WASHINGTON COLLEGE

June 25, 2021

Dr James D. Fielder
Secretary of Higher Education
Maryland Higher Education Commission
Nancy S. Grasmick Building, 10th Floor
6 North Liberty Street
Baltimore, MD 21201

Dear Dr. Fielder,

Neuroscience is a fast-growing interdisciplinary and integrative field with the core goal of gaining a comprehensive understanding of the brain and mind in states of health and disease. Currently, no small college in the state of Maryland offers a Neuroscience major. Washington College proposes to provide Maryland students the opportunity to attend a small in-state college while majoring in an emerging and important field. I am writing to request approval of this new program in Neuroscience at Washington College.

Offering this program advances the liberal arts mission of Washington College and helps retain academically talented students in the state of Maryland. Like all Washington College programs, the Neuroscience major will be firmly grounded in the enduring values of liberal learning: analytical thought, clear communication, aesthetic insight, ethical awareness, and civic responsibility. This program will also contribute to the college's strategic initiative to advance and enhance interdisciplinary teaching and learning.

As our full application demonstrates, the new Neuroscience major, anchored in Psychology with support from the fellow STEM departments of Biology and Chemistry, can be offered by the college with current staffing and curriculum. The program will draw on already-existing courses in Biology, Chemistry, and Psychology. Having added several incremental faculty lines in these departments in recent years, Washington College is well-positioned to offer this program with existing resources.

Thank you for your consideration. I look forward to hearing from you soon.

Sincerely,

Dr. Michael Harvey
Provost and Dean of the College

300 WASHINGTON AVENUE, CHESTERTOWN, MARYLAND 21620
410-778-2800 | WWW.WASHCOLL.EDU

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Cover Sheet for In-State Institutions
New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	Washington College

Each action below requires a separate proposal and cover sheet.

- (●) New Academic Program
- ( ) New Area of Concentration
- ( ) New Degree Level Approval
- ( ) New Stand-Alone Certificate
- ( ) Off Campus Program
- ( ) Substantial Change to a Degree Program
- ( ) Substantial Change to an Area of Concentration
- ( ) Substantial Change to a Certificate Program
- ( ) Cooperative Degree Program
- ( ) Offer Program at Regional Higher Education Center

Payment Submitted: (●) Yes ( ) No

Payment Type: ( ) R*STARS # 374782 (●) Check # 374782

Payment Amount: $850.00

Date Submitted: 7/21/2021

Department Proposing Program	Biology, Chemistry, Psychology	
Degree Level and Degree Type	Bachelor of Science	
Title of Proposed Program	Nueroscience	
Total Number of Credits	128	
Suggested Codes	HEGIS: 425.00	CIP: 26.1501
Program Modality	(●) On-campus	( ) Distance Education (*fully online*)
Program Resources	(●) Using Existing Resources	( ) Requiring New Resources
Projected Implementation Date	( ) Fall (●) Spring ( ) Summer	Year: 2022
Provide Link to Most Recent Academic Catalog	URL: https://www.washcoll.edu/people_departments/offices/registrar/college-catalog.php	
Preferred Contact for this Proposal	Name: Matthew Kibler	
	Title: Assistant Vice President for Institutional Effectiveness and Analytics	
	Phone: (410) 778-7862	
	Email: mkibler2@washcoll.edu	
President/Chief Executive	Type Name: Wayne Powell	
	Signature: Wayne B Powell	Date: 07/20/2021
	Date of Approval/Endorsement by Governing Board:	05/15/2021

Revised 1/2021

Proposal for Neuroscience Program at Washington College

A. Centrality to Institutional Mission and Planning Priorities:

1. *Provide a description of the program, including each area of concentration (if applicable), and how it relates to the institution's approved mission.*

Washington College seeks the creation of a new, interdisciplinary program in Neuroscience that will advance the liberal arts mission of the college and better meet the needs of our students and prepare them to be scientists in the 21st century. The proposed program will build on current strengths within the Biology, Chemistry, and Psychology departments and allow students to gain a broad foundation in concepts and techniques essential for success at the interface between these three disciplines. This new program will support our mission, specifically, developing "habits of analytic thought" and enhancing our "broad curriculum of study."

2. *Explain how the proposed program supports the institution's strategic goals and provide evidence that affirms it is an institutional priority.*

The Neuroscience program supports Washington College's Strategic Plan. Washington College wants to be innovative and keep pace with the challenges and changing opportunities in today's world. Specifically, the creation of this program will support Goal 1, Objective D, both listed below for context:

> **GOAL 1: Reaffirm the College's core mission of providing a superior liberal arts education to prepare our students for the challenges of the 21st century.**
>
> > **Objective D:** Expand opportunities for interdisciplinary cooperation to meet emerging student interests.

The new program will be an institutional priority. Faculty and administration both believe in its creation. The addition of a Neuroscience program was approved by the faculty in the Biology Chemistry, and Psychology Departments, the entire Natural Science Division, the Curriculum Committee, and the full faculty, in that order.

3. *Provide a brief narrative of how the proposed program will be adequately funded for at least the first five years of program implementation. (Additional related information is required in section L.)*

For the foreseeable future the Neuroscience program will require no additional funding outside of our current Biology, Chemistry, and Psychology department budgets. Since this is an interdisciplinary program, it will be supported by all three departments. In the first five years of its implementation we do not expect to need additional resources to support it. We do not expect this program to attract many additional students to Washington College in the short term until it builds a reputation. We believe this program will be an ideal option for students who are already majoring in Psychology with a concentration in Behavioral Neuroscience and taking a heavy course load in Biology and/or Chemistry and receiving no recognition for it.

4. *Provide a description of the institution's a commitment to:*
    a) *ongoing administrative, financial, and technical support of the proposed program*

This is an interdisciplinary program being built out of our already approved Biology, Chemistry and Psychology programs. These programs already have administrative, financial and technical support. It will require no additional resources because at this time we are not creating new courses and we do not need to hire new faculty. Students will be satisfying the requirements of this program by completing courses that are already offered.

    b) *continuation of the program for a period of time sufficient to allow enrolled students to complete the program.*

If, by chance, we decided to discontinue the program we would allow sufficient time for enrolled students to complete the program with no issues. In this instance it would be easy to satisfy the requirement since there are no courses specific to the proposed program. The courses necessary to complete the Neuroscience program would continue to be offered through the Biology, Chemistry and Psychology Departments, causing no problems.

B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan:

1. *Demonstrate demand and need for the program in terms of meeting present and future needs of the region and the State in general based on one or more of the following:*
    a) *The need for the advancement and evolution of knowledge*

    b) *Societal needs, including expanding educational opportunities and choices for minority and educationally disadvantaged students at institutions of higher education*

    c) *The need to strengthen and expand the capacity of historically black institutions to provide high quality and unique educational programs*

Currently, students interested in majoring in Neuroscience cannot do so at a small college in the state of Maryland. Washington College is well positioned to fill this void and provide Maryland students the choice to attend a small college and major in an important and emerging field. The program we propose is also one that is unique among those within our peer and aspirant institutions in that our advanced elective courses are separated into two unique categories that focus on the properties of the nervous system. These include emphases in the physical properties and the emergent properties of the nervous system. Students completing the Neuroscience program will be prepared for a variety of career opportunities, including medical research, a range of health professions, and post-graduate education.

