

**SPRING 2011**  
**Biology 313: Microbial Pathogenesis**

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**Lecture:** Gottwald A201: W/F 9:00-10:15  
**Lab:** Gottwald B200: Fri. 1:30-4:20  
**Office hours:** By appointment

**Required for the course:**

Bacterial Pathogenesis: A Molecular Approach 3<sup>rd</sup> edition  
Blackboard access: <http://blackboard.richmond.edu>

**Course goals:**

The goal of this course is to introduce you to the varied aspects of the study of microbial pathogenesis, specifically bacterial pathogens, through examination of the primary scientific literature. During the semester, we will explore the strategies by which microorganisms subvert host defenses to infect, survive and grow in the host, thereby causing disease. We will begin by discussing general aspects of pathogenesis and the experimental techniques that are used to study microbial pathogens. The goal of this section is to give you a foundation upon which to delve deeper into the molecular aspect of microbial pathogenesis. To give you an appreciation for the wide variety of strategies pathogens use to survive and multiply in the host, we will spend the majority of the course examining mechanisms of attachment, invasion, cell and tissue damage, evasion of host immune response, and transmission. Although we will examine several characteristics of some of the major human pathogens, the purpose of the course is not to expose you to every pathogen, but instead to give you an appreciation for the strategies that the organisms use, regardless of the particular disease that they cause. In other words, this is NOT a course in which you will just memorize that major pathogens and the diseases that they cause. After we have explored the common mechanisms that are used by pathogens to survive and grow in the host, we will examine a variety of specific pathogens more thoroughly to appreciate how the combination of strategies that a single organism employs result in clinical disease.

**Course and lab schedule:** See attached

**Course policies:**

- Discussion of primary literature is a major component of this course. Every student will be expected to participate in these discussions.
- Class begins at 9:00 promptly. Please do not be late. Points will be deducted from your participation grade if you are late.
- I expect that you will be present during class both physically and mentally. You will learn the material better if you are in class each day. If you miss more than 2 class sessions, your final grade will decrease by 5% per lecture missed (unless the absence is approved - see below for exceptions)
- **There are no make up exams.** The only exceptions to this are as follows:
  - Conflict with a religious holiday observance. Note that this **MUST** be brought to my attention the FISRT week of class, otherwise this is not a valid exception.
  - Death of a family member
  - Illness that requires hospitalization or is accompanied by a medical professional's note.
  - Valid university activity
  - Interviews for post-grad activities
- Late work will be penalized 10% of the grade for that assignment for each 24-hour period beyond the due date. After the fifth day, the assignment will not be accepted and the grade becomes a zero.
- Technology failures are not acceptable excuses for late work. You should backup your files regularly as you work (in two places) and should not wait until an hour before class to print out a file.

### **General laboratory information:**

1. Purpose: The laboratory exercises are designed to help you relate the material covered in lecture with actual experimental techniques. Additionally, the laboratory exercises should give you an appreciation for the kinds of experiments that are currently being done in the field of microbial pathogenesis.
2. Correlation with class lectures: The laboratory experience is not a separate course unrelated to the lecture component. One of the goals of the laboratory exercises is to help you relate the material covered in lecture with actual experimental techniques. Thus, it is important that you do the background reading for each laboratory exercise. There may be occasions when an experiment is started before the topic is covered in the lecture class. However, the topic will certainly be covered before the laboratory assignment is to be completed. Also, the principles behind each laboratory exercise will be introduced in the laboratory exercise handout, and we will talk about them at the beginning of each lab period.
3. Out-of-class preparation/work: Many of the laboratory experiments will take the full three hours, especially on days on which you must examine your results from previous laboratory experiments and start the new experiments for the week. To use your time most efficiently and to avoid making costly mistakes, it is ESSENTIAL that you come to the laboratory prepared to do the work. At a minimum, you should have read the laboratory exercise handout. Additionally, for some laboratory exercises, you will need to return to the laboratory on days other than the assigned laboratory period to check your experiments. This reflects the nature of working with microbes.
4. In-class record keeping: To intelligently analyze and write about your experiments, it is critical that you keep careful records of the results you obtain. Once your plates, tubes, samples, etc are discarded in the biohazard waste container, it will be impossible to go back and check for any mistakes that you made.
5. Laboratory safety: Some of the microorganisms that you will be working with in the laboratory have the potential to be pathogenic. Thus it is ESSENTIAL that you adhere to the safety procedures outlined on the safety handout. **Please note that if you are immunocompromised for any reason, you should (1) discuss the risks of lab work in the course with your physician and (2) notify your instructor.**
6. Laboratory partners: Laboratory partners will be randomly assigned. This is not an attempt to keep you and your best buddy from being partners; instead, it is meant to simulate the REAL WORLD where one does not always get to choose with whom he or she will collaborate. It is essential that you develop skills that are related to working with other people. Thus, you and your laboratory partners will work together and share data. However, the written laboratory assignments are to be done separately. You are free to discuss your data with your laboratory partners and your classmates.
7. Attendance: Please note that laboratory attendance **IS MANDATORY** at every session. If you can not attend a laboratory session for a legitimate reason (see above), please contact me. Otherwise, you will lose 10% of the final course grade. Also, any information covered in lab is fair game for lecture exams.

