

# Biology 067: Emerging Diseases

Fall 2007

Tu/Th 11:30-12:55 Kanbar 107

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New and old disease-causing agents emerge out of obscurity every year and have an enormous impact on the world we live in, as seen during the recent SARS outbreak and in recurrent influenza epidemics over the 20th century. In Bio067, we will discuss the biology behind bacteria, viruses and other agents that cause infectious diseases: how these agents infect hosts, how the host immune system combats the infection and how the agents elude the immune system. We will also focus on how scientists study infectious diseases in the laboratory and field and we will design, perform and analyze our own experiments on antimicrobial resistance of bacteria. Effective control of infectious diseases requires the coordination of numerous fields of study and in studying the scientific processes involved, we will gain a greater understanding of how infectious diseases are controlled and prevented. Throughout the course, we will also look at the interplay between infectious diseases and social, political, economic and environmental forces.

## Office Hours and Communication

I will be in my office or lab (230B and 236B, respectively) during my office hours, which will be posted on the course website and Blackboard. If you cannot make one of these times, you can **set up a time** to talk to me by **emailing me at least 3 times you are free**; I will let you know within a day after I receive your email if one of the times works for me. Also, I send occasional **announcements, reminders and clarifications via email**, so it is a good idea to **check your email at least once every day or two**.

The **main course website**, which is available to people outside the class, will grow with **useful information** and **links relevant to infectious diseases** throughout the semester. We **welcome any suggestions for enhancing the site**, from information that you would like posted, to articles you have found that relate to what we are discussing, to relevant webpages (from bonafide sources). The URL for the course home page is:

<http://www.bowdoin.edu/faculty/a/amcbride/courses/bio067>

## Laboratory sessions: Tuesdays 1-3:55

### **Lab #1: Antimicrobial activity of spices**

**Sept. 11** Discussion and experimental design (Groups A&B in Druckenmiller 16)

**Sept. 18** Group A experiment (Druckenmiller 221)

**Sept. 25** Group B experiment (Druckenmiller 221)

**Oct. 2** Discussion of results (Groups A&B in Druckenmiller 110)

**Film: Oct. 16** “And the Band Played On” (Groups A&B in Druckenmiller 16)

### **Lab #2: Antimicrobial resistance of Bowdoin bacteria**

**Oct. 23** Discussion and experimental design (Groups A&B in Druckenmiller 16)

**Oct. 30** Group B experiment (Druckenmiller 221)

**Nov. 6** Group A experiment (Druckenmiller 221)

**Nov. 13** Discussion of results (Groups A&B in Druckenmiller 110)

## Class and assignment schedule

Date	Topic	Overview of Readings	Assignments/Lab
8/30	<b>Introduction to infectious disease</b>	Lederberg, "Infectious History" Garrett, Preface and Introduction Gerstman, "Epidemiology Past and Present"	
<b>Part I: Biology of infectious agents and host defenses</b>			
9/4-6	<b>Biological building blocks</b>	Mims, Ch. 1 <a href="#">University of Utah Genetic Science Learning Center Website</a> Garrett, Ch. 1 & 2	
9/11	<b>Tuberculosis</b>	*Hall, "The Return of Tuberculosis" *Koch, "The etiology of tuberculosis"	<b>Tuberculosis discussion preparation due Tues., Sept. 11</b>
9/13	<b>Host defenses</b>	Mims, Ch. 2 Hall, "Innate Defenses that Hold the Fort" in <a href="#">Arousing the Fury of the Immune System</a> pp. 18-21.	<i>Lab #1 design discussion</i>
9/18	<b>Adaptive immunity</b>	Gerstman, "Selected Epidemiologic Disease Concepts" Hall, "The Killers that Save Us" in <a href="#">Arousing the Fury of the Immune System</a> pp. 7-17, 22,23. <i>optional: Mims, Ch. 3 (focus p. 45-51, 67-69)</i>	<i>Lab #1 experiment: Group A</i>
<b>Part II: Emerging and Re-emerging Infectious Diseases</b>			
9/20	<b>Ebola</b>	Garrett, Ch. 5 <a href="#">CDC Ebola website</a> "Questions and answers"	
9/25-9/27	<b>Influenza</b>	<a href="#">CDC influenza website</a> "Key facts" Garrett, Ch. 6 *Nichol <i>et al.</i> , "The effectiveness of vaccination against influenza in healthy working adults" *Laver <i>et al.</i> , "Disarming flu viruses" Gibbs & Soares, "Preparing for a pandemic"	<i>Lab #1 experiment: Group B</i> <b>Influenza discussion preparation due Thurs., Sept 27</b>
10/2-4	<b>The genetic revolution and the fight against SARS and anthrax</b>	Garrett, Ch. 8 Pearson <i>et al.</i> , "SARS: What have we learned?" + editorial "We have been warned" Wright, "To Vanquish a Virus" Young & Collier, "Attacking Anthrax"	<i>Lab #1 results discussion: worksheet due Tues., Oct. 2</i> <b>Final project topic choice due Thurs., Oct. 4</b>
10/9	<b>FALL BREAK</b>		
10/11	<b>Urban life, microbes and STDs</b>	Garrett, Ch. 9 Farmer, "Social Inequities and Emerging Infectious Diseases"	Review session Sun., Oct. 14 (Optional, time TBA)
10/16 10/18	<b>Midterm quiz AIDS, the early years</b>	Garrett, Ch. 10, 11 (long chapter--focus on African outbreak) <a href="#">Human Immunodeficiency Infection: Overview and step-by-step animation</a> (cellsalive.com)	<i>"And the Band Played On"</i> <i>Tues. in lab</i> <b>3 possible final project articles due Fri., Oct. 19</b>

