



## NEUROSCIENCE (2021-2022)

### Division of Teacher Education & Behavioral Sciences

Julia S. Omarzu, Ph.D., Chair

The neuroscience major as an inherently interdisciplinary program has a built-in flexibility which allows students to double major and connect neuroscience with their interests in other areas. Popular choices for double major include psychology, biology and biochemistry. Career plans for neuroscience majors may include graduate school, business and industry, allied health fields (including medical school, nursing school, physical therapy, occupational therapy, speech language pathology and physician's assistant) or professional settings in the medical, research or academic fields.

The minor in neuroscience serves students in various majors who may have an interest in head injury, brain trauma, mental health counseling, and/or the brain basis of learning and/or development.

Student Learning Outcomes – Neuroscience
1. Students will be able to identify core concepts of neuroscience.
2. Students will interpret, evaluate, and contextualize peer-reviewed literature to enhance understanding of core neuroscience concepts and to independently learn new methodologies and technologies in the field of neuroscience.
3. Students will be able to apply and synthesize principles from neuroscience and other relevant disciplines to formulate hypotheses, design experiments, and collect and analyze data to state a conclusion.
4. Students will be able to communicate neuroscientific information in a clear, reasoned manner, both verbally and in writing, to different audiences.
5. Effectively use knowledge (skills and conceptual understanding) from neuroscience and other relevant disciplines.

**Requirements for the major in Neuroscience (B.S.):** The required and supporting courses for the neuroscience major must be completed with a cumulative 2.000 GPA. Summer research experience is highly recommended for neuroscience majors. See the Center for Experiential Learning for more information on internship possibilities. Students interested in graduate school should seek at least one year of experience in research before applying to graduate school. Beyond the minimum requirements listed below and in addition to further study in possible neuroscience electives, some additional recommended electives are as follows:

- L.MAT-150-Calculus of One Variable I-FM
- EITHER L.CIT-110 Computing & Information Technology Basics OR L.CSC-115 Introduction to Programming
- L.PSY-231-Abnormal Psychology
- L.PHY-210-Elements of Physics-QR
- L.PHY-211-Elements of Physics II

Req	Course	Cr's
1	L.BIO-115/L.BIO-115L: Principles of Biology I-ES w/Lab	4
2	L.CHE-111/L.CHE-111L: General Chemistry I w/Lab	4
3	L.PSY-101: Intro to Psychology	3
4	L.PSY-201: Brain and Behavior	3
5	L.NEU-201: Behavioral Neuroscience	3
6	L.NEU-202: Research Experience	1
7	L.NEU-490: Neuroscience Junior Seminar (Spring)	3
8	L.NEU-491: Neuroscience Senior Seminar (Spring)-IN	3
<b>Select one course(s) from Req 9</b>		
9	L.BIO-277-QR & L.BIO-278: Experimental Design/Biostatistics	4
9	L.PSY-211 and L.PSY-212: Research Methods	6
<b>Select two courses from Req 10</b>		
10	L.BIO-345: Neurobiology	3
10	L.NEU-211: Techniques in Neuroscience (J Term, odd years)	3
10	L.NEU-281: Exploring the Brain through Traumatic Brain Injury	3
10	L.NEU-301: Neuropsychiatric Disease	3
10	L.NEU-311: Hormones & Behavior	3
10	L.NEU-391: Functional Neuroanatomy	4
11	Content Basics within Disciplinary Focus (200-300 level course) <sup>1</sup>	3-4
12	Content Basics within Disciplinary Focus (300-400 level course) <sup>1</sup>	3-4
<b>40-41 total required credits</b>		

<sup>1</sup>The courses selected cannot count toward another major.

### Requirements for the minor in Neuroscience:

Req	Course	Cr's
1	L.BIO-115/L.BIO-115L: Principles of Biology I-ES w/Lab	4
2	L.PSY-101: Intro to Psychology	3
3	L.PSY-201: Brain and Behavior	3
4	L.NEU-201: Behavioral Neuroscience	3
5	L.NEU-202: Research Experience	1
<b>Select two courses from Req 6</b>		
6	L.PSY-301: Cognitive Psychology <sup>1</sup>	3
6	L.BIO-345: Neurobiology	3
6	L.NEU-281: Exploring the Brain through Traumatic Brain Injury	3
6	L.NEU-301: Neuropsychiatric Disease	3
6	L.NEU-311: Hormones & Behavior	3
6	L.NEU-391: Functional Neuroanatomy	4
<b>20-21 total required credits</b>		

<sup>1</sup> If selected to count toward Neuroscience Minor, cannot count toward major or minor in Psychology.

## 2021-2022 NEUROSCIENCE COURSES:

### L.NEU-145: Introductory Neuroscience-ES

This course will introduce students to the fundamental topics and concepts that are critical to understanding the biological and psychological components of neuroscience. Topics to be covered include the biochemistry of action potentials, the functioning of ion channels, a brief overview of systems neuroscience (vision, audition, etc.), neurotransmitters and peripheral endocrine systems, learning and memory, the effects of neurotransmitters on behavior, the biology underlying several psychiatric disorders, and basic neuroanatomy. Prerequisites: L.BIO-115 or L.PSY-101. 4 credits.

