

PSYC 449-301: Influences of Nature & Nurture on Brain Development

Fall 2020, Tuesdays 3-6pm

Instructor: Mike Arcaro (marcaro@sas.upenn.edu). Zoom office hours by appointment.

Course description: This discussion-based seminar will focus on the neural bases of cognitive development. Each week the class will discuss a selection of papers that consider the roles of genes and environment on topics including the development of perceptual abilities, language, and cognition. The course will cover several aspects of pre- and postnatal brain and behavioral development with particular emphasis on primates. This course is intended for students interested in neurobiology, cognitive psychology, and development. Prerequisites: Cognitive Neuroscience (PSYC 149); Recommended: Introduction to Brain and Behavior (PSYC 109).

Textbook: All readings will be posted on Canvas.

Online discussion: We will be using Piazza for outside-of-class discussion. The system is optimized for getting you help fast and efficiently from classmates and myself. Rather than emailing questions to me, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

Here is our class signup link: <https://piazza.com/upenn/fall2020/psyc449301>

Here is a short video tutorial on using Piazza:

<https://www.youtube.com/watch?v=aswdH8vXiB0&feature=youtu.be>.

----- Course overview -----

Typical weekly synchronous sessions (with some exceptions)

- There will be synchronous sessions Tuesdays 3-6pm. ~2 hours 15 mins of student-led discussion of weekly readings. ~30 mins of instructor-led presentation at end of class (will be recorded and accessible for offline viewing)

Typical weekly asynchronous activities and workload (on weeks in which there is no project due)

- There will be 3-4 of readings per week.
- Here's a useful guide for reading a science paper: https://canvas.upenn.edu/files/87649966/download?download_frd=1
- Each week, you will prepare one thoughtful discussion question for each assigned reading. Discussion questions must be submitted by **11:59PM Sunday / 12:00AM Monday**.
- Additional prep for students assigned to lead weekly discussion. (~3 hours).

----- Assignments and grading -----

Participation (20% total): Discussion questions, in class participation, and engagement on Piazza

- Each week you will submit by midnight Sunday on Canvas one question for each assigned reading. On Piazza, there is a folder for each week. Post your question on the "Discussion Questions" thread.

We will go through these questions during class, and you will be evaluated on the quality of the question.

- What makes a good question/comment? A good comment will engage with specific content. Example formats of good questions/comments: “I do not understand why this study uses X type of stimuli – I think this would lead to Y confound.” “I wonder whether X process might relate to Y process that we studied last week, because I see Z similarity.” “I am concerned that this result would not generalize to X situation because Y.” “I wish the study had included X condition, because that would allow us to know Y.” “I am having trouble thinking through whether X is a good example of Y phenomenon/concept because Z.”
- Bad questions/comments: “I did not understand this experiment.” “I liked the writing in the paper.” “This paper had many confounds.”

Leading class discussions (30% total): Students will lead class discussion on 2-3 papers throughout the semester. For experimental papers, presenters should prepare a synopsis of the motivation for the study, the authors’ hypothesis, the experimental design, main results, and interpretation. For theory and review papers, presenters should prepare a synopsis of the motivation for the paper, the authors’ hypothesis, evidence cited in the paper supporting the main argument, and relevance to the field. Presenters should also prepare points of discussion, which should include questions submitted by classmates. Each discussion should last ~45 minutes.

Poster presentations (30% total, 15% each poster presentation): You will choose a paper related to one of the prior week’s topics and present as a scientific poster. You will assume the role of the paper’s authors and make a poster as if they were presenting the results at a scientific conference. Papers can be selected from the “related papers” folders on Canvas (under files for each week) or from a lit search (e.g. [Google Scholar](#) or [PubMed](#)). To ensure no overlap between posters, you must e-mail me for approval. There will be two poster presentations: Oct 6th & Nov 3rd.

Final paper (20% total): Single-spaced 3-5 page critique of major topic on brain development covered in the course. You will also give a ~10 min presentation during the final class. Topic chosen by student. Feel free to e-mail me with proposals.

