

EVOLUTION DISCUSSION GROUP
BZ692GV / BZ492FV
Fall 2005

This semester we will be working through some fundamental and often classic papers in evolution. I believe that knowing about classic theory and experiments helps us to better understand the contemporary literature as well. How can we know where we are going if we do not know where we have been?

The objective this semester is to help students build a broad and basic background in key areas of evolutionary research. I have collected a list of fundamental papers and divided them into ten subject areas. We will cover at least one paper from each subject area, and enrolled students will be expected to lead discussion on at least one paper. There will be a number of important papers that we will not have time to read, but I hope that this discussion group will help you appreciate the value of a broad knowledge of the fundamental literature and that you will continue to read it.

Course Meeting Time and Place

2:10 – 3:00 p.m., Wednesdays only, E444 Anatomy/Zoology

Course Web Site

We will be using WebCT to post the reading schedule and pdf files of papers.

Expectations and Grading

- Regular attendance is expected from enrolled students.
- Each enrolled student will present at least one paper each semester.
- The discussion topics should be based on the 10 broad areas that are laid out below.
- If you do not understand a point brought out in the discussion, ask for clarification. However, we need to balance the need for understanding by the participants with the need to maintain a lively discussion (rather than a series of lectures on introductory material). The discussion group is targeted towards undergraduate students with extensive background (e.g., juniors and seniors working in a professor's lab), graduate students, postdocs, staff, and faculty.
- Grading is based entirely on attendance and participation. If you attend regularly, read the papers, and participate in the discussions, at least a little bit, you will receive an "A".

Selection of Paper(s)

- Choose a key area that you are interested in.
- Select one longer or two shorter papers, no more.
- If you select two papers, it's good to select papers that express different points of view.
- Do not select reply papers without also having the group read the original paper that is being replied to.
- The list of papers provided are just suggestions to get you started. If there is a specific paper (not on the list) that you would like to read, please discuss it with Colleen to see if it would be appropriate.
- If you are suggesting your own paper, do not select strictly empirical papers that do not have results of broader interest (e.g., monographs).
- **By the end of the Friday two weeks before your presentation, the presenter should send Colleen an email stating which paper you will be discussing and attach a pdf file of the paper (if a pdf file is not available online, make one using Adobe Acrobat and a scanner [200 dpi resolution in black and white]). Colleen will post the paper on WebCT so that it is available to everyone. Make sure you do the legwork of getting your paper into pdf format well ahead of time. Many of these classic papers are not available on-line, so you may need a trip to the library, to recall a book for a chapter, or to use ILL.**
- Students are encouraged to select their own papers. However, papers will be assigned to them if the student chooses not to select their own paper.

Presentation of Paper(s)

- Present a 10-15 minute overview, no longer. This is meant to be a discussion group, not a 50-minute monologue.
- Raise points of interests (i.e., highlight novel results and conclusions).
- Raise any questions or objections you have with the methods, results, and/or conclusions.
- Cite parts of the paper that you don't understand and request clarification from other participants in the discussion group.

- Tie the paper into related literature from the field that you're familiar with (e.g., does it reinforce or contradict results or conclusions from other publications?).
- Be sure to explain why you think this is a fundamental/classic paper in evolution.
- Do not present the paper by simply summarizing each paragraph. Assume that all group members have already read the paper.
- Do not spend days and days preparing your presentation. Be relaxed and informal. The discussion group is meant to be low-key.

Fundamental Papers in Evolution

Topic

1. Evolution of Populations

- Darwin, C. and A. Wallace. 1859. On the tendency of species to form varieties and on the perpetuation of varieties and species by means of selection. *Proc. Linnean Soc. London* **3**: 45-62.
- Wright, S. 1932. The roles of mutation, inbreeding, crossbreeding and selection in evolution. *Proc. 6th Intl. Congr. Genet.* **1**: 356-366.
- Dobzhansky, T. 1943. Genetics of Natural Populations IX. Temporal changes in the composition of populations of *Drosophila pseudoobscura*. *Genetics* **28**:162-186.
- Wright, S. 1951. The genetical structure of populations. *Annals of Eugenics* **15**: 323-354.
- Ehrlich, P. R. and P. H. Raven. 1969. Differentiation of populations. *Science* **165**: 1228-1232.

