Course Title: Environmental Microbiology Laboratory  
Enrollment: 2 units  
Prerequisites: None, enrollment with 425/525 Environmental Microbiology Lecture is preferred  
Meeting time: Tuesday and Thursdays, 2:00 – 4:50 PM (All students attend both days each week)  
Location: Koffer 102  
Web Info: D2L.arizona.edu (Desire2Learn) course homepage

Description of Course:  
Environmental Microbiology Laboratory introduces students to concepts and methodologies utilized by microbiologists with careers focused on the environment. The course incorporates basic techniques for isolation, characterization, and enumeration of environmental microflora. Students will execute experiment protocols specific to bacteria, actinomycetes, fungi, parasites, and viruses that are found in soil and water. From these experiment, students learn to collect and analyze data that is useful for research, industry, and government regulations. Multiple field trips allow students to experience real-world environmental microbiology in person, while meeting numerous professionals to network and provide insight on opportunities after graduation. The course familiarizes students with microbial processes, effective systems, and impacts that effect the environment and human health. This course provides the basic knowledge and skills that are essential for careers pertaining to environmental microbiology.

Objectives and Learning Outcomes:

1. Become familiar with types and relative numbers of various microorganism found in soil and water environments.
2. Isolate various microorganisms (bacteria, fungi, viruses, and parasites) from environmental samples of soil, water and wastes.
3. Observe and evaluate microbial transformations in soil and water.
4. Develop an understanding of soil and aquatic microbial processes and the effects of these systems in environmental microbiology.
5. Perform numerous microbiology and molecular protocols utilized in research and industry.

Teaching Format and Course Methodology:  
This course is taught as a hands-on laboratory section that exposes students to common procedures and experiments used in microbiology. Each class period begins with the instructor lecturing and detailing information relevant to the experiment(s) being performed during that class period. The students are expected to conduct the laboratory procedures individually or within groups, depending on
instructions. This class is taught in conjunction with SWES 426/526, but information in both courses will not overlap with the schedule of the other course.

**Required Text:** Available at the UA Bookstore


**Recommended Reading:**


**Required/Recommended Knowledge:**

This laboratory is taught concurrently with SWES 426/526, therefore students are recommended to have already completely or are currently enrolled in the soils lecture course. Students that have not completed, and are not currently enrolled in SWES 426/526, may still enroll in this course with the instructor’s approval. It is recommended, but not required, that students have laboratory experience from previous courses, volunteering, or jobs.

**Desire2Learn (D2L):** [www.d2l.arizona.edu](http://www.d2l.arizona.edu)

This program will be used to post important class information and announcements. The students are expected to check for updates on this website, as the instructor will not send email updates. In addition to handing in hard copies assignments, students will download completed assignment into the dropbox on D2L before the deadline. Students will download all excel assignments into the dropbox, and turn in written assignment to the dropbox when specified by the instructor. The dropbox is linked with Turnitin.com to check for plagiarism. Therefore, do not turn in assignments from previous classes, old papers, friends, group work, etc. as it will be classified as plagiarism. Do your own original work!

**Attendance Policy:**

Students are required to attend ALL laboratory class periods. Do not miss a lab unless it is an emergency! If a student must miss a lab, it is their responsibility to have a dean’s excuse and contact the instructor at least 24 hours in advance. It is the student’s responsibility to check with the instructor to make up the missed lab or exam as soon as possible. If the students does not contact the instructor before missing a laboratory and does not attempt to schedule a makeup within reasonable time, the instructor has the ability to deny a makeup lab without granting the student any points. It is the instructor’s decision to choose any type of makeup assignment for a missed lab.

**Late Policy:**

Late assignments will not be accepted. Failure to turn in an assignment at the beginning of the laboratory results in zero points for that assignment. There will be a grade penalty for turning in lab reports late. If the lab reports assignment is turned in within a week that it was due, only 10% will be deducted. If the assignment is turned in after one week it was due, 25% will be deducted. If the assignment is turned in two weeks late, 50% will be deducted. No lab reports will be accepted more than two weeks late, and the students will receive zero points for the assignment.

