Biology 490 Special Topics in Biology:
Discoveries in Prevention and Cure of Infectious Disease in London

Prerequisite Biology 202 This prerequisite is necessary so that students have the background to understand the concepts to be presented thoroughly enough that they can work with them creatively and not simply memorize material.

Course summary

In conjunction with honors 2XX this course will examine three major discoveries concerning the prevention and cure of infectious diseases made in and around London during the eighteenth to twentieth centuries (vaccination, transmission of cholera by contaminated water, and penicillin). Particular attention will be paid to how the thought patterns and assumptions of the society and the scientific community determine what questions a scientist is likely to ask and the kind of answers he will obtain. The role and importance of communicating scientific discoveries to other scientists and the public will also be explored.

There will be 5 sections to the course. The first will provide general background in microbiology for students who have taken molecular biology. If the students have a good background in molecular biology, this can be done in a little over a week. The remaining segments will deal with the plague of 1665, Jenner's invention of vaccination, Snow's discovery of the route of transmission of cholera, and Fleming's discovery of penicillin. In each of these segments we will begin by looking briefly at what is known about the topic today. Then we will examine common knowledge just prior to the discovery. We will read the original report of the discovery. Then we will examine what happened after the discovery. How was it communicated to society? What use was made of it? Were there negative reactions to the discovery? We will end each segment by looking at similar problems today.

London has an abundance of science museums which we will use to help us understand each of these topics. The physic garden and the Fleming museum are directly relevant to infectious disease. Other museums have exhibits which illustrate society and its reactions to science and infectious disease at various periods (the Museum of London, the British Museum, and the Science Museum) and which attempt to communicate science to the public (the Science Museum, the Natural History Museum, and the Wellcome Collection).

Readings

<u>General introduction</u>

Slonczewski and Foster, Microbiology: An Evolving Science. Chapters 3, 4, 6, and 11.

<u>Plague</u>

Plague: past, present, and future. Stenseth NC, Atshabar BB, Begon M, Belmain SR, Bertherat E, Carniel E, Gage KL, Leirs H, Rahalison L. PLoS Med. 2008 Jan 15;5(1):e3

Plague: A Very Short introduction Paul Slack 2012 Oxford University Press. Book.

<u>Small pox</u>

Smallpox book (excerpts)

Jenner's papers

<u>Cholera</u>

Curr Opin Infect Dis. 2011:472-7.Cholera in the 21st century. Charles RC, Ryan ET.

John Snow's book (excerpts)

The Ghost Map (book)

Penicillin
Fleming's papers on lysozyme and on penicillin
A current review on resistance to antibiotics

Topics

Unit 1 Background microbiology

1. What is a bacterium?
2. What is a virus?
3. How do viruses grow and cause disease
4. How do bacteria cause disease
5. How diseases are transmitted
6. How does the host respond

Unit 2 Plague An example of an epidemic infectious disease before scientific experiments and intervention. Visit to the Museum of London and to the Royal College of Physicians Physic Garden

7. What we know today
8. How could we answer questions about causes of past epidemics?
9. The plague of 1665. How did they respond? Mock meetings of London officials responsible.
10. Plague today in the US, Western Europe, and the third world.

Unit 3 Smallpox Visit to the Science museum and to the British Museum

11. What we know today
12. What was known in Jenner's day; Jenner's papers
13. Public response to Jenner's work
14. Current problems with communicating immunization priorities
15. Eradication of smallpox

Unit 4 Cholera Visit to the Natural History Museum

16. What we know today
17. European 18th century epidemics, Snow's book
18. Snow's book
19. The response and modern public health measures: clean water and sewage treatment

Unit 5 Penicillin Visit to the Fleming Museum and to the Welcome Collection

20. The desire for antibacterials and Fleming's work on lysozyme
21. Fleming's papers on penicillin
22. Why the delay in follow-up? Communication matters. Flory et al and the development of penicillin as a useful drug
23. Antibiotics today: development of resistance, why are there no new antibiotics?

Conclusions

24. How do the assumptions of the society and scientific community determine what scientific questions we ask?
25. How does communication of science matter?
26. General discussion

Final Exam

Assessment

Class participation	30% (5% each week, students will receive weekly assessments)
Journal	20% (to be graded twice during the class, this will be a joint journal for both classes and will contain a record of all out-of-class field work such as museum visits, walks, plays attended, etc.)
Short paper	10% (presented in class and handed in, topic to be approved in advance)
Long paper	20% (due at the beginning of the sixth week, topic to be approved in advance) This will be a joint paper covering the relationships between prevailing views of society and scientific discovery.
Final exam	20%

Hours

26- 1¼ contact hours of seminar and lecture = 32.5 contact hours
3- 2 hour guided tours and 1 one hour tour =7 hours of supervised field experience
3- 2 hour independent field experiences and 1 1 hour experience = 7 hours of independent field experience
1 final exam 3 hours

Format

The classes will run for 6 weeks. The two classes will each meet for 75 minutes each weekday with a short break between them. Both of the faculty will attend most classes and field trips. This will occur for 26 days. Two day(s) will be devoted to the final exams (one for each course). Most field trips will occur in the afternoon. Those that occur in the mornings will result in the cancellation or shortening of class that day. Students will be expected to participate actively in class discussions each day. There will be a short paper and in class presentation by each student in each of the courses. There will be separate final exams for each class.