

**New Hampshire Community Technical College-Stratham/Portsmouth
Syllabus:**

Fall 2007

BTEC210

Course: BTEC210

CRN: 11250

Course Title: Biotechnology Research Experience

Instructor: Harout DerSimonian, Ph.D.

FALL 2007

Overview

BT 210, Biotechnology Research Experience, is one of two courses designed to provide you with state-of-the-art tools of biotechnology and an opportunity to master the skills, knowledge, and attributes of a research technician in an atmosphere that simulates the biotechnology workplace. Mastery occurs because of total immersion of students in the tools and processes of the workplace. The biotechnology research protocols used in this course are designed to illustrate aspects of the "central dogma" of molecular biology. The central dogma states that 1) DNA carries the code for life, 2) DNA is transcribed into messenger RNA, and 3) Messenger RNA is translated into protein with the help of transfer RNA and ribosomal RNA.

Course Organization

This laboratory oriented course consists of four modules:

Module I: (2 weeks)

Module I is an overview of research in biotechnology. It begins with a historical review of the biotechnology industry, followed by a grounding in laboratory safety, an introduction to codes of practice that regulate biotechnology research, a theoretical and practical discussion of laboratory measurement and finally, the preparation of reagents, buffers, solutions and media for the semester.

Module II: (7 weeks)

Module II takes us into the heart of biotechnology-- to the isolation and manipulation of DNA, the molecule carrying the "code of life". Here we will first isolate and then "spool" DNA from calf thymus, then map a viral genome, learn about DNA fingerprinting through protocols including RFLP, PCR and Southern blot techniques, and finally, learn about cloning genes.

Module III: (2 weeks)

Module III explores protocols for the isolation, characterization and identification of proteins. Proteins will be isolated using column chromatography, then characterized via polyacrylamide gel electrophoresis.

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Module IV: (5 weeks)

Module IV focuses on the "middle man" in the central dogma, RNA. In the laboratory, a single, multi-week exercise simulates an actual biotechnology workplace project: the researcher wants to make a certain protein, tissue plasminogen activator (tPA) in large quantities for medicinal purposes. To accomplish this, we will first go to a cell that is producing large quantities of tPA and isolate mRNA from these cells. Following mRNA isolation, an expression library will be prepared using the techniques of reverse transcription and cloning. Clones containing tPA will be identified using in situ hybridization. We will finish out the semester by learning to characterize and identify clones in the library using cycle sequencing and bioinformatics tools.

Each week a formal lecture will be given on a topic that is related to the work being conducted in the laboratory. These lectures will cover the fundamentals of molecular biology including the technological breakthroughs that have allowed the explosion of knowledge in this field in recent decades. Molecular biology is the major academic discipline underlying the biotechnology industry.

Pre-requisites

Pre-requisites for enrollment in BT 210 are: basic computer literacy, demonstrated competence in English composition, college level algebra skills (Math 131), and successful completion of one semester of college level cell biology (Biology 108 or Microbiology). One semester of college-level introductory chemistry (Chem 110 or 115) is also required. Concurrent enrollment in chemistry and in BT 210 is permitted.

Assessment

Assessment will be based on a 200 point scale. A single grade will be given for the course. The grade will consist of two parts:

Skills Assessment (100 points possible): Laboratory skills and the critical thinking that goes along with them will be assessed through class preparation, laboratory performance, and through the submission of formal lab reports upon completion of each laboratory exercise. Criteria for keeping lab notes and for writing lab reports will be provided at the start of the semester. Laboratory skills assessment will account for 50% of the final grade.

Knowledge Assessment (100 points possible): Your knowledge of the "central dogma" and how this plays out in biotechnology research will be assessed through problem sets, quizzes, and a final exam. Problem sets, on-line exercises and quizzes will be worth 12.5% of your final grade. The tests will be worth 12.5% of your final grade. The cumulative final exam will be worth 25% of your final grade.

All assignments must be completed on time. This is primarily for your benefit-- this class moves along very quickly, and students have generally found that if they fall behind, it is very difficult to catch up. Assignments handed in late will be penalized. Assignments

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won't be accepted if they are handed in more than one week late. Students missing an exam will receive a grade of zero for the exam, with exceptions made for documented illnesses and family emergencies only.

Plagiarism and Cheating

Cheating and plagiarism are strictly forbidden. Any student found to be cheating on a quiz or exam, or to be repeatedly plagiarizing lab reports, will be given a failing grade in the course. All students must sign the class policy on plagiarism and cheating, indicating that they understand and agree to abide by this policy.

Attendance

In a skills-based course such as this, your physical presence in class is absolutely essential. Passing the course will require regular attendance. For absences, points will be deducted from your 200-point total as follows: 0 points for the first absence and 5 points for each subsequent absence. There will be partial deductions for lateness at the instructor's discretion.

In order to drop the class you must fill out an add/drop form and return this form to the registrar's office. You may drop this course at any point before the first class meeting of the second week of the semester, and receive a full refund. Simply ceasing to attend class or contacting the instructor does not constitute officially dropping the course.

