Lecture	TRF 10:00-10:50 in CPS 233
Lab section 1	M 14:00-16:50 in TNR 260
Lab section 2	W 14:00-16:50 in TNR 260

Instructor: Daniel Keymer
Office: 267 TNR
Email: dkeymer@uwsp.edu (preferred)
Phone: 715-346-2616
Office Hours: T 2-3 PM, R 11 AM-12 PM, or by appointment

I. Course description:

Despite being invisible to our naked eye, microorganisms play essential roles in modifying the world inside us and around us, ultimately facilitating life on this planet. This course provides an introduction to the prevalence and importance of microbes in regulating environmental processes as well as the factors that affect the fate of microbes in environmental media. We will also explore and obtain practical experience using common methods for studying the composition and function of microbial communities in environmental systems. Particular applied topics will include the role of microorganisms in nutrient cycling, soil quality, and transformation of waste.

II. Course Aims and Objectives:

Aims

Students in this course will gain a deeper understanding of the importance of microorganisms in functioning of soil resources and success of contaminant remediation or waste management projects. Emphasis will be on the ability to apply microbiology concepts governing microbial occurrence and activity to environmental and engineered systems. Laboratory exercises will provide working experience with techniques used to assess the presence, abundance, and activity of microbes in environmental samples. The knowledge and skills learned will be transferable to any number of environmental fields or careers.

Specific Learning Objectives

By the end of this course, students will be able to:

- Ask relevant questions about how microbiology affects your life and all life on earth
- Generate hypotheses about how microbes will respond to experimental manipulations in the lab or to external pressures in the environment
- Design experiments to study microbial groups in the environment
- Integrate knowledge of microbial physiology and metabolism with an appreciation for the presence, diversity, and distribution of microbial life all around you
- Communicate microbiology related information to various audiences in an accurate, compelling, and logically supported manner

During the course, students will be asked to demonstrate the following skills and be evaluated accordingly:

- Summarize requirements for microbial growth and survival
- Compare and contrast appropriate methods for addressing hypotheses
- Predict the outcome of experimental procedures
- Master the use of basic techniques for cultivating and characterizing microbial groups

- Reason possible explanations for observations
- Collaborate with peers to discuss ideas and formulate solutions
- Understand the assumptions behind microbiology methods for generating and analyzing scientific data
- Describe the role that microorganisms play in various environmental systems
- Apply principles of microbiology to novel scenarios or problems
- Integrate concepts in soil ecology and waste management with microbially-mediated processes
- Orally describe laboratory techniques and observations for the study of microorganisms
- Critically assess effectiveness of communicating microbiology concepts and data

III. Course Format:

This course contains both lecture and lab components. Lectures will introduce conceptual and applied microbiology topics, interspersed with thought exercises, small group activities, and case studies. The lab session will provide an opportunity to familiarize oneself with techniques employed in the study of microbes in environmental systems and then apply those tools to a group project on a particular system of interest. This is an oral communication in the major course, so there will be multiple required opportunities to present material to your instructor and peers and critique effective communication.

Attendance policy

If you cannot attend a scheduled class session or will be excessively tardy (>10 minutes late), you must have an excused absence to be eligible for any points awarded during the missed class. Excused absences will be considered by Dr. Keymer on a case-by-case basis. It is your responsibility to contact Dr. Keymer at least one week prior to an absence if you have a scheduled conflict that cannot be moved. Illness related absences must be excused by a doctor's note. For other unforeseen circumstances resulting in a missed class, Dr. Keymer must be contacted within 36 hours to arrange for any make-up activity. For both excused and unexcused absences, the student is responsible for reviewing all covered material and announcements with Dr. Keymer or his/her classmates.

Expectations

My expectations for you are that you will respect others, take responsibility for your own learning, participate and ask questions, and maintain a safe working environment. All communication with instructors or classmates must be respectful in content and tone. The classroom must be an environment where everyone feels comfortable and able to learn. Accordingly, students are required to treat others with respect and any behavior that impedes the ability of other students to learn will not be tolerated. Such disrespectful behavior includes, but is not limited to talking out of turn and using electronic devices for non-class related activity. Students are expected to come prepared to lab, having read through the laboratory procedures and ready to begin the exercises.

