COGNITIVE NEUROSCIENCE

Course Schedule

The study of the mind’s complex processes — perception, language, attention, memory, motor control, feelings, and consciousness — is a task that becomes feasible with the convergence of the disciplines of cognitive psychology, behavioral neurology, and neuroscience. This course, Cognitive Neuroscience, covers these understandings of the mechanisms of the mind. The discussions are organized into fourteen topics. One topic will be covered every week.

- Basics of Cognitive Neuroscience
  An overview of the physical principles of neuroscience, from the neuron to the neural system. Methodological approaches like cognitive logic, neuropsychological analysis of patients, and functional neuroimaging.

- Development (8/31 Dawei, 9/7 Gautam)
  Emerging cognition in children, language acquisition, prenatal development of the nervous system, and the plasticity of fetal tissues.

- Plasticity (9/10 Dawei, 9/14 Debbie)
  Plasticity in the context of cognitive neuroscience refers to brain mutability and flexibility. In here, the building block mechanisms of such plasticity are studied on molecular and cellular levels.

- Sensory Systems: I (9/17 Dawei, 9/21 Debbie)
  Demonstrate how the brain converts sensory signals into a perception of a coherent world through explorations of visual illusions, color perception, motion blindness, sound localization, and etc.

- Sensory Systems: II (9/24 Dawei, 9/28 Xiaomin)
  Some other features and quirks of human sensory perception.

- Attention (10/1 Dinesh, 10/5 Xiaomin)
  The examination of attention looks at how internal desires, beliefs, momentary necessities, and intent affect human perceptual experience. How, for example, are we able to focus on a single conversation at a noisy party? What happens when attention is lost due to stroke or injury?

- Motor Systems (10/8 Dinesh, 10/12 Gautam)
  We discuss how the human brain works in tandem with the body, particularly to create complex actions, such as playing a piano, that require the two hands to integrate their movements. The interruption of voluntary control — as in victims of Parkinson’s disease is also examined.

- Memory (10/15 Dinesh, 10/19 Debbie)
  These relate directly to our ability to acquire and retain information about the world and our experiences of it. Are all memories created equal? How is it possible that we can remember our first day of school but cannot remember the days before or after? Is legal eyewitness testimony something we should ever trust?

- Language (10/22 Dawei, 10/26 Gautam)
  We look at language (the dramatic dividing line between humans and other primates) by exploring the biological basis of semantics and word recognition — and examining such language disorders as aphasia, deficits in language comprehension and production, and anomia, the inability to name things in the world.
• Higher Cognitive Functions (10/29 Debbie, 11/2 Gautam)
   What is the nature of thinking? The answer hinges on two kinds of properties: first, information must be represented internally; and second, that information must be manipulated in order to draw inferences and conclusions. Especially, we explain executive function — the job of the frontal lobes — by looking at how this area of the brain activates memory for usage, regulating social behavior, and influencing decision making.

• Emotion (11/5 Dawei, 11/9 Xiaomin)
   The problem of emotion is very complex — how emotion could help in efficient decision-making, what is the neural substrate of emotion.

• Evolution (11/19 Dawei, 11/26 Dinesh)
   The evolution of cognition is explored - why natural selection produced such oddities as the differences in spatial and mathematical abilities between the genders, the evolutionary basis of emotions, the nature of learning, and evolutionary insights to human brain organization.

• Consciousness (11/30 Dawei, 12/3 Xiaomin)
   Speculations on the neural bases of consciousness, such as the idea that the brain acts as our interpreter of the outer world.