2. Systematics

- Mayr, E. 1981. Biological classification: Toward a synthesis of opposing methodologies. *Science* **214**: 510-516.
- Cracraft, J. 1983. The significance of phylogenetic classification for systematic and evolutionary biology. In J. Felsenstein (ed.), *Numerical Taxonomy*, pp. 1-17. Springer-Verlag.
- Woese, G. R. 1990. Towards a natural system of organisms: Proposal for the domains Archea, Bacteria, and Eucarya. *Proc. Natl. Acad. Sci. USA* **87**: 4576-4579.

3. Phylogenetics (Mainly molecular)

- Edwards, A. W. F. & Cavalli-Sforza, L. L. 1964. Reconstruction of evolutionary trees. In *Phenetic and Phylogenetic classification*, vol. 6, pp. 67-76: Systematics Association.
- Farris, J. S. 1983. The logical basis of phylogenetic analysis. *Advances in Cladistics, Volume 2: Proceedings of the Second Meeting of the Willi Hennig Society*, ed., N. I. Platnick and V. A. Funk. New York, Columbia University Press: 1-36.
- Fitch, W. M. 1971. Toward defining the course of evolution: minimum change for a specific tree topology. *Systematic Zoology* **20**: 406-416.
- Felsenstein, J. 1978. Cases in which parsimony or compatibility methods will be positively misleading. *Systematic Zoology* **27**: 401-410.
- Felsenstein, J. 1981. Evolutionary trees from DNA sequences: a maximum likelihood approach. *J. Mol. Evol.* **1**: 368-376.
- Felsenstein, J. 1985. Confidence limits on phylogenies: An approach using the bootstrap. *Evolution* **39**: 783-791.
- Felsenstein, J. 1985. Phylogenies and the comparative method. *Am Nat* **125**: 1-15.
- Kluge, A. G. and J. S. Farris. 1969. Quantitative phyletics and the evolution of Anurans. *Systematic Zoology* **18**: 1-32.

3. Macroevolution

- Simpson, G. G. 1944. *Tempo and Mode of Evolution*. Chapter 2, pp. 74-96. Columbia University Press.
- Eldredge, N. and S. J. Gould. 1972. Punctuated equilibria: An alternative to phyletic gradualism. In T. J. M. Schopf (ed.), *Models in Paleobiology*, pp. 82-115. Freeman, Cooper and Company, San Francisco.
- Gould, S. 1980. Is a new and general theory of evolution emerging? *Paleobiology* **6**: 119-130.
- Charlesworth, B., R. Lande and M. Slatkin. 1982. A neo-Darwinian commentary on macroevolution. *Evolution* **36**: 474-498.
- Conway Morris, S. 1989. Burgess shale faunas and the Cambrian explosion. *Science* **246**: 339-346.

5. Natural Selection

- Dobzhansky, T. 1947. Adaptive changes induced by natural selection in wild populations of *Drosophila*. *Evolution* **1**: 1-16.
- Cain, A. J. and P. M. Sheppard. 1954. Natural selection in *Cepia*. *Genetics* **39**: 89-116.
- Haldane, J. B. S. 1957. The cost of natural selection. *J. Genetics* **55**: 511-524.
- Boag, P. T. and P. R. Grant. 1981. Intense natural selection in a population of Darwin's finches in the Galapagos. *Science* **214**: 82-85.
- Frank, S.A. and Slatkin, M. 1992. Fisher's fundamental theorem of natural selection. *Trends in Ecology and Evolution* **7**: 92-95.

Reznick, D.N., F.H. Shaw, F.H. Rodd, and R.G. Shaw. 1997. Evaluation of the rate of evolution in natural populations of guppies (*Poecilia reticulata*). *Science* **275**: 1934-1937.

Grant P. R. and B. R. Grant. 2002. Unpredictable evolution in a 30-year study of Darwin's Finches. *Science* **296**: 707-711.

6. Speciation

Mayr, E. 1940. Speciation phenomena in birds. *American Naturalist* **74**: 249-278.

Dobzhansky, T. 1940. Speciation as a stage in evolutionary divergence. *American Naturalist* **74**: 312-321.

Bush, G. L. 1994. Sympatric speciation in animals: New wine in old bottles. *TREE* **9**: 285-288.

For recent discussion:

Wu Chung-I. 2001. The genic view of the process of speciation. *J. Evolutionary Biology* **14**: 851-865.

Mayr, E. 2001. Wu's genic view of speciation. *J. Evolutionary Biology* **14**: 866-867.

Rundle D. H. et al. 2001. Hybridization without guilt and the biological species concept. *J. Evolutionary Biology* **14**: 868-869.

