Instructor: Bert Boyer, Ph.D.
Office: Arctic Health Research Building, Room 226 (474-7733)
Office Hours: Preferably after 1:00 PM (Mon.-Fri.). Please call and make an appointment.

Overview:
The aim of this course is to establish a basic understanding of molecular biology and to show how molecular biological techniques have led to the explosion in our knowledge of fundamental biological processes. A concise presentation of the methods, underlying concepts, and far-reaching applications of recombinant DNA technology will be presented.

Application of recombinant DNA techniques to biology is creating a revolution in our understanding of living organisms. There are few, if any, fields of experimental biology that are untouched by the power we have in using recombinant DNA technology to isolate, analyze and manipulate genes. This new course is designed for the upper division undergraduate or graduate student in biology and/or chemistry, and is one of the few opportunities at UAF for you to be exposed to the applications of basic experimental biology at the molecular level. The basic concepts and applications of molecular biology will be presented from the textbook and the literature. You will be required to prepare, present and critique research proposals (graduate students) or research articles (undergraduate students) to illustrate the diverse applications of molecular biology. Presentations by graduate students will focus on applications of molecular biology to their current research problems, while undergraduate articles will be directed by the individual student's interests. The student presentations and reviews are designed to improve your writing and communication skills as well as to enhance your learning experience while demonstrating the broader applications of recombinant DNA technology.

Prerequisites: Genetics (Biology 262) and Organic Chemistry 321 or Biology 303, or permission of instructor.


Distinction between undergraduate and graduate student workload:
All students taking the course are expected to read the chapter or literature assignment prior to class. Students taking the course for graduate credit (653) will be expected to have a higher degree of proficiency in the Biological Sciences. Although much of the writing and discussions will be shared by all students, the quality and quantity of work to be completed is expected to be greater for graduate students than for undergraduate students. Students in Biol./Chem. 653 will be expected to do the following: (1) Present one journal article from the current literature; (2) demonstrate a deeper understanding of the subject matter in their oral and written communications; (3) write a full research proposal which adheres to the guidelines of NIH or NSF; (4) actively participate and sometimes lead class discussions.
**Exams & Grading:**

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<th><strong>Undergraduate Students</strong></th>
<th><strong>Graduate Students</strong></th>
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<tr>
<td>Writing &amp; Presentation</td>
<td>300 points (research article)</td>
<td>500 points (proposal)</td>
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<td>Lab &amp; Participation</td>
<td>200 points</td>
<td>100 points</td>
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<td>Exam I</td>
<td>150 points</td>
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<td>Exam II</td>
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<td>Exam III</td>
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<td><strong>Total:</strong></td>
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**Exams** will cover material presented in the lectures, textbook and supplemental reading. I do not give make-up exams. If you have a legitimate excuse for missing an exam, I will calculate your total grade on the basis of the exams that were taken. No early or late exams will be given. Exams I and II will be taken in class and last one hour (although there may be a take-home portion). You will have 2 days to complete Exam III. You may work on this comprehensive exam alone or in groups not to exceed 3 students. No final exam will be given, however, you are required to attend class on the scheduled final exam period. If you do not show up for the final exam period (Dec. 16, 1995), your overall final grade in the course may be lowered by as much as one letter grade.

**Undergraduate student writing & presentation (300 points total):** You may pursue a topic for your research article that reflects your interests in molecular biology. I would prefer that you discuss the subject and potential contents of your article with me after you have thought about potential projects but before you begin to write your article. You will be expected to prepare an outline of ideas for your newspaper article submission. In addition, all students will make a 8-10 minute formal presentation to the class describing their final submission and answer questions during a 5 minute discussion period. Your grade will be determined by your proficiency in preparing a concise written outline (10%) and delivering a brief oral presentation and your ability to discuss the subject of your article (25%). The remaining 65% of this section will be based on the quality of your final submission and your ability to present an application of recombinant DNA technology to the general public in an interesting and informative manner. I will provide feedback on all oral presentations.

**Graduate student writing & presentation (500 points total):** Graduate students are expected to apply recombinant DNA technology to their current research interests and project. You will be required to write a pre-proposal (20%). In addition, you are required to submit a written review of the pre-proposals submitted by all the other graduate students (10%). These reviews will be anonymous and handed back to each student. Near the end of the semester, you will be required to submit your full research proposal (50%), provide an anonymous written review of two other proposals (10%) and present your final proposal to the class in a 15 minute presentation with a 5 minute discussion period (10%). You will be graded on the quality of your proposal, presentation and reviewer skills. In addition, you will be graded on your participation in classroom discussions.
Molecular Biology Fall 1996
Lecture Topics & Dates

