

NROC64S COURSE SYLLABUS: WINTER 2005

SENSORY AND MOTOR SYSTEMS

COURSE DETAILS

Instructor:

Professor N.W. Milgram
Room S-637
287-7402
Office hours: M 14:00-16:00
email milgram@psych.utoronto.edu

Teaching Assistants:

Classrooms And Scheduled Times:

Lectures:

Monday 10:00-12:00 SW143
Wednesday 10:00-11:00 SW128

Course Description

This course covers the neurobiology of sensory and motor systems. The goal is to understand how the external world is encoded (sensory coding), recognized (perception) and acted upon (motor control). The course will start with a general discussion of neural coding and representation. The next topic will be vision. We start with an analysis of retinal processes, which include image formation, visual transduction and retinal coding. This is followed by a discussion of CNS processing – the transformation of neural codes to visual perception.

We will then cover the other main sensory systems. These include the auditory system, somatosensory system (touch, thermosensitivity, kinesthesia, pain), olfactory system and gustatory system.

The last topic will be motor control. We will first look at muscle contraction, and the associated peripheral and spinal control mechanisms. We will then focus on the brain motor system and how this is involved in planning and triggering motor sequences.

Course Materials

Tests will be based on lecture notes and assigned readings. The readings will be Scientific American articles that relate to topics covered in this course..

Powerpoint slides used in the lectures will be placed on the internet course site. The URL is <http://www.utoronto.ca/~milgram/nroc64/>

The URL also has a set of lecture notes, which are intended to provide further reference material and do not constitute assigned reading

Grading

Grades will be based on two midterms (February 2th and March 17th) worth 25% each (50% in total), a comprehensive final exam worth 50%.

The exam questions will consist of multiple choice, fill in the blank, true false, matching and short answer questions. Examples are on the course URL.

ASSIGNED READINGS

- Andersen, J.L., Schjerling, P., & Saltin, B. (2000). Muscles, genes and athletic performance. *Scientific American* (September)283, 48-55.
- Borg, E., & Counter, A. (1989). The middle-ear muscles. *Scientific American* (August), 261, 74-81.
- Bower, J.M., & Parsons, L.M. (2003). Rethinking the lesser brain. *Scientific American* (August), 289, 50-57.
- Catania, K.C. (2002). The nose takes a starring role. *Scientific American* (July), 287, 54-60.
- Dahm, T. (2004). Dying to see. *Scientific American* (October), 29, 83-89.
- Freeman, W.J. (1991). The physiology of perception. *Scientific American* (February), 264, 78-87.
- Freeman, W.J. (1991) The physiology of perception. *Scientific American* (Feb)., 78-85
- Grillner, S. (1996) Neural networks for vertebrate locomotion. *Scientific American* (January), 274, 64-69.
- Livingstone, M.S. (1985). Art, illusion and the visual system. *Scientific American*, 258, 78-85.
- Logothetis, N.K. (1999). Vision: a window on consciousness. *Scientific American* (November), 279, 69-75.
- Melzack, R. (1990). The tragedy of needless pain *Scientific American* (Feb), 262, 27-33.
- Melzack, R. (1992). Phantom limbs. *Scientific American* (April), 120-126.
- Nicolelis, M.A.L., & Chapin, J.K. Controlling robots with the mind. (2002), *Scientific American*, 287 46-53.
- Ramachandran, V.S. and Hubbard, EM (2004). Hearing colors, tasting shapes. *Scientific American*, (May), 288, 53-59.
- Ramachandran, V.S. (1992). Blind spots. *Scientific American* (May), 266, 86-91.
- Smith, D.V., & Margolske R.F., (2001). Making Sense of Taste. *Scientific American* (March), 284, 32-39.
- Sun, H., & Nathans, J. (2001). The challenge of macular degeneration. *Scientific American*, (October), 285, 68-75.
- Suga, N. (1990). Biosonar and neural computation in bats. *Scientific American* (June), 262, 60-71.
- Weinberger, N.W. (2004). Music and the brain. *Scientific American* (Nov), 291, 88-95.

COURSE SCHEDULE

| Week and Date | Topics | Assigned Reading |
|---------------|--|--|
| 1- Jan 5 | Introduction; Sensory Codes and Representations | Ramachandran |
| 2- Jan 10 | Vision: The Visual Stimulus | Dahm |
| 12 | Vision: Structure of the Eye; Formation of Retinal Images | Sun and Nathans |
| 3- Jan 17 | Vision: Transduction Mechanisms | |
| 19 | Vision: Retinal Coding; Visual Pathways in CNS | Livingstone |
| 4- Jan 24 | Vision: Representations of Objects and Space | Logothetis; Ramachandran and Hubbard |
| 26 | Audition: Sound - Peripheral Mechanisms | |
| 5- Jan 31 | Peripheral Mechanisms in Audition – the Cochlea; transduction mechanisms | Borg and Counter |
| Feb 2 | First Midterm Exam (In Class) | |
| 6- Feb 7 | Audition: The Auditory Nerve | Suga |
| 9 | Anatomy of Brain Auditory System; Cortical Mechanisms | Weinberger |
| Feb 14- 20 | Reading Week: No Classes | |
| 7- Feb 21 | Somatosensory Systems: Introduction and Historical Background | Catania |
| 23 | Peripheral Coding of the Somatosensory system - Somatosensory System anatomy | Melzack (1990) |
| 8- Feb 28 | Cortical Processing - Somatosensory Plasticity | Melzack (1992) |
| Mar 2 | Olfaction and Taste | Smith and Margolskee |
| 9- Mar 7 | Olfaction | |
| 9 | Central Nervous System Processing Odors | Freeman |
| 10- Mar 14 | Movement: Organization of Motor Control: Control of Muscle contraction | Andersen et al. |
| 16 | Second Midterm Exam | |
| 11- Mar 21 | The Muscle Spindle System | Grillner |
| 23 | Preprogrammed Response Sequences; The Cerebellum | Bower and Parsons |
| 12- Mar 28 | Premotor Networks and Motor Cortex | Nicolelis and Chaplin |
| Mar 30 | Basal Ganglia and Cortical Processing Networks; Motor Plans and Images | |
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