

*Syllabus*

**PSYC GU4491: The Parental Brain**

**Professor:** Bianca Jones Marlin, PhD

**Co-Lecturer:** Rajyashree Sen, PhD *Associate Research Scientist, Axel Lab*

**Teaching Assistant:** Dakota Greene, MA

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Fall 2024: Tuesday, 12:10 pm-2 pm, Schermerhorn Room: 200C

**I. Bulletin description**

PSYCGU4491. The Parental Brain (seminar). 4 pts

Meeting: **Tuesday 12:10 pm – 2 pm**

Office hours: By appointment Tuesdays 2:10-2:45

**Prerequisites:** Basic background in neurobiology (for instance PSYC UN1010, UN2450, UN2460, UN2480, or GU4498) and the instructor's permission.

This course will provide an overview of the field of parental and social biology, with an emphasis on changes in the adult rodent brain surrounding childbirth and caretaking behavior. We will explore how the experience of parenthood prepares the brain for survival of offspring. We will also discuss the dynamic between caregivers and parents in order to provide the structure necessary to rear young. This course will illustrate the fortitude of molecular, behavioral and circuit level investigations in concert to unveil mechanisms of social learning.

**II. Full course description:**

Marriage, friendships, family, scientific collaborations - social relationships are the cornerstone of our society. Arguably the most influential social relationship is that between parent and child. Negative parenting stifles healthy personal and familial development and burdens society with increased crime rates and financial loss. Understanding the biological basis for parental behavior is necessary to restore and protect vital parent-child bonds. Unveiling the mechanisms of parental learning opens therapeutic avenues to pathologies associated with poor parenting and failed parent-child bonds.

In the first part of the course, we will explore the major hormonal and neuromodulatory mechanisms of parental behavior and the research tools that are used to study epigenetic modifications in different model systems, including humans. Following this introduction, we will discuss the most sensitive periods during which the parent-child dynamic can be disrupted by environmental factors, including prenatal and early-life stressors. Finally, we

will discuss how these experiences may dictate future generations via epigenetic modifications.

The topics of the course will be introduced through overview lectures given by the instructor, followed by journal article presentations by students. The readings will consist of review articles and primary research articles, and will draw upon examples from both human and experimental/animal research. In addition to several classic papers to lay the foundation for parental behavior, the readings emphasize the most contemporary research and understanding of each topic area. The whole class is expected to have read the journal articles in advance and participate in discussion.

Finally, students will have the opportunity to explore and demonstrate a detailed understanding of a paper of their choice relevant to Parental Behavior through a final “News and Views” and accessible science presentation.

### **III. Rationale for giving the course:**

The primary goal of this course is to for students to gain in-depth understanding of the parental experience as it pertains to the fields of Psychology and Neuroscience. In order to aid in *remembering*, *understanding*, and *applying* the knowledge gained from the readings and lectures, students will be encouraged to ask questions and participate in discussion throughout the lectures and journal article presentations. In-class small-group activities will give students further opportunity to discuss, *apply*, and *analyze* the topics. Through presentation of journal articles and leading class discussion, students will gain a detailed understanding of a topic, *draw connections* to other course topics, *evaluate* the research, and *create* their own framework for presenting it to the class. The final “News and Views” paper on a paper of the student’s choice will further enable students to *synthesize* information from multiple sources, critically *evaluate* it as a whole, and *author* their own review of the sub-field.

More broadly, students will learn how to read primary scientific research articles, think critically, synthesize information, and write organized, evaluative papers. These skills are necessary to be informed citizens in our increasingly technological society, and in all chosen post-graduate disciplines and careers.

The Psychology Program Goals that will be advanced in this seminar (see <http://www.columbia.edu/cu/psychology/dept/ugrad/goals.html>) include 1. Knowledge preliminary syllabus base; 2. Research methods; 4. Critical thinking; 5. Values in psychology; 6. Application of psychology; 7. Communication skills—written; 8. Communication skills—oral; 9. Information and technological literacy.

PSYC GU4491 is an advanced seminar, designed particularly for graduate students, for advanced undergraduates who are majoring in Psychology or in Neuroscience and Behavior, and for students participating in the Psychology Postbac Certificate Program. These students will have priority in registration, followed by junior majors followed by non-majors. The seminar will be well suited to students who have completed two or more lecture courses beyond UN1001, such as UN1010 (Mind, Brain, and Behavior), UN2430, W2450 (Behavioral Neuroscience), UN2460 (Drugs and Behavior).

