Biochem 102 Course Information

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What is the course about?

Understanding any important phenomenon in biology ultimately comes down to understanding the structures of the molecules that participate in the relevant biochemical processes and the ways that these molecules interact and react. Biochemistry textbooks are packed to the brim with such information, but from where does this knowledge come in the first place? A great deal, perhaps a majority, of our knowledge about how biochemical processes work comes from just two basic types of laboratory experiments: First, we explore the mechanisms of biochemical reactions by measuring the rates of various reaction steps. Second, we infer the structures and behavior of biological molecules from the ways that they interact with electromagnetic radiation. A common feature of all such experiments is that they involve making and interpreting quantitative chemical and physical measurements on biochemical systems.

This course is not a laboratory course; it is not intended to teach the details of how to use specific techniques. Instead, the course covers the basic principles that underlie a wide range of quantitative biochemical experiments. Many of these principles arise from physical chemistry (the study of large collections of molecules), and their applications to real systems are worked out via mathematics. The intention here is to equip students with some of the basic attitude, approach, and knowledge they will require to read, critically evaluate, and ultimately contribute to the original research literature of the field.

Another purpose of this course is to gain experience with mathematical methods in common use in the quantitative treatment of biochemical problems – linear differential equations, concepts of probability, statistics, and stochastic processes, the relation between energy and wavelength of transitions and related tools. Students have seen most of these before, but usually have not had much practice actually using them. My object here is to empower students by teaching a few of these tools and essentially demystifying them so that when they are encountered in the biochemical literature later on, they will be seen as useful friends rather than as obscure tormentors.

Required Preparation

The course requires knowledge of basic biochemistry at the level covered in a good introductory college biochemistry course (e.g., Bchm 100). I will assume that you already are familiar with fundamental chemistry concepts like Gibbs free energy and chemical equilibria and that you have had at least some previous exposure to basic chemical kinetics. A *calculus-based* introductory physics course (e.g., Phys 11a,b) is an essential prerequisite. You should be familiar with the properties of common mathematical functions such as polynomials, logarithms, exponentials, and trig functions. You must also to be able to differentiate and integrate with ease and also to apply calculus to the solution of simple physical problems.

Readings

Throughout the course we will obtain help with mathematical techniques by reference to:

- Boas, M. L. (1983). *Mathematical Methods in the Physical Sciences.* (2nd ed.) New York, Wiley. (Qa37.2 .b59 1983).

The course will also use:

- Fersht, A. (1999). *Structure and Mechanism in Protein Science.* New York, WH Freeman.

- van Holde, K. E., W. C. Johnson, et al. (1998). *Principles of Physical Biochemistry.* Upper Saddle River, N.J., Prentice Hall. (Qp517.p49 v36 1998).

These books should be in stock at the bookstore. Readings from other texts will be assigned for some sections of the course. You should also have available an introductory biochemistry text in case you need to refresh your memory of some of the background material. Most other readings can be printed out from the E-Reserves (see below).

The following reference books have also been put on reserve:

- Berg, H. C. (1983). Random walks in biology. Princeton, N.J., Princeton University Press. (QH323.5 .b45 1983)
- Cantor, C. R. and P. R. Schimmel (1980). Biophysical chemistry. San Francisco, WH Freeman. (QH345 .c36)
- Rhodes, G. (2000). Crystallography made crystal clear : a guide for users of macromolecular models. (2nd ed.) San Diego, Calif. ; London, Academic. (547.75046QH551)
- Tinoco, I., K. Sauer, et al. (1985). Physical chemistry : principles and applications in biological sciences. (2nd ed.) Englewood Cliffs, N.J., Prentice-Hall. (QH345.t561985)

Electronic Resources

The course uses two electronic resources, with which you should familiarize yourselves.

Course web page can be found at http://www.bio.brandeis.edu/classes/biochem102. All handouts, problem sets, assignments, and solutions to problems distributed to you in class on hard copy will also be posted here. If you lose your copy or didn't get one in the first place, print another copy from the Web. Also, on this page will be simulation programs and various demos to play with.

WebCT for Bchm102. From this page you can download the **assigned literature readings,** which cannot be posted on the public course web-page above due to copyright restrictions.

Course organization

Problem sets. Much of the material covered in the course cannot really be understood just by listening to someone chatting on about it; you have to try it out for yourself. For that reason, the ***problem sets are the most important part of the course**.* Problem sets will be assigned throughout the course of the semester. These must be turned in at the end of the lecture on the due date. I will grade and return them, but the grades are mostly for your information; problem set grades will have little effect on your grade for the course. If you turn them in late I will not grade them unless they reach me before I have started grading the problem sets for the rest of the class. Problem set answers will be posted on the course webpage. Feel free to collaborate with other students on the problem sets if you feel that this will help your understanding of the material, but make sure that ***you*** understand the material yourself.

Lectures. Class starts promptly at 11:10. I usually begin each lecture by summarizing the most important point from the last lecture and the key points discussed that day so come on time.

Questions. I welcome your questions both in and out of the lectures. Unfortunately I did not get a TA assigned this year, so we really have to work closely together to make up for this. You are welcome to come by my office/lab any afternoon if you would like to talk to me outside of class. If I can't talk to you immediately when you come by, you can set up an appointment later. You can also call (ext. 6-2354) or email (dkern@brandeis.edu) to set up an appointment if that is more convenient or if I am not around when you come by.

Exams. There will be three exams given during scheduled class times. Exams will be graded by me. Each exam may cover some material all the way back to the beginning of the course. If you miss an exam, you will receive a failing grade. As it is essentially impossible to prepare two equivalent exams in this subject, no makeup exams will be given. In exceptional circumstances in which a student is absent from an exam due to a documented emergency beyond the student's control, I will give that student an oral exam. Any student requiring special academic accommodations in the exams or lectures should make arrangements with the coordinator immediately upon starting the course; see the Brandeis University Bulletin for details.

Grades. Final grades for the course will be determined based on exam grades **AND** your class participation.