

PHYS-461 & PHYS-561: BIOPHYSICS
Fall Quarter: 21 September — 12 December 2009

Course Objective: *Biophysics* is an interdisciplinary science that employs and develops theories and methods of the physical sciences for the investigation of biological systems. The undergraduate PHYS-461 & graduate PHYS-561 courses are merged into one *introductory* biophysics course on proteins. Currently, protein physics is one of the fastest growing physics research areas that is vital to many other fields, including medicine, bioengineering, and biology. There are two major ways that the protein science is affected by physics: (i) through physical principles underlying molecular interactions and (ii) through development and application of physical methods to studies of proteins.

The topics that will be presented throughout the course include elementary interactions in proteins, secondary structures of peptide chains, role of water environment in protein interactions, protein structures, denaturation, protein folding and assembly. The course will conclude by an introduction to the research topic on folding and assembly of amyloid β -protein relevant to Alzheimer's disease. No biological background is assumed, in fact, among the myriad of protein functions, we will only touch upon the ones absolutely necessary to demonstrate the role of protein spatial structures in their biochemical activities. Basic physics background including elements of thermodynamics, statistical physics, quantum physics principles, and phase transitions will be employed to the degree necessary to understand the protein physics.

The problem assignments will be given every two weeks to both undergraduate and graduate students with extra problems for the latter. Additional problems and reading assignments will be selected for graduate students also on the midterm and final exams.

Course Coordinator: Brigita Urbanc

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Office: Disque 909

Lectures: Tues. & Thur. 11:00am—12:30am (Disque Hall, 12-919)

[Note: first lecture (Tues., 22 Sept. 2009) last lecture (Thur., 3 Dec. 2009)]

Help/Office hours: By appointment: send an e-mail request to brigita@drexel.edu.

Course Textbook:

AUTHORS: Alexei V. Finkelstein and Oleg B. Ptitsyn

TITLE: Protein Physics (A Course of Lectures)

PUBLISHER: Academic Press (An imprint of Elsevier Science)

YEAR: 2002

ISBN: 0-12-256781

Additional Recommended Reading:

[A] Kerson Huang, *Lectures on Statistical Physics and Protein Folding*, World Scientific Publishing Co., 2005 (ISBN: 981-256-143-9).

[B] Thomas E. Creighton, *Proteins: Structures and Molecular Properties*, W.H. Freeman and Company, 2nd Edition, 1993 (ISBN: 0-7167-7030-X).

[C] Bengt Nölting, *Methods in Modern Biophysics*, Springer, 2nd Edition, 2006 (ISBN-13 978-3-540-27703-3).

Course Requirements/Grading Information:

Lecture attendance is obligatory. The course cannot be completed unless all required homework assignments are handed in on time. Graduate students will have to complete also one special topics assignment. The special topics assignment will consist of a 10-minute presentation of a research paper in front of the entire class. There will be no make-up exams. The final letter grade will be based on the total score, obtained from the components described in Table I.

TABLE I: GRADING

Grade Components	Contribution
Assignments	30%
Midterm Exam (1hr)	30%
Final Exam (2hrs)	40%

TABLE II: TENTATIVE SYLLABUS

WEEK	TOPICS / LECTURE #s	HOMEWORK #-DUE	EXAMS
1:	Introduction to Proteins /1-2	N/A	N/A
2:	Van der Waals Ints / Hydrogen bonds / Water /3-4	H1-10/02	N/A
3:	Hydrophobic and Electrostatic Ints /5-6	N/A	N/A
4:	Secondary Structure / Conformational Changes /7-8	H2-10/16	N/A
5:	α -Helices & β -Structures in Water /9-10	N/A	N/A
6:	Fibrous & Membrane Proteins /11-12	H3-10/30	N/A
7:	Globular, α -, & β -Proteins /13-14	N/A	MT-11/05
8:	Classification of Protein Folds /15-16	H4-11/13	N/A
9:	Heat and Cold Denaturation of Proteins /17-18	N/A	N/A
10:	<i>In Vivo</i> & <i>In Vitro</i> Protein Folding /19	N/A	N/A
11:	Amyloid β -Protein & Alzheimer's disease /N/A	H5-12/04	N/A
12:	Final Exam Week of 12/07/2009	N/A	F-TBA

Important Dates:

The last day to withdraw from the course is Friday, 10/30/2009. On the Thanksgiving day (Thursday, 11/26/2009, Week 10) there are NO classes scheduled. The midterm exam is scheduled during the regular lecture time during Week 7 (Thursday, 11/05/2009). The final exam will be given during the week of 12/07-12/12, the date and time will be announced later.