It fulfills the following degree requirements:

- For Psychology Graduate Students, PSYC GU4491 will apply toward the “two seriously graded seminars” requirement of the Master’s degree.
- For the Psychology major or concentration in the College and in G. S. and for the Psychology Postbac Certificate, GU4491 meets the Group II (Psychobiology and Neuroscience) distribution requirement.
- For the Neuroscience and Behavior joint major, GU4491 will fulfill the 5th Psychology requirement: “one advanced psychology seminar from a list approved by the Psychology Department advisor to the program.”
- For non-majors in the College and GS, pending approval of the Committee on Science Instruction, GU4491 can count as one term of the natural science requirement, provided that students have taken the prerequisite psychology courses. Graduate students, and students who are majoring in Psychology or in Neuroscience and Behavior, and postbac certificate students will have priority over students who are taking the course for the science requirement. For this reason, as well as because of the course prerequisites, we anticipate the course will rarely be used for the science requirement.
- For the Psychology Postbac certificate, PSYC GU4491 will fulfill the advanced seminar requirement.

#### **IV: Syllabus**

*PDFs of all articles will be available through Course Works/Canvas*  
 Supplemental Text: The Neurobiology of Parental Behavior. Numan & Insel  
<https://link.springer.com/book/10.1007/b97533>  
 (available through Columbia Libraries)

#### **Lecture 1.**

09/03/2024: *What is parental behavior?* Overview of course

#### **Lecture 2.**

09/10/2024: *What is maternal behavior?*

*Presenter: Prof Marlin*

*Assign Didactics*

*Didactics- Electrophysiology*

Changes in the mammalian maternal brain

1. Liu, 2015. *Nature News and Views*  
<https://www.nature.com/articles/nature14386>
2. Marlin et al., 2015. *Nature*  
<https://www.nature.com/articles/nature14402>
3. The Maternal Brain, *Scientific American*  
<https://www.scientificamerican.com/article/the-maternal-brain/>
4. *Supplemental Reading: The Neurobiology of Parental Behavior.* Numan & Insel
  - a. Neurochemistry and Molecular Biology of Maternal Behavior

### **Lecture 3.**

09/17/2024: *How are brains made? Guest Presenter: [Dr. Thiago Azura](#),  
Postdoc, Marlin Lab*

1. How are brains made: Parent to offspring brain development and stem cells

### **Lecture 4.**

09/24/2024: *What is maternal behavior? (3/3)*

*Presenter: [Dr. Rajyashree Sen](#)  
Postdoc, Axel Lab*

1. News & Views: Meyza & Knapska, 2017 eLife  
<https://elifesciences.org/articles/28514>
2. Main Article: Rickenbacher et al., 2017 eLife  
<https://elifesciences.org/articles/24080>

Supplemental <https://www.science.org/doi/10.1126/science.1253291>

### **Lecture 5.**

10/01/2024: *What can parents teach for generations? Transgenerational Epigenetic Inheritance in males*

*Didactics:*

*Presenter: Professor Marlin*

1. Dias and Ressler, 2014. Nature Neuroscience.  
<https://www.nature.com/articles/nn.3594>
2. "Can we really inherit Trauma?" 2018. New York Times  
<https://www.nytimes.com/2018/12/10/health/mind-epigenetics-genes.html>
3. Supplemental Reading:  
Van Steenwyk, 2018. Environmental Epigenetics  
<https://pubmed.ncbi.nlm.nih.gov/30349741/>

[Dads Diet](#)

### **Lecture 6.**

10/08/2024: **Society for Neuroscience Conference Week:  
Due 10/15/2024**

1. Watch movie "Three Identical Strangers"  
<https://www.imdb.com/title/tt7664504/>
2. <https://www.cnn.com/2019/01/09/health/unethical-experiments/index.html>
3. <https://www.statnews.com/2019/02/07/three-identical-strangers-address-ethical-violations/>

**Assignment 1:** Design an ethical experiment to examine the contributions of nature vs nurture in parallel animal and human models. Include mock figure and conclusion schematic. *1 pages max. Single space. Size 12 font. Figure separate.*

Study Design:

1. What were the three aims of Neubauer's experiment?
2. What were the three variables?
3. What were the ethical and experimental pitfalls?
4. Design an ethically sound experiment to address the "Three Identical Strangers" in three clearly described experimental steps. Non-human studies and figures of predicted model and data are encouraged.

Supplementary Reading

How to write Specific Aims: <https://www.biosciencewriters.com/NIH-Grant-Applications-The-Anatomy-of-a-Specific-Aims-Page.aspx>

### **Lecture 7.**

**10/15/2024:** *Dad Brain: How fathers brain changes after mating*

Didactics:

Presenter: [Dr. Rajyashree Sen](#)

1. News & Views: Rodriguez 2014. Nature  
<https://www.nature.com/articles/509294a>
2. Main Article: Wu et al., 2014. Nature  
<https://pubmed.ncbi.nlm.nih.gov/24828191/>
3. *Supplemental Reading:* The Neurobiology of Parental Behavior. Numan & Insel
  - a. Chapter 7 – Paternal Behavior

### **Lecture 8.**

**10/22/2024:** The good stuff- chemicals changing the parental brain

Didactics:

Presenter: [Dr. Rajyashree Sen](#)

