MORGAN STATE UNIVERSITY
GROWING THE FUTURE • LEADING THE WORLD

Provost and Senior Vice President for Academic Affairs

May 16, 2022

The Honorable Dr. James D. Fielder, Jr.
Maryland Higher Education Commission
6 N. Liberty Street, 10th Floor
Baltimore, MD 21201

Dear Dr. Fielder,

On behalf of Morgan State University, please find attached a proposal to establish a new Academic Program, the "*Master of Science in Applied Neuroscience"* in the School of Computer, Mathematical, and Natural Sciences. We are proposing to offer this program to students in their choice between two formats: (1) fully online in an option without thesis or (2) mostly online with some lab-based credit acquired in person and where a research thesis must be completed. This proposed Academic Program was approved by the Board of Regents on May 3, 2022.

If additional information is required, please contact me at hongtao.yu@morgan.edu or (443)885-3350.

Sincerely,

Hongtao Yu, PhD
Provost and Senior Vice President for Academic Affairs, Morgan State University

cc: Dr. David Wilson, President, Morgan State University
Dr. Phyllis Keys, Interim Associate Vice President for Academic Affairs, MSU
Dr. Cleo Hughes-Darden, Int. Dean, School of Computer, Mathematical, & Natural Sciences, MSU
Dr. Emily Dow, Assistant Secretary for Academic Affairs, Maryland Higher Education Commission

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

Institution Submitting Proposal	Morgan State University

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 # ( ) Check # Payment Amount: $850 Date Submitted: 5/15/22

Department Proposing Program	School of Computer, Mathematical, and Natural Sciences	
Degree Level and Degree Type	Master of Science (Thesis & Non-thesis options)	
Title of Proposed Program	Applied Neuroscience	
Total Number of Credits	30	
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: 2023
Provide Link to Most Recent Academic Catalog	URL: catalog.morgan.edu	
Preferred Contact for this Proposal	Name: Dr. Phyllis Keys	
	Title: Interim Associate Vice President for Academic Affairs	
	Phone: (443) 885-3350	
	Email: Phyllis.Keys@morgan.edu	
President/Chief Executive	Type Name: Dr. Hongtao Yu, Provost & Senior Vice President for Academic Affairs	
	Signature: [signature]	Date: 05/16/2022
	Date of Approval/Endorsement by Governing Board:	05/03/2022

Revised 1/2021

Morgan State University

Proposed Master of Science (MS) in Applied Neuroscience

(New M.S. Program)

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.

This Program in **Applied Neuroscience** is designed to combine **training in biomolecular neuroscience with emphasis on health disparities research, with neuroengineering/big data training approaches** to prepare students to succeed in 21st-century professional settings and/or in their matriculation into doctoral programs. A core course curriculum will prepare participants to choose among electives that will enable them to focus on either molecular neuroscience or neuroengineering applications in their preparation for the workforce or research.

Students may select between a non-thesis or a thesis option, with the non-thesis option offered entirely online (See tables 1 and 2 below).

The non-thesis option is designed for students who desire to expand their skill set, in either of the two areas of concentration, in order of advancing their career in the workplace or to become more competitive for professional school programs.

Table 1: Degree Path for MS in Applied Neuroscience without Thesis (30 credits)

	MS in Applied Neuroscience
Core Courses	20 credits, administered online
Elective Courses	Minimum of 6 credits, administered online
Research Credits	0 credits
Capstone Project Course NEUS 530	4 credits, online
Total credits	**30**

The thesis option of the Program is recommended for students interested in a research career either to provide technical services or to enhance their competitiveness for research-focused doctoral programs (Ph.D., D. Eng).

Table 2: Degree Path for the MS in Applied Neuroscience with Research Thesis (30 credits)

	MS in Applied Neuroscience
Core Courses	20 credits, administered online
Elective Courses	Minimum of 3 credits, administered online
Thesis Research Credits	Minimum of 4 credits administered in person (lab-based)
Thesis Guidance/Thesis Defense	3 credits; written thesis and oral thesis defense according to School of Graduate Studies guidelines
Total credits	**30**

This proposed MS program supports the mission of Morgan State University (MSU) in multiple ways:

- MSU is designated Maryland's Preeminent Public Urban Research University and has historically provided advanced education opportunities to an underserved student population. As such MSU has one of the lowest tuition/fee structures in the State of Maryland but ranks among the top institutions in the country that produce graduates who subsequently complete doctorates in the sciences and health professions. An affordable MS in Applied Neuroscience with a focus on brain health disparities will greatly enhance the mission of MSU in preparing top-notch, competitive scientists in a culturally supportive environment.

- Furthermore, **the MS in Applied Neuroscience supports the current initiative at MSU to build an interdisciplinary Center for Brain Science** with emphasis on research in brain health disparities. MSU was recently awarded matching funds for an endowed chair via the Maryland Department of Commerce E-Nnovation fund. This endowed chair will head the new Center for Brain Science at MSU, supported at the level of $2,000,000, which will be associated with this MS program.

- The University also has recently entered agreements with partner institutions in the Baltimore area, most prominently the Lieber Institute (https://www.libd.org/), to further brain health-related research with a focus on African Ancestry. This endeavor aims to address brain health disparities from a molecular biological as well as from a big data and public health approach.

- **The proposed MS in Applied Neuroscience is strategically situated at the intersection of Biology, Information Technology, and Engineering with a strong emphasis on health disparities studies.** This program will train students to engage in the interdisciplinary and inter-institutional neuroscience/brain sciences research endeavors and render them well prepared to enter doctoral training after graduation from MSU or to directly enter the job market in relevant Maryland Industries or research Institutions. With that, the program is focused on demographics that the University, as an HBCU and Urban University, is dedicated to serving while bringing a highly innovative and interdisciplinary approach to the table.

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

Alignment with Institutional Strategic Goals:

The MS program proposed here is aligned with **all 4 overarching goals of the University's 2021-2030 Strategic plan: 1) Enhance Student success and well-being. 2) Achieve designation as R1 Institution. 3) Serve as a premier anchor institution for Baltimore City and beyond. 4) Expand and accelerate globalization efforts**

Goal 1) As detailed further below, an MS Program that prepares students for work at the interface of biomolecular neuroscience neuroengineering and data science does not currently exist in a public institution in Maryland. In fact, **no public institution in the State offers an MS program in neuroscience or brain science** into which students can directly matriculate. Yet, this is a training environment in high demand and with good job prospects in the State. Thus, the proposed Program will enhance student success in attaining a high-demand academic/ career training. **Goal 2)** as MSU moves towards R1 status, increased research capacity will raise institutional demand for graduate students along with the need to develop innovative new graduate training programs that meet the interdisciplinary research approaches of the Center for Brain Science. **Goals 3 & 4)** The proposed Program enhances Morgan's instructional capacity to train professionals to serve the City of Baltimore, the State of Maryland, the region, the nation, and beyond, by attracting underrepresented students to this unique program. Because the proposed Program can be completed remotely (non-thesis option) it will enable working students in the urban community as well as internationally to work towards career advancement and also increase the global footprint of MSU in neuroscience. MSU currently has international consortia in several countries through which students can access and complete this degree program, enriching their available training options.

The Program also aligns well with the vision and strategic initiatives in the School of Computer, Mathematical, and Natural Sciences (SCMNS) at MSU where the program will be housed. SCMNS has been at the forefront of the development of R2 designation at MSU and will need to continue its vanguard position as we move towards R1 status. Enrolment in SCMNS has increased by over 30% in the past 6 years and external research funding has more than quadrupled during the same time frame. Strategic Initiatives of the School of Computer, Mathematical and Natural Sciences (SCMNS) include "to expand academic program offerings, including new and online degree programs and up-to-date curricula," as well as "to recruit more graduate students." The MS in Applied Neuroscience is designed to meet these SCMNS strategic goals and advance the mission of MSU to move towards R1 status.

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.)

The MS in Applied Neuroscience has received full support from Morgan's President, Dr. David Wilson, as well as Provost and Senior Vice President for Academic Affairs, Dr. Hongtao Yu. The president has prioritized interdisciplinary research in brain science toward a Center of Excellence at the University. Named the "**The Center for Brain Health" it is among the current strategic initiatives at the University and has funding committed to several new faculty positions in areas relevant to the MS Program proposed here**.

