Biology 445

Molecular Biology

Syllabus, Fall, 2006

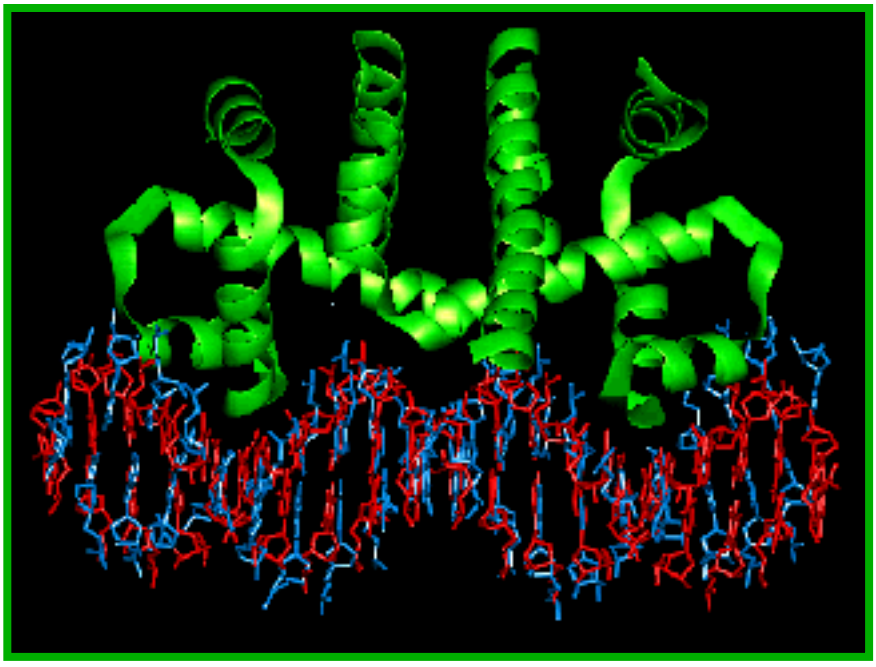
Course Description

This course is designed for biology and biochemistry majors who are interested in the structure and activity of genes and their products at the molecular level. A major goal of Biology 445 is learning how researchers use molecular techniques to answer biological questions. Although there are no formal prerequisites other than introductory biology, it is recommended that students complete genetics (Biology 331) and bacteriology (Biology 430) before registering for Biology 445. The course texts, *Molecular Biology of the Gene*, by Watson et al. (5th edition, 2004) and *Molecular Evolution and Phylogenetics* by Nei and Kumar are available in the U of E bookstore. The text will be supplemented regularly with other readings and figures. The optional text Molecular Biology, by Robert F. Weaver (2nd edition, 2002) is the source for many supplemental figures and readings.

Class meets for lecture Monday, Wednesday, and Friday at noon in KC131. Laboratory meets Monday and Friday 1:00 to 3:00 PM in KC226. Completion of the laboratory assignment will often require students to schedule time in the laboratory outside of formal class meetings.

Lectures in Biology 445 begin with a brief review of topics from previous courses (Chapters 1-5). Students who need a more extensive review should consult their texts from General Biology or Genetics. The next section of the course introduces the techniques of molecular biology (Chapters 20 and 21). We will emphasize the application of each method in answering research questions. At the end of this section, there will be a take-home exam on the use of these methods in the current literature. Chapters 6-11 cover DNA structure, replication, and other activity. The following Chapters (12-15) describe the process of gene expression. The regulation of gene expression (Chapters 16-18), comparative genomics (Chapter 19) and molecular phylogeny are treated in the main text as overviews, and will be supplemented with readings from the supplemental texts.

The laboratory component of Biology 445 is intended to engage students in the process of discovery



Trp Repressor - DNA Complex: Zhang et al., Nature 327:591 (1987)

in a research environment. To this end, each lab group of two students is assigned to complete a research project over the course of the semester. The laboratory is open-ended and projects may be proposed in any area of molecular biology that interests you. Successful completion of the proposed project is important to your laboratory grade. The scope of the project is up to you, but it should be challenging and achievable. Good projects will involve techniques and approaches that are new to all members of the lab group, or result in publishable data. For those groups desiring a more structured laboratory, the following suggested laboratory project should provide a starting point.

