

## FAU Ph.D. in Neuroscience

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**Board of Governors, State University System of Florida  
REQUEST TO OFFER A NEW DEGREE PROGRAM**

In Accordance with BOG Regulation 8.011

(Please do not revise this proposal format without prior approval from Board staff)

Florida Atlantic University

Institution Submitting Proposal

Spring 2022

Proposed Implementation Term

College of Science

Name of College(s) or School(s)

Biological Sciences, Psychology

Name of Department(s)/Division(s)

Neuroscience

Academic Specialty or Field

Ph.D. in Neuroscience

Complete Name of Degree

26.1501

Proposed CIP Code (2020 CIP)

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.

April 20, 2021

Date Approved by the University Board of Trustees

[Signature]  
Board of Trustees Chair's Signature Date

[Signature] 4/29/21  
President's Signature Date

[Signature] 4/29/21  
Provost's Signature Date

## PROJECTED ENROLLMENTS AND PROGRAM COSTS

Provide headcount (HC) and full-time equivalent (FTE) student estimates of majors for Years 1 through 5. HC and FTE estimates should be identical to those in Table 1 - Appendix A. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Table 3 in Appendix A. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 (Total E&G divided by FTE).

Implementation Timeframe	HC	FTE	E&G Cost per FTE	E&G Funds	Contract & Grants Funds	Auxiliary/Philanthropy Funds	Total Cost
Year 1	8	8	\$58,336	\$466,684	\$0	\$0	\$466,684
Year 2	16	16					
Year 3	26	26					
Year 4	36	36					
Year 5	48	48	\$35,691	\$1,713,150	\$390,450	\$0	\$2,103,600

Note: This outline and the questions pertaining to each section **must be reproduced** within the body of the proposal to ensure that all sections have been satisfactorily addressed. Tables 1 through 4 are to be included as Appendix A and not reproduced within the body of the proposals because this often causes errors in the automatic calculations.



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# Introduction

## I. Program Description and Relationship to System-Level Goals

- A. Briefly describe within a few paragraphs the degree program under consideration, including (a) level; (b) emphases, including majors, concentrations, tracks, or specializations; (c) total number of credit hours; and (d) overall purpose, including examples of employment or education opportunities that may be available to program graduates.**

The proposed Florida Atlantic University (FAU Neuroscience) Graduate Program (NGP) is designed to train a technologically-sophisticated workforce of neuroscientists, preparing them to solve some of mankind's most enduring and vexing puzzles - how intelligence, emotions and consciousness emerge from a vast interconnection of dynamically changing brain cells, how successes, failures and social experiences become embedded as memories that guide our choices throughout life, and how we can come to suffer, and be rescued from, devastating brain disorders that afflict millions of Americans each year. These brain disorders, which include addiction, autism, depression, schizophrenia, and Alzheimer's disease, to name but a few, were once pursued via siloed communities of scientists and clinicians. Today, these boundaries are recognized, in most cases, to be artificial, limiting synthesis, prediction and research progress. Indeed, it is widely appreciated that the most exciting advances are being made at the borders of traditional fields, using technologies drawn, in many cases, from areas outside the discipline (e.g. CRISPR-mediated gene editing, functional magnetic resonance imaging, deep brain stimulation, optogenetics, artificial intelligence). Additionally, the discipline of neuroscience is now seen as a mature framework of education and research, where the simpler questions that relied on single discipline-based approaches have been answered – e.g. how chemical and physical stimuli are detected by nerve cells, how neurons communicate between themselves with both electrical and chemical signals, how nutrients are transported from blood to brain, or how neurons receive or respond to signals. Answers to these questions have, however, revealed hidden complexities that continue to challenge the field to develop new technologies and concepts that can allow for integration between dimensions of analysis, moving from molecule to mind to social engagement, that can handle more complex data streams, and that can lead to new diagnostic and therapeutic tools. We contend that to overcome this complexity, the next generation of neuroscientists must be multi- and inter-disciplinarily trained, conceptually broad-minded, and skilled in the use of more refined technologies. We believe that to best accomplish this goal, it is best to train students as a cohort where peer interactions can promote a cross-fertilization of methods and ideas to sustain their careers long into the future.

The proposed NGP will tackle this contention by combining didactic exposure to historical and current concepts and methods in neuroscience, while emphasizing training in cutting-edge research in the laboratories of leading neuroscientists at FAU, the Max Planck Florida Institute for Neuroscience (Max Planck Florida), and the Florida home of Scripps Research (Scripps Florida). Our program will provide a Core Curriculum that moves from the lessons of molecular neuroscience to the discoveries that link dynamic brain circuits to behaving humans. Our program will empower creativity beyond these courses via a flexible strategy of Elective course selection. Finally, research experiences with established, research active mentors will help students move between the classroom and the laboratory. Trainees emerging from the program will be well-positioned to advance toward the goal of becoming independent scientists or to enter the workforce in allied STEM careers, fostered by a network of professional connections that can last a lifetime.

Three internationally recognized neuroscientists have reviewed the application and written letters of support. They are Joseph T. Coyle, M.D. of Harvard Medical School, former President of the Society for Neuroscience and member of the National Academy of Medicine, Susan G. Amara, Ph.D. former President of the Society for Neuroscience and current Scientific Director of the National Institute of Mental Health, member of the National Academy of Science and President-Elect of the American Academy for the Advancement of Science (AAAS), and Moses V. Chao, Ph.D., Professor of Cell Biology, Neuroscience, Physiology and Psychiatry at the NYU Langone Health Medical center, former Senior Editor of the Journal of Neuroscience and former President of the Society for Neuroscience. Additionally, Drs Ryohei Yasuda, Scientific Director of Max Planck Florida and Kirill Martemyanov, chair of the Department of Neuroscience at Scripps Florida attest to their support for the program. These letters have been compiled as **Appendix G**.

**Level:** The NGP will offer a PhD degree. PhD program students may obtain a Master's degree in allied disciplines during their doctoral studies provided that they have completed the necessary requirements of these programs and after application and review of materials by the degree-training unit and the FAU Graduate College. Students are provided with sufficient credit hrs of support post-qualification that can be used to take additional elective courses to satisfy this goal if desired. The NGP represents an academic and research-focused outcome of the FAU 2015 Strategic Plan *Race to Excellence* where a concentration on neuroscience, campus- and college -wide, was articulated as one of four Pillars for future research and educational investment. An administrative unit was created that could oversee this commitment was formalized through the establishment of the FAU Brain Institute (I-BRAIN), under the leadership of the inaugural Executive Director Randy D. Blakely, PhD., who serves as Director of the NGP.

**Emphases:** Through courses, seminars, symposia, retreats and community activities, integrated across the full duration of a student's graduate training, trainees will be provided with rich opportunities to prepare themselves to make discoveries that ultimately could bring relief to the millions of Americans who suffer from brain disorders and to engage the public through university and I-BRAIN-sponsored outreach activities. To recruit and educate top trainees, we organize our program around 3 major Areas of Research and Education Emphasis (Areas of Emphasis) that span the breadth of neuroscience inquiry: 1) Cellular, Molecular and Biomedical Neuroscience, 2) Sensorimotor, Cognitive and Behavioral Neuroscience and 3) Theoretical and Computational Neuroscience. As will be discussed below, articulation of these areas and the faculty who identify with them, serves to help the student identify courses and mentors linked to their preferred area of doctoral research. These Areas of Emphasis also are taken into consideration during student recruitment to ensure that no one area becomes underrepresented with trainees. These Areas of Emphasis are advertised to potential applicants via printed and electronic media, along with several more specific subfields that match the particular strengths of our faculty. For example, under Cellular and Molecular Neuroscience, we will note subfields of Molecular Determinants of Nervous System Development and Function and Neural Disease Mechanisms, Modeling and Therapeutics. Under Sensorimotor, Cognitive and Behavioral Neuroscience we will note Sensory, Motor and Integrative Circuitry Underlying Behavior and Social, Emotional and Cognitive Neuroscience. Under Theoretical and Computational Neuroscience, we will note Neural Network Dynamics Underlying Brain Function and Computational Modeling of Neural Activity and Complex Systems. These more specialized subfields, which can be redefined by the program Steering committee based on faculty input, are also envisioned as providing a framework for specialized journal clubs, student awards and social events attended by program trainees.

Each of the Pillars established by the 2015 Strategic Plan make contributions to the proposed program. Besides those faculty represented most directly through I-BRAIN, additional faculty primarily aligned with the Sensing and Smart Systems pillar and associated with the Institute for Sensing and Embedded Network Sensing (I-SENSE), bring skillsets in robotics, photonics, advanced prosthetics development, computational neuroscience, and artificial intelligence to our program. Additionally, the Healthy Aging pillar, organized by the Institute for Human Health and Disease Intervention (I-HEALTH), sponsors research of faculty who focus on human brain disease mechanisms, the improvement of brain disease diagnostics, and the development of enhanced therapeutics. Finally, the Ocean Science and Engineering/Environmental Sciences pillar, organized through the Harbor Branch Oceanographic Institute (HBOI), supports research into the biochemistry of aquatic organisms that can be mined collaboratively with our mentors and trainees for development of novel neurological therapeutics, as well as investigations that study the impact of environmental toxins on animal and human brain and behavior. Thus, significant financial investments of the full 2015 FAU Strategic Plan are brought to bear in enriching the training and research opportunities of students and faculty associated with the program.

**Total Number of Credit Hours:** Students in the FAU Neuroscience PhD Program will earn a minimum of 72 post-baccalaureate credit hours including 30 hours of specialized coursework and a minimum of 24 Dissertation credit hours, with the remainder a combination of Advanced Research, Dissertation Research or elective Course credits. Students are expected to complete the Program in 5-6 years, in keeping with national average of other graduate neuroscience programs (~5.5Yrs), with a target of 5 years promoted to faculty and students. Students with prior graduate education, such as the M.S. degree, may receive credit for up to 15 hrs of comparable coursework, including up to 9 hrs of Core course credit, not to include Laboratory Rotations and Neuroscience Seminar. Credit is received only after review of previous course syllabi by the program Curriculum Committee and Graduate College. Program Areas of Emphasis are designed

to aid faculty and students in identifying courses relevant to a student's thesis research. Recommended course options for these Areas are developed by the Curriculum Committee to guide students in forming their Plans of Study and are listed later in the application. As the course needs of a student are likely to be unique to their particular thesis project, the final selection of Electives lies with the faculty mentor and student and can draw from the full catalog of courses approved for the Program by the Curriculum Committee.

All students will be expected to complete three 8-week research internships (rotations) in the laboratories of Program faculty during their 1<sup>st</sup> two semesters in order to become acquainted with mentors whose programs they may join for their PhD studies, and for which they receive Core course credit. Upon positive review of a thesis proposal submitted to the student's thesis committee whose membership has been approved by the Curriculum Committee, and successful oral defense of their proposal, program students advance to candidacy for the PhD and thereafter obtain Dissertation Research or Advanced Research until a successful defense of their PhD thesis and graduation. Research credits following the qualifying exam may be exchanged for Course credits if approved by both the mentor and the Curriculum committee as being needed by the student to attain further specialized training to complete their doctoral thesis.

**Overall Purpose:** The overall purpose of the Program is to provide an advanced educational and research experience to trainees that will allow students to contribute to a technically-advanced, STEM workforce, one that can ultimately improve the lives of our citizens afflicted with brain disorders. Substance abuse and addiction have ravaged many communities across the country, with Florida particularly hard hit. In 2020, 1 in 54 children in the U.S. will be born on the Autism spectrum with many requiring lifelong care. Nearly 6 million Americans live with Alzheimer's disease, with 1 in 10 above the age of 65 suffering from Alzheimer's dementia. Depression has a lifetime prevalence in the U.S. of 20%, with suicide rates rising by 30% over the past 10 years. Chronic Depression constitutes the 10<sup>th</sup> leading cause of death in the U.S., taking nearly 50,000 of our friends and loved ones from us each year. Each of these disorders involve changes in the brain that ultimately rob many Americans of their memories, independence, productivity, and often, their lives. Striking advances in neuroscience and neurotechnology have occurred over the past three decades, allowing scientists and their trainees to peer deeper into the brain and its trillions of synapses, and modulate neuronal activity in increasingly subtle, sophisticated ways. As medications and treatments lag behind fundamental advances, a highly educated and technically sophisticated workforce is needed to translate these discoveries to treatments, and to reinstate a cycle of discovery and innovation to overcome conceptual and technical limitations. While many undergraduates get a taste of research during their college years, virtually none graduate with the skills needed to pursue research independently. Only through years of dedicated training at the graduate and postdoctoral level can an aspiring neuroscientist gain a thorough understanding of the concepts and research tools that will allow them to truly advance in this critical discipline. While opportunities abound, even the simplest nervous systems challenge our ability to predict how neural signals integrate experience, change behavior and respond to injury and disease. It is clear that tools that allow scientists to work across disciplines are leading the advances in neuroscience today, with interactive research teams that can address a problem from multiple angles now more common than in the past. Almost all of the world's top institutions of higher learning feature neuroscience doctoral training programs, drawing trainees from an increasing pool of undergraduate neuroscience majors, including those obtaining the B.Sc. in Neuroscience and Behavior offered by FAU.

The NGP, **operating under CIP 26.1501**, will build upon a history at FAU of excellence in graduate education by three PhD programs that offer training in specific subdomains of neuroscience, incorporating a broad array of course selections to provide a flexible path for new students whose areas of interests may not yet be fully explored or solidified. The Complex Systems and Brain Science (CSBS) degree (CIP 42.2706) provides advanced training in computational and systems neuroscience. The earliest of the three established FAU programs noted here, the CSBS program will be closed to new applications with the initiation of the NGP, and its faculty and courses folded into the new program. While there is overlap in the educational missions of CIPs 42.2706 and 26.1501, under CIP 26.1501, the proposed program will expand curriculum and research options to include clinical neuroscience, brain/machine interfaces, and neurogenetics. With its focus on more computational and systems aspects of neuroscience, students with overlapping interests in cellular neuroscience, brain disease mechanisms, and neuropharmacology may have been less attracted to the CSBS program. CSBS currently operates using a Direct Admission process in which students must match with a mentor before being accepted into the program, whereas the

NGP permits students the flexibility to evaluate research projects and mentors prior to making a final match. By allowing NGP students this option, those who find their primary research interests lie in Theoretical and Computational Neuroscience will populate the research laboratories in this area.

The FAU PhD degree in Experimental Psychology (XPSY), using CIP 42.2704, provides excellent training in the neuroscience of human and animal behavior and cognition. XPSY, like CSBS, operates under a Direct Admit model, and is specifically targeted by students with undergraduate degrees in Psychology or Behavioral Neuroscience. Applicants to this program often have limited foundations in molecular and cell biology, or the more biomedical aspects of neuroscience, and thus are not captured by more interdisciplinary neuroscience programs like the proposed NGP which incorporates these areas. Many XPSY applicants seek programs whose curriculum features greater breadth in Human Psychology, with fewer options in cellular neuroscience, neurological diseases, and computational neuroscience, areas that can complement training in human psychology.

The Integrative Biology (IB) PhD program, operating under CIP 26.0101, is a broad program representing many different areas of modern biological inquiry, ranging from marine and environmental science to biomedical science that targets clinical areas unrelated to neuroscience. The IB program, also a Direct Admission-oriented program, offers a Concentration (IB-NS) that along with broader Core coursework emphasizes neurogenetics, molecular and cellular neuroscience, neurophysiology and model systems (worms, flies, turtles). IB-NS, however, is not comprised of faculty whose research targets computational neuroscience, neuroengineering, cognitive neuroscience or a higher systems approach, such as studies with human brain imaging or artificial intelligence. Students who apply to IB to pursue the IB-NS Concentration are therefore distinct from the trainees we will recruit. We will offer a more flexible curriculum and research rotation experiences that allows them to explore field of neuroscience more broadly before selecting a thesis topic and mentor, including mentors available in focus areas that are less overtly biological in orientation. With its multiple Concentrations, characteristic of the 26.0101 CIP code, the IB program emphasizes exposure to a broad range of biological topics in its required seminars and retreats, often outside of neuroscience, unlike the NGP program. As the XPSY and IB degrees emphasize distinct methods of mentor selection (Direct versus Rotation), feature distinct curricular and programmatic requirements, and can target distinct communities of applicants, the XPSY and IB programs (including the IB Concentration IB-NS) will remain active and can continue to flourish with the creation of the NGP.

In 2018, with the charge of the Pillars initiative to drive innovation and integration in research and training opportunities, I-BRAIN established a non-degree granting, gateway program, the Graduate Neuroscience Training Program (GNTP), recruiting trainees for the neuroscience faculty within CSBS, XPSY, and IB through a common first year experience prior to moving to these specialized degree programs in years 2-5. Formation of the GNTP allowed I-BRAIN to accomplish part of the goal envisioned with the NGP, specifically to advertise and recruit nationally and internationally on behalf of neuroscience training opportunities at FAU, and to provide an opportunity for applicants to pursue laboratory research internships (rotations) in multiple laboratories before moving toward more specialized training. Although the GNTP has proven successful in increasing national awareness of FAU neuroscience, and in supplying the three supporting programs with talented trainees (all available slots filled in 2018, 2019, and 2020), the GNTP effort is administratively complex, is constrained by students needing to meet Core requirements for each of the 3 participating programs, and can eventually result in an educational experience similar to the outmoded model of isolated disciplines, one where the training experiences offer less opportunities to for the sharing of diverse ideas, research tools and methodologies. Our program extends the GNTP model to a full, 5-year, PhD degree-granting program that expands and integrates Core coursework and provides for a broader range of elective opportunities for trainees. The NGP takes advantage of the curricular offerings of multiple Colleges, drawing from courses offered by the FAU Colleges of Science, Engineering and Computer Science, Medicine, and Education, as well as future graduate course offerings by faculty of the Wilkes Honors College which has recently recruited several neuroscience researchers to their faculty. Additionally, faculty with appointments in two of the world's leading research institutes, Max Planck Florida, and Scripps Florida, can participate in our programs. Here, our model resembles the Neuroscience Graduate Program at UC San Diego, where a long-lasting collaboration between UC San Diego and two pre-eminent research institutes, the Salk Institute and Scripps Research California, has resulted in one of the top neuroscience graduate training programs globally (<https://www.usnews.com/education/best->



Governance of the Neuroscience PhD is organized to be transparent in decision making, and representative of faculty goals, in the recruitment and training of students in the program. The organization and roles of the Steering, Recruitment, and Curriculum Committees are given below and in **Appendix F**, which provides a summary of the governance, curriculum and support for the NGP. Briefly, the **Steering Committee** is responsible for broad program oversight, approves any changes in By-Laws, collects faculty input regarding recruitment objectives, approves recommended curriculum changes, and reviews applications for faculty to serve as program mentors. The **Recruitment Committee**, based on directives from the Steering Committee and Program Director, identifies students who will be interviewed for available positions in the three Areas of Emphasis, organizes applicant recruitment visits (with the assistance of I-BRAIN administrative staff), and ranks students for position offers. The **Curriculum Committee** reviews requests for program course additions, approves the Plan of Study for each student, approves substitutions of Course credit for Research Credit, determines whether prior coursework can be substituted for existing program courses, and reviews completion of requirements for dissertation defense and graduation. The Dean of the College of Science receives recommendations on these matters and forwards approved documents to the Graduate College for final approval.

The academic activities of the NGP are overseen by a multi-college **Steering Committee** that is responsible for maintaining program operations according to Program By-Laws, determining appointment or removal of Program faculty, and overseeing the appointment of faculty to the Recruitment and Curriculum Committees. The Steering Committee will be made up of 11 members, appointed by the Deans of the represented Colleges, with the input of NGP faculty from the College. Proportional representation of faculty in relation to College participation is a guiding goal in forming the committee. Colleges contributing at least 4 faculty to the program will be represented by at least 1 voting member on the committee. Based on the projected College representation of faculty, 6 faculty from the College of Science, 3 faculty from the College of Medicine, 1 faculty from the Wilkes Honors College, and 1 faculty from the College of Engineering and Computer Science will comprise the voting members of the committee. The NGP Director and a faculty member from both Max Planck Florida and Scripps Florida will be invited to join Steering Committee meetings in a non-voting capacity, as will the President of the Graduate Neuroscience Student Organization (NSO). Chairs of the Curriculum and Recruitment Committees will also be invited to attend committee meetings in a non-voting capacity. Total number of faculty needed to achieve proportionality, while maintaining an odd number for voting, may lead to a change in the number of faculty on the committee. Committee number and representation will be reviewed annually by the Chair of the Committee, in consultation with the NGP Director and Dean of the College of Science. College representatives on the Steering Committee will be selected by the Dean of each College or their designee based on a vote of the training faculty, with adjustments allowed based on conflicting assignments or a need to achieve balance across areas of representation. Committee members serve renewable 3 Yr terms. The Chair of the Committee is selected by a vote of the Committee prior to the first committee meeting, serving a 3-Yr term. The Steering Committee, in consultation with the Dean of the College of Science and the NGP Director, drafts the initial NGP By-Laws document that serves as guiding rules for the operation of the program. The creation and amendment of By-Laws are approved by a vote of the NGP training faculty. Annually, the NGP Director and the Chair of the Steering Committee hold a Program Faculty Assembly to review any proposed changes to By-Laws and to discuss recruitment results in the past year, program metrics, program finances and program recruitment or any other issues of relevance to the NGP in the coming year.

The activities of the NGP Steering Committee are supported by two, 9-member sub-committees, the **NGP Curriculum Committee** and the **NGP Recruitment Committee** whose representation is based on Education and Research Emphasis Areas versus Colleges as in the Steering Committee. The **NGP Curriculum Committee** reviews and approves/declines course additions to the curriculum, approves Thesis committee members selected by the student and mentor, approves Plans of Study and any needed changes therein, including the substitution of Course credits for Research credits as well as the awarding of program credit given for graduate-level coursework taken before entering the program. The Curriculum Committee is comprised of 3 NGP-affiliated faculty, one from each Area of Emphasis, and are appointed by the Steering Committee based on faculty vote for 3 Yr terms. A Chair of the Committee rotates annually between representatives of the different Emphasis Areas. The Chair of the Committee is invited to attend Steering Committee meetings as a non-voting member and reports to the Steering Committee at least once annually



on any curriculum changes and student performance issues and is assisted in Committee activities by the I-BRAIN Education Assistant. The Committee reviews Plans of Study and all forms related to admission to candidacy, change forms, request for exceptions, dismissal or other student misconduct accusations. The Committee forwards properly completed forms related to plans of study and advancement to candidacy directly to the Graduate College. After admission to candidacy, these forms will be forwarded to the Dean of the College in which the mentor holds their primary appointment. Any issues related to faculty or student misconduct will be brought to the attention of the Steering Committee and communicated to the College of Science Dean and the College where the faculty holds their primary appointment for evaluation.

The **NGP Recruitment Committee** ranks applicants for interviews and admission with the number of slots determined annually based on available institutional resources and faculty support for trainee stipends. Rankings for offers of admission to the NGP in the subsequent Fall semester are determined by representatives of each Area of Emphasis based on feedback from faculty after interviews are completed. The NGP Director works with the Steering Committee to establish the distribution of students to be ultimately accepted among the different Areas of Emphasis based on total number of positions that can be funded, the representation of Areas of Emphasis by program faculty, and prior patterns of trainee recruitment in these Areas. Faculty are provided with the files of all applicants who meet minimum program requirements, as established each year by the Steering Committee and according to Graduate College requirements. The Recruitment Committee works with staff of the Brain Institute to coordinate interviews, reviews faculty feedback after interviews, and ranks students for offers of admission. Regardless of participation in interviews, all faculty associated with the NGP will be able to view applications and provide input as desired. Members of the Recruitment Committee, composed of 3 faculty from each Area of Emphasis, are appointed by the Steering Committee based on a vote of faculty in the specific Areas of Emphasis for 3 Yr terms. A Chair of the Recruitment Committee rotates between representatives of the different Emphasis Area. The Chair of the Recruitment Committee is invited to attend Steering Committee meetings as a non-voting member and reports to the Committee on the Recruitment Committee's plans and activities at least once annually.

The Chair of the Recruitment Committee will work with the Directors of the Experimental Psychology and Integrative Biology Graduate Program, as well as the FAU-Max Planck Florida IMPRS Program to share information concerning applicants so as to consider whether students might be more appropriate for one of the other programs or should be interviewed by the different programs in parallel or collaboratively. Advanced students already in the NGP can apply to join the FAU-Max Planck Florida IMPRS Program, but will continue with the NGP as the home for their degrees. Similarly, students applying to the IMPRS program from other FAU graduate programs will remain a student of the same program for the completion of their Ph.D. Students who are accepted to the FAU-Max Planck Florida IMPRS Program from other institutions can apply to join the NGP and receive academic credit for courses taken elsewhere, with approval from the Curriculum Committee and up to limits established for other students in the NGP. Students who enter the NGP from the FAU- Max Planck Florida IMPRS Program can be approved to enter directly into a faculty member's laboratory if suitably advanced and fully supported by IMPRS mentor funds. These students will complete an NGP Plan of Study, complete Core and Elective Coursework, and complete all requirements for graduation prior to awarding of the Ph.D.

Several mechanisms are designed into the NGP to promote a fair distribution of students across the breadth of faculty programs. First, faculty we allowed a maximum of two students supported by program resources at any one time. A third student may rotate in a lab where 2 students are still pursuing dissertation work so long as one of the existing student's plans to defend their thesis in the next 6 months. Second, in order to spread invitations for interviews and offers of admission as broadly as possible, training faculty will self-define their primary Area of Emphasis so that the results of past recruitments in terms of Areas served can be considered by the NGP Director and Steering Committee in developing the next year's recruiting plan. The Emphasis Area that best defines a faculty member's research program will no doubt change for some faculty or the faculty member may wish to shift priority area. Prior to recruitment of each class, faculty will be asked to define the Emphasis Area that best defines their existing students. With this information, the NGP Director, in consultation with the Steering Committee will develop the recruitment distribution to be used by the Recruitment Committee. The NGP Director will communicate the planned distribution to the training faculty in advance and solicit feedback prior to initiation of recruitment. Regardless of Area representation, all training faculty will be expected to participate in recruitment visits and student interviews when asked, as their schedules permit.

- B. Please provide the date when the pre-proposal was presented to CAVP (Council of Academic Vice Presidents) Academic Program Coordination review group. Identify any concerns that the CAVP review group raised with the pre-proposed program and provide a brief narrative explaining how each of these concerns has been or is being addressed.**

The pre-proposal for the PhD in Neuroscience at FAU was presented to the CAVP Academic Program Coordination Working Group on November 7, 2019. No official concerns were voiced by the SUS institutions or the BOG staff, including no diversity concerns raised by FAMU or FIU. The only comments received to strengthen the full proposal were 1) to fully comment on all neuroscience curriculum and program opportunities in the SUS, including concentrations, and how the FAU proposal differs (which we have done) and 2) emphasize aspects of student demand for the degree, pursuing a strong analysis of demand and projected growth in students and student interest. We have carefully assessed demand via our external consultant and based on a >6X fold greater application to admission level for our forerunner GNTF program, which will end with the formation of the new program, we believe that there is more than enough demand to merit the implementation of the NGP.

- C. If this is a doctoral level program please include the external consultant's report at the end of the proposal as Appendix D. Please provide a few highlights from the report and describe ways in which the report affected the approval process at the university.**

#### **External Academic Consultant Report:**

On January 21, 2021, the FAU Provost's office arranged for a visit of two external academic consultants, Daniel N. Cox, Ph.D., Professor of Neuroscience and Biology, Director of the Center for Neuromics, Director of Graduate Studies in Neuroscience, Georgia State University and Lucas Pozzo-Miller, Professor of Neurobiology, Co-Director of the Comprehensive Neuroscience Center, Co-Director of Neuroscience Theme, Graduate Biomedical Sciences, University of Alabama Birmingham. Their full report can be found in **Appendix D**. The consultants visited with Robert Stackman, Ph.D., Dean of the Graduate College, Teresa Wilcox, Ph.D., Dean of the College of Science, Randy Blakely, Executive Director of the FAU Brain Institute, Dan Flynn, Ph.D., Vice President for Research, and Bret Danilowicz, Ph.D., Provost.