A strong sign of institutional commitment to the proposed Programs and the Center for Brain Health is that the University has committed matching funds to the E-Nnovation grant made by the State of Maryland Department of Commerce to endow a chair to lead the Center and its associated programs.

Ramp-up costs over the first 5 years for this MS Program will be synergistic with the Center for Brain Health. Students in the thesis option of the proposed Program will be working/training with faculty researchers in the Center. In addition to new hires, the Center includes existing faculty in Biology, Psychology, Engineering, Mathematics, and Computer Science and adjunct faculty from the Lieber Institute, who are engaged in relevant research and who will be teaching in the MS Program.

4. Provide a description of the institution's a commitment to:

a) ongoing administrative, financial, and technical support of the proposed program

The University is committed to establishing the Applied Neuroscience Program with full financial and institutional support. Morgan will support the MS Program with 11 current full-time faculty members, 2 current adjunct part-time faculty members (see Table 1 below), and 3 new faculty members in the Center for Brain Health, including the endowed chair/director of the Center.

Table 1: Program Associated Faculty

Name	**Rank, Department, School**	**Research Area**
Justin Bonney	Assistant Professor, Psychology, College of Liberal Arts (CLA)	Effects of technology on cognitive processes
Mingchao Cai	Assistant Professor, Mathematics, School of Computer, Mathematical & Natural Sciences (SCMNS)	Mathematical models of biomechanical simulation and quantification of brain activity
YunChi Chen	Associate Professor, Biology, SCMNS	HIV/Aids, neuro-inflammation
Frank Denaro	Associate Professor, Biology, SCMNS	Neurobiological effects of HIV/AIDs
Gloria Hoffman	Professor, Biology, SCMNS	Neuroendocrinology/reproductive control/developmental
Christine Hohmann	Professor, Biology, SCMNS	Brain-behavior relationships, developmental disorders, stress effects
Pilhwa Lee	Research Assistant Professor, Mathematics, SCMNS	Modeling brain processes, genomics, AI.
Timothy Meeker	*Adjunct Faculty, SCMNS* *Postdoctoral Scholar JHU, part-time*	*Pain research, brain imaging, health disparities*
Michael McConnell	*Adjunct Professor, SCMNS* *Research Scientist, Lieber Institute*	*Single-cell genome analysis of primary human neurons, brain mosaicism*
Onyema Osuagwu	Associate Professor, Electrical Engineering, School of Engineering (SoE)	Data science/artificial intelligence & neuro-engineering
Ingrid Tulloch	Assistant Professor, Psychology, CLA	Substance use disorders, brain-behavior effects, Neuroinflammation
James Wachira	Associate Professor, Biology, SCMNS	Genomics, Virology
Kimberly Warren	Associate Professor, Psychology, CLA	Mental health/obesity/healthy behaviors
3 new faculty positions	SCMNS	Molecular neuroscience, genomics/proteomics/metabolomics brain imaging and psychophysics, big data and AI competencies

All current faculty have adequate individual lab/research/office space in addition to access to core laboratories and facilities in the SCMNS and the vivarium located in facilities of the College of Liberal Arts

(Psychology Department) and computational resources in Engineering and Computer Sciences. All newly appointed faculty will be provided with furnished laboratory/research/office spaces (equipped with computers, phones, access to administrative and budgetary support) in addition to access to shared facilities as stated above. New faculty will also be provided start-up funds and given sufficient release time to jump-start their research program at MSU.

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

The president and provost of MSU are committed to supporting and growing the new Applied Neuroscience Program as part of their commitment to growing interdisciplinary brain science research at MSU but also in the service of Morgan's mission as an anchor institution (Maryland's Preeminent Public Urban Research University) in the Baltimore area and its global mission. Due to its online accessibility and Morgan's affordable tuition structure, this program is likely to provide access to student populations (working, non-traditional and international) who may ordinarily not have access to training in neuroscience/brain science.

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

   A growing disease burden in the area of brain and nervous system disorders demands a ramp-up of neuroscience research on the fundamental, translational, and clinical levels both in academia and the private sector. According to the World Health Organization, the prevalence of Mental, Neurological, and Substance Abuse disorders range from 14 to 24 percent across various nations (Charlson et al., 2019; Vigo et al., 2016). The United States has the highest burden of these disorders in North America (Vigo et al., 2019) with the potential to worsen over the next ten years. For example, emerging knowledge of the effects of COVID-19 on brain and neurological systems (Paterson et al., 2020), coupled with the significant number of COVID cases in the United States, suggests a growing need and demand for training in research and biomedical applications in the brain sciences.

   Brain Science/neuroscience has long been an interdisciplinary research endeavor drawing on insights from biology, chemistry, physics, and the behavioral sciences. However, with the onset of automatization and ever-larger data sets, the integration of new areas in data science and neuroengineering have become necessary partners in brain science research endeavors.

   Big data approaches, including machine learning/artificial intelligence, have emerged as essential tools in neuroscience to mine the plethora of data (e.g., genomics, metabolomics, and imaging data) for an integrated understanding of brain function in health and disease and, therewith, the development of informed diagnostic and therapeutic approaches (Vu et al., The Journal of Neuroscience, 2018).

In an article published a few years ago (http://dx.doi.org/10.1016/j.neuron.2016.05.030), Dr. Huda Akil, former president of the Society for Neuroscience, along with a cadre of prominent colleagues called for the need to integrate data science and bioengineering skills into neuroscience training curricula. In another report in 2017, Barone et al. highlighted substantial training needs concerning data analysis skills among all life scientists (https://doi.org/10.1371/journal.pcbi.1005755.t002), **Nevertheless, there are currently very few MS programs that can prepare students for such integrated careers and none of them are located in Maryland or at cost-effective public institutions** such as MSU, which serves local, regionally and international populations with limited access to affordable educational opportunities to meet such emerging workforce demands.

The MS in Applied Neuroscience is particularly well-designed and prepared to meet the need for individuals with appropriate skill sets to fill technical positions in brain health endeavors. Furthermore, the Program will help to prepare Maryland residents to become competitive to join Ph.D. Programs in Neuroscience such as the Programs currently offered at UMSOM and UM College Park.

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

As described above, the new generation of brain scientists must be conversant across traditional disciplinary boundaries and need to have a deepened understanding of how to analyze big data sets. In addition, the Brain Sciences/Neuroscience workforce must be cognizant of health equity issues that are pervasive in the US, as we have all come to recognize over the past few years. Such integrated training will enable the next generation of researchers and technicians to better meet current and emerging societal needs.

Furthermore, the proposed MS program will ensure that the student populations traditionally served by MSU (students of color, urban and low-income students) have access to training that will enable them to participate in, and lead, the future workforce in brain science research and precision medicine in the State of Maryland and beyond.

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

An important aspect of the MS in Applied Neuroscience Program is a focus on issues of health equity that will permeate the curriculum. The COVID-19 pandemic has unveiled the pervasive presence of brain health and other health inequities by race, ethnicity, place of residence, etc., in Maryland, the US, and beyond. Brain-related diseases such as Alzheimer's disease and dementia, stroke, and mental illness are disproportionately affecting minority populations and, in particular, populations of African ancestry.

Big data approaches are rarely applied in the investigation of health disparities both for lack of available biomedical data, and lack of suitable algorithms. As recently highlighted in a news release by the National Institutes of Health (NIH), "artificial intelligence, routine inclusion of genomics as part of clinical testing, deeper investigation of the role of phenomics and environment in health and disease and returning value across diverse populations are critical

prerequisites to establishing an equitable system for precision medicine and healthcare in the future."[1]

As an HBCU, Morgan State University is uniquely well-positioned to address such shortcomings in available data and approaches to analyze them. Appropriate training programs are at the foundation of this effort. In addition, MSU offers historical and research-based expertise and scholarship pertaining to the issues involved in social determinants of health. It is an issue of social equity in its own right that under-represented minority populations are trained and given the resources to participate in research relevant to their communities.

