**Your Brain on Pain: An Exploration of how Pain Contributes to Mental Illness**

**Spring Semester, 2022  
Interdisciplinary Honors Seminar via   
Rutgers University Psychology Department**

**Course Information:**Rutgers Course Number:  01:090:293:H3  
Date and Time:  Tuesdays 10:20 AM – 1:20 PM  
Index Number: 06708  
Location: Allison Road Classrooms (ARC) Rm. 333; [Webex for Virtual Classes](https://rutgers.webex.com/meet/djbarker)

**Instructor:**Dr. David J. Barker  
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Office:  Psych 325 (Busch Campus)  
Office Hours:  By virtual appointment until further notice.

**Introduction and Goals for this Course:**

We’ve all experienced pain in our lifetime. For the lucky among us, this pain has been short-lasting, while for others pain can be a debilitating chronic condition. Historically, much of the research on “pain” has focused on peripheral signals between the body and the spinal cord, but in truth, there is no “pain” without the brain.  While peripheral signals from pain sensors called ‘nociceptors’ help us to detect painful or noxious events, our emotional reactions, and cognitive control help to shape our true perception of just how ‘painful’ things truly are.  
  
Even more importantly, as we now consider the many ways in which the brain participates in the modulation of pain, we’re only just becoming aware of the many ways in which pathological pain comes to affect our overall mental health. The goal of this seminar is to explore how pain signaling works as well as the many ways in which pain can affect the brain. As a part of this, we will examine the scholarly literature to determine how these signals might play a causal role in mental illnesses such as anxiety, depression, drug addiction, and more.

**Textbook:**  There is no explicit textbook for the course.

As a reference, consider:  
[Pain, Its Anatomy, Physiology, and Treatment. by Aage R. Moller (2014). Second or Third Edition, The University of Texas at Dallas Richardson, Aage R. Moller Publishing.](https://amzn.to/3FWrShj)

This book provides a broad overview of the neuroscience of pain, starting with an overview of pain physiology and covering many aspects of what makes pain pathological.

**Reading:**  [Reading assignments will consist of papers from the primary literature](/courses/159635/files), including a list of papers that each student will develop for a final paper and presentation to the class.

**These readings are required each week and will be discussed during each class.**

**Canvas:** The course has a dedicated Canvas site. All registered students should be automatically added to the site. Please contact me if this is not the case. This site contains all of the required resources for the course. Also, Canvas will be used for announcements and other class communications.

**Grading:**

**Midterm                                                        50 PTS  
Participation                                                 25 PTS**

**Elevator Pitch                                               25 PTS  
Outline                                                           25 PTS  
Final Paper                                                    50 PTS  
Final Presentation                                        25 PTS  
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TOTAL                                                          200 PTS**

**Midterm:**The midterm will be an open-book, open note exam that tests your understanding of the fundamentals related to pain processing. The midterm will consist of open-ended questions.

**Participation:**Everyone will serve as the lead presenter for one of the scholarly papers presented over the semester. The expectation is that you fully read and understand this paper to the point where you can teach your classmates about the findings.

**Final Project:**A major component of your grade will be an independent research topic, where you explore the intersection of pain and mental illness. We will break this process into four parts to make things easier.

First, everyone will have a day to conduct their own research in order to develop an elevator pitch. The pitch should discuss what specific aspect of pathological pain and mental illness you will be researching. As a part of this, you should discuss what key points you hope to make, and what makes your proposal/angle unique. Finally, you should quickly discuss why your topic is translationally relevant.

Second, you will turn in an outline and annotated bibliography in week 11.  This should provide a detailed layout of the paper you plan to write, as well as brief summaries of the scholarly papers you know you will be including.  
  
Finally, you will write a paper and give a corresponding presentation to your classmates discussing what you’ve uncovered for your specific topic. The presentations will be ~15-20 minutes with 5-6 minutes for questions.

**Academic Integrity**

All students are required to comply with the University’s Academic Integrity Policy, as presented at <http://academicintegrity.rutgers.edu>.  Cheating on exams or assisting others in cheating on the exams will be treated in accordance with University Policy.