2. *Provide evidence that the perceived need is consistent with the **Maryland State Plan for Postsecondary Education**.*

The Maryland State Plan for Post-secondary Education (2017-2021) has three goals: access, innovation, and student success. We believe the proposed program will improve student success, in particular strategy 6, improving student experience facilitating prompt completion of degree

requirements. We have many students who graduate with a degree in Psychology and minor in Biology or Chemistry, or major in Psychology with the concentration in Behavioral Neuroscience and take additional courses in both biology and chemistry. We also have many students who major in Biology or Chemistry and take a large load of psychology courses. To be a neuroscientist, these various degree paths have shortcomings, mostly being that a student falls short of enough classes in one of the particular fields. This problem is exacerbated by the fact that each of the programs as a standalone require up to 72 credit hours and requires additional elective coursework to ensure a well-rounded education in neuroscience. By creating a standalone Neuroscience program, we are allowing students to complete a more tailored program of study that affords them more flexibility to take advantage of other curricular opportunities at our college, like majors or minors outside of the Natural Science and Mathematics division and study abroad. Students who complete a Neuroscience degree will be prepared for a variety of career opportunities, including medical research, a range of health professions, and post-graduate education.

C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State:

1. *Describe potential industry or industries, employment opportunities, and expected level of entry (ex: mid-level management) for graduates of the proposed program.*
2. *Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program.*
3. *Discuss and provide evidence of market surveys that clearly provide quantifiable and reliable data on the educational and training needs and the anticipated number of vacancies expected over the next 5 years.*

For most individuals who identify as neuroscientists or work in neuroscience research, entry level positions require some postgraduate level of additional training. Most often such programs require an undergraduate major in neuroscience or a related discipline such as Biology, Chemistry, Psychology, or the Computational Sciences.

According to the U.S. Bureau of Labor Statistics (BLS), jobs for medical scientists, including neuroscientists, are projected to grow by 6% between 2019 and 2029, which is faster than the national average for all occupations (www.bis.gov), and such medical scientists are projected to have a median income of $88,790.

According to NICHE (an online resource for information on such programs) there are at least 94 Doctoral Graduate Programs in Neuroscience in the United States. The Society for Neuroscience currently lists 97 programs in the United States and many more outside of the United States. The same resource currently lists 11 Undergraduate Programs (Brandeis University, Davidson College, John Carrol University, Macalester College, Michigan State University, Northeastern University, Oberlin College, Tulane University, The University of Alabama at Birmingham, Washington State University, and Williams College). This does not reflect the true number of undergraduate programs currently housing majors and/or minors in neuroscience.

The table below provides the industries and jobs that students who complete the Neuroscience program might pursue. This data comes from the Bureau of Labor Statistics employment projection website.

SOC	Occupation	2019	2029	Growth	Typical entry-level education	2019 median annual wage
13-1161	Market Research Analyst	738,100	868,400	18%	Bachelor's degree	$63,790
19-042	Medical scientists	138,300	146,700	6%	Doctoral or professional degree	$88,790
19-1021	Biochemists and biophysicists	34,600	36,000	4%	Doctoral or professional degree	$94,490
19-3030	Psychologist	192,300	198,000	3%	Doctoral or professional degree	$80,370
29-2011	Clinical Laboratory Technologists and Technicians	337,800	362,500	7%	Bachelor's degree	$53,120

4. Provide data showing the current and projected supply of prospective graduates.

	2016-17	2017-18	2018-19	2019-20	2020-21	Average
Biology Majors	129	133	116	93	81	110
Chemistry Majors	25	24	33	41	31	31
Psychology Majors	94	102	110	103	87	99
TOTAL	248	259	259	237	199	240

	2016-17	2017-18	2018-19	2019-20	2020-21	Average
BIO Major with CHE Minor	25	30	18	21	21	23
BIO Major with PSY Minor	8	14	8	7	6	9
CHE Major with BIO Minor	2	4	6	8	6	5
CHE Major with PSY Minor	1	0	1	3	2	1
PSY Major with CHE Minor	1	3	1	4	1	2
PSY Major with BIO Minor	4	2	3	4	2	3
BIO&CHE Double Majors	6	5	10	8	6	7
BIO&PSY Double Majors	7	5	6	5	4	5
CHE&PSY Double Majors	0	0	1	1	1	1
TOTAL	54	63	54	61	49	56

Peer Institutions- Number of Neuroscience Graduates	2015	2016	2017	2018	2019	Average
Allegheny College	21	33	31	17	29	26
Lake Forest College	10	20	21	21	18	18
Muhlenberg College	30	40	34	33	35	34
Transylvania University	2	10	10	9	5	7
Ursinus College	20	23	21	20	17	20
Washington & Jefferson College	21	13	18	24	14	18

D. Reasonableness of Program Duplication:

1. *Identify similar programs in the State and/or same geographical area. Discuss similarities and differences between the proposed program and others in the same degree to be awarded.*
2. *Provide justification for the proposed program.*

Currently, students interested in majoring in Neuroscience cannot do so at a small college in the state of Maryland. Washington College is well positioned to fill this void and provide Maryland students the choice to attend a small college and major in an important and emerging field.

The Neuroscience program that we are proposing is to accommodate current students enrolled at Washington College that are already taking classes across these three disciplines but not being recognized. As shown in the previous section, the number of students enrolled in these programs has been growing over the past five years. Without a combined program option, it is taking students longer to complete their desired track and it gives them less time to be able to pursue other areas of interest.

While there are other similar programs in the state, we do not anticipate our program affecting their programs or enrollment. Again, our program is going to accommodate the students already choosing Washington College. Also, in general, we are enrolling a different group of students than most of the other schools with the similar program listed above.

E. Relevance to High-demand Programs at Historically Black Institutions (HBIs)

1. *Discuss the program's potential impact on the implementation or maintenance of high-demand programs at HBI's.*

The addition of this new Neuroscience program will have minimal impact on Historically Black Institutions. The closest HBI to Washington College is the University of Maryland, Eastern Shore. This is not a high-demand program at UMES, in fact, they do not have an undergraduate program in neuroscience. Also, as stated before, we do not see this program as an avenue for major steps towards enrollment growth. Rather, we see this program as an alternative path for students who are interested in biology, chemistry, and psychology.

F. Relevance to the identity of Historically Black Institutions (HBIs)

1. *Discuss the program's potential impact on the uniqueness and institutional identities and missions of HBIs.*

The Neuroscience program, as proposed, is a fairly common program and does not reflect the uniqueness and institutional identities and missions of HBIs. We are not adding content to our curriculum, rather, we are giving students a different path towards completion of a program that combines content from our already approved Biology, Chemistry, and Psychology programs.

G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes (as outlined in COMAR 13B.02.03.10):

1. *Describe how the proposed program was established, and also describe the faculty who will oversee the program.*

The Neuroscience major at Washington College reflects the interdisciplinary nature of the field of neuroscience by innovatively integrating the disciplines of biology, chemistry and psychology to promote a deeper understanding of neuroscience. The inclusion of a Chemistry department is novel in Neuroscience majors and will provide Washington College Neuroscience students needed chemical and biochemical knowledge that will set them apart from their peers. The proposed major has the three disciplines working in concert with each other to provide our students a mastery of the core neuroscience competencies. Neuroscience majors are required to take fundamental courses within each of these disciplines and to select from more advanced learning experiences in the three. They are also encouraged to seek collaboration across these as well as other disciplines to gain a deeper understanding into the role the nervous system plays in health and disease.

A Neuroscience major is interdisciplinary by nature and therefore will have leadership from the Psychology, Biology, and Chemistry departments. An advisory board will consist of the chairs of the three departments or their designee. One member of the board will serve as the program director at any given time. The role of program director will rotate between members of the advisory board on an annual basis.

