

# ADVANCED FOOD MICROBIOLOGY

FOS 6226C Summer B 2016

M/T/W/Th: 9:30-12:35, Location: TBD

**Instructor:** Dr. Anita C. Wright

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

Aquatic Food Products Lab Room 214

392-1991x311, [acw@ufl.edu](mailto:acw@ufl.edu)

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. In the future food microbiologists will be confronted with daunting questions such as: Is the Food Safety Modernization Act appropriate and effective? 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 four hour combined lecture, group discussion, and laboratory discovery format. Topics will be introduced by instructor, followed by discussion and practical applications.
- Assigned research paper will be discussed in class each week in the format of an informal round table discussion and also as on online thread. Assigned research papers are shown in course schedule below.
- Lab-based introduction to various methodologies will be followed by discovery exercises that provide an opportunity to test out hypotheses, develop new protocols and acquire skills based on the selected topics and research discussed in class.
- Student-selected topics will be developed by literature review and explored through independent research.

## **Grading:**

Exams (50%): Two open book exams will consist of discussion questions based on critical thinking about the topics from this course.

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 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.

Oral Presentations (10%): Class oral presentations (20 min) on your projects

## **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-conducthonor-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/](http://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/](http://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**

<b>DATE</b>	<b>TOPICS</b>	<b>Assigned and Supplemental Reading</b>
June 29	<b><u>I. SURVIVAL:</u></b> VBNC	<b>Introduction and Assigned reading:</b> Daniela Pinto, et al. 2013. Thirty years of viable but nonculturable state research: Unsolved molecular mechanisms. Critical Reviews of Micro. <a href="http://informahealthcare.com/doi/pdfplus/10.3109/1040841X.2013.794127">http://informahealthcare.com/doi/pdfplus/10.3109/1040841X.2013.794127</a> ; Nilsson et al. 1991. Resuscitation of <i>V. vulnificus</i> . J Bact. 173:5054-959. <a href="http://www.ncbi.nlm.nih.gov/pmc/articles/PMC208195/">http://www.ncbi.nlm.nih.gov/pmc/articles/PMC208195/</a> ;
30	Lab Intro	<b>Lab:</b> Hypothesis, Strategy, and Discovery
July 4		HOLIDAY
5	Biofilm	<b>Assigned Reading:</b> Valderrama WB, 2013. An ecological perspective of <i>Listeria monocytogenes</i> biofilms in food processing facilities. Crit Rev Food Sci Nutr. 53(8):801-17. <a href="http://www.tandfonline.com/doi/pdf/10.1080/10408398.2011.561378">http://www.tandfonline.com/doi/pdf/10.1080/10408398.2011.561378</a>
6	Sampling	Berger et al. 2010. Fresh fruit and vegetables in transmission of pathogens. Environ Microbiol. 12:2385-239. <a href="http://www.ic.ucsc.edu/~saltikov/bio119l/readings/Berger_EM_Review_Food_Micro.pdf">http://www.ic.ucsc.edu/~saltikov/bio119l/readings/Berger_EM_Review_Food_Micro.pdf</a> Rosen. et al., USDA publication <a href="ftp://ftp-fc.sc.egov.usda.gov/WSI/pdf/Pathogens_in_Agricultural_Watersheds.pdf">ftp://ftp-fc.sc.egov.usda.gov/WSI/pdf/Pathogens_in_Agricultural_Watersheds.pdf</a>
7	Student assignments	<b>Independent Project Proposal presentations</b>
11	<b><u>II. TOOLS:</u></b> PCR	<b>Primer Design Workshop Tools:</b> <a href="http://www.molbiol-tools.ca/PCR.htm">http://www.molbiol-tools.ca/PCR.htm</a> <a href="http://seqcore.brcf.med.umich.edu/doc/dnaseq/primers.html">http://seqcore.brcf.med.umich.edu/doc/dnaseq/primers.html</a> <a href="http://bioweb.uwlax.edu/genweb/molecular/seq_anal/primer_design/primer_design.htm">http://bioweb.uwlax.edu/genweb/molecular/seq_anal/primer_design/primer_design.htm</a> <a href="http://www.premierbiosoft.com/tech_notes/PCR_Primer_Design.html">http://www.premierbiosoft.com/tech_notes/PCR_Primer_Design.html</a> <a href="http://www.ncbi.nlm.nih.gov/tools/primer-blast/">http://www.ncbi.nlm.nih.gov/tools/primer-blast/</a> <a href="http://www.ncbi.nlm.nih.gov/tools/primer-blast/search_tips.html">http://www.ncbi.nlm.nih.gov/tools/primer-blast/search_tips.html</a>
12	QPCR	<b>Assigned reading:</b> Dunbar et al., 2003. Advantages and limitations of QPCR. FEMS. 67:6-20. <a href="http://69eisenhower.csub.edu/~kszick_miranda/Smith%20and%20Osborn%20QPCR%20review.pdf">http://69eisenhower.csub.edu/~kszick_miranda/Smith%20and%20Osborn%20QPCR%20review.pdf</a>
13	QPCR	<b>Lab:</b> QPCR (See Lab Manual)
14	Biosensors	<b>Discussion of Assigned Reading:</b> Palchetti and Mascini. 2008. 391:455-471 Electroanalytical Biosensors. Anal Bioanal Chem. 391:455-471.
18	MLST	<b>Assigned Reading:</b> Foley et al., 2007. Comparison of molecular typing method for Salmonella. Foodborne Pathogens and Disease. 4:253-276. <a href="http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3209009/">http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3209009/</a>
19	MLST	<b>Lab:</b> MLST (See Lab Manual)
20	MLST	<b>Schuster et al., 2011.</b> Ecology and Genetic Structure of a Northern Temperate <i>Vibrio cholerae</i> Population Related to Toxigenic Isolates AEM 77: 7568-7575. <a href="http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3209147/pdf/zam7568.pdf">http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3209147/pdf/zam7568.pdf</a>
21	Student Choice	<b>Assigned Reading:</b> TBA

