Cognitive Neuroscience

Cognitive neuroscience is the study of higher cognitive functions in humans and their underlying neural bases. It is an integrative area of study drawing primarily from cognitive science, psychology, neuroscience, and linguistics. There are two broad directions that can be taken in this concentration - one is behavioral/experimental and the other is computational/modeling. In both, the goal is to understand the nature of cognition from a neural perspective. The standard concentration for the Sc.B. degree requires courses on the foundations, systems level, and integrative aspects of cognitive neuroscience as well as laboratory and elective courses that fit within a particular theme or category such as general cognition, perception, language development or computational/modeling. Concentrators must also complete a senior seminar course or an independent research course. Students may also participate in the work of the Brown Institute for Brain Science, an interdisciplinary program that unites ninety faculty from eleven departments.

Standard program for the ScB degree

Concentration Courses

A total of 16 courses are required for the concentration. Each student is required to pass 9 courses designed to introduce students to the foundations (5), systems level and integrative aspects (4) which uniquely define cognitive neuroscience; two laboratory courses; four elective courses; and either a senior seminar course CLPS 1900 or an independent research course. The laboratory and elective courses should fit within a particular theme or category such as general cognition, perception, language development, or computational/modeling. The design of the concentration and selection of courses should be made in consultation with the faculty advisor.

Foundation Courses:
- BIOL 0200 The Foundation of Living Systems 1
- CLPS 0200 Human Cognition 1
- Select 1 of the following:
  - CLPS 0900 Quantitative Methods in Psychology 1
  - APMA 1650 Statistical Inference I 1
  - CLPS 2906 Experimental Design 1
- MATH 0090 Introductory Calculus, Part I (or equivalent) 1
- NEUR 0010 The Brain: An Introduction to Neuroscience 1

Note: Students wishing to pursue a computational/modeling track are encouraged to take APMA 1650

Systems Level and Integrative Courses:
- CLPS 0040 Mind and Brain: Introduction to Cognitive Neuroscience 1
- CLPS 0400 Brain Damage and the Mind 1
- CLPS 1291 Computational Methods for Mind, Brain and Behavior 1
- or CLPS 1492 Computational Cognitive Neuroscience 1
- or APMA 0410 Mathematical Methods in the Brain Sciences 1
- NEUR 1030 Neural Systems 1

Laboratory Courses:

Students must choose two laboratory courses. Please note that due to enrollment limits in some lab courses, priority may be given to concentrators in that department. Students should therefore be prepared to choose from the other laboratory options.

- CLPS 1192 Experimental Analysis of Animal Behavior and Cognition
- CLPS 1193 Laboratory in Genes and Behavior
- CLPS 1290 Laboratory in Cognitive Processes
- CLPS 1490 Functional Magnetic Resonance Imaging: Theory and Practice
- CLPS 1491 Neural Modeling Laboratory

Electives:

Students must choose four additional courses around a particular theme. Electives can be characterized as either core cognitive neuroscience courses which focus directly on the intersection of mind and brain, or related courses which focus primarily on either the mind or brain. Electives may be chosen from either group.

Normally only one elective course that is below the 1000-level may count towards the elective courses required. An appropriate (but additional) laboratory course may be used in lieu of one of the four elective courses. Appropriate Topics course offerings (not listed below) may also count as electives with the approval of the Concentration Advisor.