2. *Describe educational objectives and learning outcomes appropriate to the rigor, breadth, and (modality) of the program.*

The Society for Neuroscience (SFN) is the international body that has designed the core competences that define a neuroscientist. Concurrently, the Faculty for Undergraduate

Neuroscience (FUN) has been instrumental in identifying and establishing guidelines for core competencies at the undergraduate level, spearheaded in the past by Prof. Kerchner. The core 16 Proposal for the Creation of a Neuroscience Major- 16 competencies for neuroscience students at undergraduate institutions have been published in the Journal of Undergraduate Neuroscience Education (JUNE) (e.g. see Kerchner, 2005; Kerchner, Hardwick, & Thornton, 2012). We have designed the Neuroscience major at Washington College to align with the core competencies set forth by FUN and SFN. These competencies are listed below.

Faculty for Undergraduate Neuroscience (FUN) Competencies:

- **Independent thinkers, self-motivated learners**
- **Basic knowledge in Neuroscience/Biology/Chemistry/Psychology**
- **Ability to think critically and integratively**
- **Quantitative skills (Computational & Statistical Application)**
- **Scientific inquiry/analytical skills/research skills (Rigor & Replicability)**
- **Professional and Ethical Conduct**
- **Communication skills**

The SFN Undergraduate Core Competencies are the following:

I. Conceptual Knowledge:

- Basic understanding of the development, structure, and function of the nervous system
- Basic understanding of the cellular and molecular biology of the nervous system
- Basic understanding of systems and behavioral approaches to neuroscience
- Broad-based and integrated knowledge acquisition in fields that intersect with neuroscience

II. Analytic and Scientific Thinking:

- Ability to collect, analyze, and interpret quantitative information
- Abilities in scientific inquiry, such as hypothesis development, experimental design, and data analysis and interpretation
- Ability to read and critically analyze a primary research paper

III. Rigorous and Responsible Conduct of Research:

- Basic understanding of scientifically rigorous experimental design and execution, as well as data analysis and interpretation
- Basic understanding of research ethics, such as:
  - Research misconduct and research integrity, including data falsification or manipulation
  - Policies regarding human subjects, live vertebrate animal subjects in research, and safe laboratory practices

- Responsible authorship, peer review, and publication processes

IV. Communication Skills:

- Ability to present scientific information orally in an organized and coherent manner
- Ability to communicate scientific information in written format for scientific publication
- Ability to communicate scientific information to the lay public in both oral and written formats
- Listening carefully and asking pertinent questions
- Visual presentation of data and preparation of figures

V. Individual Development and Professionalism:

- Responsible and ethical behavior
- Teamwork and professional interpersonal skills
- Exposure to the cultural diversity of the neuroscience community
- Advocacy and community outreach
- Awareness of career opportunities and the paths to achieve career goals

3. *Explain how the institution will:*
   a) *provide for assessment of student achievement of learning outcomes in the program*
   b) *document student achievement of learning outcomes in the program*

Student learning outcomes will be assessed through two processes. Our Student Learning Outcomes Assessment process is conducted annually by every department. In addition, we have a procedure for assessing learning outcomes for our general education requirements. Departments and coordinators for the general education learning outcomes must document the assessments and submit them to the Assessment Committee. These reports are then delivered to necessary stakeholders and archived on the Institutional Research website for internal purposes and future accreditation requirements.

4. *Provide a list of courses with title, semester credit hours and course descriptions, along with a description of program requirements*

The Neuroscience program requires students to complete both the institutions distribution requirements as well as the program specific requirements. A description of the Washington College distribution requirements are attached as Appendix A. The course catalog entry for the Neuroscience program is attached as Appendix B. It details the specific requirements of the program. Detailed course descriptions for each of the courses within the program are listed in Appendix C.

A list of courses, both required and elective, from the Biology, Chemistry, and Psychology Departments that make up the proposed program with their course number, title, and semester credit hours is included here for quick reference (full course descriptions are in Appendix C):

Course Number	Course Name	Credits
BIO 111	General Biology I w/Lab	4
BIO 112	General Biology II w/Lab	4
BIO 205	Cell Biology	4
BIO 209	Genetics	4
BIO 301	Integrative Human Anatomy	4
BIO 302	Developmental Biology	4
BIO 311	Neurobiology	4
BIO 328	Behavioral Ecology	4
BIO 350	Neurotoxicology	4
BIO 394	Neurodevelopment	4
BIO 409	Biochemistry	4
BIO 424	Integrative Huma Physiology	4
CHE 120	Chemical Principles of Organic Molecules	4
CHE 140	Reactions of Organic Molecules	4
CHE 220	Quantitative Chemical Analysis	4
CHE 303	Chemistry of Biological Compounds	4
CHE 309	Biochemistry	4
CHE 320	Medicinal Chemistry	4
PSY 111	General Psychology I	4
PSY 112	General Psychology II	4
PSY 210	Biopsychology	4

PSY 233	Psychopathology I	4
PSY 234	Psychopathology II	4
PSY 305	Psychopharmacology	4
PSY 313	Learning and Applied Behavioral Analysis	4
PSY 316	Cognitive Neuroscience	4
PSY 317	Sensation and Perception	4
PSY 410	Neuroscience Research Methods	4
NEU 300	Junior Seminar	2

5. *Discuss how general education requirements will be met, if applicable.*

Students within the Neuroscience program will have the same General Education requirements, called distribution requirements, as all other programs. As stated in the College Catalog, Washington College's liberal arts and sciences commitment means that students explore many areas of interest and develop the capacity to reason, to appreciate literature and the arts, and to make the connection between courses of study and their implications in society. To ensure this broad intellectual foundation, Washington College has established a set of guidelines concerning its General Education, which include:

- a 4-credit, required first-year seminar course called the Global Perspectives Seminar (GRW 101)
- a Writing Program containing four requirements (known as W1-W4) that move from the first year through the senior capstone experience. These courses are embedded within the programs, so their credit requirements are not listed here.
- the Foreign Language requirement of 2, 4-credit classes
- three, 4-credit courses distributed between the Nature Sciences and a Quantitative skills course, to include at least one laboratory course and at least one Quantitative course
- three, 4-credit courses in the Humanities and Fine Arts, including at least one course from each
- three, 4-credit courses in the Social Sciences including courses from two different departments

The first- and second-year general education requirements are designed to introduce students to an intellectual community and give them the basis to declare a major that focuses on one or more disciplines.

The Neuroscience major is being built out of three established programs, so it will not have any courses specifically within the major that count towards the whole college general education program.

6. *Identify any specialized accreditation or graduate certification requirements for this program and its students.*

Not Applicable

7. *If contracting with another institution or non-collegiate organization, provide a copy of the written contract.*

Not Applicable

8. *Provide assurance and any appropriate evidence that the proposed program will provide students with clear, complete, and timely information on the curriculum, course and degree requirements,nature of faculty/student interaction, assumptions about technology competence and skills,technical equipment requirements, learning management system, availability of academic supportservices and financial aid resources, and costs and payment policies.*

The entire Neuroscience catalog entry is attached as Appendix B. It is made available on the Washington College website at www.washcoll.edu. The catalog gives students clear and complete details about the requirements of the program. Course descriptions include prerequisites. Faculty regularly provide students information about the learning management system and academic support services in their syllabi. In addition, both of our instructional technologists, who are responsible for our LMS, and staff in our academic support areas regularly communicate with students to inform them of the services their offices provide. Financial aid and cost resources are made available to students on the financial aid section of our website and business office section of our website. In addition, students are able to be in touch directly with these offices in person, by phone, or by email whenever they have questions.

9. *Provide assurance and any appropriate evidence that advertising, recruiting, and admissionsmaterials will clearly and accurately represent the proposed program and the services available.*

Our Enrollment Management team works directly with faculty when they are putting together advertising and/or admissions materials to be sure that information is clear and accurate. The Mathematics website will also be a major resource for students. At Washington College, all websites are maintained by the individual departments. This helps to ensure that content is accurate and relevant for anyone who visits the site.

