

**Integrative Biology Department****Syllabus – IB 1XX Evolution and Earth History: From Genes to Fossils****Instructor: Seth Finnegan and Nipam H. Patel****Semester Offered:** Spring 2014**Enrollment Limit:** 80

**Brief Description:** 4 units. Three hours of lecture and one hour of discussion per week. Prerequisite is Bio 1A and 1B or equivalent. Course will present an interdisciplinary approach to understanding the patterns and mechanisms of evolution.

**Course Summary:** The staggering diversity of life on Earth is the product of evolutionary changes that have played out over billions of years. Much of what we know about patterns and mechanisms of evolution comes from two sources: the fossil record, which tells us about morphological evolution, origination, extinction, and the distribution of life in time and space, and the molecular record, which tells us not only about the evolutionary relationships among extant species, but also the raw material upon which selection can act to generate diversity from genotype to phenotype. Both of these records have strengths and weaknesses, and tell us about different but often complementary aspects of the evolutionary process and the history of life on Earth. This course will integrate fossil and molecular data to consider some of the outstanding questions in the study of evolution. Major topics covered include the (1) origin and early evolution of life, (2) the evolutionary relationships among major groups, (3) the history of life on Earth and the expansion of the biosphere through time, (4) ontogeny, development, and the origins of evolutionary novelty, (5) the generation of variation and the mechanisms of natural selection, (6) mechanisms of speciation, (7) the role of extinction in the evolutionary process, (8) genetics and genomic evolution, and (9) the relationships between microevolutionary and macroevolutionary patterns and processes.

**Grading:** Midterm #1 (20%), Midterm #2 (20%), Final Exam (40%), Discussion section performance (20%) which will include writing two papers on topics in evolutionary biology.

**Required Text:**

Barton, N.H., Briggs, D.E.G., Eisen, J.A., Goldstein, D.B., and Patel, N.H. 2007. Evolution. Cold Spring Harbor Press, New York.

Additional Readings: Course reader

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**LECTURE SYLLABUS for Spring 2014:**

**Part 1: Introduction**

Week 1:

1/22/14: Overview of evolutionary biology: historical background (pp. 1-8)

1/24/14: Evidence for evolution: paleontology and molecular biology (pp. 9-83)

**Part 2: The origin and diversification of life**

Week 2:

1/27/14: Origin of life (pp. 85-108)

1/29/14: Tree of life (pp. 109-136)

1/31/14: Constructing trees: morphology (pp. 109-136)

Week 3:

2/3/14: Constructing trees: molecules (pp. 109-136)

2/5/14: Bacterial evolution (pp. 137-193)

2/7/14: Origin and diversification of eukaryotes (pp.195-224)

**Part 3: Multicellularity and animal and plant evolution**

Week 4:

2/10/14: Evolution of multicellularity (pp. 225-244)

2/12/14: Diversification of multicellular life (pp. 225-244)

2/14/14: Diversification of animals (pp. 253-286)

Week 5:

2/17/14: Holiday

2/19/14: Conquest of land (pp. 253-286)

2/21/14: Conquest of air (pp. 253-286)

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**Part 4: Evolution of development**

Week 6:

2/24/14: Midterm #1

2/26/14: Developmental mechanisms - transcription (pp. 244-251)

2/28/14: Developmental mechanisms - signaling (pp. 244-251)

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Week 7:

3/3/14: Evolution of development - Hox genes (pp. 287-307)

3/5/14: Evolution of development - sticklebacks (pp. 307-313)

3/7/14: Evolution of development - teosinte and maize (pp. 313-318)

Week 8:

3/10/14: Evolution of development - eyes (pp. 318-322)

**Part 5: Origination**

3/12/14: Generating variation (pp. 323-379)

3/14/14: Trait variation (pp. 381-412)

Week 9:

3/17/14: Selection at the population level (pp. 457-554)

3/19/14: The consequences of drift (pp. 413-438)

3/21/14: Adaptive radiations

Week 10: Spring Break (3/24-28/13)

Week 11:

3/31/14: Speciation and biogeography (pp. 619-655)

4/2/14: Convergence (course reader)

4/4/14: Midterm #2

**Part 6: Rates and extinction**

Week 12:

4/7/14: Rates of morphological evolution (course reader)

4/9/14: Processes of extinction (pp. 457-554)

4/11/14: Extinction and macroevolution (pp. 516-517; 281-285 & course reader)

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**Part 7: Genetics and genomic evolution**

Week 13:

4/14/14: Genetics of speciation (pp. 619-655)

4/16/14: Molecular evolution (pp. 355-379)

4/18/14: Genome evolution (pp. 355-379)

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Week 14

4/21/14: Human genetics (pp. 725-781)

4/23/14: Human molecular evolution (pp. 725-781)

4/25/14: Evolution and medicine (pp. 725-781)

**Part 8: Evolution in the modern world**

Week 15

4/28/14: Humans as agents of selection (course reader)

4/30/14: The future of biodiversity (course reader)

5/2/14: In class review session

Final exam: TBA