

Possible questions and issues

(These will be updated. Keep checking for new ones.)

Group 1: Evolution

When are mother and fetus in conflict?

Haig, D. 1996. Gestational drive and the green-bearded placenta. *Proc. Natl. Acad. Sci. USA* 93: 6547-6551.

Haig, D. 1993. Genetic conflicts in human pregnancy. *Q. Rev. Biol.* 68: 495-532

Why menstruate?

Profet, M. 1987. Menstruation as a defense against pathogens transported by sperm. *Q. Rev. Biol.* 68: 335-386

Strassmann, B.I. 1996. The evolution of endometrial cycles and menstruation. *Q. Rev. Biol.* 71: 181-220

Why do some females reproduce more than others?

Vehrencamp, S. L. 1983. A model for the evolution of despotic versus egalitarian societies. *Anim. Behav.* 31:667-682

Reeve, H. K. et al. 1990. DNA 'fingerprinting' reveals high levels of inbreeding in colonies of the eusocial naked mole-rat. *PNAS* 87: 2496-2500

Reeve, H. K. 1992. Queen activation of lazy workers in colonies of the eusocial naked mole-rat. *Nature* 358: 147-149

Why do some females produce more sons than others?

Trivers, R. and Willard, D. 1973. Natural selection of parental ability to vary the sex ratio of offspring. *Science* 179: 90-92

Clutton-Brock, T. et al. 1984. Maternal dominance, breeding success and birth sex ratios in red deer. *Nature* 308:358-360

Gomendio, M. et al. 1990. Mammalian sex ratios and variation in costs of rearing sons and daughters. *Nature* 343:261-263

Why do not all pathogens evolve to be nice?

Levin, S. and Pimentel, D. 1981. Selection of intermediate rates of increase in parasite-host systems *Am. Nat.* 117: 308-315

Nowak, M. A. and May, R. M. 1994. Superinfection and the evolution of virulence. *Proc. Roy. Soc.* 255: 81-89

Does low genetic relatedness select for high parasite virulence?

Frank 1992. A kin selection model for the evolution of virulence. *Proc. Roy. Soc. Lond. B* 250:195-197.

Chao et al. 2000. Kin selection and parasite evolution: higher and lower virulence with hard and soft selection. *Quarterly Review of Biology* 75:261-275

Did sex evolve to counter parasites?

Hamilton, W. D. et al. 1990. Sexual reproduction as an adaptation to resist parasites (a review). *PNAS* 87: 3566-3573

Parker M. A. 1994. Pathogens and sex in plants. *Evol. Ecol.* 8: 560-584

Did plants and insects coevolve?

Rausher MD: Co-evolution and plant resistance to natural enemies. *NATURE* 411 (6839): 857-864 JUN 14 2001

Janz N, Nyblom K, Nylin S: Evolutionary dynamics of host-plant specialization: A case study of the tribe Nymphalini. *EVOLUTION* 55 (4): 783-796 APR 2001

EHRlich PR, RAVEN PH: BUTTERFLIES AND PLANTS - A STUDY IN COEVOLUTION. *EVOLUTION* 18 (4): 586-608 1964 (background)

What is the problem with group selection?

Maynard Smith, J. 1964. Group selection and kin selection. *Nature* 201: 1145-1147

Tsuji, K. 1995. Reproductive conflicts and levels of selection in the ant *Pristomyrmex* pungens: contextual analysis and partitioning of covariance. *Am. Nat.* 146: 586-607

Why is evolution sometimes slow and sometimes fast?

Charlesworth, B., Lande, R., and Slatkin, M. 1982. A neo-Darwinian commentary on macroevolution. *Evolution* 36: 474-498.

Gould, S.J. 1980. Is a new and general theory of evolution emerging? *Paleobiology* 6: 119-130.

Jackson, J.B.C., and Cheetham, A.H. 1999. Tempo and mode of speciation in the sea. *Trends in Ecology and Evolution* 14(2): 72-77.

