

Tentative Syllabus: "Ecological and Evolutionary Physiology" (BIOL 174) Winter 2007

Instructor: Theodore Garland, Jr., Professor of Biology, University of California, Riverside.
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Office Hours: Tuesday and Wednesday, 10-11 A.M. in 109 ULB, or by appointment.

Catalog Description: Interactions between organisms and their environments, emphasizing coadaptation of physiological, morphological, and behavioral phenotypes. Topics include: allometry and scaling, metabolism and locomotion, heat and water exchange, evolution of endothermy, artificial selection experiments, and phylogenetically based statistical methods.

Lecture: Tuesday and Thursday, 2:10 - 3:30 P.M. in 1307 SPTHW (Spieth Hall West)

Required Readings: All readings as PDF files will be posted online at <http://ilearn.ucr.edu/>.
These should be read *before* class. Lectures will be posted only *after* class.

Grading: Student Survey (10 points), Three written critiques of papers from the literature (20 points each), Mid-term Exam 1 (60 points), Mid-term Exam 2 (60 points), Final Exam (60 points).
Total = 250 points. Nine points of extra credit are possible for example exam questions.

Lecture Schedule and Required Readings:

1. 4 Jan. 2007 - Attendance and Introduction.

Tracy, C. R., and J. S. Turner. 1982. What is physiological ecology? *Bull. Ecol. Soc. Am.* 63:340-347.
Definitions and Opinions by: G. A. Bartholomew, A. F. Bennett, W. D. Billings, B. F. Chabot, D. M. Gates, B. Heinrich, R. B. Huey, D. H. Janzen, J. R. King, P. A. McClure, B. K. McNab, P. C. Miller, P. S. Nobel, B. R. Strain.

2. 9 Jan. 2007 - **Student Survey**; Historical Development of Eco Evo Phys

Bennett, A. F. 1987. The accomplishments of physiological ecology. Pages 1-10 *in* M. E. Feder, A. F. Bennett, W. W. Burggren, and R. B. Huey, eds. *New directions in ecological physiology*. Cambridge Univ. Press.
Mayr, E. 1961. Cause and effect in biology. *Science* 134:1501-1506.

3. 11 Jan. 2007 - Evolution and the Phenotypic Hierarchy

Garland, T., Jr., and P. A. Carter. 1994. Evolutionary physiology. *Annual Review of Physiology* 56:579-621.

4. 16 Jan. 2007 - Allometry and Scaling; Statistical Tutorial

Pages 1-32 *in* Schmidt-Nielsen, K. 1984. *Scaling: why is animal size so important?* Cambridge Univ. Press.

5. 18 Jan. 2007 - continue from previous lecture; Thermoregulation and Resting Metabolism 1

Angilletta, M. J., Jr., P. H. Niewiarowski, and C. A. Navas. 2002. The evolution of thermal physiology in ectotherms. *Journal of Thermal Biology* 27:249-268.

6. 23 Jan. 2007 - **Paper Critique 1** due at start (Tracy & Walsberg 2001); Thermoregulation and Resting Metabolism 2

Tracy, R. L., and G. E. Walsberg. 2001. Developmental and acclimatory contributions to water loss in a desert rodent: investigating the time course of adaptive change. *J. of Comparative Physiology B* 171:669-679.

7. 25 Jan. 2007 - Locomotor Performance and Energetics

Bennett, A. F. 1985. Energetics and locomotion. Pages 173-184 *in* M. Hildebrand, D. M. Bramble, K. F. Liem, and D. B. Wake, eds. *Functional vertebrate morphology*. Harvard Univ. Press, Cambridge.
Shillington, C., and C. C. Peterson. 2002. Energy metabolism of male and female tarantulas (*Aphonopelma anax*) during locomotion. *Journal of Experimental Biology* 205:2909-2914.

8. 30 Jan. 2007 - **Mid-term Exam 1**

9. 1 Feb. 2007 - Evolution of Endothermy

Farmer, C. G. 2000. Parental care: the key to understanding endothermy and other convergent features in birds and mammals. *American Naturalist* 155:326-334.
Angilletta, M. J. and M. W. Sears. 2003. Parental care as a selective factor for the evolution of endothermy? *American Naturalist* 162:821-825.

10. 6 Feb. 2007 - Methods for Studying Adaptation, Including Definitions

Pages 519-537 in Futuyma, D. J. 1998. *Evolutionary biology*. 3rd ed. Sinauer Associates, Sunderland, Mass.

