

NOVA SOUTHEAST UNIVERSITY
Bacterial Evolutionary Genetics Course
Graduate Level
Oceanographic Center
NOVA Southeastern University

- Lecture Time:** ON-LINE SUMMER SESSION
May XXth through August XXnd, 2014
- Location:** NOVA SOUTHEASTERN UNIVERSITY
NOVA WebCT On-line Education
- Instructor:** Eric W. Brown, Ph.D.
Adjunct Professor of Microbiology and Genetics
- Telephone:** **Office:** 410-756-5871 (After 4:00PM, leave message outside these hours) *return calls and E-mails will be the same business day usually, or the next business day at the most
- Cell phone (Emergencies only): 301-503-0508
- E-mail:** eb880@nova.edu
- Required Reading:** *Microbial Evolution: Gene Establishment, Survival, and Exchange*; Eds: Robert Miller and Martin Day, ©2004, ASM Press.; Washington, DC; ISBN 978-1-55581-271-3

Course Description: Microbial populations evolve and adapt to their surroundings in rapid and facile ways. This course is designed to familiarize the evolution/ecology/microbiology student with an understanding of the evolutionary genetic mechanisms that govern diversity of the microbial world with a particular emphasis on bacterial species and strains., including marine microbes Numerous genetic mechanisms will be discussed that can rapidly diversify or homogenize bacterial populations including hypermutation, recombination, and the selective deletion of DNA. Many of these adaptive changes lead to the acquisition of dangerous traits among bacteria including enhanced virulence attributes, multi-drug resistance, and unusual tolerance to environmental insults. In addition, methods and assays capable of detecting and measuring these kinds of evolutionary changes among bacterial species and strains will be reviewed. Finally, a survey of analytical approaches currently deployed for ascertaining population and evolutionary diversity within a bacterial population will be undertaken.

Course Objectives: Upon completion of this course, the upper-level student of ecology, evolution, microbiology, and marine biology will be able to:

- recognize and understand the role of bacterial mutators and the hypermutable phenotype in the persistence and survival of bacterial populations
- comprehend the importance and impact of horizontal gene transfer and genetic recombination on the evolutionary structure of the bacterial strain and bacterial population
- explain the emergence of dangerous phenotypes within bacterial populations including antibiotic resistance, virulence factors, and stress responses.
- detect and quantify the presence and extent of adaptive evolutionary mechanisms including recombination among bacterial species and strains
- understand the importance and roles of next-generation strategies deployed for effectively measuring populational diversity within a bacterial species

Week	Date	Topic	Reading assignment
1	5.XX	~Familiarize with WebCT classroom for Bacterial Evolutionary Genetics ~Review Syllabus in its entirety ~Start assigned text readings ~Start Conference #1 ~Topic: Intro to Mutagenesis and Recombination	Miller and Day, Ch. 1, 3, and 5
2	5.XX	~Continue Conference #1 ~Read supplementary materials ~Topic: mutagenesis and recombination (cont.) ~Read and Review Assigned Scientific Paper #1	Supplementary materials A and B
3	5.XX	~Conference #1 due (5/30) ~Start conference #2 ~Start next text readings ~Review due for Scientific Paper #1 (5/30) ~Topic: Mechanisms of DNA transfer	Miller and Day, Ch. 7, 9 and 10
4	6.XX	~Continue conference #2 ~Read supplementary materials ~Begin On-line Exam #1 ~Review Assigned Scientific Paper #2 ~Topic: Mechanisms of DNA transfer (cont.)	Supplementary materials C and D

