

# Microbiology 405: Biotechnology and Synthetic Biology

## Course Outline (4 PAGES) - Fall 2013

**Read carefully. The course is not presented and organized in the traditional manner, but rather is a “flipped classroom”. This format has students learn basic material on their own, and uses classroom time for projects.**

1. All lectures are available both as PDFs and as audio presentations of the Power Point presentations. These are available at the course “Course Space” (the new Moodle) site.

<https://www.uvic.ca/cas/login?service=http%3A%2F%2Fcoursespaces.uvic.ca%2Flogin%2Findex.php>

You are expected to view either the PDFs or the audio lectures (or both) on your own. The lectures are divided into groups corresponding to the material that will be covered in each midterm.

2. The projects are meant to inspire both independent and group learning. A reasonable effort should result in a good grade.

3 Classroom time will be devoted primarily to smaller group meetings of a subset of the class. (people outside of a particular group can attend as observers). See the class calendar to determine which days you are expected to attend with your group. Some groups will meet in DSB C118, others in DSB C114.

The final grades will be determined as follows:

Four midterms, each worth 15% of the final grade.

1 Group Project=15% of final grade

Final exam=25% of final grade (15% covers Section 5; 10% cover topics that require a synthesis of the course material)

### **Supplementary (free) Text book**

Title: Bacterial and bacteriophage genetics [electronic resource] / Edward A. Birge.

Author: [Birge, Edward A. \(Edward Asahel\)](#)

Publisher: New York : Springer, c2006. Edition: 5th ed.

Web Link (from UVic or via sign on from your home):

<http://ezproxy.library.uvic.ca/login?url=http://dx.doi.org/10.1007/0-387-31489-X>

For a review of basic concepts in bacterial genetics see Chapter 1. For a review of the basics of transcription and translation, see Chapter 4. Other chapters have information that may provide a basic review relevant to other topics in the course. You will NOT be examined directly on material from the textbook, but you will be expected to know the basics of bacterial gene regulation and genetics that you learned in lower level course in the Department of Biochemistry and Microbiology.

Course sections. Each section corresponds to a midterm, with the last section being a major part of the final examination.

### **Section 1. Cloning, PCR & Sequencing (Lectures 1 through 7).**

Introduction.

Enzymes used in biotechnology

PCR basics

Plasmid cloning.

Making a plasmid clone bank

Specialized plasmid cloning vectors and systems.

Lambda ( $\lambda$ ) cloning.

Midterm 1 will cover the material in Section 1.

## **Section 2. DNA sequencing and other technologies (Lectures 8 through 13)**

cDNA cloning.

Fosmids, BACs and YACs.

Side bar: integration and excision.

Sanger DNA sequencing.

Sequencing strategies

Next-gen sequencing.

DNA amplification and genome walking.

## **Section 3. Elements of genome engineering & synthetic biology (Lectures 14 through 20).**

Natural and synthetic promoters; attenuation and termination.

Codon usage, Operons, RBSs and their relevance to biotechnology

sRNA and ribolocks.

Biobricks and Golden Gate

In vitro genome assembly methods (F-PCR, Gibson, SLIC, Pox)

In vivo genome assembly methods (red/gam/ TAR)

Genome assembly successes.

## **Section 4. Artificial gene control, 2 hybrid systems, & recombinant protein production (Lectures 21 through 26).**

TetR systems.

Recombinases in genome engineering.

iRNA and other small RNA.

Bacterial and yeast hybrid systems

Recombinant protein production

Bioreactors

## **Section 5. Synthetic biology & related topics (Lectures 27 through 33)**

Directed evolution

Proteins with Un-natural amino acids.

Recombinant binding proteins, including engineered antibodies.

Zn-finger and Talens

Metabolic Engineering

Recombinant vaccines

Intellectual property (no audio file—really simple stuff)

**For section 5 you must read these 2 articles.** You simply need to read them, not study them. You'll be asked a very basic question on the final exam to verify that you have read them. The questions will be so basic that if you have read them with the care that you might use to read a newspaper article, you'll be able to answer the questions.