Core Cognitive Neuroscience Electives:
- CLPS 0410 Principles of Behavioral Neuroscience
- CLPS 0640 Developmental Psychopathology
- CLPS 1150 Memory and the Brain
- CLPS 1180B Biology of Communication
- CLPS 1400 The Neural Bases of Cognition
- CLPS 1470 Mechanisms of Motivated Decision Making
- CLPS 1480A Cognitive Neuroscience of Emotion
- CLPS 1480B Cognitive Aging and Dementia
- CLPS 1480C Cognitive Control Functions of the Prefrontal Cortex
- CLPS 1480D Cognitive Neuropsychiatry
- CLPS 1560 Visually-Guided Action and Cognitive Processes
- CLPS 1570 Perceptual Learning
- CLPS 1571 Visual Consciousness
- CLPS 1620 Developmental Cognitive Neuroscience
- CLPS 1621 The Developing Brain
- CLPS 1680B Topics in Development - Developmental Disorders
- CLPS 1820 Language and the Brain
- CLPS 1821 Neuroimaging and Language
- NEUR 0650 Biology of Hearing
- NEUR 1540 Neurobiology of Learning and Memory
- NEUR 1740 The Diseased Brain: Mechanisms of Neurological and Psychiatric Disorders
- NEUR 1930A Cognitive Neuroscience: Motor Learning
- NEUR 1940L Neural Correlates of Consciousness
- NEUR 1930B From Neurophysiology to Perception
- NEUR 1940D Higher Cortical Function

Related Electives:
- CLPS 0210 Human Thinking and Problem-Solving
- CLPS 0220 Making Decisions
- CLPS 0500 Perception and Mind
- CLPS 0600 Child Development
- CLPS 0610 Children's Thinking: The Nature of Cognitive Development
- CLPS 0800 Language and the Mind
- CLPS 1100 Animal Cognition
- CLPS 1130 Psychology of Timing
CLPS 1140  Psychophysiology of Sleep and Dreams
CLPS 1200  Thinking
CLPS 1210  Human Memory and Learning
CLPS 1220  Concepts and Categories
CLPS 1230  Seminar in Decision Making
CLPS 1240  Reasoning and Problem Solving
CLPS 1241  Causal Reasoning
CLPS 1320  The Production, Perception, and Analysis of Speech
CLPS 1385  Topics in Language Acquisition: Language Acquisition and Cognitive Development
CLPS 1389  Discourse Processing
CLPS 1500  Perception and Action
CLPS 1510  Auditory Perception: Sensing the World through Sounds
CLPS 1520  Computational Vision
CLPS 1530  3D Shape Perception
CLPS 1590  Visualizing Vision
CLPS 1610  Cognitive Development
CLPS 1611  Cognitive Development in Infancy
CLPS 1650  Child Language Acquisition
CLPS 1730  Psychology in Business and Economics
CLPS 1800  Language Processing
CLPS 1810  Syntactic Theory and Syntactic Processing
NEUR 1930N  Region of Interest: An In-Depth Analysis of One Brain Area
NEUR 1930F  Brain Interfaces for Humans
NEUR 1930G  Disease, Mechanism, Therapy: Harnessing Basic Biology for Therapeutic Development

**Primarily Computational/Modeling:** Students are advised to take APMA 0330 (Methods of Applied Analysis I) and APMA 0340 (Methods of Applied Analysis II) as their two supporting science courses. Note that MATH 0100 is a prerequisite for these courses. See CLPS listings (above) for other computational/modeling courses. See CLPS Topics listings for other computational/modeling courses.

APMA 1360  Topics in Chaotic Dynamics
CLPS 1211  Human and Machine Learning
CLPS 1291  Computational Methods for Mind, Brain and Behavior
CLPS 1470  Mechanisms of Motivated Decision Making
CLPS 1492  Computational Cognitive Neuroscience
CLPS 1520  Computational Vision
CSCI 1410  Applied Artificial Intelligence
CSCI 1430  Computer Vision
CSCI 1460  Computational Linguistics
CSCI 1480  Building Intelligent Robots
CSCI 1950A  Computational Modeling and Algorithmic Thinking
ENGN 1220  Neuroengineering
ENGN 1610  Image Understanding

One senior seminar course CLPS 1900 or an independent research course.

**Total Credits** 16

**Honors**

Students who would like to pursue a degree with honors are normally expected to have half of their grades as A (or equivalent) within the concentration and are required to satisfactorily complete a written thesis and an oral presentation.