

**COURSE NAME; NUMBER; SEMESTER; MEETING DAYS, TIMES, AND PLACE.**

Microbial Ecology & Diversity

11:680:491

Mondays and Wednesdays 5:35 – 6:50 pm

**CONTACT INFORMATION:**

Instructor(s): Costa Vetrani

Phone: Vetrani - (848) 932 3379

Email: Vetrani – [vetriani@marine.rutgers.edu](mailto:vetriani@marine.rutgers.edu)

Office Hours: Upon request

**COURSE WEBSITE, RESOURCES AND MATERIALS:**

- Text books:
  - Madigan, Bender, Buckley, Sattley, and Stahl, Brock Biology of Microorganisms, 16<sup>th</sup> Edition, Pearson, NJ
  - Maier, Pepper, and Gerba, Environmental Microbiology, 2<sup>nd</sup> edition 2009, Academic Press, San Diego.

**COURSE DESCRIPTION:**

The course introduces the students to the enormous taxonomic, metabolic and ecological diversity of microorganisms on Earth. The course is organized in three sections of approximately equal proportion:

1. **Microbial diversity** in which we “climb” the tree of life by first considering how life on Earth started and how it has evolved to the enormous diversity that we see now among the Bacteria, Archaea, and the microbial Eukarya and their viruses;
2. **Metabolic diversity** in which we consider the magnificent diversity of the reactions that are carried out by microorganisms as revealed to us through various element cycles on Earth;
3. **Ecosystem diversity** in which we describe how microbes live in communities and engage in interactions with each other, with plants and animals, and with their environments. We consider the uniqueness of microbial life in ecosystems and highlight the role of microbes in sustaining homeostasis on Earth;

Throughout the course we stress the importance of the processes that are discussed in class to human wellbeing and environmental sustainability. Grading consists of 3 midterm exams, a term paper, and class participation.

**LEARNING GOALS:**

1. Graduates will gain a broad knowledge of the biology of microorganisms focusing on microbial processes and their effects on other organisms and the environment, microbial communities and biogeochemical cycles.  
Learning outcomes:

Graduates will be able to:

- a) Appreciate the diversity of microorganisms and microbial communities and recognize how microorganisms solve the fundamental problems their environments present.
- b) Examine the impact of microbes on the biosphere

2. Graduates will be critical thinkers with effective written and oral communication skills; well prepared for positions in industry, government and graduate/professional study. Learning outcomes:

Graduates will be able to:

- a) Demonstrate the ability to communicate scientific information in writing.
- b) Demonstrate the ability to communicate orally in a clear, coherent and effective manner.

3. Graduates will have a fundamental understanding of ethical and current issues in microbiology and appreciate a code of ethics for microbiologists including ethical conduct, scientific integrity and the dignity of the profession and practice of microbiology. Learning outcomes:

Graduates will be able to:

- a) Evaluate the ethical implications of scientific issues in society

#### **ASSIGNMENTS/RESPONSIBILITIES, GRADING & ASSESSMENT:**

Students are required to take three midterm exams and to submit a term paper on a topic related to the course. Each midterm exam consists of 8 short essay question which are graded by course instructors. A draft term paper is reviewed and commented on by course instructors prior to final submission.

The first and second midterm exams constitute 50% of the final grade, the third which covers more material, 30%, the term paper 15% and class participation (presence and active contribution), 5%.

#### **ACCOMODATIONS FOR STUDENTS WITH DISABILITIES**

Please follow the procedures outlined at <https://ods.rutgers.edu/students/registration-form>. Full policies and procedures are at <https://ods.rutgers.edu/>

#### **ABSENCE POLICY**

Students are expected to participate in all classes with the exception of emergencies such as health and family issues or in case of exceptional educational opportunities. An e-mail notification to the instructors should be submitted, if possibly, ahead of class time.

**COURSE SCHEDULE:**

	<b>Lec</b>	<b>Topic</b>	<b>Instructor</b>
<b>Introduction and microbial diversity</b>	1	Introduction and historical perspectives	Barkay & Vetriani
	2	Origins of life	Vetriani
	3	Microbial evolution	Vetriani
	4	The prokaryotes (Bacteria and Archaea)	Barkay
	5	Microbial Eukaryotes	Barkay
	6	Viruses in microbial ecology	Barkay
	7	Methods in microbial ecology	Vetriani
	8	Microbial genetics and horizontal gene transfer	Vetriani
<b>Metabolic diversity</b>	9	Modes of microbial metabolism in the environment	Vetriani
		<b>1<sup>st</sup> midterm (Lectures 1-8)</b>	
	10	The carbon cycle	Barkay
	11	The nitrogen and sulfur cycles	Vetriani
	12	Microbe-metal interactions	Barkay
	13	Bioremediation	Marinucci
<b>Microbial interactions and ecosystems</b>	14	Cycles and humans	Barkay
	15	Microbe-animal interaction	Vetriani
	16	Microbe-plant interactions	Barkay
		<b>2<sup>nd</sup> midterm (Lectures 9-16)</b>	
	17	Hydrothermal vent microbiology	Vetriani
	18	-Omics approaches in microbial ecology	Vetriani
	19	Microbiome and nutrition	Zhao
	20	Microbiome and development	Dominguez-Bello
	21	Microbial communities and ecosystems	Barkay
		<b>Thanksgiving recess</b>	
	22	Terrestrial environments	Barkay
	23	Aquatic environments	Vetriani
24	Abiotic factors and life in extreme environments	Barkay	
	<b>3<sup>rd</sup> exam (Lectures 17-24)</b>		

**FINAL**

**EXAM/PAPER DATE AND TIME**

Online Final exam Schedule: <http://finalexams.rutgers.edu/>

**ACADEMIC INTEGRITY**

The university's policy on Academic Integrity is available at <http://academicintegrity.rutgers.edu/academic-integrity-policy>. The principles of academic integrity require that a student:

- properly acknowledge and cite all use of the ideas, results, or words of others.
- properly acknowledge all contributors to a given piece of work.
- make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.

- obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
- treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that

- everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- all student work is fairly evaluated and no student has an inappropriate advantage over others.
- the academic and ethical development of all students is fostered.
- the reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

### **STUDENT WELLNESS SERVICES**

The Rutgers University Student Assembly urges that this information be included at the end of every syllabus. Edit or delete as you wish:

Just In Case Web App <http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901 / [www.rhscaps.rutgers.edu/](http://www.rhscaps.rutgers.edu/)

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / [www.vpva.rutgers.edu/](http://www.vpva.rutgers.edu/)

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the

accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Scarlet Listeners

(732) 247-5555 / <https://rutgers.campuslabs.com/engage/organization/scarletlisteners>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.