Microbiome of Urban Waters: The Role Microbes Play in Health, Ecosystems and the Urban Environment

HONORS 352: HONORS SEMINAR IN THE NATURAL SCIENCES (NS)

Spring 2016
Syllabus

Instructor: Sandra McLellan, Professor, School of Freshwater Sciences
Course Hours: TR 9:30 a.m. – 10:45 a.m
Meeting Room: HON 190
Office Hours: Thursdays 8:30 a.m. to 9:30 a.m. HON 113 or by appointment
Email: mclellan@uwm.edu

Description: Microbes are integral to the integrity of water and sustainable urban centers. Topic of exploration and discussion will highlight how microbes interface with health, ecosystems and society. The Seminar will be divided up into three parts. The first weeks, we’ll focus on understanding microbes in general, and how they contribute to ecosystem processes and health, particularly in urban water systems. To cover these topics, we will use chalk talks and a book club format. Important concepts such as pathogen host relationships and water quality monitoring will be covered. The second portion of the course will explore important societal issues through directed readings. Cholera and Cryptosporidium outbreaks, dead zone formation in the Gulf of Mexico and Green Bay, and Legionella and Leptospira and the link to climate change are examples of case studies for discussion and writing assignments. The last part will consist of field trips and labs, and watershed exploration (i.e. EPA surf your watershed) to directly measure some of the microbes we learned about. We will focus primarily on urban infrastructure (stormwater, wastewater, green infrastructure).

Course Objectives
Students will be able to recognize significant events in history shaped by infectious disease and the important contributions of renowned microbiologists

Students will understand the basic biology of microorganisms and in particular, pathogens that affect humans. Students will be able to cite examples of waterborne disease outbreaks and convey the environmental and manmade causes

Students will be able to describe different types of urban water infrastructure, how it works, types of failure, and be able to explain the long term costs and investments needed to maintain these systems to protect public health

Students will understand components of the urban water cycle, including natural and built aspects and gain hands on experience sampling urban water sites
Students will be able to describe different types of indicator bacteria used to assess water quality, and the most important attributes of an indicator organism.

Students will be able to assess and interpret water quality data for rivers, beaches, and Lake Michigan and recognize causes of impairments to swimming and other recreational activities.

Students will demonstrate proficiency in organizing and communicating observations, experimental findings, and interpretations through lab and field reports.

Students will demonstrate an understanding of ecosystem services offered by freshwater and explain the complex interconnected impacts urbanization has on freshwater systems.

Students will be able to describe different types of green (and blue) infrastructure and explain the value of these systems to protecting water resources and enhancing the urban environment.

**Course Schedule**

**Week 1**
- January 26   Microbes I: Microbes in nature
- January 28   Microbes I: Microbes in nature

Assignments (due Tuesday by 9:30 am unless noted)
Readings: Background papers on D2L. Chapters 1-4 in the book, the Microbe Hunter.
Journal discussion forum: Initial Journal entries should include comments on the chalk talk and should be entered Jan 26-27, but normally they are due at 9 am Tuesday before class, along with follow up on the previous weeks post. Comment on your peer’s entries (initial or revised) by Thursday before class. See Journal Guidelines in D2L for more details. Also contribute to the discussion of the Microbe Hunter in the Book Club discussion forum during the week.

**Week 2**
- February 2   Microbes II: Microbiomes, pathogens, and the host
- February 4   Microbes II: Microbiomes, pathogens, and the host, continued
  Book club discussion of the Microbe Hunter, chapters 1-6

Assignments
Readings: Background papers posted on D2L, Chapters 5-6 in Microbe Hunter.
Journal entry: comment on this weeks readings/topic question and revise previous weeks topic, due Tuesday before class, with comments to peers due Thursday. Contribute to the discussion of the Microbe Hunter in the Book Club discussion forum by Thursday before class.
Week 3
February 9  Waterborne disease I: the biology of *Vibrio cholera*, *E. coli*, *Cryptosporidium* and other classic waterborne pathogens
February 11  Waterborne disease I: continued
Book club discussion of the Microbe Hunter, chapters 7-9

Assignments
Readings: scientific papers posted on D2L, Chapters 7-9 in Microbe Hunter.
Journal entry: comment on this weeks readings/topic question and revise previous weeks topic, due Tuesday before class, with comments to peers due Thursday. Contribute to the discussion of the Microbe Hunter in the Book Club discussion forum by Thursday before class.