The Center of Brain Health Disparities at MSU, which will be anchored by the MS Program, has an excellent opportunity to "move the needle" by addressing both fundamental brain research questions and the development of big data/machine learning approaches to mental health issues concerning individuals of African Ancestry and other underrepresented populations. MSU has partnered with the Lieber Institute for Brain Development (LIBD) and a faith-based consortium in Baltimore City, under the leadership of the Reverend Dr. Hathaway, to engage in the African American Ancestry Neuroscience Research Initiative (AANRI) (see: Weinberger, Dzirasa and Crumpton-Young, 2020). The resources created by this partnership will be brought to bear in the proposed MS Program creating a uniquely rich learning environment for students.

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

MD Goal Alignments
The Program meets three overarching goals outlined by MHEC in its 2017 to 2021 Strategic Plan: **Student Access, Student Success, and Innovation**. Based on available materials regarding the planning process for the, as of yet unpublished, 2021 to 2025 Strategic plan, these goals will continue to be part of the new plan.

Student Access:
- Tuition at MSU is designed to be affordable for students from modest socioeconomic backgrounds. The graduate tuition at MSU is among the lowest in the State.
- Course work in the Program will be offered entirely online, thus it is accessible for students (such as non-traditional students) who cannot relocate to the MSU campus and or are working full-time.

Student Success:
The proposed MS in Applied Neuroscience will help the State to continue "to ensure that all policies and practices reflect the dedication and commitment to equal education opportunities in the State of MD, supports and enhances the unique missions of Historically Black Colleges and Universities as well as enhances diversity by fostering collaborations between Historically Black Colleges and Universities and traditionally white institutions." Furthermore, the proposed MS Program will improve access to non-traditional students and facilitate on-time degree completion.

[1] https://www.nih.gov/news-events/news-releases/nih-leaders-future-precision-medicine-healthcare-transformation

As outlined above, the proposed MS in Applied Neuroscience is closely aligned with the MSU 2021 to 2030 strategic plan. The program is designed to render students well prepared to enter doctoral training after graduation from MSU or to directly enter the job market or advance in the job market, in relevant Maryland industries or research institutions. The program is focused on demographics at MSU as an HBCU and Urban University by providing a flexible, online training option that will work for individuals who are already in the job market and want to use this Program for professional advancement as well as for traditional students who want to gain relevant research experience before applying to a Ph.D. program. *As stated above, there is currently no neuroscience/brain science relevant MS program in any public institution in the State that students may matriculate into.*

As stated above as well, The Lieber Institute for Brain Development (https://www.libd.org/mission/) will be a training partner in the proposed MS Program. Investigators at Lieber, as adjunct MSU faculty, will not only teach some of the proposed classes but also be engaged in hands-on laboratory or *in silico* (data-based) training of students who choose the thesis option.

Innovation:

The proposed MS in Applied Neuroscience is innovative in that it combines training in biomolecular neuroscience with emphasis on health disparities research, with neuroengineering/big data training approaches. As described in more detail under B.1.a, above, Big Data approaches, including machine learning/artificial intelligence have emerged as essential tools in neuroscience to mine the plethora of genomic, metabolomic, and imaging data for an integrated understanding of brain function in health and disease and therewith the development of informed diagnostic and therapeutic approaches. There are currently very few MS programs that can prepare students for such integrated careers and none of them are in Maryland or at public institutions such as MSU, serving local, regional, and international populations with limited access to affordable educational opportunities to meet such emerging workforce demands. Moreover, based on our research, no other program in the country offers similar training within the framework of health equity. Given the substantial health disparities in neurological and psychiatric disorders in the US, which have only grown in recent years, it is extremely important for students of brain science to become cognizant of strategies to address issues of health equity.

Last, but not least, Instructions in the MS program will utilize student-centered learning approaches and best practices. Initiated by federal funding, MSU has become one of the forerunners in the State to incorporate such practices in STEM teaching and learning and has had long-standing faculty training in this area. Recently, relevant annual training workshops have become fully institutionalized under the Center for Innovative Instruction and Scholarship (CIIS).

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.

   Maryland is host to a substantial biotech and pharmaceutical industry marketplace.[2] Dozens of companies in the State are either directly or indirectly vested in producing reagents, devices, or generating research and consulting services that are related to diseases of the brain and nervous system. In addition, Maryland is home to a massive research infrastructure including the National Institutes of Health, Johns Hopkins University, and the University of Maryland at Baltimore all of which have major research foci on brain health. All these entities seek employees at the technical (MS) and doctoral levels that have the knowledge/skill integration our Program is designed to provide. As described above, the generation of big data in basic, translational, and clinical research environments has made it imperative for technical staff and doctoral-level researchers alike, to understand engineering and AI principles alongside neuro-biological understanding. **We anticipate our graduates to be in high demand as advanced-level industry and clinical technicians, laboratory managers, project managers, academic research associates, and applicants to doctoral programs. We anticipate that many of our students who will be choosing the non-thesis option for the MS will be already employed in relevant industries and research labs and seek out this Program for career advancement.**

2. Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program.

   In June of 2021, BioSpace featured an article entitled, "Neuroscience Jobs in the United States: Popular Careers in Demand," based on data gleaned from the US Bureau of Labor Statistics.[3] Although the US Bureau of Labor Statistics does not specifically name "neuroscience" as an occupation, it reports that nationally, "employment in life, physical, and social science occupations is projected to grow 8 % from 2020 to 2030 and will result in about 113,800 new jobs. Increasing demand for expertise in the sciences, particularly in occupations involved in biomedical research, psychology, and environmental protection, is projected to result in employment growth".[4] Employment in healthcare occupations is projected to grow 16 % from 2020 to 2030, much faster than the average for all occupations, adding about 2.6 million new jobs.[5] Employment in Computer information technologies will grow by 13%.[6] Such careers are associated with higher-than-average incomes, in particular, when individuals have post-secondary degrees such as an MS and higher. The need for professionals in these areas will be amplified in the State of Maryland which is home to a preponderance of industries as well as academic and non-profit institutions that employ such individuals.[7]

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[2] https://biopharmguy.com/biotech-company-directory.php
[3] https://www.biospace.com/article/neuroscience-jobs-in-the-united-states-popular-careers-in-demand/BioSpace
[4] https://www.bls.gov/ooh/life-physical-and-social-science/home.htm
[5] https://www.bls.gov/ooh/healthcare/home.htm
[6] https://www.bls.gov/ooh/computer-and-information-technology/home.htm
[7] https://biopharmguy.com/links/state-md-all-geo.php

The MS in Applied Neuroscience as proposed cuts across the areas listed above: life sciences, physical and social sciences, healthcare, and computer information technology. The Program we are proposing addresses the needs of individuals who are working in these areas by combining a core curriculum with a wide choice of electives that students can use to generate tailor-made training for their professional development needs.

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.

   A recent web search (on 2/18/2022) using the keyword "Jobs in Neuroscience" (using *adzuna & **indeed) revealed, in the State of Maryland, several hundred open job opportunities in health care, research, development, production, administration, etc. The majority of the positions posted required post-secondary education and training. Many of the positions were for laboratory or clinical specialist positions at the MS level or equivalent and job descriptions listed skills that our proposed program emphasizes. As indicated above, neuroscience research, development, and clinical work is changing towards a more data-focused approach (Akil et al.2016, Van Horne 2021; Vu et al 2018). Our proposed program offers skill training for this new marketplace.

