Biology of Water and Health
MPH-241
Cross-listed in Nutrition and Engineering
SYLLABUS-2007 Version 1.0

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Class Time:  Monday evenings, 5:30-8:30PM + Two field trips (In-class poll to determine day and time.

Class Location:  Boston Health Sciences Campus
Sackler 204


Additional material to be posted on TUSK http://tusk.tufts.edu/

Additional Resources: Environment and Health Affinity Group. 1:30 PM on Monday September 17 @ Anderson Hall, MEDFORD

WSSS Seminars Friday afternoons 4:00-5:30 in Mugar 231, Fletcher School, MEDFORD

Course Objectives:
1. Emphasis is placed on participants understanding the biology of water and health.
2. Participants will demonstrate knowledge of the central role of water in health, including adequate hydration.
3. Detailed coverage of selected prototypic or model diseases which include schistosomiasis, cryptosporidiosis, cholera, and others will be presented.
4. Participants will understand animal/human interactions and ecological factors that affect human host susceptibility.
5. Participants will become familiar with widespread chemical agents and their interactions with pathogens.
6. Participants will demonstrate a familiarity with the appropriate methods of assessing the occurrence of water borne disease.
7. Participants will become knowledgeable about the principal methods of controlling the propagation of water-borne diseases.
8. Participants will become knowledgeable about the social and institutional factors influencing sanitation and water treatment decisions and the subsequent impacts on a variety of health indices

This is a required core course for all Water: Systems, Science and Society (WSSS) students but graduate students in other programs are more than welcome.

All course notes and announcements will be posted on TUSK.
Course content:

Week 1  Gute and Griffiths
Sept 10

Overview of the course: content, expectations
The biological cycle of water and a brief distillation of human costs/risks/benefits as determined by quality and supply.
Relevance to both domestic and international settings
Time and capital involved in procurement of water at the level of the household
Social and institutional factors influencing water and health
Connection between sanitation, potable water and other health indices: Case material from Stockholm, Chicago, Malaysia,
Presentation of the basic vocabulary and concepts of the participating disciplines:
  Clinical medicine
  Environmental epidemiology
  Environmental engineering
  Ecology
  Veterinary medicine

READINGS:

3. Set of materials obtained from the World Health Organization Library. [http://www.who.int/library](http://www.who.int/library)
5. Equitable Child Health Interventions: The Impact of Improved Water and Sanitation Bo Burström; Gloria Macassa; Lisa Öberg; Eva Bernhardt; Lars Smedman. American Journal of Public Health; Feb 2005; 95, 2; ABI/INFORM Global pg. 208
Waterborne Disease

Who is at risk, what are the methods of transmission…
Overview of waterborne transmission
What makes infectious diseases epidemiology different from other fields of epidemiology?
Introduction of reproductive rate as a concept along with infectious dose; differences in clinical expression.

Surveillance for waterborne diseases: the good, the bad, and the ugly

Contrasting models of “simple” cycle infectious diseases (Crypto) versus complex, vector borne diseases such as Schistosomiasis

Introduction to water borne diseases including:
   Hepatitis A
   Polio and other Enteroviruses
   Others such as Rotavirus
Cryptosporidium
   Zoonotic and human origins, Control strategies and engineering solutions
Schistosomiasis
   A model parasitic disease
Overlap of social and environmental factors
   Role of mining and irrigation
   Schisto as a “perfect infectious disease”
Cholera
   History
   Role of human and animal sanitation
   Sanitation methods to control
   Need for molecular techniques for non-culturable pathogens

READINGS:

Supplemental:

Week 3 Gute
Sept 24

Homework Set # 1 Due

Tools of environmental epidemiology
Surveillance and monitoring – classical and emerging techniques

Identifying outbreaks

Assessment and analysis
How do you make judgments about nature of the problem?
What sorts of assays are available?
Spatial analysis
Determining cause and effect

READINGS:


Week 4 Gute and Durant
Oct 1
Homework Set # 1 Returned
Homework Set # 2 Assigned

Waterborne chemical agents
Lead
Arsenic
Endocrine disrupters
Pesticides
Antibiotics
Woburn case
EPA priority pollutants
Emerging contaminants
Sources, environmental fate and transport

READINGS:

4. Industri-Plex Superfund Site remediation plan. 2005 US EPA

**October 08- Columbus Day Holiday Observed- NO CLASS**
**THIS CLASS SHIFTED TO OCTOBER 9**

Week 5  Guest lecturer: Bela T. Matyas. M.D., M.P.H. Medical Director, Epidemiology Program. Massachusetts Department of Public Health

http://www.mass.gov/dph/

Oct 9: **NOTE: THIS IS A TUESDAY!**

*Homework #2 Due*

**Outbreak Investigation Exercise**

This will be a hands-on exercise dealing with analysis of a waterborne disease outbreak, using information on possible routes of transmission, incubation time and host behaviors to deduce cause and propose control strategies.

