

ence-researchgrowthB.S. degree (Rutgers, Drew, Rider). The  
Jersey-based Neuroscience programs.

Students will gain an in-depth understanding of the organization of the nervous system in terms of its anatomy and physiology. Topics include vertebrate anatomy and physiology, molecular structure of the neural system, areas of knowledge that are well-highly appreciated and integrated with multiple levels of analysis and these study of the nervous system (e.g., molecular, cellular, systems, behavioral and cognitive neuroscience levels).

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Students will develop fluency into multiple levels of empirical analysis and emerging methodologies in the field of behavioral neuroscience, learning, cognitive neuroscience, sensation, and perception.  
Students will also have an opportunity to perform research on specialized and advanced neuroscience topics.

## **2. Evaluation and Learning Outcomes Plan**

### **A. Full list of goals and outcomes for the Major:**

#### **Goal 1**

Understand core concepts in psychology, biology, and chemistry, as providing the basis for the scientific study of the nervous system and its relationship to behavior and mental processes.

#### **Student Learning Outcome**

1)

### C. Curriculum Map and Alignment with Goals/Outcomes

Program Goals and Learning Outcomes	Courses	Assessment Methods
<p><b>Goal 1:</b> Understand core concepts in psychology, biology and/or chemistry, as providing the basis for the scientific study of the nervous system and its relationship to behavior and mental processes.</p> <p>Student Learning Outcome (SLO)</p> <ol style="list-style-type: none"> <li>1) Demonstrate understanding of neuronal communication via resting potential, action potential and neurotransmission.</li> <li>2) Demonstrate understanding of the general organization of the brain.</li> <li>3) Relate organization of the brain to cognitive processes (such as visual processing, auditory processing, attention and/or memory) via an understanding of functional lateralization and/or hemispheric specialization.</li> <li>4) Demonstrate understanding of typical and atypical cognitive and emotional processes and the pathological mechanisms underlying common diseases and/or disorders of the nervous system.</li> </ol>	<p>All SLOs will be assessed for the following courses:</p> <p>Neur 2xx: Introduction to Neuroscience</p> <p>Neur 3xx/Psyc 310 Neuropsychology</p> <p>Neur 3xx/Psyc 352 Behavioral Neuroscience</p> <p>Neur 3xx/Psyc 353 Cognitive Neuroscience</p> <p>Neur 3xx/Psyc 355 Neuropsychopharmacology</p> <p>Neur 4xx Neuroscience Capstone</p>	<p><b>Direct:</b> Multiple Choice and Essay Exams or Quizzes - Embedded questions to assess individual outcomes.  - <i>Rubrics to track student achievement across course levels</i></p> <p><b>Indirect:</b> Student surveys that query students' perception on how their learning of these outcomes</p>
<p><b>Goal 2:</b> Development of proficient scientific literacy and analytical skill to critically evaluate the scientific merit of original research, and scientific dissemination by popular and social media.</p> <p>Student Learning Outcome (SLO)</p> <ol style="list-style-type: none"> <li>1) Demonstrate proficiency in reading papers in the primary literature by recognizing the research question being investigated and its significance, the hypothesis being tested, and the predictions from the hypothesis.</li> </ol>	<p>SLO 2 will be assessed in the following courses:</p> <p>Psyc 242: Statistics</p> <p>Neur 3xx: Research Methods</p> <p>Neur 3xx/4xx JR/SR Thesis</p> <p>SLO 1 and 3 will be assessed in the following courses:</p> <p>Neur 3xx: Research Methods</p>	<p><b>Direct:</b></p>

<p>2) Students should be able to evaluate the appropriateness of the experimental design and the interpretation of the results.</p> <p>3) Students should be able to evaluate claims in mass media against what is known from the scientific literature.</p>	<p>Neur 3xx/Psyc 352 Behavioral Neuroscience</p> <p>Neur 3xx/Psyc 353 Cognitive Neuroscience</p> <p>Neur 3xx/Psyc 355 Neuropsychopharmacology</p> <p>Neur 3xx/4xx JR/SR Thesis</p> <p>Neur 4xx Neuroscience Capstone</p>	<p><b>Indirect:</b> Student surveys that query students' perception on how their learning of these outcomes</p>
<p><b>Goal 3:</b> Demonstrate effective communication about neuroscience in both written and oral form.</p> <p><b>Student Learning Outcome</b></p> <p>1) Demonstrate effective writing skills.</p> <p>2) Demonstrate effective oral communication skills.</p>	<p>SLO 1 and 2 will be assessed in the following courses:</p> <p>Neur 3xx: Research Methods</p> <p>Neur 3xx/4xx JR/SR Thesis</p> <p>Neur 4xx Neuroscience Capstone</p>	<p><b>Direct:</b> Term papers, Projects Presentations <i>-Rubrics to track student achievement across course levels</i></p> <p><b>Indirect:</b> Student surveys that query students' perception on how their learning of these outcomes</p>

