

BIOPSYCHOLOGY OF MOTIVATION

Psychology 433 -- -Fall 2009

The University of Michigan

Professor Kent Berridge

Class: Mondays & Wednesdays at 1:00 -2:30 pm in Rm. B261 East Hall
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Office Hours: T 2:30-4:00 or by appointment

Readings: Readings are posted on the Ctools website

Description: This 3-credit course will focus upon topics in the affective neuroscience of motivation. Please note that the syllabus may change during the semester. The latest version is always posted on the Ctools web site. The date of a syllabus is at displayed bottom so you will know if you have the latest version.

Tentative Weekly Schedule (see Ctools for latest schedule):

	<u>Monday</u>	<u>Wednesday</u>
September 9:	Introduction	
September 14 & 16:	Traditional concepts of motivation & interaction with learning	
September 21 & 23:	<i>Dr. B away 21st</i>	Traditional concepts of emotion & brain
September 28 – 30:	Limbic system	Limbic system
October 5 & 7:	New Limbic systems	Limbic & Pleasure neuroscience
October 12 & 14:	Pleasure neuroscience	Hedonic consciousness
October 19 & 21	Study Break	1st Exam Oct 21
October 26 & 28:	<i>Dr B away 26th</i>	Dopamine in reward
November 2 & 4:	Dopamine &	Addiction
November 9 & 11:	Addiction	Thirst & Salt appetite
November 16 & 18:	Hunger	Hunger & -Reward connections
November 23 & 25	2nd Exam Nov 23	Hunger-Reward & Pain
Nov 30 & Dec 2:	Pain, fear & stress	Fear & Sex
December 7 & 9:	Sex	Sex & Aggression
December 14 :	Aggression	

In class exams are October 21 and November 23: Final exam is Friday, December 18 (4-6 pm)

Grading

Your grade will be based on 3 exams, and on your depth paper, online entries and class participation. Relative weighting for grades will be:

Online comments & class discussion	=	10%
Paper & class presentation	=	20%
Exams =	=	20%, 25%, 25%

Other Student Responsibilities & Grading

Our goal in this class is to make you into an expert in affective neuroscience 😊.

Reading: We will be reading advanced papers, and lots of them, which you will want to tackle in a spirit of adventure. Reading before class (and quite probably re-reading some again after class) is essential to a successful seminar! Every student is expected to read the assigned regular articles prior to that class. In addition, you are expected to choose and read at least *one* extra reading for each topic prior to discussion (or *two* extra readings for the topics you give online comments on; and *all* readings for the topic you write your paper on [up to 4 extra readings]).

Depth topic: Paper & Expert panel discussion. Everyone will pick 1 depth topic for a paper (7-10 pages) and expert panel. I will pose questions to guide you for each topic. The expert panel will post a web entry to summarize its opinion (e.g., wiki; 1 – 2 pages total). The panel entry must be posted by Saturday midnight before the week of the topic so that everyone can read. Panel members will also be expected to help in class discussion of that topic. Your paper on the depth topic is due within two weeks of class discussion of the topic (or before the beginning of Finals period for topics near the end of semester).

3 Comments Online: We will have online discussions to help stimulate thought about weekly topics. Everyone must contribute 3 online comments (half-page length). One comment is expected per month. Two comments must be given before that week's topics (entered by 3 pm Sunday prior to that week's topic; double-length if you miss the deadline), and the remaining comment can be entered within 1 week after the topic is discussed. You are also expected to participate in discussion in class of those topics.

Reading List – Psychology 433

Traditional Motivation & Learning Concepts

Regular readings:

Berridge, K. C. (2004). Motivation concepts in behavioral neuroscience. *Physiol Behav*, 81(2), 179-209 (read pp. 179-194)

Extra readings:

Dickinson, A, Balleine, B. Hedonics: The Cognitive-Motivational Interface. In: Kringelbach, ML, Berridge, KC, editors. *Pleasures of the brain*. Oxford, U.K.: Oxford University Press, 2010.

Berridge, K. C. (2001). Reward learning: Reinforcement, incentives, and expectations. In D. L. Medin (Ed.), *The Psychology of Learning and Motivation* (Vol. 40, pp. 223-278). N.Y.: Academic Press.

