Tentative Syllabus: "Ecological and Evolutionary Physiology" (BIOL 174) Fall 2004

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 Spieth Hall

Required Text: Readings posted online at http://ilearn.ucr.edu/

Grading: Student Survey (10 points), Three written critiques of papers from the literature (60 points), Quiz 1 (20 points), Quiz 2 (20 points), Mid-term exam (100 points), Final exam (100 points). Total = 310 points. Also, 6 points of extra credit are possible.

Lecture Schedule and Required Readings:

1. 23 Sept. 2004 - Intro. to Course; Student Survey; Historical Development of Eco Evo Phys

2. 28 Sept. 2004 - Evolution and the Phenotypic Hierarchy

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. 30 Sept. 2004 - Allometry and Scaling; Statistical Tutorial

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

4. 5 Oct. 2004 - 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.

5. 7 Oct. 2004 - 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.

6. 12 Oct. 2004 - Quiz 1 (includes today's readings); 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.

7. 14 Oct. 2004 - continue from previous lecture; Evolution of Endothermy 1

Farmer, C. G. 2000. Parental care: the key to understanding endothermy and other convergent features in birds and mammals. American Naturalist 155:326-334.

8. 19 Oct. 2004 - Evolution of Endothermy 2

Angilletta, M. J. and M. W. Sears. 2003. Parental care as a selective factor for the evolution of endothermy? American Naturalist 162:821-825.

Farmer, C. G. 2003. Reproduction: The adaptive significance of endothermy. American Naturalist 162:826-840.

9. 21 Oct. 2004 - Methods for Studying Adaptation, Including Definitions

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

10. 26 Oct. 2004 - continue from previous lecture; Symmorphosis

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.

Garland, T., Jr. 1998. Testing the predictions of symmorphosis: conceptual and methodological issues. Pages 40-47 in , E. R. Weibel, L. Bolis, and C. R. Taylor, eds. Principles of animal design: the optimization and symmorphosis debate. Cambridge University Press, Cambridge, U.K.

11. 28 Oct. 2004 - Midterm Exam

12. 2 Nov. 2004 - Individual Variation and Quantitative Genetics

Hayes, J. P., and S. H. Jenkins. 1997. Individual variation in mammals. Journal of Mammalogy 78:274-293.

13. 4 Nov. 2004 - continue from previous lecture; Selection Experiments 1

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

14. 9 Nov. 2004 - Selection Experiments 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.

15. 16 Nov. 2004 - Selection Experiments 3; Measuring Selection in the Wild; Paper Critique 2 due at start (either H&C1999 or Sinervo et al. 2000)

Hayes, J. P., and C. S. O'Connor. 1999. Natural selection on thermorgenic capacity of high-altitude deer mice. Evolution 53:1280-1287.

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.

16. 18 Nov. 2004 - Studying Microevolution in the Wild: Example

Guest lecture on deer mice (altitude adaptation) as a model system: Prof. 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. 23 Nov. 2004 - Quiz 2 (does not include today's reading); Interspecific Comparisons and Why Phylogeny Matters

Garland, T., Jr., and S. C. Adolph. 1994. Why not to do two-species comparative studies: limitations on inferring adaptation. Physiological Zoology 67:797-828.

18. 30 Nov. 2004 - Phylogenetically Based Statistical Methods;

Shine, R. 2002. Do dietary habits predict scale counts in snakes? Journal of Herpetology 36:268-272.

19. 2 Dec. 2004 - 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 2003 or 2004. You must include photocopy.)

9 December 2004 - Final Exam 8-11 A.M. (emphasizes second half of course)