As your instructor, you can expect Dr. Keymer to do everything in his power to be fair, to be available and willing to help you, to provide feedback on work in a timely manner, to relate tasks to real-world skills, and to ask you think.

In addition to the specific expectations outlined above, all participants in the course are expected to act in accordance with the UWSP rules for academic conduct. For more information, see the following link: https://www.uwsp.edu/dos/Pages/Student-Conduct.aspx.

Regrade requests
Unless otherwise instructed, requests for regrading any assignment or exam must be submitted to Dr. Keymer ***in writing*** within one week of the graded item being returned.

IV. Course Requirements

Required textbook
Brock Biology of Microorganisms, 14th Edition by M. T. Madigan, J. M. Martinko, K. S. Bender, D. H. Buckley, and D. A. Stahl (2015) Pearson Education, Inc.

Supplemental materials
Additional course materials will be made available through Canvas. Lecture slides will usually be posted the day before. Handouts, homework assignments, practice problems, and announcements may also be disseminated via Canvas, in lecture, or by email.

Exams
Practical exams will focus on hands-on skills developed during lab exercises and interpretation of data. Written exam will assess understanding and application of concepts covered in lecture and on homework assignments. The final exam will be a comprehensive written exam, but will focus primarily on material covered during the second half of the course. The final exam will be administered during the scheduled exam period.

Independent project
Along with their lab partner, students in this course will attempt to isolate and confirm a specific type of bacteria. Some lab time will be reserved for these projects, but you will need to use time outside of the scheduled lab period to complete most of your work. It is your responsibility (not Dr. Keymer's) to make sure you are progressing toward this goal during the time allowed. At the completion of the project, you will present your approach and findings to your lab section. Specific instructions and expectations will be provided when Dr. Keymer introduces the project in class.

Participation
Participation constitutes a fraction of your grade. Students are expected to be an ***active*** participant in all lecture and lab sections for this course. This primarily means joining discussions during lecture, engaging in class activities, providing feedback on student presentations, and contributing equally to group lab exercises. Participation in the lab ***will*** require checking on cultures and other activities outside of the scheduled lab period.

Safety
On the first day of lab, you will be provided with lab safety rules that you are expected to know and follow. This includes silencing all cell phones or other mobile devices in the lab to prevent dangerous distractions while working with hazardous materials. During lab periods, we will learn techniques that maintain a safe working environment and integrity of lab materials and equipment. Failure to abide by the safety rules and techniques communicated by Dr. Keymer will result in loss of participation points and/or removal from the lab.

Grading scale

Letter grade assignments will be made according to the following scale:

A = 93 – 100%	B = 83 – 86%	C = 73 – 76%	F = below 60%
A- = 90 – 92%	B- = 80 – 82%	C- = 70 – 72%	
B+ = 87 – 89%	C+ = 77 – 79%	D = 60 – 69%	

Point distribution

Student grades will be determined based on the following breakdown of points:

Assignments	10%
Lab reports	18%
Oral presentations	18%
Quizzes (after dropping worst one)	6%
Practical 1	10%
Practical 2	10%
Written midterm exam	8%
Final written exam	16%
Participation and safety	4%
Total	**100%**

Dr. Keymer may also offer extra credit opportunities at his discretion.

V. Academic Integrity

All students have agreed to the UWSP Code of Conduct and are expected to know and abide by the rules documented therein. The policy can be found through the Dean of Students Office (https://www.uwsp.edu/dos/Documents/UWS%2014-1.pdf). This includes knowing the difference between plagiarism and paraphrasing, whether summarizing someone else's work in writing or on presentation slides. Individual student work submitted for credit will be your own and not submitted for credit in another course.