Orr, H. A. 2001. Some doubts about yet another view of species. *J. Evolutionary Biology* **14**: 870-871.

Van Alphen J. J. M. and O. Seehausen. 2001. Sexual selection, reproductive isolation and the genic view of speciation. *J. Evolutionary Biology* **14**: 874-885.

K. L. Shaw. 2001. The genealogical view of speciation. *J. Evolutionary Biology* **14**: 880-882.

Wu Chung-I. 2001. Reply: Genes and speciation. *J. Evolutionary Biology* **14**: 889-891.

Noor. M. A. F. 2002. Is the biological species concept showing its age? *TREE* **17**: 153-154.

7. Hybridization

Immelman, K. 1974. The evolutionary significance of early experience. Tinbergen-Festschrift (ed.) A. Manning Oxford: Clarendon.

Lewontin R. C. and L. C. Birch. 1966. Hybridization as a source of variation for adaptation to new environments. *Evolution* **20**: 315-336.

Barton, N. H. 2001. The role of hybridization in evolution. *Molecular Ecology* **10**: 551-568.

Rieseberg, L. H. et al. 2003. Major ecological transitions in wild sunflowers facilitated by hybridization. *Science* **301**: 1211-1216.

8. Molecular Evolution

King, J. L. & Jukes, T. H. 1969. Non-Darwinian evolution. *Science* **164**: 788-798.

King, M.-C. & Wilson, A. C. 1975. Evolution at two levels in humans and chimpanzees. *Science* **188**: 107-116.

Hudson, R. R. 1990. Gene genealogies and the coalescent process. In *Oxford Surveys in Evolutionary Biology*, vol. 7 (ed. D. Futuyma & J. Antonovics), pp. 1-44. Oxford: Oxford University Press.

Reich, D. E., Cargill, M., Bolk, S., Ireland, J., Sabeti, P. C., Richter, D. J., Lavery, T., Kouyoumjian, R., Farhadian, S. F., Ward, R. & Lander, E. S. 2001. Linkage disequilibrium in the human genome. *Nature* **411**: 199-204.

Boffelli, D., McAuliffe, J., Ovcharenko, D., Lewis, K. D., Ovcharenko, I., Pachter, L. & Rubin, E. M. 2003. Phylogenetic shadowing of primate sequences to find functional regions of the human genome. *Science* **299**: 1391-1394.

9. Molecular Evolution and the Neutral Theory

Kimura, M. 1968 Evolutionary rate at the molecular level. *Nature* **217**: 624-626.

Ohta, T. 1996. The current significance and standing of neutral and neutral theories. *Bioessays* **18**: 673-677; discussion 683.

Kreitman, M. 1996. The neutral theory is dead. Long live the neutral theory. *Bioessays* **18**: 678-683; discussion 683.

McDonald, J. H. & Kreitman, M. 1991. Adaptive protein evolution at the Adh locus in *Drosophila*. *Nature* **351**: 652-654.

Stam, L. F. & Laurie, C. C. 1996. Molecular dissection of a major gene effect on a quantitative trait: The level of *alcohol dehydrogenase* expression in *Drosophila melanogaster*. *Genetics* **144**: 1559-1564.

10. Evolution and Development

Bateson, W. 1894. *Materials for the study of variation treated with especial regard to discontinuity in the origin of species*. London: Macmillan and Co. pp. 1-17 of Introduction.

Jacob, F. 1977. Evolution and tinkering. *Science* **196**: 1161-1166.

Lewis, E. B. 1978. A gene complex controlling segmentation in *Drosophila*. *Nature* **276**: 565-570. (Skim this article. Do not get bogged down in the details, which tend to mystify even experts in the field.)

McGinnis, W., Garber, R. L., Wirz, J., Kuroiwa, A. & Gehring, W. J. 1984. A homologous protein-coding sequence in *Drosophila* homeotic genes and its conservation in other metazoans. *Cell* **37**: 403-8.

Patel, N. H., Martin-Blanco, E., Coleman, K. G., Poole, S. J., Ellis, M. C., Kornberg, T. B. & Goodman, C. S. 1989. Expression of *engrailed* proteins in arthropods, annelids, and chordates. *Cell* **58**: 955-968.

Akam, M. 1998. Hox genes, homeosis and the evolution of segment identity; no need for hopeless monsters. *International Journal of Developmental Biology* **42**: 445-451.