#### **Highlights of the report include:**

- The FAU Brain Institute has prepared a well-designed and detailed proposal to offer a state-of-the-art graduate program awarding a PhD in Neuroscience. The Neuroscience Graduate Program (NGP) will meet the demands of PhD-level graduates capable to contribute to local, regional, and national research efforts at the fundamental, translational, and clinical levels at academic medical centers and universities; private biotech companies; education sectors; and government sectors.*
- The proposal provides a detailed description of the program, degree requirements, need of the program, supply/demand analysis of graduates from the program, and the financial support for students throughout their time in the program.*
- The proposed curriculum contains the standard elements of successful PhD-level graduate programs across the country: didactic course work, rotations during the 1st year prior to selecting a laboratory for the dissertation work, qualifying examination, and final defense of the dissertation.*
- The job market for PhD-level Neuroscientists has steadily grown since the Presidential Declaration of the "Decade of the Brain" in 1989, and the White House BRAIN Initiative (Brain Research through Advancing Innovative Neurotechnologies) of 2013. These US government initiatives have been reflected in a significant increase in federal funding for*

*Neuroscience research, which supports labs where the graduates of the proposed PhD Neuroscience Program will find a sustained source of PhD-level jobs.*

- The Neuroscience Graduate Program (NGP) proposed curriculum is directly informed by best practices in graduate training in the discipline and well-aligned to the needs of the evolving neuroscience workforce as laid out by the Society for Neuroscience Training Committee. The curriculum addresses core competencies with emphases on foundational conceptual knowledge acquisition; research skill development; rigorous training in responsible conduct of research; communication skills; and professionalism.*
- The proposed PhD Neuroscience Program fits very well with FAU's overall goals and mission, as well as those of the FAU Brain Institute. In fact, the FAU Brain Institute was created to support research and educational activities in Neuroscience, one of the four Pillars for future research and educational investment as stated in FAU's 2015 Strategic Plan Race to Excellence. Therefore, the proposed PhD Neuroscience Program is a culmination of the educational mission envisioned for the FAU Brain Institute.*
- [Program] faculty members provide adequate expertise and credentials to successfully implement the program and provide the requisite breadth of expertise to foster training in the three major program emphasis areas. The faculty are research active and engaged in scholarly publishing, grant writing, and securing extramural grant funding.*
- Access to...state-of-the-art core facilities [at FAU, Max Planck and Scripps] represents a unique, 3-way partnership that leverages millions of dollars of Florida state investments in the training of FAU's students. Technical workshops and regular use of these facilities will provide an outstanding training experience for students enrolled in the proposed PhD Neuroscience Program.*
- We felt strong support for the degree program at the College and upper-level administration. The Dean of the College of Science as well as Dean of the Graduate College expressed full-throated support for the program which was echoed in our conversations with the Vice President for Research and Provost. The program is a major priority and future strength of the FAU Brain Institute and has strong leadership and vision from the Executive Director of the FAU Brain Institute. The program is clearly aligned to the University strategic plan and there is significant investment and resource allocation to support program implementation and success.*
- The establishment of the Scripps Florida and Max Planck Florida research institutes within the FAU Jupiter campus, in addition to the new building that will house the FAU Brain Institute is the major strength of the proposed PhD Neuroscience Program, as mentioned in the letters of support. The presence of the Scripps Florida and Max Planck Florida research institutes across the street from the new FAU Brain Institute building in the FAU Jupiter campus is reminiscent of the highly successful campus of UCSD with the Scripps and Salk research institutes in close proximity and housing UCSD graduate students and employing UCSD graduates in their research labs.*
- We did not identify any insurmountable challenges FAU will face in implementing the Neuroscience PhD degree program based upon our conversations with the executive director of the FAU Brain Institute, college administration and upper administration. Challenges that the University is aware of, and has taken steps to address, include those of a distributed campus model (Jupiter, Boca Raton, Davie); faculty diversity/inclusion, including gender balance; and reputational challenges as FAU further ramps up their regional and national research standing.*

The consultants made several constructive suggestions as to how to improve the proposed program, drawn directly from the experiences they have had organizing and

running their successful Ph.D. programs. Below, we note these suggestions along with our efforts to address these in our proposal.

***1. Add a written component to the Qualifying Examination, which can be used as the basis for an extramural funding submission by the student (e.g. NRSA from NIH). Offer a monetary reward for those students submitting their written proposals defended at the Qualifying Examination to a funding agency (e.g. \$500 at UAB).***

We have built a written component (Thesis Proposal) into the Qualifying Examination, formatted so that the proposal can be submitted as a predoctoral fellowship application to the National Science Foundation, the National Institutes of Health or a comparable agency or foundation. We believe that the monetary reward for students submitting their proposals to these agencies is a terrific idea and will be implemented using funds provided by the Brain Institute. This is now noted in the proposal.

***2. Add clarity and details regarding the source of funding support for those students necessitating more time than the allotted 5 years.***

We have added additional text to clarify that while financial support for 5 Yrs is guaranteed, funds recovered due to the success of trainees in securing fellowships, faculty receiving grants, or trainees pursuing their Ph.D. at Scripps or Max Planck where all support is provided for trainees, should provide a reserve that can be used to cover students salaries until their thesis defense (to the time limits accorded by the Graduate College), to the degree that this support is not available through GTAs.

***3. Remove the requirement for the GRE entirely; i.e. making it optional still could give the impression that it will be used to evaluate candidates. This recommendation is based on evidence-based studies and best practices in holistic graduate recruitment and may further serve to enhance diversity and inclusion within the program.***

We concur with this recommendation. The GRE is currently an optional requirement at FAU for graduate admission, but as we will be empowering a Steering Committee to provide governance of the program, and the Graduate College is the academic body admitting students, we will need to defer implementation of this recommendation until these units have conferred and agreed to this approach. Importantly, the GRE was not required of this year's applicants to the GNTP program, providing an immediate opportunity to gauge the suitability of eliminating the test for our evaluations.

***4. Clarify that the requirement for published articles before the final defense also include papers "in press".***

We concur with this recommendation and have changed the proposal accordingly.

***5. Add clarity and details to the different options to exit the PhD-level program with an intermediate degree (e.g. Master's).***

We appreciate the consultant's suggestion and have further clarified the Master's option for our program.

***6. Create a seminar series for just the students in the proposed PhD Neuroscience Program or use the summer months of an existing seminar series to focus on student speakers (e.g. practicing short talks at meetings like the Annual Neuroscience Meeting of the SfN).***

We believe that this is an excellent idea. We believe that the existing graduate Neuroscience Student Organization is an excellent vehicle to accomplish this objective and will recommend it to their leadership. The Brain Institute commits to providing support by way of advertising and refreshments should this be established.

***7. Negotiate a waiver of the application fee, at least for students in need or from minoritized groups in STEM.***

We believe that this is an important suggestion and have initiated discussions on the matter with the Dean of the Graduate College. Currently, application to the GNTP is free, and we will proceed similarly with the NGP once established. There is, however, a \$30.00 application fee required by the Graduate College upon acceptance. We will seek to have this fee waived for the student groups noted above or identify funds to cover this need.

***8. Add clarity and details regarding the new proposal to integrate with Broward Health hospitals for their academic mission focused on Neuroscience, which will dovetail very well with FAU Brain Institute's mission on clinical and translational Neuroscience research (aka "bench-to-bedside").***

We have noted the creation of the FAU-Memorial Health Systems research partnership to our proposal and have noted the opportunity to explore clinical research internships during their training with MHS.

**External Marketing Consultant's Report:**

As indicated in **Appendix E-1**, Hanover Research, an independent external consultant firm, provided a comprehensive report of the market analysis for neuroscience graduate programs in December of 2019. Hanover's report took a broad view of neuroscience doctoral programs, which led to the following key conclusions:

- Neuroscience-associated job availability is projected to be strong out to 2026 and to increase at a faster than average rate whether evaluating state, regional or national statistics. The Florida growth rate in these occupations also will exceed that of the region and nation, placing high value on training neuroscientists in our area.
- The unemployment rate for graduates in neuroscience-related areas of biomedical science sampled (Natural Science Managers, Biological Scientists - All Other, Medical Scientists excluding Epidemiologists, Biological Science Teachers, Post-secondary) is exceedingly low, averaging 1.6% in both Florida, the same percentage seen across the U.S.
- Our program will allow for a minimum of 30 hrs of course credit and up to 42 credit hours of research credit, and thus emphasizes opportunities for research and technologically-sophisticated training. The consultant's report re-affirmed our commitment to state-of-the-art training in research as a key component of our program's design.
- As our program is administered by I-BRAIN, a physical embodiment of the Neuroscience Pillar, the program can draw from resources allocated to the Division of Research for support of research infrastructure, as talented, well-trained graduate student body are critical to the growth of academic research programs. Additionally, the ability of I-BRAIN to link faculty and students across departments and colleges offers a significant opportunity to build a cohesive training culture where the transfer of idea and approaches are not restricted by traditional departmental boundaries.
- Our training program provides curricular offerings and research experiences linked to six concentrations as well as an integrated lecture series that features presentations from world-class researchers. Our Max Planck Florida and Scripps Florida partners also sponsor neuroscience seminars, accessible to our trainees, that further extend their

exposure to the most up to date research in the field. Lecture series from leaders in neuroscience are highly integrated in our program, as recommended by the consultants.

- Exposure to, and training in research core facilities operated by I-BRAIN (<http://www.fau.edu/ibrain/corefacilities/>), Max Planck Florida (<https://mpfi.org/science/scientific-cores/>), and Scripps Florida (<https://www.scripps.edu/science-and-medicine/cores-and-services/>) - e.g. behavioral and neuroanatomical analysis of transgenic animals that model brain disorders, mastering electron, confocal, and optogenetic and super-resolution microscopy to visualize brain circuits and synapses, performing high-throughput drug screening to develop new brain disease medications, tapping genomics and proteomics resources to uncover disease risk factors, solving 3-D structures of neural proteins- represents a unique, three-way partnership that leverages millions of dollars of state investments in the training of our students. Ensuring access to such technologies was emphasized by the consultants. Technical workshops and regular use of these facilities will provide an outstanding training experience.

In summary, the consultant's report indicated that 1) our proposed Program addressed an area of strong local and national need with low expected unemployment for graduates, 2) indicated that the significant, technologically-advanced research emphasis of our Program was a desirable feature with respect to future employment, 3) noted the positioning of the Program under the administration of I-BRAIN versus a single department would help with program integration and promote interdisciplinary education, 4) that the breadth of our training options and integration of world-class partner Institutes would not only be attractive to students but ensure the most advanced training possible, and 5) the availability of advanced, shared research facilities between FAU, Max Planck Florida and Scripps Florida would make cutting-edge training possible and reduce cost by leveraging partner investments. As such, FAU Academic Affairs leadership encouraged submission of a Neuroscience Pre-Proposal submission to the Board of Governors, APCG, which was approved in December of 2019.

In addition, as another external source, we utilized the Hanover Report coupled with the Burning Glass data analysis platform with the CIP Codes Neuroanatomy (26.1502), Neurobiology and Anatomy (26.1503), Neurobiology and Behavior (26.1504), Neurobiology and Neurosciences, Other (26.1599), Neuroscience (26.1501), to assess aspects of employment potential for our program. We provide these data in **Appendix E-2**. This analysis shows significant demand and employment potential, particularly in the state of Florida, for our graduates and confirm the comments in **Appendix C**.

**D. Describe how the proposed program is consistent with the current State University System (SUS) Strategic Planning Goals. Identify which specific goals the program will directly support and which goals the program will indirectly support (see link to the SUS Strategic Plan on [the resource page for new program proposal](#)).**

The proposed program aligns with the 3 areas of emphasis identified in the SUS Strategic Plan: Excellence, Productivity and Strategic Priorities for a Knowledge Economy.



**Table 1. Areas of Emphasis in the SUS Strategic Plan**

GOALS	EXCELLENCE	PRODUCTIVITY	STRATEGIC PRIORITIES
<b>Teaching and Learning</b>	DIRECT Strengthen the Quality and Reputation of Academic Programs and Universities	DIRECT Increase Degree Productivity and Program Efficiency	DIRECT Increase the number of Degrees Awarded within Programs of Strategic Emphasis
<b>Scholarship, Research and Innovation</b>	DIRECT Strengthen the Quality and Reputation of Scholarship, Research and Innovation	DIRECT Increase Research Activity and Attract More External Funding	DIRECT Increase Commercialization Activity
<b>Community and Business Engagement</b>	DIRECT Strengthen the Quality and Reputation of Commitment to Community and Business Engagement	DIRECT Increase Community and Business Engagement	Increase Community and Business Workforce

### Goals in Excellence

The availability and visibility of interdisciplinary Neuroscience PhD programs at other institutions across the country indicates that FAU would benefit from developing and advertising a similar program in order to compete successfully for the best applicants in this discipline, including students from traditionally under-represented groups, as well as non-traditional, returning students aiming to further their education. By providing this new, advanced degree in an area of strategic emphasis, the University will directly enhance the quality and reputation of its academic programs, its research and scholarship activities, and community and business engagement. Neuroscience faculty from multiple FAU departments, colleges and our prestigious partner institutions, Max Planck Florida and Scripps Florida, will contribute their diverse expertise in teaching and collaborative research to provide interdisciplinary graduate education of the highest quality, strengthening both the reputation and visibility of FAU academic programs. Through access to the state-of-the-art resources available at FAU, Scripps Florida, and Max Planck Florida core facilities, students will master cutting edge experimental techniques, enabling them to excel in highly innovative, impactful research projects, while also making them competitive for NIH, NSF and other sources of predoctoral external grant support.

FAU recently received Carnegie Community Engagement Classification in recognition of its ongoing commitment to civic engagement and community outreach, achieved through the efforts of faculty, staff and students in programs such as Lifelong Learning. I-BRAIN was conceived with the goal of community outreach specifically on its agenda. This commitment to excellence in community engagement is achieved through educational programs that have impacted, and will continue to impact, the southeast Florida community in measurable and meaningful ways, with students playing important roles in these programs.

In 2019, the South Florida Science Center and Aquarium (SFSCA), in partnership with FAU, opened ***Journey Through the Human Brain***, a \$2.5 million, 2,500-square-foot permanent exhibit (visit the website at <https://www.pbs.org/video/journey-through-human-brain-zsjg11/>). The exhibit was created as a partnership between the SFSC and I-BRAIN. Drs. Randy Blakely, Executive Director of I-BRAIN, and Dr. Nicole Baganz, I-BRAIN Director of Community Engagement and

Programming, were the lead scientific advisors for the exhibit, and also responsible for organizing the participation of faculty and trainees from Max Planck Florida and Scripps Florida. Guests to the exhibit can explore 30 interactive brain exhibits appealing to both adults and, in particular children. PhD students participate as docents for special events at the exhibit, working with children at the interactive stations. In 2019, approximately 200,000 children toured the exhibit, many representing youth from Title I schools, along with more than 100,000 adults, attesting to the popularity and impact of the exhibit. Graduate students from FAU have served as guest docents for the exhibit, activities that will become regular activities for the Ph.D. students in our new program.

In 2018, I-BRAIN, with a generous donation of \$780,000 from the Stiles-Nicholson Foundation, established the **ASCEND** program (**A**dvancing **S**TEM: **C**ommunity **E**ngagement through **N**euroscience **D**iscovery). In this program (<http://www.fau.edu/ibrain/ascend/>), teams of FAU postdoctoral fellows, graduate students and undergraduates generate and deliver science lessons for middle schoolers across Palm Beach County, including tours to research labs, small group activities, and on-line exercises. The teams also visit local middle school classrooms and other community sites to provide hands-on exercises and virtual reality demonstrations of brain structure and function. The program has become a popular opportunity for FAU graduate students to become involved in community outreach and the opportunity to encourage youth to pursue education and future careers in STEM.

A recent addition to I-BRAIN's ASCEND program is **MobileMinds**, a traveling exhibit of brain science for which a van was purchased in 2020, and a full-time program manager was hired, Dr. David Cinalli. The MobileMinds program takes the interactive activities and science experiments that the ASCEND program uses to reach out to children in underserved communities, with brain science and brain health as the key topics. The van was purchased, wrapped colorful brain graphics, and outfitted with ASCEND funds and donations from the SFSCA and Palm Health Foundation. For MobileMinds, we purchased two, touch-sensitive, mobile monitors running neuroscience-related software, including memory games and deep-dive virtual experiences into the brain taken from the Human Brain Exhibit at the SFSCA. With these tools, plus other displays and interactives, our MobileMinds team of graduate students, working with Dr. Cinalli, visit community centers and sites of after school programs (e.g. at the Edna Runner Center in Jupiter FL- <https://www.ewrunnerctr.org>) to deliver lessons and fun hands-on exercises for elementary and middle schoolers.

In March of each year, I-BRAIN hosts **Brainy Days**, a month-long community outreach program to communicate the promise and progress of brain science. Brainy Days activities include lectures at community venues on advances in brain science and medicine, walks to raise awareness regarding brain disorders, fairs to link undergraduates to local nonprofits focused on mental health and brain disorders, and hands on activities for children, among other activities. To staff this program, The Institute organizes **Neurosquad**, a group of faculty, postdocs, graduate students and undergraduates who are passionate about neuroscience and eager to share their knowledge and excitement with the broader world. Neurosquad involves faculty and trainees from I-BRAIN, Max Planck Florida and Scripps Florida, further linking these three Institutes in a fun opportunity for community service.

Participants in Neurosquad activities include the members of the **Neuroscience Student Organization** (NSO), a self-governed and Student Government Association-registered organization of graduate students involved in neuroscience research from different colleges and departments across campus. Every year, the I-BRAIN has supported a campus-wide Neuroscience Retreat where students and faculty share informal time together, students present their latest research in poster format, and an invited speaker lectures on a cutting-edge research topic in neuroscience. At the most recent retreat, neuroscientist Dr. Michael Platt from the University of Pennsylvania's Wharton Neuroscience Initiative lectured on Building Better Businesses through Brain Science, which educated the group on how brain imaging of individuals engaged in purchasing decisions or viewing marketing displays can be used to understand both practical and ethical issues surrounding brain activity monitoring in the future. With the initiation of the NGP, the Retreat will be organized by the program's graduate students, including selection and hosting of the invited speaker and organization of other Retreat events. The Retreat will be an opportunity to give annual faculty and student awards and to further promote networking among faculty and students across FAU's multiple campuses.

## Goals in Productivity

By providing this new academic program, FAU will be expanding degree access and productivity in a medically relevant STEM field, directly increasing the number of professional degrees awarded in multiple programs of Strategic Emphasis identified in the 2019 update to the 2025 SUS Strategic Plan. These fall under the broader designation of Biological and Biomedical Sciences (CIP 26.9999), including Neuroscience (CIP 26.1501) and other neuroscience-related fields captured under the CIP 26 code category. The proposed program creates a breadth of coursework and research opportunities that extend beyond any of the current individual neuroscience-related programs at FAU, without the need for additional courses or laboratory space. While I-BRAIN actively engaged in hiring faculty associated with the neuroscience pillar (9 hired since 2016), the extensive curricular opportunities listed for the NGP in this application involves only the existing faculty. Establishing an advanced, interdisciplinary degree in a rapidly growing area of STEM will attract more top students with interests in neuroscience and biomedicine, as well as link the participating faculty and academic units in a common program with shared curriculum and administrative responsibilities. Interactions of both the students and faculty in the program will foster collaborations and build team research efforts across the Colleges and Institutes, leading to cooperative graduate training, the sharing of ideas and valuable experimental resources, more patent applications and publications, and the development of interdisciplinary, competitive grant proposals that the NIH, NSF, and other agencies favor, directly increasing levels of external funding at FAU.

### **Goals in Strategic Priorities for a Knowledge Economy**

Establishing a new FAU degree program in the area of Neuroscience will directly increase the numbers of doctoral graduates with high quality training in a STEM field focused on advancing medical knowledge by studying the pathological mechanisms underlying brain diseases, injuries and mental illnesses, in order to devise more effective treatments to slow disease progression, repair damage, and rescue function. This knowledge lays the groundwork for translational research aimed at designing effective diagnostics, drugs, biologics, and therapeutic devices for millions of Americans suffering from these disorders. A large percentage of federal funding, across multiple NIH Institutes and other federal agencies, is targeted to neuroscience research, and program faculty and students participating in collaborative research projects will be in a better position to compete for this funding. As the prevalence of neurological disorders, particularly in the aging population, continues to rise, the program will generate trained neuroscientists needed to fill the national and state workforces that drive translational research and drug discovery in both the public and private sectors.

Training in the NGP involves research opportunities with a technologically-sophisticated research base. Faculty who serve as dissertation mentors in the program use state-of-the art methods including CRISPR/Cas9 genome editing, RNA sequencing, mass spectrometry approaches for proteomics and metabolomics, multi-photon and super-resolution microscopy, electron microscopy, 3D volumetric reconstruction, inducible pluripotent stem cell (iPSC) approaches, *in vivo* optogenetics, *in vivo* fiber photometry, *in vivo* chronoamperometry, multielectrode array recording, forward and reverse genetics, electroencephalography (EEG), functional near-infrared spectroscopy (fNIRS), and functional magnetic resonance imaging (fMRI), artificial intelligence, machine learning, virtual reality and augmented reality approaches, among others. These skills, whether used directly or by peers in the training cohort, place our graduates in an elite class of PhD graduates, well-prepared for professional pursuits beyond graduate school.

**E. If the program is to be included in a category within the Programs of Strategic Emphasis as described in the SUS Strategic Plan, please indicate the category and the justification for inclusion. The Programs of Strategic Emphasis Categories are:**

- **Critical Workforce:**

- ☐ Education
- ☐ Health

- ☐ Gap Analysis
- **Economic Development:**
  - ☐ Global Competitiveness
  - ☐ Science, Technology, Engineering, and Math (STEM)

**Please see the Programs of Strategic Emphasis (PSE) methodology for additional explanations on program inclusion criteria at [the resource page for new program proposal](#).**

The proposed program is included in Category 3. Science, Technology, Engineering, and Math (STEM). It is a discipline within the Biological and Biomedical Sciences (CIP 26), with emphasis on neuroscience, including cellular-molecular neurobiology, neurophysiology and pathology, neurochemistry, neural networks, bioengineering and informatics, and behavioral, cognitive, and computational neurosciences.

**F. Identify any established or planned educational sites at which the program is expected to be offered and indicate whether it will be offered only at sites other than the main campus.**

Courses and seminars supporting the NGP are expected to be taught on the Boca Raton, Davie, and Jupiter campuses of FAU. FAU makes extensive use of video-conferenced lectures and meetings managed through the Office of Information Technology, as well as distance learning via university-provided Webex and Zoom platforms. These permit the teaching, advising and training of students who are pursuing research on different FAU campuses.

## **Institutional and State Level Accountability**

### **II. Need and Demand**

**A. Need: Describe national, state, and/or local data that support the need for more people to be prepared in this program at this level. Reference national, state, and/or local plans or reports that support the need for this program and requests for the proposed program which have emanated from a perceived need by agencies or industries in your service area. Cite any specific need for research and service that the program would fulfill.**

**National Health Challenges:**

The increasing importance of neuroscience research and training is evident in the staggering numbers of Americans afflicted with neurological disorders. Neurological disability affects more than 100 million Americans, at a cost of nearly \$800 billion to society in terms of annual medical needs, caretaking, and lost wages for nine of the more common disorders<sup>1</sup>. The prevalence of brain injuries, neurological diseases and mental illness continues to rise, particularly for age-related disorders such as stroke and Alzheimer's Disease (AD). Cerebrovascular disease and AD are now the fifth and sixth leading causes of death in the US<sup>2</sup>.

The growing recognition that brain dysfunction across all age groups impacts a wide sector of the US population in terms of quality of life, and the financial and emotional burdens it places on families, has prompted federal commitments specifically aimed at accelerating neuroscience research and development. In 2013, The Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative was launched, with the goal of furthering our understanding of brain function and neurological disorders through the design and application of innovative technologies that can lead to breakthroughs in medical treatments and diagnostics<sup>3</sup>. The initiative, conceived as a 10-year plan, spans multiple federal agencies, including the National Science Foundation (NSF) and the National Institutes of Health (NIH), and is and currently soliciting grant applications. Supported by congressional appropriations and the 21<sup>st</sup> Century Cures Act, the initiative represents a 3 billion-dollar investment to drive cutting-edge research in both the private and public sector. An important component of the initiative is aimed at developing high-capacity, computing database infrastructure for the input, analysis, modeling and dissemination of basic and clinical neuroscience data collected from laboratories around the country and the globe. Technological advancements in this area will require the collaborative efforts of teams of neuroscientists trained across a wide range of disciplines, including molecular biology, genetics, development, aging, medicine, cognitive science, computational modeling, bioinformatics, and engineering.

**Florida Health Challenges:** The prevalence of age-related neurological disorders has dramatically increased in Florida over the last 25 years. According to 2018 data, stroke was the third leading cause of death in Florida, and AD the sixth leading cause (Florida Department of Health, 2018 Florida Health Charts data). The current estimated number of those Florida residents over age 65 diagnosed with AD is 580,000, with 720,000 projected by 2025, making Florida second only to California in terms of the number of expected AD cases<sup>4</sup>. Based on national data collected in 2014, Florida had the fifth highest prevalence of Parkinson's disease in the nation (1,551 per 100,000), and currently there are 64,000 patients in the state, putting us in second place behind California with 85,100.<sup>5</sup> In addition to age-related disorders, many Floridians are struggling with depression, epilepsy or mental illnesses such as schizophrenia. Estimates indicate that more than 800,000 Floridians of all ages live with some form of mental illness (National Association for Mental Health), with 200,000 patients hospitalized in 2018. Diagnoses of autism spectrum disorders in Florida also have been increasing in recent years, and in a national survey conducted in 2016, the prevalence of diagnoses (at any age) was 4.88%, compared to a national average of 2.79%<sup>6</sup>. These disturbing statistics point to an urgent need to find new and better ways to improve the health, productivity and quality of life of Floridians affected by neurological disorders, a need that will increasingly rely on a workforce comprised of individuals with advanced biomedical education and sophisticated technical skills in the neurosciences and related fields.

<sup>1</sup> Gooch CL, Pracht E, Borenstein AR. *The burden of neurological disease in the United States: A summary report and call to action.* *Ann. Neurol.* (2017), 81:479-484.

<sup>2</sup> Centers for Disease Control and Prevention, 2020 National Center for Health Statistics Report.

<sup>3</sup> NIH, The Brain Initiative, <https://braininitiative.nih.gov/>.

<sup>4</sup> Alzheimer's Association, *Florida Alzheimer's Statistics, 2020*, [alz.org](http://alz.org).

<sup>5</sup> Mantri S, et. al., *State-level prevalence, health service use, and spending vary widely among Medicare beneficiaries with Parkinson Disease.* *NPJ Parkinson's Dis.* (2019) Doi: 10.1038/S41531-019-0074-8.

<sup>6</sup> Guifeng Xu et al., *Prevalence of and Treatment Patterns of Autism Spectrum Disorder in the United States, 2016.* *JAMA Pediatrics* (2019) 173:153-159.

## Market Demand and Employment Outlook

**Hanover Research Report:** As indicated in **Appendix E-1**, Hanover Research, an independent external consultant firm, provided a comprehensive report of the market analysis for neuroscience graduate programs in December of 2019. Hanover's report took a broad view of neuroscience doctoral programs, which led to the following key conclusions:

- Neuroscience-associated job availability is projected to be strong out to 2026 and to increase at a faster than average rate whether evaluating state, regional or national statistics. The Florida growth rate in these occupations also will exceed that the region and nation, placing high value on training neuroscientists in our area.
- The unemployment rate for graduates in neuroscience-related areas (Biological Scientists, All Other, Medical Scientists excluding Epidemiologists, Biological Science Teachers, Postsecondary, Natural Science Managers) is exceedingly low, as it is nationally, currently averaging 1.6% in both Florida and the U.S.
- Our program will emphasize opportunities for research and technologically-sophisticated training. The consultant's report re-affirmed our commitment to state-of-the-art training in research as a key component of our program's design,
- As recommended by the consultants, our training program provides curricular offerings that include an integrated lecture series featuring presentations from world-renowned researchers. Our Max Planck Florida and Scripps Florida partners also provide seminars that further enrich the experience of our students and provide a global view of the current advancements in the field.
- Research core facilities operated by I-BRAIN, Max Planck Florida, and Scripps Florida (e.g. behavioral analysis of transgenic animals, electron, confocal, and super-resolution microscopy, mass spectrometry, high-throughput drug screening, genomics and proteomics) represents a unique, 3-way partnership that leverages millions of dollars of state investments in the training of our students. Ensuring access to these modern, sophisticated analytical tools was emphasized by the consultants and the workshops, allowing our trainees to master technical research skills that are in high demand in academia and industry.

**National Level:** The transdisciplinary nature of modern neuroscience provides for training across a

wide of range of research areas, from uncovering cellular mechanisms of neurodegeneration and addiction, to mapping dynamic brain circuits and designing prosthetic hands can than sense touch. This training permits a graduate with a Neuroscience PhD to pursue a number of career options, including those occupations listed below in Table 2. The US Bureau of Labor Statistics (USBLS) projects that these careers will show substantial employment growth nationally. Employment of Medical Scientists, defined in the BLS Occupational Outlook Handbook as “scientists conducting research aimed at improving overall human health who typically have a PhD, usually in biology or a related life science” is one of these growth areas. According to the Handbook “the employment of Medical Scientists is projected to grow by 6.1% between 2019 and 2029, faster than the average for all occupations (3.7%). Medical Scientists will continue to be needed because they contribute to the development of treatments and medicines that improve human health.”

Industries with the highest levels of employment for this occupation include Scientific Research and Development Services, Colleges, Universities and Professional Schools, Pharmaceutical and Medical Device development and manufacturing, Biotechnology Industries, and Diagnostic Laboratories. Employment of PhD level personnel in these industries encompasses academic scientists, postsecondary educational faculty, directors of academic, government or industry laboratories, senior scientists in corporate research divisions, scientific consultants, and senior operation managers in drug/device development, manufacturing and regulatory compliance. High demand is projected for post-secondary educational employment of PhD level scientist-teachers in the fields of psychology, biomedical sciences, and in particular, the health specialties (laboratory technology, medicine, pharmacy, therapy), providing critical training for the next generation of researchers needed to advance treatment of neurological disorders. Growth in the majority of occupations listed below exceeds the average national job growth of 3.7% projected during this time (projected in September 2020, USBLS). The top six occupations listed require PhD degrees, and while some jobs within the categories shown in the bottom five categories also require the PhD for advanced positions, others require only the B.Sc. or M.S. degree. Beyond the traditional research scientist career paths, there are additional opportunities for graduates holding a Neuroscience PhD in the areas of instrumentation design and development, science and technical writing, scientific journal editing, data analytics, medical science liaisons, patent development, biological and medical data base construction and management, bioinformatics, science/public outreach and health care policy.

