Course Syllabus and Overview

Physics 323/623: Computational Biophysics Lab

Time: Tuesday, 3:00-4:50 pm

Instructors: Drs. Jacquelyn S. Fetrow and Freddie R. Salsbury Jr.

Offices: Olin 301A (FRS) and Olin 301B/Manchester 236 (JSF)

Email: salsbufr@wfu.edu, fetrowjs@wfu.edu

Web page: http://www.wfu.edu/~fetrowjs/Teaching.htm

Office Hours: Dr. Fetrow 5:00-6:00 T (physics office); 1:30-2:30 M (computer science office)
Dr. Salsbury 4:50-5:30 T and 2:30-3:30 Th

Textbook and readings:

Molecular and Cellular Biophysics, Meyer B. Jackson, Cambridge University Press 2006

Getting started with MatLab, Version 7, Rudra Pratap, Oxford University Press

Original scientific papers will be assigned as required reading throughout the semester. (See below for list of eglin c papers.)

Blackboard:

Papers and lab exercises will be posted on Blackboard under the Physics 623 course number.

Special arrangements: Do you need special arrangements due to athletics, disabilities or for other reasons? If you have a disability that may require an accommodation for taking this course, please contact the Learning Assistance Center (758-5929) within the first two weeks of the semester, and also let Dr. Salsbury and Dr. Fetrow know within the first three weeks of the semester.

Problem- or research-based learning: The best way to learn to use computational biophysics methods is to apply those methods in a research-based format and we will follow this learning approach in this course. We will teach methods and theory, but you will apply the methods and theory to a problem for which we do not yet know the "right answer;" however, it is a research problem in which we are interested.

This semester, we have chosen the protein eglin c for analysis. Each of you will be creating (in the computer) several variants of eglin c, performing calculations on those protein variants and comparing the results. This protein structure will be the one that you use and analyze during each of the laboratory exercises. Your grade will be partially dependent on:

- your knowledge of the structure,
- your observations and analysis of the results you obtain for your structure and variants,
- your critical comparison of your data to the results produced by other students in their calculations on their eglin c variants,
- your critical comparison of your results and interpretations to those reported in the literature.

As part of your course grade, you will write a scientific paper describing your project. (You will be given additional instructions regarding preparation of this paper.)

Grading:

Labs (6 exercises, 20 points each)	120 points (150 grad)
Class participation, observations, and creativity	100 points (150 grad)
Paper (5 prelim papers, 25 each; final paper 100 points)	125 points (150 grad)
Total:	345 points (450 grad)

Graduate student credit: Students registered for any of the graduate course numbers and receiving graduate credit will be held to higher expectations than students receiving undergraduate credit. Graduate students will be expected to answer lab and exam questions in more detail. Often, there will be an additional, more difficult question that graduate students must answer in addition to the other questions. Graduate students are expected to participate in class more often and to offer more insightful observations. Graduate student research papers must include more background, analysis of results, and comparison to other results found in the literature.

Software/hardware required: Laptop computer, loaded with SSH, Hummingbird Exceed (X-windowing software), NAMD (DEAC cluster), VMD (DEAC cluster), MEAD (DEAC cluster), MatLab (laptop); printer access; Blackboard

In the event of closure of the university for a significant part of the semester: In the event that the university closes due to pandemic or other disaster, please read and study the required papers (see list on the attached schedule). Work the laboratory exercises (to be distributed either through Blackboard, email, or postal mail, depending on what is available) that are listed on the course schedule and send the solutions to: Jacque Fetrow (fetrowjs(at)wfu(dot)edu or jfetrow(at)psualum(dot)com, if the internet is available; or 1014 Oaklawn Avenue, Winston-Salem, NC 27104). The return dates are stated on the course schedule; if these are changed, that will be indicated as part of communicating the exercise to you. The schedule for submitting drafts of the research paper are provided in the course schedule and those dates should be adhered to, unless you are notified otherwise by the instructors. Please submit drafts of each section of the paper and the complete final paper, by the dates indicated, to Jacque Fetrow at the email or postal mail address indicated above. If the internet is available, Professor Fetrow will be available for normal office hours by instant messenger: jsfetrow on Yahoo IM and jacquef40 on AIM.

Some background scientific literature for eglin c: The following journal articles will provide background reading for the eglin protein family. Most are available on PubMed. This is a reading list to get you started. You should not limit your research and background reading only to this list. However, each student's reading will vary, depending on their own results and what they want to present in their research paper.

- Bode, W., Papamokos, E., Musil, D. The high-resolution X-ray crystal structure of the complex formed between subtilisin Carlsberg and eglin c, an elastase inhibitor from the leech Hirudo medicinalis. Structural analysis, subtilisin structure and interface geometry. Eur.J.Biochem. v166 pp.673-692, 1987.
- Hyberts, S.G., Goldberg, M.S., Havel, T.F., Wagner, G. The solution structure of eglin c based on measurements of many NOEs and coupling constants and its comparison with X-ray structures. Protein Sci. v1 pp.736-751, 1992.
- Yi F, Sims DA, Pielak GJ, Edgell MH. Testing hypotheses about determinants of protein structure with high-precision, high-throughput stability measurements and statistical modeling. Biochemistry. 2003 Jun 24;42(24):7594-603.
- Hu H, Clarkson MW, Hermans J, Lee AL. Increased rigidity of eglin c at acidic pH: evidence from NMR spin relaxation and MD simulations. Biochemistry. 2003 Dec 2;42(47):13856-68.
- Ohnishi S, Lee AL, Edgell MH, Shortle D. Direct demonstration of structural similarity between native and denatured eglin c. Biochemistry. 2004 Apr 13;43(14):4064-70.
- Clarkson MW, Lee AL. Long-range dynamic effects of point mutations propagate through side chains in the serine protease inhibitor eglin c. Biochemistry. 2004 Oct 5;43(39):12448-58.

- Fetrow JS, Knutson ST, Edgell MH. Mutations in alpha-helical solvent-exposed sites of eglin c have long-range effects: evidence from molecular dynamics simulations. Proteins. 2006 May 1;63(2):356-72.
- Clarkson MW, Gilmore SA, Edgell MH, Lee AL. Dynamic coupling and allosteric behavior in a nonallosteric protein. Biochemistry. 2006 Jun 27;45(25):7693-9.