

# Evolution of Epidemics

## Biology 804-01

### Spring, 2013

|              |                                   |                                   |
|--------------|-----------------------------------|-----------------------------------|
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#### I. INTRODUCTION: EVOLUTION OF EPIDEMICS, THE CLASS

Plagues have caused suffering and death for humans for hundreds of years. These events have destroyed economies, ended wars, and changed the course of civilizations. Plagues have been the focus of fables, nightmares, art, and scientific breakthroughs. Attempts to combat the unseen lethal agents have ranged from the superstitious to the latest molecular biology. In this course we introduce the history of plagues, discuss the pathogens that cause them, illustrate the techniques used to defend ourselves from them, and speculate about their possible future roles.

Learning about plagues is unique in several ways. First, the words used for widespread death due to a disease are actually vague: plague, epidemic, pandemic. So, we will talk about these terms and how they are defined. The media use these words on a regular basis, and their use should be evaluated using scientific rigor. Second, there are plagues in the world now that are largely ignored, either because they are not lethal or they happen only under certain conditions. Third, the history of plagues is important. How humans bring them about and how we deal with them provides valuable lessons. And fourth, human plagues will continue to occur, so people need to understand the mechanisms that produce and propagate them, as well the best ways to prevent or halt them.

This class has implications in the present world. In the past few decades there have been several completely new disease organisms that are responsible for epidemics, and it is

reasonable to assume that there will continue to be the development of more diseases that can become epidemics. Due to wars, natural disasters, reliance on high-density animal production, failures in public health, and greater population density, we expect to see novel disease outbreaks in the future. Some of these diseases may be virulent and fast-spreading and therefore, able to cause epidemics or plagues.

Lastly, this is a Master's Program, and we strive to strengthen your skills. In particular, we want to reinforce your informational and written communication skills. To these ends we assign readings where you are expected to comprehend scientific information and to write cogent, concise, and properly cited essays on the topics in the class.

## **II. COURSE OBJECTIVES**

- Identification of different pathogenic organisms, phylogenetic groups, and strains
- Knowledge of the origin and evolution of plague organisms
- Identification of the factors behind successful plagues
- Knowledge of plague organism life cycles: hosts, vectors, and reservoirs
- Knowledge of human defenses against these organisms including: immune system, antibiotics, vaccines, water treatment, sanitation facilities, animal control
- The future of plagues and epidemics: biotechnology, bio-terrorism, tools for monitoring and containment, new diseases, possible new habitats and conditions for plague organisms

## **III. REQUIRED MATERIAL**

### **Textbooks**

Sherris Medical Microbiology, 2010, An Introduction to Infectious Disease, 5th ed., Kenneth J. Ryan and C. George Ray editors, McGraw-Hill Publishing, New York, NY, ISBN:0-8385-8529-9

The Power of Plagues, 2006. Irwin W. Sherman, ASM Press, Washington, DC, ISBN: 1-5558-1356-9

The Demon in the Freezer. 2002. Richard Preston, Random House, New York, NY, ISBN: 0-375-50856-2

### **Computer and Software**

Access to a computer with high-speed Internet access and Microsoft Office 2000 or newer is required. You will also need Windows Media player, or similar, to view the lectures. If you have an Office Version older than 2007 you will need to download the converter program that allows you to read Office 2007 documents.

We require you to use Microsoft Word 2000 or newer as these have the edit-tracking feature we will use to mark your work. No other formats, such as ".wpd," will be accepted.

Adobe Acrobat reader 7.0 or better will also be needed to read the lecture notes.

## **IV. WEB RESOURCES**

For this class we are using an online course management system called Blackboard. This provides standard interfaces for grades, assignments, discussions, and other functions. You will need to become familiar with this application. There is some online help, and in addition we will talk about this software in our first lecture to you. There are two important things to remember about this system:

- 1) You **must check and use your UNK email address** to receive and send emails pertaining to this class. The Blackboard system does not allow us to enter any other email address you may be using now.
- 2) Check the announcements page of Blackboard for breaking news. Any information we need to get to the class as a whole will be on this opening page.

## **V. COURSE STRUCTURE**

The course consists of recorded lectures, reading assignments, and online discussion boards (See schedule). Most weeks you will be required to view two lectures, complete assigned reading, a quiz and participate in discussion boards. All materials for each week will be posted on the Blackboard web site.