**Incomplete Grade Policy:**

Incomplete assignments will only be graded for the completed sections, the incomplete sections will receive zero points. If the student completes less than 50% of the assignment, the instructor will not grade the assignment and the student will receive zero points. The student can complete the assignment and turn it in late according to the late policy grading scale. If the students turns in a late assignment that is still incomplete, it is the instructors decision to grade and give partial credit or not grade the assignment and the student will receive zero points.
General Requirements:

1. **Class Participation and Attendance.** Full attendance is mandatory since this is a lab course. It is crucial to arrive on time. There will be no make-up experiments, quizzes, exams, etc. If for some reason it is necessary that you miss a class period, prior arrangements must be made.

2. **Laboratory notebook.** A gridded composition notebook is strongly suggested for a laboratory notebook (other bound notebooks will also be accepted). Further instruction on notebook preparation will be given on the first day of class. No loose-leaf sheets will be graded. The objective(s) for each experiment should be clearly stated at the beginning of each experiment. All data, observations, summary of conclusions and deviations from the experimental protocol as presented in the lab manual should be legibly recorded and well organized. *Remember, the better your notebook, the more helpful it will be when it comes time to write your lab reports, study for exams, or complete post-lab assignments.*

Class Assignments:

1. **Pre-lab quizzes.** (10% of grade) The pre-lab assignment will consist of a quiz based on the experiment to be done that day. There will be multiple quizzes throughout the semester, but not necessarily every lab period. Quizzes will be given during the first ten minutes of class. If you miss the quiz, you will receive no credit.

2. **Post-lab assignments.** (10% of grade) At the conclusion of each experiment, short questions regarding the experiment will be assigned. These questions are not designed to be complex, but will test your understanding of the material. These assignments are due approximately one week after the completion of the experiment.

3. **Laboratory notebook.** (15% of grade) A well organized and properly documented notebook will be essential for this class. The notebook is not designed to be a burden but provide a useful tool to help you succeed not only in this lab, but in any future laboratory settings.
   - Complete table of contents
   - Title, date, and page numbers for each lab
   - Objective – clearly stated at beginning of each lab (3-5 sentences)
   - Methods/Materials – brief list of important procedures including materials (illustrations)
   - Conclusions/Results – short summary of findings and discussion to explain (0.5 – 1 page)

4. **Exams.** There will be three section exams (10% each) and a final comprehensive exam (20%). Section exams are not designed to be cumulative.

5. **Graduate students.** Students enrolled for graduate credit may have different/additional exam questions. However, there will not be an additional graduate project or report.
Grading:

Exams 50%
- Section Exam 1 (10%)
- Section Exam 2 (10%)
- Section Exam 3 (10%)
- Final Exam (20%)

Lab Reports 15%
- Lab Report 1 (5%)
- Lab Report 2 (5%)
- Lab Report 3 (5%)

Pre-labs 10%
- 5 Prelab quizzes (2% each)

Post-labs 10%
- 5 Post lab assignments (2% each)

Lab Notebook 15%
- Lab notebook will be checked 3 times throughout semester (5% each check)

Laboratory Safety:

Personal protective equipment is required while performing every lab experiment. Safety goggles are required when experimental work involves the use of chemicals that can cause injury via splashes, broken glass, and other factors. Most of the laboratory experiments do not require the use of toxic chemicals, however some require chemical reagents that must be handled with care. If any chemical should spill on skin or clothing, immediately was the affected area with water and consult the instructor. All soils and chemical waste must go in special containers placed on the lab benches. Never put chemicals or soils down the drain or in sinks. If any glassware is broken, immediately alert the lab instructor. Used paper towels must be disposed in regular garbage containers. Students are required to wear clothes appropriate for lab and field studies. The instructor will warn students which clothes are appropriate for field trips and certain experiments. Closed toed shoes are required during all labs.

Student Code of Academic Integrity:

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/codeofacademicintegrity

DRC contact information:
1224 East Lowell Street Tucson, Arizona 85721
Phone: (520) 621-3268 V/TTY Fax: (520) 621 - 9423
Email: uadrc@email.arizona.edu
**Student Code of Conduct:**

The aim of education is the intellectual, personal, social, and ethical development of the individual. The educational process is ideally conducted in an environment that encourages reasoned discourse, intellectual honesty, openness to constructive change and respect for the right of all individuals. Self-discipline and a respect for the right of others in the university community are necessary for the fulfillment of such goals. The Student Code of Conduct is designed to promote this environment at each of the state universities. The Student Code of Conduct sets forth the standards of conduct expected of students who choose to join the university community. Students who violate these standards will be subject to disciplinary sanctions in order to promote their own personal development, to protect the university community, and to maintain order and stability on campus. [http://deanofstudents.arizona.edu/policiesandcodes/studentcodeofconduct](http://deanofstudents.arizona.edu/policiesandcodes/studentcodeofconduct)

