MICROBIAL ECOLOGY
(BIOL 4410/6410; EAS 8803JK)
Tentative Syllabus – Spring, 2015

Welcome to microbial ecology. This course is cross-listed for undergraduate and graduate students. The intent of the course is to introduce you to the many facets of microbial life on this planet and to show you that Earth's ecosystems and microbes are closely intertwined.

Most people think of microorganisms or microbes as harmful, causing disease or just stinking up the refrigerator. However, the reality is that the vast majority of microbes keep humans alive and healthy on Earth. Microbes indeed rule the world! Microbes are responsible directly or indirectly for producing the air we breathe, the food we eat, clean water that we drink, and diseases that make us sick. However, most of the microbial world remains to be discovered and explored. Central ecological questions, that have been largely answered for macrobes, remain understudied in microbes including:

What microbes are present in various ecosystems?
What activities do they perform?
How are these activities interrelated?
In what number does each type of organism occur?
What is the magnitude of its activity *in situ?*
What environmental factors affect this activity?

The availability of next generation genetic sequencing technologies has revolutionized the field of microbial ecology. A census of at least the predominant microbes in nature is now possible. The field is now focused on linking community structure (that is, the composition of a microbial community and the abundance of each member of the community) with the processes occurring within the ecosystem. This course provides an in-depth overview of the role of microbes in the functioning of Earth's ecosystems. Specific topics will include microbial evolution, phylogeny, physiology, metabolism, community ecology, habitats, methods, biogeochemical cycles, biofuels, food microbiology, and bioremediation. The course format will consist of interactive lectures and discussions, which will draw on information from the latest scientific discoveries in the field.

Instructor:

Joel E. Kostka, Ph.D., School of Biology
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Class Schedule and Location:

Lecture: MWF 11:05am-11:55am, Room 52 College of Computing

Required Course Reading Material:

Required text:

Processes in Microbial Ecology
David L. Kirchman
ISBN 978-0-19-958693-6

ISBN 978-0-19-958692-9

Publisher: Oxford University Press

Required additional supplemental reading:

- Microbes and Evolution: The World that Darwin Never Saw, Edited by R. Kolter and S. Maloy, 2012.
- Review articles
- Primary literature
- Websites

Additional reading material will be announced and added to the course website on T-square. You are responsible for checking T-square daily for updates to the schedule and reading material throughout the semester.

Lecture Powerpoint presentations will be posted on T-square either before or after lecture (at instructor discretion), but always before the respective exam. Additional material may be covered in lectures, and you may be tested over it.

Prerequisites: (all require a minimum grade of "D"):
BIOL 3380, Introductory Microbiology

Grading:
Undergraduate section:
First take-home exam- 20 %
Second take-home exam- 20 %
Third cumulative take-home exam- 20 %
Presentation (or critique)- 20 %
Class participation (attendance, reading, discussion)- 20 %

Graduate section:
First take-home exam- 20 %
Second take-home exam- 20 %
Third cumulative take-home exam- 20 %
Presentation (or critique)- 10 %
Class participation (attendance, reading, discussion)- 15 %
Field lab and report- 15 %

Description of Course Assignments

Take-home exams

The first and second in-class exams will each count toward 25% of your final course grade. The final exam will count toward 30% of your grade. All three exams may include several multiple choice, true/false, and short answer, but will primarily be essay questions that will require analysis and interpretation. All three exams are take-home home exams which you will have about 1 week to complete. The exams are designed so that the answers will not be ones you can simply find in a textbook, but may very well be based on simulated laboratory or

field data that I provide. You are expected to work on each exam alone but you may use the textbook, Powerpoints, your lecture notes, and research papers to aid in the completion of your exams. Exam 1 will cover material up to the exam, and exam 2 will test students on the material following exam 1. The final exam will be cumulative and cover material from the entire course, with an emphasis on the material covered in the latter third of the course. However, since the topics discussed after exam 2 rely on your knowledge of the earlier material, a comprehensive understanding of the course material will be required for the final exam.

