

ADVANCED FOOD MICROBIOLOGY

FOS 6226C Fall 2015

Tues 10:40-12:35, FSHN Conf Room

Wed 10:40 -1:40 FSHN Teaching Lab

Thurs 10:40-12:35, FSHN Conf Room

Instructor: Dr. Anita C. Wright

Office Hours: T/TH 1:00- 3:00

Aquatic Food Products Lab Room 214

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Website: <http://fshn.ifas.ufl.edu/faculty/ACWright/index.html>



Text: The material will come from classic and recent journal articles and lectures

Course overview: The field of Food Microbiology is presented with increasing challenges to provide safe food, while maintaining global food security. Future food microbiologist will be confronted with daunting questions such as: Are the new rules from the Food Safety Modernization Act appropriate and effective? How can we stem the tide of emerging antibiotic resistant microorganisms? Can we develop mitigations and therapies that are environmentally friendly? How will climate change affect our ability to ensure food safety?

This course will focus on current issues and explore cutting-edge technologies, such as QPCR, molecular typing, and genomics, that are essential to improving approaches for research, regulations, and mitigations related to foodborne pathogens. The course will integrate lecture and discussion sessions with independent student research.

Learning Objectives: Students will master the following skills:

- Critical evaluation and comprehension of current literature and research in Food Microbiology.
- Understanding basic and emerging concepts related to bacterial survival, pathogenesis, risks and mitigations; food security; and antibiotic resistance.
- Greater expertise with the tools of modern Food Microbiology, including quantitative PCR, molecular typing and genomics.

Course Format:

- The course is a combined lecture, group discussion, and laboratory discovery format. Topics will be introduced by instructor, followed by discussion and practical applications.
- One assigned research paper will be discussed each week in the format of an informal round table discussion. Assigned research papers are shown in course schedule below, along with additional background reading material that will assist in your understanding of the topic.
- Lab-based discovery exercises will provide an opportunity to test out hypotheses, develop protocols and acquire skills based on the selected topics and research discussed in class.
- Student-selected topics will be developed and explored through independent research.

Grading:

Exams (50%): Two open book exams will be given and will consist of discussion questions based on critical thinking about the topics from this course. Exam 1 (25%) will cover material in Modules I and II and be given on Oct. 15. Exam 2 (25 %) will cover material from Modules III and IV and be given during finals week on Dec 18.

Class Participation (15%): Class attendance is required and participation counts!!! Classes will be a combination of lecture and round table discussion on selected papers that are to be read before class and provide background for class. A discussion leader will be assigned for each paper and will give an informal brief overview of the paper. If you are not leading the discussion, you will be evaluated on the questions or comments that you contribute to the discussion. This will be part of your overall participation grade. Questions should be designed to address areas that are unclear to you, generate discussion, and demonstrate that you have read the paper.

Student choice papers (5%). Students will have an opportunity to select papers for class discussion. Suggested topics include (but are not limited to) PCR applications, biosensors, any pathogen except ones already in syllabus, metagenomics, metabolomics, fermentations, probiotics, vaccines, etc. You will be graded on your selection of papers,

Independent Research Project (20%) – The final module for this course will consist of an independent study on a selected topic of your choice. Your project should demonstrate your abilities in research design and data analysis. Investigations should include molecular methods described in this course. An outline of your proposal for this project will be submitted by September 30 to instructor for approval, and updates are presented periodically for class discussion. ASM format will be used to write up the results of your projects as a mini research paper due Dec 14.

Oral Presentations (10%): Class oral presentations (20 min) on your projects will be done Dec 8 and 9.

Course Outline:

I. SURVIVAL: “Wanted Dead or Alive?”

- Enumeration of viable but nonculturable (VBNC) cells
- Adaptations to stress: Biofilm formation and quorum sensing

II. TOOLS OF THE TRADE:

- Sampling strategies: Enrichment, Fecal coliforms
- Molecular detection: PCR, QPCR, RT-PCR.
- Molecular typing: MLST, PFGE, PCR-based methods, microarray

III. THE PATHOGENS:

- Enteric viruses: Norovirus update
- *E. coli*: toxins and animal models
- *Salmonella*: Environmental pathogens
- *Listeria*: Intracellular pathogens
- *Campylobacter*: Complex pathogens
- *Vibrio*: Defining virulence

IV. EMERGING ISSUES:

- Genomics (including a genomics workshop)
- Antibiotic resistance bacteria
- Evolution of disease

- Solutions: Intervention, vaccines, probiotics, genomics
- Food Security

Useful websites:

<http://www.foodsafety.gov/~fsg/fsgpath.html>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5714a2.htm>

<http://www.cdc.gov/foodnet/>

<http://epi.ufl.edu/>

<http://www.fsis.usda.gov/>

<http://www.cfsan.fda.gov/~ebam/bam-toc.html>

University Honesty Policy: UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. 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.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduccionor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

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.

