BICD194 Title: Intracellular pathogens that hijack and exploit host cells

Instructor: Emily Troemel

Location: YORK3010

Date/Time: Thursdays, 9:30-11am

COURSE WEBSITE - TED

Course Summary:

Infectious diseases that cause deadly illnesses such as food poisoning and malaria can be caused by pathogens that not only invade our bodies, but they actually invade and live inside of our cells. How can single-celled microbes invade our cells and make a home there? In this course we will discuss major discoveries in the scientific literature that explain advances in our understanding of **a)** how host cells detect intracellular pathogens, and **b)** how intracellular pathogens evade this detection and exploit host cell resources. The goal of this course is not only to provide a 'big-picture' perspective on this topic, but also to learn how to interpret and present primary literature in this fast-moving field.

Prerequisites: BICD110 (Cell Biology), and their prerequisites. It is highly recommended to have also taken BICD100 (Genetics), BIBC102 (Metabolic Biochemistry), and BIMM100 (Molecular Biology).

Office hours: I will stay after class as needed to answer questions you may have.

Lectures/Presentations: I will present the first lecture reviewing general principles of intracellular pathogens. The rest of the classes will consist of presentation and discussion of one paper related to intracellular pathogens. Selected papers will be available to download from website at least 2 weeks in advance and must be read before class. A group of ~3 students will be assigned for each paper. The presenters will identify the major question/s addressed by the paper, describe each figure and the corresponding conclusion and come up with a simple take-home message for the paper. <u>EACH presenter must be able to clearly explain ANY part of the assigned paper.</u>

Here is the template for presentations:

1) Brief introduction and general question (should be about 15-25% of presentation time)
2) Specific question 1, Figure 1, Conclusion from Figure 1
3) Specific question 2, Figure 2, Conclusion from Figure 2
4) Same as 2 and 3 with subsequent figures (Figures should be about 60-80% of time)
5) TAKE-HOME MESSAGE and next steps (~5-15% of time)

Quizzes: There will be nine quizzes, one every week (except the first week) at the beginning of each paper presentation. They will consist of multiple choice or short answer questions in relation to the paper presented and you will have 10 minutes to take the quiz (quizzes are handed by 9:40am). Thus, you must read all papers for the quarter (not just the one you are presenting). Questions will be related to conclusions or concepts emphasized during the paper presentation.

Peer Evaluations: Written peer evaluations will be done in class every week to evaluate the presenters that week. Pick up the evaluation at the beginning of class and write your name on the top of the sheet. Fill out the evaluation during the presentation and at the end of class, hand the top portion to Professor Troemel for credit, and the anonymous bottom portion to the presenters to give them feedback on their presentation. The presenters will take pictures of the evaluations and email to the others so everyone can have a copy.

Participation: Questions, comments, suggestions are encouraged at any time during the lecture – this participation contributes to your grade.

Grading: grading will be determined by your performance in:
1) presentation of the assigned paper (35%)
2) quizzes at the beginning of classes #2-10 (27% - 3%/quiz for 9 quizzes)
3) peer evaluations of other presenters in classes #2-10 (18% - 2%/evaluation for 9 evaluations)
4) verbal participation – asking questions during presentations (20% - 2%/class for 10 classes)

The grading will be normalized to the highest score. 60% or higher of that score will be a D, 70% or higher will be at least a C-, 80% or higher will be at least a B- and 90% or higher will be at least an A-.

EMAIL COMMUNICATION: etroemel@ucsd.edu is the appropriate email for all correspondence. Please remember to include your first and last name in the body of the email and WRITE BICD194 IN E-MAIL SUBJECT. I will not answer emails with questions that could be asked before or after lecture.