H. Adequacy of Articulation

1. *If applicable, discuss how the program supports articulation with programs at partner institutions. Provide all relevant articulation agreements.*

Not Applicable

I. Adequacy of Faculty Resources (as outlined in COMAR 13B.02.03.11).

1. *Provide a brief narrative demonstrating the quality of program faculty. Include a summary list of faculty with appointment type, terminal degree title and field, academic title/rank, status (full-time, part-time, adjunct) and the course(s) each faulty member will teach (in this program).*

The faculty teaching courses in the Neuroscience major are primarily tenured and tenure track faculty from the Biology, Chemistry, and Psychology departments. The interdisciplinary nature of this major brings together experts from across several different fields to provide diverse perspectives of neuroscience and create well-rounded neuroscience majors. Within each discipline, there are several faculty members whose specializations allow them to offer courses that provide an in-depth evaluation of a key area of neuroscience. For example, among the faculty members in the Psychology Department, several have teaching and research focuses in behavioral neuroscience, cognitive neuroscience, clinical neuropsychology, or biological psychology. In the Biology Department, the teaching and research focuses of some faculty are on developmental neuroscience, neurophysiology, and neuroscience-related topics within ecophysiology. And finally, the faculty in the Chemistry Department have expertise in the chemically leaning aspects of neuroscience, including medicinal chemistry, biochemistry, structural biology, computational chemistry, and biophysics. The majority of these faculty have active programs of research involving undergraduate students. Their numerous resulting publications frequently include student co-authors and are often presented at regional and national conferences.

Faculty Name	Degree and Field	Title & Rank	Status	Courses
Jennie Carr	PhD, Biology (Ecology focus)	Associate Professor of Biology, Tenured	Full-time	BIO 112, BIO 328
Martin Connaughton	PhD, Marine Science	Associate Professor of Biology, Tenured	Full-time	BIO 112
Aaron Krochmal	PhD, Ecology	Associate Professor of Biology, Tenured	Full-time	BIO 111, BIO 112, BIO 301, BIO 424
Mala Misra	PhD, Neurobiology	Assistant Professor of Biology, Untenured	Full-time	BIO 111, BIO 302, BIO 394, NEU 300
Mindy Reynolds	PhD, Pathobiology	Associate Professor of Biology, Tenured	Full-time	BIO 111, BIO 205, BIO 350, BIO 409
Robin Van Meter	PhD, Marine Estuarine Environmental Science	Associate Professor of Biology, Tenured	Full-time	BIO 112
Kathleen Verville	PhD, Biological Sciences (Microbiology focus)	Associate Professor of Biology, Tenured	Full-time	BIO 111

Jennifer Wanat	PhD, Genetics	Assistant Professor of Biology, Untenured	Full-time	BIO 111, BIO 209
James Windelborn	PhD, Neuroscience	Assistant Professor of Biology, Untenured	Full-time	BIO 111, BIO 112, BIO 311, BIO 424, NEU 300
Sarah Conlin	PhD, Counseling Psychology	Assistant Professor of Psychology, Untenured	Full-time	PSY 112, PSY 233
Michael Dooley	PhD, Psychology (Social Psychology focus)	Assistant Professor of Psychology, Untenured	Full-time	PSY 112, PSY 209
Cynthia Gibson	PhD, Experimental Psychology (Biological Psychology emphasis)	Associate Professor of Psychology, Tenured	Full-time	PSY 111, PSY 317, PSY 410, NEU xxx
Daniel Kochli	PhD, Psychology (Behavioral Neuroscience focus)	Visiting Assistant Professor of Psychology, Non-tenure-track	Full-time	PSY 111, PSY 210, PSY 305, PSY 313, PSY 410, NEU xxx
Lauren Littlefield	PhD, Clinical Neuropsychology	Professor of Psychology, Tenured	Full-time	PSY 112, PSY 234, PSY 313, PSY 410
Kevin McKillop	PhD, Psychology (Social Psychology focus)	Associate Professor of Psychology, Tenured	Full-time	PSY 112, PSY 209
Tia Murphy	PhD, Psychology (Developmental Psychology focus)	Associate Professor of Psychology, Tenured	Full-time	PSY 112, PSY 209
Audrey Weil	PhD, Psychology (Cognitive Neuroscience focus)	Assistant Professor of Psychology, Untenured	Full-time	PSY 111, PSY 316, PSY 410, NEU xxx
Aaron Amick	PhD, Organic Chemistry	Associate Professor of Chemistry, Tenured	Full-time	CHE 120, CHE 140, CHE 320, CHE 340
Sarah Arradondo	PhD, Computational Chemistry	Assistant Professor of Chemistry, Untenured	Full-time	CHE 220
Anne Marteel-Parrish	PhD, Materials Science	Professor of Chemistry, Tenured	Full-time	CHE 120
James Lipchock	PhD, Biophysical Chemistry	Associate Professor of Chemistry, Tenured	Full-time	CHE 120, CHE 220, CHE 303, CHE 405

Leslie Sherman	M.S. in Civil Engineering; PhD, Soil Science	Associate Professor of Chemistry, Tenured	Full-time	CHE 220

2. *Demonstrate how the institution will provide ongoing pedagogy training for faculty in evidenced-based best practices, including training in:*
    a) *Pedagogy that meets the needs of the students*

Currently, faculty members have access to a variety of professional development and pedagogical training opportunities at Washington College. All faculty members are eligible for annual conference travel funds. In recent years the biology and psychology department faculty have attended the following conferences that are related to the proposed Neuroscience major: Society for Neuroscience Annual Meeting, Eastern Psychological Association Annual Meeting. Faculty also have access to the Washington College Center for Teaching and Learning that offers a wide variety of programming on pedagogical development as well as Faculty Enhancement Funds that are used to further the scholarly pursuits of faculty members. Faculty also have access to a wide variety of neuroscience journals supplied through the Society for Neuroscience, American Chemical Society, American Physiological Society, and American Psychological Association and faculty can also acquire needed journal articles through interlibrary loan.

    b) *The learning management system*

Washington College has two full-time Instructional Technologists that are responsible for management of Canvas, our learning management system. They hold workshops throughout the year for faculty to provide training on the new features that are available as well as provide refreshers on commonly used pieces. Additionally, during new faculty orientation, faculty members are introduced to the Instructional Technologists and the services they provide. The Instructional Technologists are available throughout the year to meet with faculty about how best to incorporate the learning management system into their courses.

    c) *Evidenced-based best practices for distance education, if distance education is offered.*

We are not planning on offering distance education classes.

J. Adequacy of Library Resources (as outlined in COMAR 13B.02.03.12)**.**

1. *Describe the library resources available and/or the measures to be taken to ensure resources are adequate to support the proposed program.* ***If the program is to be implemented within existing institutional resources****, include a supportive statement by the President for library resources to meet the program's needs.*

This program will be implemented using existing institutional resources. A statement of support from our Interim President, Wayne Powell, addressing both this piece of the proposal and section K.1. is included in our submission application after the appendices.

K. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment (as outlined in COMAR 13B.02.03.13)

1. *Provide an assurance that physical facilities, infrastructure and instruction equipment are adequate to initiate the program, particularly as related to spaces for classrooms, staff and faculty offices, and laboratories for studies in the technologies and sciences. If the program is to be implemented within existing institutional resources, include a supportive statement by the President for adequate equipment and facilities to meet the program's needs.*

This program will be implemented using existing institutional resources. A statement of support from our Interim President, Wayne Powell, addressing both this piece of the proposal and section J.1. is included in our submission application after the appendices.

