COGNITIVE AND BEHAVIORAL NEUROSCIENCE (BS)

The B.S. in Cognitive/Behavioral Neuroscience focuses on the neural substrates of cognitive processes and behavior, utilizing methods from cognitive psychology, behavioral analysis, psychobiology, and computer science to account for empirical data about the brain.

Our neuroscience majors are designed to provide both breadth and depth to the neuroscience knowledge base of our students, and afford ample opportunities for developing creative and critical thinking skills needed to advance neuroscience (or any other life science field).

Related Programs

Major

 Molecular and Cellular Neuroscience (BS) (https://catalog.luc.edu/ undergraduate/arts-sciences/neuroscience/molecular-cellularneuroscience-bs/)

Minor

 Neuroscience Minor (https://catalog.luc.edu/undergraduate/artssciences/neuroscience/neuroscience-minor/)

Curriculum

С	ode	Title	Hours			
Basic Science and Math Foundations						
В	IOL 101	General Biology I	4			
&	BIOL 111	and General Biology I Lab				
В	IOL 102	General Biology II	4			
&	BIOL 112	and General Biology II Lab				
В	IOL 251	Cell Biology	3			
В	IOL 252	Cell Biology Laboratory	1			
	or BIOL 283	Genetics Laboratory				
В	IOL 282	Genetics	3			
В	IOL 335 /	Intro to Biostatistics	3			
S	TAT 335					
	or PSYC 304	Statistics				
N	IATH 131	Applied Calculus I	3-4			
	or MATH 161	Calculus I				
Ρ	SYC 101	General Psychology	3			
S	elect one of the	following three sets of classes:	4			
	CHEM 101	General Chemistry A Lecture/Discussion				
	& CHEM 111	and General Chemistry Lab A				
	CHEM 105	Chemical Principles				
	CHEM 160	Chemical Structure and Properties				
	& CHEM 161	and Chemical Structure and Properties Laborator	у			
S	elect one of the	following three sets of classes:	4			
	CHEM 102	General Chemistry B Lecture/Discussion				
	& CHEM 112	and General Chemistry Lab B				
	CHEM 106	Basic Inorganic Chemistry				
	CHEM 180	Chemical Reactivity I				
	& CHEM 181	and Chemical Reactivity I Lab				
S	elect one of the	following three sets of classes:	4			

	PHYS 111 & 1111	College Physics I Lec / Dis				
	PHVS 121	College Physics Lysics Laboratory 1				
	& PHYS 111L	Discussion				
	DUNO 105	and College Physics Laboratory I				
	PHYS 125 & 125L	General Physics I Lec/Dis and General Physics Laboratory I				
Se	Select one of the following three sets of classes:					
	PHYS 112	College Physics II Lec/Disc				
	& 112L	and College Physics Lab II				
	PHYS 122 & PHYS 112L	College Physics II with Calculus Lecture/ Discussion and College Physics Lab II				
	PHYS 126	General Physics II Lec/Dis				
	& 126L	and General Physics Laboratory II				
	& 120F	and Freshman Projects				
N	euroscience Fou	Indations Courses				
NI		Introduction to Neuroscience	3			
BI	OL 362	Neurobiology	3			
P3 BI	SYC 382 / OL 284	Behavorial and Cognitive Neuroscience	3			
Co	ognitive/Behavio	oral Neuroscience Track				
Сс	ognitive/Behavior	ral Neuroscience Specialty Areas Courses				
NI BI	EUR 300 / OL 303	Seminar in Neuroscience	1			
P	SYC 306	Research Methods in Psychology	3			
Se	elect one of the	following Computer Science options:	3			
	COMP 150	Introduction to Computing				
	COMP 170	Introduction to Object-Oriented Programming				
	COMP 180	Computing and Data Analysis for the Sciences				
	DSCI 101	Fundamentals of Modern Data Science with R				
Сс	ognitive/Behavior	ral Neuroscience Lecture Electives				
Se	elect three of the	e following:	9			
	BIOL 320	Animal Behavior				
	BIOL 351	Sleep/Circadian Rhythms				
	BIOL 352	Neurobiology of Feeding in Health and Disease				
	BIOL 357	Neural Disease, Degeneration, and Regeneration				
	BIOL 395	Special Topics in Biology (select topics related to				
		neuroscience)				
	PSYC 240 / BIOL 240	Psychology-Biology of Perception				
	PSYC 251	Learning and Memory				
	PSYC 332	Affective Neuroscience				
	PSYC 350	Developmental Cognitive Neuroscience				
	PSYC 352	Neuropsychology				
	PSYC 355 / PHIL 355	Neuroethics				
	PSYC 378	Drugs and Behavior				
	PSYC 383 / COMP 386	Methods in Computational Neuroscience				
Cognitive/Behavioral Neuroscience Lab Electives						
Se	elect two of the	following:	6-7			
	BIOL 395L	Special Topics Laboratory (select topics related to neuroscience)				

