**Syllabus for Spring 2025.**

G4486. Emotional Brain Development (seminar).

4 pts. N. Tottenham. Tuesdays 2:10PM-4:00PM

Office Hours: by appointment

Prerequisites: Courses in developmental psychology, neuroscience, and the instructor's permission.

Emotions are central to our well-being and our actions. This course uses a developmental approach to address the neurobiological bases of emotional behavior. We will discuss theoretical papers and empirical work that covers typical and atypical behavior and the neurobiology that supports behavioral change across age. A translational approach is taken that uses animal models and human examples to illustrate these developmental trajectories. We will cover experimental approaches during discussion of each topic. This course will be taught at a graduate level with the assumption that prerequisites have been satisfied.

**Course requirements and grading**

1. Learning and Discussion Comments/Questions: Students are required to read all of the assigned papers before class in order to ensure lively discussion in class. Students will compose questions relevant to the readings and post on Courseworks no later than the **midnight** **Sunday** night before class. LDCQs will be grades on timeliness and thoughtfulness of comments/questions.

2. Team Presentations: Students choose a topic/week on the first day of class. Your team will read the assigned articles carefully and then facilitate classroom discussion on the topic.

This should be accomplished in the following ways:

a) Choose 3–6 themes that emerge from the reading. These themes should drive the conversation in class.

b) If in a group, each member of the group will be graded separately.

c) Grading will be based on

1. Evidence of group synthesis

2. Ability to keep the class conversation on track

3. Quality of questions/themes raised.

4. incorporation of some of the questions posted by other students on courseworks.

5. Timeliness in getting materials to course instructors and classmates. These presentation outlines should be emailed to the instructor by **9AM Friday** before your presentation. You must post the final presentation on Courseworks by **5PM Monday** before class.

3. Thought paper & Paper presentations/bibliography: Students will write a paper that is due on or before **5/5/2025**. The 8-10 page paper should take the form of a critical review paper that addresses a specific question related to the topics of the seminar. The topic must be approved by **3/4/2025**. Throughout the semester, students will meet independently with the instructor & will be required to submit a list of references (bibliography) to facilitate the writing process (**3/11/2025**) Also on **4/29/2025**, students will present the thesis of their paper orally to the class (approximately 5 minutes). The paper should be a brief review of any issue or area pertinent to developmental affective neuroscience. Students are free to take their main interest area as a starting point and then to bring what we know from the biological area to bear. In many cases, we will know very little (i.e., what is the bio-behavioral developmental trajectory of self-esteem?), so the student will be attempting to take a literature that seems related (e.g., reward systems, EEG asymmetry) and making bridges to their interest area. This is the “thought” component. When little is known, talking about what is known, what needs to be studied, and (in general terms), how might we go about studying the linkages between behavior and biology with regard to the student’s interest area is what is desired. This paper should follow APA format. Paper grading will be based on creativity of the ideas, quality of writing, and strength of the argument based on existing scientific literature. The thesis should be clearly stated, the literatures should be synthesized and also organized in a fashion that best defends your argument. Presentations will be graded on clarity, command of audience, quality of presentation, and thoughtfulness of ideas. The bibliography will be graded on relevance of articles to the paper’s argument. While there is no set number of articles to include in the bibliography, I would imagine somewhere ~10-15.

4. General participation/Attendance: Evaluation of attendance and the quality of participation will be included in final grade.

**Grading**:

LDCQ: 20%

General participation/Attendance 10%

Team Presentations 20%

Bibliography 5%

Paper Presentation 15%

Thought paper 30%

**Class Meeting Format**

**2:10-2:50: Professor Lecture**

**2:50-3:00: Break**

**3:00-4:00: Team Presentations**

**VI. Class and University policies**

**Attendance**

The lecture/discussion format of this class makes attendance and participation necessary. It is understandable that there are some circumstances in which you may need to miss one class, e.g. conference attendance. If you need to miss a class, you must inform the instructor in advance. More than one excused absence may impact participation grades.

**Accommodations for students with disabilities.** If you have a disability that may necessitate an academic accommodation or the use of auxiliary aids and services in a class, please let me know within the first two weeks of class. You should also visit the Office of Disability Services (ODS) on the 7th floor of Lerner Hall as soon as possible. ODS determines the specific needs of students with disabilities, and develops and implements programs and policies to meet those needs. The procedures for registering with ODS can be found at http://health.columbia.edu/services/ods or by calling ODS Phone (212) 854-2388 (Voice/TTY).