10/23-10/25	<b>AIDS therapy and controversy</b>	*Cohen, "The Duesberg Phenomenon" *Cohen, "Confronting the limits of success"  <i>For lab: Levy, "The Challenge of Antibiotic Resistance"</i>	<i>Lab #2 design discussion</i> <b>AIDS discussion Thurs., Oct. 25</b>
10/30	<b>Prions</b>	<b>Prusiner</b> , "Detecting Mad Cow Disease"	<i>Lab #2 experiment: Group B</i>
11/1	<b>Final project article discussion</b>	Scientific article for your final project	<b>Final project questions for discussion due Thurs., Nov. 1</b>
<b>Part III: Infectious Disease Problem-Solving</b>			
11/6	<b>Microbial survival strategies</b>	Mims, Ch. 6	<i>Lab #2 experiment: Group A</i>
11/8	<b>Outbreak investigation</b>		<b>Final project outline with reference list and analysis due Fri., Nov. 9</b>
11/13	<b>Geoff Beckett talk</b>	<b>Kanigel</b> , R. "A Bull's-eye on Lyme Disease" pp. 57-71 in <u><a href="#">Arousing the Fury of the Immune System</a></u>	<i>Lab #2 results discussion:</i>
11/15	<b>Lyme disease: Issues of prevention and treatment</b>	<b>Karow</b> , J. "Battling Lyme Disease" <b>Grann</b> , D. "Stalking Dr. Steere" <a href="#">CDC Lyme Disease website</a>	<b>worksheet due Tues., Nov. 13</b>
11/20	<b>Humans, the environment and disease: Case study</b>	Garrett, Ch. 16	
11/22	<b>THANKSGIVING!</b>		
11/27	<b>Humans, the environment and disease</b>		<b>Final project summary due by email Tues., Nov. 27</b>
11/29	<b>Symposium I</b>		
12/4	<b>Symposium II</b>		
12/6	<b>What lies ahead?</b>	Garrett, Ch. 17 Mims, Ch. 11	

**Help session Tues., Dec. 11, 7:30 pm**

**Final Exam: Thurs., Dec. 13, 9 am**

**\* Asterisk denotes articles that should be summarized in your discussion preparations**

## **Reading assignments**

**Texts** (available at the Bookstore)

Garrett, L. (1994) *The Coming Plague: Newly Emerging Diseases in a World out of Balance* (New York: Penguin Books)

Mims, C. (2000) *The War Within Us: Everyman's Guide to Infection and Immunity* (London: Academic Press)

**Shared Text** (sign up to share a copy)

Howard Hughes Medical Institute Report (1998) *New Ways to Boost the Body's Defenses: Arousing the Fury of the Immune System* (Chevy Chase: Howard Hughes Medical Institute)

## **Other reading assignments**

**Electronic reserves (E)** can be found at:

<http://phebe.bowdoin.edu/search/r?SEARCH=Biology+067>

**Links to websites (W)** can be found on the course website at:

<http://www.bowdoin.edu/faculty/a/amcbride/courses/bio067/websitereadings>

### **Week of 8/30**

E Lederberg, J. (2000) "Infectious History" *Science* **288**: 287-293.