According to the NSF National Science Board “State of U.S. Science and Engineering (S&E) Report, January 2020”, S&E employment has grown more rapidly than the US workforce overall. There are now about 7 million S&E jobs, representing 5% of all US employment. In 2017, the median annual salary across all S&E occupations, for employees of all educational levels, was \$85,390 compared to the median for all employed workers in the US (\$37,690).

**Table 2. US Bureau of Labor Statistics projected job growth to 2029, listed by Standard Occupational Classification (SOC) system codes. (From 2020 table).**

Job Title	SOC code	Employment 2019	Projected Employment 2029	% change	Avg annual openings 2019-29	Annual mean wage 2019
Medical Scientists	19-1042	138,300	146,700	6.1%	11,200	\$98,770
Biological Science post-secondary teachers	25-1042	64,700	70,700	9.3%	5,600	\$98,700
Psychology post-secondary teachers	25-1066	46,800	51,000	8.8%	4,000	\$87,530
Health Specialties Teachers, post-secondary	25-1071	254,000	306,100	20.5%	26,000	\$97,320



Bioengineers and Biomedical Engineers	17-2031	21,200	22,200	4.7%	1,400	\$97,090
Biological Scientists, All Other (includes Bio-informatics Scientists)	19-1029	44,700	45,700	2.2%	3,600	\$87,590
Computer and Information Scientists	15-1221	32,700	37,700	15.4%	3,000	\$127,460
General and Operations managers	11-1021	2,486,400	2,630,200	6.7%	24,600	\$123,030
Other Management Occupations (Regulatory Affairs, Compliance)	11-9000	4,915,900	5,060,300	2.9%	382,300	\$102,560
Data Scientists and Mathematical Science, all others	15-2098	33,200	43,400	30.9%	3,600	\$100,560
Natural Science Managers (includes Research and Development Managers)	11-9121	71,400	74,800	4.8%	4,900	\$145,450
Biochemists and Biophysicists	19-1021	34,600	36,000	4.0%	1,400	\$94,490

Table 2, *Employment by detailed occupation, 2019 and projected 2029. US Bureau of Labor Statistics, Employment Projections. Accessed October 2020.*

**Although the US Bureau of Labor Statistics did not explicitly survey neuroscience in the analysis above,** an analysis of 2700 Neuroscience Ph.D. graduates conducted in 2013 found that, at 6-10 years post-graduation, 55% were employed in academia, and 35% were employed in positions in industry, government and other areas of science (Akil, H et al., 2016, "Neuroscience Training for the 21<sup>st</sup> Century", *Neuron*, 90:917-926), consistent with a significant motivation and success of Ph.D. graduates in pursuing careers that utilized the education they pursued through their doctoral studies.

#### Statewide level:

The Florida Department of Economic Opportunity (FDEO) projected job growth for doctoral graduates with a PhD in fields related to neuroscience, is summarized below in Table 3 (Neuroscience PhDs were not scored). The occupations of medical scientists and post-secondary educators are predicted to show double-digit growth between now and 2027. The Florida Strategic Plan for Economic Development 2018-2023 estimates that 67% of jobs in Florida created between 2018 and 2025 will require some type of postsecondary degree or special certification.

**Table 3. Florida Department of Economic Opportunity (FDEO), Statewide Employment Projections to 2027 for SOC job titles. (May 2019 State wage estimates shown).**

SOC Title	SOC code	Florida Employment 2019	Projected Employment 2027	Job growth	% job growth	Annual mean wage 2019
Medical Scientists	19-1042	2,213	2,589	376	17.0%	\$85,460
Biochemists and Biophysicists	19-1021	1,012	1,199	187	18.5%	\$76,970
Biological Science post-secondary teachers	25-1042	2,317	2,665	348	15.0%	\$95,750
Psychology post-secondary teachers	25-1066	1,736	1,990	254	14.6%	\$83,510
Health Specialties teachers, post-secondary	25-1071	11,384	14,208	2,824	24.8%	\$113,140

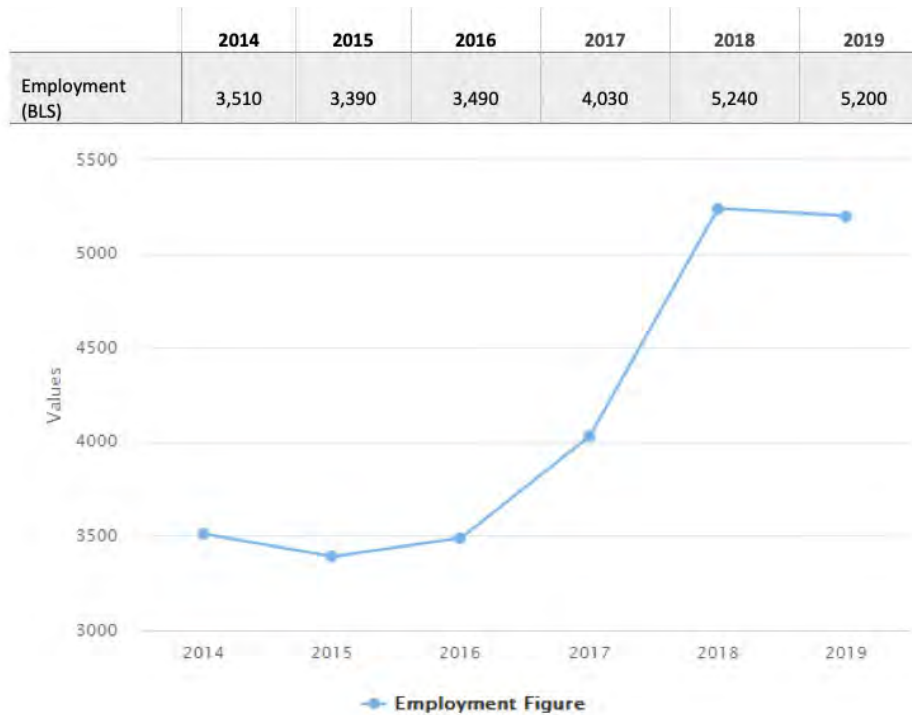
Computer and Information Research Scientists	15-1111	556	605	49	8.8%	\$127,140
Biomedical Engineers	17-2031	718	788	70	9.7%	\$85,570
Biological Scientists, all others	19-1029	1814	1976	162	8.9%	\$68,710
General and Operations Managers	11-1021	87,368	97,317	9,949	11.4%	105,260
Natural Science Managers	11-9121	1,085	1,211	126	11.6%	\$88,070

In this Economic Development Plan, the Pillar area of Talent Supply and Education identifies the need to increase the number of graduates in high-demand fields, including STEM and Health, in order to meet Florida's future needs. This is reflected in the employment growth projected in the broad categories of Professional, Scientific, and Technical Services, and Educational Services, as indicated in Table 4. Figure 1 demonstrates significant growth in employment potential for graduates with PhDs in Neuroscience (26.1501)) or in related disciplines (Neuroanatomy (26.1502), Neurobiology and Anatomy (26.1503), Neurobiology and Behavior (26.1504), Neurobiology and Neurosciences, Other (26.1599)) over the past 5 years (Figure 1).

**Table 4. Florida statewide employment projections for occupations listed by North American Industry Classification System (NAICS) codes.**

NAICS Title	NAICS code	Florida Employment 2019	Projected Employment 2027	Job Growth	% growth
Professional, Scientific, and Technical Services	54	587,589	668,412	80,823	13.7%
Educational Services	611	670,802	726,173	55,371	8.3%

From Florida Department of Economic Opportunity (FDEO), *Employment Projections*, Accessed June 2020, <https://floridajobs.org/workforce-statistics/data-center/statistical-programs/employment-projections>.



**Figure 1:** Bureau of Labor Statistics analysis of the growth of jobs in neuroscience and related disciplines in the state of FL from 2014-2019. Program Insight by Burning Glass Technologies 2020 (<https://www.burning-glass.com/products/program-insight/>)

#### Southeast Florida Job Market:

Southern Florida and the Palm Beach County-Broward County communities in which FAU has campuses (and neuroscientists) has seen explosive growth in biotechnology and related STEM industries in the past 10 years, with growth accelerating over the past 5 years including the 2017 arrival of Apotex, Inc, the 7<sup>th</sup> largest generic pharmaceutical company globally and the largest Canadian owned pharmaceutical company, launching in Weston FL in 2017, and the R&D life sciences accelerator company Beacon Pharmaceutical launching a 160,000 sq ft facility in Jupiter, FL in 2020. The region encompassed by Broward and Palm Beach counties is home to more than 1,500 biotech institutions that employs more than 26,000 people. These exciting developments encouraged Scripps Research, often ranked as the top research Institute in the country, to launch a Jupiter, FL site in 2009 on FAU's MacArthur campus, and the world famous Max Planck Institute to follow the Scripps Research lead and establish the Max Planck Florida Institute for Neuroscience Research in 2012, across the street from Scripps and neuroscience laboratories of FAU and the home of I-BRAIN. Tables 5 and 6 give results of analyses of employment potential for related biomedical disciplines broken down by county.

**Table 5: Florida Department of Economic Opportunity-Projections by County by NAICS code.**

NAICS Title	2019 employment	2027 employment	Increase	% increase
54-Professional, Scientific and Technical Services				
Miami-Dade County	86,562	98,646	12,084	14.0%
Broward County	61,260	69,137	7,877	12.9%
Palm Beach County	50,126	56,988	6,862	13.7%
611-Educational Services				
Miami-Dade County	36,120	40,047	3,927	10.9%
Broward County	22,015	25,442	3,427	15.6%

Palm Beach County	12,658	15,245	2,587	20.4%
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**Table 6: Florida Department of Economic Opportunity-Projections by County by SOC codes.**

SOC Title	2019 Employment	2027 Employment	Increase	% Increase
19-1042 Medical Scientists, not Epidemiologists				
Miami-Dade County	182	205	23	12.6%
Broward County	222	261	39	17.6%
Palm Beach County	147	164	17	11.6%
25-1042 Biology, Post-secondary Teachers				
Miami-Dade County	420	480	64	15.2%
Broward County	169	200	31	18.3%
Palm Beach County	147	172	25	17.0%
25-1071 Health Sciences, Post-secondary Teachers				
Miami-Dade County	1,684	2,113	429	25.5%
Broward County	873	1,125	252	28.9%
Palm Beach County	316	401	85	26.9%
25-1066 Psychology, Post-secondary Teachers				
Miami-Dade County	389	444	55	14.1%
Broward County	95	111	16	16.8%
Palm Beach County	79	93	14	17.7%
19-1029 Biological Scientists, all others				
Miami-Dade County	417	425	8	1.9%
Broward County	NA	NA	NA	NA
Palm Beach County	38	43	5	13.2%
11-9121 Natural Science Managers				
Miami-Dade County	172	195	23	13.4%
Broward County	113	127	14	12.4%
Palm Beach County	54	59	5	9.3%
17-2031 Biomedical Engineers				
Miami-Dade County	122	140	18	14.8%
Broward County	60	69	9	15.0%
Palm Beach County	24	25	1	4.2%
11-1021 General and Operations Managers	5723	6852		
Miami-Dade County	12,444	13,759	1,315	10.6%
Broward County	9,056	10,084	1,028	11.4%
Palm Beach County	6,413	7,227	814	12.7%

15.2

As mentioned earlier, we utilized the Hanover Report coupled with the Burning Glass data analysis platform with the CIP Codes Neuroanatomy (26.1502), Neurobiology and Anatomy (26.1503), Neurobiology and Behavior (26.1504), Neurobiology and Neurosciences, Other (26.1599), Neuroscience (26.1501), to assess aspects of employment potential for our program. We provide these data in **Appendix E-2**. This analysis shows significant demand and employment potential, particularly in the state of Florida, for our graduates and confirm the comments in **Appendix C**.

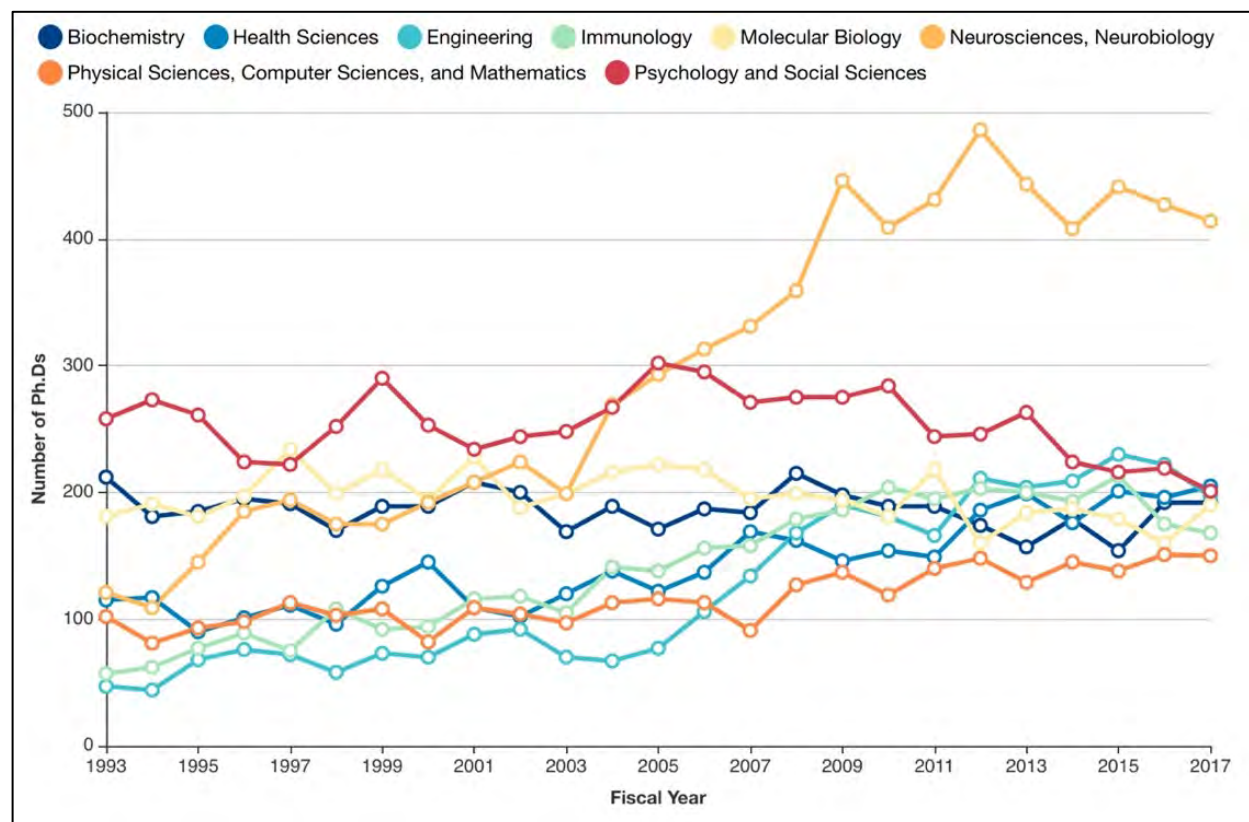
**B. Demand: Describe data that support the assumption that students will enroll in the proposed program. Include descriptions of surveys or other communications with prospective students.**

In 2017, 23% of all PhD degrees obtained nationally were awarded in the life sciences, with the biological and biomedical sciences accounting for 15.5% of this<sup>5</sup>. As indicated in Table 7 below, enrollment in all Biological Sciences graduate programs increased by 8.8% from 2010-17, while enrollment in programs within the subdiscipline of Neuroscience increased 46% during this time, making it the fastest growing field of study in the life sciences<sup>5</sup>. The number of doctoral degrees in Neuroscience/Neurobiology conferred nationally each year between 2012-2018 have averaged over a thousand<sup>6</sup>. Extramural funding for students enrolled in Neuroscience doctorate programs has kept pace with the enrollment growth. As Figure 2 highlights, NIH financial support of Neuroscience graduate students, provided through institutional program training grant awards and individual fellowships, has also increased significantly since 2007, denoting an intense educational and financial commitment to the discipline and a realization that the US was undertraining in this area.

**Table 7. National historical enrollment in research-based graduate programs 2010-2017.**

Discipline Division	2010	2011	2012	2013	2014	2015	2016	2017	% Growth 2010-2017
Biological Sciences (all)	77,726	79,540	80,994	81,444	83,413	85,098	84,372	85,217	8.8
Neurobiology Neuroscience (subdivisions)	2,798	4,117	4,547	4,795	4,923	5,002	5,226	5,189	46.1

<sup>5</sup> From Table 311.90, *National Center for Education Statistics*. Accessed June 2020.



**Figure 2.** Numbers of National Institutes of Health-supported PhD recipients, comparing the trends in major disciplines of graduate study. *NIH support includes funding from any of the following Kirschstein-NRSA or NLM awards at any point prior to the PhD: T15, T32, T35, T90, TL1, TU2, F30, F31, F32, F33, F34 or F35. Individuals supported by training grants (i.e., T awards) were included only if their training grant appointments were at least 100 days. Sources: NIH Trainee and Fellow File, IMPAC II, and the Doctorate Records File.*

Demand is also reflected at the level of undergraduate programs, a source of students for the proposed Neuroscience PhD. There are 131 colleges and universities in the U.S. that award a B.Sc. degree in Neuroscience or a closely related field (<https://www.bachelorsportal.com>). This includes 6 institutions in Florida, such as FSU, FAU and FIU, developed in recent years in response to increasing student interest. FSU's undergraduate neuroscience degree program was launched in 2018, and FIU's Faculty Senate approved their new undergraduate Neuroscience program in January 2020. FAU's undergraduate Neuroscience and Behavior major, with 409 majors currently, is offered by Psychology and the numbers of students graduating in this area have been growing. In 2014-15, undergraduates completing the B.Sc. degree under this major numbered 74, with 113 degrees awarded in 2018-19. Students completing this major would be well equipped to enter a Neuroscience PhD program at FAU or another institution, and indeed a number have applied to and been accepted by our PhD programs. In the last 5 years, 5 such students were admitted to the IB-NS program, 4 to the XPSY program and 7 to CSBS. Of the 18 GNTN students currently enrolled (1 deferred enrollment until next year due to COVID-19), 7 were former FAU undergraduates or M.S./M.A. graduates in Biological Sciences or Psychology. Students graduating from the nearby Nova Southeastern University M.S. program in Experimental Psychology/Neuroscience are another likely source of local students. We did not pursue a formal survey of prospective applicants to the program as the NGP is an outgrowth of highly successful existing programs (Complex Systems free-standing degree program and tracks in Psychology and Integrative Biology) that have filled all available slots, including the current year. Rather, we have had extensive verbal conversations with the existing GNTN students that has allowed us to design a program that offers superior training opportunities as compared to the GNTN and is more like that of nationally prominent sites offering graduate neuroscience training.

Florida State University was the first in the SUS to establish a PhD program under the CIP 26.1501 code in response to increasing student demand, and currently enrolls 45 students in its young program, another indication of ample student interest. Here at FAU, a substantial number of students have applied to the IB-NS, Experimental Psychology (XPSY) and CSBS PhD programs in recent years (Table 8). In the last 5 years, a total of 344 applications were received, with 94 students admitted. In just the last three years, the new GNTN graduate program received 114 applications. Of these 56 were received from Florida residents, 32 were received from students out-of-state, and 26 were received from international applicants. Collectively, the headcount of PhD students enrolled in the CSBS, IB-NS, and Experimental Psychology PhD programs from August 2019 to December 2020, including new GNTN students, is 46, demonstrating robust student interest in graduate neuroscience training at FAU. A survey of 120 Neuroscience Departments and Programs in 2016-17, conducted by the Society for Neuroscience, reported an average enrollment head count of 38 students, with an average admission of 10 students annually<sup>7</sup>.

<sup>6</sup> NSF National Survey of Earned Doctorates, Table 13, NSF.gov.

<sup>7</sup>Report of Neuroscience Departments and Programs Survey (Academic Year 2016-17), Society for Neuroscience, McKinley Advisors, Washington, D.C.

**Table 8. Total Number of Applicants, Admittances and Currently Enrolled Students**



Department/Program	# of applicants Fall 2016- Fall 2020	Number Admitted 2016-2020	Total # in program Fall 2020-21
Department of Psychology - XPSY	193	48	10 (4 GNTF students)
Integrative Biology-Neuroscience – IB-NS	99	33	21 (8 GNTF students)
Complex Systems and Brain Sciences - CSBS	52	15	15 (6 GNTF students)
Total	344	94	46

- C. If substantially similar programs (generally at the four-digit CIP Code or 60 percent similar in core courses), either private or public exist in the state, identify the institution(s) and geographic location(s). Summarize the outcome(s) of communication with such programs with regard to the potential impact on their enrollment and opportunities for possible collaboration (instruction and research). In Appendix C, provide data that support the need for an additional program.

Table 9 provides an overview of all doctorate programs in Neuroscience and related fields in the State University System of Florida and includes the University of Miami (UM). All are delivered as on-site graduate programs. Currently, the Graduate Program in Neuroscience at Florida State University (FSU) in Tallahassee is the only SUS institution operating under the 26.1500 CIP code and is closest to our program in terms of program content. We discuss the distinctions with our program below. As there is only a single program operating under CIP 26.1500, and each program admits a limited number of students each year (8-12/Yr for the FAU program, a similar number for the FSU program) and each program receives many times this many qualified applicants, there is clear demand for a second program, regardless of distinctions. Clearly the field is brimming with significant numbers of suitable applicants for both programs.

The FAU NGP program would be distinct from the programs at the University of Florida and University of South Florida. These each offer Ph.D. degrees in Biomedical Sciences, with the option of selecting a Neuroscience concentration from among several other focus areas (Cancer, Immunology, Genetics, Molecular Cell Biology, Physiology, Pathology, Cardiovascular Biology). Four other Ph.D. programs at UF, UCF, University of South Florida (USF), and Florida International University (FIU) offer Psychology Ph.D. degrees with concentrations in Cognitive Neuroscience, Social, Behavioral, and Developmental Psychology, similar to focus areas in FAU's Psychology department and overlapping research areas in the CSBS Ph.D. program (CIP 42.2706). Recently, FIU's Psychology concentration in Cognitive Neuroscience laid the groundwork for developing a PhD in Cognitive Neuroscience (also CIP 42.2706), which was approved in November 2020. We note below that the program at FIU, besides being offered under a different CIP code, is quite distinct from ours in breadth, and in the engagement of molecular and cellular neuroscientists, many who work on animal models of human brain disorders. The proposed program has a distinct biomedical focus, and additionally integrates curriculum and research areas employing theoretical and computational approaches, including bioinformatics, bringing together computer engineers and computational biologists to address medically relevant research questions in the neurosciences.

**Table 9. Overview of Doctorate Programs in Neuroscience and related fields in the FL SUS.**

INSTITUTION	PROGRAM(S)	CONCENTRATIONS
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<b>Florida State University, Tallahassee, FL</b>  <b>(CIP 26.1501)</b>	The Graduate Program in Neuroscience PhD  Depts. of Biological Science, Psychology, and Mathematics (Arts and Sciences) and Biomedical Science (College of Medicine).	Chemical Senses, Ingestive Behavior, and Obesity  Human Neuroscience and Animal Models of Cognition  Molecular Genetics, Proteomics, and Membrane Biophysics  Neurobiology of Brain Injury and Disease  Neuroendocrinology, Social Behavior, Stress and Drug Addiction
<b>University of Florida Gainesville, FL</b>	PhD in Psychology Dept. of Psychology  PhD in Biomedical Sciences Dept. of Neuroscience College of Medicine	Behavior Analysis, Developmental Psychology, Social Psychology, Neuro-behavioral and Cognitive Sciences  Neuroscience Concentration
<b>Florida International University Miami, FL</b>	Ph.D. in Cognitive Neuroscience	Human Neuroscience Neural Foundations of Behavior, Functional Brain Imaging, Neuropsychology
<b>University of Central Florida, Orlando, FL</b>	Ph.D. in Human Factors and Cognitive Psychology Dept. of Psychology  Ph.D. in Biomedical Sciences Burnett School of Biomedical Sciences College of Medicine	Cognitive Neuroscience  No Neuroscience concentration
<b>University of South Florida, Tampa, FL</b>	Ph.D. in Integrated Biomedical Sciences College of Medicine  Ph.D. in Psychology Dept. of Psychology	Neuroscience Concentration  Cognition, Neuroscience, and Social Psychology
<b>*University of Miami, Miami, FL</b>	Ph.D. In Neuroscience Interdepartmental/intercollegiate College of Arts and Letters, and School of Medicine	Neuroscience

\* Private institution, not in the State University System of Florida

**Differences between this proposal and existing SUS programs:** FAU's proposed program differs from all of the programs above in that students will enter an intercollegiate Neuroscience PhD program managed and administered by a research Institute. The University of Florida currently offers a PhD program in Genetics and Genomics with a similar structure within the UF Genetics Institute. As with the proposed program, it incorporates multiple departments, colleges and institutes. Institute administered degree programs are used at many of the top universities that offer interdisciplinary graduate degrees in neuroscience, including UCSD, PENN, Harvard, University of Washington, University of Miami, and Texas

A&M. The completed PhD degree will be awarded in Neuroscience, regardless of the department and college in which the faculty mentor holds a primary appointment. Currently, I-BRAIN consists of 73 faculty members engaged in collaborative neuroscience research across multiple colleges, departments and institutes, affording students a wide variety of research options to choose from during their graduate training, tailored to their specific interests and goals.

**Brief information on current neuroscience-focused SUS graduate programs is provided below for comparison to the proposed PhD program:**

### ***University of Florida***

The Neuroscience concentration in the Biomedical Sciences PhD program requires completion of the Fundamentals of Biomedical Sciences Core course in the first fall semester (Cell and Molecular Biology, Genetics, and Biochemistry). Following this, a minimum of two courses from among five neuroscience Core classes are needed (Cell and Molecular Neuroscience, Organization and Development of the Nervous System, Functional Neuroanatomy, Neural Integration and Control, Neuropharmacology). Housed in the College of Medicine, this program requires completion of 90 credit hours.

### ***Florida International University***

The Department of Psychology offers a Ph.D. with a concentration in Developmental Science with courses in Developmental Psychology, Developmental Methods, and Bio-Behavioral Development, requiring completion of 75 credit hours. There is no Ph.D. in Neuroscience offered but there is a new, recently approved PhD program in Cognitive Neuroscience (CIP 42.2706). The curriculum includes Neuropsychology, Cognitive Neuroscience Neuroanatomy, Neuroimaging Methods and Quantitative Methods. Both the Developmental Science concentration and the PhD in Cognitive Neuroscience share some similar curriculum content and research focus areas with the FAU Psychology PhD program, as well as the CSBS PhD program. Indeed, some Psychology faculty at FAU actively collaborate with researchers at FIU in these areas, including Dr. Robert Vertes (FAU) and Dr. Tim Allen (FIU), leading to joint publications (*Cell Reports*, 2019, Jayachandran, et al.). Our proposed PhD program differs from the FIU Cognitive Neuroscience degree in terms of breadth. In addition to the cognitive and behavioral neurosciences, the FAU program incorporates a cellular/molecular area of emphasis, a biomedical focus aimed at uncovering and therapeutically targeting cellular mechanisms of brain disease and injury, extensive use of genetic mouse models of mood, neurodegenerative, and neurodevelopmental disorders, and a cross-disciplinary bioengineering component that marries computational neuroscience and robotics to create brain-machine interfaces. Dr. Andres Gil, Vice President for Research at FIU, has reviewed our proposal and provided a letter of support for the FAU NGP, provided in **Appendix F**.

### ***University of Central Florida***

The interdisciplinary Biomedical Science PhD in the College of Medicine requires at total of 72 credit hours for completion. There is no Neuroscience PhD program at this level, but there is a Neuroscience M.S. program offered. The Psychology Department offers a PhD with a concentration in Cognitive Neuroscience. Required Core classes include Psycho-Physiology, Neuroanatomical Basis of Psychology and Cognitive Neuroscience.

### ***University of South Florida***

The Morsani College of Medicine offers a PhD in Integrated Biomedical Sciences with a concentration in Neuroscience. There are 7 research faculty listed under the neuroscience concentration. Two Core courses in Neuroscience are required, with three additional courses recommended. The program requires 90 credit hours for completion. The USF Psychology Department offers a PhD in Cognition, Neuroscience and Social Psychology (CNS). Required courses include two of the following: Cognitive Psychology, Physiological Psychology or Social Psychology, and two courses in experimental design/statistics. Advanced Psychology is also required, and the degree requires 90 credit hours.

### ***University of Miami (included here but not part of the SUS)***

The UM Neuroscience Graduate Program is a university-wide PhD program. Faculty from 19 departments participate, located in the Colleges of Medicine, Arts and Sciences, Engineering, and The Miami Project to Cure Paralysis. The first-year curriculum includes Research Ethics, Scientific Reasoning, Statistics and Professional Development. Required courses in the spring cover Membrane Physiology and Biophysics,

Molecular, Cellular and Developmental Neuroscience. Two more Core courses are required in the second year (Systems Neuroscience and Neuroanatomy), and 67 credits hours are needed to complete the degree.