**Evaluation of performance:**

150 points Exam 1

150 points Exam 2

100 points Class participation

100 points Oral presentation of pathogen

200 points Laboratory write-ups (2)

50 points Peer review of Final Paper

250 points Final Assignment (Literature Review/Mini-research proposal – hereby referred to as “final paper”)

**Grade assignment:** Please remember that college is about learning, not getting a certain grade. That being said, I still have to assign you a grade at the end of the semester that reflects what you have earned in the class. Accumulation of 900 points (90%) will earn you an A; 800 points (80%) = B; 700 points (70%) = C; 600 points (60%) = D; 500 points (50%) = F. Also, note that an “A” grade is reserved for truly excellent (not just above average/good or average) performance (not just effort) in the course.

**Honor code:**

*The School of Arts and Sciences, the Jepson School of Leadership Studies, and the Robins School of Business each operate under the University Honor Code Statute. Breaches of the code are cheating, plagiarism, lying, academic theft, disclosing honor council information, registration irregularity and failure to report an Honor Code Statute violation. Any person who violates these standards shall be subject to disciplinary action ranging from reprimand up to and including expulsion from the University. Determination of guilt or innocence and imposition of sanctions, when necessary, will be effected according to established procedures, with procedural fairness observed, and with appropriate appeal procedures available. The University Honor Code Statute is available from any dean’s office. ([http://oncampus.richmond.edu/academics/catalog/academic\\_policies.html#studentlife](http://oncampus.richmond.edu/academics/catalog/academic_policies.html#studentlife))*

How does the honor code apply in this course? While you are encouraged to discuss course material with others, all graded assignments must be your own work unless you are informed of an exception to this rule. Work that you are encouraged to do **as a group includes:** Planning and performing lab experiments; Compiling the results of an experiment (but you generate your own tables for reports); Discussing and interpreting the results of an experiment; Discussing papers from the primary literature; Discussing lecture notes. Work that you are expected to accomplish **on your own includes:** Calculation and analysis of experimental data; Composing tables and graphs of data; All written assignments unless otherwise noted (exams, lab reports, etc.)

Please include the following signed Honor Pledge on all work that is handed in: “I pledge that I have neither given nor received unauthorized assistance during the completion of this work.”

Please note that copying and pasting anything from the web is plagiarism. DO NOT copy and paste text from the web.

## Studying for Exams:

Content of exams:

The majority of the questions will short answer, essay, or analysis and interpretation of data. All of the questions are designed to test your comprehension and understanding of the material presented in class and lab and assigned as readings. Additionally, I strive to provide you with test questions that allow you to demonstrate your ability to make connections between the units and between lecture and lab. I try not to give simple memorization questions, because I do not think that these test your understanding of the material. However, you must know all the terms, definitions, etc to understand the material. You are responsible for all the material from lecture, assigned readings and laboratories unless otherwise indicated. Although each exam focuses on a different set of material, the exams are cumulative in the sense that you are responsible for understanding material covered in previous chapters.

Suggestions for effectively learn/understand the material in BIO 313:

1. Read the reading assignments **before** class and review carefully after class.
2. Bring PowerPoint slides (from web) to class if it helps you in note taking.
3. Carefully read primary literature before we talk about the paper and come to class prepared to discuss the data or ask questions about the data.
4. Ask questions in class.
5. Consistently spend time on this class throughout the semester (not just the week before the exams/assignments). **You should expect to spend 10-14 total hours per week on this course (including time in class and in lab).**
6. **Don't procrastinate.** You will not be able to truly understand the material if you wait until the last minute to learn it. This means that you probably will not do well on my exams since they test your ability to solve problems and interpret/analyze data. These skills require practice and thorough comprehension, neither of which can be crammed into your brain the night before an exam.