Identify a gene from *E. coli* that has been shown to be regulated in response to environmental conditions. Construct a gene fusion and reproduce the regulation of your reporter construct *in vivo*.

Laboratory work requires extensive background research and planning on the part of the student investigators. There are several intermediate due dates as outlined on the schedule. The most important of these dates is the 8 December due date for final proposals, as they must be submitted for funding to the UExplore undergraduate research committee. Lab groups will present their experimental design and results regularly. Each student must pay a $10.00 lab fee before beginning work in the laboratory.

Exams, Notebooks and Grading

There will be four exams and a final in this course. Exams will be given in laboratory, and may consist of multiple choice, experimental design and analysis, and short essay (less than one page) questions. Exam I will be split, with 25% available as a review exam in the first lab period, and 75% as a take-home methods exam. The final exam is cumulative, and will also include essay questions. Exam questions will be based on lecture and laboratory material as well as assigned reading. If a student cannot take an exam on the scheduled date, and has a valid excuse, a makeup will be allowed. The instructor must be notified at least one week prior to the exam date, otherwise the student will receive a grade of zero for the exam. Each exam will contribute 15% of the course grade, for a total of 60%, laboratory work, including quizzes, presentations in class, and lab notebook, will contribute 20%, and the final exam will contribute 20%.

Students should keep two notebooks for Biology 445. The first may be of any type, and should contain reprints, class notes and notes from readings. The second notebook must be a bound notebook. This notebook should contain experimental design, protocols for experiments, results, and analysis. Students are required to number the pages in this notebook and obtain the signature of the instructor or lab helper before and after each experiment. These notebooks must be brought to each class meeting, and may be collected for grading at any time. Students whose laboratory notebooks are incomplete or missing when requested will receive a grade of zero for that class period.

Course grades will be assigned using the following scale. Pluses and minuses will be assigned within grade ranges.

90-100	A
80-89	B
70-79	C
60-69	D
0-59	F

Web Page

News, announcements, and instructor contact information are constantly updated on the course web site: http://faculty.evansville.edu/be6/b4456

Expectations

Academic Honor Code

Students are expected to abide by the University's Honor Code. Accordingly, students are expected to neither give nor receive unauthorized aid on exams, lab reports, or class papers. When writing, all citations must be acknowledged and referenced. If in doubt about how to use references in your writing, please see your instructor. Do not use uncited text from any source in your written assignments, even with minor changes. This constitutes academic dishonesty, and will be penalized harshly.

Reading

All assigned reading is to be completed before class. This is important so that students begin with the required background. Quizzes at the beginning of class will give students an opportunity to demonstrate mastery of the assigned reading.

Attendance

Attendance at all class meetings is required. Unexcused absence will result in a grade of zero for any missed assignments. Students excused from a class meeting will be responsible for making up the missed material.

Assignments

Assignments are to be turned in on time, with the exception of excused absence. Students with excused absence should turn in their work the following day. When using computers for writing, data analysis, or presentation graphics, be sure to back up often and check the status of file transfers, printing, *et cetera* before the last minute. Failure of technology does not constitute a valid excuse.