1. Microbial engineering for the production of advanced biofuels. Pamela P. Peralta-Yahya, Fuzhong Zhang, Stephen B. del Cardayre & Jay D. Keasling. Nature 488: 320-328 (2012). doi: 10.1038/nature11478  
<http://www.nature.com/nature/journal/v488/n7411/full/nature11478.html>

2. Refactoring biological parts, devices and chassis for delivery of therapeutic agents.

Nano FE. Curr Opin Biotechnol. 2012 Dec;23(6):897-9. doi: 10.1016/j

<http://www.sciencedirect.com/science/article/pii/S0958166912001139>

GO TO NEXT PAGE FOR A DESCRIPTION OF THE NEW UNIVERSITY GRADING SYSTEM.

Revised UVic Grading Scheme (effective May 1, 2012)

Grades	Grade Point Value	Percentage	Description
A+ A A-	9 8 7	90 – 100 85 – 89 80 – 84	<b>Exceptional, outstanding and excellent</b> performance. Normally achieved by a minority of students. These grades indicate a student who is self-initiating, exceeds expectation and has an insightful grasp of the subject matter.
B+ B B-	6 5 4	77 – 79 73 – 76 70 – 72	<b>Very good, good and solid</b> performance. Normally achieved by the largest number of students. These grades indicate a good grasp of the subject matter or excellent grasp in one area balanced with satisfactory grasp in the other area.
C+ C	3 2	65 – 69 60 – 64	<b>Satisfactory, or minimally satisfactory.</b> These grades indicate a satisfactory performance and knowledge of the subject matter.
D	1	50 – 59	<b>Marginal</b> Performance. A student receiving this grade demonstrated a superficial grasp of the subject matter.
F	0	0-49	<b>Unsatisfactory</b> performance. Wrote final examination and completed course requirements; no supplemental.
N	0	0-49	Did not write examination or complete course requirements by the end of term or session; no supplemental. Failure to complete one or more components of student evaluation will result in a grade of “N” regardless of the cumulative percentage on other elements of the course. An N is a failing grade, and it factors into a student’s GPA as O. The maximum percentage that can accompany an N on a student’s transcript is 49

## **DEPARTMENT INFORMATION AND POLICIES**

1. The Department of Biochemistry and Microbiology upholds and enforces the University's policies on academic integrity. These policies are described in the current University Calendar. All students are advised to read this section.
2. Cell phones, computers, and other electronic devices must be turned off at all times unless being used for a purpose relevant to the class. Students having a cell phone, tablet, or computer on their person during an exam will be assumed to have it for the purpose of cheating.
3. Any recordings of lectures may only be performed with written permission of the instructor, and are for personal use only. The instructor retains copyright to such recordings and all lecture materials provided for the class (electronic and otherwise); these materials must not be shared or reposted on the Internet.
4. Students are expected to be present for the midterm and final exams. Instructors may grant deferrals for midterm examinations for illness, accident, or family affliction, and students must provide appropriate documentation 48 hours after the midterm exam. The Department of Biochemistry and Microbiology considers it a breach of academic integrity for a student taking a deferred examination to discuss the exam with classmates. Similarly, students who reveal the contents of an examination to students taking a deferred examination are considered to be in violation of the University of Victoria policy on academic integrity (see current University Calendar). Deferral of a final exam must be requested with an Academic Concession form and submitted directly to Undergraduate Records. Deferred final exams for fall term courses will be arranged by the instructor. Deferred final exams for spring term courses will be arranged through Undergraduate Records and must be written before the end of the summer term as stipulated in the University Calendar.
5. Scan sheets for multiple choice exams (bubble sheets) will not be made available for review. Therefore, in addition to filling in answers on the scan sheet, students should also circle their answers in ink on their exam.
6. Professors may refuse to review/remark exams not written in ink. In addition, requests for review/remark of a midterm exam must be made within one week of the exam being returned. Students are expected to promptly pick up midterm exams after marking has been completed, either in class or from the instructor.
7. Examination papers that have pages removed, or are mutilated will not be marked.