**Nova Southeastern University** (*included here but not part of the SUS*)

The Department of Psychology and Neuroscience offers the M.S. degree in Experimental Psychology. The Core curriculum includes Behavioral Neuroscience, Developmental Psychology, and Cognitive Psychology, with a minimum of 33 credit hours needed to complete the degree.

**Florida State University**

The Program in Neuroscience at FSU (CIP 26.1501) has participating faculty from the departments of Biological Sciences, Math, and Psychology in the College of Arts and Sciences, and the Biomedical Science department in the College of Medicine. There are 5 research areas identified: Chemical Senses, Ingestive Behavior and Obesity; Human Neuroscience and Animal Models of Cognition; Molecular Genetics, Proteomics, and Membrane Biophysics; Neurobiology of Brain Injury and Disease; and Neuroendocrinology, Social Behavior, Stress and Drug Addiction. Core courses include Cellular and Molecular Neuroscience, Systems and Behavioral Neuroscience, Neuroanatomy and a survey of neuroscience research techniques. Electives include Advanced Neurophysiology, Learning and Memory, and Sensory Physiology. A minimum of 54 semester credit hours are needed for degree completion, with 24 dissertation credits required.

The proposed FAU Neuroscience PhD program will use the same CIP code used by FSU. The programs are widely separated in terms of geography, each with opportunities to recruit from a large number of their own undergraduates, or more proximal feeder colleges. Comparisons of the FAU and FSU programs below highlight some of the similarities and differences:

1. Like FSU's program, the FAU program includes participation of faculty from multiple departments and colleges within a single degree program, with a fundamental Core curriculum and enough breadth in elective coursework to allow students to tailor their education to suit their primary research interests.
2. Like FSU, the FAU PhD program specifies a number of neuroscience research focus areas to aid prospective students in identifying an area that best aligns with their primary interests. Faculty associated with that area will be listed, along with details of their research programs, in the program handbook and on the program website, allowing students to contact potential mentors for more information, and identify faculty of interest in their applications.

**Distinctions:**

1. The FAU program includes participation of faculty from a larger number of departments and Colleges, with administrative management of recruitment and admissions, tracking of student progress, and program oversight provided by an Institute representing all of these entities, I-BRAIN. I-BRAIN faculty members teach and conduct research in the Colleges of Science, Medicine, Engineering, Nursing, and Arts and Letters, and affiliate faculty at Max Planck Florida and Scripps Florida are included as program faculty. This adds significant breadth to the program, incorporating unique areas of training beyond the traditional neuroscience focus areas within biology and psychology, including biosensory engineering and medical bionics, biosignal processing, crystallographic analysis of membrane proteins, cognitive robotics, machine learning and artificial intelligence, and bioinformatics. Each institution can be expected to touch on most or all of these subjects to more or lesser degree in distinct ways and depth which applicants explore in deciding ultimately where to pursue training.
2. Two world class research institutes, Max Planck Florida and Scripps Florida, are uniquely part of the FAU GNTF. Researchers at Max Planck Florida, and in the Department of Neuroscience at Scripps Florida, hold affiliate faculty appointments at FAU and already serve as FAU graduate faculty mentors in the IB-N and GNTF programs. As affiliates in the new program, they will continue to mentor and train FAU Neuroscience PhD students in top research labs, with access to some of the best scientific Core facilities in the state. In just the past three years, four of our GNTF students have joined laboratories at Max Planck Florida to pursue their PhD training. These Institutes also provide exposure of our students with the curricula and research of Scripps Research La Jolla and Max Planck Institutes in Germany, another unique offering.
3. As a requirement for acceptance, students applying to the FSU program are matched to a faculty sponsor based on their research interests prior to enrollment. Students thus do not pursue rotations to select a mentor. However, accepted students are asked to gain research experience in 2 laboratories outside their

home lab, an activity that may be accomplished at any time. Although students may change mentors, a student's first sponsor is typically the mentor for dissertation work. The proposed FAU program does not require students to identify a primary faculty sponsor prior to admission, though applicants are encouraged to name 3-5 faculty of interest when they apply. The three laboratory rotations in year 1 serve the purpose of allowing students to find their best match in terms of mentor and research area. Accepted students do reach out to faculty to arrange their first rotation prior to matriculating, and later select where they will perform their second and third rotations after learning more about the different research areas being pursued by program faculty. In the last 3 years, we have had 4 students in the GNTP program who, at the time of application, expected to eventually do their dissertation work in a particular FAU laboratory and program, only to change direction at the end of their first year and select a different laboratory, and in some cases a different final PhD program. This pattern confirms for us that some new students find the best match to their research interests after gaining experience during their laboratory rotations.

While matching up front to a given laboratory during the application process allows a program to ensure adequate financial support is available for the student to train in that environment, the Recruitment Committee of our proposed program will similarly take available financial support for faculty in Areas of Emphasis into consideration when selecting students for interviews and position offers. Funding for any student admitted is guaranteed by resources committed by I-BRAIN or College of Science in the form of Graduate Teaching Assistantships (GTAs), or by faculty grants or student fellowships that fund Graduate Research Assistantships. Faculty members accepting students are expected to have a pattern of long-term funding that will allow for support of student research projects. Also considered is the distribution of new students in terms of Areas of Emphasis, and in terms of faculty representation in these areas. To ensure fair and broad access to trainees in the NGP, faculty are limited to mentoring no more than two program students in their laboratories at the same time. Dr. Lisa Eckel, Director of the FSU program has reviewed the proposed FAU NGP and has provided a letter of support for our application in **Appendix G**.

- D. Use Table 1 - Appendix A (1-A for undergraduate and 1-B for graduate) to categorize projected student headcount (HC) and Full Time Equivalents (FTE) according to primary sources. Generally undergraduate FTE will be calculated as 30 credit hours per year and graduate FTE will be calculated as 24 credit hours per year. Describe the rationale underlying enrollment projections. If students within the institution are expected to change majors to enroll in the proposed program at its inception, describe the shifts from disciplines that will likely occur.**

We propose to recruit 8 PhD students in Yrs 1 and 2, 10 students in Yrs 3 and 4, and 12 students in Yr 5. We will recruit full-time students only, thus the headcount and FTE will be identical. Our enrollment predictions are based on several factors. First, the growth of our program parallels the expected growth of the research enterprise at FAU, generally, and of I-BRAIN, in particular. Over the past 5 years, research expenditures at FAU grew from \$29.6M in FY2015 to \$67.2M in FY20 (Figure 3). This growth in funded research has been paralleled by an increase in grant applications and in faculty recruitment, providing the essential critical mass needed to provide for state-of-the-art training such as we propose with the NGP. With respect to I-BRAIN, 9 tenured faculty have been recruited since 2017 and these faculty accounted for \$12M in sponsored grant awards in FY20, up from 9.3M in FY19. An additional 8 faculty that will be part of the NGP have been recruited through other mechanisms, making similar contributions to institutional research funding.

**Figure 3: Growth in Research Expenditures at FAU (FY15-FY20)**

Second, in 2015, FAU's President John Kelly announced Neuroscience as one of four "Pillars" of investment



to build FAU research and education over the next decade, leading to the hiring of Dr. Randy D. Blakely in 2016 as inaugural Executive Director of I-BRAIN. As part of Dr. Blakely's recruitment, funds were set aside to invest in neuroscience graduate education

under his leadership, with the belief that recruitment and training of more top students would be required to recruit talented faculty and thereby accelerate growth in FAU neuroscience research. With these resources, Dr. Blakely launched the GNTP which is now in its third year (see Section VI: C below for process leading to the GNTP and then to the NGP proposal).

We expect that we will easily fill the expanded number of slots we can provide as we did in the first three years of the GNTP. We filled all available slots each year (6), and applications that met admittance standards rose from 31 in 2018 to 42 for the 2020 class, exceeding available slots by 6.3-fold. We expect to see even higher application numbers in moving from a gateway program to the provision of a free-standing, multi-college Neuroscience PhD, a degree recognized by most applicants as the "coin of the realm" for those training for neuroscience careers, much like the M.D. is for a clinical career or a J.D. is for a legal career. A national pipeline to stock this program is well developed. Most top tier U.S. universities offer an undergraduate neuroscience major, with 118 colleges offering majors in "neuroscience" or "neural science" in the U.S. as of 2017 (Pinard-Welyczko et al, 2017). The growth in undergraduate neuroscience programs, often among a university's most popular interdisciplinary major, initiated the formation in 1991 of a national society (Faculty for Undergraduate Neuroscience (FUN <https://www.funfaculty.org>) that publicizes graduate training opportunities, provides professional workshops for faculty, as well as travel awards and internship opportunities for students.

We do not expect that implementation of the NGP will diminish the number of applicants to the XPSY or IB programs (or the IB Concentration IB-NS). First, students may apply to the NGP and the XPSY and IB programs in parallel, with the Directors of these programs discussing their applicant pools to determine overlap and whether to separately consider applicants that overlap or to forego NGP interview based on the trainee's stated interests and credentials (e.g. desiring a Direct Admission, oriented toward an area that the program doesn't represent, or appearing less competitive within the pool). Second, the XPSY and IB/IB-NS programs utilize a Direct Admission approach for recruitment which by its very nature captures applicants that are already committed to a specific mentor and line of research than would be appropriate for the broader, rotation-structured NGP. Last, the core course structure is different, and the faculty base is larger when comparing the NGP with XPSY and IB/IB-NS, and as such presents different training opportunities that will attract different populations of students. Since faculty do overlap between these programs, students will be able to apply and potentially be accepted for admission to more than one. The Directors of these three programs will review the applicant pool and determine whether independent interviews are warranted. If a student is accepted to both the NGP and one of the other programs, it will be the student's choice as to which program offer to accept. Moving forward, the Directors of these programs will review statistics on dual applications and acceptances, as well as final student program choices to determine whether the programs are adequately advertising their different structures, faculty, and curricula.

- E. Indicate what steps will be taken to achieve a diverse student body in this program. If the proposed program substantially duplicates a program at FAMU or FIU, provide, (in consultation with the affected university), an analysis of how the program might have an impact upon that university's ability to attract students of races different from that which is predominant on their campus in the subject program. The university's Equal Opportunity Officer shall review this section of the proposal and then sign and date Appendix B to indicate that the analysis required by this subsection has been completed.

FAU serves students in southeastern Florida, an area with high ethnic diversity which is reflected in our enrollment statistics. Hispanic American students currently make up 25.8% of the student population, with African American students comprising 19.6%. In 2017, FAU received designation as a Hispanic Serving Institution by the US Department of Education. In 2018, FAU was listed as one of the nation's most ethnically diverse universities by US News and World Report, scoring a diversity index rating of 0.69 (out of 1.0), ranking it 31<sup>st</sup> out of the top 50 ethnically diverse schools in the nation. Currently FAU has 45.6% minority enrollment, and 41.6% Caucasian enrollment. Females make up 57% of all enrollment and males 43%.

Many FAU students from underrepresented minorities earn their B.Sc. or M.S. degrees in majors that would prepare them to enter a Ph.D., M.D., or D.D.S program, and through campus-wide advertising the GNTP has worked to attract some of these local students. In academic year 2019-20, 198 minority students completed their undergraduate degree in Biological Sciences, with 59 minority students graduating from the Psychobiology-Neuroscience and Behavior undergraduate program. Nineteen minority students completed their M.S. degree in Biomedical Science, Biological Science, or Psychology. In the last 3 years, 5 of 19 students admitted to the GNTP Ph.D. program were Hispanic or African American, and 3 of these were former FAU undergraduates. Current headcounts show that of the 21 Ph.D. students enrolled in the IB-NS program, 5 are minority students. There are 2 minority students out of 15 total trainees in the CSBS program. There are 4 minority students out of 34 total students presently enrolled in the XPSY Ph.D. program.

Undergraduate students at FAU are aware of our GNTP program through the annual on-campus Graduate and Professional Student fair, and widespread publicizing of neuroscience seminars through emails, class announcements and posted flyers. Additionally, special events are held on the Boca Raton and Jupiter campuses throughout Brain Awareness month each March, and program brochures are provided to all that visit the I-BRAIN Educational Office. We strive to increase our visibility to non-local minority applicants through recruitment at the Graduate Fair held at annual national meeting of the Society for Neuroscience. The GNTP maintains a list of institutions across the US that offer an undergraduate major in the neuroscience, and brochures with GNTP program information are sent to these annually to target all types of non-local students, prior to our application site opening each fall. This includes schools that are Hispanic Serving Institutions like FAU (including FAMU and FIU), and Historically Black Colleges and Universities, including Spelman College, which has a BS/MS program in neuroscience with Morehouse School of Medicine. A similar mailing system is used to target students that have indicated an interest in Neuroscience when registering for the Graduate Record Examination.

To further ensure that maximum opportunities are taken to ensure the application, recruitment and success of trainees from underrepresented groups, a subcommittee of the Steering Committee will be formed that is focused on Diversity Opportunities. The members of the subcommittee will report on ongoing and potential changes to NGP practices to optimize program diversity. Actions recommended by the subcommittee will be voted on by the full committee for implementation.

#### **How would our program affect FIU's or FAMU's ability to attract more students that differ from their predominate ethnic groups?**

Our neighboring university to the south, FIU, also is designated as a Hispanic Serving Institution, with 64% Hispanic American enrollment, 12% African American enrollment, and 12% Caucasian enrollment (2018 data). FIU does not offer a competing Ph.D. program in Neuroscience, and we anticipate that establishment of our new program will have no direct effect on their ongoing ability to attract prospective students of all races and ethnic groups to their existing Psychology PhD concentration in Human Developmental Psychology/Social Science, or their new PhD in Cognitive Neuroscience. These programs are similar to the existing focus areas in FAU's Psychology Ph.D. program (Cognitive Neuroscience, Developmental Psychology, Social/Personality Psychology, Behavioral Neuroscience). FAMU has no graduate programs in Neuroscience, and our proposed program would have no impact on their currently established Ph.D. programs. At any rate, neither school raised objection to the diversity issue when the pre-proposal was presented at the CAVP Academic Curriculum Program Group.

### **III. Budget**

#### **A. Use Table 3 - Appendix A to display projected costs and associated funding sources for**



**Year 1 and Year 5 of program operation. Use Table 4 - Appendix A to show how existing Education & General funds will be shifted to support the new program in Year 1. In narrative form, summarize the contents of both tables, identifying the source of both current and new resources to be devoted to the proposed program. (Data for Year 1 and Year 5 reflect snapshots in time rather than cumulative costs.)**

Education and General funds (E&G) will be reallocated from the participating programs to fully support the effort of faculty governance, teaching and mentoring in the new program throughout the 5 years projected in the tables associated with Appendix A. These funds, along with anticipated Contracts & Grants are discussed below.

**Faculty Salaries and Benefits:** In Table 4, we note reallocated support for faculty to provide for service on Program Committees (Steering, Recruitment Curriculum), teaching of Core and Elective Course, and the mentoring of trainees. Here our costs are divided by the Colleges participating in the program, with amounts varying in proportion to the number of faculty expected to contribute to these activities. We estimate costs using the following distributions and considerations:

- 1) **Faculty serving on governing committees utilize 1% reallocated effort support/committee**
- 2) **Faculty teaching Core courses utilize 12.5% reallocated effort/course**
- 3) **Faculty teaching Elective courses utilize 6.25% reallocated effort/course**
- 4) **Faculty mentoring students for PhD research utilize 3.75% of reallocated effort**

Costs for teaching represent reallocated effort as all of the courses utilized for the program already in existence and can accommodate the increase in students associated with the program. The effort support for student teaching, mentoring and committee activities are already covered by salary provided as part of departmental or I-BRAIN service (some faculty are co-hired between a department and I-BRAIN, with service activity supported by both units). In Yr 1, these activities summed across Colleges equals \$139,946. At Yr 5, with the increase of student numbers from 8 to 48, costs associated with student mentoring and faculty teaching increases. **This results in a growth in costs associated with faculty salary and benefits to a total equal to \$576, 862 in the 5<sup>th</sup> year of the program. As in year 1, these added instructional costs will come from reallocations within the participating colleges.**

**Administrative and Professional Salaries and Benefits:** To oversee the activities of program advertising, the generation and distribution of advertising materials, the publicity of the program through social media and websites, the hotel, flights and itineraries associated with student recruitment visits, the visits of seminar speakers, and administrative support to the 3 program committees, we budget (reallocate) the full-time effort a fulltime Education Administrative Assistant, with annual salary and benefits totaling \$66,738. The Assistant is presently on staff at I-BRAIN, overseeing the Graduate Neuroscience Training Program (GNTP) which will cease with the establishment of the NGP. No additional A&P funds are requested. There will be no A&P change by Year 5.

**Assistantships and Fellowships:** Students in the program are supported through Graduate Teaching Assistantships (GTAs) with E&G funds for Year 1, and through both GTA stipends and Graduate Research Assistantships (GRAs) funded by Contracts and Grants (C&G) by Year 5. Stipends are set at an annual amount of \$30,000 for each trainee. **For Yr 1, this stipend for 8 students is \$240,000 of reallocated E&G funds for GTAs. At year 5, with 48 total students in the program, the total costs for Assistantships and Fellowships amounts to \$1,440,00. This total includes the \$240,000 of Yr 1 stipends, an additional reallocated E&G commitment from participating units of \$809,550, and a contribution from Contract and Grant Awards that total \$390,450 [240,000+809,550+390,450=1,440,000]**

**Program Expenses:** The currently allocated expense costs associated with advertising and recruitment for the GNTP currently total \$20,000 (funded by I-BRAIN). With the initiation of the NGP, the GNTP will cease operation, with these funds reallocated to the NGP in Yr 1. As there are economies of scale for Expenses, we believe we do not need to increase the amount of annual Expenses and as such they remain budgeted at \$20,000 in Year 5.

- B. Please explain whether the university intends to operate the program through continuing education, seek approval for market tuition rate, or establish a differentiated graduate-level tuition. Provide a rationale for doing so and a timeline for seeking Board of Governors'**

**approval, if appropriate. Please include the expected rate of tuition that the university plans to charge for this program and use this amount when calculating cost entries in Table 3.**

This program will be operated as a regular E&G funded program and will not be seeking self-supporting or market rate approval. Current E&G FAU graduate tuition rates will apply (\$371.82/credit hour for Florida residents and \$1026.81 for non-residents).

- C. If other programs will be impacted by a reallocation of resources for the proposed program, identify the impacted programs and provide a justification for reallocating resources. Specifically address the potential negative impacts that implementation of the proposed program will have on related undergraduate programs (i.e., shift in faculty effort, reallocation of instructional resources, reduced enrollment rates, greater use of adjunct faculty and teaching assistants). Explain what steps will be taken to mitigate any such impacts. Also, discuss the potential positive impacts that the proposed program might have on related undergraduate programs (i.e., increased undergraduate research opportunities, improved quality of instruction associated with cutting-edge research, improved labs and library resources).**

### **Potential Negative Impact**

With the creation of the NGP, the I-BRAIN GNTF program will cease, with all allocated resources used for advertising, recruitment and program management reallocated to serve the new program. Two of the three PhD programs that currently receive students from the GNTF, XPSY and IB, will continue to recruit students directly as is currently being done, with no alterations required in their curricular programming. However, the faculty of the CSBS PhD, after reviewing the governance and curricular structure of the Neuroscience PhD program, and the increased financial investments being made in the recruitment and training of students aligned with theoretical and computational neuroscience, have voted unanimously to join forces to build a more broadly impactful NGP, ceasing admission of new Complex Systems and Brain Science Ph.D. students at the time of merger (letter provided in **Appendix G**) CSBS students presently in training at the time of the merger will continue in a “teach-out” plan so that they will graduate with the degree for which they were originally admitted, following its guidelines for graduation. The cessation of the GNTF could reduce the number of degrees awarded by XPSY and IB since GNTF students previously tracked to these degree programs. Since GTA support for these programs will be minimally impacted (see below), and departments can secure new GTAs as a consequence of the awarding of I-BRAIN sponsored stipends, the departments sponsoring XPSY and IB programs should have equivalent, if not increased GTAs with which to recruit students as they do presently. As the existing XPSY and IB faculty with neuroscience research programs will be training faculty members of the NGP, the presence of the new program will increase the number of paths through which to recruit graduate students. Overall, the NGP has the potential to attract a cohort of students who currently either do not explore FAU, or who decide against training in our programs because they wish to obtain a Neuroscience PhD such as offered at most top universities across the country today.

There are no perceived negative impacts on undergraduate programs related to the Neuroscience PhD. Indeed, as FAU provides a Neuroscience and Behavior major co-directed by the Departments of Psychology and Biological Sciences, the presence of a Neuroscience PhD on campus will likely encourage the best of the undergraduate majors to apply to our program and remain in state versus leaving for a Neuroscience PhD out of state.

The commitment of funds to establish the NGP will not impact resources available to XPSY or IB programs or faculty. Students in XPSY and IB are supported either by College of Science funded GTAs, by GRAs provided by the mentor or by individual fellowships. NGP funding will not diminish the support from GRAs. With respect to GTAs, the NGP draws support for half of its GTAs from funds that are independent of funding supporting XPSY and IB. Specifically, as noted in **Appendix F**, of the 8 trainees noted in Yr 1 of the program, 4 GTAs/Yr are committed exclusively to the NGP by the Division of Research through I-BRAIN. Second, with the merger of the CSBS program into the NGP, 2-3 GTAs/Yr of the pool from the College of Science will be reallocated from CSBS to the NGP. This leaves 1-2 GTAs/Yr needed to support the NGP from the College of Science. We believe that with the growth of the neuroscience research enterprise at FAU, it is reasonable to expect that faculty will increasingly assume support for trainees on grants. In our proposal, we budget

conservatively for a modest (less than 25%) substitution of GTAs by GRAs generated by faculty grants, student fellowships or other Institute funds (11 out of 48 at year 5). Thus, it is highly likely that the commitment of GTAs by the College of Science to the NGP, with continued growth of FAU neuroscience research programs, and the support for GTAs provided by I-BRAIN, will continue to be a small number beyond those originally committed to CSBS.

Based on the demand generated by anticipated growth of neuroscience research at FAU, we propose an increase in the size of the NGP from 8 students in Yr 1 to 12 in Yr 5 (**Appendix A**), reaching a steady-state number of 48 trainees at this time. The predicted growth will be annually evaluated based on the demonstrated success of faculty in supporting students on grants, the success of students in securing individual fellowships, or the availability of additional sources of revenue to support graduate training (e.g. philanthropy). The specific number of GTAs committed to support the NGP by either the College of Science or I-BRAIN is determined prior to NGP recruitment each year on the basis of faculty need, commitments made of funds to other units, and available resources. This annual recalibration allows for adjustments to be made in funding by the College of Science if resources must be shifted to accommodate shortages elsewhere, or if more students than expected are being supported by non-E&G funds. Thus, an increase in GTA commitment is not projected nor should program growth impact resources needed to support the XPSY and IB programs. Importantly, the need for GTA support is predicated on the assumption that federal training grants or philanthropy are unavailable to support NGP trainees. We believe that with the creation of the NGP, the continued investment in research infrastructure that attracts top trainees, and a continued recruitment of funded, research-intensive faculty, FAU will be optimally situated to draw additional support from both training grants and philanthropy.

GTA support provided by the College of Science is used both to provide stipends for graduate training and to cover teaching support needed for undergraduate classes. To ensure that the assignment of GTAs to support the NGP does not negatively impact the teaching missions of College of Science departments, students receiving College of Science-supported GTAs will be assigned to undergraduate courses organized by departments within the College (e.g. Psychology and Biological Sciences). Should another College wish to contribute GTAs to the NGP, a similar assignment of teaching responsibilities back to that College will occur. For the 4 GTAs provided by I-BRAIN, teaching will be carried out in the College/department of the mentor.

### **Potential Positive Impact**

Currently, the College of Science reserves 6 GTAs/Yr for use by the trainees of the GNTP, whose teaching assignments are linked to the undergraduate teaching missions of the Departments of Biological Sciences and Psychology. With the initiation of the Neuroscience PhD, the College of Science contribution will be reduced to 4 GTAs, matched by an equal number of GTAs/Yr funded by I-BRAIN, *in toto* supporting the 8 students entering the program in Yr 1. The reduced commitment of GTAs by the College of Science will allow the freed up GTAs to be re-designated to support departmental PhD programs. The 4 GTAs provided the College of Science to support the Neuroscience PhD will also continue to be used to support the teaching missions of the Departments of Biological Sciences and Psychology. These students, however, will not receive a PhD degree in one of these two departmental PhD programs as they did in the past. This potential negative impact on graduate degrees offered by the departments may be offset if NGP students apply their Neuroscience PhD coursework toward a Master's Degree in the departmental programs. Moreover, the 4 students supported by the new GTAs provided by I-BRAIN will be assigned to teach in the home department of their mentor. Should these students train with Psychology or Biological Sciences faculty, these departments will reap additional GTAs that they did not previously have access to that year. Since the ultimate destination of the GTAs for the NGP students is based on the attractiveness of individual laboratories, a secondary benefit to the departments will be an encouragement to faculty and departments to sustain a competitive research environment that can secure the desired trainees.

Finally, it is important to note that the ability to recruit students through multiple graduate programs is an advantage for faculty members and trainees as this often brings students with complementary interests and educational backgrounds into some of the same laboratories, building graduate student teams that can cooperate and share their individual talents and research skills. Additionally, each program may have different sources of funds to draw from (e.g. training grants, targeted fellowships), which can allow faculty members to have multiple, funded students in their labs. This is particularly important for faculty who train for the NGP as a limit of 2 students from this program

at any one time will be imposed.

**D. Describe other potential impacts on related programs or departments (e.g., increased need for general education or common prerequisite courses, or increased need for required or elective courses outside of the proposed major).**

There is no anticipated need for our admitted graduate students to take prerequisite courses taught by other programs, or elective courses beyond those already described in the proposed curriculum.

**E. Describe what steps have been taken to obtain information regarding resources (financial and in-kind) available outside the institution (businesses, industrial organizations, governmental entities, etc.). Describe the external resources that appear to be available to support the proposed program.**

There are no specific financial resources available from outside the institution at this time that directly offset costs to support the program, though significant external resources that have been sought and obtained that will enrich the experiences and training of NGP students. Indeed, the FAU Division of Institutional Advancement has committed significant internal resources, including a dedicated Advancement officer, to pursue philanthropy on behalf of the I-BRAIN missions, with one area of focus being support for the training of graduate students. The gift we sought and received to initiate the ASCEND program within I-BRAIN was structured to provide stipend enhancement for graduate students and postdoctoral fellows who commit effort each month by providing educational programs to middle schoolers, including those at Title I schools, and to community learning enrichment centers that target the disadvantaged (e.g. the Edna Runner Center in Jupiter). Such efforts are a win-win event for the growth of community awareness of STEM careers, the FAU academic mission to train the next generation of brain scientists, and the Brain Institute's commitment to meaningful engagement in community education. In another example, in 2016, I-BRAIN sought and was awarded designation as a Nikon Center of Excellence, a designation accorded to only 17 institutions in the U.S., and 15 institutions in Europe, with luminary sites such as the Karolinska Institute, Kings College of London, Harvard and Columbia University among them. This designation has brought over \$1M in high technology benefits to FAU, including free service, price reductions on instrumentation, and outstanding training support for Center installations on the Jupiter and Boca Raton campuses (see [https://www.microscope.healthcare.nikon.com/en\\_EU/imaging-centers](https://www.microscope.healthcare.nikon.com/en_EU/imaging-centers)).

## **IV. Projected Benefit of the Program to the University, Local Community, and State**

**Use information from Tables 1 and 3 - Appendix A, and the supporting narrative for “Need and Demand” to prepare a concise statement that describes the projected benefit to the university, local community, and the state if the program is implemented. The projected benefits can be both quantitative and qualitative in nature, but there needs to be a clear distinction made between the two in the narrative.**

Quantitatively, the NGP will help drive a knowledge economy in terms of the federal and foundation dollars brought to the state to support the costs of research (>\$12M by I-BRAIN recruits in 2020), and the employment of local citizens in high-paying jobs in these funded research programs. Without the ongoing talent pool represented by high quality graduate students, external faculty at R1 universities will not relocate. With this student workforce, our faculty recruitment can accelerate, along with the transfer of significant federal dollars to support this. As an example, when Dr. Randy Blakely moved from Vanderbilt to FAU, he relocated approximately \$1M/annually in direct costs, funds that were spent to support graduate students, staff and postdoctoral fellows, and pay local businesses that provided materials and maintenance services for an active laboratory. When one standard (R01) grant transfers with a faculty recruit, \$250,000/Yr transfers, along with more than \$125,000 in indirect costs awarded to the institution. All of the faculty recruited by I-BRAIN since its initiation have transferred grants or been awarded grants at the time of transfer. In recognition of the benefits of this growth in life sciences research, the state of Florida awarded

\$33M to FAU for the construction of a new research building in Jupiter which will house I-BRAIN in early 2022 and provide additional research space for recruiting faculty. Filling these new laboratories means increased demand for high quality trainees, as offered through the NGP. Moreover, by the 5<sup>th</sup> year of the program, we will have a student population of 48, linked together in the common pursuit of a Neuroscience PhD, a degree providing a valuable credential for employment in academia, in industry, or in the private sector. The NGP will directly increase the number of advanced STEM degrees awarded in the state, an important goal specified in the SUS and FAU Strategic Plans. STEM professions we have noted in this application pay significantly more than the mean of most other occupations, and our graduates will be qualified to meet the projected state job growth in this area. Qualitatively, our program will benefit the university in the creation of an expanding, multi-college, multi-institute Neuroscience graduate program, one that will further Florida's national reputation in research and education. An additional qualitative benefit is the progress that program participants will make in acquiring new knowledge about brain function and neurological disorders that can lead to translational breakthroughs. Neurological disorders take a toll annually on a large number of Florida residents, as in other states, and a translationally-oriented graduate program can offer hope to our citizens that new treatments are on the horizon.