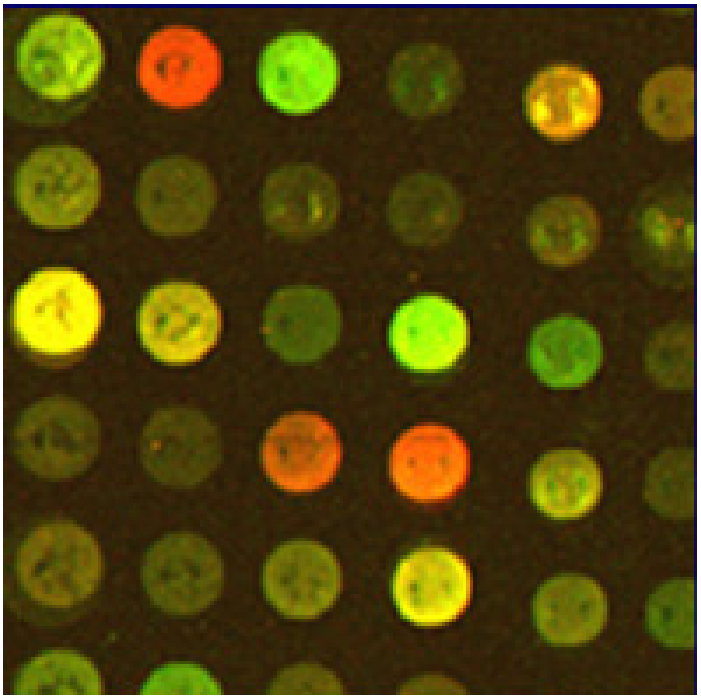
Written work will be checked for originality by computer. This means that any use of uncited text or copying will be detected. In addition to turning in a paper copy of your work to the instructor, you must submit an electronic copy to http://www.turnitin.com. Your assignment will not be graded until the computer originality analysis is complete. Students are encouraged to visit the turnitin.com website for more information on this plagiarism prevention system.

Schedule, Fall, 2006

Date	Text Reading	Topics	Lab Activities
23 Aug	1,2	Course Intro, Review Genetics, DNA Structure	
25 Aug	2, 3	Weak Chemical Bonds	Review Exam
28 Aug	4	High-Energy Bonds	Pre-proposal Meetings
30 Aug	5	Macromolecular Structure	
1 Sep	20	Methods: Nucleic Acids	Proposal Due, Student Presentations
4 Sep	20, 21	Methods: Proteins, Model Systems	Student Presentations
6 Sep	21	Methods: Model Systems	
8 Sep	OTR	Specialized Methods	
		Hand Out Methods Take-Home Exam	Final Proposal Due
11 Sep	6	DNA Structure	Methods Exam Due
13 Sep	6, 7	RNA, Chromosome Structure	
15 Sep	7	Chromosome Structure	
18 Sep	8	DNA Replication	
20 Sep	8	DNA Replication	
22 Sep	9	DNA - Mutation and Repair	

Date	Text Reading	Topics	Lab Activities
25 Sep	10	DNA - Homologous Recombination	First Progress Report
27 Sep	10, 11	DNA - Homologous Recombination, Transposition	
29 Sep	11	Transposition	First Progress Report
2 Oct		Exam II	Exam II
4 Oct	12	Transcription	
6 Oct	12, 13	Transcription, Splicing	
11 Oct	13	Splicing	
13 Oct	14	Translation	
16 Oct	14	Translation	
18 Oct	14	Translation	
20 Oct	15	The Genetic Code	
23 Oct	16	Regulation in Prokaryotes	
25 Oct	16, 17	Regulation in Prokaryotes, Eukaryotes	
27 Oct	17	Regulation in Eukaryotes	Second Progress Report
30 Oct		Exam III	Exam III
1 Nov	18	Regulation of Development	
3 Nov	18	Regulation of Development	Second Progress Report
6 Nov	19	Comparative Genomics	
8 Nov	19	Comparative Genomics	
10 Nov	NK1	Molecular Evolution	
13 Nov	NK2	AA Sequence Evolution	
15 Nov	NK2	AA Sequence Evolution	
17 Nov	NK3	DNA Sequence Evolution	
20 Nov	NK4	Nucleotide Substitution	Last Day for Lab Work

Date	Text Reading	Topics	Lab Activities
27 Nov	NK5	Phylogenetic Trees	Final Lab Report
29 Nov	NK5	Phylogenetic Trees	
1 Dec		Final Lab Report	Final Lab Report
4 Dec		Exam IV	Exam IV
5 Dec		Hand Out Take-home Final Exam	
6 Dec		Reading Day	Lab Manuscript Due
8 Dec, 12:30 PM		Final Exam	Take-home Due



DNA microarray hybridized with Cy3- and Cy5-labeled probes