**Confidentiality of Student Records:**

For policies regarding privacy of student records, please see the following: [http://www.registrar.arizona.edu/ferpa/default.htm](http://www.registrar.arizona.edu/ferpa/default.htm)

**Notification of Objectionable Materials:**

Cell phones and computers are not allowed during the class period as they cause distractions to other students and the instructor. Cell phones are not allowed for the use of calculators during exams, students are expected to bring a calculator to class during exams.

**Policy on Disruptive Behavior:**

The University seeks to promote a teaching and learning environment free from material and substantial classroom disruptions. Faculty members and teaching staff have the authority and responsibility to effectively manage their classroom environments. Instructors may determine the time and manner for student questions and expression of points of view in the instructional setting. Accordingly, instructors should establish, communicate and enforce reasonable rules of classroom behavior and decorum via the syllabus and classroom discussion. This policy is not intended to discourage appropriate classroom expression, discussion or disagreement, but to promote respectful interactions. [http://policy.arizona.edu/disruptive-behavior-instructional](http://policy.arizona.edu/disruptive-behavior-instructional)

**Special Needs and Accommodations Statement:**

Students who need special accommodation or services should contact the Disability Resources Center, 1224 East Lowell Street, Tucson, AZ 85721, (520) 621 – 3268, FAX (520) 621 – 9423, email: uadrc@email.arizona.edu, [http://drc.arizona.edu/](http://drc.arizona.edu/). You must register and request that the Center or DRC send me official notification of your accomodations needs as soon as possible. Please plan tomeet with my by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate. *The need for accommodations must be documented by the appropriate office.*

**Subject to Change Statement:**

Information contained in the course syllabus may be subject to change with advance notice, as deemed appropriate by the instructor.
# SCHEDULE FALL 2014

ENVS 426/526  SWES 426/526  MIC 426/526  IMB 426/526  
ENVIRONMENTAL MICROBIOLOGY LABORATORY  
I. Pepper, C. Gerba, B. Schmitz  

Koffler Building, Room 102  
2:00PM - 4:50PM  
***THIS SCHEDULE IS SUBJECT TO SLIGHT CHANGES DISCUSSED IN CLASS***

All course material will be available via D2L: [http://d2l.arizona.edu/](http://d2l.arizona.edu/)

