Sample Syllabi – Subject to Change

Contagion: Infectious Agents and Emerging Diseases

Course Instructor:
Beatrice Fineschi

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 and a half break for lunch. Time will include background lectures, laboratory activities and independent study.

Course objectives: by the end of the three week program students will be able to:
Appreciate the importance of understanding evolution in the control of infectious diseases.
Distinguish between the biology of bacteria and viruses.
Identify the causes for the evolution antibiotic/drug resistance and appreciate the role we can all play in curbing this problem.
Understand the biology of virulence.
Identify the causes for the evolution of emerging infectious diseases.
Describe the biology of some important pathogens such as influenza and HIV.
Master a number of microbiological and molecular biology techniques used to study infectious diseases
Acquire skills to design, perform, keep track and interpret scientific experiments
Learn how to perform literature research, summarize information and present it in a poster format.

Evaluation:

Students will be evaluated based on: daily short lab reports, daily upkeeping of the lab notebook, antibiotic resistance comprehensive lab report, poster presentations 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 micropipetters, 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.

- **Lake Michigan Water Project** –Finish and lab report due.

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

WEEK 2

Lecture:

- **Pathogenic *E. coli.* The biology and evolution. Vertical and horizontal gene transfer.**
- **Antibiotic Resistance. "Superbugs".**
- **Immune evasion strategies of bacteria**
- **The Biology of Viruses.**

Laboratory activities:

- **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.
- **RNAinterference.** Students will learn the function of RNAi in viral immunity and will study the role of RNAi as a tool to silence genes in the lab. The will use *C. elegans* as a model system.

Independent Study. Students will continue their topic research.

WEEK 3

Lecture:

- **Emerging Diseases. Ebola.**
- **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.

Poster Presentations – Based on chosen topic and paper.

Lab Schedule

Week 1

Safety Training	3-way streak	Lysis, PCR [ExoSap]	Speaker, Analysis	ABR- dilution
Microscopy, Lake	Hemoglobin	Selective Differential	Gram Stain	BLAST

Week 2

Count, lysis, PCR [Ex]	Guest Speaker	Sequencher/Modeling		
Patch	Gels, Patch	RNAi (worm lab)	Modeling/Paper RNAi (worm lab)	

Week 3

T4 SimBio/Glove Lab	T4 HIV/ELISA	Contagion Poster	Poster Presentation	