   The Society for Neuroscience is the largest professional society in the US with over 36,000 members (https://www.sfn.org/about). The field of Neuroscience/brain science encompasses a myriad of sub-specialties and research/service areas. As demonstrated by the posted job openings (*adzuna & **indeed), neuroscientists/brain scientists work in education, labs, health care, policy, and many other occupations.[8]

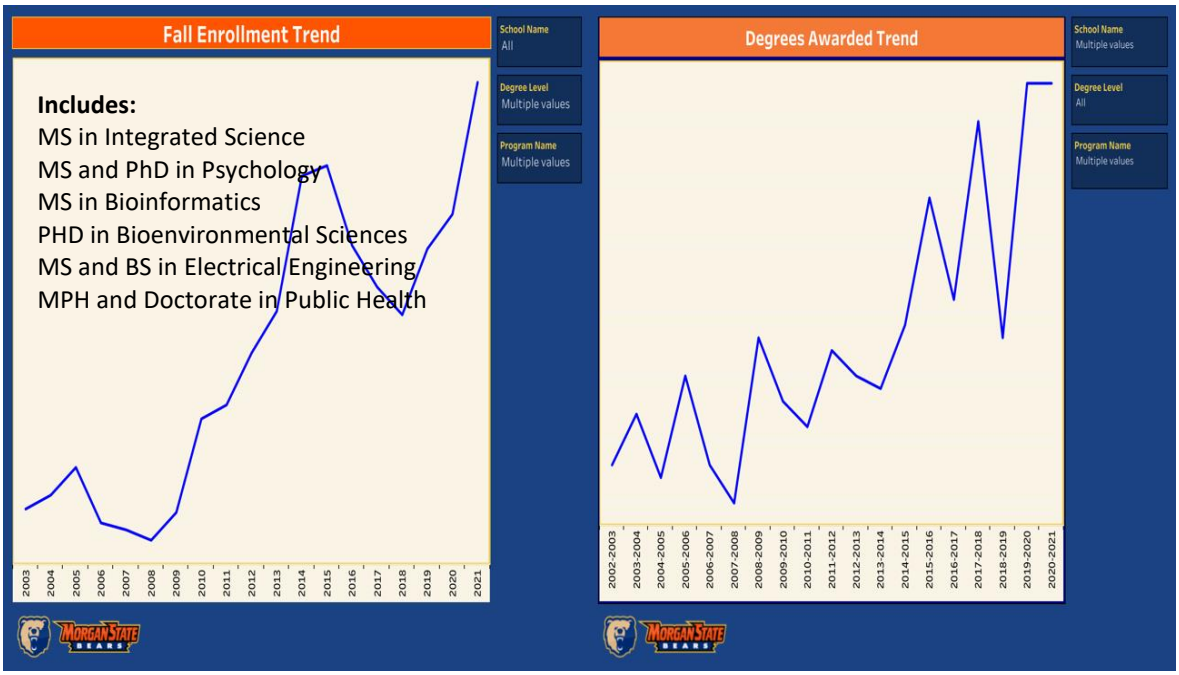
4. Provide data showing the current and projected supply of prospective graduates

   Undergraduate students at MSU, predominantly students in SCMNS, Psychology (College of Liberal Arts), and Electrical Engineering (School of Engineering) have expressed a strong interest in Neuroscience careers for many years. So far students who wanted to get an MS degree had to be content with the MS in Interdisciplinary Science (SCMNS) or MS in Psychology (CLA) if they wanted to get their degree from MSU or pay higher tuition to attain an MS in Biology from a Maryland PWI before applying to a Ph.D. program or job. We anticipate an applicant pool of at least 10 -15 students annually from among our graduates. Importantly, since this will be predominantly online, we anticipate numerous applicants from individuals who are working professionals eager to acquire the cutting-edge skills this Program is offering to advance their careers and employment opportunities.

   Applications, enrollment, and graduation rates for graduate programs in STEM and Social/behavioral science have been steeply growing at MSU over the past decade (see Figure 1 below). This indicates a strong interest in our cost-effective and innovative program offerings in these disciplines. We anticipate that the proposed Program in Applied Neuroscience will follow a similar trajectory**.**

[8]*https://www.adzuna.com/search?ag=1245746963129539&c=326615089&cat=20&dv=c&gclid=1&gpl=68772&kw=neuroscience%20jobs%20Maryland&locadd=0&loc=151967&msclkid=b50b790cae351e4210cd1b035c7749ad&nw=o&partnerb=1&pp=20&utm_content=EN_US_Generic_Location_Maryland_Neuroscience_Exact&utm_term=neuroscience%20jobs%20Maryland&q=neuroscience
** https://www.indeed.com/q-Neuroscience-l-Maryland-jobs.html?vjk=ffdf4a9f6ba2ed68

FIGURE 1



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.

   The proposed MS Program in Applied Neuroscience will be the only such program that students can directly matriculate into in the State of Maryland. Although Johns Hopkins University offers an MS in Neuroscience, this program is only accessible via linked enrollment as a linked BS/MS Program for undergraduates at the Krieger School of Arts and Sciences. Another MS in Neuroscience is cross-listed by UMBC and the University of Maryland College Park, but this degree is awarded *en route* to the Ph.D. at these institutions and students are not able to matriculate directly into this MS Program. There have been no degrees awarded by this Program in recent years. **Therefore, the Program proposed here is unique and does not duplicate any other Program in the State of Maryland.**

   Nationally there are few Programs at non-profit academic institutions that award an MS degree in Neuroscience, however, none of these programs are in areas of concentration that are similar to the Program we propose here, and in general, they are more costly.[9]

2. Provide justification for the proposed program.

   The proposed program provides students with a unique opportunity to acquire state-of-the-art skills in the neuroscience/brain science landscape of tomorrow. The integration of fundamental

[9] https://www.onlinemasterscolleges.com/masters-in-neuroscience-online/#:~:text=Masters%20in%20Neuroscience%20Online%201%20University%20of%20Florida,Clark%20St%2C%20Evanston%2C%20Illinois%2060208%20More%20items...%20

molecular and health-directed neuroscience knowledge with neuroengineering/data science skills is at the cutting edge of market demand (see section C) and very few programs in the country provide similar training. **None of them, according to our research, have an online option**. **Thus, MSU, as an HBCU and designated as Maryland's Preeminent Public Urban Research University, can play a prominent educational role for all students in this context and fill an educational market gap.**

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 proposed Program will be in high demand because it provides students with a unique opportunity to acquire state-of-the-art skills in the neuroscience/brain science landscape of tomorrow. The integration of fundamental molecular and health-directed neuroscience knowledge with neuroengineering/data science skills is at the cutting edge of market demand (see section C) and very few programs provide similar training. None of them, according to our research, have an online option. **Thus, MSU, as an HBCU and designated as Maryland's Preeminent Public Urban Research University, can play a prominent educational role for all students in this context and fill an educational market gap.**

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 proposed program in Applied Neuroscience has a focus on health disparities and therefore is uniquely well-suited to be located at MSU, a Historically Black University, where it synergizes with existing research and community outreach efforts regarding health equity in the Baltimore and larger Maryland community.

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.

   Program Establishment:
   The Provost of the University has provided the impetus for the Program. The proposed Program was established via the appointment of an interdisciplinary faculty committee with experience in the relevant areas of neuroscience/brain science including faculty who had previously participated in or led successful proposals for new graduate training Programs at Morgan State University. Two outside consultants from Johns Hopkins University and the Lieber Institute, respectively, also participated in the committee.

Program Oversight:
The Program will be directed in its initiation by Dr. Christine Hohmann, chair of the faculty committee which generated this proposal, and will subsequently be overseen by the Director of the Center for Brain Science at MSU who will appoint a Program director from among the Center faculty. The Program will be placed in the School of Computer, Mathematics, and Natural Sciences (SCMNS). Faculty from multiple academic units, including the Departments of Biology, Physics, Computer Science, and Mathematics in SCMNS as well as faculty from Psychology (College of Liberal Arts), Electrical Engineering (School of Engineering), and Public Health (School of Community Health and Policy) will participate in teaching in the Program. Research Scientists from the Lieber Institute, as well, will be participating as adjunct faculty.

A committee of faculty from these different academic entities will serve as Steering Committee, working closely with the Program Director to ensure appropriate guidance of students in the Program.

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

Educational Objective:

The program targets students with a BS degree in STEM, Behavioral Sciences, or similar disciplines, who either want to work in the area of neuroscience/brain science in industry, academia, at federal agencies or who are aiming to enhance their competitiveness for Ph.D. training in Neuroscience. Due to its predominantly online nature for all non-thesis students, this Program is particularly well-suited for working professionals who desire to enhance their career opportunities in this area.

Learning Outcomes:

Students will be able to:

- Demonstrate a fundamental understanding of the physiological and molecular processes in the mammalian nervous system and how these relate to cognitive functioning and behavioral health.
- Apply quantitative reasoning and data analytics appropriately to specific brain science problems.
- Select and apply appropriate neuroengineering/data science approaches to the analysis of neuroscience data sets.
- Analyze the impact of research findings on issues of health equity.
- Apply sound principles of research conduct and research ethics in all their work.
- Communicate data and study outcomes effectively both orally and in written form in an interdisciplinary setting.