Class Attendance and Participation

Attendance and active participation are **required**. As outlined in the course requirements section of this syllabus, 20% of your course grade will be determined by your active participation in class. I will use a "cold-calling" mode of questioning in class. Using index cards you fill out during our first class, I will randomly call on students during each class period to promote discussion. I will grade your response based on the scheme below. Therefore, you are expected to read the required material for each class and come ready to participate and contribute. Participation in the discussions and questioning during student presentations is also expected and will be included in your participation grade. Much of the information needed to succeed on the exams will be provided orally in class, but will not be present in the Powerpoint presentations. **If you do not attend class and rely solely on the textbook and the Powerpoint presentations available on T-square following each class, you will most likely do very poorly in this course.**

Index-card class participation grading:

0 - no attempt given to answer question, absent
1 - a poor attempt is given to answer the question, unclear on many points
2 - a good answer with some of the essential features addressed
3 - an excellent answer with most or all of the essential features addressed

Presentation/critiques

Research articles will be chosen by Dr. Kostka to complement the lectures and to reflect the latest developments in the field. Graduate students will be assigned and responsible for one of the research papers. Groups will be developed in the first few weeks of class depending on enrollment. Working together, graduate students, will design and present a Powerpoint presentation on the research paper and relevant background information. Their oral presentation will be given during class on the date assigned. Plan the presentation for 30-35 minutes, allowing 15-20 minutes for questions.

Each undergraduate in class will select one of the supplemental research papers and independently write up a critical review of that paper. The instructor will indicate a date when undergraduates must decide on which paper they will write a critique. Undergraduates who do not choose a paper by that date will be assigned one by the instructor. A paper copy of the critique is due at the beginning of class on the day of the presentation. An identical digital copy must also be submitted via e-mail or T-square to the instructor by the start of that class. The rubric provided below details the specifics sections of the review and critique.

All students that are not presenting that day will fill out the "presentation

assessment form" (see below) at the end of the presentation and turn it in. The presentation grade for each group will be derived from the average of the assessment grade from your peers (50%) and from the instructor (50%). The independent critical review by undergraduate students will be graded by the instructor using the critique rubric (see below). The grade from your presentation or critique represents 10% of your course grade.

Extra credit:
Extra credit **may** be offered for attending specific departmental seminars and symposia, taking good quality notes, and handing in the notes.

Course expectations and policies:
Consideration: Appropriate classroom behavior is expected at all times. Turn off all cell phones, pagers, and beepers. The only electronic device used can be a laptop if you would like, although this is not required. If you use a laptop, it is for note-taking for this course only, and not for web-surfing, social networking… Students are also expected to be proactive, meeting with their instructor should they encounter difficulties in the class, require assistance or have any unanswered questions. **I encourage you to ask questions!**

GT Honor Code:
All students are expected to follow the Georgia Tech Academic Honor Code (www.honor.gatech.edu). Violations will be taken very seriously. This includes, but is not limited to the following issues pertaining to exams and presentations for this class. Examples of academic honor violations from the policy statement include committing or attempting: 1) plagiarism, 2) cheating, 3) unauthorized group work, 4) fabrication, falsification and misrepresentation, 5) multiple submission.

Americans With Disabilities Act:
Students with disabilities needing academic accommodation should:
(1) register with and provide documentation to the ADAPTS Disability Services Program; and
(2) bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class.
This syllabus and other class materials are available in alternative format upon request.

Syllabus change policy:
Syllabus changes substantially affecting the grading of the course will not be made. Other syllabus changes may be made and will be announced.

Course Schedule (TENTATIVE!):
Please note that topics may be modified/ omitted due to time constraints and exams may be changed.

Day	Date	Topic		Reading	
M	5 Jan	Introduction/ Overview		Ch. 1, Kirchman	
W	7 Jan	Introduction/ Overview		Darwin and	

				Microbiology, Kolter and Maloy	
F	9 Jan	Review, Discussion			
M	12 Jan	Composition of bacteria, fungi, protists		Ch. 2, Kirchman	
W	14 Jan	Composition of bacteria, fungi, protists			
F	16 Jan	Review, Discussion			
M	19 Jan	Martin Luther King Jr. National Holiday			
W	21 Jan	Microbial Evolution and Phylogeny		Deep History of Life, A.H. Knoll	
F	23 Jan	Microbial Evolution and Phylogeny			
M	26 Jan	Physical-chemical environment		Ch. 3, Kirchman	
W	28 Jan	Physical-chemical environment			
F	30 Jan	Review/ discussion			
M	2 Feb	Thermodynamics and Metabolism		Appendix 1, Brock	
W	4 Feb	Thermodynamics and Metabolism			
F	6 Feb	Exam 1; Review/ discussion			
M	9 Feb	Primary Production and Phototrophy		Ch. 4 Kirchman Falkowski article	
W	11 Feb	Primary Production and Phototrophy		Ch. 4 Kirchman Chisholm essay	
F	13 Feb	Discussion/ review			
M	16 Feb	Organic Matter Decomposition and Heterotrophy		Ch. 5 Kirchman	
W	18 Feb	Organic Matter Decomposition and Heterotrophy		Ch. 5 Kirchman	
F	20 Feb	Presentation/ critique			
M	23 Feb	Microbial mortality: predation and viral ecology		Ch. 7, 8 Kirchman	
W	25 Feb	Microbial mortality: predation and viral ecology		Ch. 7, 8 Kirchman	
F	27 Feb	Review/ discussion			
M	2 March	Methods			
W	4 March	Methods			
F	6 March	Exam 2, Presentation/ critique			
M	9 March	Wetlands ecology			
W	11 March	Wetlands ecology			
F	13 March	Discussion/ review			
M-F	16-20 March	Spring Break			
M	23 March	Carbon cycle			
W	25 March	Carbon cycle			
F	27 March	Discussion/ review			

