

G4475: The Neurobiology of Social Behavior

Fall 2013 F 10:10 – 12

405 Schermerhorn Hall

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I. Bulletin description

Prerequisites: At least two other psychology courses and the instructor's permission.

Seminar on recent advances in the neurobiological basis of social behaviors, interactions, relationships and structure. Primary focus will be research conducted in non-human mammalian species, particularly laboratory rodents and primates, but studies of other vertebrates as well as invertebrates will be included. This broad approach will provide an evolutionary perspective on social neuroscience as well as important insights into the applicability of translating animal research to studies of human social neuroscience.

II. More complete course description

This seminar course will cover recent advances in understanding the neurobiological basis of social behaviors, interactions, relationships and structure. For this class, only social behaviors that occur outside of reproductive contexts (i.e. not sexual or parental behaviors) will be considered. Topics will include what it means to be social; the development of social behavior; social learning and social competence; aggression and social dominance, social affiliation; supportive social relationships, and social complexity. Course topics are discussed in detail in Section V.

Our primary focus will be research conducted in non-human mammalian species, particularly laboratory rodents and primates, but data from work carried out in other vertebrates such as birds, fish and reptiles as well as invertebrates will be included. This broad approach will give students an evolutionary perspective on social neuroscience and will provide important insights into the applicability of translating this animal research to studies of human social neuroscience.

This seminar is limited to 12 students. Please note - **DO NOT** register for this course without my permission. I expect to receive a lot of applications for this course, so please email me well before the registration period to declare your interest in taking the class.

III. Rationale for giving the course:

This is an advanced seminar, most fitting for undergraduates who are majoring in Psychology or in Neuroscience and Behavior, for students participating in the Postbac Psychology Program, and for psychology graduate students. This course places a very strong emphasis on neurobiological aspects of social behavior but will also bring in research from the fields of ethology, evolutionary biology and social psychology. The Psychology Program Goals that will be advanced in this seminar are described under Section IV.

This course fulfills the following degree requirements:

- The Group II (Psychobiology and Neuroscience) distribution requirement of the Psychology major or concentration in the College and in GS, the Psychology minor in Engineering, and the Psychology Post-bac certificate.
- For the Neuroscience and Behavior joint major, it fulfills the 5th Psychology requirement: “one advanced psychology seminar from a list approved by the Psychology Department advisor to the program.”
- The seminar requirement of the Psychology Post-bac certificate.
- For the science requirements of the College and GS, this seminar will satisfy one term of the requirement, provided that students obtain the necessary permission and have taken the prerequisite two psychology courses. Students who are majoring in Psychology or in Neuroscience and Behavior will have priority over Biology and E3B students, or students who are taking the course for the science requirement.
- For Psychology Graduate Students the course will apply toward the “two seriously graded seminars” requirement of the M. Phil. Degree.

IV. Course requirements and grading [subject to revision]:

Oral Presentations – 30%

Written Responses to Questions posted Weekly on Courseworks – 30%

Final Essay on Topic of Student's own choice – 40%

Oral Presentations

Each student will complete two 20-25 minute oral presentations of a recent research paper (last 3 years) on a topic from one of the preceding weeks. The presentation should consist of approximately 15 powerpoint slides and should include: introduction to the research area, discussion of methods, results and conclusions and future directions. Students not presenting will be expected to read the papers before coming to the class and to participate in discussions following presentations. Students should arrange an appointment with Prof Curley to discuss their paper selection.

Written responses to questions placed weekly on Courseworks

During weeks where Prof Curley will lead a class discussion on one of the main topics (see Schedule below), students will be expected to complete the weekly reading before class and to have submitted on Courseworks written responses to questions placed online by Prof Curley. As well as being required for assessment purposes, these written responses will also help stimulate class discussion. Graded feedback will be given to students on these written responses prior to mid-Semester.