**Academic Integrity.** Academic honesty in writing assignments, examinations, clicker participation, and communication with me is expected of all students in this class. Academic dishonesty is one of the most serious offenses a student can commit at Columbia University. It not only violates Columbia standards, it also severely inhibits your opportunity to develop academically, professionally, and socially. You are expected to do your own work on all tests and assignments for this class and to act in accordance with the Faculty Statement on Academic Integrity (below) and the student Honor Code.

*Faculty Statement on 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.*

*Scholarship, by its very nature, is an iterative process, with ideas and insights building one upon the other. Collaborative scholarship requires the study of other scholars’ work, the free discussion of such work, and the explicit acknowledgement of those ideas in any work that inform our own. This exchange of ideas relies upon a mutual trust that sources, opinions, facts, and insights will be properly noted and carefully credited.*

*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.*

*Any breach of this intellectual responsibility is a breach of faith with the rest of our academic community. It undermines our shared intellectual culture, and it cannot be tolerated. Students failing to meet these responsibilities should anticipate being asked to leave Columbia.*

Because any academic integrity violation undermines our intellectual community, if you are found to have cheated, plagiarized, or committed any other act of academic dishonesty you will likely receive a zero for the work in question and may fail the class.  You will also be referred to the Dean's Disciplinary Process, described here: www.college.columbia.edu/academics/disciplinaryprocess:

It is your responsibility to ensure that your work maintains expected standards. This requires that you understand what constitutes academic dishonesty on this campus and in this class. Should you have any questions or concerns regarding my expectations of you, please me for clarification, and refer to the Columbia University Undergraduate Guide to Academic Integrity: www.college.columbia.edu/academics/academicintegrity

**The reading list and weekly syllabus (Subject to change)** – readings are accessible via scholar.google.com

Students are encouraged to incorporate additional readings (particularly from empirical papers) if they feel that they would enhance discussion.