We expect you to keep up with the pace of the course, and the course structure (e.g., weekly quizzes) is designed to help with this. If this is your first distance class, you will find that these classes are fast paced. Everyone in these classes is busy with school, classes, and family. We understand, but if you fall behind, it is difficult to catch up. Please do not procrastinate.

### **LECTURE NOTES**

Most weeks two recorded lectures and lecture outlines will be posted. The lecture outlines will be in pdf format, so you must have Adobe Acrobat Reader in order to open the files. (Remember that this information is copyrighted, so it is illegal to copy this material and distribute it without permission.) These outlines are not a substitute for doing class work (viewing lectures, reading papers and the text). The notes will allow you to listen during lecture without the need to frantically copy each word spoken in the lecture. However, the notes are skeletal and we do talk about more than is on the notes. This means that total reliance on the notes will result in poor understanding of class material.

### **DISCUSSION BOARDS**

Discussion board questions, based primarily upon the readings from Sherman & Preston, will be posted most weeks. Students will be expected to respond to the discussion questions and to fellow other students' comments. The participation grade will be weighted by the quality and number of responses elicited by the student. There will be a total of 12 weeks with a discussion board component and the lowest two scores will be dropped at the end.

All posts for the week should be completed by Sunday at midnight (CST). Participation in class will be monitored and graded based on the following general criteria (a grading rubric will be made available at a later date):

- 1) **Participate at least twice each week.** You should check the discussion board a minimum of every other day and post comments, questions, etc. You are welcome to suggest other readings, websites, and similar materials that may carry discussion and inquiry in new directions. In order to keep a discussion going and to allow everyone to participate in a meaningful way, we need comments to be made throughout the course.
- 2) **The quality of your contribution.** This is somewhat subjective, but the more insightful your comments the better the quality of discussion will be. Your comments should generally consist of at least a short paragraph. Conciseness and clarity are necessary to keep the work load for this class to a reasonable level so page long postings are discouraged. Your comments should be supported with specific details, usually references, and should be relevant to the current topic of discussion. Posts about the weather, Blackboard issues, or simple posting of a web link are not examples of posts that will count for credit.
- 3) **How well you interact as classmates.** Be nice. These are online discussions of scientific issues. You should read all postings, and you can respond to some of them. Your responses should demonstrate that you are aware of the discussion that has been taking place. Go beyond either simply “I agree” with someone, state your reasons. Be polite and constructive in your posts.

## QUIZZES

There will be 10 assigned quizzes worth 5 points each. The quiz schedule is included with the syllabus outline. Quizzes will be posted on Friday at 5 p.m. CST. You will have until Tuesday at 5 p.m. CST (96 hrs) to take the quiz. You are responsible for remembering and taking each quiz on Blackboard. You will only be able to take the quiz one time. The quizzes are timed so as not to allow you to use your books or notes. The grade will be automatically entered in the grade book on Blackboard. If you have any problems accessing the quiz, please let us know immediately.

## EXAMS

Reading and understanding of scientific papers is crucial to the way science works. We believe that experience with primary scientific literature is a necessary part of the graduate experience. We will ask you to find and read both popular media and scientific source material. In addition to the core material on plagues, this course is designed to improve critical thinking skills. We expect everyone in the class to both be able to read and write papers in scientific style.

Exams will generally be provided 2 weeks before their due date. Exams must be submitted through the Blackboard Assignment function, not any other method. Formatting is important

for these documents. **Referencing is required!** Plagiarism is a serious offense academically. We will check papers for plagiarism and severe grade reductions can result. If you have any questions, please contact us **before** you turn in any papers.

Formatting of the midterm and final exams should be as follows: (Note the use of Word outline function, we encourage this for your own work in building exam papers.)