### 3. Relationship of the Program to Institutional Strategic Plan

The major in Neuroscience aligns with Goal 1 of the Strategic Plan, *“Increase Student Success and Engagement.”* Specifically, the major will recruit and maintain a diverse student body through curricular and extracurricular engagement (e.g., student-faculty research and conference attendance). Given the interdisciplinary curricular demands and research requirements, it may be advantageous for Neuroscience students to reside on campus and have opportunities to participate in campus life. The major would also address Goal 3: *“Advance Innovation as the College's Promise and Obligation to its Students, Community, and the State of New Jersey”* by developing a new and in-demand academic program. The major integrates coursework from two schools, TAS and SSHS, to provide students with an interdisciplinary study of the underlying processes motivating animal and human behavior in the realms of cognition and social-emotional behavior. This is examined in both typical and atypical populations as well as multiple contexts.

#### Relationship of the Program to the College's Mission

The major provides students with the opportunity to engage in an interdisciplinary curriculum and experiential learning through faculty-student research. Students will evaluate neuroscience's influence in developments in medicine, biology, psychology, nursing, criminology, philosophy, art, music, and education (among others).

in eight semesters. We anticipate that many Neuroscience majors would either double major or minor in Psychology and Biology (see Survey Results below). Based on anecdotal evidence from prospective student emails and inquiries at Open-House events regarding the availability of a Neuroscience Major at Ramapo, we expect the major would attract these students who would have otherwise enrolled in other institutions with Neuroscience programs.

#### **4. Program need/Student demand:**

##### **Student Survey**

In February 2020, a request to complete a brief Qualtrics online survey was sent to current Psychology and Biology majors as well as students declaring a Neuroscience minor with a different major than Psychology or Biology. The survey included a description of the proposed neuroscience curriculum. One hundred seventy-five students completed the survey. Ninety (52%) of the respondents indicated that they are *Very Interested or Interested* in the Neuroscience major. Another 47 (27%) students reported that they are *Somewhat Interested* in the major. Even some students that indicate a low interest in the major, commented that a Neuroscience major would be beneficial to the college (see comments below). Importantly, a large proportion of students (~55%) indicated they were either *Very Interested or Interested* in double majoring with Neuroscience being one of the majors. These data suggest that a Neuroscience major would appeal to prospective students interested in the intersection of Psychology and Biology and appeals to current students interested in adding a Neuroscience major to a Psychology or Biology major. As noted earlier, the success of our Neuroscience minor over the past 5 years demonstrates an on-going interest in Neuroscience among Ramapo students.

##### **Sample Open-Ended Survey Comments**

“Even though I personally wouldn’t be a neuroscience major, I think it would be perfect to have a neuroscience major at Ramapo college. Since so many people I k974 (nc)4 (e)4 4 Tc 0.004 Tw -1 (s)-5 (.)-4i (r)3 (f)-7 (e)4 (c)4 (tu)4

related academic areas. The Neuroscience major will also better prepare students to apply to schools of medicine, dentistry, and veterinary medicine as well as clinical psychology, physical therapy, occupational therapy, and speech-language pathology graduate programs.

### **Labor Demand**

According to the United States Bureau of Labor Statistics <https://www.bls.gov/ooh/life-physical-and-social-science/medical-scientists.htm#tab-6>, Medical Scientists such as Neuroscientists will experience ~8% increase in employment opportunities from 2018-2028. This growth outpaces the average growth in all occupations. In New Jersey, Medical Scientists are projected to grow “As Fast as Average “with an 8.3% increase in annual job openings from 2016 to 2026 <https://www.edeps.org/DemandIndicators.aspx?UA=2612A&pn=0&st=NJ>. Moreover, the Pharmaceutical and Life Science industry in New Jersey, a major private sector employer of neuroscientists, is growing and is rated as one of the top industries driving the state’s GDP <https://www.investopedia.com/articles/investing/011316/new-jerseys>

## 5. Students

Based on our survey results we anticipate approximately 30 students will enroll immediately with ~70 students at the steady-state level. The table below charts the estimated progression of the first expected cohort in AY 2022-2023 through graduation. Successive cohorts of 20 students are added to the expected retention rate (83%) of the previous AY total enrollment. Total program enrollment equals the current AY enrollment plus the previous year(s)' retention.

