

PSYCH 4559-9: Animal Behavior

University of Virginia
College of Arts and Sciences
Department of Psychology

Semester: Spring 2014
Class Times: TR 12:30–1:45p
Location: Gilmer B001

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Course Description

Animal behavior is an integrative field that brings together evolutionary biology, ecology, neuroscience, and psychology. A behavior is a consistent pattern in how a species or individual interacts with the external world. Behaviors range from simple, stereotyped programs of locomotion to complex and flexible systems of learning and communication.

This course covers different theoretical frameworks for understanding animal behaviors and relating them to the environment, evolutionary history, and underlying neural and genetic mechanisms. We will use the primary literature to examine major developments and outstanding questions in the field and to compare methods of experimental design and analysis.

Course Goals

Conceptual:

- Identify simple and complex behavioral patterns in a range of taxa.
- Describe distinctions between proximate and ultimate causes of behavior and how they relate to experimental methods and questions of study.
- Describe methods of classifying, quantifying, and analyzing behaviors.
- Discuss how relationships between genes, behavior, and environment (including social environment) lead to evolution of behavioral specializations.
- Discuss the contributions and interactions of genetics, learning, and cultural transmission in the development of behaviors, and how these might be addressed experimentally.

Analytical:

For a given behavior, be able to:

- Describe methods for quantifying the behavior,
- Pose questions about the development, mechanism, function, and evolution,
- Propose testable models and hypotheses based on preliminary data.

Practical:

- Retrieve journal articles and perform literature searches using PubMed and related tools.
- Explain and critique a paper's theoretical foundations, experimental design, data collection methods, and statistical analyses.
- Orally present the main findings of a paper and field questions.

Course Structure

With the exception of a few introductory lectures, most of our meetings will be seminar format. If you haven't taken a seminar course before, it's a format that emphasizes discussion of different ideas covered in assigned readings. Seminar courses are similar to the group meetings and journal clubs you would encounter as a graduate student, as well as meetings of all kinds outside academia.

The seminar format is well-suited to animal behavior, which is a broad, heterogeneous field that's still growing and defining itself. There's no systematic body of knowledge you need to memorize. Instead, you'll learn theories about behavior and different methods for studying it scientifically, look at foundational papers and open questions in the field, and practice applying these ideas to new systems.

For a typical class meeting, the instructor will have assigned 1–3 papers for you to read. They may be different perspectives on the same system, or studies of different systems on a common theme. If the readings are not on the syllabus, they will be posted on Collab at least two weeks beforehand. Your responsibilities are to:

- Retrieve the papers using PubMed or related tools. (Difficult-to-find sources will be posted to Collab).
- Read the material well in advance of the seminar meeting so that you have time to think about, or process, the ideas and to conduct some outside research.
- Bring the reading material to class, along with your marginalia, your research notes, a notepad and the anticipation that you will share some of your responses to the reading material.
- Contribute your responses to the paper(s) in class, which can include questions and critiques of conceptual issues, theory, methodology, and conclusions.
- Thoughtfully attend to the ideas and discourse of others.
- Respond to the contributions of others. Your questions may be supportive or critical, as long as they are respectful, not caustic or derisive. The best seminars (and the best science) happen when people who disagree dig into the data and have an informed discussion.

Your attendance and contributions will be noted in each class and will contribute strongly to your final grade. One unexcused absence from class is allowed without a penalty. Contact your instructor ahead of time if you must be absent; only major emergencies are acceptable excuses after the fact.

Paper presentations

You will also be required to facilitate discussion for one paper later in the term, once you've had a chance to observe the instructor. This involves providing a verbal summary of the paper and several questions designed to begin a conversation over the content that the class members have read. Facilitators will also be responsible for bringing in outside sources of information about the material they are covering. This could be artwork, other journal articles, video clips, demonstrations, activities that illustrate the ideas presented, etc.. The instructor will act as co-facilitator with the student on this exercise, but it is the responsibility of the student to lead.

Facilitators will be evaluated with the following rubric:

1. Development of background ideas presented in the reading
2. Clarity of your presentation of key ideas in the reading
3. Material from outside sources used to illustrate or add dimension to material
4. Quality and relevance of questions used to encourage discussion
5. Summary and Conclusion - How well did you wrap up the discussion

Each category gets a score with the following meanings:

- 1 - 3 = Pick up the Clue Phone, 4 - 5 = Poor, 6 = So, So,
7 = Average, 8 = Good, 9 = Excellent, 10 = Astonishing.