Qualitatively, our program will benefit the university in the creation of an expanding, multi-college, Neuroscience graduate program, one that will attract high quality research talent to FAU, furthering Florida's national reputation as a top state for brain research. An additional qualitative benefit is the progress that program participants will make in acquiring new knowledge about brain disorders that can lead to translational breakthroughs. Neurological disorders take a toll annually on a large number of Florida residents, as in other states, and a translationally-oriented graduate program can offer real hope to our citizens that new treatments are on the horizon.

I-BRAIN has already raised over \$2M in philanthropy in its short existence, in no small part because of its engagement with the local community served. Nearly \$2.5 million in philanthropy was raised by the South Florida Science Center and Aquarium with I-BRAIN partnership for construction of the **Journey Through the Human Brain** exhibit which after its opening in March of 2019, has now been seen by more than 300,000 youths and adults, a quantitative testament to the community benefit of our activities. The qualitative impact of having young people engage directly with science through the SFSC exhibits, while interacting with our trainees in a way that allows them to envision themselves as future scientists, is immeasurable.

## V. Access and Articulation – Bachelor's Degrees Only

- A. If the total number of credit hours to earn a degree exceeds 120, provide a justification for an exception to the policy of a 120 maximum and submit a separate request to the Board of Governors for an exception along with notification of the program's approval. (See criteria in Board of Governors Regulation 6C-8.014)

The NGP is a doctoral level program and thus this item is not applicable.

- B. List program prerequisites and provide assurance that they are the same as the approved common prerequisites for other such degree programs within the SUS (see link to the Common Prerequisite Manual on [the resource page for new program proposal](#)). The courses in the Common Prerequisite Counseling Manual are intended to be those that are required of both native and transfer students prior to entrance to the major program, not simply lower-level courses that are required prior to graduation. The common prerequisites and substitute courses are mandatory for all institution programs listed, and must be approved by the Articulation Coordinating Committee (ACC). This requirement includes those programs designated as "limited access."

If the proposed prerequisites are not listed in the Manual, provide a rationale for a request for exception to the policy of common prerequisites. NOTE: Typically, all lower-division courses required for admission into the major will be considered prerequisites. The curriculum can require lower-division courses that are not prerequisites for admission into the major, as long as those courses are built into the curriculum for the upper-level 60 credit hours. If there are already common prerequisites for other degree programs with the same

proposed CIP, every effort must be made to utilize the previously approved prerequisites instead of recommending an additional “track” of prerequisites for that CIP. Additional tracks may not be approved by the ACC, thereby holding up the full approval of the degree program. Programs will not be entered into the State University System Inventory until any exceptions to the approved common prerequisites are approved by the ACC.

The NGP is a doctoral level program and thus this item is not applicable.

- C. If the university intends to seek formal Limited Access status for the proposed program, provide a rationale that includes an analysis of diversity issues with respect to such a designation. Explain how the university will ensure that Florida College System transfer students are not disadvantaged by the Limited Access status. NOTE: The policy and criteria for Limited Access are identified in Board of Governors Regulation 6C-8.013. Submit the Limited Access Program Request form along with this document.

The NGP is a doctoral level program and thus this item is not applicable.

- D. If the proposed program is an AS-to-BS capstone, ensure that it adheres to the guidelines approved by the Articulation Coordinating Committee for such programs, as set forth in Rule 6A-10.024 (see link to the Statewide Articulation Manual on [the resource page for new program proposal](#)). List the prerequisites, if any, including the specific AS degrees which may transfer into the program.

The NGP is a doctoral level program and thus this item is not applicable.

## Institutional Readiness

### VI. Related Institutional Mission and Strength

- A. Describe how the goals of the proposed program relate to the institutional mission statement as contained in the SUS Strategic Plan and the University Strategic Plan (see link to the SUS Strategic Plan on [the resource page for new program proposal](#)).

Florida Atlantic University is a multi-campus research university that pursues excellence in its missions of research, scholarship, creative activity, teaching, and active engagement with its communities. FAU aspires to be recognized as a university known for excellent and accessible undergraduate and graduate programs, distinguished for the quality of its programs across multiple campuses, and classified as a very high research institution that is internationally acclaimed for its contributions to creativity and research.

The goals of the proposed PhD program are related to the FAU Institutional Mission Statement above, as contained in FAU's Strategic Plan for 2025. This plan created the Pillars as part of the Race to Excellence. The Pillars were established to heighten the University's national prominence and reputation in education, research and public outreach. The goals of the proposed doctoral program directly relate to the institutional missions of pursuing excellence across these areas, as well as to the stated missions of the Neuroscience Pillar, which are to:

- Stimulate advanced neuroscience research
- Promote superior neuroscience education
- Facilitate the translation of research discoveries for the benefit of society
- Enhance the public understanding of the many dimensions of brain research and its benefits

A comparison of the SUS Strategic Plan Goals and FAU's Strategic Plan Goals for 2025 highlight their alignment in the areas of Excellence, Productivity and Strategic Priorities for a Knowledge Economy. FAU's goals are directly related to its stated mission.

#### Table 10. The Florida BOG Strategic Plan for 2025: Areas of Emphasis



Goals	Excellence	Productivity	Strategic Priorities for a Knowledge Economy
<b>Teaching and Learning</b>	Strengthen the Quality and Reputation of Academic Programs and Universities	Increase Degree Productivity and Program Efficiency	Increase the number of Degrees Awarded within Programs of Strategic Emphasis
<b>Scholarship, Research and Innovation</b>	Strengthen the Quality and Reputation of Scholarship, Research and Innovation	Increase Research Activity and Attract More External Funding	Increase Commercialization Activity
<b>Community and Business Engagement</b>	Strengthen the Quality and Reputation of Commitment to Community and Business Engagement	Increase Community and Business Engagement	Increase Community and Business Workforce

**Table 11. The Florida Atlantic University Strategic Plan for 2025: Areas of Emphasis**

Goals	Excellence	Productivity	Strategic Priorities for a Knowledge Economy
<b><u>Boldness</u></b> A uniquely competitive and globalized student body	Recruit and retain nationally competitive students and become a national model for student body diversity	Develop an academic structure for timely student graduation	Increase enrollment in BOG areas of strategic emphasis
<b><u>Synergy</u></b> Prominent teams of Researchers and Scholars	Recruit and retain outstanding students and faculty	Invest in focused Pillars and Platforms to enhance interdisciplinary teams and grow the research enterprise	Develop a capacity to promote economic development
<b><u>Place</u></b> Deep Engagement with South Florida's Global Communities	Institutionalize a culture of collaborative and experiential engagement with community partners	Create and maintain an infrastructure that will encourage and support faculty, staff, and student engagement with the community	Support workforce and economic development in FAU's regional and global communities

**PhD Program Goals: Support the FAU Missions of Excellence in Education, Research, Teaching, Scholarship and Community Engagement**

**Excellence**

By establishing a new PhD program in Neuroscience that combines the educational resources of multiple colleges and institutes, a structure similar to many of the top neuroscience programs in the country, FAU will improve its ability to compete with such programs to recruit the best qualified applicants. The flexible, cross-disciplinary nature of the academic program and the scope of research areas to explore should capture applicants with a wide range of interests in the discipline. The array of core research facilities at FAU, Max Planck Florida and Scripps Florida provide student access to the most modern technical approaches to research, including high resolution imaging, mass spectrometry, high-throughput drug



screening, sequencing, genomics and proteomics. Additionally, the increased amount of stipend provided by I-BRAIN will put FAU on par with many other universities in terms of financial support, an important consideration for applicants that might otherwise choose a different graduate program. Our current GNTP recruitment mechanisms have resulted in 114 applicants over the last 3 years, with 32 received from students out-of-state, and 26 from international applicants, demonstrating that our methods are successfully reaching beyond Florida to attract a broad pool of diverse students. Of the 19 GNTP PhD students currently enrolled, ~25% are from under-represented minorities and we aim to increase their numbers going forward through strategic advertising for the new program.

The interactions of faculty and students addressing diverse, but complementary, research questions under the umbrella of the Neuroscience Pillar will promote active, experiential learning, and the exchange of ideas, experimental models and technical expertise needed to foster a culture of collaborative enquiry. Collaborative research of this type is favored by funding agencies and will increase faculty success in obtaining external funding, enhancing the standing of FAU as a high research institution. Additionally, it will provide a more attractive environment for the recruitment of outstanding new faculty that can join interdisciplinary research teams and develop multi-investigator projects with colleagues across the university.

### **Productivity**

Investment in the Neuroscience Pillar is aimed at building on current strengths in neuroscience, developing productive, interactive research programs, and expanding the local research infrastructure. Expanding research opportunities for graduate students and postdoctoral research fellows is an integral part of the plan, designed to attract the most talented of these valuable trainees who, by investing their efforts in laboratory work, paper publications, and grant writing, will measurably grow the FAU research enterprise in a focus area of STEM. The building of interdisciplinary research teams will provide opportunities for students to train with more senior members of multiple laboratories and thereby acquire a wider set of experimental skills to advance the progress of their own research projects.

An important feature of the NGP is the financial support guaranteed by I-BRAIN for up to five years for each student supported. The proposed timetable for degree completion sets advancement to the end of year 2, with the expectation that dissertation work will be completed by the end of year 5. The stipend support provided in the Fall and Spring semesters of Yr 1 substitutes for paid teaching assistantships (GTAs) that fund students in later semesters, allowing them to devote more time to gaining research experiences and identifying a focus area and mentor for dissertation studies, via their laboratory rotations. These provide students with the opportunity to make a well-informed decision regarding the research area that best matches their interests and aptitudes before committing to a particular laboratory. This system, widely used by top neuroscience research programs around the country, fosters retention in the program by allowing this self-directed selection process, whereas students that take a direct admission path may later find that the lab is not a good fit in terms of mentor style, communication, or experimental focus. This can lead to students switching labs at much later dates, which slows their progress, or may result in students leaving the program. The structure of the proposed curriculum and projected schedule for advancement and thesis defense will also encourage timely degree completion. Average time to degree completion is taken into account by NIH and NSF study sections when reviewing predoctoral training grant applications. The national average for NGP-like programs is ~5.5 years, and programs that average significantly longer are not seen as productive, reducing the likelihood of fellowship funding. Should a student require support beyond the 5 Yr period, I-BRAIN and the supporting departments and colleges, along with the mentor, will work together to ensure support for the student in the form of GRAs, GTAs or direct grant support, until graduation, up to the limit imposed by the Graduate College.

As described in section 1D, I-BRAIN has established a number of highly active community outreach programs in which graduate students, postdocs, faculty and staff participate. Moreover, the Institute has obtained funding from donors to support these efforts. Many of these are aimed at children in the south Florida community, including those that may not often have the opportunity for hands-on science experiences. These include the ASCEND program, the Mobile Mind, and the Human Brain exhibit at the South Florida Science Center (SFSC). The latter in particular has substantially raised community awareness of FAU Neuroscience and I-BRAIN. We expect our program students to actively participate in these outreach activities while pursuing their degree, including a student docent program that is under development at the SFSC (post COVID-19).

### **Strategic Priorities for a Knowledge Economy**

Establishing this new degree program will directly increase student access, enrollment, and the number of degrees conferred, in an area of strategic emphasis that has relevance to the advancement of medical knowledge in the area of neurological disorders. As the population of afflicted Florida residents continues to grow, so too will the need to respond by developing more effective ways to relieve patient symptoms and improve their quality of life. The proposed program will be only the second of its kind in the state. It will increase the number of highly trained STEM graduates with the background and technical skills needed to fill educational, research-oriented and biomedical-related positions in the Florida economy, most of which are projected to show double digit growth by 2027, as detailed in Tables 2-6 of this proposal.

Besides the literally hundreds of neuroscience and biotechnology-related businesses in which graduates of the NGP can find employment, the region is also home to outstanding educational institutions and Research Institutes whose ranks employ many Ph.D. trained scientists and educators. These include the University of Miami, Florida International University, Florida Atlantic University, Nova Southeastern University (NSU), Palm Beach State College (PBSC), Kaiser University, and Palm Beach Atlantic University (PBAU), Scripps Research Florida and Max Planck Florida. Letters from Dr. Becky Mercer, Associate Dean for Academic Affairs at PBSC, Dr. Debra Schwinn, President of PBAU, Dr. Peter Gannet, Associate Dean for Research at NSU, Dr. Douglas Bingham, Esq, Executive Vice President of Scripps, FL, and Dr. Matthias Haury, Chief Operating Officer of Max Planck Florida, attest to our program as one whose graduates would be of great interest to fill research, educator and staff positions at their institutions. These letters are collected as **Appendix H**.

**B. Describe how the proposed program specifically relates to existing institutional strengths, such as programs of emphasis, other academic programs, and/or institutes and centers.**

FAU has had a prominent institutional presence in Neuroscience for over 30 years, formalized with the initiation of the Center for Complex Systems in 1986 by J.A. Scott Kelso, Ph.D. In 1987, the Center was renamed the Center for Complex Systems and Brain Sciences to capture its predominant focus on CNS processes. Recruitment of neuroscientists in the Department of Psychology and Biological Sciences augmented the neuroscience depth and participation in campus leadership, with Brenda Claiborne, Ph.D. serving as provost from 2011-2013, Gary Perry, Ph.D. holding the positions of Dean of the College of Science (2006-2013) and Provost (2014-2018). Neuroscientist Janet Blanks, Ph.D. also served as Interim Dean of the College of Science (2015-2016). Neuroscientists have also served as Chairs of academic departments at FAU, with David Wolgin, Ph.D. serving as Psychology Chair (1996-2016), Rodney Murphey, PhD serving as Chair of Biological Sciences (2006-2019), and Sarah Milton, Ph.D., currently serving as Interim Chair of Biological Sciences. Robert Stackman, Ph.D. currently serves as Dean of the Graduate College, Teresa Wilcox, Ph.D., currently serves as the Dean of the College of Science, and Janet Robishaw, Ph.D., currently serves as Chair of Biomedical Science.

Randy Blakely, Ph.D. was recruited in 2016 to the position of Professor of Biomedical Science and the inaugural Executive Director of I-BRAIN, a physical and programmatic embodiment of the Neuroscience Pillar articulated in the 2015 FAU Strategic Plan *Race to Excellence* (<https://www.fau.edu/provost/files/approved.plan2015.pdf>). Prior to coming to FAU, Blakely held the Allan D. Bass Chair in Pharmacology and Psychiatry at Vanderbilt and is an elected member of the American Association for the Advancement of Science, the National Academy of Inventors, the American College of Neuropsychopharmacology, and the Brain and Behavioral Research Foundation. As Director of the Vanderbilt Center for Molecular Neuroscience, Blakely launched the Vanderbilt Brain Institute and its associated Neuroscience Ph.D. program, directed by Elaine Sanders-Bush. For 11 years, Blakely led the Vanderbilt/NIMH Postdoctoral Training Program in Functional Neurogenomics and prior to his departure, was Director of the Silvio O. Conte Center for Neuroscience Research. Blakely has supervised over 30 Ph.D. students and over 30 postdoctoral fellows across his career and in 2008 was awarded the Julius Axelrod Award by the American Society of Pharmacology and Experimental Therapeutics, which emphasizes career-long excellence in mentorship. In 2009, he was recognized with the F. Peter Guengerich Award for postdoctoral mentorship from Vanderbilt, and in 2015, was awarded the Dolores P. Shockley Partnership Award for Minority Research Mentorship from Meharry University. In 2019, Blakely was honored with both the Southeastern University Research Association's Distinguished Researcher Award and a Lifetime Achievement Award in STEM Education from the South Florida Science Center and Aquarium. Dr. Blakely will serve as the Director of the proposed NGP.

**C. Provide a narrative of the planning process leading up to submission of this proposal. Include a chronology in table format of the activities, listing both university personnel**

**directly involved and external individuals who participated in planning. Provide a timetable of events necessary for the implementation of the proposed program.**

## **1. Creation of the Graduate Neuroscience Training Program (GNTP), a forerunner to the Neuroscience PhD Program (2017-2019)**

In March of 2017, then Provost Gary Perry charged a faculty committee, along with a member of the Neuroscience Student Organization, to work with I-BRAIN Executive Director Dr. Randy Blakely as a Neuroscience Graduate Program Working Committee (NGPWC) to develop a plan for integrating the graduate educational activities of three existing PhD programs at FAU with neuroscience emphases or concentrations – Complex Systems and Brain Sciences (CSBS), Integrative Biology-Neuroscience (IB-NS) and Experimental Psychology (XPSY). The NGPWC met with at roughly two-week intervals over the Spring Semester of 2017

### **Neuroscience Graduate Program Working Committee (NGPWC):**

Randy D. Blakely, PhD Exec Director, FAU Brain Institute, Professor, Dept of Biomedical Science, FAU College of Medicine  
Ken Dawson-Scully, PhD, Associate Director, FAU Brain Institute, Associate Professor, Department of Biological Science, FAU College of Science  
Tanja Godenschwege, PhD, Associate Professor of Biological Science, FAU College of Science  
Steven Bressler, PhD, Interim Director, Center for Complex Systems and Brain Sciences, Department of Psychology, FAU College of Science  
Robert Stackman, PhD, Associate Professor, Department of Psychology, FAU College of Science  
Bryan Conklin, President, Neuroscience Student Organization, PhD candidate. Complex Systems and Brain Sciences PhD Program

While a free-standing, multi-college Neuroscience PhD was envisioned at the time of the formation of I-BRAIN, and was discussed in the early stages of the NGPWC meetings, the NGPWC agreed with Dr. Blakely that a more appropriate vehicle to initiate integrative neuroscience graduate programming and promote faculty engagement across programs and colleges was to develop a one year “gateway program” that could provide for national exposure of neuroscience-related training opportunities at FAU, promote increased and broader student recruitment, and provide more nationally competitive student financial support. The program was envisioned as sponsored and administered by I-BRAIN, whose administrative staff would advertise for, recruit and route admitted students to one of the three degree-granting programs after two initial semesters of research internships (rotations) to be selected by the trainees. During the course of these rotations, students would take courses that are accepted as Core courses for the three existing PhD programs. Financial support for advertising, recruiting, and student stipends and health insurance would be provided by I-BRAIN. Students would nominate a PhD program of highest interest during application, and this program would recommend selected applicants for admission to the Graduate College. Once students had selected a mentor and one of the three graduate programs in which to pursue their PhD, the programs would provide Graduate Teaching Assistantships if needed while I-BRAIN would supplement these Assistantships to ensure that a nationally competitive stipend of \$30,000/Yr was maintained for up to 5 total years of training.

The program noted above, termed the Graduate Neuroscience Training Program (GNTP), was formulated by the NGPWC, with structure, administration and funding formulated in a white paper for presentation to a committee of relevant Deans, program leaders, members of the NGPWC and the Provost on August 23, 2017. Following positive deliberations, the GNTP was approved by the Provost and initiated shortly thereafter through a national advertising effort.

### **Leadership Review of Proposed GNTP Program:**

Gary Perry, PhD, Provost, FAU  
Daniel Flynn, PhD Vice President for Research  
Ata Sarjedini, PhD, Dean, FAU College of Science  
Philip Boisselle, M.D., Dean, FAU College of Medicine  
Deborah Floyd, PhD, Dean FAU Graduate College  
Sarah Milton, PhD, Associate Professor of Biological Sciences, FAU College of Science, Director, Integrative Biology Graduate Training Program  
Brett Laursen, PhD, Professor of Psychology, FAU College of Science, Director, Experimental

Psychology Graduate Training Program  
 Randy Blakely, PhD, Professor of Biomedical Science, FAU College of Medicine, Executive Director, FAU Brain Institute, NGPWC Chair  
 Ken Dawson-Scully, PhD, Associate Professor of Biological Sciences, FAU College of Science, NGPWC Member  
 Steven Bressler, PhD, Professor of Biological Sciences, FAU College of Science, Interim Director, Center for Complex Systems and Brain Sciences, NGPWC Member  
 Robert Stackman, PhD, Associate Professor of Psychology, FAU College of Science, NGPWC Member  
 Tanja Godenschwege, PhD, Professor of Biological Sciences, FAU College of Science, NGPWC Member  
 Bryan Conklin, Graduate trainee, CSBS PhD Program, President, Neuroscience Student Organization, NGPWC Member

The first class of GNTTP students was recruited and interviewed in collaboration with faculty of the three supported PhD programs in the Fall and Winter Semesters of 2017-2018, with arrival of the first 6 trainees in the Fall of 2018. Since this time, the GNTTP has recruited two additional classes for a total of 19 students and is now recruiting for the GNTTP class to enter in the Fall of 2021. While the GNTTP had demonstrated success in graduate student recruitment and mentoring during the 1<sup>st</sup> year of graduate training, applicants have expressed confusion as to whether the GNTTP was a degree granting program (it is not) or a post-baccalaureate program (it is not), versus the intended entry year for 3 supported PhD programs who provide neuroscience education and research opportunities, leading to a reluctance of some applicants to accept offers of admission. Additionally, once successfully recruited GNTTP students arrived on campus, many perceived their status as already targeted to the program that initially recommended admission, though they were reminded that their program of record was not to be selected until they had completed their rotations, making some faculty reluctant to host rotations in the future for students admitted by another program. We also experienced reluctance of faculty to assist the GNTTP with interviews of students whose backgrounds did not match those traditionally entering their programs, reducing our ability to broadly represent opportunities for training in the field. Additionally, once GNTTP students moved into one of the 3 programs, we sometimes perceived a return to a more traditional disciplinary orientation versus the interdisciplinary engagement for which we were striving. Lastly, a Neuroscience PhD remains a highly valued commodity in the discipline, and we wished to now capitalize on our program building efforts to offer this degree and become known as a major contributor to neuroscience research and education worldwide.

## **2. Transition to a PhD granting Neuroscience Graduate Training Program**

With the demonstration that I-BRAIN, via its support for the GNTTP, could successfully oversee multiple aspects of neuroscience doctoral training, and having established collaborations between I-BRAIN and FAU neuroscientists for student recruitment, placement and mentoring, Provost Bret Danilowicz moved in the Summer of 2019 to initiate the process to establish a free-standing Neuroscience PhD program administered by I-BRAIN. Provost Danilowicz convened a Neuroscience PhD Planning Committee (NPPC), composed of experienced administrators, educators and neuroscientists, to develop a plan for the conversion of the GNTTP into a free-standing, PhD degree-granting program, the NGP proposed in this application.

### **Neuroscience PhD Planning Committee**

Randy Blakely, PhD, Executive Director of the Brain Institute and GNTTP Director  
 Kathleen Guthrie, PhD, Associate Professor of Biomedical Science, FAU College of Medicine and GNTTP Assistant Director  
 Ata Sarajedini, PhD, Dean, FAU College of Science  
 Gary Perry, PhD, former Provost and Interim Director of Complex Systems and Brain Sciences, and Interim Director of the Complex Systems and Brain Sciences PhD Program  
 Sarah Milton, PhD, Professor and Interim Chair of the Department of Biological Sciences and Director of the Integrative Biology Training Program  
 Ken Dawson-Scully, PhD, Associate Professor of Biological Sciences and Head of Institutional Partnerships for FAU and the Max Planck Florida Institute for Neuroscience  
 Teresa Wilcox, PhD, Professor and Chair, FAU Department of Psychology  
 Rod Murphey, PhD, Professor, FAU Department of Biological Sciences and Associate Provost for Academic Affairs for the Jupiter Campus  
 William Kalies, Ph.D., Professor of Mathematics and Associate Dean of the College of Science for Graduate Studies  
 Robert Stackman, PhD, Professor of Psychology and Dean, FAU Graduate College

Across 6 meetings, the NPPC reviewed how the proposed NGP would interface with existing PhD programs, the allocation of credit for trainees in terms of institutional and state metrics, mechanism of joint resourcing of the NGP by the Provost and the Vice President for Research, and program administration, governance and curriculum. A major conclusion of the NPPC was that because the CSBS PhD Program had been attracting a diminishing number of trainees for a number of years, and had experienced the loss of a number of core faculty due to either leaving the university or no longer directly training students, the program was not likely to prosper moving forward and should have its to focus areas merged into the proposed NGP. After discussion with Provost Danilowicz and Board of Governors staff, a decision was made to propose a merger of the CSBS PhD Program with a new Neuroscience PhD program being developed by Randy Blakely. A written summary of this and other committee recommendations was provided to Provost Danilowicz who encouraged submission of a Pre-Proposal to the Council of Academic Vice Presidents (CAVP) Academic Program Coordination review group for recommendations in the generation of a full proposal to the Board of Governors. After discussions with program faculty regarding the plans discussed by the NPPC, CSBS voted unanimously to move forward with development of Pre-Proposal for the FAU NGP, incorporating CSBS themes into the new program's Areas of Emphasis. I-BRAIN Executive Director Randy Blakely then worked with Russ Ivy, PhD, Senior Associate Provost for Academic Affairs to develop the Pre-Proposal, which was reviewed by CAVP APCG on November 17, 2019 with approval subsequently given by the CAVP APCG to move forward with a full proposal. Below, we tabulate the meetings and events pertinent to Planning Process and Submission of Pre-Proposal to CAVP and for the creation of the full proposal.

### 3. Neuroscience PhD Planning Process and Submission of Pre-Proposal to CAVP

#### Planning Process

Date	Participants	Planning Activity
Neuroscience PhD. Planning Committee Meetings to discuss transition of the GNTF to a free-standing Neuroscience PhD program: June 12, 2019 June 19, 2019 July 15, 2019 July 26, 2019 August 23, 2019 August 30, 2019	Randy Blakely, PhD, Ata Saradejini, PhD, Kathleen Guthrie, PhD, Robert Stackman, PhD, Gary Perry, PhD, Rod Murphey, PhD, Sarah Milton, PhD, Ken Dawson-Scully, PhD	Committee met to discuss aspects of Neuroscience PhD Program governance, administration, financial support, and curriculum
Meeting with Complex Systems and Brain Sciences PhD Program Training Faculty: October 2, 2019	Randy Blakely, PhD, Gary Perry, PhD, Russ Ivy, PhD and faculty associated with the Complex Systems and Brain Sciences PhD Program	Drs. Blakely, Perry and Ivy reviewed the structure of the proposed NGP and the benefits of merging the CSBS PhD program with this initiative. Subsequently, CSBS voted to move forward with a Pre-Proposal that would allow for a full NGP proposal if CAVP approved.
November 17, 2019	Russ Ivy, PhD and CAVP APCG	Presentation of NGP Pre-Proposal to CAVP, Board of Governors APCG

#### 4. Proposal Creation and Review prior to submission to Board of Governor's Staff

## Events Leading to Implementation

Date	Implementation Activity
October 9, 2020	I-BRAIN Executive Director Randy Blakely reviewed Draft NGP Proposal with Provost Bret Danilowicz, Dean of Graduate College Robert Stackman, PhD Associate Vice Provost for Academic Affairs for Jupiter Campus Rod Murphey, PhD, Interim Dean of College of Science Teresa Wilcox, PhD, Senior Associate Provost for Academic Affairs Russ Ivy, PhD
October 16, 2020	I-BRAIN Executive Director Randy Blakely reviewed Draft NGP Proposal with faculty of the Complex Systems and Brain Sciences Ph.D. Program including Interim Director Dr. Gary Perry
October 21, 2020	I-BRAIN Executive Director Randy Blakely reviewed Draft NGP Proposal with faculty of the Department of Psychology including Chair Dr. Robin Vallacher
October 23, 2020	I-BRAIN Executive Director Randy Blakely reviewed Draft NGP Proposal with neuroscience faculty of the Wilkes Honors College including Dean Dr. Justin Perry
October 26, 2020	I-BRAIN Executive Director Randy Blakely reviewed Draft NGP Proposal with faculty of the Department of Biomedical Science including Chair Dr. Janet Robishaw
October 26, 2020	I-BRAIN Executive Director Randy Blakely reviewed Draft NGP Proposal with faculty of the Department of Biological Sciences including Chair Dr. Sarah Milton
October 27, 2020	I-BRAIN Executive Director Randy Blakely reviewed NGP Program with Dean of the College of Science Dr. Teresa Wilcox
October 28, 2020	I-BRAIN Executive Director Randy Blakely reviewed Draft NGP Proposal with leadership of the Max Planck Florida Institute for Neuroscience
October 29, 2020	I-BRAIN Executive Director Randy Blakely reviewed Draft NGP Proposal with neuroscience faculty of the Department of Chemistry including Chair Dr. Predrag Cudic
November 20, 2020	I-BRAIN Executive Director Randy Blakely reviewed Draft NGP Proposal with neuroscience faculty of the Department of Computer Science and Computer Engineering including Chair Dr. Hanqui Zhuang and Dean Dr. Stella Batalama.
November 25, 2020	Review of proposal by Graduate Program Committee of the College of Science
December 10, 2020	Discussion of points on current proposal from faculty associated with PhD programs in Experimental Psychology, Integrative Biology and Complex Systems and Brain Sciences with Dean of the College of Science Teresa Wilcox, Associate Dean for Graduate Studies in College of Science William Kalies, Chair of Department of Biology Sarah Milton, Chair of Department of Biology Robin Vallacher, Interim Director of Center for Complex Systems and Brain Sciences Gary Perry
January 6, 2021	Submission of revised proposal to College of Science Dean Teresa Wilcox, Psychology Chair Robin Vallacher, Biological Sciences Chair Sarah Milton, and Complex Systems and Brain Sciences Interim Director Gary Perry for review and vote of the associated faculty
January 21, 2021	Visit of External Academic Consultants Daniel N. Cox, Ph.D., Georgia State University Lucas Pozzo-Miller, University of Alabama Birmingham Consultant's report received on January 22, 2021
January 29, 2021	Receipt of letter of support from Gary Perry, Ph.D. on behalf of the

	faculty of Complex Systems and Brain Sciences to merge the CSBS PhD into the proposed Neuroscience Graduate Program
February 10, 2021	Review of proposal by College of Science Graduate Committee to University Graduate Program Committee
February 24, 2021	Review of proposal by University Graduate Program Committee
March 3, 2021	Review of proposal by University Graduate Committee
TBD	Review of proposal by University Faculty Senate Planning and Budget Committee
March 18, 2021	Review of proposal by University Faculty Senate Steering Committee
March 29, 2021	Review of proposal by University Faculty Senate
April 20, 2021	Review of proposal by University Board of Trustees
TBD	Proposed review of proposal by Board of Governors Staff
TBD	Proposed review of proposal by Board of Governors

## VII. Program Quality Indicators - Reviews and Accreditation

**Identify program reviews, accreditation visits, or internal reviews for any university degree programs related to the proposed program, especially any within the same academic unit. List all recommendations and summarize the institution's progress in implementing the recommendations. Please include evidence that teacher preparation programs meet the requirements outlined in Section. 1004.04, Florida Statutes, if applicable.**

The Florida Board of Governors mandates formal program reviews every 7 years to be conducted in a process approved by the institution's Board of Trustees. As part of the review process, FAU requires programs to file a post-review report on progress made on the individual action items that came out of the formal review. The unit is responsible for implementing the action plan and assessing its progress on key goals at the 4-year interim. This progress report is to be completed by the Department Chair/School Director in consultation with faculty and Dean of the College. Below is commentary on the reviews on the three programs in the College of Science playing the strongest role in offering the degree program being proposed.

