

BIOS 998 – Graduate Seminar – Fall 2014

## SPECIES CONCEPTS AND SPECIATION

**Description and goal:** The study of biodiversity is a central focus of many biologists, and a considerable body of theory and empirical work has shed light on the underlying processes of diversification and speciation. Despite significant progress since the publication of *On the Origin of Species*, our efforts to understand the processes driving the diversification of life are complicated by the difficulty of delimiting species. In this seminar we will explore the history and theory relevant to species concepts and their differential application across the kingdoms of life. We will begin with a survey of species concepts (Biological, Ecological, Phylogenetic, Morphological, General Lineage, etc.) before exploring some contemporary investigations into the causes and consequences of biological diversification (pre- and post-zygotic reproductive isolation, ecological differentiation, etc.). By parsing the diversity of thought on species as biological entities and the processes that underlie diversification, students will gain an appreciation for such concepts as “cryptic species,” “speciation genes” or “species hybridization.”

### Tentative Schedule:

8/26 Week 1 Organizational Meeting

### Overview of Species Concepts

9/2 Week 2 Coyne J.A. and H.A. Orr. 2004. Chapter 1, Species: Reality and Concepts, pp. 9-54. In: *Speciation*, J.A. Coyne and H.A. Orr. Sinauer Associates, Inc., Sunderland, MA.

Harrison, R.G. 1998. Linking evolutionary pattern and process: the relevance of species concepts for the study of speciation, pp. 19-31 In: *Endless Forms: Species and Speciation*, D. J. Howard and S. J. Berlocher (eds.). Oxford University Press, New York.

### Biological Species

9/9 Week 3 Mayr, E. 1992. A local flora and the biological species concept. *American Journal of Botany*. 79(2): 222-238

Whittemore, A.T. 1993. Species Concepts: A Reply to Ernst Mayr. *Taxon*. 42(3): 573-583

### Phenetic Species

9/16 Week 4 Highton, R. 1998. Is *Ensatina eschscholtzii* a ring-species? *Herpetologica* 54:254-278.

Wake, D.B. and C.J. Schneider. 1998. Taxonomy of the Plethodontid salamander genus *Ensatina*. *Herpetologica*. 54:279-298.

### Phylogenetic Species

9/23 Week 5 Avise, J.C. 2000. Review: Cladists in Wonderland. *Evolution*, 54 (5): 1828-1832

Cracraft, J. 1991. The species of the birds-of-paradise (Paradisaeidae): Applying the phylogenetic species concept to a complex pattern of diversification. *Cladistics* 8:1-43.

## General Lineage Species Concept

9/30 Week 6 de Queiroz, K. 1998. The general lineage concept of species, species criteria, and the process of speciation, pp. 57-75 In: *Endless Forms: Species and Speciation*, D.J. Howard and S.J. Berlocher (eds.). Oxford University Press, New York.

Martin et al. 2014 CU Press Release

## Sexual Selection

\*10/7 Week 7 Safran, R.J., E.S.C. Scordato, L.B. Symes, R.L. Rodriguez, T.C. Mendelson. 2013. Contributions of natural and sexual selection to the evolution of premating reproductive isolation: a research agenda. *Trends in Ecology & Evolution* 28: 643-650.

## Measuring Reproductive Isolation

10/14 Week 8 Coyne J.A. and H.A. Orr. 2004. Chapter 2, Studying Speciation, pp. 55-82. In: *Speciation*, J.A. Coyne and H.A. Orr. Sinauer Associates, Inc., Sunderland, MA.

## Fall Break

## Ecological Speciation

10/28 Week 10 Rosenblum E.B. and L.J. Harmon. 2011. Same Same But Different: Replicated Ecological Speciation at White Sands. *Evolution* 65: 946-960.

Light, J.E., M.A. Toups, D.L. Reed. 2008. What's in a name: the taxonomic status of human head and body lice. *Molecular Phylogenetics and Evolution* 47: 1203-1216.

Van Valen, L. 1976. Ecological species, multispecies, and oaks. *Taxon* 25:93-106.

Anoles, Sticklebacks, Hawaiian Silverswords...

11/4 Week 11 Sun, M, K. Gross, F. P. Schiestl. 2014. Floral adaptation to local pollinator guilds in a terrestrial orchid. *Annals of Botany* 113: 289-300.

Sorria-Carrasco, V., Z. Gompert, A.A. Comeault, T.E. Farkas, T.L. Parchman, J.S. Johnston, C.A. Buerkle, J.L. Feder, J. Bast, T. Schwander, S.P. Eagan, B.J. Crespi, P. Nosil. 2014. Stick Insect Genomes Reveal Selection's Role in Parallel Speciation. *Science* 344: 738-742.

## Post-Zygotic Speciation - Colin

\*11/11 Week 12 Coyne J.A. and H.A. Orr. 2004. Chapters 7, Postzygotic Isolation, pp. 247-282. In: *Speciation*, J.A. Coyne and H.A. Orr. Sinauer Associates, Inc., Sunderland, MA.

Coyne J.A. and H.A. Orr. 2004. Chapters 7, Postzygotic Isolation, pp. 283-320. In: *Speciation*, J.A. Coyne and H.A. Orr. Sinauer Associates, Inc., Sunderland, MA.

Laurie 1997. The weaker sex is heterogametic: 75 years of Haldane's Rule. *Genetics* 147: 937-951

\*11/18 Week 13 Presgraves 2010. The molecular evolutionary basis of species formation. *Nature Reviews Genetics* 11:175-180.

Zanders et al 2014. Genome rearrangements and pervasive meiotic drive cause hybrid infertility in fission yeast. *eLife* 3: e02630, DOI: 10.7554/eLife.02630.

### **Thanksgiving Break**

### **Putting it All Together**

12/2 Week 15 Flaxman, S.M., A.C. Wacholder, J.L. Feder, P. Nosil. 2014. Theoretical models of the influence of genomic architecture on the dynamics of speciation. *Molecular Ecology* 23: 4074-4088.

Rabosky D.L. and Matute D.R. 2013. Macroevolutionary speciation rates are decoupled from the evolution of intrinsic reproductive isolation in *Drosophila* and birds. *Proceedings of the National Academy of Sciences of the USA* 110: 15354-15359.

Ramsey et al. 2003, Kay 2006, Martin & Willis 2007, Lowry et al. 2008, Husband & Sabara 2003, Borges et al. 2012, Hersch-Green 2012

\*12/9 Week 16

## **GENERAL INFORMATION**

**Instructor:** Robert Laport      robert.laport@unl.edu  
411 Manter Hall

**Office hours:** By Appointment

**Course web site:** Blackboard

**Grading:** Final grades will be based on presentation/leading discussion of weekly readings and contribution to group discussions. You are expected to be present for, and to participate in, all formal meetings/discussions. Please arrange for absences in advance.