Traditional Emotion Concepts

Does the brain have specialized emotion structures or does all the brain generate emotion?

Regular readings:

James, W., What is an emotion, *Mind*, 9 (1884) 188-205.

Cannon, W. B. (1987). The James-Lange theory of emotions: a critical examination and an alternative theory. By Walter B. Cannon, 1927. *Am J Psychol*, 100(3-4), 567-586.

Extra readings:

Feldman Barrett, L., & Wager, T. D. (2006). The Structure of Emotion: Evidence From Neuroimaging Studies. *Current Directions in Psychological Science* 15(2), 79-83.

Beer, J. S., Heerey, E. A., Keltner, D., Scabini, D., & Knight, R. T. (2003) The regulatory function of self-conscious emotion: insights from patients with orbitofrontal damage. *Journal of Personality and Social Psychology*, 85: 594-604.

Burke, KA, Miller, D, Schoenbaum, G. Conditioned Reinforcement and the specialized role of corticolimbic circuits in the pursuit of happiness and other more specific rewards. In: Kringelbach, ML, Berridge, KC, editors. *Pleasures of the Brain*. Oxford, U.K.: Oxford University Press, 2010.

Critchley, H. D., Wiens, S., Rotshtein, P., Ohman, A., & Dolan, R. J. (2004). Neural systems supporting interoceptive awareness. *Nat Neurosci*, 7(2), 189-195.

Old Limbic System

What is the limbic system? Is it still a good idea?

Regular readings:

LeDoux, J. (1996). Limbic system chapter in *The Emotional Brain*. New York: Simon & Schuster (easy to read intro on classic limbic system)

Extra readings:

Papez, J. W. (1995 [original 1937]). A proposed mechanism of emotion. 1937 [classical article]. *Journal of Neuropsychiatry & Clinical Neurosciences*, 7(1), 103-112.

Maclean, P. (1955). The limbic system ('visceral brain') and emotional behavior. *Archives of Neurology & Psychiatry*, 73, 120-133.

Damasio, A. (2003). Feelings of emotion and the self. *Ann N Y Acad Sci*, 1001, 253-261.

New Limbic system

How should new limbic structures fit into the limbic system? (nucleus accumbens, ventral pallidum, extended amygdala, orbitofrontal cortex, ventromedial cortex [infralimbic and limbic cortex], insula cortex, etc)?

Regular readings:

Heimer, L., & Van Hoesen, G. W. (2006). The limbic lobe and its output channels: Implications for emotional functions and adaptive behavior. *Neuroscience & Biobehavioral Reviews*, 30(2), 126-147. (not easy but authoritative update)

Extra readings:

Morgane, P. J., & Mokler, D. J. (2006). The limbic brain: Continuing resolution. *Neuroscience & Biobehavioral Reviews*, 30(2), 119-125. (update commentary)

Zahm, D. S. (2006). The evolving theory of basal forebrain functional--anatomical 'macrosystems'. *Neuroscience & Biobehavioral Reviews*, 30(2), 148-172. (update commentary)

Swanson, L. W. (2005). Anatomy of the soul as reflected in the cerebral hemispheres: neural circuits underlying voluntary control of basic motivated behaviors. *J Comp Neurol*, 493(1), 122-131. (alternative large systems view)

Alheid, G. F. (2003). Extended amygdala and basal forebrain. *Ann N Y Acad Sci*, 985, 185-205. (the case for new concept of extended amygdala)

Expanding new limbic system?

Is nearly every brain structure part of the limbic system? Even sensory and motor structures?

- Shuler, M. G., & Bear, M. F. (2006). Reward Timing in the Primary Visual Cortex. *Science*, 311(5767), 1606-1609. (reward in sensory cortex?)