----- Schedule -----

1. Week of August 30: Introduction

- Tuesday, September 1: Synchronous class. This session will be recorded in case some miss it. Zoom link: <https://tinyurl.com/psyc449-301>

2. Week of September 6: Genetic determination

- Weekly reading question due for:
 - Sur et al. **Experimentally induced visual projections into auditory thalamus and cortex.** 1988. Science.
 - Constantine-Paton & Law. **Eye-specific termination bands in tecta of three-eyed frogs.** 1978. Science.
 - Rakic. **A novel cytoarchitectonic area induced experimentally within the primate visual cortex.** 1991 PNAS.
- Tuesday, September 8: Synchronous class

3. Week of September 13: Activity-dependent processes
 - Weekly reading question due for:
 - Van der Loos & Woolsey et al. **Somatosensory cortex: structural alterations following early injury to sense organs.** 1973. Science.
 - Pons et al.. **Massive cortical reorganization after sensory deafferentation in adult macaques.** 1991. Science.
 - Hubel et al. **Functional architecture of area 17 in normal and monocularly deprived macaque monkeys.** 1976. Cold Spring Harbor Symposium.
 - Blakemore et al. **Development of the brain depends on the visual environment.** 1970. Nature.
 - Tuesday, September 15: Synchronous class
4. Week of September 20: Evolution
 - Weekly reading question due for:
 - Garcia et al. **Dynamic patterns of cortical expansion during folding of the preterm human brain.** 2018. PNAS.
 - Krubitzer & Seelke. **Cortical evolution in mammals: The bane and the beauty of phenotypic variability.** 2012. PNAS.
 - Chaplin et al. **A conserved pattern of differential expansion of cortical areas in simian primates.** 2013. J Neuroscience.
 - Tuesday, September 22: Synchronous class
5. Week of September 27: Nature and Nurture
 - Weekly reading question due for:
 - Johnston & Edwards. **Genes, Interactions, and the Development of Behavior.** 2002. Psychological Review.
 - Greenough et al. **Experience and Brain Development.** 1987. Child Development.
 - Gottlieb. **Normally occurring environmental and behavioral influences on gene activity: from central dogma to probabilistic epigenesis.** 1998. Psychological Review.
 - Tuesday, September 29: Synchronous class
6. Week of October 4: 1st Poster session
 - No weekly reading
 - Tuesday, October 6: Poser presentations
7. Week of October 11: Development constraints
 - Weekly reading question due for:
 - Kiorpes. **The puzzle of visual development: behavior and neural limits.** 2016. J Neuroscience.
 - Fausey et al. **From faces to hands: changing visual input in the first two years.** 2016. Cognition.
 - Bourne & Rosa. **Hierarchical development of the primate visual cortex, as revealed by neurofilament immunoreactivity: early maturation of the middle temporal area (MT).** 2006. Cerebral Cortex.
 - Tuesday, October 13: Synchronous class
8. Week of October 18: Functional specialization
 - Weekly reading question due for:
 - Polk et al. **Nature versus nurture in ventral visual cortex: a functional magnetic resonance imaging study of twins.** 2007. J Neuroscience.
 - Sugita. **Face perception in monkeys reared with no exposure to faces.** 2008. PNAS.

Le Grand et al. **Expert face processing requires visual input to the right hemisphere during infancy.** 2003. Nature Neuroscience.

Hyvarinen. **Early visual deprivation alters modality of neuronal responses in area 19 of monkey cortex.** 1981. Neuroscience Letters.

- Tuesday, October 20: Synchronous class

9. Week of October 25: “Core” systems

- Weekly reading question due for:
 - Kinzler & Spelke. **Core systems in human cognition.** 2007. Progress in Brain Research.
 - D’Souza & Karmiloff-Smith. **When modularization fails to occur: A developmental perspective.** 2011. Cognitive Neuropsychology.
 - Johnson MH. **Functional brain development in humans.** 2001. Nature Reviews.
- Tuesday, October 27: Synchronous class

10. Week of November 1: 2nd Poster session

- No weekly reading
- Tuesday, November 3: Poster presentations

11. Week of November 8: Language development

- Weekly reading question due for:
 - Kim et al. **Distinct cortical areas associated with native and second languages.** 1997. Nature.
 - Saffran et al. **Statistical learning in 8-month-old infants.** 1996. Science.
 - Rilling et al. **The evolution of the arcuate fasciculus revealed with comparative DTI.** 2014. Nature Neuroscience.
 - Bedney et al. **Language processing in congenitally blind adults.** 2011. PNAS
- Tuesday, November 10: Synchronous class