2. *Provide assurance and any appropriate evidence that the institution will ensure students enrolled in and faculty teaching in distance education will have adequate access to:*

   a) *An institutional electronic mailing system, and*
   b) *A learning management system that provides the necessary technological support for distance education*

Not applicable

L. Adequacy of Financial Resources with Documentation (as outlined in COMAR 13B.02.03.14)

1. *Complete **Table 1: Resources and Narrative Rationale**. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each resource category. If resources have been or will be reallocated to support the proposed program, briefly discuss the sources of those funds.*

The following table represents the combined resources of both the Biology, Chemistry and Psychology departments. As stated throughout this proposal, the Neuroscience program is being built out of three well established programs. The Neuroscience program will not receive its own resources so portraying the resources available in this way is the best way to estimate. In putting this proposal together, we assume that a modest increase in tuition of 2% over the next five years will be the reason for the availability of additional resources. The number of F/T students was estimated using the five-year average number of majors in the Biology, Chemistry, and Psychology departments.

TABLE 1: RESOURCES:					
Resources Categories	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1. Reallocated Funds	0	0	0	0	0
2. Tuition/Fee Revenue (c + g below)	$ 11,916,480	$ 12,154,810	$ 12,397,906	$ 12,645,864	$ 12,898,781
a. Number of F/t Students	240	240	240	240	240
b. Annual Tuition/Fee Rate	$ 49,652	$ 50,645	$ 51,658	$ 52,691	$ 53,745
c. Total F/T Revenue (a x b)	$ 11,916,480	$ 12,154,810	$ 12,397,906	$ 12,645,864	$ 12,898,781
d. Number of P/T Students	0	0	0	0	0
e. Credit Hour Rate	0	0	0	0	0
f. Annual Credit Hour Rate	0	0	0	0	0
g. Total P/T Revenue (d x e x f)	0	0	0	0	0
3. Grants, contracts, & Other	0	0	0	0	0
4. Other Sources	0	0	0	0	0
Total (Add 1-4)	$ 11,916,480	$ 12,154,810	$ 12,397,906	$ 12,645,864	$ 12,898,781

2. *Complete **Table 2: Program Expenditures and Narrative Rationale**. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year.*

Program expenditures were built combining the budgets of both the Biology, Chemistry, and Psychology departments. Again, the Neuroscience program is being built out of the Biology and Chemistry program. At this time, and for the foreseeable future, Neuroscience will not have its own budget. Combining expenditures is the best way to estimate the expenses. There will be no changes in the number of faculty in the departments or changes in the types of expenses incurred by either department as a result of the Neuroscience program. A modest increase of 2% per year for employee compensation and no increase in related departmental expenses is projected for budgetary planning. The proposed program will have no additional impact on the budget.

TABLE 2: EXPENDITURES:					
Expenditure Categories	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1. Faculty (b + c below)	$ 2,093,166	$ 2,135,030	$ 2,177,730	$ 2,221,285	$ 2,265,710
a. #FTE	22	22	22	22	22
b. Total Salary	$ 1,674,533	$ 1,708,024	$ 1,742,184	$ 1,777,028	$ 1,812,568
c. Total Benefits	$ 418,633	$ 427,006	$ 435,546	$ 444,257	$ 453,142
2. Admin. Staff (b + c below)	$ 25,747	$ 26,262	$ 26,787	$ 27,323	$ 27,869
a. #FTE	0.75	0.75	0.75	0.75	0.75
b. Total Salary	$ 17,165	$ 17,508	$ 17,858	$ 18,216	$ 18,580
c. Total Benefits	$ 4,291	$ 4,377	$ 4,465	$ 4,554	$ 4,645
3. Support Staff (b + c below)	$ 57,538	$ 58,688	$ 59,862	$ 61,059	$ 62,280
a. #FTE	1.5	1.5	1.5	1.5	1.5
b. Total Salary	$ 46,030	$ 46,951	$ 47,890	$ 48,847	$ 49,824
c. Total Benefits	$ 11,508	$ 11,738	$ 11,972	$ 12,212	$ 12,456
4. Equipment	$ 13,900	$ 13,900	$ 13,900	$ 13,900	$ 13,900
5. Library	$ 26,080	$ 26,080	$ 26,080	$ 26,080	$ 26,080
6. New or Renovated Space	$ 0	$ 0	$ 0	$ 0	$ 0
7. Other Expenses	$ 85,450	$ 85,450	$ 85,450	$ 85,450	$ 85,450
TOTAL (Add 1-7)	$ 2,301,881	$ 2,345,410	$ 2,389,809	$ 2,435,097	$ 2,481,290

M. Adequacy of Provisions for Evaluation of Program (as outlined in COMAR 13B.02.03.15).

1. *Discuss procedures for evaluating courses, faculty and student learning outcomes.*
2. *Explain how the institution will evaluate the proposed program's educational effectiveness, including assessments of student learning outcomes, student retention, student and faculty satisfaction, and cost-effectiveness.*

The Neuroscience program will be subject to the same requirements for assessment and evaluation as existing programs. All Washington College students complete course evaluations at the end of each of their courses. The results of these evaluations are delivered to department chairs and the Dean and Provost of the College for use in tenure and promotion decision making.

Washington College has worked hard to ensure that the assessment activities we pursue are actually meaningful and help us improve the teaching and learning priorities that we identify as being most important. We have established a regular practice of assessment that is manageable and sustainable. Every year each department completes a Student Learning Outcomes Assessment (SLOA) report that outlines measurable objectives, describes how assessment data are captured, and presents student learning outcomes data. It also summarizes changes that the departments have made in response to previous assessment. In addition, every three years, each department submits Department Program Assessment and Planning (DPAP) reports in which

they reflect on the programmatic strengths and challenges of the previous three years and set a plan for moving forward. While SLOA reports focus on student learning outcomes, DPAP reports provide an opportunity to focus on issues other than student learning outcomes, such as enrollment growth, changes in the field, and strategic academic priorities.

N. Consistency with the State's Minority Student Achievement Goals (as outlined in COMAR13B.02.03.05).

1. *Discuss how the proposed program addresses minority student access & success, and the institution's cultural diversity goals and initiatives.*

The recruitment and retention of minority students is a priority for Washington College. In fall 2015, 12.8% of undergraduates were minority students and 5.2% African American. The good news for the College is that the diversity of incoming classes has been steadily increasing, even exceeding 20% for first-time, full-time students in fall 2016. That trend is consistent today with our institution still maintaining a 20% minority student population.

Washington College is committed to minority student access and success. We have hired an admissions counselor whose focus is on minority student recruitment. We have an Office of Intercultural Affairs with two professional staff members that support our minority students on campus as well as provide programming to educate the entire campus community. Faculty, staff, and students were invited to a diversity training in January. We also have a diversity committee on campus that has faculty, staff, and student members.

O. Relationship to Low Productivity Programs Identified by the Commission:

1. *If the proposed program is directly related to an identified low productivity program, discuss how the fiscal resources (including faculty, administration, library resources and general operating expenses) may be redistributed to this program.*

Not Applicable

P. Adequacy of Distance Education Programs (as outlined in COMAR 13B.02.03.22)

1. *Provide affirmation and any appropriate evidence that the institution is eligible to provide Distance Education.*

Not Applicable

2. *Provide assurance and any appropriate evidence that the institution complies with the C-RAC guidelines, particularly as it relates to the proposed program.*

Not Applicable

Appendix A: Distribution Requirements

Students are required to complete courses from the four categories listed below, unless a waiver is granted on the basis of Advanced Standing credits (AP, CIE, CLEP, or IB) or Transfer Credit equivalency. Other than the Natural Science component, combining courses from two departments to satisfy part of a distribution requirement is not allowed without permission from the chairs of the two departments involved. This permission must be obtained by the student and submitted in writing to the Associate Provost for Academic Services before the student takes the second of the two courses. Students may not use a single course to satisfy more than one distribution requirement simultaneously. However, courses offered to satisfy distribution requirements may also count toward any number of major or minor requirements.

