Proposal for a Neuroscience Major Program (B.S.)

Curricular Phase (ARC)

1. Objectives

Program summary, objectives, and cooperative arrangements (if any)

Neuroscience is the most rapidly growing scientific field. During the past 30 years, doctoral degrees in Neuroscience outpaced all other sciences and neuroscience research[1] has expanded tremendously between 2006-2015https://neurosciencenews.com/neuroscience-research-growth-6459/. The Major in Neuroscience will help our students understand how the wider neuroscience community investigates the nervous system and how it produces behavior, in the widest sense of that term. In a sense we will have our students explore the mystery of the human mind and consciousness within the context of the liberal arts/interdisciplinary focus of our institution. At present, there only are three New Jersey colleges/universities that offer an undergraduate Neuroscience B.S. degree (Rutgers, Drew, Rider). Thus, Ramapo College is well situated to capitalize on the dearth of New 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, primate developmental neurobiology and comparative neural anatomy and physiology. By exploring these areas of knowledge students will gain an appreciation of and fluency with multiple levels of analysis and study of the nervous system (e.g., molecular, cellular, systems, behavioral and cognitive neuroscience levels).

Students will gain a basic understanding of the interaction between neural structure and function by exploring the brain's relation to behaviors such as motor control, basic sensory processes (e.g., audition, proprioception, and vision), higher cognition (e.g., attention, memory, learning and language) and emotional processing. Major theories of brain-behavior relations will be studied. Several of these topics include behavioral neuroscience, learning, cognitive neuroscience, sensation, and perception.

Students will develop fluency into multiple levels of empirical analysis and converging methodologies in the research and study of brain and behavior. The major will allow student to gain a basic understanding of the methodology and current technology used to investigate phenomena from the molecular to complex behaviors. A critical analysis of the reliability, efficacy and validity of current research methods and techniques will be employed to engage students in developing in-depth knowledge of the state of primary neuroscience research on specialized and advanced neuroscience topics. Students will also have an opportunity to perform neuroscience research with faculty members.

Students will develop an understanding of the role of the brain in the behavior of atypical populations, in comparison to typical populations. In depth investigation of the assessment techniques and methods used in neuropsychological research will be presented so that students understand the typical assessment tools and procedures used for diagnosing and treating neurologically based disorders (such as dyslexia, ADD, ASD, cerebral palsy, Parkinson's disease, dementia, and stroke).

Furthermore, students will also gain an appreciation of the interdisciplinary nature of neuroscience and the study of mind, brain, and behavior. Students will be encouraged to seek new insights by integrating across subject areas that have traditionally been studied separately (e.g., psychology, philosophy, public health, anthropology, and art/literature). Students will explore the relationships of conscious and unconscious behaviors with consideration of the spectrum defining typical and atypical behaviors. Students will be encouraged to use a broad ecological perspective to contextualize findings from current neuroscience research.

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[1] Boyette- Davis J. (2018) A Report on the Qualities, Skills, and Characteristics Desired by Top Neuroscience Graduate Programs. *The Journal of Undergraduate Neuroscience Education (JUNE)*,17(1): A54-A58.

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) Demonstrate understanding of neuronal communication via resting potential, action potential, and neurotransmission.
2) Demonstrate understanding of the general organization of the brain.
3) Relate organization of the brain to cognitive processes (such as visual processing, auditory processing, attention, and memory) via an understanding of functional lateralization or hemispheric specialization.
4) Demonstrate understanding of typical and atypical cognitive and emotional processes and the pathological mechanisms underlying common diseases and disorders of the nervous system

Goal 2

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.

Student Learning Outcome

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.
2) Students should be able to evaluate the appropriateness of the experimental design and the interpretation of the results.
3) Students should be able to evaluate claims in mass media against what is known from the scientific literature.

Goal 3

Demonstrate effective communication about neuroscience in both written and oral form.

Student Learning Outcome

1) Demonstrate effective writing skills
2) Demonstrate effective oral communication skills.

B. Assessment Process

Each AY, 1-2 of the SLOs will be assessed starting with Goal 1. Assessments will consist of both direct and indirect measures as described in the section C. Whether the Achievement Targets were met or not, the convening group will make recommendations and implement an action plan to improve student achievement for the next assessment. Inclusion of current developments in neuroscience across the curriculum will be assessed bi-annually. Yearly enrollment and completion rates will assist in assessing the program's health. A full cycle of assessment/reassessment of all SLOs will require five years. This timeline aligns with the required 5-year Program Review. Program success will be evaluated through records of student graduate school admissions, post-graduation employment and post-graduate student surveys. The Neuroscience Convener and Convening faculty members will be responsible for assessment.

