

**COLLEGE OF ARTS AND SCIENCES
GOVERNORS STATE UNIVERSITY
DIVISION OF SCIENCE**

Index Number: BIOL 841

Course Title: Microbial Ecology Laboratory

Credit Hours: 1.0

Professor: Timothy C. Gsell, Ph.D.

Office Number: F1653

Office Hours:

Office Phone: 534-4921

E-mail t-gsell@govst.edu

Trimester:

Catalog Description:

Comprehensive usage of the principles, methodologies, and applications used to describe the ecology of A a variety of microorganisms. This laboratory course will focus on areas of microbial ecology with experiments and activities designed to quantitatively and/or qualitatively examine microbial populations and population interactions, microbial communities and ecosystems, biogeochemical cycling, and the biotechnological aspects of the ecology of microbes from various environmental samples.

Rationale:

BIOL 841 is a core lab course requirement that satisfies the following two Degree Objectives and Expected Outcomes as delineated in the current Outcomes Assessment Plan for Environmental Biology majors:

1. ENBI graduates will demonstrate improved critical thinking skills.
2. ENBI graduates will be able to interpret and critique relevant scientific literature, apply appropriate methodology to the solution of new problems, communicate scientific ideas and technical information in a coherent and logically organized manner, and work independently to carry out research in the discipline.

Prerequisites:

BIOL 430/431; BIOL 322/323; Co-requisite BIOL 840

Intended Audience:

Master students interested in learning about the ecology of microorganisms and the applications used in a modern environmental microbiology laboratory to study the interactions between microbes, other organisms, and the environment.

Expected Student Outcomes:

During the course of the trimester students are expected to be able to:

1. Determine the moisture content of various soil types. (ENBI 1, 2)
2. Produce a contact slide containing a diverse array of microbes from soil and describe these microorganisms qualitatively. (ENBI 1, 2)
3. Quantify filamentous fungi from environmental samples using solid culture media by counting colony forming units. (ENBI 1, 2)
4. Isolate and enumerate bacteria and actinomycetes using various media techniques. (ENBI 1, 2)
5. Perform proper direct counting method using DAPI and Fluorescence microscope. (ENBI 1, 2)
6. Examine water samples for coliform bacteria using the coliform MPN test. (ENBI 1, 2)
7. Examine water samples for coliform bacteria using the coliform membrane filter technique. (ENBI 1, 2)

8. Detect and quantify bacteriophages in water samples using a plaque assay. (ENBI 1, 2)
9. Using the Biological Oxygen Demand (BOD), plot a curve of phenol biodegradation. (ENBI 1, 2)
10. Using molecular techniques, extract and purify microbial community DNA from soil. (ENBI 1, 2)
11. Detect microbes using cultural and molecular methods, including BiOLOG, the polymerase chain reaction (PCR) and describe community diversity using these fingerprinting techniques. (ENBI 1, 2)
12. Utilize PCR to evaluate the presence of particular bacteria in water samples. (ENBI 1, 2)
13. Collect and analyze data regarding the above list. (ENBI 1, 2)

Instructional Activities:

Lab introductions, demonstrations, and discussion of results.

Laboratory Manual:

Environmental Microbiology: A Laboratory Manual, I.L Pepper, C.P. Gerba., 2nd Ed. Academic Press . 2004.

Supplemental Material:

Handouts and journal articles that accent materials from the lab manual will be used when appropriate.

Course Outline (tentative):

Class session	Outcome #	Laboratory Activity	Lab #
1	1 and 2	Microbial Ecology Lab Introduction: Dilution and plating of bacteria and Contact slide assay + Winogradsky column and graduate test and survey	1, 2 and 3 + Handout
2	3 and 4	Filamentous Fungi, Bacteria and Actinomycetes and microscope review	4 and 5
3	5 and 6	Viable and direct microbial counts (isolate bacteria for later BIOLOG metabolic fingerprinting technique	4, 5, and handout
4	7	Water microbiology: Bacteriological examination of water: Coliform MPN test, membrane filter technique and Film medium for detection of coliforms	15, 17 and 18
5	8	Detection of Bacteriophage and BIOLOG metabolic fingerprinting technique	19 and handout
6	1-8	Finish labs and review for lab exam 1	From above
7	1-8	Lab Exam 1	
8	9	Biodegradation of Phenol compounds or alternate lab	12
9	10	DNA extraction and purification from soils	MoBIO Handout
10	11	PCR overview/set up and explanation of molecular cloning of target 16sRNA gene	24 and handout Chapter 14 from text
11	11	Molecular detection of Microbes using Polymerase Chain reaction	24 + handout
12	12	Use of arbitrarily primed PCR or rep-PCR fingerprinting and sequencing DNA	Old lab 19 and Chapter 15 from text
13	10, 11, 12, 13	Finish labs and review for lab exam 2 and Denaturing Gradient Gel Electrophoresis DGGE demonstration (or other methods)	Handout All since last test
14	10, 11, 12, 13	Lab Exam 2	
15		Student Presentations* Lab wrap-up	Various topics

***Note:**

In-class presentations by the students may be scheduled as the trimester progresses.

Also, it will be common practice to have to come in and check microbial incubations 1-2 days post inoculation for many of the lab exercises scheduled. Some lab exercises are subject to change based on results.

General course policies:

All students are required to attend all lab sessions. If you miss a lab you will get a 5 point deduction from the participation points automatically. **You** are responsible for obtaining the missed lecture notes or hand-out material given out during that period, but **you will not be allowed to hand in any lab report involved with the missed materials**. If an exam is missed the **result will be a zero** for that test. Make up exams are only given at the instructor’s discretion, and will only be given once during the semester due to some substantiated extenuating circumstances as determined by me.