Final essay paper

Students will complete a 5000 word essay on a topic of their choice following consultation with the instructor. These papers should be based upon about 20 research paper references and be mini-review / opinion pieces in style. Students should have decided on their topic choices by mid-October following discussions with Prof Curley. By Thanksgiving, they should submit a 500 word topic summary and 20 references for approval. Final essays will be due the second week of December.

Program goals for student learning

All three activities that students will be assessed on during this course (written responses, oral presentations, final essay paper) will increase the critical thinking skills, communication skills and the knowledge base of students. All three activities will also lead to students having a better understanding and appreciation of the values and application of psychology particularly as it relates to how animal research can be translated to human research and improve human health. The final essay and oral presentations will also improve the abilities of students to perform critical analyses and evaluation of empirical research.

V. Weekly outline of topics and readings [subject to revision]:

The fourteen week semester will be comprised of:

- One introductory class
- Eight weeks where Prof Curley will lead a class discussion based around a particular topic (see below). This will take the form of a mini-lecture by Prof Curley and feedback/discussion from students from assigned weekly readings and their online written responses to questions.
- Five weeks where students will present a 20-25 minute oral presentation describing findings from a research journal article based upon one of the preceding classes. Students are encouraged to make an appointment with Prof Curley at least 3 days prior to their presentation. Each student will make two oral presentations during the semester.

SCHEDULE

Week 1 – Introduction

Week 2 - What Does it Mean to be Social?

Week 3 - The Development of Social Behavior

Week 4 – Oral presentations on week 2 & 3 topics

Week 5 – Social Learning & Social Competence

Week 6 - Oral presentations on week 5 topic

Week 7 - Aggression & Social Dominance

Week 8 – Oral presentations on week 7 topic

Week 9 - Social Affiliation

Week 10 - Supportive Social Relationships: Social Buffering, Empathy & Prosociality.

Week 11 - Oral presentations on week 9 & 10 topics

Week 12 - Social Complexity

Week 13 - Translating animal research to human social neuroscience

Week 14 - Oral presentations on week 12 & 13 topics

There is no textbook for this course. Readings of journal articles will be assigned weekly and available on Courseworks.

TOPICS

Week 1: Introduction

Course overview and introduction.

Week 2: What Does it Mean to be Social?

What is the difference between social behavior, social interactions, social relationships, social structure and social systems? How varied are animals in their sociality and what drives this variation? What are some of the major neuroendocrinological differences between socially gregarious and asocial species? What fundamental differences in social recognition and memory systems exist between such species?

Chamero P. et al., 2012, From genes to social communication: molecular sensing by the vomeronasal organ, *TINS* 35: 597-606.

Gabor et al. 2012, Interplay of Oxytocin, Vasopressin, and Sex Hormones in the Regulation of Social Recognition, *Behav Neurosci* 126: 97–109.

Goodson, J. L. et al., 2012, Evolving nonapeptide mechanisms of gregariousness and social diversity in birds. *Hormones and Behavior* 61, 239-250.

Goodson, J.L., 2013, Deconstructing sociality, social evolution and relevant nonapeptide functions, *Psychoneuroendocrinology*. (14 pages)

Week 3: The Development of Social Behavior

This week we shall discuss how individuals become socialized and develop their social relationships during early life. We particularly discuss peer and sibling interaction and the functional role that play has in enabling young to learn about the social world. We also describe what is currently understood regarding the neurobiological basis of social play.

Colonnello V et al., 2011, *Octodon degus*. A useful animal model for social-affective neuroscience research: Basic description of separation distress, social attachments and play, *Neuroscience and Biobehavioral Reviews* 35: 1854–1863.

Cooke BM & Shukla D, 2011, Double Helix: Reciprocity between juvenile play and brain development, *Developmental Cognitive Neuroscience* 1: 459–470.

Siviy SM & Panksepp J, 2012, In search of the neurobiological substrates for social playfulness in mammalian brains, *Neuroscience & Biobehavioral Reviews* 35: 1821-1830.

