**Virtual Discussion** R 10-11 AM on Zoom
**Lab section 1** W 14:00-16:50 in TNR 260
**Lab section 2** M 14:00-16:50 in TNR 260

Instructor: Daniel Keymer
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Virtual Office Hours: T 10-11 AM, 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 be offered in two formats. Voice-over lecture slides will be posted on Canvas to introduce conceptual and applied microbiology topics. You are responsible for making time to view these asynchronous lectures. A synchronous discussion will be offered once per week via Zoom to review material interspersed with thought exercises, small group activities, and case studies. You are expected to regularly attend and participate in these discussions. The lab session will include in-person exercises conducted in cohorts to provide an opportunity to familiarize oneself with techniques employed in the study of microbes in environmental systems. Due to space and time constraints, pre-lab explanations and lab demonstrations will be made available through Canvas and must be viewed by students prior to attending the in-person lab period. This is an oral communication in the major course, so there will be multiple required opportunities to present material to your instructor 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. 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. To aid in contact tracing efforts, if necessary, attendance will be taken each class meeting and students will need to sit in assigned seats for all in-person activities.

### *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. Students are expected to come prepared to lab, having read through the laboratory procedures, viewed provided online demonstrations, 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.

## 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*

Most course materials will be made available through Canvas. Lecture slides with audio voice over will usually be posted the day before. Handouts, homework assignments, practice problems, and announcements may also be disseminated via Canvas and/or by email.

### *Exams*

A lab exam will focus on skills developed during lab exercises and interpretation of data. Two online exams 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.

### *Individual project*

Students in this course will investigate an environmental microbiology topic related to their primary area of study. At the completion of the project, you will produce a video of your findings and interpretations. Specific instructions and expectations will be provided when Dr. Keymer introduces the project in class.

### *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 | 15% |
| Lab reports | 18% |
| Oral presentations | 20% |
| Quizzes | 8% |
| Lab exam | 10% |
| Midterm exam | 8% |
| Final exam | 16% |
| Participation and safety | 5% |
| **Total** | **100%** |

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

## *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.

## *Participation*

Participation constitutes a fraction of your grade. Students are expected to be an ***active*** participant in virtual lecture and lab sections for this course. This primarily means joining discussions during lecture, engaging in class activities, 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.

## *Face Coverings*

At all UW-Stevens Point campus locations, the wearing of face coverings is mandatory in all buildings, including classrooms, laboratories, studios, and other instructional spaces. Any student with a condition that impacts their use of a face covering should contact the Disability and Assistive Technology Center to discuss accommodations in classes. Please note that unless everyone is wearing a face covering, in-person classes cannot take place. This is university policy and not up to the discretion of individual instructors. Failure to adhere to this requirement could result in formal withdrawal from the course.

## *COVID-19 Mitigation*

- Please monitor your own health each day using this screening tool. If you are not feeling well or believe you have been exposed to COVID-19, do not come to class; email your instructor and contact Student Health Service (715-346-4646).
    - As with any type of absence, students are expected to communicate their need to be absent and complete the course requirements as outlined in the syllabus.
- Maintain a minimum of 6 feet of physical distance from others whenever possible.
- Do not congregate in groups before or after class; stagger your arrival and departure from the classroom, lab, or meeting room.
- Wash your hands or use appropriate hand sanitizer regularly and avoid touching your face.
- Please maintain these same healthy practices outside the classroom.

## 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.

Lecture materials and recordings for this course are protected intellectual property at UW-Stevens Point. Students in this course may use the materials and recordings for their personal use related to participation in this class. Students may also take notes solely for their personal use. If a lecture is not already recorded, you are not authorized to record my lectures without my permission unless you are considered by the university to be a qualified student with a disability requiring accommodation. [Regent Policy Document 4-1] Students may not copy or share lecture materials and recordings outside of class, including posting on internet sites or selling to commercial entities. Students are also prohibited from providing or selling their personal notes to anyone else or being paid for taking notes by any person or commercial firm without the instructor's express written permission. Unauthorized use of these copyrighted lecture materials and recordings constitutes copyright infringement and may be addressed under the university's policies, UWS Chapters 14 and 17, governing student academic and non-academic misconduct.