3. Explain how the institution will:

a) Provide for assessment of student achievement of learning outcomes in the program

The Office of the VP for Assessment has devised an evaluation rubric that annually needs to be completed by each academic program in the university. In this instrument, programs describe their evaluation process, outcome data, and reflective information on their students.

In addition, the MS Program in Applied Neuroscience and the Institution will monitor the number of students admitted to the Program annually and the graduation rates and time to completion.

The program will also establish an external advisory board of industry and academic stakeholders to provide regular feedback on changes in market needs as well as to conduct alumni surveys. All of these listed methods will be used to make admissions or programmatic adjustments as needed.

b) Document student achievement of learning outcomes in the program

- Course-specific learning outcomes will be determined and assessed in each course and criteria for passing each course will, therewith, be determined.
- Non-thesis students will complete a problem-based course requirement (NEUS 530) in accordance with their core courses and selective courses.
- Thesis students will prepare an MS thesis in compliance with the MSU School of Graduate rules and regulations and defend their thesis in the form of an oral presentation.

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

Table 4: Courses

Semester #1	Core Course (credit hours)	Comments	Course (Catalog) Description
	BIOL 536 (3) Molecular and Behavioral Neuroscience	Existing course, Biology, various instructors	This course investigates the fundamental concepts of the nervous system, brain, and behavior, by emphasizing the interrelationship between the biology of brain function and behavior and cognition. Part I of the course will focus on nervous system structure, function, and development and this will be used in part II, towards understanding the biological basis of learning, memory, and behavior in both normal and altered states. Current research, such as the latest discoveries in the genetics and molecular biology of behavior and the social implications of these discoveries will be used in graduate-level discussions and presentations. Critical thinking and analysis of relevant scientific literature are emphasized.
	PSYM 560 (3) Principles and Foundations of Statistical Methods	Existing course, Psychology, various instructors	This course covers statistical concepts and methods that can be applied in psychological research. The course is intended to provide a conceptual understanding of basic statistical procedures for quantitatively exploring and understanding data in applied research and includes data representation, descriptive statistics, estimation, and hypothesis testing. It also helps students develop the computational skills needed to carry out statistical procedures in practical settings. The course will include reading journal articles and using statistical computer packages.
	PSYM 502 (3) Learning and Cognition	Existing course, MS in Psychology, J. Bonney	A study of major theories and models of human learning from both the traditional behaviorist and contemporary cognitive perspective and an experiential overview of how people acquire, store, and use information. This theoretical and empirical information will be applied to human understanding and behavior in a wide variety of settings.

	NEUS 501 (1) Special Topics in Brain Health Disparities	Seminar, team-taught	This seminar-style course explores current topics in brain health and neuroscience with special emphasis on topics of relevance to health disparities. Topics will be explored by reading relevant scientific literature followed by group discussions.
Semester#2			
	NEUS 500 (3) Computational Approaches to Brain Data Analysis	New course, team-taught	This course provides an overview of computational and machine learning, artificial intelligence approaches utilized in understanding and analyzing brain data. Topics include neural networks representation spiking neurons, processing of information in neural networks, and algorithms for adaptation and learning. Specific tools will include the use of Matlab/ Python/R.
	NEUS 510 (3) Genomics and Epigenomics of the Nervous System	New course, team-taught	This course introduces basic principles of chromatin structure and epigenetic regulation of neuronal gene expression. Didactic lectures will cover different processes used for genomic analysis (e.g. DNAseq, GWAS) as well as experimental approaches to assess epigenomics like chromatin immunoprecipitation and ATACseq "Dry lab" modules will teach DNA sequencing data analysis in silico.
	SCIE 503 (3) Scientific Communications and Ethics	Existing course in Integrative Science	The course engages students in techniques and mechanics of scientific writing and presentations. Emphasis is put on critical reading and analysis of the literature, development of scientific communication skills, ethics, and professional standards in the conduct of science.
	NEUS 502 Special Topics in Brain Health Disparities (1)	Seminar, team-taught	This seminar-style course explores current topics in brain health and neuroscience with special emphasis on topics of relevance to health disparities. Topics will be explored by reading relevant scientific literature followed by group discussions.
Semester # 3 Thesis Track	**NEUS 710 Thesis Research (offered fall, spring, summer I & II) (4)**	Program associated faculty; see Table 1	This course enables the student to develop and execute an approved scholarly research project in consultation with the student's thesis chairperson and committee. Students may register for this course continuously to maintain enrollment.
	NEUS Master's Pre-candidacy	Program associated faculty	This course conveys full-time status to a master's graduate student engaged in study prior to the achievement of master's candidacy. Students preparing for their thesis proposal defense enroll in this course. Additionally, students needing additional time to complete a Master's Project enroll in this course after initial enrollment in the appropriate Master's Project course. This course is a non-curricular course and cannot be used as a program credit requirement. The student registers for 3 credit hours and the registration reports the full-time status of 9 graduate credit hours.
Semester # 4 Thesis Track	**NEUS 797/799 Thesis Seminar (3)**	Program associated faculty	Upon achieving Master's Candidacy, the student will continuously register in Fall and Spring terms for NEUS 797 (Thesis Guidance) until the Master's Thesis is completed and submitted to the School of Graduate Studies for review. The course is used only when the curriculum is near completion, and the student is completing the research and writing of the thesis. The course registration maintains the student's status as a matriculated, full-time student (student is registered for 3 credit hours and the system reports a full-time 9 credit hour load). After the Intent to Defend the Master's Thesis form has been accepted by the School of Graduate Studies, this course registration will be changed to NEUS 799 (Thesis Defense) for the given semester and count for 3 credit hours of curricular coursework (NEUS 799 will also count for 9 credit hours of load). Other courses cannot be

			substituted for NEUS 797 (Thesis Guidance). The only eligible grade for NEUS 797 (Thesis Guidance) is the grade of "S" and the only acceptable grade for NEUS 799 (Thesis Defense) is "P/F" (Pass/Fail).
Non-Thesis Track Requirement			
	NEUS 530 (4) Decision Making with Neural Data	New course, team-taught	This course builds on information conveyed in NEUS 500 and NEUS 510. Students will select an approach from the toolsets they were introduced to in NEUS 500 and NEUS 510 and complete the analysis of a real-life data set over the course of the semester. ***This project-based course is mandatory for all students who choose the non-thesis option and should be completed in semester 4.***
Elective courses for semesters # 3 and # 4			
	NEUS 525 (3) Molecular Pharmacology of the Brain	New course, team-taught	This course provides a detailed overview of the molecular principles involved in drug design and action. Emphasis is placed on underlying molecular biology involved in drug development for cellular and molecular effects on the nervous system.
	NEUS 526 (3) Functional Human Brain Science	New course, Timothy Meeker	This course focuses on non-invasive methods to measure and manipulate brain activity, including magnetic resonance imaging, electroencephalography, magnetoencephalography, transcranial magnetic stimulation, and transcranial direct current stimulation. Experimental design, techniques, and principles behind understanding the human brain will be explored.
	NEUS 527 Microbiology & Immunology of the Nervous System	New course, Yun Chi Chen	This course provides current and advanced knowledge on microbial infections of the CNS and host responses to the infections. The pathogenesis of CNS diseases caused by the infections and the ensuing immune responses will be introduced at the organistic, cellular, and molecular levels. Special focus will be emphasized on neuroinflammation as a result of the infections and host immune responses, as well as long-term outcomes of the dysregulated neuroinflammation.
	NEUS 528 Epidemiology & Pathogenesis of Neurologic Diseases: A Health Disparities Perspective	New course, Yun Chi Chen	This course aims to introduce, in a comprehensive and in-depth manner, different neurologic diseases: from population health to molecular level, from etiology to host immune defense, and from medical history to current medical advances. The epidemiology of the diseases, including incidence, prevalence, risk factors, and causal effects will be introduced in the context of health disparities and social determinants of health.
Students may also choose from the following existing courses			
	BIOI 511 (3)	Existing course in Bioinformatics	The course introduces principles, concepts, methods, techniques, algorithms, tools, and strategies to transform and process the masses of information from biological experiments focusing particularly on sequence data. It covers topics such as DNA and protein sequence alignment and analysis, sequence analysis software, database searching, database search heuristic algorithms, sequence alignment dynamic programming algorithms, RNA folding, and multiple sequence alignment and analysis.
	BIOI 521 (3) Bioinformatics Tools and Databases	Existing course in Bioinformatics	The course introduces bioinformatics tools and databases for processing and management of biological data available through the World Wide Web. It covers topics such as bioinformatics tools and databases at the National Center for Biotechnology Information, protein resources at the European Molecular Biology Laboratory, and Biology Workbench at the San Diego Supercomputer Center.