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|  | Topic & Readings | Additional Recommended Reading |
| 21-Jan | **Intro** |  |
| 28-Jan | **Background/history** |  |
|  | * Gottlieb, G. (2007). Probabilistic epigenesis. *Developmental Science, 10*(1), 1-11. |  |
|  | * Tottenham, N. (2020). Early adversity and the neotenous human brain. *Biological psychiatry*, *87*(4), 350-358. |  |
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| 4-Feb | **Sensitive periods & plasticity** |  |
|  | * Scott, J. P. (1962). Critical Periods in Behavioral Development: Critical periods determine the direction of social, intellectual, and emotional development.   *Science*, *138*(3544), 949-958. | Yang, E. J., Lin, E. W., & Hensch, T. K. (2012). Critical period for acoustic preference in mice. *Proceedings of the National Academy of Sciences*, *109*(supplement\_2), 17213-17220. |
|  | * Werker, J. F., & Hensch, T. K. (2015). Critical periods in speech perception: new directions. *Annual review of psychology*, *66*(1), 173-196. |  |
|  | * Bertolino, A., Saunders, R. C., Mattay, V. S., Bachevalier, J., Frank, J. A., & Weinberger, D. R. (1997). Altered development of prefrontal neurons in rhesus monkeys with neonatal mesial temporo-limbic lesions: a proton magnetic resonance spectroscopic imaging study. *Cerebral cortex (New York, NY: 1991)*, *7*(8), 740-748. |  |
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| 11-Feb | **Stress Physiology** |  |
|  | * Gunnar, M. R., Brodersen, L., Krueger, K., & Rigatuso, J. (1996). Dampening of adrenocortical responses during infancy: Normative changes and individual differences. *Child Development*, *67*(3), 877-889. | Gunnar, M. R., Gonzalez, C. A., Goodlin, B. L., & Levine, S. (1981). Behavioral and pituitary-adrenal responses during a prolonged separation period in infant rhesus macaques. *Psychoneuroendocrinology*, *6*(1), 65-75. |
|  | * Neonatal Handling Enhances Contextual Fear Conditioning and Alters Corticosterone Stress Responses in Young Rats |  |
|  | * Rosen, J. B., & Schulkin, J. (1998). From normal fear to pathological anxiety. *Psychological review*, *105*(2), 325. |  |
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| 18-Feb | **Development of Cued Fear learning** |  |
|  | * *Moriceau, S. et al., (2004). Corticosterone controls the developmental emergence of fear and amygdala function to predator odors in infant rat pups. International Journal of Deveopmental Neuroscinece,* 22(5-6): 415–422. | Ehrlich DE, Ryan SJ, Rainnie DG. (2012). Postnatal development of electrophysiological properties of principal neurons in the rat basolateral amygdala. J Physiol. 2012 Oct 1;590(Pt 19):4819-38. |
|  | * Camp, L. L., & Rudy, J. W. (1988). Changes in the categorization of appetitive and aversive events during postnatal development of the rat. Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology, 21(1), 25-42. |  |
|  | * Reinhard, J., Slyschak, A., Schiele, M. A., Andreatta, M., Kneer, K., Reif, A., ... & Romanos, M. (2022). Fear conditioning and stimulus generalization in association with age in children and adolescents. *European Child & Adolescent Psychiatry*, *31*(10), 1581-1590. |  |
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| 25-Feb | **Dr. Kate Humphreys talk** [**(register now)**](https://columbiauniversity.zoom.us/meeting/register/tJUtcu6hqDktH9C-iLb1quVw_TI_alof6cUZ#/registration) |  |
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| 4-Mar | **Development of Context Fear learning** |  |
|  | * Pattwell, S. S., Bath, K. G., Casey, B. J., Ninan, I., & Lee, F. S. Selective early-acquired fear memories undergo temporary suppression during adolescence. *Proc Natl Acad Sci U S A, 108*(3), 1182-1187 |  |
|  | * Rudy, J. W., & Morledge, P. (1994). Ontogeny of contextual fear conditioning in rats: implications for consolidation, infantile amnesia, and hippocampal system function. *Behavioral neuroscience*, *108*(2), 227. |  |
|  | *NOTE: PAPER TOPIC MUST BE APPROVED BY THIS DATE* |  |
| 11-Mar | **Infantile Amnesia** |  |
|  | * Bisaz, R., Bessières, B., Miranda, J. M., Travaglia, A., & Alberini, C. M. (2021). Recovery of memory from infantile amnesia is developmentally constrained. *Learning & Memory*. | Travaglia, A., Bisaz, R., Sweet, E. S., Blitzer, R. D., & Alberini, C. M. (2016). Infantile amnesia reflects a developmental critical period for hippocampal learning. Nature neuroscience, 19(9), 1225-1233. |
|  | * Callaghan, B. L., & Richardson, R. (2014). Early emergence of adult-like fear renewal in the developing rat after chronic corticosterone treatment of the dam or the pups. *Behavioral neuroscience*, *128*(5), 594. |  |
|  | * Akers, K. G., Martinez-Canabal, A., Restivo, L., Yiu, A. P., De Cristofaro, A., Hsiang, H. L., ... & Frankland, P. W. (2014). Hippocampal neurogenesis regulates forgetting during adulthood and infancy. Science, 344(6184), 598-602. |  |
|  | *NOTE: BIBLIOGRAPHY DUE* |  |
| 25-Mar | **Emotion regulation** |  |
|  | * Kim, J. H., Hamlin, A. S., & Richardson, R. (2009). Fear extinction across development: the involvement of the medial prefrontal cortex as assessed by temporary inactivation and immunohistochemistry. *J Neurosci, 29*(35), 10802-10808 | Bouwmeester, H., Smits, K., & Van Ree, J. M. (2002). Neonatal development of projections to the basolateral amygdala from prefrontal and thalamic structures in rat. *Journal of Comparative Neurology*, *450*(3), 241-255. |