E Gerstman, B. (1998) "Epidemiology Past and Present" Chapter 1 in *Epidemiology Kept Simple* (New York: Wiley-Liss), pp. 1-15.

### **Week of 9/4**

W University of Utah Genetic Science Learning Center Website: The Basics and Beyond

<http://gslc.genetics.utah.edu/units/basics/index.cfm>

*Tour of the Basics: What is DNA? What is a Gene? What is a Protein?*

*From DNA to protein: Build a DNA molecule, Transcribe and Translate a Gene*

### **Week of 9/11**

E Hall, S. (1996) "The Return of Tuberculosis" in *The Race Against Lethal Microbes* (Chevy Chase: Howard Hughes Medical Institute), pp. 6-21.

E Koch, R. (1882, 1884) "The etiology of tuberculosis" in *Milestones in Microbiology*, ed. T. Brock (1961), (Washington, DC: ASM Press) pp. 109-118

### **Week of 9/18**

E Gerstman, B. (1998) "Selected Epidemiologic Disease Concepts," Chapter 2 in *Epidemiology Kept Simple* (New York: Wiley-Liss), pp. 19-33.

W Special Pathogens Branch, Centers for Disease Control and Prevention (2005) "Questions and Answers about Ebola Hemorrhagic Fever."

<http://www.cdc.gov/ncidod/dvrd/spb/mnpages/dispages/ebola/qa.htm> [Aug. 28, 2007].

### **Week of 9/25**

- W National Center for Infectious Diseases, Centers for Disease Control and Prevention (2006) "Key Facts about Influenza and the Influenza Vaccine" <http://www.cdc.gov/flu/keyfacts.htm> [Aug. 28, 2007]
- E Nichol, K.L., Lind, A., Margolis, K.L., Murdoch, M., McFadden, R., Hauge, M., Magnan, S., Drake, M. (1995) "The effectiveness of vaccination against influenza in healthy working adults" *N Engl J Med* **333**: 889-893.
- E Laver, W.G., Bischofberger, N., Webster, R.G. (1999) "Disarming Flu Viruses" *Sci. Am.* **280**: 78-87.
- E Gibbs, W.W., Soares, C. (2005) "Preparing for a pandemic" *Sci. Am.* **293**: 45-54.

### **Week of 10/2**

- E Pearson, H., Clarke, T., Abbott, A., Knight, J., Cyranoski, D. (2003) "SARS: What have we learned?" *Nature* **424**: 121-126. (+ editorial "We have been warned", p. 113)
- W Wright, L., Scientific American (2003) "To Vanquish a Virus" [http://www.sciam.com/print\\_version.cfm?articleID=000B9459-E009-1F16-B4FD80A84189EEDF](http://www.sciam.com/print_version.cfm?articleID=000B9459-E009-1F16-B4FD80A84189EEDF) [Aug. 28, 2007]
- E Young, JAT, Collier, RJ (2002) "Attacking Anthrax" *Sci. Am.* **286**: 48-54.

### **Week of 10/11**

- E Farmer, P. (1996) "Social Inequities and Emerging Infectious Diseases" *Emerg Infect Dis* **2**: 259-269.

### **Week of 10/16**

- W Quill Graphics, CELLS Alive! (2003) "Human Immunodeficiency Infection: Overview and step-by-step animation" <http://www.cellsalive.com/hiv1.htm> [Aug. 28, 2007].

### **Week of 10/23**

- E Cohen, J. (1994) "The Duesberg Phenomenon" *Science* **266**: 1642-1649.
- E Cohen J. (2002) "Confronting the Limits of Success" *Science.* **296**: 2320-4.
- E Levy, S. (1998) "The Challenge of Antibiotic Resistance" *Sci. Am.* **278**: 46-53.

### **Week of 10/30**

- E Prusiner, S.B. (2004) "Detecting Mad Cow Disease" *Sci. Am.* **291**: 86-93.