Resources: For students having personal problems or lacking clear career or academic goals, which interfere with their academic performance. Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Services for Students with Disabilities: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation 0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

Course Evaluations: Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

Counseling and Wellness Center :Contact information for the Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc/Default.aspx>, Phone: 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

FOS 6226C COURSE SCHEDULE 2015

DATE	TOPICS	Assigned and Supplemental Reading
25	Course Intro	Welcome to course
26	Lab Intro	Hypothesis, Strategy, and Discovery
27	I. SURVIVAL: VBNC	Introduction and Background reading: Daniela Pinto, et al. 2013. Thirty years of viable but nonculturable state research: Unsolved molecular mechanisms. <i>Critical Reviews of Micro.</i> http://informahealthcare.com/doi/pdfplus/10.3109/1040841X.2013.794127
Sept 1	VBNC	Discussion of Assigned Reading: Nilsson et al. 1991. Resuscitation of <i>V. vulnificus</i> . <i>J Bact.</i> 173:5054-959. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC208195/
2	VBNC	Lab: Plate counts vs. BacLight (See Lab Manual)
3	Biofilm	Introduction: See Class Notes
8	Biofilm	Discussion of Assigned Reading: Valderrama WB, 2013. An ecological perspective of <i>Listeria monocytogenes</i> biofilms in food processing facilities. <i>Crit Rev Food Sci Nutr.</i> 53(8):801-17. http://www.tandfonline.com/doi/pdf/10.1080/10408398.2011.561378
9	VBNC	Lab: Continued
10	Sampling	Introduction and Background reading: Berger et al. 2010. Fresh fruit and vegetables in transmission of pathogens. <i>Environ Microbiol.</i> 12:2385-239. http://www.ic.ucsc.edu/~saltikov/bio119/readings/Berger_EM_Review_Food_Micro.pdf Rosen. et al., USDA publication ftp://ftp-fc.sc.egov.usda.gov/WSI/pdffiles/Pathogens_in_Agricultural_Watersheds.pdf
15	Student Choice	Discussion of Assigned Reading: TBA
16	II. TOOLS: PCR	Primer Design Workshop Tools: http://www.molbiol-tools.ca/PCR.htm http://seqcore.brcf.med.umich.edu/doc/dnaseq/primers.html http://bioweb.uwlax.edu/genweb/molecular/seq_anal/primer_design/primer_design.htm http://www.premierbiosoft.com/tech_notes/PCR_Primer_Design.html http://www.ncbi.nlm.nih.gov/tools/primer-blast/ http://www.ncbi.nlm.nih.gov/tools/primer-blast/search_tips.html
17	PCR	Introduction: See Class Notes
22	Student Choice	Discussion of Assigned Reading: TBA
23	PCR	Lab: PCR (See Lab Manual)
24	QPCR	Introduction and Background reading: Dunbar et al., 2003. Advantages and limitations of QPCR. <i>FEMS.</i> 67:6-20. http://69eisenhower.csub.edu/~kszick_miranda/Smith%20and%20Osborn%20QPCR%20review.pdf
29	Student Choice	Discussion of Assigned Reading: TBA
30	QPCR	Lab: QPCR (See Lab Manual) INDEPENDENT PROJECTS TOPIC DUE
Oct 1	RT-PCR	Introduction and Background reading: TBA

