Evolution in Marine Systems
ZOOL 719 (3 credits), Fall 2015

Instructor: Dr. Peter Marko, EDM 317
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Meeting Time: Tuesdays and Thursdays 9:00-10:15 am, Webster 102

Course Overview

This course focuses on the fundamentals of modern evolutionary theory and research, with a strong emphasis on the natural history of marine organisms. The course consists of lectures and student-led discussions of the literature. Grading will be based on three exams, three homework assignments, and active participation in discussions. Homework will include problems and short writing assignments.

Learning Outcomes

At the end of ZOOL 719, students will be able to:

1. Communicate the development of evolutionary biology from Darwin to the present, including knowledge of key contributors in the field, particularly those working on marine systems.
2. Explain the action, influence, and interaction of evolutionary forces, such as natural selection and genetic drift.
3. Express how two-phase life histories uniquely influence the distribution, abundance, population genetic structure, and evolution of marine organisms.
4. State how molecular evolutionary concepts are applied to understand biological evolution.
5. Discuss the relationships among species concepts, species discovery, and molecular methods of species delimitation.
6. Describe major events documented in the fossil record and be able to discuss the potential causes for large changes in biodiversity over time.

Exams and Grades

Exam 1	**October 13th**	20%
Exam 2	**December 15th** (9:45 am)	20%
Discussion		30%
Homework		30%
Total		100%

Each exam covers the preceding lectures **and** discussions. Exams will be a mix of problems and short written answers (half to one page per question). Exam 2 is not cumulative, but it assumes a good grasp of concepts covered on Exam 1.

Letter grades will be based on these cutoffs:

A = 90% and higher B = 80% - 89.9% C = 70% - 79.9% D = 60% - 69.9%

Homework

Homework will consist of practice problems and three short writing assignments. You may discuss these assignments with other students, but the work you submit to me must be your own. The writing assignments are short (<2000 words) literature summaries on assigned topics. I encourage you to give me a draft to read and comment on, but no less than 7 days before the assignment is due.

Discussions

For each Discussion meeting I will assign a background paper that you must read plus two additional papers that we will discuss in class. **Before each Discussion meeting, students must submit two discussion questions (1 per paper) to me by e-mail.** Discussion questions are those that promote discussion by focusing attention on important concepts in the paper. Each Discussion will have two student leaders who are responsible for providing a short verbal summary of each paper (5 min each) and developing a list of questions and comments for the group that will promote discussion. Everyone should carefully read the papers as many times as necessary to have a good understanding of the work, so that you are able to think about and answer questions such as:

- *What were the hypotheses or questions the study addressed or tested? If a review paper, what was the central theme or thesis?*
- *Were the conclusions of the paper supported by the results?*
- *Were there any important assumptions made by the authors and how critical are they to their conclusions?*
- *Are there potential problems with the methods used? Focus on the overall approach, not the details of the particular techniques used.*
- *What's most significant about the paper? Why might it be an important contribution to the literature?*
- *What could have been done to improve the hypotheses, methods, conclusions, or the writing of the paper?*
- *What could/should be done next?*

I expect that everyone will actively read each paper by thinking about what is written as you read. If you run into a sentence, concept, or term that you do not understand, you have to read up about it. That often means looking at other papers that are cited by the authors of our focal papers.

Attendance

Attendance **and** participation is an important component of the class because half of the meetings are discussions. You can miss a maximum of two class meetings. Each

additional absence will result in the loss of 2% of your final grade. I can accommodate a few more absences if they are directly related to research field trips or off-island conferences. But, if you plan to miss a month while you are in the field you should take this class at your next opportunity. If you have any potential conflicts, please let me know on the first day of class.

KOKUA Program

Any student who feels she or he needs an accommodation based on the impact of a disability should contact the Office for Students with Disabilities to ensure reasonable accommodations in this course. KOKUA can be reached at (808) 956-7511 or (808) 956-7612 (voice/text) in room 013 of the Queen Lili'uokalani Center for Student Services.

Academic Integrity

Failure to comply with University of Hawaii guidelines of academic integrity will typically result in a zero score for an assignment and may result in referral to the Student Conduct Administrator and a failing grade in the class. If you have not before, I strongly urge you to review the student conduct code:

http://studentaffairs.manoa.hawaii.edu/policies/conduct_code/table_of_contents.php

and UH definitions of cheating and plagiarism:

http://studentaffairs.manoa.hawaii.edu/policies/conduct_code/proscribed_conduct.php.

Class Schedule

Date	**Topic**	**Discussion Readings** **(Subject to change, italics = background reading)**
Aug 25	Course introduction	
Aug 27	Lecture 1: Darwin to the Modern Synthesis	
Sept 1	Discussion 1	*Darwin 1859 (p.60-69, 80-90)*, *Williams 1966 (excerpts)*, Gould & Lewontin 1979, Rose & Oakley 2007
Sept 3	Lecture 2: Principles of phylogenetics **Homework 1 distributed (due 9/29)**	
Sept 8	Discussion 2	*Maddison 1997*, Strathmann & Eernisse 1994, Aguinaldo et al. 1997
Sept 10	Lecture 3: Molecular evolution	
Sept 15	Discussion 3	*TBA*, Swanson & Vacquier 1995, Foote et al. 2015
Sept 17	Lecture 4: Evolution in the fossil record	
Sept 22	Discussion 4	*Kidwell & Flessa 1995*, Vermeij 1995, Erwin et al. 2001
Sept 24	Lecture 5: Adaptation	
Sept 29	Discussion 5 **Homework 1 due 5 PM (email to me)**	*Sanford & Kelly 2010*, Kelly et al. 2012, Gagnaire et al. 2012

Oct 1	Lecture 6: Life history evolution	
Oct 6	Discussion 6	*Pechenik 1999*, Levitan 1993, Moran 2004
Oct 8	**No class**	
Oct 13	**Exam 1**	
Oct 15	Lecture 7: Population genetics **Homework 2 distributed (due 11/12)**	
Oct 20	Discussion 7	*TBA*, Johnson & Black 1982, Karl & Avise 1992
Oct 22	Lecture 8: Gene flow and connectivity	
Oct 27	Discussion 8	*TBA*, Gilg & Hilbish 2003, TBA
Oct 29	Lecture 9: Phylogeography	
Nov 3	Discussion 9	*Avise et al. 1987*, Burton 1998, Wares & Cunningham 2001
Nov 5	Lecture 10: Species concepts	
Nov 10	Discussion 10	*Dobzhansky 1935*, Knowles & Carstens 2007, TBA
Nov 12	Lecture 11: Speciation **Homework 2 due 5 PM** **Homework 3 distributed (due 12/8)**	
Nov 17	Discussion 11	*Valentine & Jablonski 1983*, Palumbi et al. 1997, Butlin et al. 2014
Nov 19	Lecture 12: Sexual selection	
Nov 24	Discussion 12	*West-Eberhard 1983*, Evans & Sherman 2013, Levitan & Stapper 2009,
Nov 26	**Thanksgiving**	
Dec 1	Lecture 13: Biogeography	
Dec 3	Discussion 13	*TBA,* Williams & Duda 2008, Renema et al. 2008
Dec 8	**TBA** **Homework 3 due 5 PM**	
Dec 10	**TBA**	
Dec 15	**Exam 2 (9:45 am)**	