NEUR 301 / BIOL 373 / PSYC 388	Laboratory in Neuroscience I				
PSYC 311 / BIOL 313	Lab in Psychobiology				
PSYC 312	Lab in Cognitive Neuroscience				
PSYC 313	Lab in Behavioral Neuroscience				
PSYC 314	Lab in Experimental Psychology: Cognition				
PSYC 316	Lab in Experimental Psychology: Sense & Perception				
PSYC 384 / COMP 389	Computational Modeling of the Brain				
May include one o	of the following independent research options:				
BIOL 396	Research (with a Cognitive/Behavioral focus)				
PSYC 370	Psychology Honors Research (with a Cognitive/ Behavioral focus; PSYC 369 is pre-req)				
PSYC 397	Independent Research (with a Cognitive/ Behavioral focus)				
Cognitive/Behavioral Neuroscience Capstone					
PSYC 387	Seminar in Behavorial and Cognitive Neurosciences	3			
Total Hours					

Undergraduate Research

Neuroscience students have numerous opportunities to conduct scientific research in the labs of our neuroscience-affiliated faculty at Loyola's Lake Shore Campus (https://www.luc.edu/neuroscience/ aboutus/facultydirectoryandresearch/#den422313), in the labs of other faculty on any of Loyola's campuses, or at other institutions in the Chicago area. Depending on the applicability of the research project to the student's Neuroscience Major or Minor, independent research may be able to qualify for course credit as one of the required specialty labs (see below).

Cognitive/Behavioral Neuroscience Majors Research Credit

Cognitive/Behavioral Neuroscience (NRCB) majors can earn specialty lab credit for conducting **independent research that has a neuroscience or cognitive/behavioral focus** in labs within the psychology or biology departments. Your research project must be approved by the NRCB Director for NRCB credit through one of the 3-credit courses below:

- PSYC 397 Independent Research (relevant research with faculty in Psychology)
- PSYC 369 Psychology Honors Readings/PSYC 370 Psychology Honors Research (relevant research with faculty in Psychology for NRCB credit; additionally must use neuroscientific technique if desire NRCB Honors)
- BIOL 396 Research (relevant research with faculty in Biology)

Please contact the NRCB Director for questions about earning credit from cognitive/behavioral or neuroscience-related research in other departments (e.g., computer science, engineering, chemistry) or at other institutions.

Suggested Sequence of Courses Title Course Hours Freshman Fall **BIOL 101** General Biology I 3 1 **BIOL 111** General Biology I Lab **CHEM 160 Chemical Structure and Properties** 3 1 **CHEM 161 Chemical Structure and Properties** Laboratory **PSYC 101** General Psychology 3 **MATH 131** Applied Calculus I 3 14 Hours Spring **BIOL 102** General Biology II 3 **BIOL 112** General Biology II Lab 1 **CHEM 180** Chemical Reactivity I 3 **CHEM 181** Chemical Reactivity I Lab 1 **NEUR 101** Introduction to Neuroscience 3 Hours 11 Sophomore Fall **PHYS 111** College Physics I Lec / Dis 3 PHYS 111L College Physics Laboratory I 1 **BIOL 251** Cell Biology 3 **NEUR 300** Seminar in Neuroscience 1 **PSYC 304** Statistics 3 11 Hours Spring 3 **PHYS 112** College Physics II Lec/Disc PHYS 112L College Physics Lab II 1 **BIOL 282** 3 Genetics **BIOL 283 Genetics Laboratory** 1 or BIOL 252 or Cell Biology Laboratory **PSYC 306** Research Methods in Psychology (or 3 **Computer Science Choice**) Hours 11 Junior Fall **PSYC 382** Behavorial and Cognitive Neuroscience 3 **COMP 150** 3 Introduction to Computing or COMP 170 or Introduction to Object-Oriented or COMP 180 Programming or DSCI 101 or Computing and Data Analysis for the Sciences or Fundamentals of Modern Data Science with R Specialty Lecture 3 9 Hours Spring 3 **BIOL 362** Neurobiology Specialty Lecture 3 6 Hours

Senior		
Fall		
Specialty Lecture	3	
Specialty Lab		3-4
	Hours	6-7
Spring		
PSYC 387	Seminar in Behavorial and Cognitive Neurosciences	3
Specialty Lab		3
	Hours	6
	Total Hours	74-75

Course Objectives

Because the nervous system is the organ for behavior, neuroscience cuts across traditional fields in the biological and behavioral sciences. Owing to this breadth, we have designed two major tracks for students who wish to focus on neuroscience in their course of study at LUC. Completing either of these options will prepare students well for a variety of careers, including but not limited to medicine and life sciences research, particularly in neuroscience-related fields. Both options require at least two semesters of courses in biology, chemistry, and physics.