## 6. Additional resources needed for the first five years:

The proposed curriculum below will require students to take a Neuroscience Research Methods course (comparable to the Research Methods and Data Analysis courses in Psychology) and to have at least four credits of student-faculty research. These curricular requirements will be funded through course fees. Most courses in the curriculum are currently offered in Psychology, Biology and Chemistry and the new courses

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## Four Year Plan

<b>Second Year</b>					
<b>Fall Semester</b>	<b>HRS</b>	<b>?•</b>	<b>Spring Semester</b>	<b>HRS</b>	<b>?•</b>
Major – Biol 111,111L – Fund. of Biology I Gen Ed: Scientific Reasoning ████████████████████	5		Major: PSYC 242 - Statistics	4	

## Course Descriptions

### New Proposed Courses

**INTRODUCTION TO NEUROSCIENCE (NEUR 2xx):** A broad level course that will survey the various topics that Neuroscientists study. Students will learn the basic concepts and language of Neuroscience. A general overview of the nervous systems structure and function will be provided. The course will serve as a foundation for upper-level coursework in the Neuroscience major. **4 credits**

*\* New course for the major*

**RESEARCH METHODS IN NEUROSCIENCE (NEUR 3xx):** An introduction and survey of neuroscience research methodologies and techniques. Topics will include the philosophy of scientific research, ethical questions in neuroscientific research, use of library resources, quantification and measurement, critical evaluation of research techniques, the collection and analysis of data, an introduction to descriptive and inferential statistics, and reporting of research. There will be a lecture, laboratory exercises, and written reports. *Writing Intensive course.* **4 credits**

**JUNIOR/SENIOR RESEARCH THESIS (NEUR 3xx/4xx):** Students will undertake a two-semester long research project that will explore a topic of interest to the individual student. Students may fulfill this requirement through Faculty/Student research and writing a publication-style manuscript or by writing a literature-based thesis. **TWO semesters – 2 credits each** *Writing Intensive Course.*

**SENIOR HONORS RESEARCH THESIS (NEUR 4xx):** Students have the option of doing an additional semester of research for Honors. *Writing Intensive Course.* **4 credits**

**\*NEUROSCIENCE CAPSTONE (NEUR 4xx):** A Capstone course will rigorously explore selected topics in Neuroscience. *Writing Intensive Course.* **4 credits**

### Crosslisted Courses

**Descriptions are according to the 2020-2021 Ramapo College Catalog Psychology course listings**

**\*NEUROPSYCHOLOGY (NEUR/PSYC 310):** This course is designed to introduce the student to the field of clinical neuropsychology. This course will review the anatomy and basic function of the brain, particularly that of the cerebral cortex. Major neuropsychological dysfunctions related to brain damage, as well as what neurological disorders can reveal about normal brain functioning, will be presented. Students will also gain an understanding of the typical assessment tools and procedures used for diagnosing neuropsychological disorders. **4 credits**

*\* Course listing and numbering needs to be updated.*

**\*BEHAVIORAL NEUROSCIENCE (NEUR/PSYC 352): (FORMERLY: PSYC 245)** An introduction to the biological bases of behavior. Topics will include evolution and animal behavior; the brain and central nervous system; visual and auditory perception; and brain behavior relationships (neural regulation of hunger, sleep, consciousness, aggression, sex, and drug action). Also discussed will be ethical issues in brain control. **4 credits**

*\* Course listing and numbering needs to be updated.*

**\*COGNITIVE NEUROSCIENCE (NEUR/PSYC 353):** This course will be concerned with how brain activity and structure support cognitive processes. We will discuss the findings of researchers who have applied advances in neuroscience to the investigation of cognition, perception, memory, language, and other high-level cognitive processes. There will be a focus on understanding the methods used in cognitive neuroscience. Historical and cutting-edge research will be explored. Implications within the larger context of the field of psychology will also be considered. **4 credits**

*\* Course listing and numbering needs to be updated.*

**\*NEUROPSYCHOPHARMACOLOGY (NEUR/PSYC 355):** This course surveys basic neuropharmacology, neurophysiology, neurotransmitter system, the effects of various psychotropic drugs and the actions of drugs used to treat mental disorders. The emphasis of the first part of the course is on basic principles of neuropharmacology, distribution and elimination of drugs, drug-receptor interactions and dose-response relationships, structure of neurons,

neurophysiological mechanisms involved in synaptic activity and the distribution of neurotransmitters. The last two weeks will focus on contemporary designer drugs. Upon successful completion of this course, you should be able to:  
Demonstrate knowledge of the theory and research on pharmacology, neurotransmitter systems and the effects of psychotropic drugs on the brain and behavior. Use the concepts, language, and major theories of psychopharmacology. Use critical thinking effectively in context of course material. **4 credits**

*\* Course listing and numbering needs to be updated.*

**\*NEUROSCIENCE (NEUR/BIOL 343):** A survey of the nervous system designed for upper-level science students. The course will focus on the human, beginning with coverage of the structure and function of the brain and spinal cord. Following there will be discussions on sensory systems, motor systems and higher order functions which involve the hypothalamus, limbic system, reticular formation, thalamus, and cortex. **4 credits**