1. News and View:  
McCarthy, 2023. Science  
<https://www.science.org/doi/full/10.1126/science.adk2495>
2. Ammari et al., 2023. Science  
<https://www.science.org/doi/10.1126/science.adi0576>

Supplemental Listening:

NPR:

<https://www.npr.org/2023/10/05/1203982602/pregnancy-really-does-change-the-brain-study-shows>

### **Lecture 9**

**10/29/2024:** *What can parents teach for generations?*

Didactics:

Presenter: Prof. Marlin & [Clara Liff](#)

1. Liff et al., eLife, 2024  
<https://elifesciences.org/reviewed-preprints/92882>
2. “Inherited memories: Too good to be true?”  
<https://www.discovermagazine.com/mind/inherited-memories-too-good-to-be-true>
3. “When results are too good to be true”  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4196601/>

**11/05/2023: Academic holiday, no class**

**Lecture 10.**

**11/12/2024:** *I'll always love my mama.* Mothers, offspring and fear.

*Didactics:*

1. Carmona, 2007. Scientific American  
<https://blogs.scientificamerican.com/news-blog/mamas-boys-are-braver-maternal-pres/>
2. Moriceau, 2006. Nature Neuroscience  
<https://www.nature.com/articles/nn1733>

Supplemental Reading:

3. Opendak et al., 2021  
[https://www.cell.com/neuron/pdfExtended/S0896-6273\(21\)00714-5](https://www.cell.com/neuron/pdfExtended/S0896-6273(21)00714-5)

**Lecture 11.**

**11/19/2024:** **Zuckerman Lab Tour:** Marlin Lab, Abdus-Saboor Lab, Axel Lab (Dr. Sen)  
**Due:** *News & Views* topic choice. Please include justification for choosing paper.

**Lecture 12.**

**11/26/2024:** **Assignment #2: Accessible Science Presentations ½**  
All accessible science presentations due.

**Lecture 13.**

**12/03/2024:** **Accessible Science Presentations 2/2**

**Finals Week.**

**12/10/2024:** Academic Finals Week. No Class

**Final Due.**

**12/17/2024:** **News & Views paper due:** “News and Views on Parental Behavior Paper from 2022-2023” Include strengths & weaknesses.  
*3 pages max. Single space. Size 12 font. 1 summary schematic figure.*

**V. Course requirements and grading:**

Grades:

- 25% Participation
- 25% 3 Identical Strangers
- 25% Individual Assignment: “News and Views on Parental Behavior Paper from 2021-2022”
- 25% Accessible Science Presentation

Participation (25%): All students are expected to participate in weekly paper discussions, virtually or in-person. If class is over Zoom, I request that students keep their camera on to foster a more collaborative discussion and simulate in-person class. To effectively participate, it is expected that all students read the assigned articles in advance of the class. Papers will be assigned to a student to present. Fellow students are expected to participate in the journal club conversation. Each student (non-presenting) should come prepared with at least one question for the original research article(s) being presented. If medical or other emergencies prevent students from attending a class, an email to Dr. Marlin is required *in advance of class* to explain the absence.

News & Views paper (25%): All students are required to select a recent paper (2021-2022) relevant to parental behavior for a final 2-3 page (single spaced) “News and Views” piece. Students will submit the topic/title and short rationale for its selection to Dr. Marlin for approval/feedback.

## **VI: Other**

### **Academic honesty**

As members of this academic community, we are responsible for maintaining the highest level of personal and academic integrity: “[E]ach one of us bears the responsibility to participate in scholarly discourse and research in a manner characterized by intellectual honesty and scholarly integrity.... The 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... [and] you must always submit your own work and not that of another student, scholar, or internet agent” (from the Columbia University Faculty Statement on Academic Integrity. All allegations of academic misconduct will be immediately referred to the office of Student Conduct and Community Standards.

<https://www.college.columbia.edu/faculty/resourcesforinstructors/academicintegrity/statement>).

Plagiarism – whether intentional or inadvertent – is a serious violation of academic integrity. If you have any questions about what constitutes plagiarism and/or how to properly cite sources, please come to me. I am more than happy to help. Similarly, if you put yourself in a situation, e.g., starting an assignment very late, in which you think your best option might be to cut some corners, see me. It is far better to have a few points deducted from a paper than to compromise your academic integrity and potentially put your academic standing in jeopardy.

### Disability Services

Students with special needs who may require classroom/test accommodations should make an appointment with me before or during the first week of class. You should also contact the Office of Disability Services (ODS) in Lerner Hall before the start of the course to register for these accommodations. The procedures for registering with ODS can be found at <http://health.columbia.edu/services/ods> or by calling (212) 854-2388.

### Writing Center

I encourage you to visit the Writing Center, where you can receive free individual consultations on your writing at any stage in the writing process, including brainstorming. Writing consultants work with all members of the Columbia community on any academic or nonacademic writing. You can make an appointment and view drop in hours on their website [[www.college.columbia.edu/core/uwp/writing-center](http://www.college.columbia.edu/core/uwp/writing-center)].