Each person should take the tests individually with absolutely no outside help. The penalty for a first offense is an immediate F (0 points) on that exam. The second will result in an automatic F for the course, and action may be taken to get you removed from Governors State University. The definition used for academic misconduct is the following: “All violations of academic honesty related to fulfilling academic requirements, including but not limited to cheating, plagiarism, and/or knowingly assisting other students to engage in such conducts. I will follow the procedures found in the Governors State University student handbook regarding any violation of academic honesty by a student. My hope is that this will not be necessary. These considerations are not intended to discourage people from studying together.

Evaluation:

Student evaluations are based on the two in class exams, 4 lab reports on labs to be determined later, a 20 minute presentation of a laboratory topic or procedure found in the primary scientific literature, and your participation and clean up efforts. Students are required to give a 20 minute presentation on a topic approved by the professor. Topics can be anything related to Microbial Ecology, but should not be redundant with what has been covered by the instructor. The presentation will be worth 50 points: 10 for an outline handout for the audience; 10 for visuals and graphics; 15 for understanding of the topic and 15 for presentation and style. Students should use a current, or landmark, journal article from a primary scientific publication and present the work described in the paper. Journal choices for references should be from Applied and Environmental Microbiology and Microbial Ecology.

Exam 1	100 points
Exam 2	100 points
Lab reports	75 (3 X 25)
Student Presentation	50 points
Discussions and Attendance/Clean-up	25 points
Total Points	350 points

Grade scale	Letter grade
90-100%	A
80-89%	B
70-79%	C
60-69%	D
below 60%	F

Services for students with Disabilities: GSU is committed to providing all students equal access to all university programs and facilities. Students who have a documented physical, psychological, or learning disability and need academic accommodations, must register with Access Services for Students with Disabilities (ASSD). Please contact the Coordinator of ASSD in Room B1201 in person; by e-mail, assd@govst.edu; or by calling 708.235.3968. If you are already registered, please contact your instructor privately regarding your academic accommodations.

Avoiding Plagiarism by Good Paraphrasing, Quoting and Documentation

Give credit to your sources, because they deserve it. Many students inadvertently plagiarize the intellectual work of others, and run the risk of receiving an F. It is easy to plagiarize, especially with all the information on the web! Simply fail to give credit where credit is due, and you are a plagiarist. That is all there is to it. But how can one know when credit is due, you ask? Read this carefully:

Document your source if you paraphrase or quote. Failure to do so is an act of plagiarism, even if it is innocent. It is easy to plagiarize even though one does not intend to steal another's work. Therefore, it is very important to understand the essentials of paraphrasing and quoting discussed below.

If in doubt, consult a handbook on good writing or contact me. I strongly recommend this if you are not sure about documenting written material. The following quotes are from the Prentice-Hall *Handbook for Writers*, 10th edition. Chapter 45 (The Research Paper). But there are other good handbooks with similar words of wisdom:

A **paraphrase** is a restatement of the source material in your own words, syntax, and style but preserving the tone of the original... and of approximately the same length (not as summary). A paraphrase uses the original author's idea and presents it in your own language. Since in paraphrasing you borrowing someone's thoughts, you must document the source when you use the paraphrase in your paper (page 470).

A **direct quotation** records exactly the words of the original source (as well as the exact punctuation and even any spelling errors). Like summaries and paraphrases, direct quotations require citations in your paper crediting the source from which you copied them. In general, use direct quotations only for particularly telling phrases or for information that must be rendered exactly as you found it (page 470).

Plagiarism consists of passing off ideas, opinions, conclusions, facts, words (intellectual property) of another as your own. Plagiarism is dishonest and carries penalties not only in academic environments but in all professions, as well as copyright law (page 470).

Long word-for-word quotations are rarely appropriate to a paper or particularly to a lab report. Use of all or most of a single sentence or an apt figure of speech without acknowledgment from another source is also dishonest and considered plagiarism (page 470).

Even if you acknowledge the source in a citation, you are still plagiarizing when you incorporate in your work faultily paraphrased or summarized material from another author in which you follow almost exactly the original's sentence patterns and phrasing. Paraphrasing and summarizing require that you fully digest an author's ideas and interpretations and restate them in your own words. It is not enough simply to modify the original author's sentences slightly, to change a word here and there (page 472).

A research report or paper loaded with quotations or consisting of long quotations stitched loosely together with brief comments will almost always be an unsatisfactory paper (page 474).

Make use of paraphrases and summaries instead of quotations in most cases where sources are cited. Frequently, the point can be made better in your own words, with proper citations, than in the words of the original (page 474).

Graduate Report Guidelines BIOL 841

Research based lab reports should contain the following sections with the type of material described after each sub-heading.

Abstract:

Summarizes the main points of the lab report and experiments performed. No references should appear in this section.

Introduction:

Sets the stage for the scientific work accomplished in the lab. It is used to place your work in a broad theoretical context. You should be clear about the goals and specific aims and convey the principle findings and the relevance of your results. You should also explain the rationale for the work described in the report.

Materials and Methods:

Include enough information so the study can be repeated. It should provide the context for evaluating the data, but not give the results.

Results:

This section summarizes and illustrates the findings. Do not interpret the data or draw conclusions in this section.

Discussion:

This is where you interpret your results and support your conclusions with evidence from the experiment or literature. This is also where you should answer all the questions posed in the lab manual. Recognize the importance of negative results. You can learn a great deal from experiments that do not work perfectly.

Reference:

This section should list all sources cited in the text alphabetically by lead author. The references should be numbered and placed in brackets (1) in appropriate sections of lab report text. Always give your sources credit. Failure to do so is plagiarism, an offense that can get you expelled from the university. See the attached sheet for details.