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Tentative Syllabus: "Ecological and Evolutionary Physiology" (BIOL 174) Winter 2008

Professor: Dr. 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.

Teaching Assistant: Mr. Thomas H. Meek, Ph.D. student, Dept. of Biology, UCR
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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, 8:10 - 9:30 A.M. in 1471 BOYHL (Boyce Hall)

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: Mid-term Exam 1 (50 points), Mid-term Exam 2 (50 points), Final Exam (50 points), Discussion Section (50 points). Total = 200 points.

Lecture Schedule and Required Readings for both Lecture and Discussion:

1. 8 Jan. 2008 - Introduction to Course; Historical Development of Eco/Evo Physiology
No assigned reading.

9 Jan. 2008 Discussion Reading:
Tracy, C. R., and J. S. Turner. 1982. What is physiological ecology? Bulletin of the Ecological Society of America 63:340-347. Definitions and Opinions by: G. A. Bartholomew, A. 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. 10 Jan. 2008 - continue from previous lecture
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 University Press.
Mayr, E. 1961. Cause and effect in biology. Science 134:1501-1506.

3. 15 Jan. 2008 - Evolution and the Phenotypic Hierarchy
Pages 1-32 in Schmidt-Nielsen, K. 1984. Scaling: why is animal size so important? Cambridge University Press.

16 Jan. 2008 Discussion Reading:

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

4. 17 Jan. 2008 - Allometry and Scaling

Angilletta, M. J., Jr., A. F. Bennett, H. Guderley, C. A. Navas, F. Seebacher, and R. S. Wilson. 2006. Coadaptation: a unifying principle in evolutionary thermal biology. Physiological and Biochemical Zoology 79:282-294.

5. 22 Jan. 2008 - finish Allometry; Statistical Tutorial; Thermoregulation & Resting Metabol.

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. Journal of Comparative Physiology B 171:669-679.

23 Jan. 2008 Discussion Reading (and Quiz #1):

Duman, J., and A. DeVries. 1975. The role of macromolecular antifreezes in cold water fishes. Comparative and Biochemical Physiology 52A:193-199.

6. 24 Jan. 2008 - finish Thermoreg.; 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 University 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. 29 Jan. 2008 - Mid-term Exam 1

30 Jan. 2008 Discussion Reading:

Hulbert, A. J., and P. L. Else. 2004. Basal metabolic rate: history, composition, regulation, and usefulness. Physiological and Biochemical Zoology 77:869-876.

8. 31 Jan. 2008 - finish Locomotor Performance and Energetics; Evolution of Endothermy

Grigg, G. C., L. A. Beard, and M. L. Augee. 2004. The evolution of endothermy and its diversity in mammals and birds. Physiological and Biochemical Zoology 77:982-997.

9. 5 Feb. 2008 - Eco/Evo Phys of Animal Flight: Guest lecturer Prof. Douglas L. Altshuler

Altshuler, D. L., R. Dudley, and J. A. McGuire. 2004. Resolution of a paradox: Hummingbird flight at high elevation does not come without a cost. Proceedings of the National Academy of Sciences USA 101:17731-17736.

Altshuler, D. L. 2006. Flight performance and competitive displacement of hummingbirds across elevational gradients. American Naturalist 167:216-229.

6 Feb. 2008 Discussion Reading:

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 Comparative Biol. 46:1191-1205.

10. 7 Feb. 2008 - Evolution of Endothermy

Chapter 17 = Pages 519-537 in Futuyma, D. J. 1998. Evolutionary biology. 3rd ed. Sinauer Associates, Sunderland, Mass.

11. 12 Feb. 2008 - Optimality Models and Symmorphosis

Gans, C. 1979. Momentarily excessive construction as the basis for protoadaptation. Evolution 33:227-233.

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.

13 Feb. 2008 Discussion Reading:

Metabolic theory of ecology from Wikipedia 21 Dec. 2007.

Allen, A. P., and J. F. Gillooly. 2007. The mechanistic basis of the metabolic theory of ecology. Oikos 116:1073-1077.

12. 14 Feb. 2008 - Individual Variation

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*). Journal of Experimental Biology 205:3877-3889.

13. 19 Feb. 2008 - Quantitative Genetics xxneed to expand for next year

20 Feb. 2008 Discussion Reading (and Quiz #2):

Buckley, L. B. 2008. Linking traits to energetics and population dynamics to predict lizard ranges in changing environments. American Naturalist 171:E1-E19.

14. 21 Feb. 2008 - Mid-term Exam 2

15. 26 Feb. 2008 - Measuring Selection in the Wild

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.

27 Feb. 2008 Discussion Reading (Paper Critique #1 due at start):

McGlothlin, J. W., J. M. Jawor, and E. D. Ketterson. 2008. Natural variation in a testosterone-mediated trade-off between mating effort and parental effort. American Naturalist 170:864-875.

16. 28 Feb. 2008 - Studying Microevolution in the Wild: Guest lecturer Prof. M. 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. 4 March 2008 - Phenotypic Plasticity

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

Gibbs, A. G. 1999. Laboratory selection for the comparative physiologist. Journal of Experimental Biology 202:2709-2718.

5 March 2008 Discussion Reading:

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.

18. 6 March 2008 - Selection Experiments & Experimental Evolution 1

Sleight, S. C., and R. E. Lenski. 2007. Evolutionary adaptation to freeze-thaw-growth cycles in *Escherichia coli*. Physiological and Biochemical Zoology 80:370-385.

19. 11 March 2008 - Selection Experiments & Experimental Evolution 2

Garland, T., Jr., A. F. Bennett, and E. L. Rezende. 2005. Phylogenetic approaches in comparative physiology. Journal of Experimental Biology 208:3015-3035.

12 March 2008 Discussion Reading (Paper Critique #2 due at start):

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.

20. 13 March 2008 - 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.

21 March 2008 - Final Exam 3:00 - 6:00 P.M. (emphasizes last third of course)