Topic suggestions

A lot of the fun of studying animal behavior is the stories! Animals have developed some pretty amazing and wacky abilities. For example, did you know some species of archerfish can knock an insect out of the air with a jet of water from as much as 2 m away?

As an exercise that will encourage you to apply the different ways you've learned to think about and look at animals (including humans!), we will select topics for the final two weeks of class based on student input. Your assignment is to submit a question about a behavior (for example, "Does the archerfish learn to lead its target through experience?") and a list of three papers that address the question, preferably from several angles. If there's no papers on your behavior yet, you may suggest a research plan and two papers on relevant theory or methods. The suggestions will be posted to Collab and the class will vote on which ones to cover.

Final paper

There will not be a final exam in this course. Instead, you are required to submit a short grant proposal (5 pages, not including references) on a topic of your choice. The proposal should be structured like a pre- or post-doctoral NIH fellowship application, with the following sections:

- A. Specific Aims: 1 page describing 1–2 specific questions you propose to examine
- B. Background and Significance: 2 pages about how the research relates to the field. Describe what's known about the system, the theoretical or practical basis for the methods you plan to use, and how the results help to answer more general questions.
- C. Research Design and Methods: 2 pages detailing your experimental design. Describe what you will measure, how many treatment and control groups you'll use, how you'll randomize the groups and perform the treatments, and how you'll interpret positive and negative results in light of the question you're addressing.

More detailed information about the assignment and example proposals will be posted to Collab by March 1st. You have the option of turning in two preliminary assignments related to the proposal, and you are required to submit an initial full draft of the proposal. See the schedule for due dates. The optional assignments are:

Research topic and background papers. A title and paragraph describing the research topic you'd like to work on for your proposal and references for at least two papers (reviews or primary research) related to it. Topics submitted by the due date will be returned with feedback on your choice and suggestions of some additional resources.

Research proposal background. A draft of the background section for your proposal. This should be relatively polished and include references. Backgrounds submitted by the due date will be returned with feedback that will probably be useful in crafting the rest of the proposal.

Grading:

Seminar attendance and participation	50%
Paper presentation	20%
Proposal draft	5%
Final proposal	15%
Topic suggestion	10%

Letter Grade Assignments:

A : 90% +
 B : 80-89.9%
 C : 70-79.9%
 F : below 70

Important dates:

2/20	Student facilitators assigned
3/6	Optional research proposals due
3/25	Topic suggestions due
3/27	Optional research proposal background due
4/10	Draft research proposal due
5/9	Final research proposal due

Schedule:

Unless otherwise noted, the class format will be a seminar, with the required readings listed below or posted to Collab. Schedule and readings will be adjusted as necessary.

1/14	Course introduction and overview. Lecture: History of the field of animal behavior. What is behavior? What kinds of scientific questions can be asked about it?
1/16	Lecture: Categories of behaviors. Measuring behavior. How to critically read a paper. - Tinbergen, N. 1963. "On aims and methods of ethology", <i>Z Tierpsych</i> 20:410–433. - Bateson, P. and Laland K.N. 2013. "Tinbergen's four questions: an appreciation and an update", <i>Trends Ecol Evol</i> doi:10.1016/j.tree.2013.09.013
1/21	Evolution: A biological foundation for behavior. - Charles Darwin, "Instinct", ch. 8 in <i>The Origin of Species</i> . (see http://www.gutenberg.org/ebooks/2009) - Bastock, M. 1956. "A gene mutation which changes a behavior pattern", <i>Evolution</i> 10:421–439.