	BIOL 525 (3) Cellular Biology	Existing course in Integrative Science (Biology)	Structure, function, and biogenesis of macromolecules and cellular organelles, cell membrane and the cytoskeleton, membrane transport mechanisms, cell surface and intracellular communication, energy requirements for cellular activities, synthesis and sorting, distribution of specific organellular proteins and their major role in overall cellular function. It includes discussions on major experiments leading to discoveries in cellular biology.
	BIOL 526 (3) Molecular Biology	Existing course in Integrative Science (Biology)	Structure and properties of nucleic acids; DNA replication, repair, and recombination; molecular biology of gene expression and its regulation in prokaryotes and eukaryotes; protein structure and translational control; and molecular biotechnology in recombinant DNA technology, protein engineering, vaccines and therapeutics, immunodiagnostics, and genetic engineering of mammalian and plant organisms.
	BIOL 528 (3) Immunobiology	Existing course in Integrative Science (Biology)	New advances in immunology, immunobiology, and immunotherapy that integrate molecular biology, cell biology, and physiology. It covers basic research in immunology applicable to the diagnosis and development of treatments for immunodeficiency, autoimmune disease, cancer, and AIDS. The course also covers new biotechnological strategies for the development of novel vaccines.
	BIOL 629 (3) Developmental Neurotoxicology	Existing course in Biology	This course will introduce students to the full spectrum of environmental effects on the developing nervous system. This includes pre-and postnatal effects of toxicants on the developing nervous system along with a discussion of physical, psychological, and sociological constraints of nervous development. Special emphasis will be directed to issues concerning the urban environment.
	EEGR 607 Information Theory	Existing course in Electrical Engineering	This course presents measures of information, information sources, coding for discrete sources, the noiseless coding theorems, Huffman coding, channel capacity, the noisy-channel coding theorems, and applications to gambling and investing.
	EEGR 503 Communication Theory	Existing course in Electrical Engineering	This course introduces students to the basic concepts of communication theory. It includes an introduction to analog AM and FM modulation, digital modulation, baseband and bandpass digital communication, communication link analysis, channel coding, modulation, and coding trade-offs.
	PUBH 504 Public Health and Health Disparities	Existing course in Public Health, SCHP	This course introduces the history of public health and health disparities. Students learn about the role of social determinants, such as race, gender, and socioeconomic status, in shaping the quality of services, the distribution of risk factors, and health outcomes.

New Course Outlines (provides additional detail to the course catalog description):

New Core Courses:

NEUS 500 Computational Approaches to Brain Data Analysis (3)

This course will provide an overview of important computational and machine learning, artificial intelligence approaches utilized in understanding and analyzing brain data. Students will review the relationship between neurobiology, the environment, and mental/behavioral symptoms that can be understood in computational terms. The main topics to be covered include neural network modeling, representation of information by spiking neurons, processing of information in neural networks, and algorithms for adaptation and learning. Specific tools will include the use of Matlab/ Python/R for analyzing brain data. Students will practice analyzing real-life data sets.

NEUS 501 through 504 Special Topics in Brain Health Disparities (1)
This seminar-style course explores current topics in brain health and neuroscience with special emphasis on topics of relevance to health disparities. Topics will be explored by reading relevant scientific literature followed by group discussions. Topics will be related to areas such as:

- Health disparities in mental/behavioral health & substance use
- Environmental effects on brain development, cognition, and aging
- Population studies and relevant analytics (e.g. genomics, epigenomics, metabolomics, imaging, etc.) concerning social determinants of health

This is a team-taught, recurrent course that will present a new topic for reading and discussion each semester. Students may participate during each semester that they are in their degree program. Students in the MS in Applied Neuroscience Program must complete at least two semesters of this course.

NEUS 510 Genomics and Epigenomics of the Nervous System (3)
This course introduces basic principles of chromatin structure and epigenetic regulation of neuronal gene expression. Didactic lectures will cover different processes used for genomic analysis (e.g. DNAseq, GWAS) as well as experimental approaches to assess epigenomics like chromatin immunoprecipitation and ATACseq. "Dry lab" modules will teach DNA sequencing data analysis *in silico*.

After completion of the course work the graduate student should be able to:

- Describe the fundamental relationship between genomic structure, gene expression, and protein formation in the nervous system.
- Define the positive or negative regulation of gene expression brought about by various epigenetic modifications.
- Determine appropriate biochemical assays for specific questions related to genomic analysis and epigenetic questions.
- Obtain and re-analyze published genomics and epigenomic data.

New Electives:

NEUS 530 Decision Making with Neural Data (4)
This course builds on information conveyed in NEUS 500 and NEUS 510. Students will select an approach from the toolsets they were introduced to in NEUS 500 and NEUS 510 and complete the analysis of a real-life data set over the course of the semester. Such projects may include e.g. the analysis of genomics/genetics/proteomics data sets in correlation with demographic information using databases such as "All of Us" (https://allofus.nih.gov/) or N3C (https://ncats.nih.gov/n3c) or the analysis or modeling of imaging data, psychophysical data, behavioral health data, etc., sourced from one of our instructors or open-access databases. Students may also choose to utilize their own data sets (with employer/source permission). ***This project-based course is mandatory for all students who choose the non-thesis option.***

NEUS 525 Molecular Pharmacology of the Brain
This course provides a detailed overview of the molecular principles involved in drug design and action. Emphasis is placed on underlying molecular biology involved in drug development for cellular and molecular effects on the nervous system. By the end of the course, students will

- Discuss the biology underlying drug development,
- Describe drug pathways and the interactions between drugs and the brain
- Analyze gene and protein expression related to drugs.
- Describe receptors and neurotransmitters systems in terms of their targets for drugs
- Discuss autonomic and central nervous system pharmacology
- Apply molecular pharmacology principles for solving relevant questions related to brain health disparities and drug-based interventions.

NEUS 526 Functional Human Brain Science (3)
This course focuses on noninvasive methods to measure and manipulate brain activity, including magnetic resonance imaging, electroencephalography, magnetoencephalography, transcranial magnetic stimulation, and transcranial direct current stimulation. Experimental design, techniques, and principles behind understanding the human brain will be explored. Instructions will combine didactic and "hands-on" (simulated) activities.

NEUS 527 Microbiology and Immunology of the Nervous System
This course provides current and advanced knowledge on microbial infections of the CNS and host responses to the infections. The pathogenesis of CNS diseases caused by the infections and the ensuing immune responses will be introduced at the organistic, cellular, and molecular levels. Special focus will be emphasized on neuroinflammation as a result of the infections and host immune responses, as well as long-term outcomes of the dysregulated neuroinflammation. In this course, the students will gain knowledge of and insights into real-life disease scenarios such as HIV/AIDS dementia, HIV-associated neurocognitive disorder (HAND), Covid-19 associated neurocognitive decline, and other bacterial, fungal, parasitic, and viral infections of the brain. CNS opportunistic infections and other neurocognitive or neurodegenerative disorders with infectious etiologies, as well as the underlying pathogenic mechanisms and potential therapeutic and prophylactic regimens and strategies for these infections and diseases will be discussed.

NEUS 528 Epidemiology and Pathogenesis of Neurologic Diseases: A Health Disparities Perspective
This course aims to introduce, in a comprehensive and in-depth manner, different neurologic diseases: from population health to molecular level, from etiology to host immune defense, and from medical history to current medical advances. The epidemiology of the diseases, including incidence, prevalence, risk factors, and causal effects will be introduced in the context of health disparities. In addition, clinical manifestations, diagnosis, and management as well as the pathogenesis of different neurologic diseases will be introduced in various biological and genetic aspects as well as social determinants of health with special emphasis on health disparities in these disorders. In addition to understanding diverse aspects of these diseases, the students will also have the opportunities to gain fundamental concepts and methodological skills in epidemiology and epidemiological research, including basic statistical concepts and methods.

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

   Not applicable; this is an MS Program.

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

   There are no specialized graduate certification requirements for this program.

