Classroom: Engineering Computer Science Bldg 116
Time: Monday and Thursday (8:30am – 9:50am)

Textbook: There is no text book for this course

Course Coordinator / Instructor: Dr. Aditya Mojumdar (he/him), Petch 270
Office hours: By appointment
email: amojumdar@uvic.ca

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

The classroom will be a place where everyone will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expression, national origins, religious affiliations, sexual orientations, ability-and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class.

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 Engineering Computer Science Bldg 116, and at that time we will discuss the structure of the class.

Course Organization and Marking:
The course is organized as a hybrid of traditional and ‘flipped’ lesson. Some of the concepts will be included in the traditional lecture/seminar given by me and other concepts will be presented by the student groups. The lecture/seminar topics are listed below and are divided into sections.

You will be divided into groups and each group will present twice during the course as specified in the class schedule. The two presentations include –
1. A seminar topic (25 min for each group presentation).
2. A journal club, present in detail a research article (20 min for each group presentation).

The seminar topics and research articles will be assigned to you. The presenter is indicated infront of the lecture topics, for eg. (AM) means I will present those topics and (G1-G10) means those topics will be presented by Groups 1 to 10; and same stands for the research articles (see below the article list).
Everyone is required to read all the research articles as it will enable a discussion of the paper following the respective presentation.
The PowerPoint slides need to be submitted on Brightspace by the respective due date (see the due dates).
All lectures are available as **PDFs only (No recordings)** at the MICR 408 Brightspace site. You are expected to view the PDF lectures on your own.

See course calendar for your group’s formal meeting dates. I will attend all the formal meeting dates and note students’ attendance and participation. **Attendance and Participation in class is mandatory and contributes to your group presentation mark.**

Your group might want to meet 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 will not attend.

**Due dates and weighted values of exams, assignments and presentations –**

<table>
<thead>
<tr>
<th>Assessment type</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Presentation 1 – Seminar Topic</td>
<td>30%</td>
</tr>
<tr>
<td>In-class Assessment 1</td>
<td>20%</td>
</tr>
<tr>
<td>In-class Assessment 1</td>
<td>20%</td>
</tr>
<tr>
<td>Group Presentation 2 – Research article</td>
<td>30%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment type</th>
<th>Due date</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-class Assessment 1</td>
<td>Monday, February 06, 2023</td>
</tr>
<tr>
<td>In-class Assessment 2</td>
<td>Thursday, March 09, 2023</td>
</tr>
<tr>
<td>PPT slides submission of Group Presentation 1 (Seminar Topic)</td>
<td>All groups - 9.00pm Wednesday, January 25, 2023</td>
</tr>
<tr>
<td>PPT slides submission of Group Presentation 2 (Research article)</td>
<td>All groups - 9.00pm Wednesday, March 15, 2023</td>
</tr>
</tbody>
</table>

Completion of all components (in-class assessments, group presentations and final assignment) are required to complete the course and receive a passing grade.