C. Curriculum Map and Alignment with Goals/Outcomes

Program Goals and Learning Outcomes	Courses	Assessment Methods
Goal 1: 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. ***Student Learning Outcome (SLO)*** 1) Demonstrate understanding of neuronal communication via resting potential, action potential and neurotransmission. 2) Demonstrate understanding of the general organization of the brain. 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. 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.	All SLOs will be assessed for the following courses: Neur 2xx: Introduction to Neuroscience Neur 3xx/Psyc 310 Neuropsychology Neur 3xx/Psyc 352 Behavioral Neuroscience Neur 3xx/Psyc 353 Cognitive Neuroscience Neur 3xx/Psyc 355 Neuropsychopharmacology Neur 4xx Neuroscience Capstone	**Direct:** Multiple Choice and Essay Exams or Quizzes - Embedded questions to assess individual outcomes. - *Rubrics to track student achievement across course levels* **Indirect:** Student surveys that query students' perception on how their learning of these outcomes
Goal 2: 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. ***Student Learning Outcome (SLO)*** 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.	SLO 2 will be assessed in the following courses: Psyc 242: Statistics Neur 3xx: Research Methods Neur 3xx/4xx JR/SR Thesis SLO 1 and 3 will be assessed in the following courses: Neur 3xx: Research Methods	**Direct:** Projects and Presentations - *Rubrics to track student achievement across course levels*

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

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). This critical examination, integration and synthesis is the hallmark of a liberal arts education.

Program's impact on the College's other programs:

The Neuroscience major is an interdisciplinary program (Psychology, Biology and Chemistry). The major is designed to augment the existing Psychology and Biology programs and will not negatively impact either program. Most of the major consists of courses already offered in Psychology, Biology and Chemistry, and we believe will not require additional faculty resources for the first five years. We have had the Neuroscience minor operating successfully for 5 years (2015-2020) with ~40 students on average declaring the minor annually. These students are roughly split between Psychology and Biology majors. According to Registrar Fernanda Papalia, a Neuroscience/Psychology double major is achievable within the normal eight semester plan. A Neuroscience/Biology is also achievable; however, it would require a few summer terms to complete

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 know who major in bio are interested in neuroscience. Please open up a Neuroscience major !!!!!"

"Hearing that this can become a major is very exciting! I'd love to hear more about this and hopefully it actually coming true."

"Hello, I just wanted say that I'm really interested in neuroscience becoming a major here at Ramapo. If you were able to get the program together for next year, I would switch into it in a heartbeat."

"I think a neuroscience major would bring a lot more attention to our college in general. If we have more specific majors like neuroscience, it will bring a lot more people to the college interested in a science related field."

"I think the new major would attract a lot of prospective students."

"It's not particularly an area I would've been interested in, but I know so many people that do neuroscience minors that I really wouldn't be surprised if it had a strong interest."

"The neuroscience minor already exists, why not take it a step further? There seems to be a significant amount of people who double major in psychology or minor in neuroscience as biology majors or psychology majors."

Opportunities for further education
The major in Neuroscience will provide students with the capacity to bridge connections with advanced educational opportunities in several academic and professional areas. Academically these students will be trained as critically thinking empiricists capable of analyzing data generated from work in areas as diverse as psychology, biology, cognitive science, behavioral genetics, neurophilosophy and neuroeconomics. This background will better enable students to apply to masters and doctoral level programs in all of these and

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 Statisticshttps://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 2026https://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 GDPhttps://www.investopedia.com/articles/investing/011316/new-jerseys-economy-9-industries-driving-gdp-growth.asp. Neuroscience-based careers also span into the Allied Health, Business, Law, and Government sectors https://pni.princeton.edu/undergraduate-concentration/careers-neuroscience. The outlook for neuroscience-based jobs regionally and nationally appears healthy.

Comparison with similar programs in the State:

Institutions in New Jersey with a Neuroscience (or similar) Major

Drew University (BS, Neuroscience)
Rider University (BS, Behavioral Neuroscience)
Rutgers University, New Brunswick (BS, Cell Biology and Neuroscience)
Rutgers University, Newark (BA, Neuroscience and Behavior)
Princeton University (BA with a Neuroscience Concentration)
Farleigh Dickinson University (BA, Psychology with a Behavioral Neuroscience Track)