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| 1    | Aug 26  | **Introductory Class Assessment**  
Lecture: Significance of Environmental Microbiology (*Pepper and Schmitz*)  
Start Experiment #2 Soil Moisture Content Determination |
| 1    | Aug 28  | **Finish Experiment #2 Soil Moisture Content Determination**  
Start Experiment #3 Contact Slide Assay  
Lecture: Soil as a Microbial Environment (*I.L. Pepper*) |
| 2    | Sept 2  | **Pre-Lab Quiz 1**  
Lecture: Most Probable Number: Theory (*B.W. Schmitz*)  
Start Experiment #4 Filamentous Fungi  
Start Experiment #19 Detection of Bacteriophages |
| 2    | Sept 4  | **Pre-lab Quiz 2**  
Finish Experiment #19 Detection of Bacteriophages  
Start Experiment #5 Bacteria and Actinomycetes  
Lecture: Significance of Soilborne Microorganisms (*I.L. Pepper*) |
| 3    | Sept 9  | **Post-Lab Assignment 1**  
Part II Experiment #4 Filamentous Fungi  
Finish Experiment #3 Contact Slide Assay |
| 3    | Sept 11 | **Part II Experiment #5 Bacteria and Actinomycetes**  
Lecture: Growth Curves: Theory and Problem (*B.W. Schmitz*) |
| 4    | Sept 16 | **Lab Report due** on Experiment #3 Contact Slide Assay  
Part III Experiment #5 Bacteria and Actinomycetes  
Finish Experiment #4 Filamentous Fungi |
| 4    | Sept 18 | **Lecture: Microbial Metabolism (*I.L. Pepper*)**  
Part IV Experiment #5 Bacteria and Actinomycetes  
Review for Exam #1 |
| 5    | Sept 23 | **Finish Experiment #5 Bacteria and Actinomycetes**  
Tour: West Center |
| 5    | Sept 25 | **EXAM I**  
NOTEBOOK CHECK 1 |
| 6    | Sept 30 | **Start Experiment #7 Oxidation of Sulfur on Soils** |
| 6    | Oct 2   | **Pre-lab Quiz 3**  
Start Experiment #9 Nitrification and Denitrification  
Lecture: Ascaris lumbricoides Survival in Class B Biosolids (*B.W. Schmitz*)  
Start Experiment: Ascaris Viability |
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| Oct 7 | Lecture: Nitrogen Cycle *(J.L. Pepper)*  
Part II Experiment #7 Oxidation of Sulfur on Soil |
| Oct 7 | Post-Lab Assignment 2&3  
Part II Experiment #9 Nitrification and Denitrification |
| Oct 8 | Field trip: Wastewater Treatment Plant |
| Oct 8 | Finish Experiment #9 Nitrification and Denitrification |
| Oct 9 | Post-Lab Assignment 4  
Start Experiment #8 Dehydrogenase Activity of Soils  
Finish Experiment #7 Oxidation of Sulfur on Soils |
| Oct 9 | Pre-lab Quiz 4 Ascaris  
Lab Report due on Experiment #9 Nitrification and Denitrification  
Finish Experiment: Ascaris Viability |
| Oct 10 | Finish Experiment #8 Dehydrogenase Activity of Soils  
Lecture: Enrichment and Isolation of Bacteria that Degrade 2,4-D  
Review for Exam II |
| Oct 10 | EXAM II  
NOTEBOOK CHECK 2 |
| Nov 4  | Start Experiment #12 Biodegradation of Phenol Compounds  
Start Experiment #17 Defined Substrate Technology for Detection of Coliforms and Fecal Coliforms (Colilert) |
| Nov 6  | Pre-Lab Quiz 5  
Part II Experiment #12 Biodegradation of Phenol Compounds  
Part II Experiment #17 Defined Substrate Technology for Detection of Coliforms and Fecal Coliforms (Colilert)  
Start Experiment #15 Bacteriological Examination of Water: The Coliform MPN Test |
| Nov 11 | VETERANS DAY – NO CLASS |
| Nov 13 | Post Lab Assignment 5  
Part III Experiment #12 Biodegradation of Phenol Compounds  
Finish Experiment #17 Defined Substrate Technology for Detection of Coliforms and Fecal Coliforms (Colilert)  
Finish Experiment #15 Bacteriological Examination of Water: The Coliform MPN Test |
| Nov 18 | Lecture: Waterborne Disease *(C.P. Gerba)*  
Lecture: Indicator Organisms *(C.P. Gerba)*  
Part IV Experiment #12 Biodegradation of Phenol Compounds |
| Nov 20 | Lecture: Viruses and Parasites *(C.P. Gerba)*  
Finish Experiment #12 Biodegradation of Phenol Compounds  
COLLECT ONE WATER SAMPLE UA CAMPUS FOR HA FILTRATION, STUDENTS DECIDE  
Finish Experiment #16 HA Membrane 1st Concentration Technique *(Pepper Lab)*  
Review for Exam III |
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| 14   | **Nov 25**  
Lab Report due on Comparison of MPN, Colilert and Membrane Filter Technique  
Lecture: PCR, RT-PCR, and qPCR *(B. Schmitz)*  
Start Experiment #24 PCR gel electrophoresis  
EXAM III (Take home exam over thanksgiving break)  
NOTEBOOK CHECK                                                                                           |
| 14   | **Nov 27**  
Thanksgiving Break (No UA classes)                                                                                                                               |
| 15   | **Dec 2**  
Finish Experiment #24 PCR gel electrophoresis  
STUDENTS EACH COLLECT 100 mL H₂O SAMPLE FROM ANY LOCATION THEY DESIRE  
Start Experiment: Quantitray 2000 for Total Coliform/E. coli Detection                                                                                           |
| 15   | **Dec 4**  
Lecture: Pyrosequencing *(B. Schmitz)*  
Finish Experiment: Quantitray 2000 for Total Coliform/E.coli Detection  
Review for Final Exam                                                                                             |
| 16   | **Dec 9**  
FINAL EXAM  
FINAL NOTEBOOK CHECK                                                                                             |