I. Foreign Language Requirement – Students must complete one or two courses in a foreign language depending on their placement level.
II. Natural Science and Quantitative Requirement – Students must complete three courses, with at least one satisfying the Natural Science component and another satisfying the Quantitative component. The third course is the student's option but must follow a set of pairing rules. Generally, this means students take the second course in the sequence of either their Natural Science or Quantitative component choice. A complete description of this requirement is included in Appendix E.
III. Humanities and Fine Arts Requirement – Students must complete three courses, with at least one satisfying the Humanities component and another satisfying the Fine Arts component. The third course is the student's option but must follow a set of pairing rules. Generally, this means students take the second course in the sequence of either their Humanities or Fine Arts component choice.
IV. Social Science Requirement – Students must complete three courses, with at least two from the same department.

Appendix B: Neuroscience Catalog Entry

Catalog Language

The Neuroscience major at Washington College is an interdisciplinary major that provides students a broad foundation in the concepts and techniques that are essential for a discipline that lies at the interface of biology, chemistry, psychology, and other disciplines. What makes neuroscience distinctive at Washington College is that it is designed such that students take advanced elective courses within two categories that emphasize the physical and emergent properties of the nervous system while providing a breadth of knowledge.

Table 1. Advanced Elective Categories

Physical Properties of the Nervous System	**Emergent Properties of the Nervous System**
Courses that deal with the underlying chemical, biochemical, and physiological principles that dictate how neurons function	Courses covering how collections of neurons combine to produce behavior, emotions, and self-awareness

Students will share a common set of courses and opportunities for extensive interdisciplinary learning in the classroom as well as through research experiences. There will be a common Junior Seminar course and SCE requirement that is intended to encourage collaborative learning and research across the various disciplines involved in the major.

Students completing the Neuroscience major will be prepared for a variety of career opportunities, including neuropsychological, neurobehavioral assessment and neurorehabilitation, biomedical research, a range of health professions, and post-graduate education. This program is jointly administered by representatives of the Biology, Chemistry, and Psychology Departments.

Requirements

The Neuroscience major requires two introductory courses in Biology, Chemistry, and Psychology, as well as a quantitative course requirement that may be met by completing one of two course options. There are two core courses, and either one may be completed to satisfy this curricular requirement. Students must then take six advanced courses comprised of at least two from each department. Neuroscience majors will take a common Junior Seminar course and senior capstone experience (SCE) to complete the requirements for the major. The junior seminar course will be designed to prepare majors for the SCE and will fulfill the campus W3 writing requirement. A total of 62 credits are required to complete a major in Neuroscience. The requirements for the major are summarized in **Table 2**.

Appendix B: Neuroscience Catalog Entry

Table 2. The Proposed Neuroscience Curriculum.

Introductory Courses

Students are required to take all six courses

BIO 111 – General Biology I	CHE 120 – Chemical Principles of Organic Molecules	PSY 111 – General Psychology I
BIO 112 – General Biology II	CHE 140 – Reactions of Organic Molecules	PSY 112 – General Psychology II

Neuroscience Core Courses

Students must take one of these two courses

BIO 311 – Neurobiology

PSY 210 – Biopsychology

Advanced Elective Courses

Students must take a combination of six additional courses from the two advanced elective categories. The courses must be from three different departments, at least two courses must be from each department and at least 4 at or above the 300 level.

Physical Properties of the Nervous System	***Emergent Properties of the Nervous System***
BIO 205 – Cell Biology	BIO 328 – Behavioral Ecology
BIO 209 – Genetics	PSY 233/234 – Psychopathology I or II
BIO 301 – Integrative Human Anatomy	PSY 305 – Psychopharmacology
BIO 302 – Developmental Biology	PSY 313 – Learning and Applied Behavioral Analysis
BIO 350 – Neurotoxicology	PSY 316 – Cognitive Neuroscience
BIO 394 - Neurodevelopment	PSY 317 – Sensation and Perception
BIO 424 – Integrative Human Physiology	PSY 410 – Neuroscience Research Methods
CHE 220 – Quantitative Chemical Analysis	NEU xxx Approved Special Topics
CHE 303 – Chemistry of Biological Compounds	NEU xxx Approved Research Experience
CHE 309/BIO 409 - Biochemistry	
CHE 320 – Medicinal Chemistry	
NEU xxx Approved Special Topics	
NEU xxx Approved Research Experience	

Quantitative Courses

Students must take one of these two courses.

***Substitute statistics courses can be made at the discretion of the Program Chair.

MAT 109 – Statistics

PSY 209 – Statistics and Research Design I

Additional Required Courses

Students must take both of the following courses

NEU 300 – Neuroscience Junior Seminar

Senior Capstone Experience

Appendix B: Neuroscience Catalog Entry

Sample 4-Year Plan

Based on the academic requirements for the Neuroscience major, below is a typical plan of study for students wishing to complete the major in four years. The proposed curriculum can be condensed to three years to accommodate students who begin the major late, desire to graduate in three years or choose to study abroad.

Table 3. Sample 4-Year Plan for Students Pursuing a B.S. in Neuroscience

Year 1		Year 2	
Fall	Spring	Fall	Spring
BIO111 *PSY111* *CHE 120* *FYS Course*	*BIO112* *PSY112* *CHE 140* *HFA Distribution*	*PSY 210/ BIO 311* *MAT 109 or PSY209 or Elective* *1st Physical Elective* *Language Course*	*1st Emergent Elective* *Language Course* *HFA Distribution* *SS Distribution*
Year 3		Year 4	
2nd Physical Elective *HFA Distribution*	*2nd Emergent Elective* *NEU Junior Seminar*	*3rd Physical Elective*	*4th Physical Elective* *Senior Capstone Experience*
** Students interested in Pre-Med will have to take MAT 111 or MAT 106/MAT 107 in addition to MAT 109 or PSY 209.*			

Majoring or Minoring in Biology, Chemistry, and Psychology

Due to the interdisciplinary nature of the Neuroscience major, students majoring in Neuroscience cannot double major in, or minor in, Biology, Chemistry, or Psychology.

Seminar Requirements (NEU 300)

All junior Neuroscience majors will participate in this required 2-credit course, normally taken during the fall semester of the junior year, that will further develop foundational skills that are essential skills to conduct, evaluate and advance neuroscience as a profession. These skills include appropriate research ethics, critiques of primary research literature, writing in the discipline, and oral presentation and research proposal development. A goal of the seminar is to bring majors together to foster interdisciplinary discourse and potential collaboration. Additionally, students will have the opportunity to focus on and clarify goals and develop academic and career plans. This course will fulfill the W3 requirement.

Senior Capstone Experience

The culmination of the student's academic experiences, the SCE in neuroscience, is intended to provide each student with an opportunity to deeply explore a research topic in neuroscience. In consultation with a faculty mentor, a process of active inquiry is facilitated that requires critical thinking, integration of acquired knowledge and skills, and mastery of intellectual accomplishment beyond the classroom. A theoretical review of a problem/question in the field or a data-driven research project is completed by each student. For the senior capstone experience, students will either be advised by a Biology, Chemistry, or Psychology faculty member. Students will be able to choose from two different options to complete the SCE which includes an experimental project or a written monograph on a topic of their choosing. Senior capstone students will be assigned to

a faculty advisor by the program director in consultation with program faculty. Seniors present the results of their project in a poster session that is open to the College community. The program has a set of Senior Capstone Experience Guidelines that are distributed to both junior and senior Neuroscience majors each Fall. Students must enroll in Neuroscience SCE in their final semester to obtain credit for the Senior Capstone Experience. The Senior Capstone Experience is graded according to the Washington College grading system, which involves the use of letter grades (A-F).