### **Biological Sciences:**

The most recent program review occurred in 2015. The department and university strengths that were cited were "collegiality, emerging strengths in neuroscience and environmental science, undergraduate and graduate research, transparency in governance, energy, enthusiasm and ambition". Taken directly from the review: "The research productivity of the Biological Sciences faculty as a whole has increased markedly over the last decade, doubling the numbers of scientific presentations, publications, and grant applications submitted. This is quite remarkable, especially in the face of a simultaneous doubling of the number of FTE students to teach and a national tightening of research support." The challenges and opportunities that were recognized by the review team were: "departmental cohesion across separate campuses, increasing intercampus interactions, the challenge of 2600 biology majors for 31 faculty members, retention rates, enticing biology majors and avoiding shipwrecks, support and interventions, data-driven answers, graduate programs and graduate student support, faculty mentoring program, enhancement of research". Among the recommendations made by the reviewers pertinent to the current application were to:

**1. To continue to build research and instruction on the Boca Raton, Jupiter and Davie campuses along the lines already established.** FAU's president signed an agreement with Scripps Florida's CEO and the Max Planck Florida Institute for Neuroscience CEO and Scientific Director in March 2015, fortifying relationships both in research and education on the Jupiter campus with members of multiple FA departments including Biological Sciences.

**2. To develop a reliable, efficient transportation system between the different campuses for students and faculty as soon as possible.** FAU now offers a free intercampus shuttle service between the Boca Raton and Jupiter campuses. This Wi-Fi enabled service operates Monday through Friday with four trips per day between the two campuses and is offered to students and staff free of charge. This shuttle



service is widely used and expected to increase in the coming years and will directly support the ability of NGP students to access courses and seminars and collaborations across campuses.

**3. To strengthen research productivity by improving the graduate student support package offered to Ph.D. and M.A./M.S. students.** Financial support for graduate students is a top priority of FAU's new Provost that was recruited in July 2018, Dr. Bret Danilowicz. He is working closely with the President's Office to establish more competitive graduate student support packages. This issue was mentioned in every interview for the Graduate Program Dean and Dr. Stackman was selected for this position. Dr. Stackman is a neuroscientist whose lab is housed on the Jupiter campus. Notably, FAU now provides a significant portion (~75%) of the cost for annual health insurance and with the creation of the NGP, the remainder will be covered. Additionally, cumulative salary support for NGP students will be elevated to \$30,000/Yr, which provides these students with salaries on a par with prestigious neuroscience training universities across the country.

## **Psychology:**

The last departmental review occurred in 2015. The Psychology Department articulated multiple goals in response to the review. Goals relevant to the present application, along with specific recommendations made by the review team, are listed below. Also listed is the progress made on each of these goals.

**1. Create a 5-year hiring plan (consisting of tenure-track and professional-track faculty) that: (i) bridges new university hiring priorities, departmental strengths, and programmatic needs; (ii) considers recent and impending retirements; (iii) will maintain and enhance the research and graduate training areas of the department; (iv) will serve to increase class offerings, lower class sizes, and reduce student:faculty ratios; and (v) increase the percentage of women in faculty positions, especially at the advanced level. In addition, the review team identified loss of tenure-track faculty to outside offers as a significant issue and recommended that the administration increase efforts to retain productive faculty.**

As part of the 5-year strategic hiring plan developed, the department made several tenure track hires in program areas with the greatest need and that aligned with university priorities (assistant professors in cognitive/cognitive neuroscience, neuroscience, and social psychology), a full professor to fill the position of department chair (developmental neuroscientist), and an instructor to teach statistics (a high demand course that serves psychology, biology, and other departments in the college). Five of these hires were female, so that currently 45% of the faculty are female, an increase from 30% in 2015. Female faculty were added at the full, assistant, and instructor level. At the same time, however, we lost faculty to outside job offers, retirement, and movement to an administrative position. Currently, we have 2,400 majors (B.A and B.S) and 24.5 faculty (19.5 tenure- track, 4 instructors, 1 research associate) giving us a student/faculty ratio of 95:1. In addition, we fill approximately 13,000 undergraduate seats each year, providing service to the college and the university. This means that a large percentage of courses offered on the Boca and Davie campus are taught by adjuncts or visiting instructors (55% in AY 2017-2018 and 45% in AY 2018-2019). In summary, the hires we have made in the last four years have moved us in the right direction, but with increased enrollment and faculty losses, our faculty ratio is higher than it was in 2015, which negatively impacts the quality of our undergraduate and graduate training.

**2. Improve graduate student recruitment. To this end, the review team suggested that we increase graduate student financial packages and improve the department website.**

The department has increased graduate student stipends, from \$20,050 to \$22,750. This is a moderate increase and not sufficient to be competitive, but it is a good start. Note, however, that because their graduate student budget has not increased, they now have fewer graduate student teaching assistant (GTA) positions available and, as a result, they are able to admit fewer graduate students. They will need additional funds from the college to alleviate this problem. To improve graduate student recruitment, they have also taken the following actions: (i) moved our graduate application deadline to December 11 (from January 15), which allows us to move more quickly in January to admit the most competitive students; (ii) identified additional resources to bring top prospective students to campus; and (iii) created a part-time Assistant Director of Graduate Studies position (see F. below) to facilitate department-coordinated visits of prospective graduate students and other recruitment efforts.

**3. Create a graduate student handbook containing policies and benchmarks for successful completion of degree requirements. The review team also recommended that the department review its graduate curriculum.**

They have created a graduate student handbook that will be available online. They are in the process of reviewing their graduate curriculum.

**4. Create a greater sense of community among faculty and graduate students. The review team made the following suggestions: (i) create a 1-2 credit required weekly “research seminar” (often colloquially referred to as a “brown bag” meeting) to provide students and faculty with the opportunity to present their research findings, and to provide faculty and students across campuses to interact; (ii) identify a space to create a “Graduate Student Laboratory” to which psychology graduate students from all three sites would have access; (ii) identify office workspace to which faculty from the other two campuses would have access.**

To address these issues, on the Boca campus they have: (i) created a Graduate Student Professional Development Series that meets three times each semester, and to which all graduate students are expected to attend; (ii) created a Graduate Student Library (rather than Laboratory) to which students from all campuses have access, which includes 3 internet-connected computers, printer access, several desks, a large table for group work, lockers to secure belongings, and a lounge area with comfortable seating and bookshelves; (iii) created a shared GTA space to which students from all campuses have access, and in which they can hold office hours and give make-up exams; (iv) created office workspace for faculty who travel from the other two campuses. In addition to the recommendations of the review team, the department has instituted a yearly fall faculty retreat to address issues and plan for the upcoming academic year. We are also in the process of planning a yearly departmental event that occurs in the spring for faculty, staff, graduate students, and undergraduate students, but this will depend on availability of resources.

**5. Develop a strategy to coordinate the program across multiple campuses. This should include (i) steps to foster a more unified departmental climate; (ii) attention to course scheduling to avoid across campus conflicts in course offerings; (iii) development of on-line courses and courses broadcast across campuses; and (iv) regularly-scheduled commuter transportation to facilitate movement of faculty and students across campuses.**

To address these issues, the department has: (i) taken steps to foster a more unified departmental climate and has planned additional steps; (ii) assessed course scheduling to avoid conflicts across campuses and to ensure that all upper-division courses required for graduation are offered on each campus; (iii) developed seven additional on-line courses and developed two upper-divisions courses that are taught in Boca Raton and broadcast to Jupiter and Davie.

### **Center for Complex Systems and Brain Sciences:**

The last Center review occurred in 2015. The Center faculty articulated multiple goals in response to the review. Goals relevant to the present application, along with specific recommendations made by the review team, are listed below. Also listed is the progress made on each of these goals.

**1: Leadership transition:** Dr. Janet Blanks stepped down as CCSBS Director in 2015 shortly after completing the Program Review. She became Interim Dean of the College of Science. Dr. Steven Bressler, a computational/cognitive neuroscientist and member of the CCSBS since 1990, was appointed to the position of Director (interim) beginning Summer 2015. During Dr. Bressler’s tenure as Director, several new faculty members were added to the Center representing research in areas **recommended in the Program Review** in the human brain sciences, that includes Computational, Cognitive, Theoretical and Systems Neurosciences, as well as Robotics, Deep Learning, Artificial Intelligence (AI) and Brain-Machine Interface. Dr. Bressler stepped down as Director in Summer 2019 and Dr. Gary W. Perry, a member of the Center since 1989 (and former Dean and Provost) agreed to act as Director while discussions began about initiating a national search for a new Director, as well as integrating CCSBS better under the umbrella of the Neuroscience Pillar established in the new University Strategic Plan, 2015-2025, *A Race to Excellence* (see below). It is expected that a new Director will start before the end of the 2020-2021 academic year.

The new FAU Strategic Plan established four focal research pillars – Neuroscience, Healthy Aging, Sensing and Smart Systems and Ocean and Environmental Sciences. Each pillar is now established as a

University Institute and the Neuroscience pillar is now embodied as the Brain Institute at FAU. Pertinent to the discussion in this Update is that the first Executive Director for the Brain Institute was hired in May, 2016 and will have an integral role to play in selection of a new Director for CCSBS. Dr. Perry agreed to act as CCSBS Director after securing a commitment from the Dean of Science and Executive Director of the Brain Institute to begin the search for a new CCSBS Director during the 2019-2020 academic year. As of writing, these discussions are underway in Summer 2019.

## **Goal 2: Defining the Center's research focus**

The research and instructional focus of the Center since its inception in 1985 has been the brain as a complex system incorporating many areas of the brain sciences. This focus fits extremely well with the neuroscience pillar in the University's Strategic Plan, 2015-2020. The neuroscience pillar across the university during the past five years has included the establishment of basic molecular and cellular neuroscience research programs (what I call small brain model systems – invertebrates and lower vertebrates) on the FAU Jupiter Campus that is also home to the FAU Brain Institute, the Max Planck Institute for Neuroscience and the Scripps Florida Research Institute. Given the broad focus of the neuroscience pillar, the Center will further **focus its research program, as recommended in the Program Review and action plan**, on human neuroscience (what I call big brain model systems) especially quantitative analysis that includes computational/cognitive/theoretical neuroscience, complex neural systems, brain imaging and also developing research programs in the very topical area of AI/Deep Learning/Cognitive Robotics and the Brain-Machine Interface. This has been reflected in the continuing research of the existing CCSBS faculty members as well as recent hires and faculty added to the Center and mentioned above (see also next section). The search for a new Director will reflect this focus on human brain science and ideally will be a mid-career individual whose research expertise reflects these areas.

## **Goal 3: Increase faculty members to meet mission goals**

As mentioned in the previous section, several new faculty members have joined the Center staff since the program review and in response to this recommendation. Two of these positions were new faculty positions funded as Center positions with faculty appointments in college of science departments. Dr. William Alexander, a computational neuroscientist, who works on mechanisms underlying cognitive control, decision making and learning, was hired with the Psychology department and was essentially a replacement for Dr. Ed Large who took a senior position at the University of Connecticut. Dr. William Hahn, a graduate of the Ph.D. program in CSBS, was hired with the Department of Mathematics and works on AI/Deep Learning in collaboration with Dr. Elan Barenholz. Hahn and Barenholz recently received a \$1 million gift to develop the "Rubin and Cindy Gruber Sandbox" that will allow students to explore machine perception and cognitive robotics.

Since the program review the new Center faculty includes (with associated academic department in parenthesis):

Dr. William Alexander (Psychology) – Computational and Cognitive Neuroscience

Dr. William Hahn (Mathematics) – Deep Learning, Robotics and AI

Dr. Summer Sheremata (Psychology) – Cognitive Neuroscience and Brain Imaging. Dr. Edward Ester (Psychology) – Cognitive Neuroscience and Perception

Dr. Sang-Wook Hong (Psychology) – Cognitive/Visual Neuroscience and Brain Imaging

Dr. Gizelle Anzures (Psychology) – Social Neuroscience and Cognition and Brain Imaging

Dr. Erik Engeberg (Ocean and Mechanical Engineering) – Robotics, Sensing and Brain- Machine Interface

## **Goal 5: Increase interaction with neuroscientists from FAU Jupiter campus, Max Planck Florida and Marcus Neuroscience Institute at Boca Raton Regional Hospital.**

Both instructional and research interactions are underway with neuroscience colleagues from the Jupiter campus, Max Planck Florida Institute for Neuroscience and Scripps Florida. As mentioned above, state-of-the-art video-conferencing capability was installed in the Center's seminar room (Room 303) in 2017 as a result of funding requested from the provost/OIT that connects across campuses; and connectivity is also provided through FAU's Academic Computing Center that allows for courses to be taught across campuses including Davie and Harbor Branch Oceanographic Institute (HBOI). For instance, the core graduate courses, Neuroscience 1 and 2, which are required in the PhD program in CSBS, as well as Integrative Biology-Neuroscience and Experimental Psychology are offered at the Boca Campus as well the Jupiter

Campus, and if need be could include Davie and HBOI. Other courses can also be offered across campuses and this is an opportunity to be further explored going forward.

In research, Center faculty are actively collaborating with faculty in Jupiter, and with researchers at Max Planck Florida and Scripps Florida.

For example, **JA Scott Kelso and Armin Fuchs\*** collaborate with Nancy Jones and Aliza Sloan (Psychology, Jupiter) on purposeful movement analysis and development of agency in infants using the Vicon/Optotrack Lab at the Center (Grant support: NIMH MS 080838)

**Robert Stackman** collaborates with Ryohei Yasuda of Max Planck Florida examining memory performance of lines of mice (Grant support: Max Planck Florida); with Sathya Puthanvettill of Scripps Florida pursuing RNAseq analysis of learning-induced changes in the patterns of gene expression in the perirhinal cortex and hippocampus of mice (Grant support: FAU Seed Grant; NIH submitted)

**Elan Barenholz and William Hahn** collaborate with various faculty at the Max Planck Institute for Neuroscience to apply deep learning analysis to neuro-microscopy data; and in course and program development in partnership with FAU High School (FAUHS) to train data scientists for integration in Max Planck Florida labs (Support: Rubin and Cindy Gruber Sandbox)

Collaboration with a private company, University MRI (UMRI) in FAU's Research Park, to provide access to a 3T fMRI scanner for Center faculty and other FAU faculty was funded by the University at \$300,000 per year for five years and UMRI. The new scanner allowed new faculty to be hired who used imaging in their research (Anzures, Ester, Hong, and Sheremata). The collaboration was included as part of the Action Plan and a GE 3T MR scanner was installed in October 2015 and established as a University Core Facility overseen by the Division of Research at FAU.

#### **Goal 6: Increase collaborations with other colleges at FAU**

As mentioned above both instructional and research collaborations are underway with colleagues from other colleges at FAU. For example, in instruction, the core graduate courses Neuroscience 1 and 2 are now team-taught courses with neuroscientists from the Colleges of Science and Medicine contributing to the course. In research, Center faculty collaborate with faculty members from other colleges and who in some cases as a result have joined the Center, for example:

**Emmanuelle Tognoli** collaborates with Erik Engeberg (FAU, Ocean and Mechanical Engineering, OME), Wei (FAU, College of Medicine, COM), Du (FAU, OME): restoring touch in amputees (Grant support: NIBIB EB025819); Scott Kelso, Armin Fuchs\* and Christopher Beetle (Physics, FAU) in social coordination dynamics (Grant support: NIMH MS 080838); Dimitri Pados (College of Engineering and Computer Science, CECS, FAU): on connected assured autonomy and data analytics; Shihong Huang (CECS, FAU) on co-adaptive software systems (Grant support: NSF submitted).

**Janet Blanks** collaborates with Howard Prentice (COM, FAU), also now a member of the Center faculty, on gene therapy approaches to retinal degeneration during Age-related Macular Degeneration (AMD) and Hypoxia (Grant support: AHA 0615022E; NEI EY0116119).

**Howard Hock** collaborated with Hari Kalva (CECS, FAU) on projects concerned with masking effects and pupillary responses to movies.

**Elan Barenholz and William Hahn** collaborate with James Galvin (COM, FAU) to employ deep learning models to clinical data for detection of Alzheimer's/dementia; Tech Runway: five teams from lab have participated in venture class; and FAU High School: Course offerings in deep learning.

Importantly, Center faculty members continue to also have ongoing collaborations with researchers **outside FAU** that brings national and international recognition to the Center. For example:

**Steven Bressler** collaborates with Vaibhar Diwadkar (Wayne State) on functional connectivity (FC) analysis of fMRI data and Maurizio Corbetta (Washington University) (Grant support NIMH MH096482).

**JA Scott Kelso** continues collaboration with the Intelligent Systems Research Centre (University of Ulster,) labs of Michael McGinnty and Damien Coyle on brain imaging and neural dynamics in neurological disease states (Grant support: NIMH MS 080838).

**Robert Vertes** collaborates with Tim Allen (FIU) on investigating the influence of Nucleus Reunians (RE) of the midline thalamus in the coordination of the medial prefrontal (mPFC)-hippocampal (HF) brain circuit using animal models (Grant support: NINDS NS108259)

**Howard Hock** has a long-term collaboration with Gregor Schöner (University of the Ruhr), primarily concerned with the dynamical modeling of motion perception, motion pattern formation, perceptual grouping and object formation; and an ongoing collaboration with Paul Azzopardi (University of Oxford) primarily studying motion perception in individuals with damage to cortical Area V1.

**William Alexander** collaborates with Thilo Womelsdorf (Vanderbilt University) on computational modeling of monkey neurophysiological data and behavior during structured learning; Axel Cleeremans/Irene Cogliati-Dezza (Universite Libre de Bruxelles) on computational modeling and fMRI of human prefrontal cortex during resolution of the exploration/exploitation dilemma; and Eliana Vassena (Donders Institute, Radboud University) on testing computational models of cognitive control and decision making using behavioral and fMRI experiments.

**Robert Stackman** has a standing collaboration with John Adelman (Oregon Health & Science University) on the contribution of small conductance calcium-activated potassium channels on long-term memory and cognition (Grant support: NIH R21 under review).

**Gizelle Anzures** currently collaborates with Frank Haist (University of California, San Diego) on looking at the development of functional neural networks related to face perception (Grant support: NICHD HD018483).

**William Hahn and Elan Barenholz** collaborate with several companies on Deep Learning and AI application, for example, Trainerspace for AI-based fitness training, Ghost Robotics and Drone Data to develop robotic dog and EZSight Solutions for automated turbine inspection.

## VIII. Curriculum

- A. Describe the specific expected student learning outcomes associated with the proposed program. If a bachelor's degree program, include a web link to the Academic Learning Compact or include the document itself as an appendix.**

As part of its mission to help inform an evolving neuroscience workforce, the Society for Neuroscience (SFN) Training Committee has developed Core Competencies in training for institutions to consider when designing and evaluating their neuroscience graduate programs, and for trainees to consider when evaluating training opportunities. The proposed PhD program is structured to address these specific competencies through coursework, workshops, research experiences, teaching experiences, the writing of NIH or NSF predoctoral fellowship applications, and classroom and public presentations to the FAU neuroscience community, as well as audiences at national and international scientific meetings. The major *learning outcomes* expected for our students fall into the following categories (adapted from the SFN Core Competencies Graduate Training):

### 1. Conceptual knowledge at a depth beyond the M.S degree:

- Understand of the development, structure, and function of the nervous system.
- Understand the detailed biology and function of the cells of the nervous system.
- Develop advanced, broad-based and cross-disciplinary knowledge in the discipline.
- Demonstrate critical analytical and creative thinking skills.

### 2. Research Skill Development

- Acquire detailed knowledge and expertise within specific research areas of neuroscience.

- Be able to design scientifically testable hypotheses.
- Gain proficiency in analytical approaches to defining scientific questions.
- Be able to conduct independent and novel research that adds to the body of knowledge in neuroscience.
- Develop proficiency in experimental design and scientific tools and techniques, including computer-based data handling.
- Be able to demonstrate proficiency in data analysis and interpretation.

### 3. Rigorous And Responsible Conduct Of Research (RCR Training)\*

- Be able to design and execute scientifically rigorous experiments, including appropriate data analysis and interpretation.
- Understand:
  1. Conflicts of interest — personal, professional, and financial.
  2. Policies regarding human subjects and vertebrate animal subjects in research, and safe laboratory practices.
  3. Mentor-mentee responsibilities and relationships.
  4. Research collaborations.
  5. Peer review (grants, manuscripts etc).
  6. Data acquisition, management, sharing, and ownership.
  7. Research misconduct and research integrity, including understanding what constitutes plagiarism, and data falsification or manipulation.
  8. Responsible authorship and publication.

***\*Required graduate RCR training workshops will be held for Neuroscience PhD students in year 1, beginning with the Bootcamp Week preceding the students' first rotation. These cover the 8 areas listed above, in addition to required online RCR courses through the Collaborative Institutional Training Initiative (CITI) Program. RCR training must be updated by students every 4 years.***

### 4. Communication Skills

- Develop proficiency in scientific writing, speaking, and active listening.
- Specific writing skills: Be able to write scientific papers; grant applications, and career-related documents, including *curriculum vitae*, resumes, cover letters, and research statements, and communicate to diverse audiences, including scientific and non-expert readers.
- Speaking: Be able to present research to scientific and non-expert audiences; at conferences and seminars, including posters, slide presentations, and formal talks.
- Be able to effectively teach science topics.\*
- Be able to prepare and present accurately, scientific data in figures, tables, and graphs.
- Gain proficiency in preparing for job interviews.

*\*Students in the program will gain teaching experience by working as university Teaching Assistants in undergraduate classes and teaching laboratories during some semesters. This experience is important for those that plan to pursue an academic teaching and research career in the future. The projected market demand in 2027-2029 for Biology, Psychology, and Health Sciences postsecondary teachers in Florida is between ~15-25%, and 9-20% nationally. Moreover, the opportunity to gain teaching experience is taken into account during review of NIH and NSF graduate training fellowship applications. For those FAU graduate students interested in future academic employment, there is also the opportunity to earn a Certificate in Effective College Instruction through online courses offered over a period of 2 semesters by the Association of College and University Educators (ACUE). Program enrollment is accessible through the FAU Department of Educational Leadership and Research Methodology. There is also an 8-week virtual course on teaching strategies offered by the FAU Center for eLearning.*

**eLearning Certificates: An 8-Week virtual course presenting online teaching strategies offered**

through the FAU Center for eLearning.

## 5. Professionalism

- Develop leadership, mentoring, and management skills.
- Be able to work collaboratively
- Be able to develop solutions to problems.
- Contribute to advocacy, education and public outreach.
- Be culturally aware and respectful.
- Be able to actively plan your career path.

### B. Describe the admission standards and graduation requirements for the program.

The program seeks to admit applicants (full-time only) who are academically excellent and have completed an undergraduate or M.S. degree *demonstrating substantial training in the biological sciences, psychology, or engineering and computer sciences*. Recommended preparation includes upper division courses in biology (molecular/cellular biology, genetics, physiology), psychology (animal and human behavior, learning and memory, cognition), chemistry (organic chemistry, biochemistry), mathematics (statistics and calculus), and computer engineering and programming. Prior coursework neuroscience is desirable, and evidence of prior research experience is particularly important. A competitive applicant usually will have prior research experience and should describe their research experience in the Statement of Purpose/Personal Statement.

#### Admission Requirements (See also Appendix I)

All students must meet the minimum graduate admission requirements of the University. Additional requirements are:

- Completion of an Bachelor's or M.S. degree from a regionally accredited institution in an appropriate major, prior to anticipated start date in the PhD Program.
- Minimum grade point average of 3.40 as an undergraduate and/or M.S. student.
- Complete sets of transcripts from previous institutions(s) attended.
- A minimum of 3 letters of recommendation, preferably from instructors and advisors who are familiar with the applicant's recent academic or research experience.
- An essay of Purpose/Interests in the form of a Personal Statement
- Graduate Record Examination scores are optional
- International students whose native language is not English must score at least 79-80 (Internet-based test) on the Test of English as a Foreign Language (TOEFL). Satisfactory TOEFL scores can offset verbal GRE scores at the discretion of the program's admission committee. Additionally, international students whose transcripts are from non-U.S. institutions must have their credentials evaluated course-by-course. International students must also demonstrate competency in spoken English.

Previous Graduate coursework may be applied toward the course requirements of the Neuroscience Ph.D. Students may receive up to 15 credits earned beyond the baccalaureate degree, including up to 9 credits of Core course credit, not to include Laboratory Rotations and Neuroscience Seminar, based on comparable courses taken prior to admission. Transfer credits must be approved by the Program Curriculum Committee and the Graduate College. Evaluation of transfer credits will be based on content and will require an official copy of each course syllabus for assessment.

#### Degree Requirements: (See also Appendix I)

The Doctor of Philosophy in Neuroscience is a research-intensive degree requiring a minimum of 72 credits beyond the baccalaureate degree.

The following are the specific, minimum requirements for the Neuroscience Ph.D. degree:

1. Completion of 21 core credits listed in the table below.
2. Completion of 9 elective credits.



3. Completion of 24 dissertation credits.
4. The remaining 18 credits may include elective coursework at the 6000-level or above, advanced research, or dissertation that support the student's research plan with approval of the student's Ph.D. supervisor.
5. Completion of 3 Research Rotations, representing 8-week research internships in different laboratories in the Fall and Spring semesters of Year 1.
6. Acceptance into the laboratory of an approved program faculty member for thesis research by the end of the Spring Semester of Year 1.
7. Achievement of a "B" or higher grade in all courses, with an overall GPA of at or above 3.0 maintained.
8. With the exception of Neuroscience Seminar and Laboratory Rotations, no Core or Elective courses can be taken as Satisfactory/Unsatisfactory.
9. Students must enroll in the Neuroscience Seminar each Fall and Spring semester for the entire time they remain in program, with the expectation that most students will graduate in 5 years. Starting in Year 2, the Neuroscience Seminar will be taken for 0 credit.
10. Admission to PhD candidacy requires the writing and successful public defense of an original dissertation research proposal.
11. Degree completion requires the writing and successful public defense of a dissertation describing the context, approach, results and impact of thesis research.
12. Students are expected to publish at least one peer-reviewed research paper as first author involving research activities described in their dissertation proposal prior to degree completion.

**C. Describe the curricular framework for the proposed program, including number of credit hours and composition of required core courses, restricted electives, unrestricted electives, thesis requirements, and dissertation requirements. Identify the total numbers of semester credit hours for the degree.**

As noted above, a minimum of 72 credit hours beyond the baccalaureate degree is required for completion of the degree. Of this, 21 credits are earned in required Core courses, with 9 additional, unrestricted Elective credits also required. A minimum number of 24 Dissertation Research credits are required with the remaining credits taken as either Advanced Research, Dissertation Research, or Elective Course credits. Students may not exceed 79 credits prior to graduation.

### **Program Curriculum**

Students will attend NGP, Graduate College, and Teaching Assistantship Orientations, prior to their first semester lab rotations. They will also participate in a one week-long, required Bootcamp with activities led by NGP Faculty and I-BRAIN staff. The Bootcamp sessions will 1) introduce students to the research opportunities of faculty in the NGP, 2) increase awareness of opportunities they may pursue in rotations 2 and 3 (rotation 1 will be set in advance of arrival on campus), 3) ensure that any necessary certifications are completed prior to rotations, 4) complete in-person Responsible Conduct in Research (RCR) training, and 5) complete an initial Plan of Study, and 6) review current approaches common to the field of neuroscience as presented by existing graduate students.

