

**Proposed Program:** Bachelor of Science in Neuroscience

**Institutional Setting:** UW-Milwaukee, College of Letters & Science

**Mode of Delivery:** Face-to-face, blended, and online course offerings

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### **Description of anticipated program and learning outcomes**

The nervous system controls nearly every aspect of how our body functions, for example learning new information, converting sensory stimuli to meaningful units like faces and songs, initiating voluntary movements, digesting our food, and breathing. To understand how actions of the brain and its peripheral nerves result in the thoughts and behaviors that allow organisms to survive and thrive, neuroscientists must understand how physical and chemical changes in molecules within individual cells translate into electrical and chemical signals that propagate messages among cells in the brain and periphery to coordinate the expression of behaviors. Thus, Neuroscience is an inherently interdisciplinary endeavor, drawing from numerous fields, including biology, chemistry, physics, and psychology.

**An integrated B.S. in Neuroscience would allow students interested in neuroscience to select a single major that incorporates required courses in biology, chemistry, physics, and psychology, with electives in these fields and others.**

Neuroscience majors will be required to complete core courses in Biological Sciences (e.g., Neurobiology), Psychology (e.g., Physiological Psychology), Chemistry, Physics, and Statistics to provide a foundation for understanding how the brain works. This core foundation will prepare students for an array of elective courses, including laboratory courses that provide hands-on experience with classic and current research methods. For example, students interested in molecular biology might elect to take courses like Cell Biology, Molecular Genetics, or Developmental Biology. Those more interested in behavioral phenomena may elect courses such as Cognitive Neuroscience, Hormones and Behavior, and Neurobiology of Learning and Memory. Students will also be highly encouraged to participate with program faculty in empirical laboratory research to enhance and refine their research skills and expertise. This research could be conducted as elective credits or through paid or volunteer positions.

**Learning outcomes:** Students who complete the Neuroscience major will be able to: (a) Understand how neurons and glia function on a biological, chemical, physical, and systems level; (b) Appreciate how the actions of neurons and glia translate into behavioral and physiological change; (c) Critically evaluate the scientific literature to identify key gaps and design experiments to fill those gaps; (d) Demonstrate hands-on expertise collecting and analyzing data; (e) Clearly communicate scientific ideas and research findings in written and oral forms.

### **The program and its relation to other offerings**

The Neuroscience major would draw its required core courses and its electives from offerings in the **College of Letters and Science**. Additional electives could come from the School of Engineering, School of Health Sciences, and School of Public Health. The major is likely to attract students with primary interests in Psychology and Biological Sciences who might otherwise major in those disciplines. Although this might slightly reduce the numbers of those majors, these students would still take the same courses in Psychology and Biological Sciences that they would in those majors, so the student credit hours in those departments should not decrease. Indeed, we expect a Neuroscience major to draw new students to UWM, so enrollments in both departments are likely to increase.

### **Existing or anticipated resources required to deliver the program**

Expenses associated with the new major would be relatively minimal because the required and elective courses are already being taught by existing faculty members.

### **Accrediting bodies**

The major will be accredited by the Higher Learning Commission.

### **The new program's alignment with institutional mission and strategic plan**

The Bachelor of Science in Neuroscience will fulfill a gaping need in UWM's undergraduate science offerings, thereby better aligning our curriculum with the [university's mission](#) to be a top-tier research university. Nearly all top-tier research universities, and indeed most 4-year liberal arts colleges, have had Neuroscience majors for many years and they have proven very popular. UWM stands out among its peers for its lack of a Neuroscience major, which has undoubtedly led to a **loss of enrollment** as students with strong interests in Neuroscience select other institutions that offer the major. As an institution that espouses the guiding values of innovation, scholarship, and research, and the only R-1 research university in the UW System located in southeastern Wisconsin, UWM must lead rather than follow.

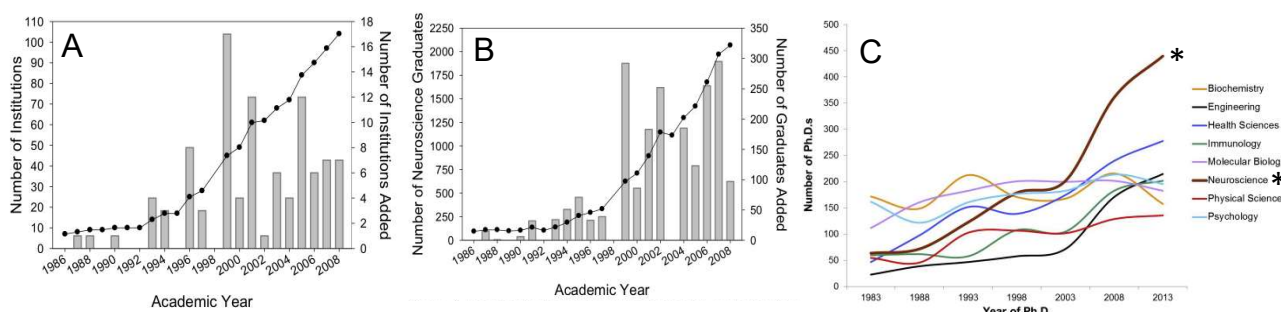
UWM already supports a rich Neuroscience community, with faculty and students conducting neuroscience research in Psychology, Biological Sciences, Chemistry, Physics, Engineering, Health Sciences, and Public Health. The [Neuroscience at UWM](#) program has existed for at least two decades, and is comprised of core and affiliated faculty from numerous departments and colleges. These faculty have already shown a commitment to Neuroscience through their attendance at weekly seminars by distinguished outside speakers and semiannual graduate/undergraduate research symposia. However, we cannot effectively attract and educate students at the undergraduate level without a dedicated major.