Internship and Research Opportunities

Neuroscience majors are strongly encouraged to participate in internships during their undergraduate education. These experiences afford students the opportunity to enhance their understanding of neuroscience concepts, gain additional laboratory experience, and/or network with other scientists and professionals. Internships may be located on or off-campus and may occur at any point during the academic year. Students wishing to earn course credit for an internship must gain approval from the Neuroscience program director prior to beginning the internship. A number of stipend-bearing internships and research opportunities exist for neuroscience majors. Summer on-campus research projects as well as summer and semester-long off-campus internships not only provide additional laboratory experience, but also allow students the opportunity to explore areas of neuroscience not covered in-depth by the core curriculum. Off-campus and on-campus internships may or may not bear credit.

Distribution Courses

Students are instructed to consult the section of the catalog on Distribution Requirements to see what courses count for distribution.

Advanced Placement Credit

Students are instructed to consult either the Biology, Chemistry, or Psychology Department catalog section to determine the policy on Advanced Placement or IB credit.

Transfer Credit

Students are instructed to consult either the Biology, Chemistry, or Psychology Department catalog section to determine the policy on transfer credit.

NOTE ABOUT PREREQUISITES

To enroll in any course, a student must complete and successfully pass all prerequisites that are required.

Appendix C: Course Descriptions for the Neuroscience Program

The following are a list of the courses, with descriptions, that count towards the Neuroscience program from the Biology, Chemistry, and Psychology Departments. Not all of these courses are required as part of the proposed program, but they could be used as an elective.

Required Introductory Courses

BIO 111, 112. General Biology with laboratory
This course provides an introduction to living systems. Topics studied include biomolecules, cell structure and function, metabolism, genetics and molecular biology (111) and diversity of life, physiology of plants and animals, evolution, and ecology (112). The laboratory complements the lecture and also provides an introduction to experimentation and communication of experimental results. These courses are designed for students with a strong interest in the biological sciences and are prerequisites for upper-level biology courses. An honors section of BIO 111 and of BIO 112 is offered. Biology 111 or permission of instructor is required for Biology 112.

CHE 120 - Chemical Principles of Organic Molecules
This one-semester course provides a foundation in the fundamental principles of chemical structure and reactivity of organic molecules. Key topics include atomic and molecular structure, intramolecular and intermolecular forces, organic functional groups, thermochemistry, acid/base equilibria, kinetics, and basic organic reaction mechanisms. Laboratory work is designed to complement the lecture material. Three hours of lecture and three hours of laboratory each week. Offered every semester.

CHE 140 - Reactions of Organic Molecules
Reactions of Organic Molecules (CHE 140) builds upon the fundamental principles discussed in CHE 120 Chemical Principles of Organic Molecules. This course will focus on the reactivity of organic molecules, including aliphatic and aromatic hydrocarbons, their halogenated derivatives, and molecules containing heteroatoms such as oxygen, nitrogen, and sulfur, alone or those incorporated in biologically relevant molecules. Particular emphasis is placed on the structure and function of organic molecules important in biological systems as well as the discussion of reaction mechanisms. Students will also be exposed to chemical synthesis and the use of modern spectroscopic techniques for the determination of molecular structure. This course will meet for three hours of lecture and three hours of lab per week. Prerequisite: Chemistry 120.

PSY 111, 112. General Psychology
An introduction to the scientific study of behavior and mind, embracing all aspects of human experience. Topics include the anatomical and functional organization of the nervous system, consciousness, learning, memory, development, emotion, social interactions, psychopathology, and society and culture. This course surveys the methods and major findings of the various fields of psychology. PSY 111 introduces the student to the cognitive, neurological, and biological aspects of psychology in addition to basic research methodologies. PSY 112 covers the clinical/counseling, developmental, personality, and social aspects of psychology.

Appendix C: Course Descriptions for the Neuroscience Program

Required Core Courses

BIO 311 – Neurobiology with lab
This course will present an overview of the field of neurobiology. We will discuss the structure and components of the nervous system, the development of the nervous system including early events that specify neuronal cells and processes required for neuronal migration and function. In addition, we will examine the methods of communication within the nervous system and include and overview of some of the sensory systems that relay environmental cues for processing in the CNS. We will explore the general maintenance and repair within the nervous system. As well as explore topics of neurological diseases/disorders via student presentations. The purpose of this laboratory is for you to become familiar with the neuroanatomy as well as experimental techniques used in the field of neuroscience both by hands on experience and reading/presenting journal articles. The laboratory is designed to help you to develop your skills in carrying out experiments and analyzing/presenting experimental data. Prerequisite: Biology 111-112 and one 200-level biology course.

PSY 210 – Biopsychology with lab
The study of the biological bases of human and non-human behavior. The emphasis is on the organization of the nervous system as it relates to behavior and conscious thought. Specific topics may include: structure and function of the nervous and endocrine systems; mechanisms of neurotransmission; neurologic disorders; feeding; reproduction; aggression; sleep and dreaming; functional organization of sensory and motor systems; lateralization of function and language disorders; learning and memory; and the biological bases of emotion and psychopathology. Laboratory. Prerequisite 111, 112 or Biology 111, 112 either before or concurrently.

Advanced Electives – Physical Properties of the Nervous System

BIO 205 – Cell Biology with Laboratory
An examination of the structure and function of cells. Topics covered will include the various chemical components and physical factors which contribute to cell structure and function. Lectures will also include surveys of cellular diversity and subcellular organization, including organelles, membranes, and the cytoskeleton. The laboratory explores these components using microscopy, tissue culture, and molecular techniques. Biology 205 provides a broad foundation for subsequent cellular, molecular, biochemical and genetics courses. Prerequisite: Biology 111-112.

BIO 209 – Genetics with Laboratory
A study of heredity in cells, individuals, and populations, and of the molecular expression of genes. The course emphasizes genetic analysis in both lab and lecture. Topics in the laboratory include experiments in transmission, population, cellular, and molecular genetics using a variety of organisms as models. Prerequisite: Biology 111-112.

Appendix C: Course Descriptions for the Neuroscience Program

BIO 301 – Integrative Human Anatomy with Laboratory
A comparative study of the major body systems of vertebrates, with emphasis placed on system structure, function, and evolutionary modification across vertebrate phylogeny. Laboratory work consists of detailed systems-level examination and comparative dissection in numerous representative vertebrates. Prerequisite: Biology 111-112 and one 200-level biology course.

BIO 302 – Developmental Biology with Laboratory
Examines embryo development, focusing on cellular and regulatory mechanisms that guide the process. We will cover the events of development from fertilization through organogenesis in a range of animal systems including sea urchins, Drosophila, amphibians, chickens and mammals. This course will also examine the role of developmental biology in medicine including stem cells. The laboratory portion is an investigative approach to the study of animal development, emphasizing cellular and molecular techniques that will complement many of the topics covered in lecture using sea urchin and chicken animal models. Prerequisite: Biology 111-112 and one 200-level biology course. Biology 205 recommended.

BIO 394 – Neurodevelopment with Laboratory
The human brain contains about 86 billion neurons, each with a unique role in the nervous system as a whole, from keeping you breathing to helping you decide what to eat for lunch. An enduring mystery of animal biology is how this astonishing variety arose from a uniform, nondescript clump of cells in the early embryo. In this course, you will investigate the cellular mechanisms that regulate the development and functional specialization of the nervous system as well as the environmental factors that influence these mechanisms. Coursework emphasizes discussion and analysis of primary literature. Weekly laboratory sessions utilize model organisms such as fruit flies and embryonic chicks for molecular and cellular-level investigations. Prerequisite: Biology 111 and one 200-level Biology course.