Like our proposal, the Neuroscience (BS) curriculums at Drew and Rider Universities have foundation courses in neuroscience, biology, chemistry, research methods and statistics with upper-level psychology/biology electives and a neuroscience capstone course. However, our program has a research requirement, whereas Drew's and Rider's majors encourage but do not require faculty-student research. Engagement in faculty-student research will provide students with a rich experiential component to our curriculum. Furthermore, Drew and Rider are private institutions, thus Ramapo College would offer a less expensive alternative to these two schools. Although Rutgers is also a public institution, its two programs are less comparable to our proposal. The Cell Biology and Neuroscience program at the New Brunswick campus is solely a biology-based program with no Psychology requirements. The Neuroscience and Behavior program at Newark is interdisciplinary, however it only offers a BA and does not allow for a double majoring with Psychology or Biology. The ability to double major in Neuroscience and Psychology appears to be a major strength of our proposal compared to these other programs. The ability to double-major will provide the Ramapo Neuroscience student options to customize one's education to fit individual career goals. Ramapo's location is advantageous as being the only public institution in northern New Jersey to offer a Neuroscience program. Our program would make Ramapo a competitive option for students interested in Neuroscience that are considering institutions in neighboring states like Lafayette College and Muhlenberg College in PA and Quinnipiac University in CT.

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.

Program Cohort Entry	AY 2022-2023	AY 2023-2024	AY 2024-2025	AY 2025-2026	AY 2026-2027
AY Enrollment	30	20	20	20	20
Previous Year(s) Retention		25	45	55	50
Graduation				25	
Total Enrollment	30	55	65	75	70

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 can be readily offered by current faculty; thus, we do not anticipate needing any additional faculty or personnel resources for the first five years.

7. Curriculum
Neuroscience Major

Ramapo's General Education requirement consists of 9 courses (4 credits each) that total 36 credits. The Neuroscience major will be part of the School of Social Sciences and Human Services (SSHS). SSHS requires all students to take 3 School Core courses (4 credits each) for a total of 12 credits. The Neuroscience major itself will consist of 15-16 courses (2-5 credits each) that total 60-65 credits. The total amount of credits to complete the degree program equals 105-113 credits. Graduation requires 128 credits; thus, a student would have 15-20 credits to use towards a minor or another major.

Neuroscience Major Requirements

Foundational Courses

Biol 111 Fundamentals of Biology **4 credits**
Biol 111L Fundamentals of Biology Lab I **1 credit**
Biol 113 Fundamentals of Biology II **4 credits**
Biol 113L Fundamentals of Biology Lab II **1 credit**

Chem 116 General Chemistry II **4 credits**
Chem 116L General Chemistry II **1 credit**
Chem 117 General Chemistry II **4 credits**
Chem 117L General Chemistry II **1 credit**

Neur 2xx Introduction to Neuroscience **4 credits**

Psyc 242 Statistics **4 credits**

Neur 3xx Neuroscience Research Methods **4 credits**

Total Credits = 32 credits

Neuroscience Electives:

Pick three of the following:

Neur 3xx/Psyc 310 Neuropsychology **4 credits**
Neur 3xx/Psyc 352 Behavioral Neuroscience **4 credits**
Neur 3xx/Psyc 353 Cognitive Neuroscience **4 credits**
Neur 3xx/Psyc 355 Neuropsychopharmacology **4 credits**
Neur 3xx/Biol 343 Cell and Molecular Neuroscience **4 credits**

Total Credits = 12 credits

Psychology Electives:

Pick one of the following:

Psyc 202 Learning **4 credits**
Psyc 209 Perception **4 credits**
Psyc 227 Cognition **4 credits**

Total Credits = 4 credits

Biology Electives:

Pick one of the following:

Biol 332 Genetics Lecture **4 credits**
Biol 332L Genetics Lab **1 credits**
OR
BIIN 350 Molecular Genetics **4 credits**

Total Credits = 4 or 5 credits

Research:

Neur 3xx Junior Research Thesis **2 credits**
Neur 4xx Senior Research Thesis **2 credits**
Neur 3xx Honors Research Thesis (Optional) **4 credits**

Total Credits = 4 or 8 credits

Capstone:

Neur 4xx Capstone in Neuroscience **4 credits**

Total Credits for Major = 60 to 65 credits

General Education Requirements

As listed in the College Catalog **36 credits**

SSHS School Requirements

As listed in the College Catalog **12 credits**

Career Pathway Requirements

As listed in the College Catalog **0 credits**

Total Credits for Degree = 108 to 113 credits

Four Year Plan

First Year					
Fall Semester	**HRS**	✓	**Spring Semester**	**HRS**	✓
Gen Ed: INTD 101-First Year Seminar	4		Gen Ed: Quantitative Reasoning – (Preferred) MATH 108 – Elementary Probability and Statistics	4	
Gen Ed: SSHS School Core-Social Science Inquiry (SOSC 110)	4		Gen Ed: Studies in Arts and Humanities (AIID 201)	4	
SSHS School Core- PSYC 101-Introduction to Psychology	4		Gen Ed: Historical Perspectives	4	
Gen Ed: CRWT 102-Critical Reading & Writing II	4		**Major – Neur 2xx Introduction to Neuroscience**	4	
			Career Pathways: SOSC 001 – Career Pathways Module 1	Degree Rqmt.	
Total:	16		**Total:**	16	