12. Week of November 15: Tool use

- Weekly reading question due for:
 - Lancaster. **On the evolution of tool-using behavior.** 1968. American Anthropologist.
 - Proffitt et al. **Wild monkeys flake stone tools.** 2016. Nature.
 - Peeters. **The representation of tool use in humans and monkeys: common and uniquely human features.** 2009. J Neuroscience
 - Lockman & Kahrs. **New insights into the development of human tool use.** 2017. Current Directions in Psychological Science.
- Tuesday, November 17: Synchronous class

13. Week of November 22:

- No class

14. Week of November 29: Dynamic development

- Weekly reading question due for:
 - Karmiloff-Smith. **An alternative to domain-general or domain-specific frameworks for theorizing about human evolution and ontogenesis.** 2015. AIMS Neuroscience.
 - Smith & Thelen. **Development as a dynamic system.** 2003. Trends in Cognitive Sciences.
 - Dehaene & Cohen. **Cultural recycling of cortical maps.** 2007. Neuron.
- Tuesday, December 1: Synchronous class

15. Week of December 6: Final week paper presentations

- No weekly reading
- Tuesday, December 8: Paper presentations

----- Other information and resources -----

Support, resources, and practical tools for wellness at Penn: <https://www.wellnessatpenn.com/>

Accommodations for students with disabilities:

The University of Pennsylvania provides reasonable accommodations to students with disabilities who have self-identified and received approval from the Office of Student Disabilities Services (SDS). If SDS has approved your request for accommodations, please get in touch with me as soon as possible in order to discuss the arrangements for your accommodations.

If you have not yet contacted Student Disabilities Services, and would like to request accommodations or have questions, you can make an appointment by calling (215) 573-9235. Please visit the SDS website at <https://wlrc.vpul.upenn.edu/sds/>

SDS services are free and confidential.

Code of Academic Integrity:

Since the University is an academic community, its fundamental purpose is the pursuit of knowledge. Essential to the success of this educational mission is a commitment to the principles of academic integrity. Every member of the University community is responsible for upholding the highest standards of honesty at all times. Students, as members of the community, are also responsible for adhering to the principles and spirit of the following Code of Academic Integrity.

Academic Dishonesty Definitions

Activities that have the effect or intention of interfering with education, pursuit of knowledge, or fair evaluation of a student's performance are prohibited. Examples of such activities include but are not limited to the following definitions:

- Cheating: using or attempting to use unauthorized assistance, material, or study aids in examinations or other academic work or preventing, or attempting to prevent, another from using authorized assistance, material, or study aids. Example: using a cheat sheet in a quiz or exam, altering a graded exam and resubmitting it for a better grade, etc.
- Plagiarism: using the ideas, data, or language of another without specific or proper acknowledgment. Example: copying another person's paper, article, or computer work and submitting it for an assignment, cloning someone else's ideas without attribution, failing to use quotation marks where appropriate, etc.
- Fabrication: submitting contrived or altered information in any academic exercise. Example: making up data for an experiment, fudging data, citing nonexistent articles, contriving sources, etc.
- Multiple submission: submitting, without prior permission, any work submitted to fulfill another academic requirement.
- Misrepresentation of academic records: misrepresenting or tampering with or attempting to tamper with any portion of a student's transcripts or academic record, either before or after coming to the University of Pennsylvania. Example: forging a change of

grade slip, tampering with computer records, falsifying academic information on one's resume, etc.

- Facilitating academic dishonesty: knowingly helping or attempting to help another violate any provision of the Code. Example: working together on a take-home exam, etc.

- Unfair advantage: attempting to gain unauthorized advantage over fellow students in an academic exercise. Example: gaining or providing unauthorized access to examination materials, obstructing or interfering with another student's efforts in an academic exercise, lying about a need for an extension for an exam or paper, continuing to write even when time is up during an exam, destroying or keeping library materials for one's own use, etc.

If a student is unsure whether their action(s) constitute a violation of the Code of Academic Integrity, then it is that student's responsibility to consult with the instructor to clarify any ambiguities.