BIO 424 – Integrative Human Physiology with Laboratory
A comparative study of physiological processes in animals. Topics will include gas exchange, circulation, water and ion balance, and excitable cells. As a comparative study, we will examine a variety of animals that are adapted to function in diverse environments. A weekly laboratory illustrates physiological principles. Prerequisites Biology 111-112 and two 200-300-level Biology courses.

CHE 220 – Quantitative Chemical Analysis
This one-semester course is intended to provide an introduction to analytical methods utilized in chemistry. Both classical and instrumental methods of analysis are considered. A detailed treatment of simple and complex chemical equilibria with particular emphasis on acid-base, oxidation-reduction, and precipitation equilibria is presented as a basis for the classical gravimetric and titrimetric methods. The instrumental techniques include electroanalytical, UVvisible molecular spectroscopy, atomic spectroscopy, and chromatography. Other topics include a review of intermolecular forces and states of matter. Three hours of lecture and three hours of laboratory each week. Offered every semester. Prerequisite: CHE 120.

Appendix C: Course Descriptions for the Neuroscience Program

CHE 303 – Chemistry of Biological Compounds

This course is designed to provide a comprehensive introduction to the structure and function of biological molecules at the molecular level. Using post-translational modification of proteins as a guide, we will explore intermolecular interactions, biomolecular structure (proteins, nucleic acids, carbohydrates and lipids) and fundamental concepts in mechanistic enzymology. Students will learn to interpret biochemical data, predict the impact of mutations associated with disease and visualize biomolecular structures with the aid of computer software commonly utilized in the field. Additional topics include: RNA transcription, protein translation, enzyme engineering and more. Three hours of lecture and three hours of laboratory each week. Prerequisite. Prerequisite: Chemistry 140 or 202 and 220. (Offered annually)

CHE 309/BIO 409 – Biochemistry

An examination of living systems at the chemical level. Topics will include structure and function of macromolecules, cellular energetics, cellular respiration, and photosynthesis. A laboratory will be conducted weekly to introduce students to experimental techniques. Prerequisites: Biology 111, Chemistry 140 or 202 and Chemistry 220, or permission from instructor. (Offered annually: Fall)

CHE 320 – Medicinal Chemistry

This course is an introduction to the field of Medicinal Chemistry and will focus heavily on the chemistry of pharmacological agents as well as their synthesis. Attention will also be placed on enzyme mechanisms and how bioactive molecules affect their activity. This course meets three hours each week. Prerequisite: Chemistry 201 AND 202. (Offered Biennially)

Approved Special Topics

Departments regularly offer novel courses under a special topics course code (ex. BIO 394/494, CHE 394/494). Those courses may be approved for inclusion in the requirement for this advanced elective category when their content is considered related to the physical properties of the nervous system.

Advanced Electives – Emergent Properties of the Nervous System

BIO 328 – Behavioral Ecology

This course addresses how animal behavior has evolved in response to ecological pressures in the environment. Topics covered in the course include competition, sexual selection, parent-offspring conflict, social interactions, and game theory. Laboratory work will include discussions of primary literature, activities in the classroom, and field excursions. The course will include three hours of lecture and three hours of lab each week. Prerequisite: Biology 111 and Biology 112.

PSY 233 – Psychopathology I

Evaluation of the etiology of various forms of behavior disorders (anxiety, mood, substance abuse, psychotic), their symptoms, and treatment. These disorders will be considered in relation to clinical theories, research, and practice. Prerequisite: Psychology 111, 112 either before or concurrently.

Appendix C: Course Descriptions for the Neuroscience Program

PSY 234 – Psychopathology II
Evaluation of the etiology, symptoms, and treatment of behavior disorders within the broad areas of childhood/developmental disorders and medical/organically-induced abnormal behavior. Specific topics include disorders of personality, impulse-control, eating, sleep, sex, and neurocognition. Disorders will be considered in relation to clinical theories, research, and practice. Prerequisite: Psychology 111, 112 either before or concurrently. Psychopathology I is NOT a prerequisite.

PSY 305 – Psychopharmacology with Laboratory
An in-depth study of the chemistry and pharmacology of the nervous system. Laboratory exercises will emphasize the use of laboratory animal models in pharmacological research. The actions of pharmacological agents on both the central nervous system and the peripheral nervous system will be explored. Laboratory exercises emphasize the use of behavioral measures used by pharmaceutical researchers to assess dose effects, drug tolerance, withdrawal, and drug interactions. Laboratory. Prerequisite: Psychology 210 or Biology 111, 112 either before or concurrently. Psychology 209 is recommended.

PSY 313 – Learning & ABA with Laboratory
Reviews of theoretical and empirical research related to classical, operant and cognitive aspects of learning. Emphasis in lectures and the laboratory will be on the use of these theoretical contributions within the discipline of Applied Behavioral Analysis. Laboratory. Prerequisite: Psychology 111, 112 either before or concurrently.

PSY 316 – Cognitive Neuroscience with Laboratory
How is consciousness created? Cognitive neuroscience investigates the biological bases of higher order cognition and complex human behavior. Discussion topics include the methodologies of cognitive neuroscience as well as the neural underpinnings of perception, attention, learning, memory, language, executive function, emotion, development, social cognition, intelligence, neural and psychiatric disorders, and consciousness. Prerequisites: Psychology 111, 112, and Psychology 209 or Math 109 either before or concurrently. Recommended courses: Psychology 210.

PSY 317 – Sensation & Perception with Laboratory
A survey of the methods by which humans detect and process external stimuli and the brain pathways involved in creating meaningful perceptions out of sensory information. Special attention is directed to experimental approaches, sensory physiology, perceptual illusions and deficits in each sensory modality, including vision, audition, olfaction, taste, and touch. Laboratory demonstrations and simulations are intended to provide concrete examples and provide a mechanism for exploring each sensory modality. Laboratory. Prerequisites: Psychology 111, 112 either before or concurrently.

Appendix C: Course Descriptions for the Neuroscience Program

PSY 410 – Neuroscience Research Methods

This course is recommended for students who are preparing for graduate study in neuroscience or medicine and combines seminar and lab work. The topics discussed in the seminar vary from year to year (e.g., Psychopharmacology of Mood Disorders, Animal Models of Mental Illness, Traumatic Brain Injury, Cognitive & Neurological Assessment) and may be repeated with permission of the concentration advisor. During the final portion of the course, students design and conduct a pilot research project. The project should be a means for the student to hone skills (e.g., perfect a specific surgical procedure) or apply specific research techniques (e.g., neural tract-tracing, histochemistry, clinical neurological assessment, animal behavioral assessments, or topographic EEG mapping) available to students in the department laboratories for his or her senior thesis project. Prerequisite: Psychology 111, 112 or Biology 111, 112 and Psychology 209 either before or concurrently; or permission of the instructor.

WASHINGTON COLLEGE

June 23, 2021

James D. Fielder, Jr., Ph.D., Secretary
Maryland Higher Education Commission
6 North Liberty Street
Baltimore, MD 21201

Dear Dr. Fielder:

We are preparing a proposal for the approval from the Maryland Higher Education Commission of a Neuroscience major at Washington College. I am writing to provide an assurance that the library resources, physical facilities, infrastructure and instruction equipment are adequate to support the proposed program. In fact, the program will be implemented within existing institutional resources. The library resources and physical facilities are both sufficient because the Neuroscience major is being built out of our current Biology, Chemistry, and Psychology curriculum.

Thank you for your consideration of our proposal. We appreciate your service of higher education in the state of Maryland.

Sincerely,

Wayne B Powell

Wayne B. Powell
Washington College
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410-778-7201