

Microbial Population Biology 2011

BIOL 6297

Course outline:

This course will use reviews and primary research to examine (i) the processes that underlie microbial population dynamics and (ii) how these processes contribute to patterns of microbial diversity and evolution.

The course will follow a combination of lecture and seminar styles. In the first part of each meeting, I will present a short introduction to the week's topic and then we will discuss 1-2 papers of my choosing. For each paper, one or two assigned members of the class will lead discussion. You will lead the second part of the course – each week class members will collaborate to present a topic to the class. In consultation with me, 2-3 papers will have been distributed to the class prior to the presentation. Members of the class not involved in the presentation will be expected to write a short critical summary of the presentation.

An important emphasis of this course will be on critical evaluation of the primary research we will cover. This is a crucial skill, both for reading papers and for writing them. Our aim will be to, in as much detail as possible, follow the aims, experimental design and experimental interpretation of each primary research paper we cover. To this end, it might help to think through the following workflow while reading each paper (note, this is only a guide—you will think of additional aspects to evaluate papers on):

- i. What question/hypothesis did the authors aim to test?
(Is it interesting? Is it novel? Is it important/trivial?)
- ii. What experimental approach did the authors take?
(Are experiments properly controlled? Should alternative/additional approaches have been used?)
- iii. What results were obtained?
- iv. How were experiments interpreted?
(Are limitations of experimental approaches properly accounted for? Are conclusions properly supported? Would other interpretations have been possible if some additional experiments were done—if so, should they have been done?)
- v. Are results discussed in a useful context?
(Are other relevant studies responsibly addressed?)

Schedule (Subject to change):

- January 26 Introduction.
- February 2 Stress and Mutation. Mutational processes, Pros and cons of mutations, measuring mutation rates, adaptive mutation.
Review: Horst et al. (1999) TIM 7: 29-36.
Tenailon et al. (2004) TIM 12: 264-270.
Primary: Bjedov et al. (2003) Science 300: 1404-
Wrande et al. (2008) PNAS 105: 11683-.
- February 9 Adaptation. Examples of adaptation, mechanisms and basis.
Review: Sniegowski et al. (2000) BioEssays 22: 1057-
Primary: Gonzalez et al. (2008) PLoS Genetics 4 (10): e1000208.
Blount et al. (2008) 105: 7899-.
- February 16 Robustness and evolvability. Processes that influence the affect of genetic variation, mechanisms of these processes, evidence that they play a role in evolution of real populations.
Review: Lenski et al. (2006) PLoS Biology 4(12): e428
Primary: Montville et al. (2005) PLoS Biology 3(11): e381.
Sanjuan et al. (2007) PLoS Genetics 3(6): e93.
- February 23 Heterogeneous populations. Persistors, Bimodal (switch) regulatory responses, strategies for fluctuating environments.
Review: Smits (2006) Nature R. Micro. 4:259-
Primary: Novick and Weiner (1957) Proc. Natl. Acad. Sci. USA 43:554-
TBD
- March 2 Cooperation. Bacteria as members of communities, emergent phenotypes, cheating.
Review: Redfield (2002) Trends Micro 10: 365-
Primary: Griffin et al. (2004) Nature 430: 1024-.
- March 9 Antibiotic resistance. Mechanisms, natural ecological role, strategies to minimize, compensatory mutations.
Review: Martinez et al. (2007) Nature R. Micro 5: 958-
Interest: Antonovics et al. (2007) PLoS Biology 5: e30.
Primary: Levin et al. (2000) Genetics 154: 985-
Boles et al. (2004) PNAS 101: 16630-.
- March 16 **Spring Break**
- March 23 Population structure and bacterial species. Bacterial species concepts, ecology and evolution in bacterial species distributions.

Review: Achtman et al. (2008) N. Rev. Micro 6: 431-.
Primary: Heinemann and Sprague (1989) Nature 340: 205-.
Rasko et al. (2008) J. Bacteriol. 190: 6881-.

March	30	Class presentations (practice).
April	6	Class presentations (practice).
April	13	Class presentations (assessed).
April	20	Class presentations (assessed).

Assessment:

Class participation:	20%
Critical summary of class presentation:	30%
Presentation:	50%

Assessment Criteria:

Class participation: Class members are expected to contribute to discussion of all papers that are presented – not just those they are responsible for directing discussion of. Everyone must read all papers presented in each class. If you are not presenting a paper, you should identify aspects you do not understand. If you are presenting a paper, you should try and anticipate difficulties and do extra reading as necessary to ensure you have a good working understanding of the paper’s aims, results and interpretations. Full participation marks will be earned by demonstrating that you have met these standards, for example by asking non-trivial questions about experimental design or interpretations presented in a paper.

Critical summary of class presentation: You are required to write short (~0.5 page) critiques of those class presentations (March 30 – April 20) you do not take part in. The aim is to develop skills of synthesizing and effectively communicating a critique of a presentation, and to provide useful peer feedback to presenters. Critiques that score high marks will be well written (concise and grammatically correct), accurate (points that were addressed in the presentation should not be raised needlessly) and demonstrate a logical grasp of what the presentation should have achieved (what points should have been raised for a convincing scientific argument to have been made).

Presentation: Presentations provide an opportunity to practice getting across complex scientific information to an educated but non-expert audience. We’ll spend some time going over details of the presentations on March 23. High marks will be obtained if presenters are successful in identifying and getting across at least one important central idea. This will involve properly introducing the idea, including sufficient context for its importance to be established, and presenting experiments and results as required for key conclusions to be reached.