- 1/23 Genes and behavior
- Hodos W. and Campbell C.B.G. 1969. “Scala Naturae: Why there is no theory in comparative psychology”, *Psych Rev* 76:337-350.
 - Wolff J.O., et al. 2002. “Multi-Male Mating by Paired and Unpaired Female Prairie Voles (*Microtus ochrogaster*)”, *Behaviour* 139:1147–1160.
 - Lim M.M., et al. 2004. “Enhanced partner preference in a promiscuous species by manipulating the expression of a single gene”, *Nature* 429:754–757.
- 1/28 Mechanisms of behavior: biomechanical, hormonal, neural
- Bargmann C.I. and Horvitz H.R. 1991. “Chemosensory neurons with overlapping functions direct chemotaxis to multiple chemicals”, *Neuron* 7:729–742. doi:10.1016/0896-6273(91)90276-6
 - von Holst E. 1954. “Relations between the central nervous system and the peripheral organs”, *Brit J Anim Behav* 2:89–94.
 - Bruder R.H. and Lehrman D.S. 1963, “Role of the mate in the elicitation of hormone-induced mating behavior in the ring dove”, *J Comp Phys Psych* 63:382–384. doi:10.1037/h0024634
- 1/30 Sensation and response; extracting information from sensory signals
- Tinbergen N. and Perdeck A.C. 1950, “On the stimulus situation releasing the begging response in the herring gull chick (*Larus argentatus argentatus* Pont.)”, *Behaviour* 3:1–39. <http://www.jstor.org/stable/4532715>
 - Catania K.C. 1999. “A nose that looks like a hand and acts like an eye: the unusual mechanosensory system of the star-nosed mole”, *J Comp Physiol A* 185:367-372. doi:10.1007/s003590050396
 - Ewert J-P. 1974. “The neural basis of visually guided behavior”, *Scientific American* 230:34-42.
- 2/4 Learning and memory
- Craig W. 1918. “Appetites and aversions as constituents of instincts”, *Biol Bull* 34:91–107. <http://www.biolbull.org/content/34/2/91.full.pdf>
 - Garcia J. and Koelling R.A. 1966. “Relation of cue to consequence in avoidance learning”, *Psychon Sci* 4:124–124.
 - Marler P. and Tamura M. 1964. “Culturally transmitted patterns of vocal behavior in sparrows”, *Science* 146:1483–86. <http://www.jstor.org/stable/1714851>
- 2/6 Psychophysics and perceptual learning
- Gibson E.J. and Walk R.D. 1956. “The effect of prolonged exposure to visually presented patterns on learning to discriminate them”, *J Comp Physiol Psych* 49:239–242. doi:10.1037/h0048274
 - Gentner T.Q. and Hulse S.H. 2000. “Perceptual classification based on the component structure of song in European starlings”, *J Acoust Soc Am* 107:3369–3381. doi:10.1121/1.429408
 - Herrnstein R.J., Loveland D.H., and Cable C. 1976. “Natural concepts in Pigeons”, *J Exp Psych: Anim Behav Process* 2:285–302. doi: 10.1037/0097-7403.2.4.285
 - (optional) McLaren I.P.L. and MacKintosh N.J. 2000. “An elemental model of associative learning: I. Latent inhibition and perceptual learning”, *Anim Learn Behav* 28:211–246.
- 2/11 & 2/13 No class

- 2/18 Orientation and movement
- Suga, N. 1990. "Biosonar and Neural Computation in Bats", *Scientific American* pp. 60-68
 - Khan J.A. and Roberts A. 1982. "Experiments on the central pattern generator for swimming in amphibian embryos", *Philos Trans R Soc Lond B Biol Sci* 296:229-243. doi:10.1098/rstb.1982.0004
- 2/20 Sensorimotor integration and learning II
- Brainard, M.S. and Doupe, A.J. 2002. "What songbirds teach us about learning", *Nature* 417:351-358. doi:10.1038/417351a
 - Sober S.J. and Brainard M.S. 2009. "Adult birdsong is actively maintained by error correction", *Nat Neurosci* 12:927-931. doi:10.1038/nn.2336
- Student facilitators will be assigned dates and papers**
- 2/25 Spatial navigation
- Helbig A. 1991. "Inheritance of migratory direction in a bird species: a cross-breeding experiment with SE- and SW-migrating blackcaps (*Sylvia atricapilla*)", *Behav Ecol Sociobiol* 28:9-12. doi:10.1007/BF00172133
 - Wehner R. et al 2006. "Ant navigation: one-way routes rather than maps", *Curr Biol* 16:75-79. doi:10.1016/j.cub.2005.11.035
 - Packard M.G. and McGaugh J.L. 1996. "Inactivation of hippocampus or caudate nucleus with lidocaine differentially affects expression of place and response learning", *Learn Mem* 65:65-72. doi:10.1006/nlme.1996.0007
- 2/27 Behavioral state
- DeCoursey P.J. 1960. "Phase control of activity in a rodent", *Cold Spring Harb Symp Quant Biol* 25:49-55.
 - Farner D.S. 1964. "Time measurement in vertebrate photoperiodism", *Am Nat* 98:375-386.
- 3/4 Social behavior I
- Burmeister S.S., Jarvis E.D., Fernald R.D. 2005, "Rapid behavioral and genomic responses to social opportunity." *Plos Biol* 3:e363 doi:10.1371/journal.pbio.0030363
 - Deag J.M. 1977, "Aggression and submission in monkey societies", *Anim Behav* 25:465-474.
- 3/6 **Lecture:** How to write a grant proposal.
Optional assignment: Research proposal title and two references
Seminar: Social behavior II
- 3/11 & 3/13 Spring break
- 3/18 Kin recognition/selection/conflict
- Beecher M.D. 1982. "Signature Systems and Kin Recognition", *Amer Zool* 22:477-490.
 - Rubenstein D.R. 2007. "Female extrapair mate choice in a cooperative breeder: trading sex for help and increasing offspring heterozygosity." *Proc R Soc B* 274:1895-1903. doi:10.1098/rspb.2007.0424