During the 1<sup>st</sup> year, students will pursue Core coursework, initiate Elective coursework, complete three 8-week laboratory rotations, and register for and attend the Neuroscience Seminar course. In the 2<sup>nd</sup> year, students will complete Core coursework, complete Elective coursework, obtain Advance Research credits, attend Neuroscience Seminar, and write and orally defend their dissertation proposal (public and committee components). In subsequent years, students will obtain Dissertation Research credits and attend the Neuroscience Seminar, prior to an oral defense of their written thesis. Total credits to be obtained in the Program are at least 72, projected as 30 Core and Elective credits and at least 21 Dissertation research credit, with the remainder being a tailored combination of Advanced Research and additional (if needed) Elective credits. Students may receive credit for up to 15 hrs of course credit, including up to 9 hrs of Core course credit not to include Laboratory Rotations and Neuroscience Seminar, based on comparable courses taken prior to admission and after review of the associated syllabi by the Curriculum Committee.

### **Coursework:**

#### **Fall Year 1**

- 1. Cell and Molecular Neuroscience – 3 Credits (Core)**
- 2. Experimental Design I or Computational Neuroscience I – 3 Credits (Core)**

3. **Neuroscience Laboratory Rotations (1<sup>st</sup> and 2<sup>nd</sup> Rotation) – 2 Credits (Core)**
4. **Neuroscience Seminar – 1 Credit**

Spring Year 1

1. **Systems and Integrative Neuroscience – 3 Credits (Core)**
2. **Elective 1 – 3 Credits**
3. **Neuroscience Laboratory Rotations (3<sup>rd</sup> Rotation) – 2 Credits (Core)**
4. **Neuroscience Seminar – 1 Credit**

Summer Year 1

1. **Advanced Research – 1 Credit**

Fall Year 2

1. **Brain Disorders and Therapeutics– 3 Credits (Core)**
2. **Elective - 3 Credits**
3. **Advanced Research – 3 Credits**
4. **Neuroscience Seminar – 0 Credits**

Spring Year 2

1. **Elective 3 – 3 Credits**
2. **Scientific Communications– 3 Credits (Core)**
3. **Advanced Research – 3 Credits**
4. **Neuroscience Seminar – 0 Credits**

Summer Year 2 (write and submit thesis proposal)

1. **Advanced Research – 1 Credit**

Year 3 Fall (Defend Proposal)

1. **Advanced Research – 9 Credits**
2. **Neuroscience Seminar – 0 Credits**

Years 3-5 Fall, Spring and Summer

1. **Dissertation Research – 1-9 Credits each semester**
2. **Neuroscience Seminar – 0 Credits**

**Approved Electives: Students take a minimum of 3 courses from the following list during years 1-2.**

Experimental Design 2	PSY 6207	3 credits
Human Neuroanatomy	BSC 6748	3 credits
Functional Neuroanatomy	PSB 6930	3 credits
Neurophysiology	PCB 6835C	3 credits
Neuroimmunology	PCB 6933	3 credits
Advanced Molecular and Cellular Biology	PCB 5532	3 credits
Advanced Cell Physiology	PCB 6207	3 credits
Developmental Neurobiology	PCB 6515	3 credits
Neurobiology of Addiction	PCB 5844	3 credits
Neuroscience of Sleep	PSY 6930	3 credits
Neuroplasticity	PCB 6933	3 credits
Adult Neurogenesis	PCB 6848	3 credits
Pharmacology	PCB 6933	3 credits
Cognitive Neuroscience	ISC 5465	3 credits
Principles of Neurobiological Signal Processing	ISC 6466	3 credits
Biosignal Processing	COT 5930	3 credits
Seminar in Cognition	EXP 6609	3 credits
<b>Attention and Cognition</b>	<b>EXP 6030</b>	<b>3 credits</b>
Seminar in Behavioral Neuroscience	PSB 6058	3 credits
Seminar in Sensory Processes	PSB 6609	3 credits
Foundations of Vision	CAP 6411	3 credits
Seminar in Human Perception	EXP 6208	3 credits

Developmental Neuropsychology	PSB 6516	3 credits
Methods in Complex Systems	ISC 6450	3 credits
Nonlinear Dynamical Systems	ISC 5453	3 credits
Introduction to Neural Networks	CAP 5615	3 credits
Computational Neuroscience 1	ISC 6460	3 credits
Brain Modeling	EEL 6035	3 credits
Artificial Intelligence	CAP 6635	3 credits
Machine Perception and Cognitive Robotics	EXP 6930	3 credits
Introduction to Data Science	CAP 5768	3 credits
Data Mining and Machine Learning	CAP 6673	3 credits
Data Mining for Bioinformatics	CAP 6546	3 credits
Biomedical Data and Informatics	BSC 6459	3 credits
Bioinformatics: Bioengineering Perspectives	BME 6762	3 credits
Neural Basis of Human Communication	SPA 5107	3 credits
Adult Language Disorders	SPA 6410	3 credits
Genetics of Communication Disorders	SPA 6438	3 credits
Motor Speech Disorders and Augmentative Comm	SPA 6230	3 credits

In year 1, students enroll for 9 credit hours of required courses in both the Fall and Spring semesters. The Core Neuroscience 1 class begins in the Fall semester, with continuation of this subject matter in the Neuroscience 2 course in the Spring. Collectively these courses provide foundational knowledge on the structural-functional organization of the nervous system, neurophysiology, neurotransmitters, the cellular and molecular biology of neurons and glia, neural development, as well as systems neuroscience, including sensory and motor processing, basic cognitive functions, and mechanisms of neural plasticity. Experimental Design 1 is a required course in the first semester that can be substituted with Computational Neuroscience for those students entering with a particularly strong math background and evidence of formal training in statistics. An elective course is taken in the Spring semester. Students earn 1 credit hour each semester in year 1 for participation in the Neuroscience Seminar course, and 2 credits each semester for Laboratory Rotations in year 1. Grading for the latter is based on written evaluations of student research performance from the supervising faculty. Students identify a permanent mentor and research lab before the end of the third rotation in Year 1. Students work with their mentors to during the first summer to design a formal Plan of Study (POS) outlining the anticipated courses and schedule they plan to follow toward degree completion. A Supervisory committee of 4 graduate faculty including the mentor, is assembled by the fall of year 2. A copy of the POS is provided to the Curriculum Committee for review, with an approved copy submitted to the Graduate College. The POS is updated annually with approval by the faculty mentor and Committee.

Starting their first Summer session, students enroll in Advanced Research credits, continuing into year 2 (1-6 credits per semester), training and collecting data that serves as the basis for their thesis proposal. Students are also required to enroll in a minimum of 3 elective courses during years 1-3, selected in consultation with their mentor to expand their knowledge base in their particular research focus area (9 credit hours total). There are also journal clubs at FAU that focus on neuroscience topics, and students are encouraged to participate in order to gain experience in discussion and review of recent publications in the field.

To qualify for advancement to PhD candidacy, students must have maintained a minimum GPA of 3.0, completed the 21 required course credits, and collected sufficient research data to develop a thesis proposal, write this in the format of a fellowship/grant application, and present this to their thesis committee in a seminar-style public meeting open to all faculty and students. After completing advancement within 2.5 years, students are required to complete a minimum of 24 credit hours of Dissertation research, with the goal of successfully writing and publicly defending their thesis by years 5-6.

### **Doctoral Thesis Proposal and Qualification**

NGP students will prepare a written proposal modeled on NIH or NSF templates for a predoctoral fellowship. Use of such a format allows for the oral exam component to serve as an opportunity to gain critical feedback for modifying the proposal for fellowship submission. Trainees will also be provided with a cash award (e.g. \$500) should they submit their approved proposal as a fellowship for possible funding. Costs for this reward will be supported by the Brain Institute. The proposal will be targeted to their projected area of research and include relevant Background, Specific Aims, Preliminary Findings, and Research Approach. Students will present their proposal orally in a forum open and advertised to the public, followed by an oral examination by the student's thesis committee. The thesis committee will consist of at least 4 members

knowledgeable in aspects of the project. Students will be encouraged to include a faculty-level member of their committee who is not a member of the Program, including faculty from other institutions, and who will be one of the 4 noted, once approved. The faculty mentor serves as the Thesis Committee Chair. Research-track faculty or non-FAU faculty are allowed to join the committee as non-voting members but do not substitute to fulfill Committee requirements for number of faculty. Following the defense, committee members vote to either Pass, Pass with Conditions, or Fail the student. Student must be able to satisfy any conditions within 3 months prior to resubmission of their proposal for a second oral examination. The Committee shall determine whether a second, public oral presentation is required. Should the student not Pass the second examination, the student will be asked to leave the Program. Students who have passed their Qualifying exam may qualify for a Master's Degree in another Program at FAU if they have completed the academic requirements of that Program, upon positive review by the Director of the Master's Training Program, and following approval by the Graduate College. Since the NGP does not grant a Master's degree itself, should a desire to obtain a Master's degree should be discussed with the mentor and the Director of the relevant program as soon as possible so that as much use of NGP coursework can be made as possible for the Master's degree. Should a student not complete the Ph.D. and wish to utilize their coursework for a Master's degree, costs may be incurred by the student to complete these courses if they cannot be taken within the course of the student's tenure in the NGP (e.g. if they do not pass their qualifying exam).

### **Doctoral Thesis Defense**

NGP students will develop a written thesis following the format required by the Graduate College, present the findings of their research orally in a forum open and advertised to the public, followed by an oral examination by the student's Thesis Committee. Following the defense, committee members vote to either Pass, Pass with Conditions, or Fail the student. Students must satisfy any conditions imposed by the committee within 3 months, prior to resubmission of their proposal and/or completion a second oral examination. The Committee shall determine whether the student Passes or Fails the thesis defense examination and allow for a re-examination following the rules of the Graduate College.

### **D. Provide a sequenced course of study for all majors, concentrations, or areas of emphasis within the proposed program.**

The sequence of Courses for students in the program is as follows:

#### **Fall Year 1**

5. Cell and Molecular Neuroscience – 3 Credits (Core)
6. Experimental Design I or Computational Neuroscience I – 3 Credits (Core)
7. Neuroscience Laboratory Rotations (1<sup>st</sup> and 2<sup>nd</sup> Rotation) – 2 Credits (Core)
8. Neuroscience Seminar – 1 Credit

#### **Spring Year 1**

5. Systems and Integrative Neuroscience – 3 Credits (Core)
6. Elective 1 – 3 Credits
7. Neuroscience Laboratory Rotations (3<sup>rd</sup> Rotation) – 2 Credits (Core)
8. Neuroscience Seminar – 1 Credit

#### **Summer Year 1**

2. Advanced Research – 1 Credit

#### **Fall Year 2**

5. Brain Disorders and Therapeutics– 3 Credits (Core)
6. Elective - 3 Credits
7. Advanced Research – 3 Credits
8. Neuroscience Seminar – 0 Credits

#### **Spring Year 2**

5. Elective 3 – 3 Credits
6. Scientific Communications– 3 Credits (Core)
7. Advanced Research – 3 Credits
8. Neuroscience Seminar – 0 Credits

Summer Year 2 (write and submit thesis proposal)

2. Advanced Research – 1 Credit

Year 3 Fall (Defend Proposal)

3. Advanced Research – 9 Credits
4. Neuroscience Seminar – 0 Credits

Years 3-5 Fall, Spring and Summer

3. Dissertation Research – 1-9 Credits each semester
4. Neuroscience Seminar – 0 Credits

Core Courses are listed below, followed by approved Electives that can be chosen by students and faculty mentor as noted above. Program Emphasis Areas are noted for each Elective following the course name as follows: Cellular, Molecular and Biomedical Neuroscience (CMB), Sensorimotor, Cognitive and Behavioral Neuroscience (SCB) and Theoretical and Computational Neuroscience (TC). These designations are given as guides for expectations of a specific background and thesis direction that may find the course most appropriate but are not indicated to limit construction of an individualized curriculum, which is the responsibility of the student and mentor. Area of Emphasis designations are developed in consultation with course directors. by the Curriculum Committee as Elective options to consider for Plans of Study.

**E. Provide a one- or two-sentence description of each required or elective course.**

**Core Courses**

**Cellular and Molecular Neuroscience**

**PSB 6345**

**3 credits**

This course is the first of a two-part sequence which covers the structural and functional organization of the nervous system, neurophysiology, neurotransmitter and receptor systems, cellular and molecular biology of neurons and glia, and neural development.

**Systems and Integrative Neuroscience**

**PSB 6346**

**3 credits**

Continuation of Cellular and Molecular Neuroscience. In-depth coverage of systems neuroscience, including sensory and motor processing, cognitive functions, learning and memory, and mechanisms of neural plasticity.

**Experimental Design 1**

**PSY 6206<sup>#</sup>**

**3 credits**

Covers experimental design and analyses, with special emphasis on statistical analysis of variance models. Students learn how to design experiments to test hypotheses and apply appropriate, rigorous data analysis to achieve objective findings.

**Computational Neuroscience 1**

**ISC 6460<sup>#</sup>**

**3 credits**

This course covers the basics of computational neuroscience, incorporating both biological and artificial neural networks.

**Scientific Communication**

**BSC 6846**

**3 credits**

Introduces students to techniques and software available for data processing and presentation of research data. Students learn to present research to the general public and scientific community in written and spoken form by preparing research proposals, conference presentations, seminar talks and publications.

**Brain Diseases: Mechanisms and Therapy**

**BMS 6736**

**3 credits**

Discussion of the molecular and cellular basis of neurological disorders, including neurodegenerative diseases, stroke, epilepsy and depression, as well as the current status of therapeutic interventions for these disorders.

**Neuroscience Seminar  
credit**

**BSC 6938**

**0-1**

Distinguished neuroscience researchers from across the country are invited to visit the university to meet with faculty and students and present their work at afternoon seminars held biweekly

during the fall and spring semesters. First year students enroll for 1 credit. Thereafter, student have the option to enroll and attend for 0 credit.

**Neuroscience Laboratory Rotations (to be created)                      TBD\*                      3 x 1 credit**

During Year 1, PhD students in the Neuroscience PhD program will join 3 research labs under the supervision of faculty mentors to gain training in graduate level research and inquiry in neuroscience. The work is typically laboratory-based, and each rotation will last 8 weeks. Requirements for lab work and criteria for evaluation will be agreed upon by the research mentor and the student at the start of each rotation.

**#Either Experimental Design 1 or Computational Neuroscience 1 can be taken to satisfy requirements**

**Recommended Electives for Trainees in the Cellular, Molecular and Biomedical Emphasis Area**

**Human Neuroanatomy    BSC 6748    3 credits**

Detailed study of the anatomical components of the human nervous system at the cellular and systems level, with particular emphasis on the structure and function of the brain and spinal cord. An overview of diseases and injuries of the human nervous system is included.

**Functional Neuroanatomy    PSB 6930    3 credits**

This course examines the neuroanatomical organization of the brain (from the brainstem to the anterior forebrain) and its functional characteristics. This includes a laboratory component where students section, mount, stain and examine brain tissue.

**Practical Cellular Neuroscience    BSC 6417C    3 credits**

The course looks at signaling from the perspective of single ion channels to cellular synaptic transmission. The electrical properties of neurons and their signaling are the basis for all neuronal function. The students learn these principles through both theory and practical laboratory and apply them in an experimental proposal, which they present and then execute resulting in a final report.

**Neurophysiology    PCB 6835C    3credits**

This course provides students with an understanding of neurophysiological signaling at the cellular level and whole animal through the use of wet and dry laboratory sessions supplemented with lectures. Focuses on signaling from the perspective of the electrical properties of neurons.

**Advanced Molecular and Cellular Biology    PCB 5532    3 credits**

This course is designed to provide students with a basic background in advanced topics in cell and molecular biology. Emphasis is placed on human cellular physiology and disease.

**Developmental Neurobiology    PSB 6515    3 credits**

In-depth coverage of the principles and recent advances in understanding development of the nervous system, including neural determination, neuron migration, axon outgrowth, synapse formation and plasticity, neurotropism, and the influence of experience on the developing brain.

**Advanced Cell Physiology    PCB 6207    3 credits**

Course describes in-depth membrane physiology, intracellular signaling pathways and organelle functions, with an emphasis on electrically excitable neurons and muscle cells.

**Neurobiology of Addiction    PCB 5844    3 credits**

This course covers the fundamentals of molecular, cellular and circuit systems in the brain that are responsible for drug addiction. Common neurobiological elements are emphasized that provide insights into how the brain mediates the rewarding effects of drugs of abuse and how it changes during the transition to addiction.

**Pharmacology    PCB 6933    3 credits**

This course introduces the study of the properties, effects, and therapeutic value of the primary agents in the major drug categories, including those that affect the nervous and cardiovascular systems.

**Adult Language Disorders****SPA 6410****3 credits**

The study of language disorders in adulthood including aphasia, TBI, and senility. Covers the normal changes in language and memory as a result of aging, and the evaluation and treatment of adult language disorders.

**Genetics of Communication Disorders****SPA 6438****3 credits**

Students study the basic concepts of genetics and its relation to communication sciences and disorders, including disorders of speech and hearing. Students also learn about hereditary syndromes and birth defects associated with speech, language, cognition and hearing impairments.

**Motor Speech Disorders and Augmentative Communication****SPA 6230****3 credits**

Study of the motor systems involved with speech production, including cranial nerves. After three weeks devoted to evaluation and treatment techniques related to speech-language pathology, the remainder of the course covers different types of dysarthria and apraxia, including a review of the different neural structures involved in these disorders.

**Neuroplasticity****PCB 6933****3 credits**

This course is designed to provide students with a functional understanding of neural mechanisms of brain plasticity throughout lifespan. Emphasis is on the integrated understanding of learning and memory, and structural and synaptic plasticity in animal models, with relevance to human brain function in health and disease

**Neuroimmunology****PCB 6933****3 credits**

An introduction to concepts in the field of psychoneuroimmunology, which studies the interplay between the CNS, the immune system, and behavior. Understanding these interactions identifies novel mechanisms of physiology and pathology that can be targeted by new therapies aimed at inflammatory diseases, neurodegeneration, and affective disorders.

**Adult Neurogenesis****PCB 6848****3 credits**

The subject of neural stem cells is covered, including the process of neurogenesis, where and when CNS neurogenesis happens, how it happens, why it happens and, more importantly, how it might help the brain heal itself.

**Recommended Electives for Trainees in the Sensorimotor, Cognitive and Behavioral Neuroscience Emphasis Area****Neuroscience of Sleep****PSY 6930****3 credits**

A graduate seminar course devoted to a comprehensive and up-to-date examination of the neural substrates controlling states of sleep (NREM and REM) and the function(s) of sleep. Theories of the function of sleep are explored and evaluated.

**Biomedical Data and Informatics****BSC 6459****3 credits**

This course teaches essential concepts and methodology for biomedical data acquisition and analysis with an emphasis on the analysis of massive data. The course sets up the foundation for careers in biomedical informatics in a wide range of fields including the pharmaceutical and biotechnology industries.

**Data Mining for Bioinformatics****CAP 6546****3 credits**

This course focuses on the principles of data mining as it relates to bioinformatics. Topics covered include gene selection, class imbalance, classification, biomarker discovery and prediction models.

**Cognitive Neuroscience****ISC 5465****3 credits**

An interdisciplinary survey of the neural basis of cognitive functions such as perception, attention, memory, and language.

**Seminar in Cognition****EXP 6609****3 credits**

Covers the experimental and theoretical aspects of cognition. Topics include attention, human learning and memory, organization of knowledge, problem solving, and decision making.



**Seminar in Cognitive Development** **DEP 6067** **3 credits**  
A course covering the development of cognitive processes involved in thinking and learning.

**Attention-based Behavior** **EXP 6030** **3 credits**

This course covers the methods used to study attention and consciousness using behavior, animal studies, and brain imaging, and how new techniques have revealed cognitive and brain mechanisms involved in our subjective experience of the world.

**Seminar in Behavioral Neuroscience** **PSB 6058** **3 credits**

A subdiscipline of neuroscience, behavioral neuroscience explores how behavior is controlled by the nervous system. Topics such as neural control of waking and arousal, neural control of movement, and the role of dopamine in reinforcement are covered.

**Seminar in Sensory Processes** **PSB 6609** **3 credits**

A survey of the sensory processes. Topics include sensory transduction and psychophysics, biological potentials, sensory coding, and anatomy and connectivity of the five fundamental sensory systems.

**Foundations of Vision** **CAP 6411** **3 credits**

Study of the interdisciplinary science of vision combining the psychological, neurophysiological, and computational aspects of vision research. Research papers and project topics will be chosen from a list of latest developments in the field.

**Seminar in Human Perception** **EXP 6208** **3 credits**

A study of the development of theoretical models of perception with an emphasis on human information-processing capacities.

**Developmental Neuropsychology** **PSB 6516** **3 credits**

Study of the theories and research on brain maturity and human cognitive development. Key concepts such as brain asymmetry and neuroplasticity are analyzed. Abnormalities resulting from neurological or other biological disruptions are discussed.

**Neural Basis of Human Communication** **SPA 5107** **3 credits**

Study of the neuroanatomy and neurophysiology underlying normal speech, language and hearing. Focus is on central and peripheral nervous systems related to human communication, with consideration of embryonic development as well.

**Recommended Electives for Trainees in the Theoretical and Computational Neuroscience Emphasis Area**

**Experimental Design 2** **PSY 6207** **3 credits**

Advanced treatment of experimental design, with special emphasis on the analysis of variance in multifactor experiments. It also examines covariance and multiple regression analysis.

**Biostatistics** **STA 5195** **3 credits**

An introduction to statistical tools used routinely for inference and data analysis in the health sciences. Topics include biostatistical design of medical studies, measure of disease occurrence and association, methods for rates and proportions, ROC analysis for screening and diagnosis, discrimination and classification, principal component analysis and factor analysis, and log-linear models.

**Principles of Neurobiological Signal Processing** **ISC 6466** **3 credits**

A study of neural function, cortical electrogenesis, and theories of the origin of EEG, covering practical issues and methods of EEG analysis. Auto-covariance, cross-covariance, Fourier analysis, autoregressive modeling, and digital filtering are covered.

**Biosignal Processing** **COT 5930** **3 credits**

This course covers the generation of bioelectrical signals, their acquisition, modeling and analysis. Modeling and analysis tools cover adaptive filtering, time-frequency analysis, model-based spectral analysis, and wavelet transforms.

**Methods in Complex Systems**

**ISC 6450**

**3 credits**

Classical statistical analysis and inference of linear systems and how those statistical methods and analysis procedures differ for non-linear complex systems. Topics include fractals, chaos, neural networks, and self-organizing critical systems.

**Nonlinear Dynamical Systems**

**ISC 5453**

**3 credits**

Introduction to nonlinear dynamical systems in an interdisciplinary setting. Topics covered include one-, two- and three-dimensional ordinary differential equations, bifurcations, one- and two-dimensional maps, iterated function systems, time scale separation and self-organization and elementary stochastic systems.

**Introduction to Neural Networks**

**CAP 5615**

**3 credits**

Introduction to biological neural systems and models of neural mechanisms of learning and memory. Neural net applications to image processing, pattern recognition, machine learning, optimization problems, and robotics/hardware implementation issues are covered.

**Principals of Neurobiological Signal Processing**

**ISC 6466**

**3 credits**

The study of neural function and cortical electrogenesis, and theories on the origin of EEG covering practical issues of EEG analysis. Auto-covariance, cross-variance, Fourier analysis, autoregressive modeling, and digital filtering are covered.

**Brain Modeling**

**EEL 6035**

**3 credits**

This course deals with the biology and physics of data processing in nervous systems, including the electrochemical processes that are the basis of computation in biological systems, and how nerve cells encode information and communicate in networks. Topics include the processes of learning and memory consolidation, and are covered from the viewpoint of mathematics, physics, and computational models.

**Artificial Intelligence**

**CAP 6635**

**3 credits**

Covers the basic concepts, techniques, and applications of artificial intelligence, representations, search strategies, control, communication, deduction, agents, evolutionary computation and machine learning.

**Machine Perception and Cognitive Robotics**

**EXP 6930**

**3 credits**

Introduction to the foundations of theoretical neuroscience that led to the modern field of deep learning. Similarities and differences between theoretical visual neuroscience and abstract machine learning will be discussed and explored. Students will use state-of-the-art deep learning algorithms to analyze real world data sets from biology, neuroscience and medicine.

**Introduction to Data Science**

**CAP 5768**

**3 credits**

An introductory course that will survey foundational topics in data science and reinforce practical programming skills in the context of data analytics. Students will learn the fundamentals of computational data analysis using statistics and machine learning.

**Data Mining and Machine Learning**

**CAP 6673**

**3 credits**

This course deals with the principles of data mining and machine learning. Topics to be covered include machine learning methods, knowledge discovery and representation, classification and prediction models.

**Bioinformatics: Bioengineering Perspectives**

**BME 6762**

**3 credits**

Introduction to bio- and genetic-engineering. Concepts and definitions of molecular biological terms. Information resources and databases: Proteins and genomes. Biological sequence analysis and applications. Sequence search/analyses tools and protocols. Bioinformatics versus modern information networks and the World Wide Web.

**Research Courses**

**Advanced Research (To be created)****TBD\*****1-6 credits**

This course represents guided laboratory research performed by the trainee primarily in year 2 while students train and work as lab team members in preparation for their advancement to PhD candidacy. Students acquire technical skills, collect, analyze, and interpret experimental data that forms the rationale for their thesis proposal, written in a format compatible with predoctoral fellowship application requirements.

**Dissertation Research (To be created)  
credits****TBD\*****1-9**

This course represents independent laboratory research conducted during dissertation studies. Students manage their own research project to completion. During this period and prior to graduation, students are required to complete and submit to their committee a written thesis and then successfully defend publicly their thesis in front of university faculty, students and staff, with final assessment by the Dissertation Committee.

**\* Course will be created with the approval of the degree by the Board of Governors, based on courses used for the same purpose in other College of Science Doctoral degree programs**

- F. For degree programs in the science and technology disciplines, discuss how industry-driven competencies were identified and incorporated into the curriculum and indicate whether any industry advisory council exists to provide input for curriculum development and student assessment.**

The Hanover Report indicates that in 2019 job postings, communication and data analysis skills were among the most important traits sought by employers in science and technology, along with cooperative team skills, good organization skills, and high self-motivation. This is verified in publications such as “Neuroscience Training for the 21<sup>st</sup> century” (H. Akil et al., 2016, *Neuron*, 90:971- 926), and the online publication “20 Transferable Skills for PhDs”. The latter is authored by Isaiah Hankel PhD and Arunodoy Sur, Ph.D. Dr. Sur is a Technology Licensing Officer in the Office of Research and Technology Transfer at NOVA Southeastern University. This publication addresses the skills needed in the Biotech, Biomed and BioPharm industries. Skills specified in this work include data, time and project management, leadership/mentoring skills, creative problem solving, up-to-date technical skills, and strategic planning. Students develop these skills under the mentorship of faculty members during the course of their training, and when they transition to fully managing their own research project after advancement to PhD candidacy. Training in the areas of Responsible Conduct of Research (RCR) is provided through mentors, FAU RCR workshops, and online courses offered by the national CITI training program. These provide detailed knowledge on research practices required in both academic and corporate environments in terms of conflicts of interest, human and vertebrate animal subjects, safe laboratory practices, data acquisition, management, sharing, and ownership, research misconduct and responsible authorship.

There is no formal industry advisory council that exists to provide input into our curriculum development, however the Society for Neuroscience national Neuroscience Training Committee has developed a set of Core competencies for graduate education (detailed in section 8A) that align with industry competencies and incorporate the skills needed and sought by employers of neuroscience graduates in both the public and private sectors. These, along with recommendations provided in Dr. Sur’s “20 Transferable Skills for PhDs”, were taken into consideration when designing the curriculum for the proposed program, assuring that students will train in communication skills (Scientific Communication course) and analytical skills (Experimental Design or Biostatistics) within their first 2 years in the program. Development of communication skills is also built into the program requirements by the writing of an advancement proposal in the format of a federal grant application, and the public, oral presentation of the proposed dissertation project. In fact, the advancement process is designed to identify those students who have not successfully developed the research skills expected, leading to remediation or dismissal. While enrolled in the PhD program, all students are expected to participate in journal club presentations, present posters or research talks at the Society for Neuroscience annual meetings (or equivalent) and demonstrate the writing skills needed to prepare research papers for publication in high quality journals. All students are required to generate at least one published, peer-reviewed research paper as first author prior to graduation from the program. A paper drawn from key aim(s) of the proposal that has been designated as “in

press" in a peer-reviewed journal satisfies the latter requirement for graduation.

- G. For all programs, list the specialized accreditation agencies and learned societies that would be concerned with the proposed program. Will the university seek accreditation for the program if it is available? If not, why? Provide a brief timeline for seeking accreditation, if appropriate. For degree programs in medicine, nursing, and/or allied health, please identify the courses that meet the requirements in Section 1004.08, Florida Statutes for required patient safety instruction.**

There are no neuroscience accrediting bodies. We have designed the program using the Society for Neuroscience (SFN) Neuroscience Training Committee-identified Core Competencies for graduate students. The Commission on Colleges of the Southern Association of Colleges and Schools (SACSCOC) is the only accreditation agent. In December 2013, SACSCOC reaffirmed Florida Atlantic University's accreditation. According to the SACSCOC website, FAU will seek re-affirmation in 2024.