1. Sept. 6 Introduction

Section I. Analysis of Cloned Genes
2. Ch. 5 Sept. 9 Creating & isolating recombinant DNA molecules
3. Ch. 7 Sept. 11 Creating & isolating recombinant DNA molecules
4. Ch. 7 Sept. 13 Creating & isolating recombinant DNA molecules
6. Ch. 6 Sept. 18 The polymerase chain reaction
7. Ch. 9 Sept. 20 Control of eukaryotic gene expression
8. Ch. 9 Sept. 23 Control of eukaryotic gene expression

Section II. Tools to StudyGene Function
9. Ch. 12 Sept. 25 Transferring genes into mammalian cells
10. Ch. 12 Sept. 27 Transferring genes into mammalian cells
11. Exam I Sept. 30 Chapters 5-7, 9 and 12
12. Ch. 13 Oct. 2 Yeast in Eukaryotic gene function
13. Ch. 13 Oct. 4 Yeast in Eukaryotic gene function
14. Ch. 14 Oct. 7 Transgenic mice

Section III. Molecular Physiology & Recombinant DNA Technology
16. Ch. 15 Oct. 11 Genetic Engineering of Plants
   Oct. 11 Outline of undergraduate student research topics due
17. Ch. 16 Oct. 14 Molecules of Immune Recognition
   Oct. 16 Graduate Student pre-proposals due
19. Ch. 17 Oct. 18 Signal Transduction
21. Exam II Oct. 23 Chapters 13-17
22. Ch. 18 Oct. 25 Oncogenes and Anti-oncogenes
24. Ch. 21 Oct. 30 Recombinant DNA technology in Neurobiology
Final undergraduate research articles due

25. Article Nov. 1 A defect in Nurturing in Mice Lacking the Immediate Early Gene fosB

26. Nov. 4 Presentation of undergraduate research articles
27. Nov. 6 Presentation of undergraduate research articles
28. Nov. 8 Presentation of undergraduate research articles
29. Nov. 11 Presentation of undergraduate research articles
30. Nov. 13 Presentation of undergraduate research articles

Section IV. Recombinant DNA in Biotechnology and Human Genetics

31. Ch. 23 Nov. 15 Medicine and Industry
Nov. 17 Final graduate research proposals due

32. Article Nov. 20 Genetic testing: Growth retardation and tumor inhibition by BRCA1
Nature Genetics 12:298-302

33. Article Nov. 22 Researchers view genetic testing with high hopes, but caution
The Scientist 10:1, 6-9 (1996)

36. Article Dec. 2 AIDS. CC CKR5: A RANTES, MIP-1α, MIP-1β Receptor as a fusion

37. Ch. 26 Dec. 4 Mapping and cloning human disease genes
A Genome wide search for human type 1 diabetes susceptibility genes
Nature 371:130-136
Graduate student review of research proposals & articles due

38. Article Dec. 6 Diagnosis of genetic diseases: Whose genes are they anyway?

39. Ch. 28 Dec. 9 Human gene therapy
In vivo Gene Delivery and Stable Transduction of Nondividing Cells by a
Lentiviral Vector Science 272:263-267

Exam III Dec. 11 Comprehensive: Take home & Return on Dec. 13

Final Period
8:00-10:00 AM, Dec. 16 No final exam will be given. Final Presentation &
Discussion of Graduate research proposals. You must attend
this class!

The exact dates of the lectures are likely to change, however, the order should remain.
Molecular Biology Lab Fall 1996
Topics & Dates

*Time:* To be determined on the first day of class

*Place:* Natural Science 137

*Teaching Assistant:* Yancy Bodenstein (Office Hours MWF 11:45-12:45, Chem. Grad. Ofc.-5125)

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<td>3.</td>
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Measurements, Micropipetting and Sterile Techniques

Bacterial Culture Techniques

DNA Restriction and Electrophoresis

Rapid Colony Transformation of *E. coli* with plasmid DNA

Purification and Identification of Plasmid DNA

Recombination of Antibiotic Resistance Genes

Transformation of *E. coli* with recombinant DNA

Purification and Identification of Recombinant Plasmid DNA

Isolation of Genomic DNA from whole blood

Quantitative analysis of DNA and PCR Optimization

PCR Troubleshooting

Microsatellite Analysis Begins

Microsatellite Analysis

Microsatellite Analysis

Microsatellite Analysis

Final Research Report due in class.

Students are expected to conduct a literature search to provide them with the background necessary to complete the research project, and to identify current progress in this rapidly changing field. Once you have identified an acceptable research plan, you will begin your research in the laboratory. If the project is successful, representatives will present their research findings at a special seminar and possibly publish the results.

Student’s information resources include the library, Yancy and Bert. Your grade will be determined by your library research, ability to develop a focused and organized research plan, your research progress, final research report and participation.

Some students are taking only the lab portion of this course and will be conducting research on the development of microsatellite primers. They will be evaluated on their progress, final research report and participation.