What are evolutionary constraints and what role do they play in evolution?

Alberch, P. and Gale, E. A. 1985. A developmental analysis of an evolutionary trend: digital reduction in amphibians. *Evolution* 39: 8-23

Antonovics, J. and van Tienderen, P. H. 1991. Ontoecogenophylo-constraints? The chaos of constraint terminology. *TREE* 6: 166-168

In whose interest do pillbugs change sex?

Werren et al. 1986. Male-killing bacteria in a parasitic wasp. *Science* 231: 990-992
Rigaud, T. et al. 1991. Experimental study of temperature effects on the sex ratio of broods in the terrestrial Crustacea *Armadillidium vulgare*. Possible implications in natural populations. *J. evol. Biol.* 4: 603-617

Do plants carry an especially large genetic load?

Barrett and Charlesworth 1991. Effects of a change in the level of inbreeding on the genetic load. *Nature* 352: 522-524
Klekowski, E. J. 1988. Genetic load and its causes in long lived plants. *Trees* 2: 195-203
Wiens, D. et al 1987. Reproductive success, spontaneous embryo abortion and genetic load in flowering plants. *Oecologia* 71: 501-509.

Do founder effects accelerate speciation?

Rundle, H. D. et al. 1998. Single founder-flush events and the evolution of reproductive isolation. *Evolution* 52: 1850-1855
Templeton, A. R. 1999. Experimental tests of genetic transience. *Evolution* 53: 1628-1632
Rundle, H. D. et al. 1999. Experimental tests of founder-flush: a reply to Templeton. *Evolution* 53: 1632-1933

Is Muller's Ratchet a sufficient explanation for senescence?

Klekowski and Godfrey 1989. Ageing and mutations in plants. *Nature* 340: 389-391
Melzer and Koeslag 1991. Mutations do not accumulate in asexual isolates capable of growth and extinction - Mueller's ratchet reexamined. *Evolution* 45: 649-655.

Do findings on *C. elegans* support the evolutionary theory of aging?

Keller L, Genoud M. 1999. Evolutionary theories of aging 1. The need to understand the process of natural selection. *GERONTOLOGY* 45: 336-338.
Apfeld, J Kenyon, C. 1999. Regulation of lifespan by sensory perception in *Caenorhabditis elegans*. *Nature* 402: 804-809.

Are mutations random or directed?

Sniegowski and Lenski 1995. Mutation and adaptation: the directed mutation controversy in evolutionary perspective. *Ann. Rev. Ecol. Syst.* 26: 553-578
Foster, P. L. Adaptive mutation: the uses of adversity. *Ann. Rev. Microbiol.* 47: 467-504

What is phylogenetic information?

- Graybeal A (1994) Evaluating the phylogenetic utility of genes: a search for genes informative about deep divergences among vertebrates. *Systematic Biology* **43**, 174-193.
- Shpak M, Churchill GA (2000) The information content of a character under a Markov model of evolution. *Mol Phylogenet Evol* **17**, 231-243.
- Goldman N (1998) Phylogenetic information and experimental design in molecular systematics. *Proc Biol Sci* **265**, 1779-1786.
- Felsenstein J (2001) Taking variation of evolutionary rates between sites into account in inferring phylogenies. *Journal of Molecular Evolution* **53**, 447-455.
- Steel M, Penny D (2000) Parsimony, likelihood, and the role of models in molecular phylogenetics. *Molecular Biology and Evolution* **17**, 839-850.
- Simmons MP, Carr TG, O'Neill K (2004) Relative character-state space, amount of potential phylogenetic information, and heterogeneity of nucleotide and amino acid characters. *Mol Phylogenet Evol* **32**, 913-926.
- Farris JS (1989) The Retention Index and the Rescaled Consistency Index. *Cladistics-the International Journal of the Willi Hennig Society* **5**, 417-419.