### **Week of 11/13**

- W Karow, J., Scientific American (2000) "Battling Lyme Disease" [http://www.sciam.com/print\\_version.cfm?articleID=00026621-4FE9-1C75-9B81809EC588EF21](http://www.sciam.com/print_version.cfm?articleID=00026621-4FE9-1C75-9B81809EC588EF21) [Aug. 28, 2007].
- E Grann, D. (June 17, 2001) "Stalking Dr. Steere" *NY Times Magazine* pp. 52-57.
- W Division of Vector-Borne Infectious Diseases, Centers for Disease Control (2007) "CDC Lyme Disease Home Page" <http://www.cdc.gov/ncidod/dvbid/lyme/index.htm> [Aug. 28, 2007].

## **Requirements and Grading Criteria**

### **Class participation: 15%**

The participation portion of the grade combines a number of aspects that are critical to enhancing one's understanding of infectious diseases.

- 1. Discussions:** Over the course of the semester, **three** classes (Sept. 11, Sept. 27, Oct. 25) will be dedicated to **small group discussions** of readings and issues we have talked about in class. **Individual preparation** for these discussions will be **critical** for their success and therefore each person will write a **one-page “Discussion Preparation,”** which will be **handed in at the end of class**. This preparation will include three sections: **questions/comments/ thoughts** inspired by the reading, a short **summary** of the reading, and a **highlighted passage** for group consideration. You should make sure that you **attend** these classes and **actively participate** in the discussions. **I will read** your preparations and **make comments** and **suggestions for improvement**. **Handing** the preparations in **on time** and **participating** in discussions is more important than the mark on each preparation ( $\checkmark$ ,  $\checkmark+$ ,  $\checkmark-$ ).
- 2. Class:** The more actively everyone becomes involved during class, the more **dynamic, exciting, and comprehensible infectious diseases** will become. Active participation includes **asking questions, responding** to my queries, and **making comments** that are **relevant** to the topic we are discussing. You can also participate by coming to **talk with me** after class or at other times.
- 3. Practice problems and help sessions:** One of the best ways to **prepare** for **exams** is to work through **practice problems**, which I will be posting periodically on the course website. Although you will not turn in your answers, it is in your best interest to **work on the questions earlier** rather than later and to **visit my office hours** or **attend** the optional **help sessions** if you are confused by a problem or wish to know whether you are on the right track.

### **Laboratory work: 15%**

In class we will discuss experiments that biologists, doctors and epidemiologists have performed to understand infectious diseases. Twice during the semester, you will develop and test hypotheses about **antimicrobial resistance of bacteria** during our **lab session on Tuesdays from 1-3:55 pm**. Our first lab session will be on **Sept. 11 in Druckenmiller 16**.

### **Final group project: 35%**

The diseases we have time to cover in this course represent only a small percentage of the microbes with major impacts on the world we live in. To expand our understanding of the role of infectious microbes in the world today, **over the course of the semester groups of 3** will **prepare presentations** about an **infectious disease we have not discussed in class**. Groups will present their work in **two poster sessions** during class on **Nov. 29** and **Dec. 4**. Since you will be working on this project from October through December, there will be **intermediate deadlines** to help guide your progress.

### **Midterm quiz: 10%**

### **Final exam: 25%**

**Reminder of grades as defined in the Bowdoin College Course Catalog 2007-2008, p. 34:**

- "**A**, the student has **mastered material** of the course and has demonstrated **exceptional critical skills** and **originality**;
- B**, the student has demonstrated a **thorough** and **above average understanding** of the **material** of the course;
- C**, the student has demonstrated a **thorough** and **satisfactory understanding** of the **material** of the course;
- D**, the student has demonstrated a **marginally satisfactory understanding** of the **basic material** of the course;
- F**, the student has **not** demonstrated a **satisfactory understanding** of the **basic material** of the course."

**Late assignment policy**

All discussion preparations, lab worksheets and final project posters are designed to help stimulate discussion in class, in lab or in the final project symposia. Therefore, a late assignment will have 50% of the grade deducted if handed in later the same day, 75% of the grade deducted if handed in the next day and will not be accepted thereafter. If your discussion preparation or lab worksheet is not finished by class or lab, **please still come participate in the discussion or lab**, since participation counts toward your grade and we would like to hear what you have to say!

Intermediate deadlines for the final project (topic choices, scientific article choices, reference analyses and outlines) are scheduled to keep your group on pace to finish your project in plenty of time for the **first poster symposium** on **Thurs., Nov. 29** and to allow me to give you feedback along the way. Therefore it is in your best interest to turn these assignments in on time. For each day an assignment is late, 1% of your final project grade will be deducted.