

Psychology W1010: Mind, Brain and Behavior

Fall, 2013

Tuesday & Thursdays 11:40-12:55, Schermerhorn Hall Room # 501

Professor Dean Mobbs

Office Hours: Monday 4:10-6:00 + Wednesday 4.10-6:00
(Schermerhorn: Room 370) and by appointment.

TAs: emails (office hours, location in Schermerhorn)
TBD

****Note: this syllabus is subject to change. Please always check website for the most current version.**

Course Description

This course will provide an introduction to what we know about the fascinating link between the brain, the mind, and behavior. We will start with a basic review of the brain as a biological organ, its evolution, development, and its basic operations including visual, olfaction and others senses. Next, we will discuss how the brain gives rise to a wide variety of complex behaviors, memory, social and emotional behaviors. The course will finally introduce you to the wider neurophilosophical questions concerning freewill, death and consciousness.

Readings

The main textbook will be **Principles of Cognitive Neuroscience (2nd Edition)**, by Dale Purves et al., (Sinauer Press, 2013). This textbook will provide the primary reading source.

Additional supplements from articles and other book chapters will be available online as discussed in class. This information will be posted on Courseworks, in a folder called "Supplements".

Exams:

Format: Multiple choice.

Make-up exams: Will be allowed only with written justification and will be given only on a single date.

Exam 1: <u>September 25th</u> (20% of final grade)
Section 1: Basic neuroscience: basic anatomy, neurons, development and the senses.
Exam 2: <u>Oct 18th</u> (30% of final grade)
Section 2: Cognitive neuroscience I: Genes and cognition, neurological disorders, intelligence, memory, navigation.
Final Exam: <u>Dec. 13th</u> (50% of final grade)
Section 3: Cognitive neuroscience II: Body-ownership, decision-making, emotion and social behaviors, consciousness, freewill, and death. And all sections covered in the course.

Experiments

Participation in the experiment subject pool can earn you up to 6 credits, each worth 1/2 a point towards your final grade (for a maximum of 3 points).

Classroom policies

You may not use phones, laptops etc. for anything not directly related to the course (such as taking notes).

Calendar:

Tuesday Sept 3: What's this course about?

Introduction to the study of mind, brain and behavior.

Thursday Sept 5: What is the brain?

Introduction to the brain, its global architecture and basic functional features, pathways in the brain, methods

Required Reading: Chapters 1 (pp 16-32) + 2 + 3.

Tuesday Sept 10: What are neurons and what do neurons do?

The Basics: general architecture to cell structure and function, action potentials, neuronal firing and neurotransmitters.

Required Reading: Chapter 1 (pp 7-15 + Appendix)

Thursday Sept 12: The Developing Brain.

From conception to the adult brain.

Required Reading: Chapter 27

Tuesday Sept 17: The Senses I: The visual and auditory system

How we see and hear the world, how these senses influence each other in a multimodal fashion.

Required Reading: Chapters 5 + 6

Thursday Sept 19: The Senses II: The smelling and taste system

Olfactory and taste systems, how they influence our world. Synesthesia

Required Reading: Chapter 7 (pp 187-193) + Additional Reading Online.

- Hubbard, E. M. & Ramachandran, V. S. (2005). *Neurocognitive Mechanisms of Synesthesia*, 48(3), 509-520.

Tuesday Sept 24: Exam #1 (20% of grade)

Thursday Sept 26: How Genes Change Cognition – A case study of Williams Syndrome.

Required Reading: Articles (online)

- Meyer-Lindenberg A., Hariri, A. R., Munoz, K. E., Morris, C. A., Mervis C., Mattay, V. S., & Berman, K. F. (2005). Neural correlates of genetically abnormal social cognition in Williams Syndrome. *Nature Neuroscience*, 8(8), 991-993.
- Haas, B. W., Mills, D., Yam, A., Hoefl, F., Bellugi, U., & Reiss, A. (2009). Genetic influences on sociability: Heightened amygdala reactivity and event-related responses to positive social stimuli in Williams syndrome. *The Journal of Neuroscience*, 29(4), 1132-9.
- Bellugi, U., Järvinen-Pasley, A., Doyle, T., Reilly, J., & Korenberg, J. (2007). Affect, social behavior and brain in Williams Syndrome. Invited Paper Submitted to *Current Directions in Psychological Science*, 16(2), 99-104.
- Meyer-Lindenberg et al. (2006). Neural mechanisms in Williams syndrome: a unique window to genetic influences on cognition and behaviour. *Nature Reviews Neuroscience*, 7, 380-393.