What is the closest phenotype to genotype? What phenotypes are most closely linked to genotypes?

Townsend JP, Cavalieri D, Hartl DL (2003) Population genetic variation in genome-wide gene expression. *Molecular Biology and Evolution* **20**, 955-963.

Wray GA, Hahn MW, Abouheif E, *et al.* (2003) The evolution of transcriptional regulation in eukaryotes. *Molecular Biology and Evolution* **20**, 1377-1419.

What is a microbial species?

Gogarten JP, Townsend JP (2005) Horizontal gene transfer, genome innovation, and evolution. *Nature Microbiology Reviews* **3**, 679-687.

Is horizontal gene transfer dangerous?

Nielsen KM, Townsend JP (2004) Monitoring and modeling horizontal gene transfer. *Nature Biotechnology* **22**, 1110-1114.

Nielsen KM (2003) Transgenic organisms—time for conceptual diversification? *Nature Biotechnology* **21**, 227-228.

How can we assess whether it is selection or constraints that determine the absence of certain organismal morphologies?

Beldade et al. 2002. Developmental constraints versus flexibility in morphological evolution. *Nature* 416:844-847

Wagner and Muller 2002. Evolutionary innovations overcome ancestral constraints: a re-examination of character evolution in male sepsid flies (Diptera: Sepsidae). *Evo. Dev.* 4:1-6.

What role does phenotypic plasticity play in the origin of new traits in organisms?

West-Eberhard 2005. Developmental plasticity and the origin of species differences. *Proc. Nat. Acad. Sci. USA* 102: 6543-6549 Suppl.

West-Eberhard 2005. Phenotypic accommodation: Adaptive innovation due to developmental plasticity. *J. Exp. Zool.* 304B (6): 610-618

Group 2: Ecology

Why do some organisms undergo a metamorphosis during their life history while others do not?

Werner, E. E. 1986. Amphibian metamorphosis: growth rate, predation risk, and the optimal size at transformation. *American Naturalist* 128: 319-341.

Vonesh, J.R. & Warkentin, K.M. 2006. Opposite shifts in size at metamorphosis in response to larval and metamorph predators. *Ecology* 87: 556-562.

How does chaos arise in population dynamics?

May, R. M. 1976. Simple mathematical models with very complicated dynamics. *Nature* 26: 459-467

Berryman, A. A. and Millstein, J. A. 1989. Are ecological systems chaotic - and if not, why not? *TREE* 4: 26-28

Hastings, A. et al. 1993. Chaos in ecology: is mother nature a strange attractor. *Ann. Rev. Ecol. Sys.* 24: 1-33

Can ecosystems move fast enough to keep up with global change?

Roberts 1989. How fast can trees migrate? *Science* 243: 735-737

Perry et al. 1990. Species migration and ecosystem stability during climate change: the belowground connection. *Conserv. Biol.* 4: 266-275

Huntley 1991. How plants respond to climate change: migration rates, individualism and the consequences for plant communities. *Ann. Bot.* 67: 15-22

Do forests store enough CO₂ to moderate global change?

Prentice and Fung. 1990. The sensitivity of terrestrial carbon storage to climate change. *Nature* 246: 48-50

Graham et al. 1990. How increasing CO₂ and climate change affects forests. *Bioscience* 40: 575-587.

Does increased carbon dioxide have indirect effects on plants and their interactions with insects?

Toumi et al. 1984. Nutrient stress: an explanation for plant anti-herbivore responses to defoliation. *Oecologia* 61: 208-210

Fajer. 1989. The effects of enriched CO₂ atmospheres on plant-insect herbivore interactions: growth responses of larvae of the specialist butterfly, *Junonia coenia* (Lepidoptera: Nymphalidae). *Oecologia* 81: 514-520

Do predator-prey interactions produce surprising dynamics?

Abrams, P. A. 1994. The fallacies of ratio-dependent predation. *Ecology* 75: 1842-1850
Berryman, A. L. 1992. The origins and evolution of predator-prey theory. *Ecology* 73: 1530-1535.