## 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 |
| **9/04** | Microbial environments | | Ch. 19.3, 1.4-1.5 |
| **9/08** | Cell structure | Lab safety | Ch. 2.5-2.12 |
| **9/10** | Cell structure | | Ch. 2.1, 2.13-2.19 |
| **9/11** | Cell structure | | Ch. 4.3 |
| **9/15** | Cell structure | Aseptic technique | Ch. 2.2 |
| **9/17** | Nutrition | *** Microscopy, subculturing** | Ch. 3.1, 3.3, 10.1 |
| **9/18** | Cultivation media | | Ch. 3.2 |
| **9/22** | Growth | *** Smears and staining** | Ch. 5.1, 5.5-5.10 |
| **9/24** | Environmental factors | | Ch. 5.11-5.16, 22.8, 23.1-23.4 |
| **9/25** | Environmental factors | | |
| **9/29** | Bioenergetics | *** Growth and enumeration** | Ch. 3.4-3.8, 3.10-3.13 |
| **10/01** | Bioenergetics | | Ch. 13.16 |
| **10/02** | Bioenergetics | | Ch. 13.6 |
| **10/06** | Respiration | Growth and enumeration | |
| **10/08** | Respiration/Fermentation | | Ch. 3.9 |
| **10/09** | Phototrophy | | Ch. 13.1-13.4 |
| **10/13** | Classification | *** Heterotrophic plate counts, substrate induced respiration** | Ch. 10.1, 12.4, 12.10, 18.1-18.2 |
| **10/15** | Archaea | | pg. 518 |
| **10/16** | Eukarya | | Ch. 2.20, 17.9, 22.1 |
| **10/20** | Eukarya | Heterotrophic plate counts, substrate induced respiration | |
| **10/22** | Early earth, endosymbiosis | | Ch. 1.3, 2.21, 12.1-12.3, 17.1 |
| **10/23** | **Midterm exam** | | |
| **10/27** | Bacteriophage | *** Differential media, identifying unknowns** | Ch. 3.2, 8.1-8.4, 8.8-8.11, 22.5 |
| **10/29** | Biogeochemical cycles | | Ch. 20.1-20.2, 20.8, 27.4 |
| **10/30** | Carbon cycle | | Ch. 13.11, 13.19-13.20 |
| **11/03** | Carbon cycle | Viruses, bacteriophage | |
| **11/05** | Carbon cycle | | Ch. 13.15, 13.23-13.24 |
| **11/06** | Water quality | | Ch. 31.1-31.2 |
| **11/10** | Nitrogen cycle | *** Microbial water quality** | Ch. 20.3, 3.17, 13.10, 13.17 |
| **11/12** | Nitrogen cycle | | Ch. 20.4, 13.8, 13.18, 21.10-21.11 |
| **11/13** | Nitrogen cycle | | |
| **11/17** | Sulfur cycle | Molecular methods | Ch. 11.1, 11.3, 18.5, 27.10 |
| **11/19** | Sulfur cycle | | |
| **11/20** | Iron and phosphorus cycles | | Ch. 20.5-20.6, 13.9, 21.2 |
| **11/24** | Iron and phosphorus cycles | Mycorrhizae | |
| **11/26** | **NO CLASS** | | |
| **11/27** | **NO CLASS** | | |
| **12/01** | Biofilms | **Lab exam** | Ch. 19.4 |
| **12/03** | Soil microbiology | | Ch. 19.6-19.7 |
| **12/04** | Soil microbiology | | Ch. 22.3-22.5 |
| **12/08** | Soil microbiology | **NO LAB** | |
| **12/10** | Wastewater treatment | | Ch. 21.6-21.7 |
| **12/11** | Wastewater treatment | | |
| **TBA** | **Final exam** | | |