Volkow, N. D., Wang, G. J., Telang, F., Fowler, J. S., Logan, J., Childress, A. R., et al. (2006). Cocaine cues and dopamine in dorsal striatum: mechanism of craving in cocaine addiction. *J Neurosci*, 26(24), 6583-6588. (*puts wanting in the neostriatum?*)

-Szczycka, M. S., Kwok, K., Brot, M. D., Marck, B. T., Matsumoto, A. M., Donahue, B. A., et al. (2001). Dopamine production in the caudate putamen restores feeding in dopamine-deficient mice. *Neuron*, 30(3), 819-828. (*Nice parcellation of roles for striatum and accumbens*)

Pleasure

Where does pleasure come from? What in the brain generates pleasure? What are the roles of cortex versus subcortical brain structures in pleasure? Can a pleasure ever be truly unconscious and yet exist?

Regular readings:

Short Answers to Fundamental Questions about Pleasure. In M. L. Kringelbach & K. C. Berridge (Eds.), *Pleasures of the Brain*. Oxford, U.K.: Oxford University Press.

Berridge, KC, Kringelbach, ML. *Affective neuroscience of pleasure: reward in humans and animals*. *Psychopharmacology (Berl)* 2008;199:457-480.

Extra readings:

Blood, A. J., & Zatorre, R. J. (2001). Intensely pleasurable responses to music correlate with activity in brain regions implicated in reward and emotion. *Proc Natl Acad Sci U S A*, 98(20), 11818-11823.

Small, D. M., Zatorre, R. J., Dagher, A., Evans, A. C., & Jones-Gotman, M. (2001). Changes in brain activity related to eating chocolate - From pleasure to aversion. *Brain*, 124, 1720-1733.

Wheeler, R. A., & Carelli, R. M. (2006). The neuroscience of pleasure: Focus on Ventral pallidum firing codes hedonic reward: when a bad taste turns good. *J Neurophysiol*.

Frijda, N. (2010). On the nature and function of pleasure. In M. L. Kringelbach & K. C. Berridge (Eds.), *Pleasures of the Brain*. Oxford, U.K.: Oxford University Press.

Pecina, S., Smith, K. S., & Berridge, K. C. (2006). Hedonic hot spots in the brain. *Neuroscientist*, 12(6), 500-511.

Kringelbach, M. L. (2010). The hedonic brain: A functional neuroanatomy of human pleasure. In M. L. Kringelbach & K. C. Berridge (Eds.), *Pleasures of the brain*. Oxford, U.K.: Oxford University Press.

Leknes, S., & Tracey, I. (2010). Pleasure and pain: Masters of mankind. In M. L. Kringelbach & K. C. Berridge (Eds.), *Pleasures of the Brain*. Oxford, U.K.: Oxford University Press.

Smith, K. S., Mahler, S. V., Pecina, S., & Berridge, K. C. (2010). Hedonic Hotspots: Generating Sensory Pleasure in the Brain. In M. Kringelbach & K. C. Berridge (Eds.), *Pleasures of the Brain*. Oxford, U.K.: Oxford University Press.

Can pleasure be unconscious?

Yes or no?

Regular readings:

Winkielman, P., & Berridge, K. C. (2004). Unconscious emotion. *Current Directions in Psychological Science*, 13(3), 120-123.

Extra readings:

Adolphs, R., Tranel, D., Koenigs, M., & Damasio, A. R. (2005). Preferring one taste over another without recognizing either. *Nat Neurosci*, 8(7), 860-861.

Schooler, J. W., & Mauss, I. B. (2010). To be happy and to know it: The experience and meta-awareness of pleasure. In M. L. Kringelbach & K. C. Berridge (Eds.), *Pleasures of the Brain*. Oxford, U.K.: Oxford University Press.

Electrical Brain Stimulation & Pleasure

Do reward electrodes cause pleasure? If not, what do they cause?

Regular readings:

Heath, R. G. (1972). Pleasure and brain activity in man. Deep and surface electroencephalograms during orgasm. *Journal of Nervous and Mental Disease*, 154(1), 3-18. (original human pleasure electrode)

Extra reading:

Herzog J, Reiff J, Krack P, Witt K, Schrader B, et al. (2003) Manic episode with psychotic symptoms induced by subthalamic nucleus stimulation in a patient with Parkinson's disease. *Mov Disord* 18: 1382-1384.