1. File Formatting: Save your papers as Word attachments.
  - a. We will be using the 'Track Changes' function in Word to give you feedback on your papers, so you are best off with Microsoft Word, preferably Word 2007, but Word 2000/XP should work as well.
  - b. Name your file with your last name and assignment number, e.g. 'shafferj\_paper01'
2. Page Formatting: for ease of reading and general organization please do the following
  - a. Use 'Header and Footer' function to number pages; also include your name, paper title, and name of assignment on the first page of the paper
  - b. Double space all sections of the paper, except references which should be single spaced with a blank line between them and reverse indented
  - c. Font size 12
  - d. Margins: please use the Word defaults so the documents print properly if we need to print them out
3. Proofreading: we feel the level of writing should reflect that of a Master's degree at a quality university
  - a. Check your work and remove grammatical, spelling, punctuation, and awkward sentence construction errors
  - b. Use thesis sentences at the beginning of sections and paragraphs (yes, just like English teachers have been saying since junior high), and create paragraphs where needed given the flow and content of information given
  - c. Watch the use of antecedents when using pronouns, it is better to repeat a proper noun than confuse terms with a pronoun. It is probably better not to use pronouns
  - d. No contractions
  - e. See all the material we provide on scientific writing, plus any papers you have from good primary journals
  - f. References:
    - i. Text references: we prefer the (Smith 1999) format, alternatively Smith (1999) works, and when there is more than one author (Smith et al. 1999) or (Kline and others 2002; Markham 2002)
    - ii. Literature Cited: at the end of any paper or question give full citations of your resources. See the CBE style manual for descriptions, or see the literature cited section of any paper from a quality journal. There are small differences between formattings, the most important thing is to adopt one and be consistent with it.

- g. Use the scientific writing style. This is a distinct style. Use the websites we provide and the scientific literature you read as the model for your writing. No prose or stream of consciousness please! Cut out un-needed words and phrases (especially: “in order to”, “it stands to reason”, “it is natural”). Simple sentences, clear information, and organized progression of thought mark good scientific writing.
4. Paper Organization: a well-organized paper makes the information you have so carefully collected more readable to us
- a. Liberal use of figures, tables you make, and charts is encouraged, make sure to reference any sources you copy, format figures and tables correctly
  - b. Use section headings as they are helpful to the organization of the paper
  - c. Make sure you use paragraphs when they are needed (yes, this is a repeated point)
  - d. Pay attention to page requirements. If we say at least 5 pages for a paper, two and a half pages is probably too short, and 15 pages is too long. Much of the reason behind the scientific style of writing is the need to say as much as clearly as possible with the *fewest words*. Strive for that.

## VI. GRADES AND GRADING

Your grade for this course is split between two exams (midterm and final), ten quizzes, and online discussion board participation.

Your Grade will be calculated as follows:

| Graded Assignments                  | Points     |
|-------------------------------------|------------|
| Quizzes (10 @ 5 pts each)           | 50         |
| Online Discussion (10 @ 5 pts each) | 50         |
| Midterm Exam                        | 100        |
| Final Exam                          | 100        |
| <b>Class Total</b>                  | <b>300</b> |

**Grading Scale.** Grades will be assigned using the standard grading scale for the Department of Biology, as follows: A (93-100%), A- (90-92%), B+ (88-89%), B (83-87%), B- (80-82%), C+ (78-79%), C (73-77%), C- (70-72%), D+ (68-69%), D (63-67%), D- (60-62%), and F (below 60%). Grades will be rounded up (e.g.,  $\geq 87.5$  will be at least a B+).

## VII. ADDITIONAL INFORMATION

### **Students with Disabilities**

Students with disabilities are encouraged to contact me for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska at Kearney to provide flexible and individualized reasonable accommodation to students with documented disabilities. To receive accommodation services, students must be registered with UNK Disabilities Services Coordinator, David Brandt, in the Academic Success Office, 163 Memorial Student Affairs Building, 308-865-8214 or by email [brandtdl@unk.edu](mailto:brandtdl@unk.edu).

### **Withdraw (W) and Incomplete (I) Grades:**

Until the conclusion of the 5th week of the semester, you may withdraw from any class and receive a grade of "W." This grade does not count toward your grade point average and merely indicates that you withdrew from (or "dropped") the class. No instructor can withdraw a student from the roster; that is, if you stop coming to class the instructor cannot withdraw you from the class. The instructor will be forced to assign you a failing ("F") grade for the class. Withdrawing from a class involves filling out a simple form that the instructor and student both sign and returning this form to the registrar's office by the withdraw deadline.

Under very unusual circumstances, a grade of incomplete ("I") may be issued. An incomplete is not a substitute for a "W" (withdraw), and it is not a substitute for a poor or failing grade. An incomplete is issued if circumstances beyond the student's control prevent the student from completing the required work for the class by the end of the semester (example: student is hospitalized during final exam week). If you qualify for an incomplete grade, it is expected that you will receive this grade in all your classes. An incomplete grade will give you an extension to complete outstanding work only; it is not an opportunity to "start over" in the class. All outstanding work must be completed within one year or the "I" grade automatically converts to a failing ("F") grade. An incomplete grade will be considered only during the final six weeks of the semester, after the deadline for receiving a "W" has passed.