- 3/20 Foraging, swarming, population dynamics
 - Zach R. 1979. "Shell dropping: Decision-making and optimal foraging in Northwestern crows" *Behaviour* 68:106–117.
 - Ioannou C.C. et al 2012. "Predatory fish select for coordinated collective motion in virtual prey" *Science* 337:1212–1215. doi:10.1126/science.1218919
- 3/25 Cooperation
 - Axelrod R. and Hamilton W.D. 1981. "The evolution of cooperation", *Science* 211:1390–1396.
 - Clutton-Brock T.H. et al 1999. "Selfish sentinels in cooperative mammals", *Science* 284:1640–1644. doi:10.1126/science.284.5420.1640
Due: topic suggestions
- 3/27 Cultural transmission
 - Galef B.G. and Allen C. 1995. "A new model system for studying behavioural traditions in animals", *Anim Behav* 50:705–717.
 - Whiten A. et al 2005. "Conformity to cultural norms of tool use in chimpanzees", *Nature* 437:737–740.
Optional assignment: Research proposal background draft
- 4/1 Communication
 - Heinrich B. 1988. "Winter foraging at carcasses by three sympatric corvids, with emphasis on recruitment by the raven, *Corvus corax*", *Behav Ecol Sociobiol* 23:141–156.
 - Seyfarth R. and Cheney D. 1990. "The assessment by vervet monkeys of their own and another species' alarm calls" *Anim Behav* 40:754–764.
- 4/3 Human sociobiology
 - Daly M. and Wilson M.I. 1999. "Human evolutionary psychology and animal behavior", *Anim Behav* 57:509–519
 - Kalick S.M. et al 1998. "Does Human Facial Attractiveness Honestly Advertise Health? Longitudinal Data on an Evolutionary Question", *Psych Sci* 1998:8–13.
 - Singh D. 2002. "Female mate value at a glance: Relationship of waist-to-hip ratio to health, fecundity, and attractiveness", *Neuroend Lett* 23:81–91.
- 4/8 Animal cognition: theory of mind
 - Paz-y-Miño G. et al 2004, "Pinyon jays use transitive inference to predict social dominance" *Nature* 430:778–781.
 - Clayton N.S. et al 2007, "Social cognition by food-caching corvids. The western scrub-jay as a natural psychologist" *Philos Trans R Soc Lond B, Biol Sci* 362:507–522. doi:10.1098/rstb.2006.1992
- 4/10 Animal cognition: personality
 - van Oers K. et al 2004. "Realized heritability and repeatability of risk-taking behaviour in relation to avian personalities", *Proc R Soc Lond B* 271:65–73.
 - Herboren K.A. et al 2010. "Personality in captivity reflects personality in the wild", *Anim Behav* 79:835–843.
Due: draft research proposal