<table>
<thead>
<tr>
<th>Class #</th>
<th>Date</th>
<th>Topic</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 09 (Mon)</td>
<td>Introduction to course</td>
<td>A.M.</td>
</tr>
<tr>
<td>2</td>
<td>Jan 12 (Thurs)</td>
<td>Topic I - Introduction</td>
<td>A.M.</td>
</tr>
<tr>
<td>3</td>
<td>Jan 16 (Mon)</td>
<td>Groups 1 to 3 meeting</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Jan 19 (Thurs)</td>
<td>Groups 4 to 6 meeting</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Jan 23 (Mon)</td>
<td>Groups 7 to 10 meeting</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Jan 26 (Mon)</td>
<td>Topic II – Host pathogen interactions</td>
<td>AM. And Group 1</td>
</tr>
<tr>
<td>7</td>
<td>Jan 30 (Mon)</td>
<td>Topic II – Host pathogen interactions</td>
<td>Group 2 and 3</td>
</tr>
<tr>
<td>8</td>
<td>Feb 02 (Thurs)</td>
<td>Topic II – Host pathogen interactions</td>
<td>Group 4 and 5</td>
</tr>
<tr>
<td>9</td>
<td>Feb 06 (Mon)</td>
<td>In-class Assessment 1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Feb 09 (Thurs)</td>
<td>Topic III – Microbiome</td>
<td>Group 6</td>
</tr>
<tr>
<td>11</td>
<td>Feb 13 (Mon)</td>
<td>Topic IV – Mechanisms of bacterial pathogenesis</td>
<td>Group 7 and 8</td>
</tr>
<tr>
<td>12</td>
<td>Feb 16 (Thurs)</td>
<td>Topic IV and V – Infectious disease treatment strategies</td>
<td>Group 9 and 10</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
<td>Group Details</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------</td>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Feb 20 (Mon)</td>
<td>Family Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb 23 (Thurs)</td>
<td>Reading Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Feb 27 (Mon)</td>
<td>Groups 1 to 3 meeting</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Mar 02 (Thurs)</td>
<td>Groups 4 to 6 meeting</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Mar 06 (Mon)</td>
<td>Groups 7 to 10 meeting</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Mar 09 (Thurs)</td>
<td>In-class Assessment 2</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Mar 13 (Mon)</td>
<td>In-class Assessment day – No class</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Mar 16 (Thurs)</td>
<td>Group presentation 2</td>
<td>Groups 10 and 9</td>
</tr>
<tr>
<td>19</td>
<td>Mar 20 (Mon)</td>
<td>In-class Assessment day – No class</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Mar 23 (Thurs)</td>
<td>In-class Assessment day – No class</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Mar 27 (Mon)</td>
<td>Group presentation 2</td>
<td>Groups 8 and 7</td>
</tr>
<tr>
<td>22</td>
<td>Mar 30 (Thurs)</td>
<td>Group presentation 2</td>
<td>Groups 6 and 5</td>
</tr>
<tr>
<td>23</td>
<td>Apr 03 (Mon)</td>
<td>Group presentation 2</td>
<td>Groups 4 and 3</td>
</tr>
<tr>
<td>24</td>
<td>Apr 06 (Thurs)</td>
<td>Group presentation 2</td>
<td>Groups 2 and 1</td>
</tr>
</tbody>
</table>

**Lecture topics –**

**Topic I – Introduction (AM)**

A. History and Impact of infectious diseases
   - Definitions and Examples of infectious diseases
   - Effect on communities
   - Global burden of infectious diseases
   - Antimicrobial resistance

B. Introduction to Microbial pathogenesis
   - Emerging and Re-emerging diseases
   - Two main pathogenic strategies
     - Frontal assault – Acute
     - Stealth assault – Chronic

**Topic II - Host-pathogen interactions**

A. Host defense mechanisms and Bacterial evasion strategies
   - General overview of immune system (AM)
     - Lines of defense against infection
       - Non-specific defense
       - Innate immunity
     - Adaptive immunity
   - Complement cascade and bacterial evasion (G1)
     - Complement cascade activation pathways – Classical, Lectin and Alternative
     - Mimic host complement membrane regulators, eg. Borrelia burgdorferi
     - Secrete Proteases, eg. Pseudomonas aeruginosa
     - Secrete evasion molecules, eg. Staphylococcus aureus
     - Binding host complement regulatory proteins, eg. Streptococcus pneumoniae
   - Phagocytosis, Opsonization and bacterial evasion (G2)
     - Phagocytosis
     - Autophagy
     - Xenophagy
Opsonization

Examples of bacterial evasion strategies

*Lysteria monocytogenes*
*Mycobacterium tuberculosis*
*Staphylococcus aureas*

PAMPs, PRR's and bacterial evasion (G3)

- **PAMPs**: Pathogen-Associated Molecular Patterns
- **DAMPs**: Damage-Associated molecular Patterns
- **PRRs**: Pattern Recognition Receptors
  - Soluble PRR
  - Membrane bound PRR
  - TLR: Toll-like receptors: signalling pathways

B. Microbial colonization and adherence strategies (G4)

- Microbial content within host
- Surfaces for adhesion – Teeth, Skin, Mucosae (small intestine)
- Steps in colonization
  - Non-specific interaction
  - Initial anchoring
  - Tight adhesion
- Bacterial adherence components
  - Capsule, S-layers, Pili, Flagella, Adhesins – Features, Classes, Mechanisms

C. Microbial invasion strategies (G5)

- Classification of invasive pathogens – Obligate intracellular, Facultative intracellular, Extracellular bacteria
- Overview of Host tissue organization
  - Cell junctions – Occluding/Tight junctions and Anchoring junctions
    - Function, Composition and types
  - Invasive intracellular pathogen mechanisms – Zipper and Trigger mechanisms eg. *Yersenia sp, Listeria sp*
  - Invasive extracellular pathogen mechanisms
    - Disruption of Tight junctions and Paracytosis
    - Exploitation of Adherens junctions and Transcytosis