M	30 March	Nitrogen Cycle			
W	1 April	Nitrogen Cycle			
F	3 April	Discussion/ review			
M	6 April	Bioremediation		Head, 2006; Kostka et al., 2011	
W	8 April	Bioremediation			
F	10 April	Exam 3, Review/ discussion			
M	13 April	Food Microbiology and Fermentation		Peralta-Yahya et al., 2012	
W	15 April	Food Microbiology and Fermentation			
F	17 April	Discussion/ review			
M	20 April	Animal and Plant Microbiomes			
W	22 April	Animal and Plant Microbiomes			
F	24 April	Discussion/ review			
	29 April- 3 May	Final Exam Week			

Presentation Assessment Form*
BIOL 4410/6410; EAS 8803JK

Presentation Date: _____

Presentation Title: _____

Names of Presenters: _____

5 = excellent; 4 = very good; 3 = good; 2 = fair; 1 = poor

						Total
	5	4	3	2	1	
Mechanics of Communication (10 points)						
Were the speakers familiar with the A/V equipment?						
Were the slides easy to read and not overcrowded?						
Presentation (20 points)						
Was the talk well presented? (e.g. typos, slide order, time management)						
Did the speakers speak loud enough and avoid trash phrases?						
Did the speakers strive to keep the audience's attention? (e.g. eye contact, voice, expression)						
Were the speakers attentive to the needs of a general audience? (e.g. explain technical terms)						
Did the speakers avoid jargon when simple phrases suffice?						
Content (50 points)						
Did the talk have distinct introduction, body, and conclusions sections?						
Was the introduction clear and adequate and did it make the audience curious?						
Were the results explained clearly, accurately, and simply?						
Did the conclusion summarize the main points and make clear the "take home message" of the talk?						
Questions (10 points)						
Did the talk stimulate interesting questions and were they answered adequately?						
Group dynamics (10 points)						
Did each group member contribute sufficiently to the presentation?						

Grand Total Points: _____

Strengths: _____

Suggestions for improvement:_____

Overall Evaluation: _____

Note: this assessment will be provided to presenters after the grade totals are recorded.

Rubric for Grading of Written Critiques
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You are to write a review and critique of a paper from the primary literature. The critique is limited to 6 pages in length with 12 pt font and 1 in. margins, not including the title page, and should be completed according the guidelines below. Grading will follow these guidelines. The text of the critique will be written in your own words and should not duplicate statements from the paper your are critiquing. The Summary/ Abstract section, in particular, should be able to stand alone in describing the main points of the critique.

Title page (4 pts)
Article title and authors- 1 pt
One line summary of paper- 2 pts
Your name, date, and course listing- 1 pt

Summary/ Abstract (< 250 words or 0.5 page) (16 pts)
Introductory statement- 4 pts
Summary of the author's major materials and methods- 4 pts
Summary of the major results- 4 pts
A brief interpretation of the results- 4 pts

Background (~ 1 page) (10 pts)
A brief summary of the relevant background information- 5 pts
The objective or purpose of the study- 5 pts

Experimental Approach and Findings (~ 2 pages) (30 pts)
Experimental methods- 15 pts
Major observations- 15 pts

Critical Review and Original Analysis (~ 2 pages) (40 pts)
Is the problem clearly stated and important to the field?
Does the introduction provide sufficient background to help understand the study? (e.g. too narrow, too broad, biased, cited properly?)
Is the methodology well described and appropriate? Were sufficient controls included?
Is a reasonable conceptual model given to explain their results?
Were there unexpected results? Is a satisfactory explanation given for these?
Do the authors describe the implications of their study to the field? Do you agree or disagree?
What impressed you about this article? Concerned you?
What is your overall assessment of the article?

As the grading scheme implies, the critical review and analysis section is most important and you are expected to address each of the above questions in your critique.

Total = 100 pts

You will lose points according to the following guidelines:
Length of review is longer than the maximum allowed- -10 pts
Hand in critique late- -10 pts per day
Misspelling of word, run-on or incomplete sentence, sentence that makes no sense- -1 pt per