Krack, P., Kumar, R., Ardouin, C., Dowsey, P. L., McVicker, J. M., Benabid, A. L., et al. (2001). Mirthful laughter induced by subthalamic nucleus stimulation. *Movement Disorders: Official Journal Of The Movement Disorder Society*, 16(5), 867-875.

Morgan, J. C., diDonato, C. J., Iyer, S. S., Jenkins, P. D., Smith, J. R., & Sethi, K. D. (2006). Self-stimulatory behavior associated with deep brain stimulation in Parkinson's disease. *Mov Disord*, 21(2), 283-285. (very recent reward study)

Okun, M. S., Bowers, D., Springer, U., Shapira, N. A., Malone, D., Rezai, A. R., et al. (2004). What's in a "smile?" Intra-operative observations of contralateral smiles induced by deep brain stimulation. *Neurocase: Case Studies In Neuropsychology, Neuropsychiatry, And Behavioural Neurology*, 10(4), 271-279. (

Halbig, T. D., Gruber, D., Kopp, U. A., Schneider, G. H., Trottenberg, T., & Kupsch, A. (2005). Pallidal stimulation in dystonia: effects on cognition, mood, and quality of life. *J Neurol Neurosurg Psychiatry*, 76(12), 1713-1716.

Green, A. L., Pereira, E. A., & Aziz, T. Z. (2010). Deep brain stimulation and pleasure. In M. L. Kringelbach & K. C. Berridge (Eds.), *Pleasures of the brain*. Oxford, U.K.: Oxford University Press.

What is the role of dopamine in reward?

Does dopamine cause pleasure? Learning? Incentive salience? Arousal and vigor? Or??

Regular readings:

Berridge, K. C. (2007). The debate over dopamine's role in reward: the case for incentive salience. *Psychopharmacology* 191, 391-431, 2007.

Extra reading:

Montague, P. R., Hyman, S. E., & Cohen, J. D. (2004). Computational roles for dopamine in behavioural control. *Nature*, 431(7010), 760-767.

Leyton, M. The neurobiology of desire humans. In: Kringelbach, ML, Berridge, KC, editors. Pleasures of the brain. Oxford, U.K.: Oxford: Dopamine and the regulation of mood and motivational states in University Press, 2010

Schultz, W. (2006). Behavioral Theories and the Neurophysiology of Reward. *Annu Rev Psychol*.

Wise, R. A. (2006). Role of brain dopamine in food reward and reinforcement. *Philos Trans R Soc Lond B Biol Sci*, 361(1471), 1149-1158.

Robbins, T. W., & Everitt, B. J. (2007). A role for mesencephalic dopamine in activation: commentary on Berridge (2006). *Psychopharmacology (Berl)*.

Evans, A. H., Pavese, N., Lawrence, A. D., Tai, Y. F., Appel, S., Doder, M., et al. (2006). Compulsive drug use linked to sensitized ventral striatal dopamine transmission. *Ann Neurol*, 59(5), 852-858.

Pessiglione, M., B. Seymour, et al. (2006). "Dopamine-dependent prediction errors underpin reward-seeking behaviour in humans." *Nature* 442(7106): 1042-5.

Addiction

What makes addiction so compulsive? Escape from withdrawal? Distorted learning circuits? Incentive-sensitization? Or??

Regular readings:

Koob, GF, Le Moal, M. Review. Neurobiological mechanisms for opponent motivational processes in addiction. *Philos Trans R Soc Lond B Biol Sci* 2008;363:3113-3123.

Robinson, T. E., & Berridge, K. C. (2003). Addiction. *Annual Review of Psychology*, 54(1), 25-53.

Everitt, BJ, Belin, D, Economidou, D, Pelloux, Y, Dalley, JW, Robbins, TW. Review. Neural mechanisms underlying the vulnerability to develop compulsive drug-seeking habits and addiction. *Philos Trans R Soc Lond B Biol Sci* 2008;363:3125-3135.

Extra reading:

Kalivas, P. W., & Volkow, N. D. (2005). The neural basis of addiction: a pathology of motivation and choice. *Am J Psychiatry*, 162(8), 1403-1413.

