

**PSYC 50.05**  
**Neuroscience of Motivation, Drugs & Addiction**  
Professor Smith  
Spring '14  
MWF 10-11:05am  
Room 202, Moore Hall

Office hours: by appointment

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X-hours: As of now they are unscheduled, but they *could be used* as we progress through the term, e.g., for review sessions or for catching up on material. (Th 12:00 - 12:50).

This course will explore how the brain controls different motivated behaviors and how drugs of abuse hijack those brain mechanisms to cause addiction. This will be an interactive course. Through readings and lectures, you will be given some material to know, but emphasis will also be placed on thinking about the material and applying it to other scenarios. Each week will likely contain a mix of lectures/presentations, discussions, and application-related activities.

### **PRIMARY READINGS**

- 1) Koob & Le Moal (2006). *Neurobiology of addiction*. Academic Press, Elsevier Inc.
- 2) Berridge KC (2004). Motivation concepts in behavioral neuroscience. *Physiology and Behavior*, 81(2):179-209.
- 3) Additional articles (as below; posted on Canvas).

### **ASSIGNMENTS AND EXAMS**

**READINGS:** We will be reading published peer-reviewed articles and book chapters. Doing the reading before class is essential to a successful course experience. The reading may be substantial at times, light at other times. The textbook can be very dense. What you need to do is read before the class and be 'primed' to understand the lecture or presentation material. In addition to the textbook, the reading list and electronic PDFs (or links) will be posted on Canvas.

**PARTICIPATION (10% of grade):** Attendance is key for understanding the material and the exam contents. You will be required to participate on the presentation days (see below). You might also be called on to give your opinions and thoughts in class discussions and activities. There are no bad questions or comments; throw 'em out there.

**PRESENTATION (20% of grade):** Everyone will be assigned one day to present to the class as part of a team using Powerpoint, Prezi, or similar software. You will be assigned (1) background material, and (2) one experimental article. The background should be presented in ~15 minutes, and the experiment in ~15 minutes. A big challenge will be extracting what you think are the main points and concisely covering them. It is fine to have just a few slides; bullet point coverage of the experiment would work (research question, methods, findings). I will then open up the class for questions about specifics of the experiment, and about creative ideas or applications regarding it. The day will end with groups attempting to answer these questions and posting to Canvas.

**PAPER (20% of grade):** Pick a topic, other than your discussion topic, and write a paper on it. Required materials are the *required readings and one experiment article from the readings list*. For this, half of it should be a summary of the experiment articles that you read (being concise is a challenge here) and half should be your independent thoughts/comments/ideas/extensions of the experiments (see writing tips below). This should be written like a normal academic essay and should include a citation list. Format: 5-7 typed double-space pages, 11pt Ariel or Times font. I don't care if you use the first-person. There should be an academic citations format and bibliography (bibliography not included in the page limit).

Paper due date: 2/20 at class. \*Late papers are accepted, but one letter grade lower for each 24 hr period it is late. This includes lateness due to conflicts related to athletics and other coursework (plan ahead).

**MIDTERM AND FINAL EXAMS (MIDTERM: 20%; Final: 30% of grade):** A mix of multiple-choice and short answer. I will provide you with an outline of material that could be covered. It will include the required readings and lecture material, including a few key findings or ideas from each student presentation. Content will heavily favor the lecture; if

something is in the lecture and in the readings, it is good exam material. The final is non-cumulative, date tbd. I will hold Q&A review sessions prior to each, likely during the x-hour.

## NOTES AND TIPS ON WRITING

**Plagiarism:** Writing about scientific publications without just rephrasing is difficult, particularly when not everything is fully understood. Doing this properly takes time and practice, and one goal of the course is to move us in that direction. I don't expect to see a perfect scientific treatment at this stage. But I do want to see evidence of independent thought, of considering the material and implications (rather than just regurgitating it), and of some creativity in putting this together. When quoting, be sure appropriate citations are made.

**Writing tips:** (1) Get a big picture or idea in your mind from the reading, and then write with paragraphs tackling sub-themes, as we all learned to do (topic sentence, etc.). (2) It can work well to interleave your own thoughts and experiences, or to reference material not on the reading list even from other disciplines, or to take question the validity of the results and interpretations (e.g., if experiments were well-controlled, or if gaps are missing in arguments; don't worry whether I would agree). I don't care if you use the first person. (3) Consider incorporating thoughts on future experiments, whether directly feeding off of the work or applied to other species or conditions; likewise, general ideas to test in some way in the future. (4) Quoting the material can work if done in moderation, but the majority of it must be your own writing. (5) Always feel free to get feedback prior to deadlines.

**Some thought questions for the creative section of your presentation and paper if you are stuck:** What might be some additional useful experiments or comparisons? Are you convinced by the findings & interpretations? Does this give you insight into your own experiences? What kind of reward might you experience on occasions, and how could you test that? In the case of a patient or experimental preparation, what are some other tests or questions that you would like to address? What are the limitations to the experimental approach or concept, and how might they be improved? If there were dysfunction (hyper- or hypo-activity) in these systems, what might happen to a person? What are your ethical limitations for experiments and treatments of disorders as our knowledge of motivation evolves? Although we are focusing on biological mechanism here, consider other factors for the type of motivation being discussed (evolutionary, developmental, societal, cross-species comparisons, etc.).