- 4/15 Cannibalism
- Fox, L.R. 1975. "Cannibalism in natural populations", Annual Review of Ecology and Systematics, Vol. 6, 87-106
 - Amstrup, S.C., Stirling, I., Smith, T.S., Perham, C., and Thiemann, G.W. 2006, "Recent observations of intraspecific predation and cannibalism among polar bears in the southern Beaufort Sea" Polar Biol 29: 997-1002
- 4/17 Autotomy
- Dial, B.E., & Fitzpatrick, L.C. (1981). "The Energetic Costs of Tail Autotomy to Reproduction in the Lizard *Coleonyx brevis* (Sauria: Gekkonidae)", *Oecologia* 51(3):310-317.
 - Wasson, K., Lyon, B.E., & Knope, M. (2001). "Hair-trigger autotomy in porcelain crabs is a highly effective escape strategy", *Behavioral Ecology* 13(4):481-486. doi: 10.1093/beheco/13.4.481
- 4/22 Dolphin communication and individual recognition
- Watwood S.L., Owen E.C.G., Tyack P.L., & Wells, R.S. 2005. "Signature whistle use by temporarily restrained and free-swimming bottlenose dolphins, *Tursiops truncatus*". *Animal Behaviour* 69: 1373-1386
 - Harley, H.E. 2007. "Whistle discrimination and categorization by the Atlantic bottlenose dolphin (*Tursiops truncatus*): A review of the signature whistle framework and a perceptual test". *Behavioural Processes* 77: 243-268
- 4/24 Mimicry
- Stuart-Fox D., and Moussalli A. 2009. "Camouflage, Communication and Thermoregulation: Lessons from Colour Changing Organisms", *Philos Trans: Biol Sci* 364:463-470.
 - Norman, M.D., Finn, J., and Tregenza T. 2001. "Dynamic Mimicry in an Indo-Malaysian Octopus", *Proc R Soc Lond B* 268:1755-1758.
 - Garamszegi L.Z., Eens M., Pavlova D.Z., Avilés J.M., and Møller A.P. 2007. "A comparative study of the function of heterospecific vocal mimicry in european passerines", *Behavioral Ecology* 18(6):1001-1009. doi: 10.1093/beheco/arm069
- 4/29 Self-recognition
- Gallup G.G. 1970. "Chimpanzees: Self-Recognition", *Science* 167:86-87. doi: 10.1126/science.167.3914.86
 - Plotnik J.M., de Waal F.B.M, and Reiss D. 2006. "Self-recognition in an Asian elephant", *PNAS* 103:17053-17057. doi:10.1073/pnas.0608062103
 - Reiss, D. and Marino, L. 2000. "Mirror self-recognition in the bottlenose dolphin: A case of cognitive convergence", *PNAS* 98:5937-5942. doi:10.1073/pnas.101086398
- 5/9 **Due: final research proposal**

Other Course Policies:

I trust every student in this course to fully comply with all of the provisions of the UVA Honor System. By enrolling in this course, you have agreed to abide by and uphold the Honor System of the University of Virginia, as well as the following policies specific to this course.

Your written assignments must be wholly your own work.

All suspected violations will be forwarded to the Honor Committee and at my discretion, you may receive an immediate zero on that assignment regardless of any action taken by the Honor Committee

If you believe you may have committed an Honor Offense, you may wish to file a Conscientious Retraction (“CR”) by calling the Honor Offices at (434) 924-7602. For your retraction to be considered valid, it must, among other things, be filed with the Honor Committee before you are aware that the Act in question has come under suspicion by anyone. More information, including contact information for student representatives, can be found at www.virginia.edu/honor.

Please let me know if you have any questions regarding the course honor policy.

Bibliography

Textbooks

Slater, P. J. B. (1999). *Essentials of animal behaviour*. Cambridge, UK: Cambridge University Press.

Shettleworth, S. J. (2010). *Cognition, evolution, and behavior*. 2nd ed. Oxford: Oxford University Press.

Alcock, J. (2009). *Animal behavior : an evolutionary approach*. 9th ed. Sunderland, Mass.: Sinauer Associates.

Dugatkin, L. Alan. (2009). *Principles of animal behavior*. 2nd ed. New York: W. W. Norton.

Zupanc, G. K. H. (2010). *Behavioral neurobiology : an integrative approach*. 2nd ed. Oxford, UK: Oxford University Press.

Vauclair, J. (1996). *Animal cognition : an introduction to modern comparative psychology*. Cambridge, Mass.: Harvard University Press.

References

Martin, P., & Bateson, P. P. G. (1986). *Measuring behaviour : an introductory guide*. Cambridge: Cambridge University Press.

Classic books and collections of papers

Houck, L. D, & Drickamer, L. C. (1996). *Foundations of animal behavior : classic papers with commentaries*. Chicago: University of Chicago Press.

Lorenz, K. (1952). *King Solomon's ring: new light on animal ways*. New York: Crowell.

Wilson, E. O. (2000). *Sociobiology : the new synthesis*. 25th anniversary ed. Cambridge, Mass.: Belknap Press of Harvard University Press.

Fox, M. W. (1973). *Readings in ethology and comparative psychology*. Monterey: Brooks/Cole Pub. Co.

Denny, M. Ray, & Ratner, S. C. (1970). *Comparative psychology: research in animal behavior*. Rev. ed. Homewood, Ill.: Dorsey Press.