**L.NEU-201: Behavioral Neuroscience**

This course will explore the structure and function relationship at the molecular, cellular, synaptic, circuit, and behavioral levels of the central and peripheral nervous systems (CNS and PNS). To appreciate how the brain works to produce specific behaviors, topics to be covered include functional neuroanatomy and neurophysiology, sensory and motor systems, learning and memory, and emotion. Students will integrate behavioral and biological information to fully appreciate the complex workings of the brain. 3 Credits.

**L.NEU-202: Research Experience**

This lab course is designed to introduce students to methods utilized in neuroscience. Depending on the faculty member, the methods that will be highlighted will be either cellular and molecular techniques and animal models; or cognition-based assessments and human behavior. This lab should be taken con-currently with NEU 201 or after. 1 Credit.

**L.NEU-211: Techniques in Neuroscience**

This course will introduce students to techniques relevant to the field of neuroscience, both in terms of the theory that describes the techniques and in terms of practicing the techniques with biological samples. Students will read and discuss primary literature sources from work with both human and non-human models. Extensive laboratory work will teach students laboratory techniques that may include sterile technique, radioimmunoassay, and enzyme immunoassay. Part of the term may be spent at a university. 3 credits. Prerequisite: L.NEU-145. Instructor permission required. January term.

**L.NEU-281: Exploring the Brain through TBI**

It is difficult to fully understand how the brain functions under completely normal working conditions. One technique used to investigate brain functioning through clinical cases where there has been trauma in a specified region of the brain. Thus, in people with traumatic brain injuries (TBI) neuroscientists can locate the region of trauma and any change in functioning of the individual. This course is designed to explore the brain through various historical cases and provide a deeper understanding of neuro-functioning from resulting deficits in dissociated brain regions. Clinical cases will be provided as we travel from the frontal lobe to the temporal lobe, parietal lobe, occipital lobe and beyond. Prerequisite: L.NEU-145 or L.BIO-345. 3 credits.

**L.NEU-301: Neuropsychiatric Diseases**

This course will explore how translational research applies neuroscience knowledge to inform, prevent, treat, and cure brain diseases. Some topics will include the role of the blood brain barrier in preventing disease, the role of both central and peripheral cytokines in the manifestation of psychiatric disorders, how genetic and environmental factors influence susceptibility to psychiatric conditions, and several psychiatric conditions including Parkinson's, Huntington's, and Alzheimer's Diseases, anxious and depressive disorders, and multiple sclerosis. Prerequisites: L.NEU-145 and L.BIO-115. 3 credits.

**L.NEU-311: Hormones and Behavior**

This course will introduce students to several topics within the field of neuroendocrinology. Topics to be discussed will include the blood brain barrier, synthesis and release of neurotransmitters relevant to behavior, psychosomatic interactions, and the effects of various monoamine, peptide, and steroid hormones on sexual, reproductive, affiliative, aggressive, parental, and reward-seeking behaviors. In addition to readings from the text, students will read and discuss primary literature sources from work with both human and non-human models. Laboratory work will teach students several research skills and laboratory techniques including study design, behavioral observation and scoring, blood sampling, processing and storage, and data set management. Prerequisite: L.NEU145. 3 credits.

**L.NEU-390: Research Experience**

This experiential class will require students to either 1) propose a novel neuroscience research study or 2) conduct neuroscience research and write up a report of their findings. Students will meet weekly with the course instructor and students may take this course up to 3 (three) times (with 1 credit given each semester). This course will give students a clear understanding of the scientific method and skills needed to conduct research in the field of

neuroscience from conception to implementation to presentation. Prerequisite: L.NEU-145. Open to declared Neuroscience majors only. Instructor permission required. 1 credit.

**L.NEU-391: Functional Neuroanatomy**

We will study the topography, functional distribution of nerve cell bodies, and ascending and descending tracts in the spinal cord. Brainstem organization and functional components will be covered, to include cranial nerve nuclei, ascending/descending pathways, structure and information flow in the cerebellar and vestibular systems. Once we have identified all of the functional units of the nervous system, we will continue with how these various pieces and parts work together: motor and sensory systems, cortical versus cerebellar systems, and their functional integration. Prerequisites: L.BIO-115. Restriction: Not open to first year students. Spring semester every other year. 4 credits.

**L.NEU-490: Junior Seminar I**

This course will serve as the first semester of a capstone series for all students completing a major in Neuroscience. The course will meet once per week, and majors will enroll in the course during the fall semester of their Junior year at Loras College (exceptions (e.g. for study abroad programs, etc.) will be made at the discretion of the Neuroscience faculty). Restricted to Neuroscience majors only. Prerequisite: L.NEU-145. 1 credit.

**L.NEU-491: Senior Seminar II-IN**

This course will serve as the second semester of a capstone series for all students completing a major in neuroscience. The course meetings will occur once per week, and majors will enroll in the course during the spring semester of their senior year at Loras College (exceptions (e.g. for study abroad programs, etc.) will be made at the discretion of the neuroscience faculty). Restricted to senior neuroscience majors only. Prerequisite: L.NEU-145. 1 credit.