6	MLST	Introduction and Background reading: Foley et al., 2007. Comparison of molecular typing method for Salmonella. Foodborne Pathogens and Disease. 4:253-276. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3209009/
7	MLST	Lab: MLST (See Lab Manual)
8	MLST	Schuster et al., 2011. Ecology and Genetic Structure of a Northern Temperate Vibrio cholerae Population Related to Toxigenic Isolates AEM 77: 7568-7575. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3209147/pdf/zam7568.pdf
13	Biosensors	Discussion of Assigned Reading: Palchetti and Mascini. 2008. 391:455-471 Electroanalytical Biosensors. Anal Bioanal Chem. 391:455-471.
14	MLST	Lab: MLST (See Lab Manual)
15	EXAM 1	
20	III. Pathogens: Viruses	Introduction and Background reading: Koopmans and Duizer, 2004. Foodborne viruses: an emerging problem. Int. J. Microbiol. 90: 23-41. http://www.unc.edu/courses/2006fall/envr/431/001/Koopmans%20and%20Duizer_2004%20review.pdf Patel, M.M. et al. 2009 Norovirus: a comprehensive review. J. Clin. Virol. 44:1-8; Atreya, 2004.
21	Viruses	Lab: Virtual tour of Noro Lab (Jones)
22	Viruses	Discussion of Assigned Reading: Jones et al., 2014
27	<i>Salmonella</i>	Introduction and Background reading: Zheng et al., 2013. Colonization and internalization of Salmonella enterica in tomato plant. Appl Environ Microbiol. 79: 2494-2502 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3623171/pdf/zam2494.pdf Fatica MK, Schneider KR. Salmonella and produce: survival in the plant environment and implications in food safety. Virulence. 2011. 2(6):573-9 https://www.landesbioscience.com/journals/virulence/article/17880/?nocache=273427847
28		Lab: Independent projects Discussion
29	<i>Salmonella</i>	Discussion of Assigned Reading: McEgan R, et al., 2013. Predicting Salmonella populations from biological, chemical, and physical indicators in Florida surface waters. Appl Environ Microbiol. 79(13):4094-105. http://aem.asm.org/content/79/13/4094.full.pdf+html
Nov 3	<i>E. coli</i>	Discussion of Assigned Reading Epidemic profile of Shiga-toxin-producing Escherichia coli O104:H4 outbreak in Germany. N Engl J Med. 10;365(19):1771-80. http://www.nejm.org/doi/pdf/10.1056/NEJMoa1106483
4		INDEPENDENT PROJECTS UPDATE
5	<i>Listeria</i>	Discussion of Assigned Reading: Di Bonaventura et al., 2008. J Appl Microbiol. 2008 Influence of temperature on biofilm formation by L. monocytogenes on various food-contact surfaces: relationship with motility and cell surface hydrophobicity. 104(6):1552
10	<i>Vibrios</i>	Discussion of Assigned Reading: Piarroux et al. 2011. Understanding the Cholera epidemic, Haiti. Emerg. Infect. Dis. 17:1161-1167. http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19870

11		EPI Field Trip
12	<i>Campylobacter</i>	Discussion of Assigned Reading: Axelsson-Olsson D, et al., 2005. Protozoan Acanthamoeba polyphaga as a potential reservoir for Campylobacter jejuni. <i>Appl Environ Microbiol.</i> 2005 Feb;71(2):987-92. http://aem.asm.org/content/71/2/987.full.pdf+html
17	IV. EMERGING: Genomics	Discussion of Assigned Reading: Lebeer et al., 2008 Cao G, et al. 2013. Phylogenetics and differentiation of Salmonella Newport lineages by whole genome sequencing. <i>PLoS One.</i> 8(2) http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0055687
18	Genomics	Genomics workshop http://res.illumina.com/documents/products/sequencing_introduction_microbiology.pdf http://www.illumina.com/applications/microbiology.ilmn?sciid=2013225IBN3
19	Resistance	Discussion of Assigned Reading: Antimicrobial resistance of emerging foodborne pathogens: Status quo and global trends. <i>Critical Reviews in Microbiology</i> , 2013; 39(1): 57–69. http://informahealthcare.com.lp.hscl.ufl.edu/doi/pdf/10.3109/1040841X.2012.691458
24	Virulence	Discussion of Assigned Reading: Guy et al., 2013. Adaptive Mutations and Replacements of Virulence Traits in the <i>Escherichia coli</i> O104:H4 Outbreak Population. Ahmet Koluman1 and Abdullah Dikici 2013.
25	THANKSGIING	
26		
Dec 1	Security	Discussion of Assigned Reading: Saeed Akhtar et al., 2013. Microbiological food safety: a dilemma of developing societies. <i>CRITICAL REV MICRO.</i> http://informahealthcare.com.lp.hscl.ufl.edu/doi/pdf/10.3109/1040841X.2012.742036
2	Genomics	Genomics workshop cont.
3	SOLUTIONS	Discussion of Assigned Reading: TBA
8		Student Oral Presentations of your project
9		Student Oral Presentations of your project
14	Written Report of Project Due	
18	EXAM 2	