5	6.XX	<ul style="list-style-type: none"> ~Continue Online Exam #1 ~Start next text readings ~Review due for Scientific Paper #2 (6/13) ~Begin working on PPT presentation ~Conference #2 is DUE (6/13) ~Start Conference #3 ~Topic: acquisition of pathogenicity in bacteria 	Miller and Day, Ch. 16 and 18
6	6.XX	<ul style="list-style-type: none"> ~On-line Exam #1 is due for submission (6/20) ~Read next supplementary materials ~Continue working on Conf. #3 ~Start review of Scientific Paper #3 ~Topic: acquisition of pathogenicity in bacteria (cont.) 	Supplementary materials E and F
7	6.XX	<ul style="list-style-type: none"> ~Continue working on PPT ~Start next text readings ~Conference #3 is due (6/27) ~Start working on Conf. #4 ~Review of Scientific Paper #3 is due (6/27) ~Topic: HGT and Bacterial evolution and diversity 	Miller and Day, Chs. 11, 19, and 20
8	7.XX	<ul style="list-style-type: none"> ~Continue working on PPT ~Continue working on Conf. #4 ~Read Next supplementary materials ~Start review of scientific paper #4 ~Begin working on On-line Exam #2 ~Topic: HGT and Bacterial evolution and diversity (cont.) 	Supplementary materials G and H
9	7.XX	<ul style="list-style-type: none"> ~Continue working on PPT ~Start next text readings ~Conference #4 is DUE (7/11) ~Start working on Conf. #5 ~Continue working on On-line Exam #2 ~Review of Scientific Paper #4 is due (7/11) ~Topic: HGT/mutagenesis and the speciation of bacteria 	Miller and Day, Chs. 21 and 22
10	7.XX	<ul style="list-style-type: none"> ~Continue working on PPT ~On-line Exam #2 is due (7/18) ~Continue working on Conf. #5 ~Start review of Scientific paper #5 ~Read supplementary materials 	Supplementary materials I and J

		~Topic: Methods for detecting hypermutability and recombination (HGT)	
11	7.XX	~PPT presentation is due (7/25) ~Conference #5 is DUE (7/25) ~Prepare for Final Exam and make arrangements for Final Exam ~Review of Scientific Paper #5 is due (7/25) ~Topic: Methods for detecting hypermutability and recombination (HGT) (cont.)	Continue reading supplemental materials
12	7.XX	FINAL EXAM and ALL ASSIGNMENTS and CONFERENCES- FINAL DUE DATE	None

Other Resource Texts (not required):

(1) Microbial Phylogeny and Evolution: Concepts and controversies by Jan Sapp (ed), (Oxford University Press), 2005, ISBN 978-0-19-516877-1

(2) Microbial Population Genetics by Jianping Xu (ed), (Caister Academic Press), 2010, ISBN 978-1-904455-59-2

(3) Virulence Mechanisms of Bacterial Pathogens by Kim Brogden (ed), (ASM Press), 2000, ISBN 1-55581-174-4

Other Supplementary readings (not required):

(1) M. Ridley 2004 Evolution, 3rd Edition Blackwell

(2) D. Futuyma, Evolution 2nd Edition Sinauer

(3) Supplementary handouts will also be provided during the class.

Bacterial Evolution Glossary:

<http://www.ncbi.nlm.nih.gov/books/NBK45715/>

Other Important Websites:

(1)

General terminology

<http://www.blackwellpublishing.com/ridley/a-z/>

Grading and Evaluation:

On-line General Exams	2 @ 100 points each	200 points
Paper Reviews	5 @ 20 points each	100 points
Bio-sci PPT pres	1 @ 50 points each	50 points
On-line Confs	5 @ 20 points each	100 points
Final Exam	1 @ 100 points each	100 points
(cumulative)	total points available	550 points

<u>Points translated into letter grades:</u>	495-550 points = A
	440-494 points = B
	385-439 points = C
	330-384 points = D
	329 or less pts = F

Exams: There will be two general exams and a final exam in this class. The general exams will be posted online and will include 5 conceptual questions on the subject matter being covered. These exams will be submitted by a specific due date in the WebCT and can be taken open book. The final exam will be taken at a scheduled place and time at the end of the semester and will consist of a mix of multiple choice and essay questions. Exam due dates are listed below on the course schedule. The instructor should be notified within 24 hours of the date of the exam if the student will not take the exam.