**BIOLOGY 313 (MICROBIAL PATHOGENESIS) COURSE SCHEDULE AND READING LIST: Version 3/5/11**

DATE	ASSIGNED READING	TOPICS COVERED	LAB (Fri of that week)	DUE DATES
1/12	W1, T1, R1	Intro to microbial pathogens	Biosafety; Koch's postulates; finish lecture material	
1/14	T2	Microbial pathogenesis techniques		
1/19	T3	Evolution of pathogens	Koch's postulates; finish lecture and P2	
1/21	P1-P2	Evolution of pathogens papers		
1/26	T4 and R2	Attachment to host cells	Koch's postulates; finish lecture; Finish P3	
1/28	P3	Attachment paper		
2/2	R3	Attachment consequence	Attachment Lab Week 1	
2/4		Attachment consequences finish		
				Koch Lab Rpt (T 2/8)
2/9	T5 and R4	Invasion	Attachment Lab Week 2; finish P4	
2/11	P4	Attachment paper		
2/16	T5 and R4 -cont	Invasion	Invasion Lab Week 1	
2/18	T5 and R4 -cont	Invasion		
2/23	T5 and R4 -cont	Invasion; Invasion consequences	Group meeting #1 pathogen presentation; Finish P5	Att/Inv Lab Report (Th 2/24)
2/25	P5	Invasion paper		
				Pathogen presentation topic (M 2/28)
3/2		Catch up	Toxin lectures (T6)	
3/4	T6	Exam 1		
3/9		Spring Break	No lab	
3/10		Spring Break		
3/16		Research for final paper	Group meeting #2 pathogen presentation: Attachment and invasion work	
3/18		Research for final paper		
				Final paper topic (3/18 noon) Attachment and invasion summary for presentation (T 3/22)
3/23	T6-cont	Toxin	Toxin Lab Week 1	
3/25	P6	Toxin Paper		
				Final paper sources due (T 3/29)
3/30	R5, R6	Transmission	Toxin Lab Week 2; Group meeting #3: Toxin and transmission	
4/1	P7	Transmission paper		
				Toxin and transmission summary for presentation (T 4/5)
4/6	T7	Host defenses – innate	Peer review of papers	Final paper draft due (4/7 Th)
4/8	T8	Host defenses – acquired		
				Peer review due T 4/12
4/13		Catch up	Group meeting #4: Immune response and finish PP	
4/15		Exam 2		
4/20		Pathogen presentations (3)	Quiz on your presentation	Pathogen PP (T 4/19)
4/22		Pathogen presentations (3)		
4/28				Final paper by 4/28 Th at 1:30

Please note that this is a tentative schedule. The dates may change depending on the pace at which we cover the material. Note however that the exams will remain fixed on the indicated dates.

**TENTATIVE READING LIST – see BB for most current version**

P = primary literature readings – found on BB

Paper #	title
P1	Black holes and bacterial pathogenicity
P2	Lysogenic Conversion by a Filamentous Phage Encoding CT
P3	Genetic analysis of <i>Pseudomonas aeruginosa</i> adherence
P4	UPEC apop
P5	Protein Kinase G from Pathogenic <i>Mycobacteria</i> Promotes Survival Within Macrophages
P6	Cytotoxic Effects of Streptolysin O and Streptolysin S or anthrax toxin paper
P7	Role of <i>Yersinia</i> Murine Toxin in Survival in Midgut of Flea

R = general topical readings – found on BB or passed out in class 1 week before reading is due

Reading #	title
R1	Microbial virulence results from the interaction between host and microbe (review article).
R2	Bacterial Adhesion to Host Cells (pages 191-193, 196, 201-203)
R3	Bacterial Adhesion to Host Cells (pages 203-218)
R4	Hijacking of eukaryotic functions by intracellular bacterial pathogens (review article).
R5	Processes controlling the transmission of bacterial pathogens in the environment (review).
R6	A plague of fleas (review article).

T= textbook readings from Bacterial Pathogenesis

Reading #	
T1	pg 1-8, 12-13 (Genomes, Experimental Animals), and pages 13-14 (Brave New World)
T2	Ch 8 pg 131-139 (Animal Models), 139-141(Tissue Culture), 141-143 (Gent Protection Assay later for lab expts 2 and 3), 143-144 (Microscopy) Ch 7 107-108 Ch 9 pg 149-151, 152 (Molecular Genetics), 169 (Microarrays), 171 (Bacterial Physiology)
T3	Ch 7 pg 111-112, 116-120 (HGT: Mobile Genetic elements), 121-127 (PAI and Evolution)
T4	Ch 11 pg 199-200, 203-205, 208-210
T5	Ch 11 pg 213-222
T6	Ch 12 Ch 12 pg 225 - 231(1st column) and pg 234(Type II) - 239 for first lecture on 3/2 Ch 12 pg 239-250 for rest of toxin lectures
T7	Ch 3 pg 28-38
T8	Ch 4 pg TBA

W = web readings

Reading #	Web page
W1	<a href="http://textbookofbacteriology.net/structure.html">http://textbookofbacteriology.net/structure.html</a> - see email from 1/2/11- read before classes begin

S = optional supplemental readings - found on BB

Reading #	Title
S1	Mechanisms of bacterial pathogenicity
S2	Common Themes in Microbial Pathogenicity Revisited
S3	The Damage-response framework of microbial pathogenesis
S4	Host-pathogen interactions: basic concepts of microbial commensalism, colonization, infection, and disease
S5	A plague of fleas