Timeline, Papers, Categories & Presenters – all papers will be uploaded to class website

Topic A) How hosts detect intracellular pathogens, Topic B) How pathogens exploit host cell biology

Date	***Paper #***	***Paper title, authors & citation (click on PDF to download)***	***Topic***	***Presenters***
4/2/15	N/A	**Introductory Lecture: Overview of intracellular pathogens**	A, B	Emily Troemel
4/9/15	#1	**The LRR and RING domain protein LRSAM1 is an E3 ligase crucial for ubiquitin-dependent autophagy of intracellular Salmonella Typhimurium.** Huett A, Heath RJ, Begun J, Sassi SO, Baxt LA, Vyas JM, Goldberg MB, Xavier RJ. Cell Host Microbe. 2012 Dec 13;12(6):778-90.	A	Emily Troemel
4/16/15	#2	**Amino acid starvation induced by invasive bacterial pathogens triggers an innate host defense program.** Tattoli I, Sorbara MT, Vuckovic D, Ling A, Soares F, Carneiro LA, Yang C, Emili A, Philpott DJ, Girardin SE. Cell Host Microbe. 2012 Jun 14;11(6):563-75.	A	
4/23/15	#3	**The ubiquitin ligase parkin mediates resistance to intracellular pathogens.** Manzanillo PS, Ayres JS, Watson RO, Collins AC, Souza G, Rae CS, Schneider DS, Nakamura K, Shiloh MU, Cox JS. Nature. 2013 Sep 26;501(7468):512-6.	A	
4/30/15	#4	**Regulatory mimicry in Listeria monocytogenes actin-based motility.** Chong R, Swiss R, Briones G, Stone KL, Gulcicek EE, Agaisse H. Cell Host Microbe. 2009 Sep 17;6(3):268-78.	B	

5/7/15	#5	**Listeria monocytogenes ActA-mediated escape from autophagic recognition.** Yoshikawa Y, Ogawa M, Hain T, Yoshida M, Fukumatsu M, Kim M, Mimuro H, Nakagawa I, Yanagawa T, Ishii T, Kakizuka A, Sztul E, Chakraborty T, Sasakawa C. Nat Cell Biol. 2009 Oct;11(10):1233-40.	A, B	
5/14/15	#6	**The Legionella effector protein DrrA AMPylates the membrane traffic regulator Rab1b.** Müller MP, Peters H, Blümer J, Blankenfeldt W, Goody RS, Itzen A. Science. 2010 Aug 20;329(5994):946-9.	B	
5/21/15	#7	**Modulation of Rab GTPase function by a protein phosphocholine transferase.** Mukherjee S, Liu X, Arasaki K, McDonough J, Galán JE, Roy CR. Nature. 2011 Aug 7;477(7362):103-6.	B	
5/28/15	#8	**The Legionella effector SidC defines a unique family of ubiquitin ligases important for bacterial phagosomal remodeling.** Hsu F, Luo X, Qiu J, Teng YB, Jin J, Smolka MB, Luo ZQ, Mao Y. Proc Natl Acad Sci U S A. 2014 Jul 22;111(29):10538-43.	B	
6/4/15	#9	**The small GTPase RAB-11 directs polarized exocytosis of the intracellular pathogen N. parisii for fecal-oral transmission from C. elegans.** Szumowski SC, Botts MR, Popovich JJ, Smelkinson MG, Troemel ER. Proc Natl Acad Sci U S A. 2014 Jun 3;111(22):8215-20.	B	

Recommended reviews to help understand the above primary literature papers:

1. Autophagy: Bacteria-autophagy interplay: a battle for survival. Huang J, Brumell JH. Nat Rev Microbiol. 2014 Feb;12(2):101-14.

2. Pathogens hijack host cytoskeleton (Listeria): Subversion of the cytoskeleton by intracellular bacteria: lessons from Listeria, Salmonella and Vibrio. de Souza Santos M, Orth K. Cell Microbiol. 2015 Feb;17(2):164-73.

3. Pathogens use post-translational modifications to hijack membrane trafficking (Legionella): Post-translational modifications are key players of the Legionella pneumophila infection strategy. Michard C, Doublet P. Front Microbiol. 2015 Feb 10;6:87.

4. Intracellular pathogen exit: Prison break: pathogens' strategies to egress from host cells. Friedrich N, Hagedorn M, Soldati-Favre D, Soldati T. Microbiol Mol Biol Rev. 2012 Dec;76(4):707-20.