Trezza V., 2010, The pleasures of play: pharmacological insights into social reward mechanisms, *Trends in Pharmacological Sciences* 31: 463–469.

Week 4: Oral Presentations

Week 5: Social Learning & Social Competence

From early life and throughout adulthood animals continue to learn about their social world and adapt and express their social behaviors appropriately. We describe research that has revealed the neurobiology of such social learning. We also detail new studies investigating social skills and social competence – the ability of individuals to exhibit appropriate social behaviors for specific social contexts.

Branchi I et al., 2012, Early interactions with mother and peers independently build adult social skills and shape BDNF and oxytocin receptor brain levels, *Psychoneuroendocrinology*. (11 pages).

Lipina TV & Roder JC, Co-learning facilitates memory in mice: A new avenue in social neuroscience, *Neuropharmacology* 64: 283-293.

Rushworth, MFS et al., 2013, Are there specialized circuits for social cognition and are they unique to humans? *Current Opinion in Neurobiology*. (7 pages).

Sanchez-Andrade G & Kendrick KM, 2009, The main olfactory system and social learning in mammals, *Behavioural Brain Research* 200: 323–335.

Week 6: Oral Presentations

Week 7: Aggression & Social Dominance

Aggression can take many forms and serve many different functions. It can be intra- or inter-specific, inter-male, inter-female or occur between the sexes. We describe the similarities and differences in the neural circuits underlying aggression and implications this research has for human aggression. We also discuss the function of social dominance and how its neural basis differs from aggression.

Chiao JY, 2010, Neural basis of social status hierarchy across species, *Current Opinion in Neurobiology* 20: 803–809.

Haller J., 2012, The neurobiology of abnormal manifestations of aggression—A review of hypothalamic mechanisms in cats, rodents, and humans, *Brain Research Bulletin*. (13 pages).

Fernald, R.D. & Maruska, K.P., 2012, Social information changes the brain, 109: 17194–17199.

Nelson, RJ & Trainor BC, 2007, Neural mechanisms of aggression, 8: 536-546.

Week 8: Oral Presentations

Week 9: Social Affiliation

Affiliative relationships are perhaps even more diverse in their forms than agonistic relationships. We will discuss several of these including pair-bonding, social grooming, and post-conflict reconciliation. We will also determine what is meant by the terms ‘attachment’ and ‘bonding’ and whether these are useful definitions. Finally, we evaluate what all these forms of affiliative behavior have in common at the neurobiological level – particularly what occurs in the brain to make such behaviors so rewarding.

Machin AJ & Dunbar RIM, 2011, The brain opioid theory of social attachment: a review of the evidence, *Behaviour* 148: 985-1025.

Panksepp, J. The basic emotional circuits of mammalian brains: Do animals have affective lives? *Neuroscience & Biobehavioral Reviews* 35: 1791-1804.

Phelps SM et al., 2010, Beating the boojum: Comparative approaches to the neurobiology of social behavior, 58: 17–28.

Stoesz BM et al., 2013, Neurophysiological mechanisms underlying affiliative social behavior: Insights from comparative research, Neuroscience and Biobehavioral Reviews 37: 123–132.

Week 10: Supportive Social Relationships: Social Buffering, Empathy & Prosociality.

This class explores how it is possible to determine the quality of a social relationship between two or more individuals through observing how their behavior and interactions change following adverse circumstances such as pain or stress. In particular, we discuss the function and neurobiological process of social buffering – the ability of animals to minimize the stress or anxiety experienced by another individual. We shall also go on to describe recent research on the neurobiology of complex socio-emotional process that were once thought unique to higher primates or even just humans such as emotional contagion, state-matching and empathy – broadly speaking. Finally, we shall describe work on the neuroscience of prosocial and altruistic behavior.