25	<b>III. Pathogens:</b> Viruses	<b>Introduction and Background reading:</b> Koopmans and Duizer, 2004. Foodborne viruses: an emerging problem. <i>Int. J. Microbiol.</i> 90: 23-41. <a href="http://www.unc.edu/courses/2006fall/envr/431/001/Koopmans%20and%20Duizer_2004%20review.pdf">http://www.unc.edu/courses/2006fall/envr/431/001/Koopmans%20and%20Duizer_2004%20review.pdf</a> Patel, M.M. et al. 2009 Norovirus: a comprehensive review. <i>J. Clin. Virol.</i> 44:1-8; Atreya, 2004. Jones et al., 2015. <i>Science</i> .
26	<i>Salmonella</i>	<b>Introduction and Background reading:</b> Zheng et al., 2013. Colonization and internalization of <i>Salmonella enterica</i> in tomato plant. <i>Appl Environ Microbiol.</i> 79: 2494-i2502 <a href="http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3623171/pdf/zam2494.pdf">http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3623171/pdf/zam2494.pdf</a> ; McEgan R, et al., 2013. Predicting <i>Salmonella</i> populations from biological, chemical, and physical indicators in Florida surface waters. <i>Appl Environ Microbiol.</i> 79(13):4094-105. <a href="http://aem.asm.org/content/79/13/4094.full.pdf+html">http://aem.asm.org/content/79/13/4094.full.pdf+html</a> ; Fatica MK, Schneider KR. <i>Salmonella</i> and produce: survival in the plant environment and implications in food safety. <i>Virulence.</i> 2011. 2(6):573-9 <a href="https://www.landesbioscience.com/journals/virulence/article/17880/?nocache=273427847">https://www.landesbioscience.com/journals/virulence/article/17880/?nocache=273427847</a>
27	<i>Shigella</i>	TBD
28	STEC	<b>Assigned Reading</b> Epidemic profile of Shiga-toxin-producing <i>Escherichia coli</i> O104:H4 outbreak in Germany. <i>N Engl J Med.</i> 10;365(19):1771-80. <a href="http://www.nejm.org/doi/pdf/10.1056/NEJMoa1106483">http://www.nejm.org/doi/pdf/10.1056/NEJMoa1106483</a>
1	<i>Listeria</i>	<b>Discussion of Assigned Reading:</b> Di Bonaventura et al., 2008. <i>J Appl Microbiol.</i> 2008 Influence of temperature on biofilm formation by <i>L. monocytogenes</i> on various food-contact surfaces: relationship with motility and cell surface hydrophobicity. 104(6):1552
2	<i>Vibrios</i>	<b>Discussion of Assigned Reading:</b> Piarroux et al. 2011. Understanding the Cholera epidemic, Haiti. <i>Emerg. Infect. Dis.</i> 17:1161-1167. <a href="http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19870">http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19870</a>
3	<i>Campylobacter</i>	<b>Discussion of Assigned Reading:</b> Axelsson-Olsson D, et al., 2005. Protozoan <i>Acanthamoeba polyphaga</i> as a potential reservoir for <i>Campylobacter jejuni</i> . <i>Appl Environ Microbiol.</i> 2005 Feb;71(2):987-92. <a href="http://aem.asm.org/content/71/2/987.full.pdf+html">http://aem.asm.org/content/71/2/987.full.pdf+html</a>
4	Virulence	<b>Assigned Reading:</b> 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.
8	<b>IV. EMERGING:</b> Genomics	<b>Assigned Reading:</b> Lebeer et al., 2008 Cao G, et al. 2013. Phylogenetics and differentiation of <i>Salmonella</i> Newport lineages by whole genome sequencing. <i>PLoS One.</i> 8(2) <a href="http://res.illumina.com/documents/products/sequencing_introduction_microbiology.pdf">http://res.illumina.com/documents/products/sequencing_introduction_microbiology.pdf</a> <a href="http://www.illumina.com/applications/microbiology.ilmn?sciid=2013225IBN3">http://www.illumina.com/applications/microbiology.ilmn?sciid=2013225IBN3</a> <a href="http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0055687">http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0055687</a>
9	Genomics	<b>Assigned Reading:</b> Lebeer et al., 2008 Cao G, et al. 2013. Phylogenetics and differentiation of <i>Salmonella</i> Newport lineages by whole genome sequencing. <i>PLoS One.</i> 8(2) <a href="http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0055687">http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0055687</a>
10	Antibiotic resistance	<b>Assigned Reading:</b> Antimicrobial resistance of emerging foodborne pathogens: Status quo and global trends. <i>Critical Reviews in Microbiology</i> , 2013; 39(1): 57–69. <a href="http://informahealthcare.com/lp.hscl.ufl.edu/doi/pdf/10.3109/1040841X.2012.691458">http://informahealthcare.com/lp.hscl.ufl.edu/doi/pdf/10.3109/1040841X.2012.691458</a>