## SCHEDULE FOR EVOLUTION OF EPIDEMICS SPRING 2013

| Week            | Lecture | Lecturer | Lecture Topic                               | Assignments<br>(Q=Quiz,<br>D=Discussion) | Readings<br>(P=Preston,<br>Sm=Sherman,<br>Sr=Sherris)        |
|-----------------|---------|----------|---|--|--|
| 1<br>(1/7/12)   | 0       | Both     | Syllabus and Introduction                   | D1 (due 1/13/12)                         | SrCh1<br>Review of Basic Microbiology SrCh 6-8, 21-23, 47-49 |
| 2<br>(1/14/12)  | 1       | Shaffer  | Epidemiology                                | D2 (due 1/20/12)<br>Q1 (due 1/22/12)     | Sm1-12, SrCh5  |
|                 | 2       | Simon    | Evolutionary Principles                     |  | Assigned in lecture  |
| 3<br>(1/21/12)  |         |          | MLK Day                                     | D3 (due 1/27/12)<br>Q2 (due 1/29/12)     |  |
|                 | 3       | Simon    | Evolution of Virulence                      |  | Sm18-21  |
| 4<br>(1/28/12)  | 4       | Simon    | Human Evolution & Susceptibility to Disease | D4 (2/3/12)<br>Q3 (due 2/5/12)           | SmCh2  |
|                 | 5       | Shaffer  | Immune Response: Innate Immunity            |  | SrCh2  |
| 5<br>(2/4/12)   | 6       | Shaffer  | Immune Response: Specific Immunity          | D5 (2/10/12)<br>Q4 (due 2/12/12)         | SrCh3  |
|                 | 7       | Shaffer  | Vaccination—the great equalizer             |  | SrCh4  |
| 6<br>(2/11/12)  | 8       | Simon    | Plagues of Antiquity                        | D6 (due 2/17/12)<br>Q5 (due 2/19/12)     | SmCh3  |
|                 | 9       | Simon    | Bubonic Plague                              |  | SmCh4, Sr633-38  |
| 7<br>(2/18/12)  | 10      | Simon    | AIDs  | D7 (2/24/12)<br>Q6 (due 2/26/12)         | SmCh5, Sr305-22  |
|                 | 11      | Simon    | Typhus                                      |  | SmCh6, Sr681-87  |
| 8<br>(2/25/12)  | 12      | Shaffer  | Malaria                                     | Midterm Assigned (due 3/11/12)           | SmCh7, Sr779-90  |
|                 | 13      | Simon    | Cholera                                     |  | SmCh8, Sr565-71  |
| 9<br>(3/4/12)   |         |          | Complete Midterm                            |  |  |
| 10<br>(3/11/12) | 14      | Simon    | Pox   | D8 (due 3/10/12)                         | SmCh9, Sr205-212, P1-160                                     |
|                 | 15      | Simon    | Smallpox & other diseases                   |  | P161-233   |
| 11<br>(3/18/12) |         |          | Spring Break                                |  |  |
| 12<br>(3/25/12) | 16      | Shaffer  | Preventing Plagues                          | D9 (due 3/31/12)<br>Q7 (due 4/2/12)      | SmCh10   |
|                 | 17      | Shaffer  | Antibiotic Resistance                       |  | SmCh11, Sr403-27   |
| 13<br>(4/1/12)  | 18      | Shaffer  | Sexually Transmitted Disease                | D10 (due 4/7/12)<br>Q8 (due 4/9/12)      | SmCh12, Sr643-52   |
|                 | 19      | Simon    | Tuberculosis                                |  | SmCh13, Sr489-505  |

|                     |    |         |                         |  |                          |
|---------------------|----|---------|-------------------------|--|--------------------------|
| 14<br>(4/8/12)      | 20 | Shaffer | Leprosy                 | D11 (due 4/14/12)<br>Q9 (due 4/16/12)                                  | <b>SmCh14</b> , Sr501-03 |
|                     | 21 | Shaffer | Prions                  |  | Sr337-344                |
| 15<br>(4/15/12)     | 22 | Shaffer | Influenza               | Final Assigned (due 4/29/12)<br>D12 (due 4/21/12)<br>Q10 (due 4/23/12) | Sr167-177                |
|                     | 23 | Simon   | Future plagues          |  | Assigned in lecture      |
| 16<br>(4/22/12)     | 24 | Both    | Course Summary & Review |  |                          |
| Finals<br>(4/29/12) |    |         | Final Exam Week         |  |                          |