Through week 10 of the semester, if you miss three consecutive classes and fail to contact me you will be dropped from the course and receive "AD" (Administrative Dismissal) as a grade. The "AD" grade will not affect your GPA. Students may also initiate withdrawal from the course at any time through the fourteenth week of the semester. Students withdrawing from the course prior to the completion of semester week 10, will be given a grade of "W". Like the "AD" grade, the "W" grade will not adversely affect your GPA. Following the tenth week of the semester, students who withdraw will receive either a "WP" (withdraw passing) or "WF" (withdraw failing) grade. "WF" is counted on your GPA as a failing grade.

Student Support

Academic support can be obtained through the college's Center for Academic Placement and Support (CAPS). The CAPS office is located in the library at Pease, and on the second floor (room 202) on the Stratham campus. Information about services offered through CAPS can be found on their web site: www.ms.nhctc.edu/caps.

The disabilities support specialist for this college is Sharon Cronin. Sharon can be reached in Stratham at: 775-2376. If you have a documented learning disability that may require special arrangements for support in this class, please discuss this with me ASAP.

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Course Instructors

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Course Materials

The following book has been chosen as required text for the course:

- Thieman, William and Palladino, Michael (2004) **Introduction to Biotechnology**. San Francisco: Pearson: Benjamin Cummings (ISBN# 0-8053-4825-5).
- Additional reading material will be handed out throughout the course as required reading.

The following book may be purchased at your discretion:

- Watson, Baker, Bell, Gann, Levine, and Losick (2004) **Molecular Biology of the Gene**. 5th Edition. San Francisco: Pearson: Benjamin Cummings (ISBN# 0-8053-4635-X). This excellent text is recommended for any of you interested in more fundamental Molecular Biology concepts. It is intended as a supplement to the required text.

BT 210 laboratory protocols, the class discussion board and a variety of other course-related material can be found on our course Blackboard site. Blackboard can be accessed at: <http://nhctcs.blackboard.com/webapps/login/>. As an NHCTC student, you will automatically be set up with a Blackboard account and with access to our course-specific site. However, it is your responsibility to learn how to find and to navigate your way around this site. Those encountering problems are urged to contact the instructor immediately. You are expected to check Blackboard at least once each day during the course of the semester.

You will need to bring a calculator to each class meeting.

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Lecture Topic	Lab Exercise
Module I: Overview and Lab Orientation (September 5 – 12)	
Week 1	Introduction to Biotechnology (Review syllabus and course schedule; post message to Blackboard discussion board)
Week 2	Weight/Volume/Concentration
	Solution preparation

Module II: DNA Isolation and Manipulation (September 17 – October 31)	
Week 3	Introduction/ DNA Structure and Function
	DNA spooling (P1)
Week 4	Genome Mapping I: Restriction Enzymes and Physical Maps
	Restriction mapping (P2)
Week 5	Genome Mapping II: Genetic Maps and RFLP's
	Simple RFLP's (P3) RFLPs w/ Southern blot (P4)
Week 6	Genome Structure in Eucaryotes and Procaryotes
	RFLPs w/ Southern blot (P4)
Week 7	Gene Isolation and Amplification: Chromosome Walks, Cloning and PCR
	PCR in fingerprinting (P5)
Week 8	Regulation of Gene Expression in Procaryotic Cells
	Gene cloning (P6)
Week 9	Regulation of Gene Expression in Eucaryotic Cells
	Gene cloning (P6)

Module III: Working with Proteins (November 5 – 14)	
Week 10	Characteristics of Proteins
	Column chromatography and PAGE (P7)
Week 11	Translation Close-up
	Column chromatography and PAGE (P7)

Module IV: RNA-Mediated Bioproduction (November 19 – December 19)	
Week 12	mRNA Structure and Function
	CHO cell mRNA isolation (P8)
Week 13	RNA and the Challenge to the Central Dogma
	Reverse transcription, Library production (P9/10)
Week 14	RNAi and Other Breakthroughs on Expression Analysis
	Colony screening (P11)
Week 15	New Approaches to Gene Isolation
	DNA Sequencing (P12)
Week 16	Wrap-up and Final Exam
	Lab Clean-up

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September 4	Semester begins
September 11	Last Day to Withdraw with a full refund
October 8	Last day to drop with a "W" grade for first 8-wk classes
October 19	Last day to drop with a "WP/WF" grade from first 8-week classes
November 6	Last day to drop with a "W" grade
November 12	Veteran's Day Holiday - No Classes
November 13	Last day to drop with a "W" grade for 12-week classes
November 22-25	Thanksgiving Holiday - College Closed
November 26	Last day to drop with a "W" grade for second 8-wk classes
December 7	Last day to drop with a "WP/WF" grade for all classes in session
December 19	Semester Ends

BTEC210 Biotechnology Experience I: Discovery Research 2-9-6

The first of two experiential, cornerstone courses in Biotechnology. The course begins by introducing the student to the field of biotechnology, the role of the technician in biotechnology, and GLP or good laboratory practices. The remainder of the course is a hands-on exposure to biotechnology research tools and protocols used for DNA isolation, gene mapping, DNA fingerprinting, gene cloning, gene expression regulation, protein identification, mRNA isolation, cDNA synthesis from mRNA, the production of gene libraries, and gene sequencing. A two-hour-per week lecture provides the knowledge base for biotechnology discovery research. Prerequisite: Permission of Instructor or Advisor.

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