

MICROBIOLOGY 405
Biotechnology and Synthetic Biology
Course Outline: Fall 2021

Place: Online lectures

Time: Monday and Thursday (11:30 – 12:50)

Includes: formal group meetings, assessments and independent study

Thursday: office hours 1:30 – 2:30 pm

This course is offered as a flipped classroom and group project, and includes face to face group work and asynchronous, pre-recorded lectures. Greater detail into how this will work is provided below.

Textbook: There is no text book for this course

Course Coordinator / Instructor: Dr. Vanessa C. Thompson

Office hours: Th 1:30 – 2:30 pm (or by appointment)

Office: Petch 183

email: vanessathompson@uvic.ca

Classroom: Clearihue Building C112

Prerequisites: Complete all of:

MICR200A, MICR200B, BIOC300A, BIOC300B

We acknowledge and respect the lək'wəŋən peoples on whose traditional territory the university stands and the Songhees, Esquimalt and WSÁNEĆ peoples whose historical relationships with the land continue to this day.

Software and communication platforms:

The primary website for the course will be on Brightspace.

Lectures will be available on Brightspace.

Groups will meet with me in class to work on group projects during scheduled times.

Any online communication outside of Brightspace will utilize Zoom, with details to accessing this platform to be available within the Brightspace site. Additional notifications will be made through Brightspace as necessary.

First Scheduled Lecture of course:

This will be in Clearihue Building C112, and at that time we will discuss the structure of the class.

Course TA: Dr. Fran Nano

Office: Petch 185

email: fnano@uvic.ca

Fran will be available to answer questions about the course topics, and provide mentorship on group projects. His particular expertise and interests include DNA assembly methods, primer design, and bioinformatics tools. More information will be available on Brightspace.

Course Organization and Marking:

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.

Your group will attend meetings with me in Clearihue Building C112 and elsewhere as you see fit.

It is entirely likely (and encouraged) that your group meets outside of these times, as possible for your collective schedules. You can meet up in person or you may set up your own online conferencing sessions for these meetings that I do not attend if you prefer.

See course calendar for your group’s formal meeting dates. I will attend all of these and note students’ attendance and participation. **Attendance is mandatory and contributes to your group project mark.**

1. All lectures are available both as PDFs and (almost all) as audio presentations in MP4 format. They are available at the MICR405 “Brightspace” site. You are expected to view either the audio/video lectures 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 SARS-CoV-2 detection or treatment, or climate change mitigation. A reasonable effort on the project should result in a good grade that will help buffer a poor exam or final assignment grade.
3. Classroom time will be devoted primarily to smaller group meetings of a subset of the class. See the class calendar (in Brightspace) to determine which days you are expected to attend with your group. **Please note this schedule of group meetings is subject to change dependent upon class size changes.**

Due dates and weighted values of exams, assignments and presentations:

| Assessment type | Weight | Due Date |
|------------------------|---------------|---|
| Assignment 1 | 1% | Monday, September 13, 2021 |
| Assignment 2 | 1% | Monday, September 27, 2021 |
| Assignment 3 | 1% | Tuesday, October 12, 2021 |
| Midterm | 30% | Monday, October 18, 2021 |
| Assignment 4 | 1% | Monday, October 25, 2021 |
| Assignment 5 | 1% | Monday, November 8, 2021 |
| Group Project | 30% | Sunday, November 28, 2021 |
| Group Presentations | - | Monday, November 29, and Thursday, December 2, 2021 |

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| Final Assignment | 35% | Monday, December 6, 2021 |
|------------------|-----|--------------------------|

See the document “Grading and Exams” to understand what will be on the midterm and Final Assignment.

****describe all figure in your presentation so that you could listen to the presentation as if it were a podcast****

Completion of all components (midterm, group project, and final assignment) are required to complete the course and receive a passing grade.

Lecture topics

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. DNA sequencing and other technologies.

Generation of cDNA.

Fosmids, BACs and YACs.

Sanger DNA sequencing.

Sequencing strategies

2nd and 3rd 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

Nucleic acid detection strategies

Sidebar: Expanding the genetic code with new nucleobases.

Sidebar: Intellectual property related to biotechnology.

UVic Grading Scheme

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

** N grades

Students who have completed the following components will be considered to have completed the course and will be assigned a final grade:

Midterm, Group Project, Final Assignment

Failure to complete one or more of the course components, including the Midterm, the Group Project and the Final Assessment, 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 during live class sessions unless being used for the purpose of connecting and engaging with the class.
3. No recordings of live lectures are permitted without permission of the instructor. However, many courses will be recorded by the instructor for accessibility for students unable to attend. If you do not wish to be recorded, contact your instructor to determine if alternative arrangements can be made.
4. Students and instructors are expected to assess their health daily and avoid campus if they are ill.
5. 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.
6. Students are expected to be available for all exams. Instructors may grant deferrals for midterm examinations for illness, accident, or family affliction. Although students do not require documentation, students must contact their instructor and BCMB office (biocmicr@uvic.ca) with the reason for their absence within 48 hours after the midterm exam. The Department will keep a record of the absences. It is the responsibility of the student to ensure all required components are complete, and to arrange deferred exams/assignments with the instructor, which normally should occur within one week of the original exam date.
7. 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 an examination are considered to be in violation of the University of Victoria policy on academic integrity (see current University Calendar). Students must abide by UVic academic regulations and observe standards of scholarly integrity (no plagiarism or cheating). Online exams must be taken individually and not with a friend, classmate, or group, nor can you access notes, course materials, the internet, or other resources without the permission of the instructor. You are prohibited from sharing any information about the exam with others. Use of unauthorized electronic devices and accessing the internet and class material during exams is prohibited unless permission is granted by the instructor. Instructors may use Browser Lockdown Software to block access during classes and exams.
8. 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 or 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.
9. Requests for review/remark of a midterm exam must be made within one week of the exam being returned.
10. The instructor reserves the right to use plagiarism detection software or other platforms to assess the integrity of student work.
11. Supplemental exams or assignments will not be offered to students wishing to upgrade their final mark.
12. Anonymous participation in online classes is not permitted without permission of the instructor.

Important note about COVID-related stress

The current pandemic is placing added stressors- financial, mental, and physical- on everyone. Your wellbeing is of foremost importance. If you are experiencing difficulties coping, the University has

resources to help. Please reach out to Counselling Services, the Centre for Academic Communication, or Learning Assistance Program for assistance.

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 us regarding the course and our 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. We will remind you nearer the time but please be thinking about this important activity.