NEUROSCIENCE

Directors of undergraduate studies: Damon Clark (MCDB), KBT 224 and Nicholas Turk-Browne (Psychology), SSS 305; neuroscience.dus@yale.edu; neuroscience.yale.edu

Neuroscience aims to understand how the brain produces the mind and behavior, with the goal of advancing human understanding, improving physical and mental health, and optimizing performance. This entails a broad, interdisciplinary effort that spans molecules to minds. At one end, molecular and cellular biology, chemistry, and physics are improving our understanding of the molecular and cellular mechanisms of neuronal signaling and development. At the other end, psychology, psychiatry, and neurology link neural processes and systems to the mind and behavior. At all levels, the rich array of methods and data analysis depends on a strong foundation in the basic sciences, mathematics, statistics, and computer science.

PREREQUISITES
The foundational biology courses required of all Neuroscience majors are BIOL 101, 102, 103, and 104. All majors must also complete one of the following S&Ds 103, S&Ds 105, S&Ds 262, or PSYC 200.

PLACEMENT PROCEDURES
Students must apply to enter the major. Applications are reviewed at the end of each term; decisions are based on a cover letter, transcript, completed Neuroscience major worksheet, and optional resume. More information regarding the application process is available on the program's website (http://neuroscience.yale.edu).

REQUIREMENTS OF THE MAJOR

Both the B.S. and B.A. Neuroscience degrees require a minimum of 18.5 credits, including the three prerequisites, 15 lecture or seminar courses, and one laboratory, as follows:

1. Two neuroscience foundation courses, NSCI 160 and NSCI 320.
2. One neuroscience lab chosen from NSCI 321L; NSCI 235; NSCI 240; NSCI 260; NSCI 558; ANTH 148L.
3. Eleven electives from the following core groupings, with a minimum of two from the Systems/Circuits/Behavior Core, two from the Molecular/Cellular/Biological Core, one from the Quantitative Core, one from the Basic Allied Core, and one from the Advanced Allied Core (or a second course from the Quantitative Core). No more than two credits may be taken from the Other Allied Core.

Systems/Circuits/Behavior Core: NSCI 340; NSCI 341; NSCI 346; NSCI 352; NSCI 355; NSCI 360; NSCI 442; NSCI 445
Molecular/Cellular/Biological Core: NSCI 324; NSCI 325; NSCI 420; MCDB 200; MCDB 202; MCDB 205; MCDB 210; MCDB 310; MCDB 300 or MB&B 300; MB&B 370; MCDB 450; MCDB 452
Quantitative Core: MATH 116 (recommended) or 112, 115, 120; MATH 222, 225, or MATH 230, 231; MATH 244; MATH 246 or 247; AMTH 262; NSCI 324 or 325; CPSC 202; PHYS 301
Basic Allied Core: PHYS 170, 180, 200, or 260; PHYS 171, 181, 201, or 261; CHEM 161 or 163; CHEM 165 or 167; CHEM 174 or 220; CHEM 175 or 221
Advanced Allied Core: BENG 350; BENG 444 or 485; CPSC 100 or CPSC 112; CPSC 201; CPSC 202; CPSC 223; CPSC 323; CPSC 365; CPSC 475 or 476; EENG 200; PHYS 420; S&Ds 361
Other Allied Core: NSCI 141; NSCI 147; NSCI 161; CGSC 110

Credit/D/Fail No course taken Credit/D/Fail may be counted toward the major, including prerequisites.

SENIOR REQUIREMENT
In addition to the course requirements described above, all students must satisfy a senior requirement undertaken during the senior year. More information about the senior requirements of the B.A. and B.S. degree is available on the department website (http://catalog.yale.edu/ycps/subjects-of-instruction/neuroscience/%20http://neuroscience.yale.edu). All students must fill out a checklist of requirements and go over it with the undergraduate registrar by the spring term of the junior year.