Robinson, TE, Berridge, KC. Review. The incentive sensitization theory of addiction: some current issues. *Philos Trans R Soc Lond B Biol Sci* 2008.

Volkow, ND, Wang, G-J, Fowler, JS, Telang, F. Overlapping neuronal circuits in addiction and obesity: evidence of systems pathology. *Philosophical Transactions of the Royal Society B: Biological Sciences* 2008;363:3191-3200.

Hyman, S. E., Malenka, R. C., & Nestler, E. J. (2006). Neural mechanisms of addiction: the role of reward-related learning and memory. *Annu Rev Neurosci*, 29, 565-598.

Solomon, R. Acquired motivation and affective opponent processes. *Neurobiology of Learning, Emotion, and Affect* (J. Madden, Ed), Raven Press, 1991.

Naqvi, N. H., Rudrauf, D., Damasio, H., & Bechara, A. (2007). Damage to the insula disrupts addiction to cigarette smoking. *Science*, 315(5811), 531-534.

Pain, Fear & Stress

What in the brain causes pain? What is special about insula cortex? How do acupuncture or hypnosis control pain?

Regular readings:

Fields, H. (2004). State-dependent opioid control of pain. *Nat Rev Neurosci*, 5(7), 565-575.

Craig, A.D., How do you feel right now? *Nature Neurosci Review*, 2009

Extra reading:

Calder, A. J., Lawrence, A. D., & Young, A. W. (2001) Neuropsychology of fear and loathing. *Nature Reviews Neuroscience* 2, 352-363.

Hilgard: Hypnotic experience

Zhao, ZQ. Neural mechanism underlying acupuncture analgesia. *Prog Neurobiol* 2008;85:355-375.

Schweinhardt P, Glynn C, Brooks J, McQuay H, Jack T, Chessell I, Bountra C, Tracey I: An fMRI study of cerebral processing of brush-evoked allodynia in neuropathic pain patients. *Neuroimage* 2006, 32:256-265.

Bob, P. Pain, dissociation and subliminal self-representations. *Conscious Cogn* 2008;17:355-369.

Wobst, AH. Hypnosis and surgery: past, present, and future. *Anesth Analg* 2007;104:1199-1208.

Melzack, R., & Scott, T. H. (1957). The effect of early experience on the response to pain. *Journal of Comparative and Physiological Psychology*, 50, 155-161.

Hilgard, E.R., & Hilgard, J.R. *Hypnosis in the Relief of Pain*, Kaufman, Los Altos, 1983

Lee, S. J., Ralston, H. J., Drey, E. A., Partridge, J. C., & Rosen, M. A. (2005). Fetal pain: a systematic multidisciplinary review of the evidence. *Jama*, 294(8), 947-954

Thirst & Salt Appetite

Regular reading:

Stricker, E. M., & Sved, A. F. (2000). Thirst. *Nutrition*, 16(10), 821-826.

Krause EG, Sakai RR (2007) Richter and sodium appetite: From adrenalectomy to molecular biology. *Appetite*.

Extra reading:

Johnson, A. K. (2007). The sensory psychobiology of thirst and salt appetite. *Med Sci Sports Exerc*, 39(8), 1388-1400.

Johnson, A. K., de Olmos, J., Pastuskovas, C. V., Zardetto-Smith, A. M., & Vivas, L. (1999). The extended amygdala and salt appetite. *Ann N Y Acad Sci*, 877, 258-280.

Sakai, R. R. (2004). The future of research on thirst and salt appetite. *Appetite*, 42(1), 15-19.

Stricker, E.M. Thirst. In: *Handbook of Behavioral Neurobiology*, volume 14, Food and Fluid Intake, edited by Stricker, E.M., and Woods, S.C. New York: Kluwer Academic/Plenum, pp. 505-543, 2004

Johnson, A. K. (2007). The sensory psychobiology of thirst and salt appetite. *Med Sci Sports Exerc*, 39(8), 1388-1400.

Hunger

Is hunger driven by a body weight set-point? What brain mechanisms control appetite?

