

BINF740/PHYS630: *Introduction to Biophysics*

Instructor: Dmitri Klimov

Class website: www.binf.gmu.edu/dklimov

Course objective: This graduate course is designed as a broad introduction into the field of biophysics for graduate students with the background in chemistry, physics, computer science, and biology. The goal of the course is to present the concepts of physical chemistry and map their application on a rapidly expanding interdisciplinary interface, combining biology, chemistry, and physics. The course aims to balance the need for rigorous mathematical treatment with the simplicity of presentation.

Course description: The course consists of three parts. The first part introduces students to the fundamental concepts in physical chemistry, which are commonly used in the description of biological systems. Two other parts demonstrate a multiscale nature of biophysics by exploring *macroscopic* and *microscopic* applications. The use of computational approaches is emphasized.

Part I introduces the basic notions of thermodynamics, statistical mechanics, and physical kinetics. Molecular interactions, ranging from covalent bonding to electrostatic and van-der-Waals interactions, are thoroughly discussed. The course then shows how these interactions are combined to produce a complex array of biomolecular structures found in DNA, RNA, and proteins.

Part II describes several important *macroscopic* aspects of biophysics. The energetics of living systems is studied, including energy consumption, photosynthesis, and ATP production. The fundamental role of biomembranes is investigated in detail. Other important topics, such as nerve signals, memory function, biomechanics, hearing, are introduced.

Part III focuses on several important *microscopic* aspects of biophysics. This part reveals the mystery of protein folding and the function of cellular chaperone system assisting proteins to fold. The phenomenon of protein misfolding and aggregation is discussed and linked to a new class of diseases. The unfolding of proteins implicated in variety of biological processes is investigated.

Prerequisites: Students are expected to be familiar with basic concepts of physics, calculus, and biology on undergraduate level.

Grading basis: Students will be graded on the basis of homework (30%), final course paper or final exam (40%), and class participation (30%). Late assignments will not be accepted unless due to emergency or work-related reason (for working students).

Course materials:

1. Rodney Cotterill “Biophysics: An introduction” (for parts I and II of the course)
2. Roland Glaser “Biophysics” (for parts I and II of the course)
3. Online lecture notes (for part III of the course)

Course Time: Thursdays, 4:30 pm - 7:10 pm

Location: Innovation Hall, Room 320, Fairfax Campus

Instructor: Dmitri Klimov
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Office hours: 2-3pm Monday or by appointment

Academic Honesty Policy: Students are expected to follow the Honor Code. Academic dishonesty will not be tolerated in this class. Exams, projects, and homework must reflect individual work. If you have difficulty with the assignments, discuss it with the instructor.

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Resources at 703/993-2474. All academic accommodations must be arranged through that office.