Is the biosphere comparable to an organism?

Kirchner, J. W. 1989. The Gaia hypothesis: Can it be tested? *Rev. Geophysics* 27: 223-235
Lovelock, J. 1990. Hands up for the Gaia hypothesis. *Nature* 344: 100-102
Monasterky, R. 1987. The plankton-climate connection. *Science News*

Do researchers contribute to the extinction of threatened species?

Burrows, R. et al. 1995. Population dynamics, intervention and survival in African wild dogs (*Lycaon pictus*) *Proc. R. Soc.* 262: 235-245
Ginsberg, J. R. et al. 1995. Local extinction! in a small and declining population: wild dogs in the Serengeti. *Proc. R. Soc.* 262: 221-228

Why do rodent populations cycle?

Hanski, I. et al. 1993. Population oscillations of boreal rodents: regulation by mustelid predators leads to chaos. *Nature* 364: 232-235
Lomnicki, A. 1995. Why do populations of small rodents cycle? A new hypothesis with numerical model. *Evol. Ecol.* 9: 64-81

Is there cooperation between plants?

Eissenstat and Newman, 1990. Seedling establishment near large plants: effects of vesicular-arbuscular mycorrhizas on the intensity of plant competition. *Funct. Ecol.* 4: 95-99
Grime J. P. et al. 1987. Floristic diversity in a model system using experimental microcosm. *Nature*. 328: 420-422
Loehle and Jones 1990. Adaptive significance of root grafting in trees. *Funct. Ecol.* 4: 268-271

Through what mechanisms do plant species compete?

Thomson and Grime 1988. Competition reconsidered - a reply to Tilman. *Funct. Ecol.* 2: 114-116
Tilman, D. 1987. The importance of the mechanism of interspecific competition. *Am. Nat.* 129: 769-774

Can hierarchical models describe ecological reality?

Carney, H. J. 1989. On competition and the integration of population, community and ecosystem studies. *Funct. Ecol.* 3: 637-641
Allen and Hoekstra 1989. Further comment of Carney's article. *Funct. Ecol.* 3: 642-643
Huston, M. et al. 1988. New computer models unify ecological theory. *BioScience* 38: 682-691.

How do bees choose flowers?

Hills, P. M. S. et al. 1997. Spontaneous flower constancy and learning in honey bees as a function of colour. *Anim. Behav.* 54: 615-627
Dukas, R. and Real, L. A. 1993. Learning constraints and floral choice behavior in bumble bees. *Anim. Behav.* 46: 637-644

Is there a way to determine what makes grouse populations cycle?

Hudson ! PJ, Dobson AP, Newborn D. 1998. Prevention of population cycle! s by parasite removal. *SCIENCE* 282: 2256-2258.
Matthiopoulos J, Moss R, Lambin X. 1998. Models of red grouse cycles. A family affair? *OIKOS* 82: 574-590.

Is the 3/2 self-thinning rule the strongest ecological law or a simple accident?

Lonsdale, W. M. 1990. The self-thinning rule: dead of alive? *Ecology* 71: 1373-1388
Weller, D. E. 1990. Will the real self-thinning rule please stand up? - a reply to Osawa and Sugita. *Ecology* 71: 2004-2007
Lonsdale and Watkinson 1983. Plant geometry and self-thinning. *J. Ecol.* 71: 285-297

Are there 'emergent properties' in communities and ecosystems?

O'Neill, R.V. 2001. Is it time to bury the ecosystem concept (with full military honors, of course)! *Ecology* 82: 3275-3284.
Knight, R. L. and Swaney, D. P. 1981. In defense of ecosystems. *Am. Nat.* 117: 991-992

Do trees "talk" to each other?