Working in groups is encouraged and required for parts of this course. This does not include exams and any collaboration among students on an exam is strictly forbidden. Appropriate credit must be given to all authors of assignments submitted for credit. It is assumed that students attaching their name to a group assignment have been responsible for a substantial contribution to its completion. Dr. Keymer should be notified if you are aware of any student taking credit for someone else's work. Violation of this policy could lead to failure on the assignment/exam, failure of the course, or other disciplinary action at the University level.

VI. Academic Accommodations

Accommodations for students with disabilities will be made on an individualized basis. Students must register with Disability and Assistive Technology Center to identify and confirm appropriate accommodations. Dr. Keymer will be happy to accommodate, but must be notified of any documented accommodations during the first three weeks of the semester, so that satisfactory arrangements may be provided. Please notify Dr. Keymer immediately if circumstances arise during the semester that change your accommodation needs.

VII. Anticipated Course Schedule: (*Subject to change*)

Date	Lecture topic	Lab activity	Readings
9/03	Course intro	**NO LAB**	Ch. 1.1-1.2
9/05	Microbial environments		Ch. 19.3, 1.4-1.5
9/06	Cell structure		Ch. 2.5-2.12
9/10	Cell structure	Lab safety, microscopy, aseptic technique	Ch. 2.1, 2.13-2.19
9/12	Cell structure		Ch. 4.3
9/13	Cell structure		
9/17	Cell structure	Smears and staining, independent projects	
9/19	Nutrition		Ch. 3.1, 3.3, 10.1
9/20	Cultivation media		Ch. 3.2
9/24	Growth	Cultivation media and normal flora	Ch. 5.1, 5.5-5.8, 5.10
9/26	Environmental factors		Ch. 5.11-5.16, 22.8, 23.1-23.4
9/27	Environmental factors		
10/01	Bioenergetics	Growth and enumeration	Ch. 3.4-3.8, 3.10-3.13, 5.5, 5.9
10/03	Bioenergetics		Ch. 13.16
10/04	Bioenergetics		Ch. 13.6
10/08	Respiration	Heterotrophic plate counts, substrate induced respiration	
10/10	Respiration/Fermentation		Ch. 3.9
10/11	Phototrophy		Ch. 13.1-13.4
10/15	Classification	Selective cultivation	Ch. 10.1, 12.4, 12.10, 18.1-18.2
10/17	Archaea		pg. 518
10/18	Eukarya		Ch. 2.20, 17.9, 22.1
10/22	Eukarya	Independent projects	
10/24	Early earth, endosymbiosis		Ch. 1.3, 2.21, 12.1-12.3, 17.1
10/25	**Written midterm**		
10/29	Biogeochemical cycles	**Practical 1**	Ch. 20.1-20.2, 20.8
10/31	Biogeochemical cycles		
11/01	Carbon cycle		Ch. 13.11, 13.19-13.20
11/05	Carbon cycle	Differential media, unknown identification	Ch. 3.2, 27.4
11/07	Carbon cycle		Ch. 13.15, 13.23-13.24
11/08	Nitrogen cycle		Ch. 20.3, 3.17, 13.10, 13.17
11/12	Water quality	Microbial water quality	Ch. 31.1-31.2
11/14	Nitrogen cycle		Ch. 20.4, 13.8, 13.18, 21.10-21.11
11/15	Bacteriophage		Ch. 8.1-8.4, 8.8-8.11, 22.5
11/19	Sulfur cycle	Mycorrhizae, bacteriophage	Ch. 11.1, 11.3, 18.5, 27.10
11/21	Sulfur cycle		
11/22	Iron and phosphorus cycles		Ch. 20.5-20.6, 13.9, 21.2
11/26	Iron and phosphorus cycles	Molecular methods, independent projects	
11/28	**NO CLASS**		
11/29	**NO CLASS**		
12/03	Biofilms	**Project presentations**	Ch. 19.4
12/05	Soil microbiology		Ch. 19.6-19.7
12/06	Soil microbiology		Ch. 22.3-22.5
12/10	Soil microbiology	**Practical 2**	
12/12	Wastewater treatment		Ch. 21.6-21.7
12/13	Wastewater treatment		
12/18	**Final exam**		