|  | * Arruda-Carvalho, M., Wu, W. C., Cummings, K. A., & Clem, R. L. (2017). Optogenetic examination of prefrontal-amygdala synaptic development. *Journal of Neuroscience*, *37*(11), 2976-2985. | Bouwmeester, H., Wolterink, G., & Van Ree, J. M. (2002). Neonatal development of projections from the basolateral amygdala to prefrontal, striatal, and thalamic structures in the rat. *Journal of Comparative Neurology*, *442*(3), 239-249. |
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| 1-Apr | **Intergenerational Transmission of Fear** |  |
|  | * Debiec, J. & Sullivan, R.M. (2014). Intergenerational transmission of emotional trauma through amygdala-dependent mother-to-infant transfer of specific fear. Proceedings of the National Academy of Sciences. 111(33):12222-7. | Silvers, J. A., Callaghan, B. L., VanTieghem, M., Choy, T., O'Sullivan, K., & Tottenham, N. (2021). An exploration of amygdala‐prefrontal mechanisms in the intergenerational transmission of learned fear. *Developmental science*, *24*(3), e13056. |
|  | * Callaghan, B.L., Cowan1, C., & Richardson, R. (2016). The transgenerational effects of maternal separation on fear expression and fear extinction in infant rats: rescue by probiotic treatment. Psychological Science | Dias, B. G., & Ressler, K. J. (2014). Parental olfactory experience influences behavior and neural structure in subsequent generations. *Nature neuroscience*, *17*(1), 89-96. |
|  | * Waters, S. F., West, T. V., & Mendes, W. B. (2014). Stress contagion: Physiological covariation between mothers and infants. *Psychological science*, *25*(4), 934-942. |  |
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| 8-Apr | **Caregiver/Attachment** |  |
|  | * Moriceau S, Sullivan RM. (2006). Maternal presence serves as a switch between learning fear and attraction in infancy. *Nature Neuroscience. 9*(8):1004-6. | Gee, D.G., Gabard-Durnam, L., Telzer, E.H., Humphreys, K.L., Goff, B., Shapiro, M., Flannery, J., Lumian, D.S., Fareri, D.S., Caldera, C., & Tottenham, N. (in press). Maternal buffering of human amygdala–prefrontal circuitry during childhood. Psychological Science. |
|  | * Sroufe, L. A., & Waters, E. (1977). Attachment as an Organizational Construct. *Child Development*, *48*, 1184-1199. | *Bosmans, G., Bakermans-Kranenburg, M. J., Vervliet, B., Verhees, M. W., & van IJzendoorn, M. H. (2020). A learning theory of attachment: Unraveling the black box of attachment development. Neuroscience & Biobehavioral Reviews, 113, 287-298.* |
|  | * HOFER, M. (1994). Early relationships as regulators of infant physiology and behavior. *Acta paediatrica. Supplement*, *83*(397), 9-18. | Weaver, I. C., Cervoni, N., Champagne, F. A., D'Alessio, A. C., Sharma, S., Seckl, J. R., ... & Meaney, M. J. (2004). Epigenetic programming by maternal behavior. *Nature neuroscience*, *7*(8), 847-854. |
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| 15-Apr | **Early adversity, part 1** |  |
|  | * Hanson, J. L., Albert, W. D., Skinner, A. T., Shen, S. H., Dodge, K. A., & Lansford, J. E. (2019). Resting state coupling between the amygdala and ventromedial prefrontal cortex is related to household income in childhood and indexes future psychological vulnerability to stress. *Development and psychopathology*, *31*, 1053-1066. | Davis, E. P., Stout, S. A., Molet, J., et al (2017). Exposure to unpredictable maternal sensory signals influences cognitive development across species. *Proceedings of the National Academy of Sciences*, *114*(39), 10390-10395. |
|  | * Uliana, D. L., Gomes, F. V., & Grace, A. A. (2021). Stress impacts corticoamygdalar connectivity in an age-dependent manner. *Neuropsychopharmacology*, *46*(4), 731-740. | Sheridan, M. A., & McLaughlin, K. A. (2014). Dimensions of early experience and neural development: deprivation and threat. *Trends in cognitive sciences*, *18*(11), 580-585. |
|  | * McEwen, B. S. (2013). Allostasis and allostatic load: implications for neuropsychopharmacology. *Stress and the Brain*, 2-18. | Smith, K. E., & Pollak, S. D. (2021). Rethinking concepts and categories for understanding the neurodevelopmental effects of childhood adversity. *Perspectives on psychological science*, *16*(1), 67-93. |
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| 22-Apr | **Early adversity, part 2** |  |
|  | * Raineki, C., Sarro, E., Rincón-Cortés, M., Perry, R., Boggs, J., Holman, C. J., ... & Sullivan, R. M. (2015). Paradoxical Neurobehavioral Rescue by Memories of Early-Life Abuse: The Safety Signal Value of Odors Learned during Abusive Attachment. *Neuropsychopharmacology*, *40*(4), 906. | Ohta, K. I., Suzuki, S., et al. (2020). The effects of early life stress on the excitatory/inhibitory balance of the medial prefrontal cortex. *Behavioural Brain Research*, *379*, 112306. |
|  | * Tooley, U. A., Bassett, D. S., & Mackey, A. P. (2021). Environmental influences on the pace of brain development. Nature Reviews Neuroscience, 22(6), 372-384. |  |
|  | * Callaghan, B. L., & Richardson, R. (2011). Maternal separation results in early emergence of adult-like fear and extinction learning in infant rats. *Behavioral neuroscience*, *125*(1), 20. |  |
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| 29-Apr | Presentations (PAPERS DUE MAY 5, 2025) |