Tuesday Oct 1: What neurological disorders teach us about the brain.

Delusions, hallucinations, prosopagnosia, etc.

Required Reading: Articles (online)

- Ellis, H. D., & Young, A. W. (1990). Accounting for delusional misidentifications. *The British Journal of Psychiatry*, 157(2), 239-48.
- Barton, J. (2011). Disorder of higher visual function. *Current Opinion in Neurology*, 24, 1-5.

Supplementary reading

- Sacks, O. (1985). *The Man Who Mistook His Wife for a Hat*. Paperback, Touchstone Books, ISBN 0-684-85394-9.

Thursday Oct 3: Intelligence.

Types of intelligence, neural systems, demand network. Was Einstein's Brain different? Evolutionary vs. conventional intelligences.

Required Reading: Articles (online)

- Deary, I. J. et al., (2010). The neuroscience of human intelligence differences. *Nature Reviews Neuroscience*, 11, 201-211.
- Gray, J. R. and Thompson, P. (2004). Neurobiology of intelligence: science and ethics. *Nature Reviews Neuroscience*, 5, 471-482.
- Witelson et al., (1999). The exceptional brain of Albert Einstein. *The Lancet*, 353.
- Kanazawa, S. (2004). General Intelligence as a Domain-Specific Adaptation. *Psychological Review*, 111(2), 512-523.

OCT 8TH – LAST CHANCE TO DROP CLASS!

Tuesday Oct 8: How does the brain store memories?

Learning and memory in the brain: Different neural systems support different kinds of memory.

Required Reading: Chapters 13 + 14 + 15

Thursday Oct 10: How we navigate the world.

Voies, taxi drivers, and place cells. Neural and cognitive mechanisms of way-finding.

Required Reading: Articles (online)

- Jacobs et al., (1990). Evolution of spatial cognition: sex-specific patterns of spatial behavior predict hippocampal size. *PNAS*, 87(16), 6349-6352.
- Woollett, K., Glesman, J., & Maguire, E. A. (2008). Non-Spatial Expertise and Hippocampal Gray Matter Volume in Humans. *Hippocampus*, 18(10), 981-984.
- Maguire, E. A., Gadian, D. G., Johnsrude, I. S., Good, C. D., Ashburner, J., Frackowiak, R. S., & Frith, C. D. (2000). Navigation-related structural change in the hippocampi of taxi drivers. *Proc Natl Acad Sci USA*, 97(8), 4398-4403.
- Woollett, K., Maguire, E. A. (2011). Acquiring "the Knowledge" of London's Layout Drives Structural Brain Changes. *Curr Biol*, 21(24), 2109-2114.
- Moser, et al., (2008). Place Cells, Grid Cells, and the Brain's Spatial Representation System. *Annu. Rev. Neurosci.* 2008, 31, 69-89.

Tuesday Oct 15th: "Catch-up" Day and Review Session.

Thursday Oct 17th: Exam #2 (30% of grade).

Tuesday Oct 22: Ownership over our bodies.

How we know our body is ours?

Required Reading: Articles (online)

- Blanke, O. (2012). Multisensory brain mechanisms of bodily self-consciousness. *Nature Reviews Neuroscience*, 13, 556-571.
- Ehrsson, H. H. (2011). The concept of body ownership and its relation to multisensory integration. In: *The New Handbook of Multisensory Processes*, B.E. Stein (Ed.), MA: MIT Press (Cambridge), pp. 775-792.
- Van der Hoort, B., Guterstam, A., & Ehrsson, H. H., (2011). Being Barbie: the size of one's own body determines the perceived size of the world. *PLoS One*, 6(5), 1-10.
- Ehrsson, H. H., Spence, C., & Passingham, R. E. (2004). 'That's my hand!' Activity in the premotor cortex reflects feeling of ownership of a limb. *Science*, 305, 875-877.
- Petkova, V. I., Björnsdotter, M., Gentile, G., Jonsson, T., Li, T. Q., & Ehrsson, H. H. (2011). From part to whole-body ownership in the multisensory brain. *Current Biology*, 21, 1-5.