**Course Schedule for Methods in Neuroscience:**

**Week 1-January 18th**

**Introduction to the course**We will start with an overview of the course and get to know one another. We will also discuss the differences between nociception and pain, as well as why we need to study pain. As needed, we will review the principles of communication in the nervous system.  
PAPERS: [Steeds 2009 (Broad overview of Pain)](/courses/159635/files);  **Article: "**[The curse of people that never feel pain"](https://www.bbc.com/future/article/20170426-the-people-who-never-feel-any-pain)

**Week 2- January 25thAn Overview of Bodily Senses**How do we sense touch? Temperature? How does our brain integrate this into a map of ourselves and the space around us? What kinds of connections support this information flow?  
[PAPERS: “Feel the Force” Article by Amber Dance; Coste et al., 2010 (Discovery of Piezo Receptors)](/courses/159635/files)

**Week 3-February 1st – WINTER BRAIN CONFERENCE**

**“Library Day”**Spend some time individually or with a classmate to work and develop your plan for the end-of-semester presentation/paper. Come prepared with an elevator pitch for the next class and a bibliography of ~5-10 papers you might include.

**Week 4-February 8thElevator pitch (3-5 minutes)  
How do we perceive pain?**How do noxious stimuli activate peripheral nerves? What types of signaling and receptors are involved in specific types of pain? What are the circuits that allow these signals to reach the brain?  
[PAPER: Caterina et al., 1997; Caterina et al., 2000 (Discovery and validation of TRPV1 receptors)](/courses/159635/files)

**Week 5-February 15thHow do we perceive pain (Continued)?**[PAPER: Julius & Basbaum, 2001 (Molecular Mechanisms of Nociception); Caterina & Julius, 1999](/courses/159635/files)

**Week 6-February 22ndHow Do we Measure Pain?**We will cover methods for measuring pain in humans and rodents, discuss what these methods teach us, and consider the translational relevance for the animal models.  
[PAPER: Kalina et al., 2018;  Lee et al., 2020](/courses/159635/files)

**Week 7-March 1st   
Pain Sensitization and Modulation**How can top-down circuits modulate these signals to change the pain experience?  
[PAPER: Li et al., 2021; Ikeda et al. 2006; Cervero 1996](/courses/159635/files)

**Week 8-March 8th**

**MIDTERM EXAM**

**Week 9-March 15th**

**SPRING RECESS- NO CLASS**

**Week 10-March 22nd   
Treatment of Pain**We will discuss some of the common therapies for treating different types of pain, including triptans for Migraines, Opioids and NSAIDs for acute pain, Gabapentin and SNRIs for neuropathic pain, and promising future therapies.  
[PAPERS: Cole 2002; Price 2002;](/courses/159635/files)

**Week 11-March 29th   
Paper outlines with annotated bibliography due.  
Emotions as a Physiological Process**How can we objectively examine emotions? What is the physiological basis for human emotion and how might that relate to pain processing? How do we dissociate the physiological and affective components of pain?  
[PAPERS: James 1984- “What is emotion?”; Buhle et al., 2013](/courses/159635/files)

**Week 12-April 5th   
Pathological pain and mental illness.**For this final week, we will review a series of papers that examine the comorbidity of pain and discuss the ways in ways pain transitions from acute to pathological.

[**TENTATIVE PAPERS:**](/courses/159635/files)  
[Pain and Depression: Verma & Gallagher, 2000](/courses/159635/files)  
[Pain and Anxiety: Michalska et al., 2018](/courses/159635/files)  
[Pain and Substance User Disorders- Cicero et al 2008](/courses/159635/files)  
[“Pain Memory”- Price & Inyang 2015](/courses/159635/files)

**Week 13-April 12thFinal Papers Due by Friday the 15thPeer Feedback on Presentations:** Groups with similar topics will meet to give practice presentations, ask questions about the material, and to provide feedback on the design and presentation.

**Week 14-April 19thStudent Presentations**

**Week 15-April 26thStudent Presentations**