Regular readings:

Bolles: "Some functionalistic thoughts about regulation"

Gao, Q., & Horvath, T. L. (2007). Neurobiology of feeding and energy expenditure. *Annu Rev Neurosci*, 30, 367-398.

Extra reading:

Gura, T. Science news report Feb 7 2003: Obesity drug pipeline not so fat, *Science* Vol 299 p849-852

Robertson, S. A., Leininger, G. M., & Myers Jr, M. G. (2008). Molecular and neural mediators of leptin action. *Physiology & Behavior*, 94(5), 637-642.

New hunger-reward connections

How does hunger alter the brain's response to food reward stimuli? How do hypothalamic regulatory and limbic reward structures interact?

Regular readings:

Shin AC, Zheng H, Berthoud H-R (2009) An expanded view of energy homeostasis: Neural integration of metabolic, cognitive, and emotional drives to eat. *Physiol Behav* 97:572-580.

Palmiter, R. D. (2007). Is dopamine a physiologically relevant mediator of feeding behavior? *Trends Neurosci*, 30(8), 375-381.

Morton, G. J., Cummings, D. E., Baskin, D. G., Barsh, G. S., & Schwartz, M. W. (2006). Central nervous system control of food intake and body weight. *Nature*, 443(7109), 289-295. (*leptin, orexin et al -- interact with reward circuits*)

Extra readings:

Kelley, A. E., Baldo, B. A., & Pratt, W. E. (2005). A proposed hypothalamic-thalamic-striatal axis for the integration of energy balance, arousal, and food reward. *J Comp Neurol*, 493(1), 72-85. (*anatomical circuit model*)

-Cota, D., Tschop, M. H., Horvath, T. L., & Levine, A. S. (2006). Cannabinoids, opioids and eating behavior: the molecular face of hedonism? *Brain Res Rev*, 51(1), 85-107.

Scammell, T. E., & Saper, C. B. (2005). Orexin, drugs and motivated behaviors. *Nat Neurosci*, 8(10), 1286-1288. (*orexin and dopamine get together summary*)

Harris, G. C., Wimmer, M., & Aston-Jones, G. (2005). A role for lateral hypothalamic orexin neurons in reward seeking. *Nature*, 437(7058), 556-559. (*orexin and dopamine actual study*)

Berthoud, H.-R. (2004). Mind versus metabolism in the control of food intake and energy balance *Physiology & Behavior*, 81(5), 781-793. (*more on anatomical circuit interactions*)

Sex

What brain systems generate sexual desire? Are male and female 'styles' of human sexuality entirely different, with different neural systems? Or are they essentially similar? What determines human sexual orientation or gender identity? How do sexual stimuli & experiences (including pheromone exposure) alter subsequent physiology or fertility?

Regular readings:

Morris, JA, Jordan, CL, Breedlove, SM. Sexual differentiation of the vertebrate nervous system. *Nature neuroscience* 2004;7:1034-1039

Georgiadis, J. R., & Kortekaas, R. (2010). The sweetest taboo: functional neurobiology of human sexuality in relation to pleasure. In M. L. Kringelbach & K. C. Berridge (Eds.), *Pleasures of the Brain*. New York: Oxford University Press.

Extra readings by subtopic:**Sexual orientation & gender identity**

Money, J., Agenda and credenda of the Kinsey scale. In D. P. McWhirter, S. A. Sanders and J. M. Reinisch (Eds.), *Homosexuality/Heterosexuality: Concepts of sexual orientation*, Oxford University Press, New York, 1990, pp. 41-60.

Gooren, L. The biology of human psychosexual differentiation. *Horm Behav* 2006;50:589-60

Savic, I., & Lindstrom, P. (2008). PET and MRI show differences in cerebral asymmetry and functional connectivity between homo- and heterosexual subjects. *Proc Natl Acad Sci U S A*, 105(27), 9403-9408.

Swaab, DF. Sexual orientation and its basis in brain structure and function. *Proc Natl Acad Sci U S A* 2008;105:10273-10274.

Rahman, Q. The neurodevelopment of human sexual orientation. *Neurosci Biobehav Rev* 2005;29:1057-1066.