Supplementary Readings:

- Ehrsson, H. H., Weich, K., Weiskopf, N., Dolan, R. J. & Passingham, R. E. (2007). Threatening a rubber hand that you feel is yours elicits a cortical anxiety response. *Proc. Natl. Acad. Sci. USA*, 104, 9828-9833.
- Petkova, V. I. & Ehrsson, H. H. (2008). If I were you: perceptual illusion of body swapping. *PLoS One*, 3(12), 1-9.
- Ehrsson, H. H., Rosén, B., Stockselius, A., Ragnö, C., Köhler, P., Lundborg, G. (2008). Upper limb amputees can be induced to experience a rubber hand as their own. *Brain*, 131, 3443-3452.
- Guterstam, A., Petkova, V. I., Ehrsson, H. H. (2011). The illusion of owning a third arm. *PLoS One*, 6(2), 1-11.

Thursday Oct 24: How do we make decisions?

Decision Neuroscience and Neuroeconomics

Required Reading: Chapter 24

Tuesday Oct 29: The Social Brain I

The basics of the social brain

Required Reading: Chapter 19 + Articles (online)

- Mobbs, D., Yu, R., Meyer, M., Passamonti, L., Seymour, B., Calder, A. J., Schweizer, S., Frith, C. D., Dalgleish, T. (2009). A key role for similarity in vicarious reward. *Science*, 324, 900.
- Mitchell, J. P., Macrae, C. N., & Banaji, M. R. (2006). Dissociable medial prefrontal contributions to judgments of similar and dissimilar others. *Neuron*, 50, 655-663.
- Rizzolatti, G. & Sinigaglia, C. (2010). The functional role of the parieto-frontal mirror circuit: interpretations and misinterpretations. *Nature Reviews Neuroscience*, 11, 264-274
- Frith, C. & Frith, U. (1999). Interacting minds--a biological basis. *Science*, 286(5445), 1692-1695.

Thursday Oct 31: The Social Brain II

Interacting with others

Required Reading: Articles (online)

- Takahashi, H., Kato, M., Matsuura, M., Mobbs, D., Suhara, T., & Okubo, Y. (2009). When Your Gain Is My Pain and Your Pain is My Gain: Neural Correlates of Envy and Schadenfreude. *Science*, 323, 937-939.
- Singer, T., Seymour, B., O'Doherty, J., Kaube, H., Dolan, R. J., & Frith, C. D. (2004). Empathy for pain involves the affective but not sensory components of pain. *Science*, 303(5661), 1157-1162.
Supplementary Reading.
- Bernhardt, B. C., & Singer, T. (2012). The neural basis of empathy. *Annual Review of Neuroscience*, 35, 1-23.

Tuesday Nov 5: Election Day - University Holiday- NO CLASS

Thursday Nov 7: The Moral Brain

Required Reading: Articles (online)

- FeldmanHall, O., Dalgleish, T., Thompson, R., Evans, D., Schweizer, S., & Mobbs, D. (2012). Differential neural circuitry and self-interest in real versus hypothetical moral decisions. *Social Cognitive and Affective Neuroscience*, 1-9.
- Greene, J. D., Sommerville, R. B., Nystrom, L. E., Darley, J. M., & Cohen, J. D. (2001). An fMRI investigation of emotional engagement in moral judgment. *Science*, 293, 2105-2108.
- Young, L., Camprodon, J., Hauser, M., Pascual-Leone, A., & Saxe, R. (2010). Disruption of the right temporo-parietal junction with transcranial magnetic stimulation reduces the role of beliefs in moral judgment. *PNAS*, 107(15), 6753-8.
- Moll, J., Zahn, R., de Oliveira-Souza, R., Krueger, F., & Grafman, J. (2005). Opinion: the neural basis of human moral cognition. *Nat Rev Neurosci*, 6 (10), 799-809.

Tuesday Nov 12: The Emotional Brain I

What are the neural mechanisms underlying negative emotions?

Required Reading: Chapter 17 + Articles (online)

- Mobbs, D., Yu, R. Rowe, J.B., Eich, H., FeldmanHall, O., & Dalgleish, T. (2010) Neural activity associated with monitoring the oscillating threat value of a Tarantula. *Proc Natl Acad Sci. USA*, 107(47), 20582-20586.
- Mobbs, D., Petrovic, P., Marchant, J., Hassabis, D., Seymour, B., Weiskopf, N., Dolan, R. J., & Frith, C. D. (2007). When Fear is Near: Threat Imminence Elicit Prefrontal - Periaqueductal Grey Shifts in Humans. *Science*, 24(317), 1079-83.
- McNaughton, N. & Corr, P. J. (2004). A two-dimensional neuropsychology of defense: fear/anxiety and defensive distance. *Neuroscience and Biobehavioural Reviews*, 28, 285-305.