Lecture Course Objectives

Both of the majors require three courses in neuroscience fundamentals: NEUR 101 (https://catalog.luc.edu/search/?P=NEUR %20101) Introduction to Neuroscience, BIOL 362 (https://catalog.luc.edu/ search/?P=BIOL%20362) Neurobiology (which stresses cellular and electrophysiological mechanisms of neural function), and PSYC 382 (https://catalog.luc.edu/search/?P=PSYC%20382)/BIOL 284 (https:// catalog.luc.edu/search/?P=BIOL%20284) Behavioral and Cognitive Neuroscience (which stresses the neural substrates underlying mental processing and behavior). After completing this sequence, majors can design their own course of study within cognitive/behavioral or molecular/cellular neuroscience. There is some overlap in the list of lecture courses from which students may choose to complete their elective requirements, but there is also great diversity in the topics that are available in each major track.

Lab Course Objectives

Aside from first-year labs in chemistry and biology, and organic chemistry lab for molecular/cellular neuroscience majors, neuroscience majors choose their own lab experiences. Because the nervous system is cellular, computational, and a control center, the range of techniques that are useful is extremely broad, from cellular/molecular to behavioral, and the student can decide which techniques will be most helpful in answering the questions they want to address. Students who are interested in conducting independent neuroscience research have several neuroscience labs from which to choose, and may also seek permission to carry out a neuroscience-relevant project in a lab that is not focused on neuroscience. Independent research is the best preparation for doctoral programs, and is also regarded highly by medical, dental and other life science professional schools. For this reason, getting an independent research position in a lab is competitive.

Seminar Courses

There are three seminar style courses available to neuroscience undergraduates. In these courses, students tackle the primary literature and react to seminars given by neuroscientists on their research. Cognitive/Behavioral Neuroscience majors are required to take the 1-credit hour NEUR 300 (https://catalog.luc.edu/search/?P=NEUR %20300) Seminar in Neuroscience course, providing basic exposure to the primary literature and a wide range of research talks. Both major tracks culminate with a required capstone seminar class, which immerses the students in the primary literature and encourages development of critical thinking and presentation skills.

College of Arts and Sciences Graduation Requirements

All Undergraduate students in the College of Arts and Sciences are required to take two Writing Intensive courses (6 credit hours) as well as complete a foreign language requirement at 102-level or higher (3 credit hours) or a language competency test. More information can be found here (https://www.luc.edu/cas/college-requirements/).

Additional Undergraduate Graduation Requirements

All Undergraduate students are required to complete the University Core, at least one Engaged Learning course, and UNIV 101. SCPS students are not required to take UNIV 101. Nursing students in the Accelerated BSN program are not required to take core or UNIV 101. You can find more information in the University Requirements (https://catalog.luc.edu/undergraduate/university-requirements/) area.

Learning Outcomes

By the end of this program of study, students will be able to:

- functional neuroanatomy at the gross, cellular, and subcellular levels. [Neuroanatomy]
- electrochemical signaling and information processing in the nervous system. [Neurophysiology]
- the general methodological approaches, applications, strengths, and weaknesses of the major laboratory and computational techniques used in the study of the nervous system. [Neuroscience Methods]
- the neural bases of sensory processing and behavior (e.g., movement, appetitive behaviors, biological rhythms). [Sensory/Behavior]
- the neural bases of cognitive and affective aspects of mental life (e.g., memory, attention, executive function, language, emotion). [Cognitive/Affective]
- genetic, environmental, and experiential influences on neural development and neuroplasticity. [Neural Development/Plasticity]
- the relationships between neurological and psychiatric disorders (e.g., Alzheimer's disease, Parkinson's disease, schizophrenia, depression), their underlying neuropathology, and common treatments. [Clinical Disorders]
- read, understand, critically evaluate, and draw appropriate conclusions from reports of neuroscientific investigations. [Critical Analysis]
- effectively communicate findings from neuroscience research studies to both scientific and nonscientific audiences in multiple formats. [Scientific Communication]
- formulate scientific questions, construct testable hypotheses, and design scientific investigations that contribute to neuroscience. [Research Design]
- engage in scientific investigations using appropriate neuroscientific laboratory or computational techniques, statistically analyze the

data, and interpret the findings. [Laboratory Skills & Inquiry/Statistical Analysis]

 develop awareness of the philosophical, moral, and ethical issues raised by neuroscience and influences of neuroscience on other fields such as medicine, education, and social sciences. [Science & Society]