Second Year					
Fall Semester	**HRS**	✓	**Spring Semester**	**HRS**	✓
Major – Biol 111,11lL – Fund. of Biology I	5		**Major: PSYC 242 - Statistics**	4	
Gen Ed: Scientific Reasoning ***Chem116, 116L** **Gen. Chemistry-** ***Prerequisite for Chem 117***	5		SSHS School Core: History of Social Thought	4	
Gen Ed: Global Awareness	4		**Major – Biol 113,113L – Fund. of Biology II**	5	
School Core: Sustainability, Society and Civic Mindedness: Intro Course Outside of Major - EDUC 221, OR ENST 209, OR LAWS 131, OR SOCI 101	4		**Major – Chem 117, 117L** **Gen. Chem II**	5	
Career Pathways: SOSC 002 – Career Pathways Module 2	Degree Rqmt.		Career Pathways: SOSC 003 – Career Pathways Module 3	Degree Rqmt.	
Total:	18		**Total:**	18	

Third Year					
Fall Semester	**HRS**	✓	**Spring Semester**	**HRS**	✓
Major- Neur 3xx Research Methods	4		**Major – Neuro Elective – Pick 1**	4	
Major – Neuro Elective – Pick 1	4		**Gen Ed: Distribution Category (Choose one) Culture and Creativity, (or) Systems, Sustainability, and Society (or) Values and Ethics - PSYC 206 The Ethical Self (recommended)	4	
Major: Psychology Elective	4		**Major- Neur 3xx JR Thesis**	2	
General Elective: Elective	4		**Major- Biology Elective**	4-5	
Total:	16		**Total:**	14-15	

Fourth Year					
Fall Semester	**HRS**	✓	**Spring Semester**	**HRS**	✓
Major – Neuro Elective – Pick 1	4		**Major- Neur 4xx Capstone**	4	
Major- Neur 4xx SR Thesis	2		General Elective: Elective or Honors Thesis	4	
General Elective	4		General Elective: Elective	4	
General Elective	4		General Elective: Elective	4	
Total:	14		**Total:**	16	

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**

Cross-listed 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 specific neurotransmitter systems. The last two-thirds of the course examine the actions of specific drugs and their effects on behavior with a special emphasis 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 BlOL113L. **4 credits**

FUNDAMENTALS OF BIOLOGY II LAB (BIOL 113L): A continuation of Fundamentals of Biology 1 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 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 II LAB (CHEM 117L): This lab course is complementary to the General Chemistry II 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 liquids and solutions, intermolecular forces, colligative properties, kinetics, solution equilibria, acid-base equilibria, buffers, solubility equilibria, thermochemistry, and thermodynamics. Students will continue to build upon the background of chemical experimentation techniques that were garnered in General Chemistry I lab. **1 credit**

STATISTICS (PSYC 242): An introduction to statistics with examples from the behavioral sciences, especially psychology. The course will cover techniques for describing observations, including frequency distributions, stem plots, graphs, averages, measures of variability, and coefficients of correlation; and techniques for drawing inferences from observations, including regression, hypothesis testing, and confidence intervals. Prerequisite: a college-level mathematics course or permission of instructor. Students matriculated at Ramapo must have satisfied the General Education mathematics requirement. Highly recommended for all psychology majors, especially for students planning to attend graduate programs in psychology. Fulfills requirement for a psychology elective. **4 credits**

Electives:

PSYCHOLOGY OF LEARNING (PSYC 202): A consideration of theory and research on the basic process of learning and memory from simple conditioning in animals to more complex cognitive processes in humans. The course will include laboratory research and demonstrations. Intended for Psychology students. Lab Fee. **4 credits**

PSYCHOLOGY OF PERCEPTION (PSYC 209): The study of perception is one of the oldest areas of psychological speculation and research. It raises many interesting questions about mind, reality, truth, and aesthetic experience. We will approach the study of perception historically by showing how it developed in parallel within philosophy, science, and art, with each approach providing important insights for the other. Our basic question will concern the relations that exist between descriptions of the physical world, our brain, and our experience. We will investigate what modern research has to say about the ways in which we experience color, object, space, motion, and event perception. Aspects of the visual arts will be discussed in this context, both as employing perceptual principles and helping to reveal them. **4 credits**

COGNITIVE PSYCHOLOGY (PSYC 227): This course will provide an overview of the theories and methods used in the study of human cognitive processes, as well as give the student an opportunity to experience first-hand some of the phenomena within cognitive psychology. Some of the topics covered will be attention, memory, language, and problem solving. **4 credits**

GENETICS LECTURE (BIOL 332): 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. **4 credits**

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**