Diamond LM, 2003. What does sexual orientation orient? A biobehavioral model distinguishing romantic love and sexual desire. *Psychological Review*, 110(1), 173-192.

Experiential control of sexual physiology:

Wysocki, C. J., & Preti, G. (2004). Facts, fallacies, fears, and frustrations with human pheromones. *Anat Rec A Discov Mol Cell Evol Biol*, 281(1), 1201-1211.

More detail on experiential controls of physiology (if you're really interested)

Preti, G., Wysocki, C. J., Barnhart, K. T., Sondheimer, S. J., & Leyden, J. J. (2003). Male axillary extracts contain pheromones that affect pulsatile secretion of luteinizing hormone and mood in women recipients. *Biology of Reproduction*, 68(6), 2107-2113.

van Anders S. M., Hamilton, L. D., Schmidt, N., & Watson, N. V. (2007). Associations between testosterone secretion and sexual activity in women. *Hormones and Behavior*, 51, 477-482

McClintock, M. K. (1999). Reproductive biology - Pheromones and regulation of ovulation - Reply. *Nature*, 401(6750), 232-233.

Stern, K., & McClintock, M. K. (1998). Regulation of ovulation by human pheromones. *Nature*, 392(6672), 177-179.

Culture & Identity:

Nichols, M. Lesbian relationships: implications for the study of sexuality and gender. In *Homosexuality-Heterosexuality: concepts of sexual orientation*. D.P. McWhirter, S.A. Sanders, J. Reinisch (Eds.) pp. 350-364, Oxford Press (1990).

Diamond, M. and Sigmundson H. K., Sex reassignment at birth. Long-term review and clinical implications, *Arch Pediatr Adolesc Med*, 151 (1997) 298-304.

Vasey PL and Bartlett NH. (2007) What can the Samoan "Fa'afafine" teach us about the Western concept of gender identity disorder in childhood? *Perspect Biol Med*. 50(4):481-90.

de Waal, F. B. M. (1995). Bonobo sex and society. *Scientific American*, March 1995, 82-

Aggression

What are the chief brain bases of aggression? Do different types of aggression correspond to different neural systems? Can any type of pathological aggression be controlled in principle via drugs Can any type of pathological aggression be controlled by psychosurgery? In violent patients? In prisoners

Regular readings:

Nelson, RJ, Trainor, BC. Neural mechanisms of aggression. *Nat Rev Neurosci* 2007;8:536-546.

Siever, L.J. Neurobiology of aggression and violence. *Am J Psychiatry* 2008;165:429-442.

Extra readings:

Valenstein, E.S. *Brain Control*, New York: Wiley & Sons, 1973, pp. 209-263.

Siegel, A, Bhatt, S, Bhatt, R, Zalcman, SS. The neurobiological bases for development of pharmacological treatments of aggressive disorders. *Curr Neuropharmacol* 2007;5:135-147.

Fountas, K. N., & Smith, J. R. (2007). Historical evolution of stereotactic amygdalotomy for the management of severe aggression. *J Neurosurg*, 106(4), 710-713.

Lee GP, Bechara A, Adolphs R, Arena J, Meador KJ, Loring DW, Smith JR. Clinical and physiological effects of stereotaxic bilateral amygdalotomy for intractable aggression. *J Neuropsychiatry Clin Neurosci*. 1998 Fall;10(4):413-20

Kim, M. C., Lee, T. K., & Choi, C. R. (2002). Review of long-term results of stereotactic psychosurgery. *Neurol Med Chir (Tokyo)*, 42(9), 365-371.

Mpakopoulou, M., Gatos, H., Brotis, A., Paterakis, K. N., & Fountas, K. N. (2008). Stereotactic amygdalotomy in the management of severe aggressive behavioral disorders. *Neurosurg Focus*, 25(1), E6.

Sano, K. & Mayanagi, Y. Posteromedial hypothalamotomy in the treatment of violent aggressive behavior. *Acta Neurochirurgica Supplementum*, 44, 145-154, 1988

Weiger, W.A. & Bear, D.M., An approach to the neurology of aggression j. *Psychiat. Res.* 22, 8598, 1988.