Baldwin! , I. T. and Schultz, J. C. 1983. Rapid changes in tree leaf chemistry induced by damage: evidence for communication between plants. *Science* 221: 277-278
Bruin, J. et al. 1992. Plants are better protected against spider-mites after exposure to volatiles from infested conspecifics. *Experientia* 48: 525-529
Fowler and Lawton 1985. Rapidly induced defenses and talking trees: the devil's advocate position. *Am. Nat.* 126: 181-195

Why is the world green (or lake blue)?

- Hairston, N. G., Sr., F. E. Smith, and L. B. Slobodkin. 1960. Community structure, population control, and competition. *American Naturalist* **94**:421-425.
- Pace, M. L., J. J. Cole, S. R. Carpenter, and J. F. Kitchell. 1999. Trophic cascades revealed in diverse ecosystems. *Trends in Ecology & Evolution* **14**:483-488.
- Carpenter, S. R., J. F. Kitchell, J. R. Hodgson, P. A. Cochran, J. J. Elser, M. M. Elser, D. M. Lodge, D. Kretchmer, X. He, and C. N. von Ende. 1987. Regulation of lake primary productivity by food web structure. *Ecology* **68**:1863-1876.

What determines food-chain length?

- Post, D. M. 2002. The long and short of food-chain length. *Trends in Ecology & Evolution* **17**:269-277.
- Post, D. M., M. L. Pace, and N. G. Hairston. 2000. Ecosystem size determines food-chain length in lakes. *Nature* **405**:1047-1049.
- Pimm, S. L., and J. H. Lawton. 1977. The number of trophic levels in ecological communities. *Nature* **275**:542-544.

Group 3: Behavior

Do sexually selected traits signal the possession of “good genes”?

- Petrie, M. 1994. Improved growth and survival of offspring of peacocks with more elaborate trains. *Nature* 371: 598-599.
- Wilkinson, G.S. et al. 1998. Male eye span in stalk-eyed flies indicates genetic quality by meiotic drive suppression. *Nature* 391: 276-279.

Are male traits genetically connected to female preferences?

- Wilkinson, G. S. and Reillo, P. R. 1994. Female choice response to artificial selection on an exaggerated male trait in a stalk-eyed fly. *Proc. Roy. Soc.* 255: 1-6
- Bakker, T. C. M. 1993. Positive genetic correlation between female preference and preferred male ornament in sticklebacks. *Nature* 363: 255-257

Are sexiness and choosiness genetically linked?

- Nichols, R. A. and Butlin, R. K. 1989. Does runaway selection work in finite populations? *J. evol. Biol.* 2: 299-313
- Wilkinson, G. S. and Reillo, P. R. 1994. Female choice response to artificial selection on an exaggerated male trait in a stalk-eyed fly. *Proc. Roy. Soc.* 255: 1-6
- Bakker, T. C. M. 1993. Positive genetic correlation between female preference and preferred male ornament in sticklebacks. *Nature* 363: 255-257

Is there really any connection between symmetry and mate choice, or is the literature biased?

- Palmer, A.R. 1999. Detecting publication bias in meta-analyses: A case study of fluctuating asymmetry and sexual selection. *Am. Nat.* 154: 220-223
- Thornhill, R., Moller, A.P., and Gangestad, S.M. 1999. The biological significance of fluctuating asymmetry and sexual selection: A reply to Palmer. *Am. Nat.* 154: 234-241

Why are there leks?

- Balmford, A. et al. 1993. Testing hotspot models of lek evolution: data from three species of ungulates. *Behav. Ecol. Sociobiol.* 33: 57-65
- Bradbury, J. et al. 1986. Hotspots and the dispersion of leks. *Anim. Behav.* 34: 1694-1709

Do females select males for their ability to resist pathogens and parasites?