Other: Post in your discussion thread your first and second choice for group book club and post in your discussion why you are interested in your particular choices. Groups will be formed February 11 in class

Week 4
February 16  Waterborne disease II: Watersheds past and present
February 18  Waterborne disease II: Exposure routes
Book club discussion of the Microbe Hunter, chapters 10-12

Assignments
Readings: scientific papers posted on D2L, Chapters 10-12 in Microbe Hunter.
Journal entry: comment on this weeks readings/topic question and revise previous weeks topic, due Tuesday before class, with comments to peers due Thursday. Contribute to the discussion of the Microbe Hunter in the Book Club discussion forum by Thursday before class.

Week 5
February 23  Water quality monitoring 101—the lab
February 25  Water quality monitoring 101—the lab

Assignments
Readings: background and scientific papers posted on D2L
Journal entry: comment on this weeks readings/topic question and revise previous weeks topic, due Tuesday before class, with comments to peers due Thursday. Participate in your group Book Club discussion forum during the week.

Week 6
March 1    Urban Infrastructure 101: Drinking water—the lab
March 3    Urban Infrastructure 101: Wastewater treatment and combined sewers
Assignments
Readings: background and scientific papers posted on D2L
Journal entry: comment on this weeks readings/topic question and revise previous weeks topic, due Tuesday before class, with comments to peers due Thursday. Participate in your group Book Club discussion forum during the week

Other: Lab reports due from water quality monitoring lab Monday am
Visit the Jones Island wastewater treatment plant (WWTP) in the Month of March

Week 7
March 8 Cryptosporidium outbreak and the Wakerton case
March 10 Urban Infrastructure 101: Stormwater

Assignments
Readings: background and scientific papers posted on D2L
Journal entry: comment on this weeks readings/topic question and revise previous weeks topic, due Tuesday before class, with comments to peers due Thursday. Participate in your group Book Club discussion forum during the week

Other: Lab reports due from drinking water lab Monday am
Stormwater outfall scavenger hunt over the next two weeks--take pictures of stormwater outfalls in the City of Milwaukee

Week 8
March 15 SPRING BREAK SPRING BREAK SPRING BREAK
March 17 SPRING BREAK SPRING BREAK SPRING BREAK

Week 9
March 22 Urban Infrastructure 101: Stormwater systems
Outbreaks II: typhoons, hurricanes and earthquakes
Stormwater outfall scavenger hunt mapping
March 24 Book Club group meetings

Assignments
Readings: background and scientific papers posted on D2L
Journal entry: take the week off. Participate in your group Book Club discussion forum

Week 10
March 29 Dead zones: From the heartland to Green, Bay Wisconsin
Harmful algal blooms: Lake Erie and the city of Toledo
March 31 Implications of the build environment: Legionella and Leptospiroa
Field trip and stormwater outfall hunt report out
Assignments
Readings: background and scientific papers posted on D2L
Journal entry: comment on this weeks readings/topic question and revise previous weeks topic, due Tuesday before class, with comments to peers due Thursday. Participate in your group Book Club discussion forum during the week

Other: Field reports due: Stormwater scavenger hunt and WWTP field trip. Also Stormwater scavenger hunt and WWTP field trip report out (5 minute oral)

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<th>Week 11</th>
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<tr>
<td>April 5</td>
<td>Book Club presentations</td>
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<td>April 7</td>
<td>Book Club presentations</td>
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Assignments
Journal entries: take a break this week
Book Club Discussion forum- comment on you peers book club presentation and reports

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<th>Week 12</th>
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<td>April 12</td>
<td>Milwaukee’s Inner Harbor Revitalization Project (Jim Wasley, guest)</td>
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<td>April 14</td>
<td>Outside Activity: Field notes and photo journal of green infrastructure</td>
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Assignment
Readings: background papers posted on D2L
Journal entry: comment on this weeks readings/topic question, due Tuesday before class, with comments to peers due Thursday.

