Contagion: Infectious Agents and Emerging Diseases

Course Instructor:
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TAs: To be determined

Course description:
Where did Ebola come from? How can we control its spread? To answer these questions we need to understand the nature and evolution of infectious agents. In this three weeks course students will learn about the origin and the biology of some of the most feared viruses, such as Ebola, HIV and Influenza. We will also study the biology and evolution of lethal bacteria that cause major outbreaks such as E. coli. We will cover the nature of emerging diseases and will use Influenza and Ebola as an example to discuss how we can predict and control their spread. Our dependence on microbes from an evolutionary point of view will also be discussed. Students will have access to the state-of-the-art laboratory facilities at the University of Chicago for hands-on activities (and will not be exposed to dangerous materials).

Schedule: The class will run from 9:00 AM to 3:00 PM with an hour break for lunch. Time will include background lectures, laboratory activities and independent study.

Evaluation:
Students will be evaluated based on: class presentations, lab reports, weekly quizzes, papers and participation.

WEEK 1
Lecture:
- Review of basic cell and molecular biology concepts
- Microbiota
- Introduction to pathogens. How bacteria spread and cause disease.

Laboratory activities:
- Lab Safety
- Lab Basics - How to use micropipettes, basic microbiology techniques, use of microscope, how to plan an experiment, etc.
- Microscopy Basics- Students will learn how to study bacteria using the Gram staining technique.
- Lake Michigan Water Project – Students will start a series of tests to determine the safety of Lake Michigan water in terms of total bacteria and fecal bacteria content. During this series of laboratory activities students will learn basic microbiology techniques as well as methods for bacterial species identification.

Independent Study. Students will choose a topic that they will research for the following three weeks. They will be instructed on how to use the internet to do literature searches, how to write a paper and how to plan and deliver an oral presentation.

Weekly Quiz 1
WEEK 2
Lecture:
- Antibiotic Resistance. “Superbugs”.
- Immune evasion strategies of bacteria
- The Biology of Viruses.
Laboratory activities:
- Lake Michigan Water Project - Finish and lab report due.
- Antibiotic Resistance Project - Students will study the evolution of rifampicin resistance in the bacterium E. coli. They will perform experiments that will allow them to determine the frequency of resistant bacteria, sequence a portion of the bacterial RNA polymerase gene and identify the specific mutation involved in antibiotic resistance. Lab report will be due at the end of the week.
Independent Study. Students will spend time in the library to continue their topic research.

Weekly Quiz 2

WEEK 3
Lecture:
- HIV, Influenza, mutations, immune evasion
- Vaccines. Smallpox to HIV challenge.
Laboratory activities:
- ELISA: How to test for HIV. In this simulated activity students will learn about how the HIV test is performed based on the presence of anti HIV antibodies in the blood. Lab report due this week.
- Epidemiology, In this computer simulation of disease spread, students will learn about the variables that influence the rate at which diseases are transmitted within a population. They will use smallpox as an example to understand immunological memory and vaccine power. Lab report due this week.
Independent Study. Students will have time in the library to finish their paper and presentation.
Weekly Quiz 3
Presentations – Based on chosen topic and paper.