

# Microbiology 405: Biotechnology and Synthetic Biology

## Course Outline (4 PAGES) - Fall 2019

**Course Instructor: Francis Nano**

**Office: 245 Petch (if dropping in, check my lab, room 248. Walk in; there's nothing dangerous)**

**Office Hours: M-F 09:00-17:00. It's best to e-mail/call me for a specific appointment.**

### **READ THIS! READ THIS! READ THIS! READ THIS! READ THIS!**

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. As described in the Course Calendar **your group will attend meetings in either room ECS108 or Petch 206** (next to BIOC office). See course calendar for your group's formal meeting dates. I will attend all of these and note students' attendance and participation.

We “own” four rooms on Monday/Thursday throughout the semester. Room C118 (Strong Bldg) will be used FOUR times for the whole class during the semester: the first day, for the midterm and for the presentations at the end of the semester. Thus, it is available (contact me) for groups to meet. Petch 194 is also available. The formal group meetings will be in Petch 206 and in ESC 108 (see the course calendar).

1. All lectures are available both as PDFs and (almost all) as audio presentations of the Power Point presentations. They are available at the M405 “Course Spaces” site.

You are expected to view either the PDFs or the audio lectures (or both) on your own. The lectures are divided into groups to help you know what material will be covered on which exam.

2. The projects are meant to be an “intellectual laboratory” where you try out the methods described in the course in a creative way to solve real world problems. This year, you will be highly encouraged to come up with ideas that contribute to climate change mitigation. A reasonable effort on the project should result in a good grade, that will help buffer a poor exam grade.

3 Classroom time will be devoted primarily to smaller group meetings of a subset of the class. See the class calendar to determine which days you are expected to attend with your group.

### **The final grades will be determined as follows:**

(30%) Midterm exam. **October 17, 2019 (Thursday after Thanksgiving).**

(35%) Group project.

(35%) Final exam.

**See the document “Grading and Exams” to understand what will be on the exams.**

**Completion of all three components are required to complete the course and receive a passing grade.**

## **Section 1. Cloning, PCR & Sequencing.**

Introduction.

Enzymes used in biotechnology

PCR basics

Plasmid cloning.

Making a plasmid clone bank

Specialized plasmid cloning vectors and systems.

Section 2 and beyond, next page.

## **Section 2. DNA sequencing and other technologies.**

Generation of cDNA.

Fosmids, BACs and YACs.

Sanger DNA sequencing.

Sequencing strategies

2<sup>nd</sup> and 3<sup>rd</sup> Generation “next-gen” DNA sequencing.

DNA amplification and genome walking.

## **Section 3. DNA and Genomic Assembly**

Biobricks and Golden Gate

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

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

Approaches to Bacterial Genome Engineering

Bacterial Genome Assembly.

*Sidebar: Counter-selection (a “side-bar” means an extra bit of information that is examinable for the concepts; e.g. what is counter-selection and how you use it; but NOT the list of counter-selection genes.)*

## **Section 4. Elements of genetic circuits.**

Natural and synthetic promoters; attenuation and termination.

Codon usage, Operons, RBSs and their relevance to biotechnology

sRNA and ribolocks.

Hybrid systems.

## **Section 5 Recombineering and Genome engineering.**

Recombineering for eukaryotes

CRISPR-based engineering

TetR regulation of genes. (For 2019 this has been greatly reduced. Don’t use old TetR lectures or problem sets)

Recombinases used in genome engineering.

iRNA used to control gene expression

*Sidebar: CRISPR gone crazy.*

## **Section 6. Making and expressing products.**

Directed evolution

Recombinant expression

Metabolic Engineering

Bioreactors

*Sidebar: Inclusion bodies.*

## **Section 7. Examples of applications.**

Proteins with Un-natural amino acids.

Recombinant antibody display

Recombinant vaccines

*Sidebar: Expanding the genetic code with new nucleobases.*

*Sidebar: Intellectual property related to biotechnology.*

Grades will be assigned as follows:

<b>A+</b>	90 -100	<b>B+</b>	77 - 79	<b>C+</b>	65 - 69	<b>F</b>	< 50
<b>A</b>	85 - 89	<b>B</b>	73 - 76	<b>C</b>	60 - 64	<b>N **</b>	< 50
<b>A-</b>	80 - 84	<b>B-</b>	70 - 72	<b>D</b>	50 - 59		

\*\* N grades

Students who have completed the following elements will be considered to have completed the course and will be assigned a final grade: midterm exam, final exam, a group project. Failure to complete one or more of these elements 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 0. 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. Course materials, such as notes, problem sheets, quizzes, examinations, example sheets, or review sheets, may not be redistributed without the explicit written permission of the instructor.
5. 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. 6. Multiple choice scan sheets for machine scoring (bubble sheets) are considered the authentic exam answer paper and will be retained by the department for 1 year.
7. Professors may refuse to review/re-mark exams not written in indelible ink. In addition, requests for review/re-mark 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.
8. Examination papers that have pages removed, or are mutilated will not be marked.
9. I reserve the right to use plagiarism detection software or other platforms to assess the integrity of student work.”
10. Supplemental exams or assignments will not be offered to students wishing to upgrade their final mark.

### **Centre for Accessible Learning**

*Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, approach the Centre for Accessible Learning (CAL) as soon as possible in order to assess your specific needs.*

<https://www.uvic.ca/services/cal/index.php>

### **Course Experience Survey (CES)**

*We value your feedback on this course. Towards the end of term you will have the opportunity to complete a confidential course experience survey (CES) regarding your learning experience. The survey is vital to providing feedback to me regarding the course and my teaching, as well as to help the department improve the overall program for students in the future. When it is time for you to complete the survey, you will receive an email inviting you to do so. If you do not receive an email invitation, you can go directly to your [CES dashboard](#). You will need to use your UVic NetLink ID to access the survey, which can be done on your laptop, tablet or mobile device. I will remind you nearer the time but please be thinking about this important activity*

Use space below for doodling.