*\* Course title, description, and listing need to be updated*

### Established Courses (not cross listed)

**Descriptions are according to the 2020-2021 Ramapo College Catalog**

**FUNDAMENTALS OF BIOLOGY I LECTURE (BIOL 111):** An introduction to the principles of biological science. This first semester of a two-semester sequence will cover the cell from its chemical composition, structure, and function to the nature of information coding and transmission. This course also surveys the major phyla of animals, plants, and fungi. **4 credits**

**FUNDAMENTALS OF BIOLOGY I LAB (BIOL 111L):** This laboratory course will instruct students in the use of the instrumentation and techniques used in the biological sciences. Students will also be taught how to interpret, analyze, and document, via laboratory reports, their results. This course will also survey the major phyla of animals, plants, and fungi. **1 credit**

**FUNDAMENTALS OF BIOLOGY II LEC (BIOL 113):** A continuation of Fundamentals of Biology I Lecture (BIOL111). This course is a lecture course which examines animal and plant structure and function. Diversity among homeostatic mechanisms will be covered, but there will be an emphasis on mammalian and angiosperm systems. This course is a prerequisite for ALL required Biology courses in the Biology, Biochemistry and Bioinformatics curricula. In addition, the material here is found in MOST standardized exams in the Biological sciences. You will be expected to know much of the material in Fund. of Biol. I & II lectures & laboratories in the workplace as well as graduate schools. The prerequisite of this course is BIOL 111. The corequisite of this course is BIOL113L. **4 credits**

**FUNDAMENTALS OF BIOLOGY II LAB (BIOL 113L):** A continuation of Fundamentals of Biology I Laboratory (BIOL 111L). This course is a laboratory course which examines animal and plant structure and function. Diversity among homeostatic mechanisms will be covered, but there will be an emphasis on mammalian and angiosperm systems. Dissection is carried out in this laboratory. Please refer to the Student Handbook for the College's dissection policy. This course is a prerequisite for ALL required Biology courses in the Biology, Biochemistry and Bioinformatics curricula. In addition, the material here is found in MOST standardized exams in the Biological sciences. You will be expected to know much of the material in Fund. of Biol. I & II lectures & laboratories in the workplace as well as graduate schools. The prerequisite of this course is BIOL 111L. The corequisite of this course is BIOL 113. **1 credit**

**GENERAL CHEMISTRY I LECTURE (CHEM 116):** This Lecture course offers a comprehensive introduction to chemistry for science majors. Chemistry is a mature science that continues to expand and evolve in step with recent developments in science and technology. This course will provide a basic study of atomic structure, chemical measurements, chemical formulas, equations, chemical reactions, nomenclature, gas laws, quantum theory, periodicity, ionic and covalent bonding, and chemical bonding theory. This course introduces students to the language and theoretical foundations chemistry. Students will learn to conceptualize abstract ideas about atoms and molecules. The depth and breadth of the topics covered meet or exceed the standards of the American Chemical Society. Required for Biochemistry, Chemistry, Environmental Science, and Biology majors, and recommended for Physics majors. **4 credits**

**GENERAL CHEMISTRY I LAB (CHEM 116L):** This lab course is complementary to the General Chemistry I lecture course which is taken concurrently. The experiments were chosen to reinforce ideas and concepts that are introduced in the lecture. Students will perform experiments in the areas of properties of matter, chemical formulas, chemical reactions, volumetric methods, graphical analysis, properties of gases, atomic spectroscopy, and molecular geometry and bonding. Students will begin to build a foundation of chemical experimentation techniques that will be useful in all science disciplines. **1 credit**

**GENERAL CHEMISTRY II LECTURE (CHEM 117):** This Lecture course offers a comprehensive introduction to chemistry for science majors. Chemistry is a mature science that continues to expand and evolve in step with recent developments in science and technology. This course will provide a basic study of atomic structure, chemical

**GENETICS LAB (BIOL 332L):** A study of the mechanisms of inheritance and gene action from the molecular to the organismic and population levels. Topics include Mendelian principles, transmission genetics, molecular genetics, genetic mapping, population genetics, quantitative genetics and genomics in both lecture and laboratory. (This course is a Writing Intensive Course). **1 credit**

**MOLECULAR GENETICS (BIIN 350):** This course is designed to serve as an elective for students of Bioinformatics, Biology and Biochemistry majors. In this course, students will receive semester-long advanced level lectures on molecular mechanisms of basic genetic processes in organisms. Students will also be familiarized with selected current issues and advancements in this field. Some of the topics to be covered in this course are structure and study of macromolecules, genomics and proteomics techniques, molecular structure and organization of the genetic material, DNA replication, DNA repair and recombination, molecular mechanisms of transcriptional initiation and regulation, RNA processing, translation, and post-transcriptional control mechanisms. Some lectures may be augmented by hands-on activities using classroom computers. **4 credits**