UNIVERSITY of GUELPH

COLLEGE OF BIOLOGICAL SCIENCE
Department of Molecular and Cellular Biology

Pathogenic Bacteriology MICR*4010

Course offered by: Department of Molecular and Cellular Biology
Course coordinator and instructor: Dr. Joseph Lam, x53823, SSC 4244, jlam@uoguelph.ca
Co-instructor: Dr. Amber Park, x53823, SSC 3516, jlam@uoguelph.ca

Lectures: See schedule below.

Classes will be held in MCKN 228, on Tuesdays and Thursdays from 8:30 – 9:50 am.

Calendar Description
Interactions between bacterial pathogens and host animals, including immune and inflammatory responses of the host's defense mechanisms. The structural and physiological characteristics of a number of important bacteria causing human and animal diseases are considered.

Prerequisites: (MBG*2020, MCB*2210) or MCB*2050, (MICR*2020, MICR*2420), (MICR*3230 recommended)
This course is aimed at senior students, who will be encouraged to integrate information from previous courses in the study of bacterial pathogenesis.

Required text book: Bacterial Pathogenesis – A Molecular Approach, 3rd Edition, by Brenda Wilson, Abigail A. Salyers, Dixie D. Whitt, and Malcolm E. Winkler. (2011) ASM Press, ISBN: 978-1-55581-418-2.

Methods of Evaluation
One Midterm Exam will be held in class, during the first hour of class, on the specified date (see schedule below), and is worth 30% of the final grade.
Please ensure you are present for the midterm exams, as there will be no opportunity available to sit the exams at an alternative time.

Part of your learning experience will be gained by fulfilling 2 assignments, one for each half of the course. Both will be term papers, the first one will be focused on a specific pathogen for each student and the second one will be a critique on a current literature paper related to the topic of bacterial pathogenesis. Your instructor will provide a list of articles for you to choose from. The due dates for these assignments are given in the schedule.

Please ensure that a printed copy of your work is handed in to the course instructor during class time, or to SSC4244 by 5 pm on the due date. Additionally, a pdf file of your first assignment should be sent to the course instructor by 5 pm on the same due date.
Time extensions will not be allowed; 5% will be deducted from the assignment marks for every day of lateness for up to three days. After 3 days, it will not be accepted.

During the second half of the course, in-class participation and understanding will be assessed twice using Immediate Feedback Assessment Technique (IFAT) cards. In addition, students will be marked based on their in-class participation either as "presenters" of 30-min

Thesis presentation, or as "interrogators". This assessment will be worth 5% of your final grade.

No final exam has been planned for this course.

Summary of grading scheme

	% of final grade
Midterm exam (in class)	30
Assignment 1	15 + 5
Quizzes - IFAT cards	10
Assignment 2	20 + 5
3-min presentations	10
Participation	5

Approach: The aim of this course is to examine the fundamental aspects of bacterial structure, physiology, genetics, and how these factors interact with host systems during an infection. Note that the focus is on the "pathogenesis" relating to bacterial pathogens as suggested by the title of the course and will not be taught with the style of a medical microbiology course that tend to emphasize on bacteria pathogens based on various systems of infections. Hence, the instructors will endeavor to apply current knowledge to convey to you the concepts on virulence and virulence mechanisms of bacteria. Specific examples will be used to demonstrate how bacterial pathogens adapt and become successful in causing infections.

Assignment #1 is entitled "My Pet Pathogen". Each student will pick out the name of a pathogen from the box blinded. This way, there will be no bias for any of the students. It is aimed to encourage students to gain an "in-depth" understanding of the physiology and pathogenesis on one particular pathogen. This onus is on the student, who will endeavour to search the literature, read articles, and synthesize the information by writing a term paper about a specific pathogen. The completed term papers will be graded, and then returned to students with marked comments. Then each students is expected to go through marked changes, and revise the term paper accordingly. After returning the corrected copies of this assignment from students, your instructor will compile and assemble into one or two volumes and be uploaded onto D2L. This way, a broader knowledge about various bacterial pathogens will be shared among the students in this class. (Note: please avoid using Wikipedia as your sole source of information).