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

   The proposed program is not engaged in a contractual arrangement with another organization. Researchers from the Lieber Institute will have individual teaching contracts with the SCMNS at MSU when they are engaged in teaching classes through MSU or when they are training students in this proposed program in their labs. We have appended a letter of commitment from the Lieber Institute with this application.

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 support services and financial aid resources, and costs and payment policies.

- Students will be provided with a University Student Handbook and a program-specific handbook at the time of their matriculation into the Program.
- Onboarding sessions will be conducted by the Program Coordinator at the start of each semester when new students enter the Program, and at that time, each student will be assigned an academic advisor to guide them. Onboarding sessions will provide information about all relevant campus resources in addition to program-specific information. Academic advisors will be selected in accordance with the students' declared interest in either the Concentration in **Biomolecular/Brain Health Disparities or** Concentration in **Neuro-engineering/Human Machine Interface** at matriculation into the Program.
- The academic advisor will prepare an Individual Development Plan (IDP) with the student and advise supplementary courses to strengthen background areas as necessary.
- For non-thesis students, the assigned academic advisor will guide the student through their selection of elective courses (based on the IDP) and until graduation.
- For thesis students, this academic advisor will ensure that the student selects a thesis advisor and a committee no later than the end of their 1st semester. At that time the thesis advisor will become the primary advisor for the student.

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

   The Program Director and Steering committee of the Program will prepare and regularly update materials to advertise the Program. SCMNS and other affiliated Schools and Departments support advertising and recruitment activities. We will make a special effort, moreover, to advertise the Program at conferences such as the Annual Biomedical Research Conference for Minority Students (ABRCMS), The Society for the Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS), and The National Organization for the Professional Advancement of Black Chemists and Engineers (NOBCChE), etc.

H. Adequacy of Articulation

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

   There are no current articulation agreements needed or in place.

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 faculty member will teach in the proposed program.**

Table 5: Program Associated Faculty

Name	Rank, Department, School, Status	Research Area	Courses
Justin Bonney, PhD	Assistant Professor, Psychology, CLA, full time	Effects of technology on cognitive processes	**PSYM 502**: Learning and Cognition; **NEUS 520** Decision Making with Neural Data
Minchao Cai, PhD	Assistant Professor, Mathematics, SCMNS, full time	Mathematical models of biomechanical simulation and quantification of brain activity.	**NEUS 500** Computational Approaches to Brain Data Analysis; **NEUS 520** (4) Decision Making with Neural Data
Yun Chi Chen, D. Phil.	Associate Professor, Biology, SCMNS, full time	Microbiology, pharmacology, HIV AIDS	**NEUS 501/502** Special Topics in Brain Health Disparities; **NEUS 525** Molecular Pharmacology of the Brain; **BIOL 528** Immunobiology
Frank Denaro, PhD	Associate Professor, Biology, SCMNS, full time	Neurobiological effects of HIV/AIDs	**BIOL 536** Molecular & Behavioral Neuroscience; **BIOL 525** Cellular Biology; **NEUS 501/502** Special Topics in Brain Health Disparities
Gloria Hoffman, PhD	Professor, Biology, SCMNS, full time	neuroendocrinology/reproductive control/developmental	**BIOL 536** Molecular & Behavioral Neuroscience; **NEUS 501/502** Special Topics in Brain Health Disparities
Christine Hohmann, PhD	Professor, Biology, SCMNS, full time	brain-behavior relationships, developmental disorders, stress effects	**BIOL 536** Molecular & Behavioral Neuroscience; **NEUS 501/502** Special Topics in Brain Health Disparities; **NEUS 525** Molecular Pharmacology of the Brain; **BIOL 629** Developmental Neurotoxicology
Pilhwa Lee, PhD	Research Assistant Professor, Mathematics, SCMNS, full time	Modeling brain processes, genomics, AI	**NEUS 500** Computational Approaches to Brain Data Analysis; **NEUS 520** Decision Making with Neural Data
Michael McConnell, PhD	Adjunct, SCMNS, (Research Scientist, Lieber Institute), part-time	Genomics/genetics/brain mosaicism	**NEUS 510** Genomics and Epigenomics of the Nervous System; **NEUS 520** Decision Making with Neural Data
Timothy Meeker, PhD	Adjunct, SCMNS, (Postdoctoral Scholar JHU), part-time	Pain research, brain imaging, health disparities	**NEUS 500** Computational Approaches to Brain Data Analysis **NEUS 520** Decision Making with Neural Data; **NEUS 526** Functional Human Brain Science

Gabrielle McLamore, PhD	Associate Professor, Biology, SCMNS, full time	Monosodium urate de-crystallization with gold nanoparticles and low-power microwave heat in the MSUC-induced arthritic gout rat model	**NEUS 525** Molecular Pharmacology of the Brain
Onyema Osuagwu, PhD	Associate Professor, Electrical Engineering, SoE, full time	Data science/artificial intelligence & neuro-engineering	**NEUS 500** Computational Approaches to Brain Data Analysis; **NEUS 520** Decision Making with Neural Data
Ingrid Tulloch, PhD	Assistant Professor, Psychology, CLA, full time	Substance use disorders, brain-behavior effects, neuroinflammation	**NEUS 501/502** Special Topics in Brain Health Disparities; **NEUS 500** Computational Approaches to Brain Data Analysis; **NEUS 525** Molecular Pharmacology of the Brain
James Wachira, PhD	Associate Professor, Biology, SCMNS, full time	Genomics, virology	**BIOL 525** Cellular Biology; **BIOL 526** Molecular Biology; **SCIE 503** Scientific Communications and Ethics; **NEUS 501/502** Special Topics in Brain Health Disparities; **NEUS 525** Molecular Pharmacology of the Brain; **NEUS 520** Decision Making with Neural Data
Kimberly Warren, PhD	Associate Professor, Psychology, CLA, full time	Mental health/obesity/healthy behaviors	**NEUS 501/502** Special Topics in Brain Health Disparities
3 new faculty positions; terminal/doctoral degrees required	SCMNS, full time	Areas of interest: Molecular neuroscience, brain imaging, big data, and AI competencies	**NEUS 500** Computational Approaches to Brain Data Analysis; **NEUS 520** Decision Making with Neural Data; **NEUS 510** Genomics and Epigenomics of the Nervous System; & to develop new NEUS electives

Please note that all faculty members listed have substantial publication records with good impact factors. They have maintained active research programs at Morgan State University. Dr. Gloria Hoffman is among the top 2% of researchers in the country, and Dr. Christine Hohmann is a 2021 AAAS Fellow.

2. Demonstrate how the institution will provide ongoing pedagogy training for faculty in evidence-based best practices, including training in:

   a) Pedagogy that meets the needs of the students

   The University has established the Center for Innovative Instruction and Scholarship (CIIS) https://www.morgan.edu/academicaffairs/ciis which is engaged in continuous faculty development and continuous education activities including e.g. the Annual Mentorship Training Workshop and the Annual Workshop for Strategic Teaching.

b) The learning management system

The University currently uses the CANVAS learning management system.
https://www2.morgan.edu/ats/canvas411

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

The University contracts with Quality Matter (QM) https://www.qualitymatters.org/ to provide regular training in how to design and conduct online courses. The University requires all instructors who teach online to become certified by QM.

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

The students will have access to Morgan State University Earl S. Richardson Library (Morgan Library). The Morgan Library (https://library.morgan.edu/home/home) offers a range of resources and services to the Morgan community. Most library resources (USMAI Catalog, WorldCat MORGAN, Libguides, Collections, Scopus, etc.) and all services can be accessed remotely. Required textbooks will be accessible as electronic and hard copy versions, as applies, via the MSU bookstore (Barnes and Nobles).

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.

Since this is primarily an online program, classroom facilities, although readily available, are of limited significance. All current faculty listed in the Program have their own offices and, as applies, research laboratories. New hires for the Program will be provided with office and laboratory space as well as with set-up funds. All students and faculty at MSU are given free Zoom accounts and Zoom is embedded into the Course Management software. Students and faculty will have online access to all required software tools for the Program such as e.g. MATLAB, Python, R, and others as needed.