Other: Take pictures of green infrastructure around campus and post before class Tuesday

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<th>Week 13</th>
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<td>April 19</td>
<td>Presentations--photo journal and green infrastructure</td>
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<td>April 21</td>
<td>Urban Water Sample Day!</td>
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Assignment
Field Report and photo journal: Descriptions of types of green infrastructure around campus and Milwaukee. Presentations on the field report and photo journal

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<th>Week 14</th>
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<tr>
<td>April 26</td>
<td>Working with data: stormwater outfall and other data from Urban Water Sample Day</td>
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<td>April 28</td>
<td>Neesky Cruise TBA</td>
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Assignment
Readings: background papers posted on D2L
Microbiome of Urban Water

Journal entry: comment on this weeks readings/topic question, due Tuesday before class, with comments to peers due Thursday.

Field Report and photo journal: Urban water sampling day (due Monday)
Lab Report: Urban water sampling day (due Thursday)
Other: Take pictures of beaches around Milwaukee and attributes that might affect water quality and upload by Monday May 2

Week 15
May 3 Working with data: beach data from beaches around Milwaukee
May 5 Beach closings: coastal management solutions

Assignment
Readings: background papers posted on D2L
Journal entry: comment on this weeks readings/topic question, due Tuesday before class, with comments to peers due Thursday.

Field report and photo journal: beaches with observations and interpretation of water quality data

Last day of classes
May 10 Urban Water Microbiome - final presentations (5 minutes)

Course Requirements and Grading

Weekly readings. Select papers for background information or discussion will be assigned each week and will be available in D2L the week prior. Readings should be completed before class on Tuesday of the week they are assigned.

Journals: This is your format to discuss the class material. Post your comments or reflections on the weeks material. Commenting on each other’s entries is an important mechanisms for discussion among peers. When you revise your entry for the week, respond to your peer’s comments/questions/reflections. These entries will be evaluated for both content and writing. Specific guidelines will be posted in D2L.

Book Club. Each week, students should contribute discussion to the Microbe Hunter or the assigned group book. Each group will prepare a presentation for the other groups and individual students will prepare a Book Report. Specific guidelines will be posted in D2L.

Lab reports, Field Reports and Photo Journals. Students will prepare reports on field and laboratory activities that will include the background on the subject matter, observations, images, data and interpretations. Students are required to maintain a notebook throughout class to record class and outside activities. Specific guidelines will be posted in D2L.
Grading

30% Book Club: 10% in class and online discussion of the Microbe Hunter, 20% discussion, group presentation, and written individual book reports for the group assigned book.

40% Discussion: includes of scientific papers and chalk talks, divided between in class and online through journal entries, and final presentation on the last day of class.

30% Lab reports, Field reports and photo journal. This includes six assignments plus submitting your class notebook week 15 (to be returned to the students on the last day of class).

Grading scale:

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<td>A-</td>
<td>92.9 – 90</td>
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<td>B+</td>
<td>89.9 – 87</td>
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<td>86.9 – 83</td>
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<td>B-</td>
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<td>C</td>
<td>76.9 – 73</td>
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<td>C-</td>
<td>72.9 – 70</td>
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<td>69.9 – 67</td>
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<td>D-</td>
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Workload

The Microbiome of Urban Water is a 3 credit-hour course. Students will be expected to devote a minimum of 9 hours per week in addition to class time, including but not limited to:

- Book Club activities, weeks 1-10 (55 hours total). This includes reading two non-fiction books, online and group discussions, meeting to prepare a group presentation, and preparing a book report
- Reading assigned background and scientific materials, journal entries, contributing to online discussion topics (50 hours total),
- Lab Reports (15 hours total)
- Field and photo journals (15 hours total)

Resources

Class notifications: The course will be coordinated through e-mail and D2L. Students must check their official UWM e-mail and D2L frequently as they are responsible for all announcements and course changes posted there. Assignments, course materials, lecture materials, and other important information will be posted on D2L. All assignments must be submitted by the due date and time using an official UWM email address.

Required Materials

Book Assigned:
Microbe Hunters by Paul de Kruif

Group Books: (One of four books, assignments to be made after groups are formed)
The Fantastic Laboratory of Dr. Weigl by Arthur Allen (2014)
Allies and Enemies: How the world depends on bacteria by Anne Maczulak (2010)