Assignment #2 will focus on selected topics and "peer-reviewed" journal articles. Again, the topic for the students will be drawn out of a box/hat such that no bias or special treatment will be given to any of the students. Students will be asked to form groups of 2, and each pair will learn to negotiate the role each student member would play in their group efforts. The completed term paper should contain knowledge that is up-to-date, informative, telling an exciting story, and showing a strong understanding of specific aspects of bacterial pathogenesis.

Your professor will have a list of topics and suggestion reading lists for you to choose from. Each of the group of 2 students will pick an article from the titles that are put into a hat/box. Every group will adhere to the deadline for handing in the written assignment. The same pair of students will also prepare themselves for presenting the most exciting and significant knowledge learned from the written assignment in the format of "3-minute Thesis" presentations. One week before the presentation of the topic that you group is working on, an Abstract (200 words maximum) and a list of the references used must be handed in to the course instructor, who will make these available on the D2L site for the rest of the students to have access to. Besides the presenters, we expect the rest of the students in the class to serve as "Interogators". Questioning

period is restricted to 5 min. Also, taking notes during the seminar presentations is highly encouraged.

Learning objectives:
This is an advanced course. Emphasis will be placed on encouraging the students to demonstrate the abilities to "think, discuss, integrate, and synthesize". Students are expected to take responsibility for their own learning, and lectures should be seen as introductory to a given topic. More in-depth reading suggestions, from the textbook, as well as from pertinent and recent scientific papers, will be provided during class time, and for full understanding it is expected that students augment their class-time learning with home study.

Concerning Assignment 1: On the first day of class, each student will draw from a hat (or a box) the names of one pathogenic bacterial species, "a pet pathogen," which will form the basis of their take-home assignments. During class students will be especially expected to contribute information about their pet pathogens to class discussions. The primary aims of the course are as follows: a) To develop an understanding of the molecular basis for bacteria-host interactions and some of the approaches and tools used to investigate them. b) To develop critical thoughts, i.e., the ability to take information from the literature, evaluate it, and to draw your own conclusions. c) To develop an awareness of the impact of bacterial pathogens on the world around us, and an appreciation for the importance of microbiology as a scientific discipline.

Concerning Assignment 2: a similar approach as Assignment will be taken. However, the focus in these assignment is to perform a critique of a particular peer-reviewed article and relevant related literature.

Learning Outcomes:
By the end of this course, students will be expected to understand the fundamental components of host-bacterial pathogen interactions, and to apply these concepts to studies of *any* bacterial pathogen with a goal of understanding the likely outcome of infection. Students will also be expected to be proficient in the reading *and understanding* of the primary literature as it pertains to bacterial pathogenesis, with the added ability to critically evaluate experiments and to suggest pertinent future directions for research.

Presentation:
Each lecture will address a theme in bacterial-pathogen interactions. In general, human disease will be discussed, although some bacterial infections of agricultural and veterinary importance will also be explored as appropriate. A class schedule is given below. The schedule may be subject to slight change according to the needs of the class and availability of 'just published' hot topics in bacterial pathogenesis.

Date	Topic	Assignments/notes
Tuesday Jan. 10	First Day of Class bits & pieces Impact of bacterial pathogens, host defences, prevention.	Hand out: assignment 1 "Bacterial Pathogens!" Pick "a pathogen" Chapters 1-2 Lecturer: Dr. Joseph Lam
Thursday Jan. 12	Innate immunity	Chapter 3

		Lecturer: Dr. Joseph Lam
Tuesday Jan. 17	Special articles from PNAS on Type VI secretion system in Gram-negative bacteria	References will be provided. Lecturer: Dr. Joseph Lam
Thursday Jan. 19	Discussion	Lecturer: Dr. Joseph Lam
Tuesday Jan. 24	Special lecture on recent research on the prevalence multi-drug resistance (MDR) in a particular serotype of *P. aeruginosa*	Thrane et al. 2015, mBio 6(5):e01396-15. doi:10.1128/mBio.01396-15. Lecturer: Dr. Joseph Lam
Thursday Jan. 26	The Microbiome in Humans – techniques used; Metagenomic data; Are we what we eat? The normal bacterial microbiota of humans -not all bugs are bad!! Defining virulence/pathogenicity -what makes some bacteria pathogenic?	Chapter 5 – the Normal Human Microbiota Lecturer: Dr. Joseph Lam
Tuesday Jan. 31	Koch's Postulate – variations of a theme!	Chapter 6 – Microbes and Disease, establishing a connection. Lecturer: Dr. Joseph Lam **Assignment #1 is due**
Thursday Feb. 2	Guest lecture on innate immunity and *Streptococcus pneumococcal* infections and why the aging population is more prone to contract pneumonia.	(Chapter 11) Guest lecture by Dr. Dawn Bowdish, Associate Professor and Canada Research Chair, McMaster University References will be provided.
Tuesday Feb. 7	Virulence: Measuring infectivity and virulence - establishing model systems	Chapter 8 Lecturer: Dr. Joseph Lam
Thursday Feb. 9	Virulence factors I: Invading and Evading mechanisms: Adhesins -Mechanisms -Tissue tropism -Consequences	Chapter 11