## OVERVIEW OF COURSE

WEEK	DATES	TOPIC	STUDENT ASSIGNMENTS
Week 1	1/5–1/9	Concepts 1-2	
Week 2	1/12–1/16	Concepts 3; Brain circuits	
Week 3	1/19–1/23	Animal models, stimulants	
Week 4	1/26–1/30	Sign-tracking & vulnerabilities	
Week 5	2/2–2/6	Opioids	Midterm exam 2/6
Week 6	2/9–2/13	Alcohol, Nicotine	
Week 7	2/16–2/20	Nicotine, Cannabinoids	Paper due 2/20
Week 8	2/23–2/27	Addiction theories 1-2	
Week 9	3/2–3/6	Addiction theories 3-4	
Last Class	3/9	Review of addiction	
Finals week			Final exam, date tbd.

## Course Outline

### WEEK 1 – CONCEPTS 1-2

#### Required readings:

Jan 7: Berridge sections 2, 3, 5 (pages 180-192 & 201-202).

Jan 9: Berridge section 4 (pages 193-197)

- **January 5:** Introduction.
- **January 7:** Concepts 1: Homeostasis, opponent processes, drives.
- **January 9:** Concepts 2: Seeking, effort, wanting, activation.

### WEEK 2 – CONCEPTS 3, BRAIN CIRCUITS

#### Required readings:

Jan 12: Dickinson A, Balleine B (2009), pgs. 74-79. (stop at “Disliking...” section)

Jan 16: Book pgs. 1-8

- **January 12:** Concepts 3: Cognitive desires & habits.
- **January 14:** Key brain circuits; neuroscience approaches
- **January 16:** Addiction & drug overview. (assignment: chunk of Book pgs. 23-60)

### WEEK 3 – ANIMAL MODELS, STIMULANTS

#### Required readings:

Jan 19: Book pgs. 23-60 (you will be assigned a chunk of this)

Jan 23: Book pgs. 82-109

- **January 19:** Animal models and tests – group participation.
- **January 21:** Stimulants – Group 1 presentation
- **January 23:** Stimulants

#### Presenter readings - STIMULANTS

[background] Book pgs. 69-82 (stop at “behavioral mechanisms”)

[experiment] Childress et al. (2008). PLoS One, 3(1):e1506.

### WEEK 4 – MODELS OF VULNERABILITY

#### Required readings:

Jan 28. Book pgs. 8-10 (short!)

- **January 26:** Guest lecture – Dr. Stephen Chang
- **January 28:** Vulnerabilities – Group 2 presentation
- **January 30:** Guest lecture – Dr. Jibran Khokhar

#### Presenter readings – VULNERABILITY MODELS

[background] Saunders, Robinson (2013). Neurosci Biobehav Rev, 37(9 Pt A):1955-75.

[experiment] Belin et al. (2008). Science, 320(5881):1352-5.

### WEEK 5 – OPIOIDS

#### Required readings:

Feb 4: Book pgs. 135-159 (start at “behavioral mechanisms”)

- **February 2:** Opioids; Group 3 presentation
- **February 4:** Opioids
- **February 6:** MID TERM EXAM

#### Presenter readings - OPIOIDS

[background] Book pgs. 121-134 (stop at “behavioral mechanisms”)

[experiment] Bienkowski et al (2004). Eur. Neuropsychopharmacol, 14:355–360.

### WEEK 6 – ALCOHOL, NICOTINE

#### Required readings:

Feb 11: Book pgs. 190-221

- **February 9:** Alcohol; Group 4 presentation
- **February 11:** Alcohol
- **February 13:** Nicotine; Group 5 presentation

#### Presenter readings - ALCOHOL

[background] Book pgs. 173-190 (stop at “behavioral mechanism”)

[experiment] Nasrallah et al. (2011). *Proc Natl Acad Sci*, 108(13):5466-71.

#### Presenter readings - NICOTINE

[review] Book pgs. 243-258 (stop at “behavioral mechanism”)

[experiment] Clements et al (2014). *Neuropsychopharm*, 39(11):2584-93.

### WEEK 7 – NICOTINE, CANNABINOIDS

#### Required readings:

**Feb 16:** Book pgs. 258-276 (start at “behavioral mechanism”)

**Feb 20:** Book pgs. 307-325 (start at “behavioral mechanism”)

- **February 16:** Nicotine
- **February 18:** Cannabinoids; Group 6 presentation
- **February 20:** Cannabinoids

#### Presenter readings - CANNABINOIDS

[review] Book pgs. 289-307 (stop at “behavioral mechanism”)

[experiment] Mahler et al. (2007). *Neuropsychopharm*, 32(11):2267-78.

### WEEK 8 – ADDICTION THEORIES 1-2

#### Required reading:

**Feb 25.** Robinson TE, Berridge KC (2001). *Addiction*, 96(1):103-14.

- **February 23:** Review & other drugs (e.g., psychedelics)
- **February 25:** Addiction theories 1: incentive sensitization
- **February 27:** Addiction theories 2: hedonic allostasis; Group 7 presentation

#### Presenter readings – HEDONIC ALLOSTASIS

[review] Book pgs. 11-14; 435-448 (stop at “pain and addiction”)

[experiment] Wheeler RA et al. (2008). *Neuron*, 57(5):774-85.

### WEEK 9 – ADDICTION THEORIES 3-4

#### Required reading:

**Mar 2:** Everitt, Robbins (2005). *Nat Neurosci*, 8(11):1481-9.

- **March 2:** Addiction theories 3: over-learning and habits
- **March 4:** Addiction theories 4: executive control; Group 8 presentation
- **March 6:** Addiction spillover in Parkinson's

#### Presenter readings – EXECUTIVE CONTROL

[review] Kalivas, Volkow (2005). *Am J Psychiatry*, 162(8):1403-13.

[experiment] Peters et al. (2008). *J Neurosci*, 28(23):6046-53.

### LAST CLASS – March 9 – REVIEW OF ADDICTION