**Topic III – Microbiome (G6)**

A. Introduction to Microbiome

- Diversity
- Function

B. Protection from pathogens – mechanisms

- Competition for nutrients
- Production of short-chain fatty acids
- Bacteriocins

C. Microbiome and Immune response

D. Pathogen Strategies to Overcome Commensal-mediated Resistance

- Exploitation of the gut microbiome
- Express adhesins for attachment to epithelial cells
- Metabolize unique nutrients
- Pathogen-induced gut inflammation
- Utilization of different siderophores for iron uptake
Topic IV – Mechanisms of bacterial pathogenesis

A. Bacterial secretion systems – Overview, Components and Mechanisms (G7)
   Sec Pathway – SecB and SRP pathway
   Tat Pathway
   Secretion system types in Gram negative bacteria
   Type 1 Secretion System T1SS eg. E.coli for haemolysin (Hly) toxin
   Type II Secretion System T2SS eg. V. cholerae Cholera toxin
   Type III Secretion System T3SS eg. Yersinia sp.
   Type VI Secretion System T6SS
   Secretion system types in Gram positive bacteria
   Sec and Tat Pathway
   Type VII Secretion System T7SS

B. Toxins – Overview, Types and Mechanisms (G8)
   Endotoxins
   Exotoxins – Types I, II and III – General features, Mechanism of action, Regulation and examples

C. Biofilms (G9)
   Overview,
   Functions,
   Formation and Composition
   Stages – Reversible adhesion, Semi-irreversible attachment to irreversible, Maturation, Dispersal
   Extracellular Polymeric Substances (EPS) – Overview, Composition and Functions
   Regulation
   c-di-GMP – Overview
   Quorum Sensing – Overview, Types – LuxI/LuxR, Oligopeptide-two-component, LuxS-encoded
   Autoinducer 2 (AI-2)

Topic V – Infectious disease treatment strategies (G10)

A. Antibiotics – Classes and Mechanism of action
   β-lactams – Penicillin, Cephalosporins, Carbapenems,

B. Resistance – Acquisition, Mechanisms

C. Other treatments – AMPs (anti-microbial peptides) and Bacteriocins

Research Articles to be presented by students as Journal Club –

G10

G9

G8
feeding ticks to facilitate tick-to-host transmission. PLoS pathogens, 14(5), e1007106. https://doi.org/10.1371/journal.ppat.1007106

G7

G6

G5

G4

G3

G2

G1

UVic Grading Scheme

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>90 - 100</td>
</tr>
<tr>
<td>A</td>
<td>85 - 89</td>
</tr>
<tr>
<td>A-</td>
<td>80 - 84</td>
</tr>
<tr>
<td>B+</td>
<td>77 - 79</td>
</tr>
<tr>
<td>B</td>
<td>73 - 76</td>
</tr>
<tr>
<td>B-</td>
<td>70 - 72</td>
</tr>
<tr>
<td>C+</td>
<td>65 - 69</td>
</tr>
<tr>
<td>C</td>
<td>60 - 64</td>
</tr>
<tr>
<td>D</td>
<td>50 - 59</td>
</tr>
<tr>
<td>F</td>
<td>&lt; 50</td>
</tr>
<tr>
<td>N**</td>
<td>&lt; 50</td>
</tr>
</tbody>
</table>
**N grades**
Students who have completed the following components will be considered to have completed the course and will be assigned a final grade: **In-class Assessments and Group Presentations**.

Everything counts towards the marks/grades: **Attendance, Participation, Submission of PPTs on time, In-class Assessments, Group Presentations**.

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. Attendance and engagement in the classroom is an integral part of the learning process and cannot be substituted with recordings. It is at the instructor’s sole discretion whether they provide a recording or give permission to students to record a lecture. There is no obligation to do so nor is there any expectations about the quality of the recordings. Nor should students assume a lecture will be recorded as instructors may withdraw access to recordings or permission to record. It is the responsibility of students who miss lectures to catch up in the material through extra readings, and obtaining notes from fellow students. Students who miss several lectures due to illness should contact their instructors to discuss options.

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](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.

**Code of Conduct**
Information about student code of conduct can be found here. [https://www.uvic.ca/services/advising/advice-support/academic-units/student-code-of-conduct/index.php](https://www.uvic.ca/services/advising/advice-support/academic-units/student-code-of-conduct/index.php)

**BMSS blog**
Current announcements, events and award information can be found here. [https://onlineacademiccommunity.uvic.ca/bmss/](https://onlineacademiccommunity.uvic.ca/bmss/)