BioScience Real-life Powerpoint Assignment: The power point presentation is worth 50 points. The presentation is due *one* week before final exams. The PPT presentation must be at 5-10 slides and include a summary review of a concept we covered in class. Once the concept is summarized, the focus of the presentation should be researched and explored/expanded further by the student including the real-life applications for medicine, ecology, and other applied outlets of the concept in bacterial evolution. For example, multi-drug resistance in *E. coli* is affecting the way physicians treat urinary tract infections and other illnesses. The student should introduce the subject matter in the space allocated. A detailed bibliography page should be attached to the PPT assignment at the end which will include all of the sources of information used in constructing the PPT file, *including* websites / URL addresses, *etc.*

Paper Reviews: Five published research publications on the topics of recombination, the hypermutable phenotype, and the various phenotypes associated with these evolutionary mechanisms for bacterial diversity will be posted on Blackboard. You will be responsible for reviewing them as if you are a referee for publishing them. This will include a brief summary of what the paper's subject is. Also, you will identify what the hypothesis is in the paper. Then, you can summarize how the results support the hypothesis as well as

summarize overall the findings of the paper. Finally end it with a quick opinion on the quality of the science and the writing of the paper. This will be done in a single “white-paper” format where all of the information is summarized in a single typed page (single spaced if necessary). The reviews will be uploaded into the Blackboard by the designated dates in the syllabus.

On-line Conferences: There will be 5 conferences for the class in the Blackboard On-Line Summer course in Evolutionary Bacterial Genetics. These conferences will be arranged according to date in the conferences area of the WebCT and will usually be arranged according to Chapter number and title following the text. Each student will have three weeks to respond to course conferences by responding to the questions and/or topics being asked within the conference. A response entails putting together a cogent response to the question and posting it as a response within the conference area. In addition, each student is required to post a comment to at least two other classmate responses for each of the five conferences. Conferences will be posted periodically and at least two weeks in advance of the due date. Appropriate responses to the instructor’s questions in paragraph form as well as comments to your classmates’ postings will entail completion of the conference for that week. Each successful completion will be worth 20 points for 5 conferences for a total of 100 points.

Each time you enter the electronic classroom, it's recommended that you do the following:

- ~Check the Class Announcement area for any updates on the course. (You may need to scroll down to see all recent announcements.)
- ~Check your syllabus to see what tasks are due for the week and to read the relevant topics within the Course Content area. Within Course Content, you will also find useful slides and other study aids for exams and quizzes including Powerpoint presentations for the relevant chapters in the text. You may want to use the Assignment Checklist in the course content area to keep track of what you still need to complete and check off what has been accomplished.
- ~Access the Conference(s) for that week to read and respond to discussion questions posted by the instructor and to messages posted by other participants. Post any assignments indicated for that week's conferences when you are ready to submit them.
- ~Check the webliography for additional websites for the class and for other postings provided to enhance or reinforce subject matter from the text.
- ~Check your messages within WebCT. The instructor may need to contact the student as an individual rather than the class in general.

Late submissions of powerpoint presentations: PPT presentations will be accepted up to 1 week past the posted due date provided that the student has made prior arrangements by notifying the instructor of his/her absence prior to the scheduled due date and has received permission from the instructor to submit the PPT file tardy. In these instances,

some grade sanction may apply. Late presentations, without notification to the professor, will be accepted at the teacher's discretion and will likely be penalized 10 points from the start. Papers will be submitted through the assignments folder in the WebCT.

Classroom Conduct: All members of the Blackboard classroom will be treated with respect and dignity by the instructor. This behavior, in turn, is expected for fellow students and for the instructor as well. Participation on-line is heavily encouraged. The goal is to make the electronic classroom setting as informal as possible through discussion and banter (mainly within the conferencing activities) between the instructor and the students and between students also.

Returned Quizzes and Exams: Quizzes and exams will be graded and posted within 2 weeks on the webCT. Students are expected to take all exams when scheduled. In the event of illness or extraordinary circumstances, the student must contact the faculty member and provide documentation to request an exception and approval to take a makeup final exam or receive an extension to the due date on a general exam. If the request is not approved, the exam grade will be recorded as a zero.

Teaching philosophy: The instructor of this course has taught introductory-level courses at several well-respected institutions for nearly a decade. He loves to teach. He will transmit subject matter to the class with enthusiasm, honesty, and sincerity. He is here to help all who wish to learn do just that. He will make a whole-hearted effort to answer all questions and will try to make the course as interesting as possible. Each student should be expected to spend at least 5 hours per week on the various portions of this graduate class. Weeks prior to exam times may require additional study and preparation.