

# NROC64S COURSE SYLLABUS: WINTER 2004

## 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](mailto:milgram@psych.utoronto.edu)

#### **Teaching Assistants:**

Candace Ikeda-Douglas ([candace@scar.utoronto.ca](mailto:candace@scar.utoronto.ca))  
Pria Nippak ([pria.nippak@utoronto.ca](mailto:pria.nippak@utoronto.ca))  
Cleo Leung ([cleo.leung@utoronto.ca](mailto:cleo.leung@utoronto.ca))

#### **Classrooms And Scheduled Times:**

**Lectures: 10:00 M,W, F**  
Monday H305  
Wednesday BV264  
Friday H305

#### **Tutorials**

Monday 3:00 Room SW208  
Monday 4:00 Room BV514  
Monday 5:00 Room BV514

### ***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 primarily *Scientific American* articles that relate to topics covered in this course and can be discussed in the tutorials.

Powerpoint slides used in the lectures will be placed on the internet course site. The URL is <http://www.utsc.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

## **Tutorials**

Tutorials will meet weekly and will be used to both discuss lecture material and assigned readings and to organize and carry out group projects. More details will be provided in the tutorial.

## **Grading**

Grades will be based on two midterms (February 6<sup>th</sup> and March 15<sup>th</sup>) worth 20% each (40% in total), a comprehensive final exam worth 40%, and on tutorials, worth 20%.

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.
- Englert, B-G, Scully, M.O., & Walter, H. The duality in matter and light. *Scientific American* (December), 270, pp 86-92.
- Bower, J.M., & Parsons, L.M. (2003). Rethinking the lesser brain. *Scientific American*, 289 (August), pp50-57.
- Catania, K.C. (2002). The nose takes a starring role. *Scientific American* (July), 287, 54-60.
- Freeman, W.J. (1991). The physiology of perception. *Scientific American* (February), 264, 78-87.
- Grillner, S. (1996) Neural networks for vertebrate locomotion. *Scientific American* (January), 274, 64-69.
- Konishi, M. (1993). Listening with two ears. *Scientific American* (April), 66-73.
- Logothetis, N.K. (1999). Vision: a window on consciousness. *Scientific American* (November), 279, 69-75.
- 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 (4) pp 46-53.
- Ramachandran, V.S. and Hubbard, EM (2004). Hearing colors, tasting shapes. *Scientific American*, (May), 53-59.
- Ramachandran, V.S. (1992). Blind spots. *Scientific American*, (May), 266, pp 86-91.
- Smith, D.V., & Margolskee 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*, 285, (October) 68-75.
- Zeki, S. (1992). The visual image in mind and brain. *Scientific American*, (September) 267, 68-78.

## COURSE SCHEDULE

Date	Topic	Assigned Reading
1- Jan 5	Introduction	Ramachandran
7	Sensory Codes and Representations	
9	Vision: The Visual Stimulus	
2- Jan 12	Vision: Structure of the Eye	Sun and Nathans
14	Vision: Formation of Retinal Images	
16	Vision: Transduction Mechanisms	
3- Jan 19	Vision: Retinal Coding	Zeki
21	Vision: Visual Pathways in CNS	
23	Vision: Coding in VI	Ramachandran & Hubbard
4- Jan 26	Vision: Representations of Objects and Space	Logothetis
28	Audition: Sound - Peripheral Mechanisms	
30	Peripheral Mechanisms in Audition – the Cochlea	
5- Feb 2	Peripheral Mechanisms in Audition - Transduction	Borg and Counter
4	<b>First Midterm Exam</b>	
6	Audition: The Auditory Nerve	
6-Feb 9	Anatomy of Brain Auditory System	Konishi
11	Cortical Processing of Sound	
13	Somatosensory Systems: Introduction and Historical Background	Catania
	<b>Reading Week (Feb 16- 20)</b>	
7- Feb 23	Peripheral Coding of the Somatosensory system	Melzack
25	Somatosensory System anatomy	
27	Cortical Processing - Somatosensory Plasticity	
8- Mar 1	Pain	Smith and Margolskee
Mar 3	Chemical sensory systems: Taste	
Mar 5	Chemical sensory systems: Taste	
9- Mar 8	Olfaction: Olfactory Transduction	Freeman
Mar 10	Central Nervous System Processing Odors	
Mar 12	<b>Second Midterm Exam</b>	
10-Mar 15	Movement: Organization of Motor Control	Anderson et al.
Mar 17	Control of Muscle Contraction	
Mar 19	The Muscle Spindle System	Grillner
11-Mar 22	Preprogrammed Response Sequences	
Mar 24	The Cerebellum	Bower and Parsons
Mar 26	Efferent Pathways	
12-Mar 29	Premotor Networks and Motor Cortex	Nicolelis et al. (2002)
Mar-31	Basal Ganglia and Cortical Processing Networks	
Apr-2	Motor Plans and Images	