nucleic acids research.