Students who will come on campus to work on a research thesis will have access to Core laboratory facilities in SCMNS outfitted with state-of-the-art molecular and cellular biology equipment in addition to their mentors' labs. Students will have access to additional genomics, proteomics, and imaging tools through the Lieber Institute and the University of Maryland.

Students engaged in animal studies will have access to the MSU vivarium located in the Social Sciences Building (CLA) and equipped with behavioral monitoring equipment.

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

      All students are equipped with an MSU e-mail (Google) and identification numbers when they are accepted into the University. This gives them remote access to MSU resources as well as a hard-copy ID card should they be on campus. All business services of the University are electronic at this time and can be operated remotely. Information is shared with faculty and students regularly through the MSU e-mail system as well as via the MSU App.

   b) A learning management system that provides the necessary technological support for distance education

      As stated above, the University uses the Canvas learning management system. Canvas is equipped with Zoom access as well as with access to Big Blue Button. Canvas also links to many other Apps which facilitate remote learning such as Panopto (for video-recording faculty or students' presentations), Turn-It-In (plagiarism, spelling, and grammar check), Safe Assign, and Lock-Down Browser abilities to monitor exams, etc.

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

1. Complete **Table 6: 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.

TABLE 6: PROGRAM RESOURCES					
Resource 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)	$299,292	$598,584	$641,340	$641,340	$641,340
a. Number of F/T Students	15	30	30	30	30
b. Annual Tuition/Fee Rate	$14,252	$14,252	$14,252	$14,252	$14,252
c. Total F/T Revenue (a x b)	$213,780	$427,560	$427,560	$427,560	$427,560
d. Number of P/T Students	10	20	25	25	25
e. Credit Hour Rate	$713	$713	$713	$713	$713
f. Annual Credit Hours	12	12	12	12	12
g. Total P/T Revenue (d x e x f)	$85,512	$171,024	$213,780	$213,780	$213,780
3. Grants, Contracts & Other External Sources	0	0	0	0	0
4. Other Sources	$100,000	$100,000	$100,000	$100,000	$100,000
TOTAL (Add 1 – 4)	$399,292	$698,584	$741,340	$741,340	$741,340

The anticipated resources for the first five years of the program are outlined in the table above. We have set a target enrollment of 15 full-time and 10 part-time students each year with additional growth in part-time by the third year to reach a steady-state in five years of 30 full-time and 25 part-time students. The annual tuition/fee rate for full-time students as well as the credit hour rate for part-time are based on our current ratio (60% in-state) of in-state and out-of-state students in Biology. Therefore, the value shown is a weighted average of in-state and out-of-state rates based on current enrollment. The proposed curriculum calls for students to complete 20 hours of coursework in the first year and that is the number of hours used to compute the annual tuition for full-time students. We assume that part-time students may take 6 credit hours per term which yields 12 hours per year for part-time students. The proposed program does not include any reallocated funds, grants, contracts, or other external sources. Funding has already been set aside for an endowed position within the Center and the $100,000 annually for other sources represents the expected income from that position.

2. Complete **Table 7: 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. Also provide a narrative rationale for each expenditure category.

TABLE 7: PROGRAM EXPENDITURES:					
Expenditure Categories	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1. Faculty (b + c below)	$378,000	$389,340	$401,020	$413,051	$425,442
a. Number of FTE	3	3	3	3	3
b. Total Salary	$270,000	$270,000	$270,000	$270,000	$270,000
c. Total Benefits	$108,000	$111,240	$114,577	$118,015	$121,555
2. Admin. Staff (b + c below)	$84,000	$86,520	$89,116	$91,789	$94,543
a. Number of FTE	1	1	1	1	1
b. Total Salary	$60,000	$61,800	$63,654	65,564	67,561
c. Total Benefits	$24,000	$24,720	$25,462	$26,225	$27,012
3. Support Staff (b + c below)	$70,000	$72,100	$74,263	$76,491	$78,785
a. Number of FTE	1	1	1	1	1
b. Total Salary	$50,000	$51,500	$53,045	$54,636	$56,275
c. Total Benefits	$20,000	$20,600	$21,218	$21,855	$22,510
4. Technical Support and Equipment	$100,000	0	0	0	0
5. Library	$50,000	$50,000	$50,000	$50,000	$50,000
6. New or Renovated Space	0	0	0	0	0
7. Other Expenses	0	0	0	0	0
TOTAL (Add 1 – 7)	$682,000	$597,960	$614,399	$631,331	$648,771

The anticipated expenditures for the program are outlined in the table above. The primary expenditures for the program are related to personnel needs. Personnel needs include two tenure-track faculty lines and a Director for the Center (for a total of 3 faculty lines), one administrative staff position, and one support staff position for a total of 5 new hires. For each of the personnel lines, we have assumed a 3% annual salary increase and estimated benefits at 40% of the annual salary. We have included $100,000 for specialized instructional equipment (item #4) and allotted $50,000 for the annual library access to Scopus. We do not expect the new program to require any additional funding for new/renovated space or other expenses.

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.

   The Office of the VP for Assessment has devised an evaluation rubric that annually needs to be completed by each **faculty** member at MSU. These "annual reports" are used by academic units in the evaluation of the faculty in terms of teaching, research, and service.

   In the SCMNS **courses** are evaluated based on course completion with a letter grade of A or B, for graduate students. The SCMNS also conducts annual rubric-based peer teaching evaluations.

   As described above, the VP for Assessment also mandates annual rubric-based program assessments from each academic program in the university. In this instrument, programs describe their evaluation process, outcomes data, and reflective information on their students.

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.

   Program effectiveness will be based on:

   - Student enrollment
   - Student retention
   - Graduation rate/time
   - Assessment of student learning outcomes (see above H.2.)
   - Student job attainment after degree and Ph.D. program placement
   - Cost-effectiveness of program

   The MS Program in Applied Neuroscience and the Institution will monitor the number of students admitted to the Program and the graduation rate to make admissions or programmatic adjustments as necessary.

   - Course-specific learning outcomes will be determined and assessed in each course and criteria for passing each course will, therewith, be determined.
   - Non-thesis students will complete a problem-based final examination in accordance with their core courses and selective courses.
   - Thesis students will prepare an MS thesis in compliance with the MSU School of Graduate rules and regulations and defend their thesis in the form of an oral presentation.

   The **learning outcomes** listed under G2 are performance-based, directly measurable through student deliverables (e.g. problem sets, capstone papers, research projects within each of the courses, and in the completion of the final examination or the MS thesis. Thus, students' GPA and course of study completion are based directly on the assessment of learning outcomes.

   In addition, the University performs **student assessments** of its courses and instructors (electronically and anonymously) at the end of each semester. Based on these and students' outcomes, participating department chairs (since this is an interdisciplinary Program) and the Program Director, will evaluate faculty and courses and provide feedback for improvement using faculty annual reports, and the SCMNS Faculty Evaluation Instrument. Subsequently, evaluations

will be submitted to the relevant Deans and the Provost. Such faculty evaluations are integrated into the tenure and promotion system as well as into the decision for merit raises. In case of an overall unsatisfactory evaluation, the development of a Performance Improvement Plan is necessary during the next semester or academic year and is subject to approval by the Department Chair and Graduate Coordinator.

N. Consistency with the State's Minority Student Achievement Goals (as outlined in COMAR 13B.02.03.05).

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

MSU is an HBCU with a student body and faculty that is predominantly of African ancestry. Please see A2 and E 1,2 above for more detail.

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.

This program is not related to any low productivity program at MSU

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.

   The oversight of Morgan's distance education program is provided by the National Council for State Authorization Reciprocity Agreements (NC-SARA), a non-profit that regulates distance education, improving the efficiency, consistency, and effectiveness provided at institutions within the United States. The Division of Academic Affairs at Morgan maintains the required disclosures and evidence of participation in SARA on their website (https://www.morgan.edu/academic-affairs/resources).

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

   As a component of SARA membership, President Wilson regularly affirms Morgan's compliance with C-RAC guidelines. Evidence of our compliance is shown through an institutional commitment to online learning. Morgan maintains membership in Maryland Online and provides faculty training and quality course design using workshops (often with incentive grants) that promote the Quality Matters system. Online courses are required to meet the standard of the Quality Matters Rubric before being offered. The Director of Morgan Online maintains additional resources for programs and courses that fall under C-RAC guidelines. For more, go to: https://www2.morgan.edu/online.