	-Prevention	
Tuesday Feb. 14	**Midterm – in class**	No exceptions or conflicts accepted – i.e., no make up examination
Thursday Feb. 16	An opportunistic pathogen – *Pseudomonas aeruginosa*, one of the 6 scariest bacterial pathogens, virulence regulation, quorum sensing, biofilm life style, vaccine strategies.	Chapter 14, and additional references will be provided. Lecturer: Dr. Amber Park
Feb 20/24	WINTER BREAK "Winter Convocation" –NO CLASSES	
Tuesday Feb. 28	Special lecture on specially selected published articles	References will be provided. Lecturer: Dr. Amber Park **Handing out:** **Assignment #2** *Returning to students:* *Graded Assignment #1*
Thursday Mar. 2	Discussion of various techniques used in the special article presented on Tuesday	References will be provided. Lecturer: Dr. Amber Park
Tuesday Mar. 7	Virulence factors II: Evading mechanisms - Biofilms Capsules / LPS Avoidance of uptake by phagocytes Avoidance of killing by phagocytes Resistance to antibiotics	Chapter 11-12 Lecturer: Dr. Amber Park *"Revised" Assignment #1 is due.*
Tuesday Mar. 9	The role of biofilms and OMVs in virulence.	References will be provided Lecturer: Dr. Amber Park **Open book Quiz #1 – (IFAT card)** (March 10 - 40th class day – last day to drop classes)

Tuesday Mar. 14	Virulence factors III: Toxins -The world of bacterial toxins	Chapter 12 Lecturer: Dr. Amber Park
Thursday Mar. 16	Virulence factors III (contd.): Toxins -The world of bacterial toxins Virulence factor IV: Secretion Systems / Invasins	Chapter 13 Lecturer: Dr. Amber Park
Tuesday Mar. 21	Virulence factor IV: Secretion Systems / Invasins	Lecturer: Dr. Youai Hao **Assignment #2 is due**
Thursday Mar. 23	Bacteria as biological weapons - Why all the hype? - In depth: 3 microbial pathogens that could be used as biological weapons	Beginning of Assignment #2 Group presentation.
Thursday Mar. 30	Presentation – 3-min Thesis Interogations/Discussions	
Tuesday Apr. 4	Presentation – 3-min Thesis Interogations/Discussions	*Marked Assignment 2 returned to students*
Thursday Apr. 6	Class conclude	**Open book Quiz #2 – (IFAT card)**
Tuesday Apr. 11		*Revised Assignment #2 is due*
	NO FINAL EXAM	

* Please note: adaptive immunity will not be covered in any detail since this has been covered elsewhere in a recommended prerequisite (MICR*3230). Innate immunity will be reviewed since aspects of it are vital for the understanding of the role of impedins. Students who lack an immunology background are encouraged to speak to the course coordinator for advice on background reading.

Office hours:
There are no regularly scheduled office hours. Contact course coordinator to make an appointment if required.

Academic Integrity Statement:
Students are expected to have read, and understand, what constitutes academic misconduct: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconductoffen.shtml.
Ignorance of such offences is not an acceptable defense. Students suspected of committing

academic misconduct will be reported to the Associate Dean (Academic) of the College of Biological Sciences.

Accessibility:
The University of Guelph is committed to creating and maintaining a barrier-free University community and to eliminating discrimination against individuals with disabilities. To help provide the best possible service to students, the University has established an accessibility website at www.uoguelph.ca/accessibility. This site brings together the services, groups and committees at the University devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. The University welcomes feedback on any accessibility issues at this website.

Please note: Policy on Electronic Recording of Classes by Students:
"Electronic recording of classes is expressly forbidden without prior consent of the instructor. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor."