

## Syllabus for Spring 2018.

G4486. Development and Affective Neuroscience (seminar).

4 pts. N. Tottenham. Thursdays 10:10AM-12:00PM

Office Hours: Wednesdays 8:30AM-9:30AM (355D Schermerhorn)

Prerequisites: Courses in developmental psychology, and either research methods or affective neuroscience, and the instructor's permission.

There is nothing more important to us than the feelings that we have. But where do our emotions come from and why do we sometimes feel differently from our peers? The reason usually involves an understanding of one's developmental history. This course uses a developmental approach to address emotional brain-behavior relationships. 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.

### The reading list and weekly syllabus (Subject to change)

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

Week:

#### 1) (1/16) Overview & organization

#### 2) (1/23) Background (History, Theory)

- i. **Gottlieb, G. (2007). Probabilistic epigenesis. *Developmental Science*, 10(1), 1-11. Approx 12 pages**
- ii. **Smith, L. B., & Thelen, E. (2003). Development as a dynamic system. *Trends in Cognitive Sciences*, 7(8), 343-348. Approx 5 pages**
- iii. **Johnson, M.H. (2011). Interactive specialization: A domain-general framework for human functional brain development? *Developmental Cognitive Neuroscience*, 1, 7-21.**
  - i. (recommended) Greenough, W. T., Black, J. E., & Wallace, C. S. (1987). Experience and brain development. *Child Dev*, 58(3), 539-559.
  - ii. (recommended) Pollak, S.D. (2005). Early adversity and mechanisms of plasticity: integrating affective neuroscience with developmental approaches to psychopathology. *Dev Psychopathol*, 17(3): 735-752.
  - iii. (recommended) The importance of a Developmental Approach (Karmiloff-Smith, A. (1994). *Precis of Beyond modularity: A developmental perspective on cognitive science. Behavioral and Brain Sciences* 17 (4): 693-745.

#### 3) (1/30) Foundations in Developmental Neuroanatomy & Methods

- i. **Giedd, J.N., et al. (2010). Anatomic magnetic resonance imaging of the developing child and adolescent brain and effects of genetic variation. *Neuropsychological Review* 20: 349-361.**
- ii. **Nelson & Bloom, 1997, Child Development and Neuroscience. *Child Development*, 68, (5), 970-987.**
- iii. **Church, J.A., Petersen, S.E., Schlaggar, B.L. (2010). The "Task B Problem" and other considerations in developmental functional neuroimaging. *Human Brain Mapping* 31: 852-862.**
- iv. (recommended) Luna, B., Velanova, K., Geier, C.F. (2010). Methodological approaches in developmental neuroimaging studies. *Human Brain Mapping* 31: 863-871.
- v. (recommended) Thomason, M.E., Dassanayake, M.T., Shen, S., Katkuri, Y., Alexis, M., Anderson, A.L., Yeo, L., Mody, S., Hernandez-Andrade, E., Hassan, S.S., Studholme, C., Jeong, J.W., Romero, R. (2013). Cross-hemispheric functional connectivity in the human fetal brain. *Science Translational Medicine* 20: 173ra24.

#### 4) (2/6) Stress Physiology & Temperament

- I. **Romeo, R.D., Minhas, S., Svirsky, S.E., Hall, B.S., Savenkova, M., Karatsoreos, I.N. (2014). Pubertal shifts in adrenal responsiveness to stress and adrenocorticotropic hormone in male rats. *Psychoneuroendocrinology*, 42, 145-152.**
- II. **Birn, R.M. et al., (2014) Evolutionarily conserved prefrontal-amygdalar**

dysfunction in early-life anxiety. *Molecular Psychiatry*, 19(8):915-22.

- III. **Kertes, D.A., et al., (2009). Inhibited Temperament and Parent Emotional Availability Differentially Predict Young Children's Cortisol Responses to Novel Social and Nonsocial Events. *Developmental Psychobiology*, 51, 521–532.**
  - I. (recommended) Gunnar, M., & Quevedo, K. (2007). The neurobiology of stress and development. *Annu Rev Psychol*, 58, 145-173.
  - II. [recommended] Levine, S. (2005). Developmental determinants of sensitivity and resistance to stress. *Psychoneuroendocrinology*. 30(10):939-46.
- 5) **(2/13) Neurobiology of Fear and Anxiety across development**
  - i. Sevelinges Y, Moriceau S, Holman P, Miner C, Muzny K, Gervais R, Mouly AM, Sullivan RM (in press). Enduring Effects of Infant Memories: Infant Odor-Shock Conditioning Attenuates Amygdala Activity and Adult Fear Conditioning, *Biological Psychiatry*.
  - ii. 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 Developmental Neuroscience*, 22(5-6): 415–422.
  - iii. 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.
- 6) **(2/20) Emotion regulation across Development**
  - i. 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.
  - ii. Gee, D. G., Humphreys, K. L., Flannery, J., Goff, B., Telzer, E. H., Shapiro, M., et al. (2013). A developmental shift from positive to negative connectivity in human amygdala-prefrontal circuitry. *J Neurosci*, 33(10), 4584-4593.
  - iii. Jones, C. & Monfils, M. (2016). Post-retrieval extinction in adolescence prevents return of juvenile fear. *Learning and Memory*, 23, 567-575.
  - iv. (recommended) Silvers, J.A., Shu, J., Hubbard, A.D., Weber, J., Ochsner K.N. (2015). Concurrent and lasting effects of emotion regulation on amygdala response in adolescence and young adulthood. *Developmental Science*, 18(5), 771-784.
- 7) **(2/27) Caregiver Influences**
  - i. 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*.
  - ii. Moriceau S, Sullivan RM. (2006). Maternal presence serves as a switch between learning fear and attraction in infancy. *Nature Neuroscience*. 9(8):1004-6.
  - iii. 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.
  - iv. [strongly recommended] Kaffman, A., & Meaney, M. J. (2007). Neurodevelopmental sequelae of postnatal maternal care in rodents: clinical and research implications of molecular insights. *J Child Psychol Psychiatry*, 48(3-4), 224-244.
- 8) **(3/6) Adverse Caregiving (B. Callaghan)**
  - i. Tottenham, N. et al., (2011). Elevated amygdala response to faces following early deprivation. *Developmental Science*, 14(2):190-204.
  - ii. Callaghan, B. L., & Richardson, R. Maternal separation results in early emergence of adult-like fear and extinction learning in infant rats. *Behav Neurosci*, 125(1), 20-28.
  - iii. Burghy et al., (2012). Developmental pathways to amygdala-prefrontal function and internalizing symptoms in adolescence. *Nature Neuroscience*. 15, 1736–1741.
  - iv. (recommended) Gee, D.G., Gabard-Durnam, L., Flannery, J., Goff, B., Humphreys, K.L., Telzer, E.H., Hare, T.A., Bookheimer, S.Y., Tottenham, N. (in press). Early Developmental Emergence of Human Amygdala-PFC Connectivity after Maternal Deprivation. *Proceedings of the National Academy of Sciences*.
- 9) **(3/20) Sensitive periods & plasticity**

- i. Yang et al., (2012). Critical period for acoustic preference in mice. *Proc Natl Acad Sci U S A*. 2012 Oct 16;109 Suppl 2:17213-20.
  - ii. Knudsen, E. I. (2004). Sensitive periods in the development of the brain and behavior. *J Cogn Neurosci*, 16(8), 1412-1425.
  - iii. Weikum WM, et al., (2012). Prenatal exposure to antidepressants and depressed maternal mood alter trajectory of infant speech perception. *Proc Natl Acad Sci U S A*. 2012 Oct 16;109 Suppl 2:17221-7
  - iv. (Recommended) Werker et al., 2015. [Critical periods in speech perception: new directions](#). *Annu Rev Psychol*. 2015 Jan 3;66:173-96.
  - v. (Recommended) Gervain et al., (2013). *Front Syst Neurosci*. 2013 Dec 3;7:102.
- 10) (3/27) Social Perception**
- i. Scott, L. S., Pascalis, O., & Nelson, C. A. (2007). A Domain-General Theory of the Development of Perceptual Discrimination. *Current Directions in Psychological Science*, 16(4), 197-201.
  - ii. Golarai, G., et al. (2007), Differential development of high-level visual cortex correlates with category-specific recognition memory. *Nat Neurosci*, 10 (4): p. 512-22.
  - iii. Pollak, S. (2003). Experience-dependent affective learning and risk for psychopathology in children. *Ann N Y Acad Sci*. 1008:102-11.
- 11) (4/3) – Socio-Economic Influences (K. Noble)**
- i. Noble et al., (2015). Family Income, Parental Education and Brain Structure in Children and Adolescents. *Nature Neuroscience* 18, 773–778
  - ii. Noble et al., (2015). Socioeconomic disparities in neurocognitive development in the first two years of life. *DEVELOPMENTAL PSYCHOBIOLOGY* ,57(5):535-51.
  - iii. Noble et al., (2012). Hippocampal volume varies with educational attainment across the life-span. *Frontiers in Human Neuroscience*. 2012; 6: 307.
- 12) (4/10) Paper Presentations on individual topics**
- 13) (4/17) Reward Processes in Development**
- i. Somerville, L.H., Hare, T.A., Casey, B.J. (2011). Frontostriatal maturation predicts cognitive control failure to appetitive cues in adolescents. *Journal of Cognitive Neuroscience* 23: 2123-2134
  - ii. Braams, B.R. van Duijvenvoorde, A.C., Peper, J.S., Crone, E.A. (2015). Longitudinal changes in adolescent risk-taking: a comprehensive study of neural responses to rewards, pubertal developmental, and risk-taking behavior. *Journal of Neuroscience*, 35(18), 7226-7238.
  - iii. Brenhouse, H.C., et al., (2010). Enhancing the salience of dullness: behavioral and pharmacological strategies to facilitate extinction of drug-cue associations in adolescent rats. *Neuroscience*. 2010 Aug 25;169(2):628-36.
    - i. [Recommended] Spear, L.P. (2000). The adolescent brain and age-related behavioral manifestations. *Neuroscience Biobehavioral Review* 24: 417-463.
    - ii. (Recommended) Galvan, A. (2013). The teenage brain: Sensitivity to rewards. *Current Directions in Psychological Science* 22:88-93.
- 14) (4/24) Peer Influences in Development**
- i. Chein, J., Albert, D., O'Brien, L., Uckert, K., Steinberg, L. (2011). Peers increase adolescent risk-taking by enhancing activating in the brain's reward circuitry. *Developmental Science* 14(4):F1-10.
  - ii. Varlinskaya EI et al., (2015). Ethanol intake under social circumstances or alone in sprague-dawley rats: impact of age, sex, social activity, and social anxiety-like behavior. *Alcohol Clin Exp Res*. 2015 Jan;39(1):117-25.
  - iii. Falk et al., (2014). Neural responses to exclusion predict susceptibility to social influence. *Journal of Adolescent Health* 54(5 Suppl):S22-31

## V. Course requirements and grading

1. Learning and Discussion 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. Evaluation of the quality and quantity of participation will be included in final grade.

2. **Team Presentations:** Students choose a topic/week on the first day of class. You will be required to 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 work (if applicable) (work should not be divvied up by readings, but instead on themes)
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 instructors by **9AM Monday** before your presentation. You must post the final presentation on Courseworks by **5PM TUESDAY** before class.

3. **Thought paper & Paper presentations/bibliography:** Students will write a paper that is due on or before **4/27/2017**. 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 2/16/2017. Throughout the semester, students will meet independently with the instructor & will be required to submit a list of references to facilitate the writing process (**4/10/2017**) Also on **4/10/2017**, students will present the thesis of their paper orally to the class (approximately 5 minutes). The paper may be an expansion of the presentation from class, but if the student chooses this option, it must truly expand on the presentation. Otherwise, students may choose to do a brief review/critique 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. Grading will be based on creativity of the ideas, quality of writing, and strength of the argument based on existing scientific literature. The argument should be clearly stated, the literatures should be synthesized and also organized in a fashion that best defends your argument.

### **Class Meeting Format**

**10:10-11:10: Team Presentations**

**11:10-11:20: Break**

**11:20-12:00: Professor Lecture**

### **Grading:**

LDQ: 10%

General participation/Attendance 20%

Team Presentations 30%

Paper Presentations/Bibliography 10%

Thought paper 30%

## **VI. Class and University policies**

### **Attendance**

The lecture/discussion format of this class makes attendance and participation necessary. We understand that there are some circumstances in which you may need to miss a class, e.g. conference attendance. If you need to miss a class, you must inform the instructors in advance. After one excused absence, extra assignments will be considered to compensate for missed time.

**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 7<sup>th</sup> 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](http://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](http://www.college.columbia.edu/academics/academicintegrity)