- Hamilton, W. D. and Zuk, M. 1982. Heritable true fitness and bright birds: a role for parasites. *Science* 218: 384-387
- Borgia, G. and Collis, K. 1989. Female choice for parasite free male satin bowerbirds and the evolution of bright male plumage. *Behav. Ecol. Sociobiol.* 25: 445-454

Milinski, M. and Bakker, T. C. M. 1990. Female sticklebacks use male coloration in mate choice and hence avoid parasitized males. *Nature* 344: 330-333

Do humans choose mates with complementary immune genes?

Wedekind, C. et al. 1995. MHC-dependent mate preferences in humans. *Proc. Roy. Soc.* 260: 245-249

Ober, C. et al. 1997. HLA and mate choice in humans. *Am. J. Hum. Genet.* 61: 497-504

How can we detect whether sperm from different males are competing within a female?

Michiels, N. K. and Dhont, A. A. 1988. Direct and indirect estimates of sperm precedence and displacement in the dragonfly *Sympetrum danae* (Odonata: Libellulidae). *Behav. Ecol. Sociobiol.* 23: 257-263

Mueller, N. K. and Eggert, A. K. 1989. Paternity assurance by helpful males: adaptation to sperm competition in burying beetles. *Behav. Ecol. Sociobiol.* 24: 245-249

Are there non-fertilizing, Kamikaze sperm?

Baker and Bellis 1988. "Kamikaze"- sperm in mammals? *Anim. Behav.* 36: 936-939

Harcourt 1991. Sperm competition and the evolution of non-fertilizing sperm in mammals. *Evolution* 45: 314-328

Under what conditions to the sexes switch roles?

Gwynne, D. T. and Simmons, L. W. 1990. Experimental reversal of courtship roles in an insect. *Nature* 346: 172-174

Clutton-Brock, T. H. and Vincent, A. C. J. 1991. Sexual selection and the potential reproductive rates of males and females. *Nature* 351: 58-60

Gwynne, D. T. 1991. Sexual competition among females: what causes courtship reversals? *TREE* 6: 118-122

What does it mean to be truly social?

Sherman, P. W. et al. 1995. The eusociality continuum. *Behav. Ecol.* 6: 102-108

Crespi, B. J. and Yanega, D. 1995. The definition of eusociality. *Behav. Ecol.* 6: 109-115

How do bees and ants find their way through the environment?

Gould, J. L. 1982. The local map of honey bees: do insects have cognitive maps? *Science* 232: 861-865

Mueller, M. and Wehner, R. 1988. Path integration in desert ants, *Cataglyphis fortis*. *PNAS* 85: 5287-5290

When is the Prisoner's Dilemma useful?

Axelrod and Dion, 1988. The further evolution of cooperation. *Science* 242: 1385-1390
Noe, R. 1990. A veto game played by baboons: a challenge to the use of the prisoner's dilemma as a paradigm for reciprocity and cooperation. *Anim. Behav.* 39: 78-90

Have viruses solved the Prisoner's Dilemma?

Turner and Chao 1999. Prisoner's dilemma in an RNA virus. *Nature* 398:441-443.
Brown 2001. Collective action in an RNA virus. *J. Evol. Biol.* 14:821-828.

When should offspring be neglected or even killed?

Parker and Mock. 1987. Parent-offspring! conflict over clutch size. *Evol Ecol.* 1: 161-174
Kozłowski and Stearns. 1989. Hypotheses for the production of excess zygotes: models of bet-hedging and selective abortion. *Evolution* 43: 1369-1377

Is infanticide an example of conflict between the sexes?

Emlen et al. 1989. Experimental induction of infanticide in female wattled jacanas. *Auk* 106: 1-7
Packer and Pusey, 1983. Adaptations of female lions to infanticide by incoming males. *Am. Nat.* 121: 716-728

Who has the upper hand in mating?

Clutton-Brock, T.H. 1998. Reproductive skew, concession and limited control. *TREE* 13: 288-292
Reeve H.K., Emlen S.T. and Keller L. 1998 Reproductive sharing in animal societies incentives or incomplete control by dominant breeders ? *Behav. Ecol.* 9: 267-278