

**EVR 5068 Marine Microbial Ecology
Environmental Sciences Institute
Florida A & M University
Fall Semester 2009**

Instructor: Ashvini Chauhan, Ph.D.

Office: FSH Science Research Center, Room 305B

Phone: 412-5119

Email: ashvini.chauhan@famu.edu,

Office Hours: Mon. 9:00 to 10:00, Friday 3:00-5:00 or by appointment

ESI MISSION STATEMENT

The objectives of the Environmental Sciences Institute are to provide instruction, conduct research, perform public service, and initiate technology transfer which will result in the development of remedies for existing environmental problems; the enlightenment of communities on environmental science issues; and the production of students uniquely prepared to address present and future environmental science concerns. ESI fosters the development of students by emphasizing rigorous academic course work; student involvement in faculty research; community service; and student involvement in collaborative research efforts with other universities, national laboratories, regulatory agencies, and corporate environmental contractors.

Academic Learning Compacts for the Environmental Sciences Institute can be found at <http://www.famu.edu/index.cfm?a=environmentalscience>

COURSE DESCRIPTION

FAMU catalog description: This course will provide an introduction to microbial processes in the marine environment and will address how these processes relate to biogeochemical cycling on a global scale. The laboratory component of this course will include both field and laboratory studies of topics introduced during the course of the lecture.

Prerequisite(s): None

Availability to non-ESI majors: EVR 5068 is open to all graduate students provided they have the proper prerequisites.

COURSE OBJECTIVES

Microbial ecology deals with the interactions of microbes with their biotic and abiotic surroundings. The diversity of microbial metabolism distinguishes microbial diversity

from macroorganism diversity, and forms the basis of the biogeochemical cycles that maintain the Earth's biosphere. In this course we will cover the major roles that bacteria play in marine and estuarine systems. After taking the course, students are expected to demonstrate a broad understanding of:

1. Key microorganisms that are typically found in marine and estuarine ecosystems.
2. What are the techniques to assess the population and diversity of key microorganisms in the marine and estuarine environments?
3. How does the bacterial community structure influence the rates and pathways of nutrient and energy flow in marine and estuarine ecosystems?

LEARNING MATERIALS

Text: Microbial Ecology of the Oceans (second edition), Edited by David L. Kirchman. In addition, reference articles, internet material, as well as textbook chapters from other sources will be cited and made available to the students.

EXPECTED LEARNING OUTCOMES

1) Foundation skills and knowledge

- a) Students will demonstrate a basic understanding of processes that are characteristic of marine and estuarine systems.
- b) Students will demonstrate understanding of traditional approaches to study marine microorganisms and the use of emergent molecular techniques to study microbial communities.
- c) Students will demonstrate understanding of the interactions between bacteria, protists, viruses toward biogeochemical processes in marine systems.

2) Effective written and verbal communication

Gain familiarity with modern approaches and questions in microbial ecology including critical analysis through speaking and writing skills.

3) Critical thinking

Students will evaluate the major processes in marine ecosystems and the microbial communities within these ecosystems. The students will be expected to critically evaluate facts and concepts related to a) Tools to enumerate the population sizes of bacteria, viruses and protistan grazers from marine waters, and (b) use of appropriate analytical tool and bioinformatic analyses to study marine prokaryotic diversity.

COURSE ADMINISTRATION

Evaluation:

Class participation: 10%

Midterm Exam: 20%

Journal Article and Lab Presentations: 25%

Term Paper: 20%

Final Exam: 25%

Final grades will be determined on the basis of the following scale:

A = 90% - 100%
B = 80% - 89%
C = 70% - 79%
D = 60% - 69%
F = 0% - 59%

Class participation: Active participation in class discussions is strongly encouraged and highly valued.

Exams: The purpose of exams will be to evaluate students' critical thinking ability. The format for exams will be short answer and essay. The material for these exams will come from class discussions, lectures, textbook, reading handouts, and homework sets. Exam will also include information from the journal article discussions.

Journal Article Discussion: On a rotating basis each student will be responsible for leading a class discussion on the suggested refereed journal article that is pertinent to the respective current topic being covered in class. The students can also select their own articles but it must be pre-approved by the instructor (this should be done as early as possible). Once approved, the student will be responsible for making copies of the article and distributing it to their fellow classmates and professor. This must be done 1 week prior to the discussion session. Failure to do so will result in a grade of '0' for the assignment. All students are expected to actively participate in journal article discussion. **Students are expected to come to class prepared with 2 specific questions and/or comments for the discussion that is specific to the paper being discussed.** These discussion points are to be handed to the professor at the beginning of the lecture period. These written discussion questions will be included in the "class participation" grade.

Term paper: A term paper submission is also required for this course. Such papers should conform to the style of a published mini review from top journals such as Applied and Environmental Microbiology. Total length of the paper should not exceed 10 pages using double-spaced, 12-pt Times New Roman font, excluding illustrations and citations. You are encouraged to explore topics in marine microbial ecology not covered in the lecture or assigned readings. Students should prepare an outline and meet with the instructor prior to final approval of a research paper topic. Topics must be approved by the instructor by **Monday, October 19th, 2009**. Submit a hard copy of your paper to me in class on **Wednesday, November 18th, 2009**. In addition to the hard copy, you must also submit an electronic version of your paper via email at ashvini.chauhan@famuedu. Late submissions will not be accepted.

Student Symposia: A 1-day research sampling cruise will be organized in which samples will be collected and processed to survey microorganisms and macroorganisms in estuarine systems. Students are expected to lead discussions in class on their results from this laboratory module. Presentations are typically delivered via PowerPoint and should include introduction, methods used, results and discussions.