B.A. degree program The B.A. degree requires two course credits in non-empirical research, NSCI 480 and 481; or one credit in non-empirical research, NSCI 480 or NSCI 481, and one credit in empirical research, NSCI 490 or NSCI 491. These courses are only open to Neuroscience seniors and they award a letter grade. Under faculty supervision, students are required to conduct a literature review, complete written assignments, and make a presentation. The final research paper is due to the sponsoring faculty member, with a copy submitted to the department, by the stated deadline near the end of the term. Seniors are also required to present their research once in either the fall or the spring term. To register, students must submit a form, and a written plan of study with bibliography, approved by the faculty research adviser and DUS, by the end of the first week of classes. More detailed guidelines and forms can be obtained from the department website (http://neuroscience.yale.edu).
**B.S. degree program** The B.S. degree requires two course credits of empirical research, NSCI 490 and NSCI 491. These courses are only available to Neuroscience seniors (and second term juniors with DUS permission), and they award a letter grade. Students are expected to spend at least ten hours per week in the laboratory, to complete written assignments, and to make a presentation. Research can be conducted over original, archival, or consortium data sets. Written assignments include a short research proposal summary due at the beginning of the term, and a full research report due at the end of the term. Students are encouraged to pursue the same research project for two terms, in which case, the first term full research report and the second term proposal summary may be combined into a full research proposal due at the end of the first term. Final papers are due by the stated deadline near the end of the term. Seniors are also required to present their research once in either the fall or the spring term. Students should line up a research laboratory during the term preceding the research. Yale College does not grant academic credit for summer research unless the student is enrolled in an independent research course in Yale Summer Session. To register for NSCI 490 and NSCI 491, students must submit a form, and a written plan of study with bibliography, approved by the faculty research adviser and DUS, by the end of the first week of classes. More detailed guidelines and forms can be obtained from the department website (http://neuroscience.yale.edu).

**ADVISING**

**Departmental advisers** Schedules for all majors must be discussed with, and approved by, one of the directors of undergraduate studies. Only then may a schedule be submitted to the residential college dean’s office. For questions concerning credits for courses taken at other institutions, or courses not listed in the this bulletin, students should consult with one of the directors of undergraduate studies.

**REQUIREMENTS OF THE MAJOR**

**Prerequisites** BIOL 101, 102, 103, 104; and one of S&DS 103, S&DS 105, S&DS 262, or PSYC 200

**Number of courses** 18.5 courses (incl prereqs and senior req)

**Specific courses required** 2 neuroscience foundation courses, NSCI 160 and NSCI 320

**Distribution of courses**

- B.A. or B.S. – 1 neuroscience lab course; 11 electives including at least 2 systems/circuits/behavior core courses, 2 molecular/cellular/biological core courses, 1 basic allied core course, 1 advanced allied core course, and no more than 2 other allied core courses

**Senior requirement**

- B.A. – 2 courses in non-empirical research; or 1 course in empirical research and 1 course in non-empirical research;
- B.S. – 2 courses in empirical research

**FACULTY OF THE NEUROSCIENCE MAJOR**

**Professors** †Amy Arnsten (School of Medicine, Psychology), Tom Brown (Psychology), Ty Cannon (Psychology), John Carlson (Molecular, Cellular, and Developmental Biology), BJ Casey (Psychology), Marvin Chun (Psychology), Paul Forscher (Molecular, Cellular, and Developmental Biology), Jutta Joorman (Psychology), Douglas Kankel (Molecular, Cellular, and Developmental Biology), Haig Keshishian (Molecular, Cellular, and Developmental Biology), †Daeyeol Lee (School of Medicine, Psychology), Greg McCarthy (Psychology), Laurie Santos (Psychology), Jane Taylor (School of Medicine, Psychology), Nick Turk-Browne (Psychology), Robert Wyman (Molecular, Cellular, and Developmental Biology)

**Associate Professors** †Sreeganga Chandra (School of Medicine, Molecular, Cellular, and Developmental Biology), Thierry Emonet (Molecular, Cellular, and Developmental Biology), Weimin Zhong (Molecular, Cellular, and Developmental Biology), †Ifat Levy (School of Medicine, Psychology)

**Assistant Professors** Arielle Baskin-Sommers (Psychology), Steve Chang (Psychology), Damon Clark (Molecular, Cellular, and Developmental Biology), Molly Crockett (Psychology), Dylan Gee (Psychology), Avram Holmes (Psychology), †Hedy Kober (School of Medicine, Psychology)

**Lecturer** Nelson Donegan (Psychology)

†A joint appointment with primary affiliation in another department or school.