Cronin, K.A., Prosocial behaviour in animals: the influence of social relationships, communication and rewards, *Animal Behaviour* 84:1085-1093

Decety J et al., 2012, A neurobehavioral evolutionary perspective on the mechanisms underlying empathy, *Progress in Neurobiology* 98: 38–48

Fraser, O.N. & Bugnyar, T., 2012, Reciprocity of agonistic support in ravens. *Animal Behaviour* 83(1): 171–177

Hennessy, M.B. et al., 2009, Social buffering of the stress response: diversity, mechanisms, and functions. *Front. Neuroendocrinol.*, 30, 470–482.

Week 11: Oral Presentations

Week 12: Social Complexity

The social systems of certain species, from invertebrates like wasps and termites to vertebrates like primates and humans may be described as socially complex. We will evaluate these different societies and discuss what differences exist between genetically

driven versus socially learned complexity. We shall also discuss recent research that attempts to study social interactions at the level of social networks. We will also explore what is common versus unique regarding the neurobiological basis of complex social relationships across taxa.

Bickart KC et al., 2012, Intrinsic Amygdala–Cortical Functional Connectivity Predicts Social Network Size in Humans, *The Journal of Neuroscience* 32:14729–14741.

Maestriperi., D., 2012, Neurobiology of social behavior. In: *Primate Neuroethology* (ed. by M. Platt & A. Ghazanfar). Oxford: Oxford University Press. pp. 358-383.

Pollard KA & Blumstein DT, 2012, Evolving communicative complexity: insights from rodents and beyond, *Phil. Trans. R. Soc. B* 367: 1869–1878.

Sallet J et al., Social Network Size Affects Neural Circuits in Macaques, *Science* 334: 697-700.

Week 13: Translating animal research to human social neuroscience

This class asks students to consider what has been learnt from the previous weeks' material and to evaluate how this work can inform us about the neuroscience of normative human social behavior, interactions and relationships. Further, we shall be debating the efficacy and applicability of the current protocols employed to study animal models of human mental diseases that are characterized at least in part by social deficits.

Churchland PS & Winkielman P, 2012, Modulating social behavior with oxytocin: How does it work? What does it mean? *Horm Behav* 61: 392-399.

Insel TR, 2010, The Challenge of Translation in Social Neuroscience: A Review of Oxytocin, Vasopressin, and Affiliative Behavior, *Neuron* 65: 768–779.

McCall C & Singer T, 2012, The animal and human neuroendocrinology of social cognition, motivation and behavior, *Nature Neuroscience* 15: 681-688.

Yamasue, H. et al, 2012, Integrative Approaches Utilizing Oxytocin to Enhance Prosocial Behavior: From Animal and Human Social Behavior to Autistic Social Dysfunction, *The Journal of Neuroscience* 32:14109–14117.

Week 14: Oral Presentations

VI Academic Integrity

"The intellectual venture in which we are all engaged requires of faculty and students alike the highest level of personal and academic integrity. As members of an academic community, each one of us bears the responsibility to participate in scholarly discourse and research in a manner characterized by intellectual honesty and scholarly integrity. In practical terms, this means that, as students, you must be responsible for the full citations of others' ideas in all of your research papers and projects; you must be scrupulously honest when taking your examinations; you must always submit your own work and not that of another student, scholar, or internet agent."

From the Faculty Statement on Academic Integrity - www.college.columbia.edu/academics/integrity-statement.

Students are expected to do their own work on all assignments for this class and act in accordance with the Faculty Statement on Academic Integrity and Honor Code established by the students of Columbia College and the School of General Studies. Because any academic integrity violation undermines our intellectual community, students found to have cheated, plagiarized, or committed any other act of academic dishonesty can expect to receive a zero for the work in question and may fail the class.

Students will also be referred to the Dean's Disciplinary Process, described here:

www.college.columbia.edu/academics/disciplinaryprocess

It is students' responsibility to ensure their work maintains expected standards. Should you have any questions or concerns regarding these expectations, please:

- Ask the instructor
- Refer to the Columbia University Undergraduate Guide to Academic Integrity: www.college.columbia.edu/academics/academicintegrity