Ecology of Waterborne Pathogens (SOS 4xxx).

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Prerequisites: MCB3020 (Basic Biology of Microorganisms), or MCB4203 (Bacterial and Viral Pathogens) or equivalent.

Course Description: Survival strategies, gene regulation and metabolism of waterborne pathogens outside of their mammalian hosts will be discussed in detail. Risk assessment of drinking water: methods of the indicator organism identification and microbial source tracking will be addressed. Cultural and environmental factors contributing to the emergence (and re-emergence) of new pathogens. Control and management of waterborne pathogens.

Course Objectives: At the conclusion of the course, students will be able to:

- define processes associated with the survival of waterborne pathogens outside of their mammalian hosts.
- to critically evaluate methods of pathogen identification and control.
- to evaluate the role of cultural practices and environmental factors in the ecology of waterborne pathogens.

Course Format: Three lectures per week.

Frequency Taught: Spring semester, every year. Taught concurrently with SOS5xxx.

Class attendance: Required

Evaluation and Grading:
Group Project: 30%
Midterm: 40%
Final Exam: 30%

Group Project: Each group (3-4 students) will identify a problem related to the microbiological quality of water (e.g. "Multidrug-resistant coliforms are detected in the river on July 28, 2005"). The group will then formulate a hypothesis, which addresses the cause of the problem (e.g. "A break in the sewage pipe at a local hospital released multi-drug resistant bacteria into the river"). At least five experiments will be proposed to test the hypothesis. These proposed experiments should be based on the techniques and information presented during the lectures.

Advantages and limitations of each approach will be discussed. At the end of the semester, each groups delivers a 15-minute presentation and a 3-5 page report. The evaluation will be based on the following criteria:
a) does the hypothesis address reasonable causes of the problem?
b) are proposed experiments appropriate to test the hypothesis?
c) does the proposal rely on a single experimental approach? (i.e. five experiments to enumerate coliforms on five different indicator media is an example of a single experimental approach). Relying on a single approach is discouraged.
d) does the report carefully discuss advantages and limitations of each experimental approach/technique?
e) how did each group member contribute to the project (each student will submit a brief self-evaluation, and describe in 1-2 sentences how other members of the group contributed to the project).

Midterm and Final Exams will contain multiple-choice, and T/F questions. Some questions may require short answers (3-5 sentences).

Genome analysis software and other research tools will be available to the students. Tutorials will be conducted during regular office hours throughout the semester.

No makeup exams or assignments allowed without instructor's permission. Late assignments will not be accepted for full credit (10% of the grade will be deducted per each late day).

The final grade is a reflection of the individual student's mastery and comprehension of the subject material presented during the semester. The grading will not be based on a bell curve.
Grading will be: 90 to 100 A, 86 to 89 B+, 80 to 85 B, 76 to 79 C+, 70 to 75 C, 66 to 69 D+, 60 to 65 D, <60 E.

Course Outline:
Week 1. Microorganisms in the Aquatic Environments: historical outbreaks and discovery (Ch1 of IWP, Ch.2 of EM).
Weeks 2, 3, 4. Pathogen detection in water samples.
a. Sample collection and processing (Ch.8 of EM)
b. Cultural techniques (Ch.10 of EM)
c. Physiological methods (Ch. 11 of EM)
d. Immunological methods (Ch. 12 of EM)
e. Nucleic acid-based methods (Ch. 13 of EM)
Week 5, 6. Waterborne pathogens (Ch. 19 of EM, Ch. 3 of IWP + Supplemental Reading, see below).
a. Role of agricultural practices in the spread of antibiotic-resistant strains
b. Genetic recombination as a source of "new" strains
c. Opportunistic pathogens
d. Effect of climate change on soil and waterborne pathogens

Week 7. Indicator organisms. Attributes and applications of the indicator organisms (Ch. 20 of EM).
Week 8, 9, 10. Survival of waterborne pathogens outside of their mammalian hosts (based on Supplemental Reading, see below).

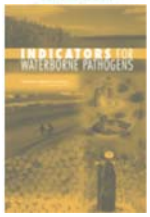
a. Microbial biofilms. Formation, signaling and survival.
b. Lifestyle cycles of *Legionella*
c. Epiphytic survival of enteric pathogens
d. Viable non culturable state.
e. Oocyst formation by *Giardia* and *Cryptosporidium*.

Week 11. Disinfection mechanisms (Ch. 23 of EM).
Week 12. Risk assessment (Ch. 24 of EM)
Weeks 13, 14. Project presentations

Required Texts:

1. Environmental Microbiology. By Maier et al. Academic Press. 2000.

2. Indicators for Waterborne Pathogens. The National Academy Press. 2004.
Purchase (or read) on-line **Chapters 1, 3 (required)**, other chapters optional.
http://www.nap.edu/books/0309091225/html



Suggested Additional Text:

3. Microbiology of Waterborne Diseases. By Percival et al. Elsevier Pub. 2004. ISBN 01255157007.

4**. Supplemental Review articles**:

1) Rabsch et al., 2001. Non-typhoidal salmonellosis: emerging problems
2) Cloeckaert et al., 2001. Molecular characterization, spread and evolution of multidrug resistant *Salmonella* DT104
3) O'Toole et al., 2000. Biofilm formation as microbial development.
4) Greenberg et al., 2003. Bacterial communication and group behavior.
5) Parsek et al., 2003. Bacterial biofilms: an emerging link to disease pathogens
6) Hall-Stoodley et al., 2004. Bacterial biofilms: from the natural environment to infectious disease.
7) Molofsky et al., 2004. Differentiate to thrive: lessons from the *Legionella pneumophila* life cycle.
8) Molmeret et al., 2005. Amoeba as training grounds for intracellular pathogens.
9) Winfield et al., 2003. Role of non-host environments in the lifestyles of *Salmonella.*

Academic Honesty:
In Fall 1995, the University of Florida student body enacted a new honor code and voluntarily committed itself to the highest standards of honesty and integrity. When students enroll at the university, they commit themselves to the standard drafted and enacted by the students.

Preamble: In adopting this honor code, the students of the university of Florida recognize that academic honesty and integrity are fundamental values of the university community. Student who enroll at the university commit to holding themselves and their peers to the high standard of honor required by the honor code. Any individual who becomes aware of a violation of the honor code is bound by honor to take corrective action…

The Honor Code: *We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.*

On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied*: On my honor, I have neither given nor received unauthorized aid in doing this assignment.*

Accommodations for Students with Disabilities:
Students requiring classroom or laboratory accommodations must first register with the Dean of Students Office. They will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation.

UF Counseling Services:
Resources are available on-campus for students having personal problems or lacking clear career and academic goals. These resources include 1.) University Counseling Center, 301 Peabody Hall, 392-1575, personal and career counseling; 2.) SHCC Mental Health, Student Health Care Center, 392-1171, personal counseling; 3.) Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling; and 4.) Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

Software Use:
All faculty, staff and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.