READINGS:

2. Additional readings to be assigned.

Week 6  Gute and Water Treatment Plant staff
Oct 15

*Homework #2 Returned*

*Field Trip #1 Water Treatment Technology and Operations.*

Cambridge Water Treatment Plant Tour OR Deer Island Treatment Plant NOTE: These activities will either be held during regular class hours BUT at the Fresh pond Water Treatment Facility in Cambridge, Massachusetts or outside of class footprint at Deer Island, Winthrop, MA.

Transportation and other logistics to be specified after class discussion.

**Modern evidence that waterborne diseases occur in the US despite water treatment**

**Exploration of conditions that allow for this.**

**Sanitation, Primary Prevention and Control Strategies - Overview**
- History of water treatment
- Techniques of control
- Land use and related issues
- Sanitation, history,
- Sanitation as a cultural construct
- Case of schistosomiasis control in Puerto Rico

**READINGS:**


**Friday October 19**  
**NOTE: This is outside normal class meeting time!**  
**Alternative time Thursday October 18 in the afternoon.**

*Field Trip #2 Mystic River water sampling acquisition.*

Participants will receive instruction and practice field sampling techniques while on the Mystic River in Medford, MA. These samples will be processed and analyzed and the results discussed. Logistics and transportation to be specified. Approximate duration of field trip = 12:00 Noon – 4:00 PM. Please meet on the front steps of Anderson Hall (Intersection of Boston and College Avenues) on the Medford Campus.

**Week 7**  
Guest lecturers: Susan Murcott, M.S.  
Senior Lecturer  
Department of Civil and Environmental Engineering  
Massachusetts Institute of Technology
Take-Home Mid-Term Examination Distributed

READINGS:


Week 8 Rioux, Gute
Oct 29

Tap water vs. bottled water – risk comparisons and life cycle analysis
Is it safe, and what about all that plastic?
Science. market forces and consumer demand – is there a disconnect?

Take-Home Mid-Term Due

Week 9 Gute, Griffiths. Guest lecturers: Eric Nelson, M.D./Ph.D. Candidate and Georgia Kaiser, Fletcher School, Ph.D, student, Jamie DeLemos, Civil and Environmental Engineering Ph.D. candidate.

Nov. 5

Five Page Term Paper Scope Due

Reports from the Field and Around the World

Point of use treatment techniques
Appropriate for pathogens or chemical contaminants
Criteria: Low cost
Safe and effective
‘Trainable’
Use locally available materials
READINGS:


Nov 12       NO CLASS
Week 10
November 19

*Mid-term Examination Returned via hard copy*
*Ungraded Term Paper Scope Returned via email*

Week 11 Nov 26      Guest lecture: Mark Pokras, D.V.M.
                    Associate Professor
                    Cummings School of Veterinary Medicine
                    Tufts University
                    [http://www.tufts.edu/home/feature/?p=pokras](http://www.tufts.edu/home/feature/?p=pokras)

*Homework #3 Distributed*

*Zoonoses, Eco-health, and conservation medicine*
  Animal to human disease transmission
  Environmental overlap with animal health
  Food webs and non human systems

READINGs: to be posted on TUSK as suggested by Dr. Pokras.
Add readings for bottled/tap lecture

Week 12
Dec 3      Wrap-up: Major Themes of Course Revisited
*Homework #3 Due*
*Poster boards distributed*
Week 13  All participating instructors
Dec 10

Homework #3 Returned

Poster session/presentations

Evaluation Criteria

1. Term paper: pick a health outcome related to water and pick one or two global geographic areas (nations or regions) where it is public health problem, or one or two contrasting interventions and discuss: nature of the problem, choice of solution, pros and cons (technical feasibility, operational, financial, political, social feasibility) and your own recommendations*.
2. Based on the term paper, a poster session summarizing results
3. Midterm (take home)
4. Homework exercises
5. Class participation

*Term paper due December 13, 2007*

Term paper: 30%
Poster: 20%
Midterm: 20%
Homework Exercises: 25%
  HW #1  10%
  HW#2  10%
  HW#3  5%
Class participation: 5%