

# BCMB 489-A01 – Spring 2022

## Antibiotics: Discovery, Clinical Challenges, and Future Therapies

### Course Outline (updated 5<sup>th</sup> January, 2022)

#### Instructor

Dr. Jo Hobbs (*pronouns: she/her*)

Research Associate, Adjunct Assistant Professor, and Sessional Lecturer

Email: jhobbs@uvic.ca

Office hours: Tuesdays 10:30-11:20 *via* Zoom, or by appointment

#### Lecture Times and Location

Tues, Weds, Fri: 11:30-12:20

Tues 11<sup>th</sup> – Fri 21<sup>st</sup> January: Synchronous lectures online *via* Zoom

Tues 25<sup>th</sup> January onwards: In-person lectures in ECS 130

#### Course Content

This course is focused on antimicrobial agents that act against bacteria – otherwise known as antibiotics – and their use in the treatment of human disease. We will cover the full spectrum of antibiotic research: discovery and development; molecular mechanisms of action; antibiotic evasion strategies (*e.g.* resistance); antibiotic stewardship; and new approaches/alternatives to traditional antibiotics. The scientific literature and my own research will be used to provide specific, up-to-date examples related to each concept.

#### Intended Learning Objectives

By the end of this course you will be able to:

- 1) Describe the molecular mechanisms of action of different antibiotics;
- 2) Compare the different methods of antibiotic discovery/design, and describe how new antibiotics are evaluated;
- 3) Discuss the diversity of antibiotic evasion mechanisms, their impact on patient treatment, and strategies to counteract them;
- 4) Understand the societal components and impacts of antibiotic use and stewardship;
- 5) Interpret and analyze experimental data related to various aspects of antibiotic research;
- 6) Work effectively as part of a team to research a given topic;

- 7) Read scientific literature, extract relevant information, and present a summary of the research.

## **Course Format**

This course will involve an initial two-weeks of synchronous online lectures and group work conducted *via* Zoom, followed by in-person lectures given by the instructor, online lectures given by guest lecturers, small group discussions and assignments, and group presentations on current research articles/emerging topics in antibiotic research. While this course will be taught face-to-face from 25<sup>th</sup> January, lecture recordings and online group work options will be available. There is no textbook and students will rely on their own literature searches (as well as research articles provided by the instructor) to support their learning and supplement the material presented in class.

## **Course Outline**

<b>1. Introduction to antibiotics</b>	<ul style="list-style-type: none"> <li>- Cellular targets of antibiotics</li> <li>- Major classes of antibiotics</li> <li>- Molecular mechanisms of action</li> </ul>
<b>2. Antibiotic discovery and development</b>	<ul style="list-style-type: none"> <li>- Sources of antibiotics</li> <li>- Antibiotic discovery strategies</li> <li>- Development and approval process</li> </ul>
<b>3. Antibiotic testing methods</b>	<ul style="list-style-type: none"> <li>- <i>In vitro</i> and <i>in vivo</i> testing methods</li> <li>- Antibiotic interactions</li> </ul>
<b>4. Antibiotic resistance (part 1)</b>	<ul style="list-style-type: none"> <li>- Global burden of resistance</li> <li>- Molecular mechanisms of resistance</li> </ul>
<b>5. Antibiotic resistance (part 2)</b>	<ul style="list-style-type: none"> <li>- Bacterial fitness and selection of resistance</li> <li>- Horizontal gene transfer</li> <li>- Multidrug-resistant bacteria</li> </ul>
<b>6. Antibiotic tolerance and persistence</b>	<ul style="list-style-type: none"> <li>- Phenotypic tolerance and biofilms</li> <li>- Stringent response and genotypic tolerance</li> <li>- Mechanisms behind tolerance and persistence</li> <li>- Detecting tolerance and persistence</li> <li>- Clinical prevalence and consequences</li> </ul>
<b>7. Combatting resistance and tolerance</b>	<ul style="list-style-type: none"> <li>- Anti-resistance treatments</li> <li>- Strategies to reverse tolerance</li> </ul>
<b>8. Non-medical uses of antibiotics</b>	<ul style="list-style-type: none"> <li>- Antibiotic use in industry</li> <li>- Effects on clinical resistance</li> </ul>
<b>9. Antibiotic stewardship</b>	<ul style="list-style-type: none"> <li>- Public and physician education</li> <li>- Infection prevention</li> <li>- Prescribing practices/restricted use</li> </ul>

<b>10. New antibiotics and alternative therapies</b>	<ul style="list-style-type: none"> <li>- New antibiotic targets and approaches</li> <li>- Microbial warfare and phage therapy</li> <li>- Microbiome manipulation</li> <li>- Resistance gene silencing</li> </ul>
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### **Assessments and Important Dates**

Performance in this course will be assessed through short- and long-answer exam questions, in-class group work with associated short individual assignments, and group presentations. Groups will be assigned by the instructor and changed for each new group activity. Marks assigned for the two group presentations will be based on individual participation in in-class group work (noted by the instructor), overall quality of the group presentation, and assessment of the submitted summary (for group presentation 2). All group work must be conducted in an inclusive and respectful manner that allows everyone the opportunity to contribute. The dates listed below are subject to change.

<b><u>Assessment</u></b>	<b><u>Date</u></b>	<b><u>Contribution</u></b>
<b>Assignment 1:</b> In-class group work Submit individual assignments	Fri Jan 21 (online <i>via</i> Zoom) Tues Jan 25	5 %
<b>Group presentation 1:</b> In-class group work Group presentations	Tues Feb 8 Weds Feb 9 and Fri Feb 11	10 %
<b><u>Midterm exam</u></b>	Tues Feb 15	25 %
<b>Assignment 2:</b> In-class group work Submit individual assignments	Fri Mar 4 Tues Mar 8	5 %
<b>Group presentation 2:</b> In-class group work Submit individual summary Final group presentations	Fri 11, 18 and 25 Mar Mon 28 Mar Tues 29 Mar, Weds 30 Mar, Fri 1 Apr	20 %
<b><u>Final exam</u></b>	TBA	35 %

### **UVic Grading Scheme**

<b>A<sup>+</sup></b>	90 - 100	<b>B<sup>+</sup></b>	77 - 79	<b>C<sup>+</sup></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<sup>-</sup></b>	80 - 84	<b>B<sup>-</sup></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
- Both group presentations
- At least one of the two assignments

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 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](mailto: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 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.
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.