

Tentative Syllabus: "Ecological and Evolutionary Physiology" (BIOL 174) Winter '14

Professor: Dr. Theodore Garland, Jr., Professor of Biology, University of California, Riverside
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Office Hours: Tuesdays 8:30-9:30 AM and Wednesdays 10:30-11:30 AM, or by appointment

Teaching Assistant: Mr. Gerald C. Claghorn, Ph.D. candidate, Dept. of Biology, UCR
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Office Hours: Monday, 11-12 PM and Thursday 1-2 PM, or by appointment

Discussion sections are on Wednesdays at 12:10-1:00, 1:10-2:00, 3:10-4:00, and 4:10-5:00 PM

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 (required): Tuesday and Thursday, 2:10 - 3:30 P.M. in 2200 Spieth Hall

Required Readings: All readings as PDF files will be posted online at <http://ilearn.ucr.edu/>.
These should be read *before* class (and before Discussion).
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; includes attendance [10 points], 3 quizzes [5 points each], and 1 paper critique [10 points]); Born to Run inquiry-based learning exercise [15 points].
Total = 200 points.

Lecture Schedule and Required Readings for both Lecture and Discussion:

1. Tues., 7 Jan. 2014 - Introduction to Course

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.

8 Jan. 2014 Discussion Reading: NO DISCUSSIONS HELD THIS WEEK!!!

Mayr, E. 1961. Cause and effect in biology. *Science* 134:1501-1506.

2. Thurs., 9 Jan. 2014 - Historical Development of Eco/Evo Physiology

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.

3. Tues., 14 Jan. 2014 - Evolution and the Phenotypic Hierarchy

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

15 Jan. 2014 Discussion Reading and Quiz #1 on this reading and the Mayr one from last week:

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.

4. Thurs., 16 Jan. 2014 - Allometry and Scaling

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

5. Tues., 21 Jan. 2014 - finish Allometry; Statistical Tutorial; Thermoregulation & Resting Metabolism

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

22 Jan. 2014 Discussion Reading (Paper Critique due at start on following paper):

Anderson, C. V., and S. M. Deban. 2010. Ballistic tongue projection in chameleons maintains high performance at low temperature. *PNAS* 107:5495-5499.

6. Thurs., 23 Jan. 2014 - finish Thermoregulation.; 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.

7. 28 Jan. 2014 (Tuesday) - Exam 1

29 Jan. 2014 Discussion Reading:

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. Thurs., 30 Jan. 2014 - Eco/Evo Phys of Animal Locomotion: Guest lecturer Prof. Tim Higham

Irshick, D. J., and J. B. Losos. 1998. A comparative analysis of the ecological significance of maximal locomotor performance in Caribbean *Anolis* lizards. *Evolution* 52:219-226.

9. Tues., 4 Feb. 2014 - finish Locomotor Performance and Energetics; Evolution of Endothermy

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

5 Feb. 2014 Discussion Reading and Quiz #2 on the following reading only:

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.

10. Thurs., 6 Feb. 2014 - Evolution of Endothermy

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

11. Tues., 11 Feb. 2014 - 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.

12 Feb. 2014 Discussion Reading and Quiz #3 on lecture 11, its reading, and this reading:

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.

12. Thurs., 13 Feb. 2014 - Quantitative Genetics

Vitzthum, V. J. 2003. A number no greater than the sum of its parts: the use and abuse of heritability. *Human Biology* 75:539-558.

13. 18 Feb. 2014 (Tuesday) - Exam 2

19 Feb. 2014 Discussion Reading:

Turkheimer, E. 2000. Three laws of behavior genetics and what they mean. *Current Directions in Psychological Science* 9:160-164.

14. Thurs., 20 Feb. 2014 - Selection Experiments & Experimental Evolution 1

Irschick, D. J., and D. Reznick. 2009. Field experiments, introductions, and experimental evolution: a review and practical guide. Pages 173-193 in *Experimental Evolution: Concepts, Methods, and Applications of Selection Experiments*. T. Garland, Jr. and M. R. Rose, eds. University of California Press, Berkeley, California.

15. Tues., 25 Feb. 2014 - 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.

26 Feb. 2014 Discussion - Begin Born to Run Exercise: formulating hypotheses

Bring your laptop with ImageJ preloaded! Make sure you have a Gmail account (or Rmail).

16. Thurs., 27 Feb. 2014 - Phenotypic Plasticity

Pigliucci, M. Phenotypic plasticity 101.

Garland, T., Jr., and S. A. Kelly. 2006. Phenotypic plasticity and experimental evolution. *Journal of Experimental Biology* 209:2234-2261.

17. Tues., 4 March 2014 - Measuring Selection in the Wild

Husak, J. F. 2006b. Does survival depend on how fast you *can* run or how fast you *do* run? *Functional Ecology* 20:1080-1086.

McGlothlin, J. W., J. M. Jawor, and E. D. Ketterson. 2007. Natural variation in a testosterone-mediated trade-off between mating effort and parental effort. *American Naturalist* 170:864-875.

5 March 2014 Discussion - Born to Run Exercise: data analysis

18. Thurs., 6 March 2014 - 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.

19. Tues., 11 March. 2014 - 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.

12 March 2014 Born to Run Exercise: write-up due at start of period; Discussion Reading:

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

20. Thurs., 13 March 2014 - Optimality Models and 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.

Wednesday, 19 March 2014 - Final Exam 8:00 - 11:00 AM (emphasizes last third of course)