### **Rationale defining the need for the new program**

*Student Demand:* Student interest in Neuroscience at UWM is evidenced by consistently strong enrollments in Neuroscience courses offered in Psychology and Biological Sciences, and by high student demand for research experiences in the laboratories of Neuroscience faculty. Students with particularly strong interest in Neuroscience are likely to be double Psychology/Biology majors or to major in one discipline and minor in the other. In Spring 2020, there were 8 double majors, 6 Biological Sciences majors/Psychology minors, and 1 Psychology major/Biological Sciences minor. Several of these students are also minoring in Chemistry and Biochemistry. Given the overlap between the proposed Neuroscience B.S. curriculum, we would expect many of these students to be possible Neuroscience majors. Although this is currently a small number of students, a Neuroscience major is certain to both attract existing students and draw new students to UWM. Growth in this major is expected to increase steeply. As an example, Michigan State's Neuroscience major grew steadily from 241 students in 2013 to 871 in 2018.

*Market Demand:* Neuroscience majors have exploded in popularity in the past two decades and have become a standard offering at private and public institutions across the country (Ramos et al., 2011; Pinard-Welyczko et al., 2017). The number of institutions offering undergraduate Neuroscience programs and numbers of graduates from these programs skyrocketed from the late 1980's through the late 2000's, with numbers tripling from 1996-2006 (Fig. 1A,B; Ramos et al., 2011). Interest in Neuroscience is further reflected in the rapid growth in numbers of Neuroscience PhDs, which greatly

outpaces that of other life and natural sciences (Fig. 1C; Akil et al., 2016). The burgeoning interest in neuroscience on the undergraduate and graduate levels is fueled by the need for a better understanding



**Figure 1.** (A) Growth of undergraduate neuroscience programs. # of institutions that report having an undergraduate neuroscience program (black line and filled circles; left-side y-axis) and the # of institutions with neuroscience programs added compared to the previous year (gray bars, right side y-axis). (B) Increase in the total number of reported graduates from undergraduate neuroscience programs/majors (black line and filled circles; left-side y-axis) and the # of additional graduates of neuroscience programs added compare to previous year (gray bars, right side y-axis). (C) Growth in # of PhDs in various sciences from 1983-2013 according to the NIH Office of Extramural Research (OER). In 2013, the # of Neuroscience (brown line) PhDs far outnumbered any other discipline.

of brain function to prevent or treat numerous neurodevelopmental (e.g., autism, Fragile X, Down syndrome), psychiatric (e.g., depression, anxiety disorders, addiction, schizophrenia), and neurodegenerative disorders (e.g., Alzheimer's, Parkinson's, ALS). In recognition of this critical need, the NIH has allocated hundreds of millions of dollars in recent years to the BRAIN Initiative, designed to improve tools for neuroscience research, as well as to NIH institutes that fund neuroscience research including the National Institute of Mental Health, National Institute on Aging, National Institute on Drug Abuse, and National Institute of Neurological Disorders and Stroke.

*Program Duplication:* A search of the “Major Mania” system for “Neuroscience” revealed just three Neuroscience majors in the UW System, at UW-Madison, UW-Eau Claire, and UW-River Falls. Of these campuses, none are in eastern Wisconsin. The proposed Neuroscience major would provide a unique opportunity for students in the Milwaukee, Northern Illinois, and Green Bay regions to obtain a Neuroscience degree. Moreover, only one UW campus offering the Neuroscience major is a research university. Thus, *the proposed Neuroscience major at UWM would not produce unnecessary program duplication.* Moreover, as a STEM discipline, Neuroscience is driven by laboratory research, and undergraduates in neuroscience labs at UWM benefit from conducting research side-by-side with PhD students and postdoctoral scholars in federally-funded research labs. These students are involved in established collaborative research projects with faculty in other departments on campus (e.g., Chemistry, Biological Sciences, Biomedical Engineering, Physics), and at other Milwaukee institutions including the Medical College of Wisconsin, Marquette University, and Concordia University Wisconsin. As such, **undergraduate Neuroscience majors at UWM would gain outstanding education and hands-on training in neuroscience from faculty actively engaged in cutting-edge federally-funded research.**

#### References:

- Akil H et al., Neuroscience training for the 21<sup>st</sup> Century, *Neuron*, 2016, 90:917-926.
- Pinard-Welyczko KM et al., Characterizing the Undergraduate Neuroscience Major in the U.S.: An Examination of Course Requirements and Institution-Program Associations, *The Journal of Undergraduate Neuroscience Education*, Fall 2017, 16(1):A60-A67.
- Ramos RL et al., Undergraduate Neuroscience Education in the U.S: An Analysis using Data from the National Center for Education Statistics, *The Journal of Undergraduate Neuroscience Education*, Spring 2011, 9(2):A66-A70.