Make-up policy: Homework, presentations and projects will not be accepted late; no make-up exams will be given. This policy will be strictly enforced. Please refer to the University catalogue regarding class attendance regulations.

Attendance: Regular and punctual attendance is expected and is fundamental to success in this course. If a student is late for class they will be marked absent for that day. Information presented during class is the responsibility of the student whether he/she is present or not. It is up to the student to obtain class material and class assignments from other students when a session is missed. Note that any student exceeding 3 unexcused absences *'may be dropped from the course and assigned the letter F'* (FAMU's 2006-2008 Catalogue). For more information regarding class attendance regulations please refer to the University Catalogue.

Academic Honesty: Plagiarism and cheating will NOT be tolerated in any form. Please review the Florida A & M University handbook (*"The Fang"*) for FAMU's academic honesty policy. The University's Academic Honor Policy is located in the FANG Student Handbook, under the Student Code of Conduct- Regulation 2.012 section, beginning on page 55-56.

Americans with Disabilities Act (ADA) Policy Statement: To comply with the provisions of the Americans with Disabilities Act (ADA), please alert instructor of accommodations required to insure participation in this course. Documentation of disability is required and should be submitted to the Learning Development and Evaluation Center (LDEC). For additional information please contact the LDEC at (850) 599-3180.

Non-discrimination Policy Statement: It is the policy of Florida Agricultural and Mechanical University to assure that each member of the University community be permitted to work or attend classes in an environment free from any form of discrimination including race, religion, color, age, disability, sex, marital status, national origin, veteran status and sexual harassment as prohibited by state and federal statutes. This shall include applicants for admission to the University and employment.

Cell Phone Policy: Cell phone use is strictly prohibited during class; no ringing, vibrating, text-messaging, games, pictures, etc. Failure to comply with this rule will result in your dismissal from the class.

Statement of Understanding

I, _____ have read and completely understand the course policies for this class.

PRINT NAME

TOPICS COVERED

Date	Topic
August 24	Overview of syllabus, Introduction of students etc.
August 26	Introduction of oceans and microbial ecology Suggested Reading: The Unchartered Microbial World: microbes and their activities in the environment. A Report from the American Academy of Microbiology.
August 31	Biodiversity of marine microorganisms
September 2	Biodiversity...contd.. Suggested Reading: Giovannoni, S. J. and Stingl, U. 2005. Molecular diversity and ecology of microbial plankton. Nature. 437:343-348. Suggested Reading: DeLong, E.F. 2006. Archaeal mysteries of the deep revealed. Proc. Natl. Acad Sci. 103: 6417-6418.
September 7	No Class- Labor Day
September 9	Viruses and protists Suggested Reading: Caron DA, Worden AZ, Countway PD, Demir E, Heidelberg KB. Protists are microbes too: a perspective. ISME J. 2009. 3(1):4-12. Suggested Reading: Predation on prokaryotes in the water column and its ecological implications by J. Pernthaler- Nature Reviews Microbiology 3, 537-546.
September 14	Methods to study marine microorganisms
September 16	Molecular approaches to study marine microbial ecology
September 21	Journal Article Discussion: Use of stable isotope-labelled cells to identify active grazers of picocyanobacteria in ocean surface waters. Frias-Lopez J, Thompson A, Waldbauer J, Chisholm SW. Environ Microbiol. 2009. 11(2):512-25.
September 23	Community interactions and associations Suggested Reading: Rules of engagement: interspecies interactions that regulate microbial Communities. Little AE, Robinson CJ, Peterson SB, Raffa KF, Handelsman J. Annu Rev Microbiol. 2008. 62:375-401.
September 28	Journal Article Discussion: Environ Microbiol. 2009. Antagonistic interactions among coral-associated bacteria. Rypien KL, Ward JR, Azam F.
September 30	Marine food web processes; Organic matter-bacteria interactions
October 5	Physiological structure and single-cell activity
October 7	Top-down, bottom-up and sideways controls Suggested Reading: The microbial loop by F. Azam- Science, Vol. 280, No. 5364, pp. 694-696.
October 12	Journal Article Discussion: Effects of viruses and predators on prokaryotic community composition. Jardillier L, Bettarel Y, Richardot M, Bardot C, Amblard C, Sime-Ngando T, Debroas D. Microb Ecol. 2005. 50(4):557-69.

October 14	Biogeochemical cycles
October 19	Biogeochemical cycles...contd.. <u>Suggested Reading:</u> Microbial ecology of ocean biogeochemistry: a community perspective. Science, 2008. 320(5879):1043-5. <u>Research paper topic due</u>
October 21	Mid-term exam
October 26	Guest Lecture on Apalachicola Bay by Megan Lamb
October 28	Marine biofilms, marine snow, nutrient patchiness
November 2	<u>Journal Article Discussion:</u> Rapid chemotactic response enables marine bacteria to exploit ephemeral microscale nutrient patches. Stocker R, Seymour JR, Samadani A, Hunt DE, Polz MF. Proc Natl Acad Sci U S A. 2008. 18; 105(11):4209-14
November 4	Overview and preparation for sampling etc.
November 9	ANERR site study and sample collection
November 11	No Class- Veterans Day
November 16	Processing of samples for enumeration of heterotrophic bacteria (MPNs), protists and bacteriophage populations etc.
November 18	Processing of samples...contd... <u>Research paper due</u>
November 23	Benthic microbial food webs, vents and seeps etc.
November 25	<u>Student Symposium 1 and 2</u>
November 30	<u>Student Symposium 3 and 4</u>
December 2	Review and take home final exam hand out
Week of Dec 7: Finals Week, Final exam due by December 10 th , 5:00 pm.	

Syllabus subject to change at the discretion of the professor(s).