

Bio 418 – Evolution

TR 4:20-6:00 PM, BioSci 244

<http://instructional1.calstatela.edu/pkrug>

Dr. Patrick Krug

LaKretz Hall 314, 3-2076

Office hours: Tues, Wed 3:00-4:00 PM

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Date	Lecture Topic	Reading (Freeman & Herron)
<i>Part I: Microevolution</i>		
Sep	24 Darwin, Wallace & Natural Selection	Ch. 2-3
	29 Alleles, Mutation & Genetic Variation	Ch. 5
Oct	01 Population Genetics: Hardy-Weinberg Equilibrium	Ch. 6
	06 Genetic Variation: Selection, Mutation + Drift	Ch. 7
	08 Sex & Recombination	Ch. 8
	13 Sexual Selection	Ch. 11
	15 Conflict Between the Sexes	
	20 Kin Selection & Eusociality	Ch. 12
	22 Altruism; Linkage Disequilibrium	
	27 --no class--	
29 Midterm Exam		
<i>Part II: Macroevolution</i>		
Nov	03 Quantitative Traits & types of selection	Ch. 9
	05 Adaptation & Life-History Evolution	Ch. 10, 13
	10 Mechanisms of Speciation	Ch. 16
	12 Ecological Speciation; Reproductive Isolation	
	17 Post-Zygotic Isolation & Hybridization	
	19 Phylogeny: Inferring Evolutionary Histories	Ch. 4
24 Evo-Devo: Development and Body Plan Evolution	Ch. 19	
Dec	01 Origins of Life & the Cambrian Explosion	Ch. 17-18
	03 Extinctions: Deep Impacts to Human Impacts	

FINAL EXAM: TUESDAY, DECEMBER 8th, 04:30-7:00 PM, BIOSCI ROOM 244

Course Description: This course provides an in-depth examination of evolution, the unifying principle of modern biology. The first half of the course centers on microevolutionary processes, which determine how the genetic composition of populations changes over time. We begin with a general discussion of natural selection as an observable process, and continue by considering the forces that promote evolutionary change (mutation, selection, migration and drift). Topics include population and quantitative genetics, the evolution of sex, kin selection, and conflict between the sexes. The second half of the class focuses on macroevolution, the genesis of new species and lineages. We begin with adaptation, the interface between genotype and environment, including phenotypic plasticity, trade-offs that limit evolution, and the evolution of life histories. We then examine mechanisms of speciation, drawing on the primary literature. Special focus is given to modern molecular methods of phylogenetic analysis, and “evo-devo”, the study of developmental processes that underlie the diversity of body form and function. We will review the history of life on earth. Finally, historic mass extinctions will be compared with human impacts on biodiversity and the mass extinction currently unfolding around us. Both lecture and text will emphasize the primary scientific literature, encouraging students to consider how evolutionary theory guides scientific inquiry, and cultivate an understanding of modern methods used by investigators to study the origins and diversity of life on earth.

Required Textbook: *Evolutionary Analysis*, Freeman & Herron, 4th edition, 2007

Drop Policy: Please see the schedule of classes for information. No exceptions will be made to the established University deadlines. The no record drop deadline is Thursday, October 1st.

Exams: Lecture exams include multiple choice, definitions, short answer and essay questions. Exams may require you to examine data and draw conclusions, testing your ability to interpret graphs as reviewed in lecture. There will be one midterm and a cumulative final exam covering lecture material. Missed exams will require prior approval by the instructor or an official excuse (i.e., doctor's note) or no make-up exam will be given. If you miss an exam, you must notify the instructor within 48 hr or you will be given an incomplete. **YOU MUST TAKE BOTH EXAMS IN ORDER TO RECEIVE A GRADE IN THE COURSE.** Students must abide by the Academic Honesty Policy (www.calstatela.edu/academic/senate/handbook/ch5a.htm); violation of this policy can result in disciplinary action and a failing grade for the course.

Policy Regarding Correction of Errors in the Grading of Exams: You have one week from the time that the lecture exams are returned to report errors in the grading or discuss appropriateness of alternative answers.

Grading: Final grades will be based on midterm and final examination scores, totaling **200** possible points. The midterm exam will account for **40%** of the final grade. The final exam will be cumulative and account for **60%** of the final grade. Grades are curved, with the mean of a normal distribution (typically ~70%) set as the border between B-/B; scores one standard deviation above the mean are in the A-range, those one standard deviation below the mean are in the C range.

Learning Objectives: By completing the course, students will understand:

- (1) the pioneering work of Darwin and Wallace in evolution & biogeography; Darwin's 4 principles for natural selection; how the Modern Synthesis fused genetics and Darwinian "descent with modification"; the Cairns "directed mutation" controversy
- (2) how different types of mutation occur & affect gene expression; neutral vs. selectionist theories of molecular evolution; how to detect positive selection on protein-coding gene regions
- (3) assumptions of Hardy-Weinberg equilibrium; how to use allele + genotype frequencies to assess whether a population is deviating from neutral expectations
- (4) factors that maintain or diminish genetic variation in populations, and the consequences of reduced variation
- (5) effects of linkage disequilibrium, what creates it and what destroys it; effects of inbreeding
- (6) features of asexual vs. sexual reproduction; sexual selection - female choice vs. run-away selection and male display traits; sexual conflict at organismal & genetic levels; parent-offspring conflicts
- (7) how trade-offs can limit adaptation and shape life-history evolution; phenotypic plasticity vs. bet-hedging
- (8) quantitative traits, and how they are affected by selection; how to measure heritability
- (9) allopatric versus ecological speciation; pre-zygotic vs. post-zygotic reproductive isolation; role of assortative mating and habitat choice; natural and sexual selection during adaptive radiations
- (10) methods of phylogenetic analysis; use of DNA sequence information and patterns of gene expression during development to infer evolutionary relationships; comparative analysis of trait evolution
- (11) theories on the origin of life, body plan evolution, and "deep homology"; the Cambrian explosion
- (12) effects of mass extinction in macroevolution; human contributions to the current mass extinction