

BIOEN 6002 Molecular Biophysics

University of Utah
Fall Semester 2017

Instructor:

Prof. Vladimir Hlady

Office Hours: By appoint. in Rm. 108A BPRB, or Immediately after class.

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COURSE OBJECTIVE This intermediate-level 3 credit-hour course is focused on the application of physical principles to:

- 1) develop quantitative understanding of biophysical processes in natural and engineered macromolecules, membranes, and cells,
- 2) learn about modern biophysical methods capturing single molecule properties, and
- 3) apply biophysical principles to the solution of biomedical engineering problems.

TA/Grader: Ms. Hannah Horthrup, office hours TBD, BPRB 101

Lecture: Tues. & Thurs. 12:25-1:45 pm. Room HSEB 5100C

Web Site: <http://afm1.pharm.utah.edu/MBiophysics/index.html>

Textbooks and Resources:

The readings come from several excellent books listed below. You should own at least one of these books, so chose one that is close to your research topic. Additional readings come from recent reviews and papers from the literature.

K.A. Dill et al: "*Molecular Driving Forces*" Garland Science, 2003

(abbr: KAD) (ISBN 0-8153-2051-5)

J. Howard: "*Mechanics of Motor Proteins and the Cytoskeleton*" Sinauer Assoc., 2004

(abbr: JH) (ISBN: 0-8789-3333-6)

R. Phillips, J. Kondev, J. Theriot: "*Physical Biology of the Cell*" Garland Science, 2009

(abbr: PBoC) (ISBN 978-0-8153-4163-5)

M. B. Jackson: "*Molecular and Cellular Biophysics*" Cambridge U. Press, 2006

(abbr: MJB) (ISBN 0-521-62470-3)

P. Nelson: "*Biological Physics*" WH Freeman, 2004

(abbr. PN) (ISBN 0-7167-4372-8)

Selected readings from these books are available on the course website (see the reading links below):

Lecture Schedule, Homework Distribution and Quiz Schedule:

Week 1 (8/23, 8/25): Proteins and polymers (lecture notes: part A, part B, part C)

Week 2 (8/30, 9/1): Molecular mechanics, elasticity and viscosity (lecture notes: part A, part B)

Week 3 (9/6, 9/8) HW1; Macromolecular conformations (lecture notes)

Week 4 (9/13, 9/15) HW1solutions; Measuring molecular forces (lecture notes); QUIZ #1

Week 5 (9/20, 9/22): Diffusion and Brownian motion (lecture notes: part A, part B)

Week 6 (9/27, 9/29): Chemical reactions, forces and association kinetics (lecture notes)

Week 7 (10/4, 10/6) HW2: Polynomials for ligand binding equilibria (lecture notes)

Week 8 (10/9 - 10/16): Fall break

Week 9 (10/18, 10/20) HW2sol: Measuring molecular diffusion in 2D and 3D (lecture notes);

Week 10 (10/25, 10/27): Biological membranes and proteins (lecture notes); Carrier mediated transport (lecture notes);

Week 11 (11/1, 11/3): Electrical properties of molecules (lecture notes)

Week 12 (11/8, 11/10) HW3: Ion transport (lecture notes); Ion channels (lecture notes)

Week 13 (11/15, 11/17) HW3sol: Osmotic pressure, crowding (lecture notes); QUIZ #3

Week 14 (11/22, Thanksgiving): Cytoskeleton, Einstein polymer (lecture notes);

Week 15 (11/29, 12/1): Force generation by filaments (lecture notes), Measuring motor protein forces (lecture notes);

Week 16 (12/6, 12/8) HW4: Polyelectrolytes, coacervates, gels (lecture notes)

Week 17 (Monday, 12/12, 10:30 am - 12:30 pm) Final exam, HW4sol: QUIZ#4

Each homework will be posted on-line on Tuesday and will be due in class next Tuesday

Grading:	4 Homework assignments	30 %
	1 Protein paper	20 %
	3 Quizzes and Final exam	50 %

General Policy: All examinations and assignments must be completed in accordance with the University of Utah [Student Code](#). Materials disclosed to the instructor for evaluation must be the original work of the student. Use of material (such as equations, text or graphics) from the web or any other source without proper citation will be considered academic dishonesty.

Homework Policy: 4 homework assignments will be required. Students will be expected to have working knowledge of a mathematical package such as Mathematica, Maple, Matlab or IgorPro and to complete their homework assignments using computer. Presentation in addition to technical content will constitute part of the grade. Late homework generally will not be accepted since solutions will be posted shortly after the due date.

Exam Policy: 4 open book, open note, 1 hour, written examinations will be given. Three of the exams will be given during the regularly scheduled class time and the fourth exam will be given during the final exam time.

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