Thursday Nov 14: The Emotional Brain II

What are the neural mechanisms underlying positive emotions?

Required Reading: Articles (online)

- Tamir, D. I. & Mitchell, J. P. (2012). Disclosing information about the self is intrinsically rewarding. *Proceedings of the National Academy of Sciences*, 109(21), 8038-8043.
- Reiss, A. L., Hoelt, F., Tenforde, A. S., Chen, W., Mobbs, D., & Mignot, E. (2008). Anomalous Hypothalamic Responses to Humor in Cataplexy. *PLoS-ONE*, 3(5), 1-6.
- Azim, E., Mobbs, D., Booil, Jo., Menon, V., & Reiss, A.L. (2005). Sex differences in brain activation elicited by humor. *Proc Natl Acad Sci. USA*, 102(45), 16496-16501.
- Mobbs, D., Greicius, M., Azim, E., Menon, V., & Reiss, A. L. (2003). Humor modulates the mesolimbic reward centers. *Neuron*, 40, 1041-1048.

Tuesday Nov 19: Consciousness

Vegetative state, implicit perception, and action

Required Reading: Chapter 28 + Articles (online)

- Bruno, M.A., Fernandez-Espejo, D., Lehembre, R., Tshibanda, L., Vanhaudenhuyse, A., Gosseries, O., Lommers, E., Napolitani, M. Noirhomme, Q., Boly, M., Papa, M., Owen, A.M., Maquet, P., Laureys, S., & Soddu, A. (2011). Multimodal neuroimaging in patients with disorders of consciousness showing "functional hemispherectomy". *Progress in Brain Research*, 193, 323-33.
- Monti, M. M., Vanhaudenhuyse, A., Coleman, M. R., Boly, M., Pickard, J. D., Tshibanda, J-F. L., Owen, A. M., & Laureys, S. (2010). Willful modulation of brain activity and communication in disorders of consciousness. *New England Journal of Medicine*, 362, 579-589.
- Silvano, J. (2008) A re-evaluation of blindsight and the role of striate cortex (V1) in visual awareness. *Neuropsychologia*, 0028-3932

Thursday Nov 21: Free will, the brain, and its implications

Required Reading: Articles (online)

- Flegel, J. (2007) Effects of *Toxoplasma* on Human Behavior. *Schizophr Bull*, 33(3), 757-760.
- Lau, H. C., Rogers, R. D., Haggard, P., Passingham, R. E. (2004). Attention to Intention *Science*, 303(5661), 1208-1.
- Stillman, T. F., Baumeister, R. F., Vohs, K. D., Lambert, N. M., Fincham, F. D., & Brewer, L. E. (2010). Personal philosophy and personnel achievement: Belief in

free will predicts better job performance. *Social Psychological and Personality Science*, 1, 43-50.

- Mobbs, D., Lau, H. C., Jones, O. D., Frith, C. D. (2007). Law, Responsibility and the Brain. *PLoS-Biology*, 5(4), 0693-0700.
- Aspinwall et al., (2012). The Double-Edged Sword: Does Biomechanism Increase or Decrease Judges' Sentencing of Psychopaths? *Science*, 337, 846-849.

Thursday Nov 26: Class movie

Thursday Nov 28: Thanksgiving Holiday- NO CLASS

Tuesday Dec 3: Death of the Brain

Neuroscience behind near-death and related experiences

Required Reading: Articles (online)

- Ehrsson, H. H. (2007). The experimental induction of out-of-body experiences. *Science*, 317, 1048.
- Mobbs, D. & Watt, C. (2011). There is nothing paranormal about near-death experiences: how neuroscience can explain seeing bright lights, meeting the dead, or being convinced you are one of them. *Trends in Cognitive Neuroscience*.
- Laureys, S. (2005). Death, unconsciousness and the brain. *Nature Reviews Neuroscience*, 6, 899-909.
- Blanke, O. (2002). Stimulating illusory own-body perceptions. *Nature*, 419, 269-270.
- Nelson, K. R. et al. (2007). Out-of-body experience and arousal. *Neurology*, 68, 794-795.
- Blanke, O. & Arzy, S. (2004). The out-of-body experience: disturbed self-processing at the temporo-parietal junction. *Neuroscientist*, 11, 16-24.

Thursday Dec 5: Review Session.

Dec 13-20 Final Exam (50% of grade)