11. 8 Feb. 2007 - continue from previous lecture; Optimality Models and Symmorphosis

Tracy, C. R., K. E. Nussear, T. C. Esque, K. Dean-Bradley, C. R. Tracy, L. A. DeFalco, K. T. Castle, L. C. Zimmerman, R. E. Espinoza, and A. M. Barber. 2006. The importance of physiological ecology in conservation biology. *Integrative and Comparative Biology* 46:1191-1205.

Weibel, E. R., C. R. Taylor, and H. Hoppeler. 1991. The concept of symmorphosis: A testable hypothesis of structure-function relationship. *Proc. Natl. Acad. Sci. USA* 88:10357-10361.

12. 13 Feb. 2007 - Individual Variation and Quantitative Genetics

Hammond, K. A., M. A. Chappell, R. A. Cardullo, R.-S. Lin, T. S. Johnsen. 2000. The mechanistic basis of aerobic performance variation in red jungle fowl. *Journal of Experimental Biology* 203:2053-2064.

Harris, M. A., and K. Steudel. 2002. The relationship between maximum jumping performance and hind limb morphology/physiology in domestic cats (*Felis silvestris catus*). *J. Exp. Biol.* 205:3877-3889.

13. 15 Feb. 2007 - continue from previous lecture; Phenotypic Plasticity

Pigliucci, M. Phenotypic plasticity 101. From <http://www.genotypebyenvironment.org/>

Pigliucci, M. 2005. Evolution of phenotypic plasticity: where are we going now? *Trends Ecol. Evol.* 20:481-486.

14. 20 Feb. 2007 - Measuring Selection in the Wild;

Paper Critique 2 due at start (either Miles 2004 or Sinervo et al. 2000)

Miles, D.B. 2004. The race goes to the swift: fitness consequences of variation in sprint performance in juvenile lizards. *Evolutionary Ecology Research* 6:63-75.

Sinervo, B., D. B. Miles, W. A. Frankino, M. Klukowski, and D. F. DeNardo. 2000. Testosterone, endurance, and Darwinian fitness: Natural and sexual selection on the physiological bases of alternative male behaviors in side-blotched lizards. *Hormones and Behavior* 38:222-233.

15. 22 Feb. 2007 - Mid-term Exam 2

16. 27 Feb. 2007 - Studying Microevolution in the Wild: Guest lecture by Professor Mark A. Chappell

Chappell, M. A., and L. R. G. Snyder. 1984. Biochemical and physiological correlates of deer mouse alpha-chain hemoglobin polymorphisms. *Proceedings National Academy of Sciences, USA* 81:5484-5488.

17. 1 March 2007 - Selection Experiments & Experimental Evolution 1

Gibbs, A. G. 1999. Laboratory selection for the comparative physiologist. *J. Experimental Biol.* 202:2709-2718.

18. 6 March 2007 - Selection Experiments & Experimental Evolution 2

Garland, T., Jr. 2003. Selection experiments: an under-utilized tool in biomechanics and organismal biology. Pages 23-56 in V. L. Bels, J.-P. Gasc, A. Casinos, eds. *Vertebrate biomechanics and evolution*. BIOS Scientific Publishers, Oxford, U.K.

19. 8 March 2007 - Interspecific Comparisons and Why Phylogeny Matters

Swanson, B. O., T. A. Blackledge, A. P. Summers, and C. Y. Hayashi. 2006. Spider dragline silk: correlated and mosaic evolution in high-performance biological materials. *Evolution* 60:2539-2551.

20. 13 March 2007 - Phylogenetically Based Statistical Methods;

White, C. R., P. G. D. Matthews, and R. S. Seymour. 2006. Balancing the competing requirements of saltatorial and fossorial specialisation: burrowing costs in the spinifex hopping mouse, *Notomys alexis*. *Journal of Experimental Biology* 209:2103-2113.

21. 15 March 2007 - Paper Critique 3 due at start; Evaluations; continue from previous lecture; Review for Final Exam.

(Critique must be a multi-species comparative study from the journal *Evolution* or *Physiological and Biochemical Zoology*, published in 2006 or 2007. You must include photocopy.)

22 March 2007 - Final Exam 11:30 A.M. - 2:30 P.M. (emphasizes last third of course)