- H. For doctoral programs, list the accreditation agencies and learned societies that would be concerned with corresponding bachelor's or master's programs associated with the proposed program. Are the programs accredited? If not, why?**

There are no accreditation agencies or learned societies that would be specifically concerned with this. Students with B.Sc. or M.S degrees in areas related to the broader field of Neuroscience are expected to have graduated from FAU or another accredited College or University before being accepted in the PhD program.

- I. Briefly describe the anticipated delivery system for the proposed program (e.g., traditional delivery on main campus; traditional delivery at branch campuses or centers; or nontraditional delivery such as distance or distributed learning, self-paced instruction, or external degree programs). If the proposed delivery system will require specialized services or greater than normal financial support, include projected costs in Table 3 in Appendix A. Provide a narrative describing the feasibility of delivering the proposed program through collaboration with other universities, both public and private. Cite specific queries made of other institutions with respect to shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.**

All NGP Core and Elective courses are taught in traditional lecture rooms on the Boca Raton and Jupiter campuses of FAU. A free shuttle outfitted with Wi-Fi makes 5 runs/day between campuses. Multiple rooms on both campuses support videoconferencing to allow for students on one campus to view live lectures and seminars from the other campus. No off-campus sites are utilized in the NGP.

## **IX. Faculty Participation**

- A. Use Table 2 in Appendix A to identify existing and anticipated full-time (not visiting or adjunct) faculty who will participate in the proposed program through Year 5. Include (a) faculty code associated with the source of funding for the position; (b) name; (c) highest degree held; (d) academic discipline or specialization; (e) contract status (tenure, tenure-earning, or multi-year annual [MYA]); (f) contract length in months; and (g) percent of annual effort that will be directed toward the proposed program (instruction, advising, supervising internships and practica, and supervising thesis or dissertation hours).**

Table 2 in Appendix A lists all full-time faculty associated with the program in Year 1 through Year 5. The following scale is used for estimation in Table 2, **but please note that the rounding function built into the formulaic layout of the BOG-provided tables will show slight differences from below.**

- One faculty member teaching one section of a course primarily for this program, such as teaching one of the Core courses, is projected to receive 12.5% reallocated annual effort.

- One faculty member teaching one section of an existing course with reallocation of seats from other programs, such as teaching one of the Elective courses, is projected to receive 6.25% annual effort.
- One faculty member mentoring a new student or supervising one PhD dissertation is projected to receive 3.75% annual effort.
- One faculty member serving on one of the 3 NGP governance committees is projected to receive 1% annual effort.

**NOTE: The effort could be additive. For example, a faculty member teaching a core course in the program, and also serving on one of the NGP governance committees would have an effort of 13.5% annually (12.5% + 1%).**

- B. Use Table 3-Appendix A to display the costs and associated funding resources for existing and anticipated full-time faculty (as identified in Table 2-Appendix A). Costs for visiting and adjunct faculty should be included in the category of Other Personnel Services (OPS). Provide a narrative summarizing projected costs and funding sources.**

The costs and associated funding resources for existing full-time faculty are provided in Table 3 of **Appendix A**. No visiting or adjunct faculty participate in our program. Core course teaching is covered at 12.5% effort/course. Elective course is covered at 6.25% effort/course. Serving as primary mentor for a Ph.D. student is covered at 3.75% effort/student. Service on one of the 3 governing committees (Steering, Recruitment, Curriculum) is covered at 1% effort. As all courses for the program are already being taught and can accommodate addition of NGP students, all teaching effort costs are reallocated from existing effort support as identified in Table 4, Appendix A. Similarly, support for student mentoring and committee engagement are reallocated from existing support provided to faculty from supporting departments. Thus, no new funding is required to support faculty activity in the NGP as all such funding is reallocated from the college of the respective faculty member.

- C. Provide in the appendices the abbreviated curriculum vitae (CV) for each existing faculty member (do not include information for visiting or adjunct faculty).**

**Appendix J** organizes the CVs of NGP-associated faculty.

- D. Provide evidence that the academic unit(s) associated with this new degree have been productive in teaching, research, and service. Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, as well as qualitative indicators of excellence.**

Evidence of graduate training productivity of the faculty of the supporting Departments (Biological Sciences and Psychology, supporting the Integrative Biology and Experimental Psychology Masters and Doctoral Programs) are shown below (Tables 12-14), along with the training efforts of the Center for Complex Systems and Brain Sciences whose Complex Systems and Brain Sciences Ph.D. program will cease admitting new students with the initiation of the NGP, and with resources for training and service reallocated to the new program. Integrative Biology and Experimental Psychology award both Master's and Doctoral degrees whereas the Complex Systems and Brain Sciences graduate program awards only the Ph.D. Since 2013, Integrative Biology faculty training has resulted in a total of 269 Masters students and 89 Doctoral degrees. Over the same period, Experimental Psychology faculty training has resulted in a total of 91 Masters and 55 Doctoral degrees. Complex Systems and Brain Sciences faculty, which have experienced losses due to departure and retirement, have trained 12 Doctoral students. The lower number of students trained, and the reinvestments in computational and theoretical neuroscience made possible through the NGP were a major reason for the Complex Systems and Brain Sciences Ph.D. program, merging into the NGP, despite its storied history and placement of graduates at major research institutions worldwide. Altogether, however, the faculty of Biological Sciences, Psychology and the Center for Complex Systems and Brain Sciences trained 360 Masters students and 156 Doctoral students, attesting to a significant commitment and productivity of faculty from the College of Science that is sponsoring our program. Considering additions of faculty from the College of Medicine, Engineering and Computer Science, Education and the Wilkes Honors College, as well as Max Planck Florida and Scripps Research Florida, we believe we have a very seasoned faculty available to train students in the NGP.

**Table 12: Biological Science Integrative Biology Graduate Program Productivity**

n, %

BY YEAR, DEGREE LEVEL

Year	2012-2013		2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		2018-2019		2019-2020	
Degree Level	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
⊕ Baccalaureate	296.5	89.4%	370.0	91.6%	397.5	90.0%	394.0	90.8%	379.0	87.1%	380.0	88.4%	430.0	90.1%	438.5	89.8%
⊕ Doctorate	15.0	4.5%	11.0	2.7%	5.0	1.1%	10.0	2.3%	12.0	2.8%	11.0	2.6%	11.0	2.3%	14.0	2.9%
⊕ Masters	20.0	6.0%	23.0	5.7%	39.0	8.8%	30.0	6.9%	44.0	10.1%	39.0	9.1%	36.0	7.5%	36.0	7.4%
Total	331.5	100.0%	404.0	100.0%	441.5	100.0%	434.0	100.0%	435.0	100.0%	430.0	100.0%	477.0	100.0%	488.5	100.0%

**Table 13: Experimental Psychology Graduate Program Productivity**

n, %

BY YEAR, DEGREE LEVEL

Year	2012-2013		2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		2018-2019		2019-2020	
Degree Level	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
⊕ Baccalaureate	329.0	94.3%	376.5	94.7%	362.5	95.0%	417.0	95.6%	459.0	96.0%	469.0	95.9%	475.0	97.1%	462.5	97.1%
⊕ Doctorate	5.0	1.4%	7.0	1.8%	5.0	1.3%	10.0	2.3%	9.0	1.9%	6.0	1.2%	5.0	1.0%	8.0	1.7%
⊕ Masters	15.0	4.3%	14.0	3.5%	14.0	3.7%	9.0	2.1%	10.0	2.1%	14.0	2.9%	9.0	1.8%	6.0	1.3%
Total	349.0	100.0%	397.5	100.0%	381.5	100.0%	436.0	100.0%	478.0	100.0%	489.0	100.0%	489.0	100.0%	476.5	100.0%

**Table 14: Complex Systems and Brain Sciences Doctoral Program Productivity**

n, %

BY YEAR, DEGREE LEVEL

Year	2012-2013		2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		2018-2019	
Degree Level	n	%	n	%	n	%	n	%	n	%	n	%	n	%
⊕ Doctorate	1.0	100.0%	1.0	100.0%	1.0	100.0%	3.0	100.0%	2.0	100.0%	1.0	100.0%	3.0	100.0%
Total	1.0	100.0%	1.0	100.0%	1.0	100.0%	3.0	100.0%	2.0	100.0%	1.0	100.0%	3.0	100.0%

Regarding research productivity, below (Table 15) we tabulate the research awards earned by the faculty of the sponsoring departments and Centers. One can see that the research faculty of the three units ranged from 28-44 funded projects awarded per year, with a recovered research cost of averaging ~\$3M each year. These numbers also do not count the funding obtained by College of Medicine, College of Engineering, College of Education, Wilkes Honors College, Max Planck and Scripps faculty who participate in our program.

**Table 15: Funding obtained by Supporting Departments and Centers FY16-FY29**

Department/Center	FY16		FY17		FY18		FY19		FY20	
	#	Amount	#	Amount	#	Amount	#	Amount	#	Amount
Department of Biological Science	23	\$1,633,126	24	\$1,142,435	29	\$793,405	24	\$1,441,713	24	\$1,575,519

Department of Psychology	4	747,243	5	665,452	13	\$1,003,943	9	1,602,883	12	\$2,027,165
Complex Systems and Brain Sciences Center	1	\$385,008	2	\$385,008	2	\$488,582	3	\$611,841	1	\$149,500
<b>Total</b>	<b>28</b>	<b>\$2,765,377</b>	<b>31</b>	<b>\$2,192,895</b>	<b>44</b>	<b>\$2,285,930</b>	<b>36</b>	<b>\$3,656,437</b>	<b>37</b>	<b>\$3,752,184</b>

Lastly, our analysis of scholarly productivity for I-BRAIN affiliated faculty, across all Colleges, reveals that 130 papers were published in peer-reviewed journals in FY 2020. This number does not include the manuscript productivity from Max Planck Florida and Scripps Research Florida. *In toto*, we believe the funding and publications of our faculty indicate a healthy and growing platform for investment in the NGP and can certainly support the 8-12 students we will admit each year in the first 5 years.

## X. Non-Faculty Resources

- A. Describe library resources currently available to implement and/or sustain the proposed program through Year 5. Provide the total number of volumes and serials available in this discipline and related fields. List major journals that are available to the university's students. Include a signed statement from the Library Director that this subsection and subsection B have been reviewed and approved.**

All of the different FAU campuses have onsite libraries, through which extensive physical and electronic collections are available. The number for Journal Titles that could be categorized as Neuroscience related totals 3,367. A short list of major journals available to our students includes:

<b>Major Neuroscience Journals (see Appendix K for entire list of 3,367 items)</b>
Acta Neuropathologica
Annals of Neurology
Annual Review of Neuroscience
Behavioral and Brain Sciences
Biological Psychiatry
Brain : A Journal of Neurology
Frontiers in Neuroscience
Journal of Neuroscience
Molecular Neurodegeneration
Molecular Psychiatry
Nature Human Behaviour
Nature Neuroscience
Nature Reviews Neuroscience
Neuron
Neuroscience & Biobehavioral Reviews
Progress in Neurobiology
Trends in Cognitive Sciences
Trends in Neurosciences

The complete list of Monographs totals 11,008 (includes print and electronic). The library also provides 61 journal packages drawn from aggregator databases (**Appendix K**).



The FAU libraries also provide our Program students with access to a number of journal titles through aggregator databases such as JSTOR, ProQuest or Academic Search Premier. A list of journal titles related to Data Science and Analytics in excel file (DataRelatedJournals.xls) and a list of aggregator databases such as JSTOR, ProQuest or Academic Search Premier in excel file (RelatedDatabases.xls) are attached. (Please see second attached file.)

**B. Describe additional library resources that are needed to implement and/or sustain the program through Year 5. Include projected costs of additional library resources in Table 3-Appendix A. Please include the signature of the Library Director in Appendix B.**

No additional resources are being requested, as the needed materials are already in place.

**C. Describe classroom, teaching laboratory, research laboratory, office, and other types of space that are necessary and currently available to implement the proposed program through Year 5.**

**Classrooms:** Collectively, across all FAU campuses, there are 110 general classrooms and 210 laboratory classrooms, including wet labs, studio labs, and computer labs. Eighty two percent of the classrooms are supported by the FAU Office of Information Technology (OIT) and include projection cameras and HD screens, document cameras, a teaching podium equipped with a computer with monitor, DVD drive, microphone, and hand-held remote, as well as internet connectivity and connections for USB drives and laptop computers. AV staff from OIT assist faculty when classes are in session and can correct technical problems that may arise. Additionally, there are 31 classrooms equipped for OIT-managed live videoconferencing of lectures, seminars, student presentations and meetings to rooms located on multiple campuses simultaneously.

**Teaching Laboratories:** Two courses in our curriculum taught by Dr. Ken Dawson-Scully (Practical Cell Neuroscience (BSC 6417C) and Neurophysiology (PCB 6835C) provide computational and wet laboratory training respectively in the recording of electrical activity produced by neuronal cells and excitability proteins. For Practical Cell Neuroscience, there are 2 computer labs: 1 in Boca Raton and 1 in Jupiter. Each has over 20 computer workstations for doing neural excitability and signaling simulations. For neurophysiology, there are also 2 labs, 1 on the Boca Raton campus and 1 on the Jupiter campus. Each lab has 10 recording rigs for extracellular recording and analysis of action potentials from earthworm and cricket neurons. These laboratories are in place and fully equipped and thus resources are reallocated for the NGP curriculum. All other classes are not taught in a laboratory setting as students received extensive laboratory training within the labs of their mentor and campus collaborators (including Scripps and Max Planck) during their dissertation studies.

**Offices:** All faculty at FAU, Max Planck Florida and Scripps are provided with personal offices where they work on manuscripts, pursue data analysis and meet with lab members, other faculty and trainees. With respect to the oversight of the NGP, I-BRAIN has a three-room suite on the Boca campus where the Institute-supported educational activities are overseen. The suite has an office for an Education Assistant and work-study student assistant, along with an adjoining conference room and a storage room. A full-time Education Assistant, Ms. Linda Petersen, works in this office and oversees the activities of the GNTP, which we will terminate with the initiation of the NGP with Ms. Petersen assuming the Assistant role for the new program. Thus, no new office resources are needed to provide for the new program.

**Other Space:** The practical training of students at research intensive universities is a combination of the work they do in their mentor's laboratory and the work they do in shared resource labs termed Core Facilities. These facilities are often run by Institutes so that the costs and usage of instrumentation can be spread out across a broader community than they would be if managed at the Department or College level. Many students in the NGP will make use of Core laboratories supported by I-BRAIN, Scripps and Max Planck during the course of their research. These laboratories, overseen by Ph.D. level Core Directors and Managers, receive support on a fee for use basis from researchers, are maintained by the respective Institutes. At FAU, I-BRAIN oversees the Cell Imaging Core facility, with locations on the Boca Raton and Jupiter campuses (<http://www.fau.edu/research/cores/cellimagingcore/>). These facilities provide high end microscopy equipment for cellular neural imaging as well as data analysis workstations equipped with image

analysis software (e.g. Amira 3D, Neurolucida). The Core provides multiple Nikon confocal and two photon microscopes as part of I-BRAIN's Nikon Center of Excellence. Training and experimental consultation is provided by a Ph.D. level Core Manager, Dr. Jana Boerner. I-BRAIN also supports the Neurobehavior Core laboratory in Jupiter under the direction of Core Manager Dr. Maureen Hahn. The Core provides training and instrumentation and 5 isolated testing rooms that allow trainees and mentors to perform semi- and fully-automated behavioral experiments on mice, many of whom carry brain disease associated mutations. Invaluable experience that can help drive drug discovery can be obtained through working with these models. Both the Cell Imaging Core and the Neurobehavior Core will be relocated and expanded with the opening of the new Neuroscience Building to open in Jupiter in the Winter of 2022. No costs are born by the NGP in having students work in these facilities. The Core facilities at Scripps Florida include laboratories for High Throughput Drug Screening, X-ray Crystallography, Mass Spectrometry and Proteomics, Neurobehavior, and Fluorescence-Activated Cell Sorting. At Max Planck Florida, Cores exist for Recombinant Viral Vector Production and for Electron Microscopy. All Cores at Scripps Florida and Max Planck Florida are accessible to NGP students with Core access and user fees equivalent for FAU, Scripps Florida and Max Planck scientists, per an established MOU. Together, these shared resources represent tens of millions of dollars in research infrastructure investments. The technical skill of the Core Managers and Core staff represent a significant asset for the training of NGP students who need these technologies in their research.

- D. Describe additional classroom, teaching laboratory, research laboratory, office, and other space needed to implement and/or maintain the proposed program through Year 5. Include any projected Instruction and Research (I&R) costs of additional space in Table 3-Appendix A. Do not include costs for new construction because that information should be provided in response to X (E) below.**

No additional classroom, research or office space is needed. Current space is adequate for program teaching and research activities. Core and elective courses in the program are already available and are taught by FAU faculty as part of other degree programs. Active research faculty in the program currently have their own research laboratories where students from existing programs are being trained. Core facilities and specialized laboratory facilities (Confocal Imaging Core, Animal Behavior Core, FACS facility, Core Facilities at Max Planck Florida and Scripps Florida) are already established.

- E. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Table 3-Appendix A includes only Instruction and Research (I&R) costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase as a result of the program, describe and estimate those expenses in narrative form below. It is expected that high enrollment programs in particular would necessitate increased costs in non-I&R activities.**

No new capital expenditures are anticipated, and levels of enrollment are not expected to lead to increased costs in non-I&R activities.

- F. Describe specialized equipment that is currently available to implement the proposed program through Year 5. Focus primarily on instructional and research requirements.**

Much of the training of NGP students that utilizes specialized equipment involves equipment located in each mentor's laboratory and is based on the particular research specialization of that lab, with specific item lists available on demand. More generally, these tools include equipment for bacterial and mammalian cell culture, worm and fly husbandry, brain sectioning, immunostaining, mRNA and protein extraction, light and fluorescence microscopy, brain slice physiology, in vivo optogenetics, fiber photometry and chronoamperometry, gel electrophoresis, scintillation spectrometry, DNA and protein quantitation, high-speed and ultracentrifugation, multi-electrode array recording, EEG, eye-tracking, and functional near-infrared imaging (fNIRS). These tools are found in many labs on the various campuses where NGP students pursue their dissertation research. More expensive instrumentation that is shared university-wide is placed in Core facilities, including 2 operated by I-BRAIN that many in the NGP will utilize. The **FAU Cell Imaging Core**, with locations in the Boca Raton College of Medicine facility, and the other in Jupiter with I-BRAIN managed facilities, provides

equipment for confocal microscopy (2 Nikon A1R platforms, upright and inverted platforms, one with total internal reflectance capabilities), a super-resolution augmented confocal microscopy system (Nikon NSIM E/A1R-HD) a two-photon microscopy system for live animal cell imaging (Nikon A1R MP). Additionally, the Core houses a Keyence automated fluorescence microscope and a Neurolucida 360 workstation. The **FAU Neurobehavior Core** internal reflectance capabilities provides automated instrumentation to analyze mouse behavior, with instrumentation for assessing sensory, motor, cognitive and anxiety behaviors. Equipment includes 20 Med Associates Activity Chambers and associated software with chamber inserts to allow for testing of Conditioned Place Preference and Light Dark Preference, 6 Med Associates Operant Chambers, 10 Lafayette Touch Screen Operant chambers, a Morris Water Maze, an Elevated Plus Maze, a Y Maze, an Oasis Maze, a T-maze, a Novel Object Recognition Chamber, a 3-Chamber Apparatus for Social Behavior testing 4 Fear Conditioning Chambers, 8 Tail Suspension Chambers, a Rotarod, a Tube Test for Social Dominance. All rooms where testing is conducted have ceiling mounted video cameras with video analyzed using Ethovision software. An incubator for performing maternal separation studies is also present. At **Scripps Florida**, a collection of Cores hold equipment for Robotic Archiving and Dispensing of Compounds and Fluorescence based cell recording for High Throughput Drug Screening, Liquid Chromatography coupled Mass Spectrometry for analysis of small molecules, peptides, lipids and proteins, Fluorescence-Activated Cell Sorting (FACS), Behavioral Testing of Rodents, Tissue Sectioning and Histological Analysis, Urinary and Fecal Collection for Whole Animal Metabolism Analysis, and for Cell Metabolism and Respirometry. At **Max Planck Florida**, equipment is available for automated sectioning of brain samples for EM analysis and micro-connectome reconstructions, electron microscopy, confocal microscopy and multi-photon microscopy, and coupled light and electron microscopy (CLEM). The Institute also offers a Recombinant Viral Core for the preparation of viral vectors used to transduce brain cells with reporter genes in vivo and houses relevant molecular tools for virus construction and production. Finally, Max Planck Florida houses a state-of-the art scientific instrumentation machine shop that can tailor instrumentation to the specialized experimental needs, construct custom instrumentation and make repairs at low cost on sensitive instrumentation. All of the equipment mentioned above is present and no costs are incurred by the program to allow NGP students or their mentors to access these tools.

**G. Describe additional specialized equipment that will be needed to implement and/or sustain the proposed program through Year 5. Include projected costs of additional equipment in Table 3-Appendix A.**

No additional specialized equipment is needed to implement or sustain the proposed program through year 5.

**H. Describe any additional special categories of resources needed to implement the program through Year 5 (access to proprietary research facilities, specialized services, extended travel, etc.). Include projected costs of special resources in Table 3-Appendix A.**

There are no additional special categories of resources needed to implement the program through year 5.

**I. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5. Include the projected costs in Table 3-Appendix A.**

In Year 1, 8 GTAs will be funded totally from reallocated E&G sources from the College of Science and I-Brain at a stipend of \$30,000 each annually. These 8 trainees all receive their stipends in the Fall and Spring Semesters reallocated from I-BRAIN. In the Summer Semester, funding for 4 GTAs is provided by reallocated funds from I-BRAIN and 4 GTAs are provided reallocated funds by the College of Science. Table 4, Appendix A shows the GTA reallocation split between the College of Science and I-Brain. No scholarships or fellowships are anticipated for Year 1. At year 5, 48 students will be funded at \$30,000 each (\$1,440,000 total) with reallocated E&G funds contributing approximately \$809, 550 and grants and contracts contributing \$390, 450.

**J. Describe currently available sites for internship and practicum experiences, if appropriate to the program. Describe plans to seek additional sites in Years 1 through 5.**

No internships or practicum experiences are required for FAU NGP trainees and none are planned to be added. However, FAU offers many optional professional and technical skills workshops that provided NGP trainees and their mentors with opportunities to extend their educational program into areas related to their ongoing science and their future professional needs. These workshops (not a comprehensive list) and symposia will be described in the weeklong Bootcamp that precedes the entry of students into their first Research Rotation. All workshops are held on the campuses of FAU, Max Planck Florida or Scripps Research Florida unless otherwise noted. No plans are currently in place to add other workshops or sites.

**Presenting Scholarly Work:** This annual 2hr workshop sponsored by the FAU Graduate College advises graduate students on preparing and presenting scholarly work at conferences, seminars, and other academic settings. Topics covered include following presentation format/guidelines, tailoring presentations/talks to a specified audience, presenting arguments concisely and appropriately, selecting the best media for presentations, and producing handouts and other visuals. Participants are encouraged to bring 15-minute presentations or posters for friendly, constructive feedback during the latter part of the workshop.

**Producing Scholarly Publications:** This annual 2hr workshop offered by the FAU Graduate College, provides guidance to graduate students on the writing of conference and journal papers, strategies for converting seminar papers and/or dissertation chapters into publishable articles, creating a web presence, and producing book reviews and editorials. Participants learn best practices for managing writing time as a graduate student; systems for planning, composing, and revising written work; and strategies for seeking publication.

**Developing Theses & Dissertation:** This annual, 2hr workshop seeks to help graduate students plan, research, write, revise and edit a thesis or dissertation. Presentations discuss academic timelines, committee selection, proposal planning, and writing cycles. Participants also learn note-taking strategies and technologies for documenting research, strategies for composing a proposal, and best practices for revising, editing and polishing the final product.

**Workshop on Beyond the Ph.D.: Becoming a Postdoc:** This annual 2hr workshop, offered by the FAU Office of Postdoctoral Affairs and the FAU Graduate College provides graduate students with an opportunity to hear from faculty and current post-doctoral fellows from various disciplines and backgrounds who can provide first-hand accounts of their paths and share what life is like as a postdoc today.

**Graduate Professional Development Workshops:** These workshops, offered each Fall and Spring Semester, and sponsored by the FAU Graduate College and the Office of Counseling and Psychological Services, present tools and opportunities that promote Healthy Communication, Stress Management, and Finding Balance in Graduate School and Work Life.

**Three Minute Thesis:** This exciting competition, sponsored by the FAU Graduate College, challenges FAU graduate students to present their research in only 3 minutes. Students compete in a preliminary round specific to their discipline; the First Place, Runner-Up, Second Runner-Up, and People's Choice winners from each heat advance to the Championship. Scholarship prizes are awarded to both Preliminary Round and Championship winners. Audience members determine the People's Choice winner by electronic ballot at each preliminary round and at the Championship. These activities build cohesion among the graduate student community and provide vital opportunities to develop advanced speaking skills that can assist trainees in future conference presentations and professional interviews.

**Introduction to Technology Transfer and Intellectual Property Workshop:** This 1 hr workshop held annually and provided by the Office of Technology Development and the Division of Research, provides an introduction to the Office of Technology Development and the services it offers to FAU faculty, staff and students. Topics covered include the different types of intellectual property and the fundamentals technology transfer process.

**Legal Issues in University Research Workshop:** This 1 hr workshop, held annually and provided by the Office of Technology Development and the Division of Research, provides students and faculty with information on emerging issues in intellectual property law that affect university research. Topics covered include how public disclosures impact intellectual property rights, best practices for licensing intellectual property for faculty start-ups, and protecting intellectual property from foreign threats.

**Commercializing University Research Workshop:** This 1 hr workshop, held annually and provided by the Office of Technology Development and the Division of Research, addresses emerging issues in technology commercialization that affect university research. Topics covered include how university

researchers can work with companies, differences between industry-sponsored research and federally-funded research, and tips for faculty start-up companies.

**FAU Entrepreneur Bootcamp:** Hosted by the Adams Center for Entrepreneurship in the FAU College of Business, the annual Entrepreneur Boot Camp is a fast-paced certificate course empowering promising entrepreneurs and ambitious students who wish to apply their skills in the Business world with the tools to write a successful business plan, find financial backing and design a blueprint for success. Upon completion of the Boot Camp, students will be prepared to enter the prestigious FAU Business Plan Competition or the FAU Tech Runway Launch Competition and compete to fund their own business based on ideas and methods developed in the laboratory.

**University Library Workshops:** Each semester, FAU students, staff and faculty are invited to attend FAU Libraries workshops on research and information sources. Workshops include: APA Boot Camp, Effective Job Searches, Understanding Google Scholar, Being Money-Money Wise as a Student: Personal Finance and Spending, and Being Money-Wise After College: Saving, Investing & Credit.

**Postdoc Career Talks:** These lectures, organized by the FAU Postdoctoral Association, provide an online forum for external, invited speakers to talk to graduate students about their careers and professional choices. Graduate students and postdoctoral fellows obtain an opportunity to hear about personal experiences, learn about different career paths, and get to ask questions on the “do’s” and “don’t’s” of job searches, interviews and position searches.

**Research Café:** These 1 hr sessions hosted by the Division of Research represent an interdisciplinary research exchange for faculty and students in an informal setting. Two faculty from different disciplines are invited to provide an overview of their research, how collaborations can be formed and their impact on science.

**Research Technology Conversations:** These monthly 1hr workshops, organized by the FAU Division of Research, invite faculty and students to learn about the type of experiments that can be pursued by FAU’s Research Core Facilities. At each monthly event, a different Core Manager describes recent experiments that were performed using Core resources and under the guidance of Core staff. These presentations are aimed at challenging faculty and students to design experiments that they may not have thought of previously, and, for trainees to consider how careers post-PhD can be directed toward research support services where Ph.D. level scientists manage high-tech service facilities in academia and industry.

**Research Development Workshops:** Multiple 1hr workshops throughout the year, hosted by the FAU Division of Research, present students and faculty with an understanding of FAU Eligibility for funding as a 501c3 vs. nonprofit organization, forging and funding research collaborations and managing collaborative projects, pursuing international collaborations and engaging corporate/industry entities in collaborative research, and the opportunities available to researchers as trainees and mentors at a Hispanic and minority serving institution.

**Workshop on Light Microscopy & Cellular Imaging in Life Sciences:** An intensive, three-day workshop in light microscopy for graduate students and postdocs in the life sciences at FAU taught by FAU faculty and staff of I-BRAIN. The course will help students understand the theory of image formation and give an introduction to different fluorescent and laser scanning techniques. Practical sessions will include hands-on demonstration of imaging systems available in the FAU Cell Imaging Core. The course also involves demonstrations and presentation by vendors of imaging tools and instruments, offering networking opportunities and discussions with PhD level scientists as to career options post-graduation.

**Workshop on Use of Nikon Elements software for Image Acquisition, Manipulation and Presentation:** This intensive 2-day course offered through the I-BRAIN Nikon Center of Excellence provides training on aspects of Elements software through exercises demonstrated on 25 workstations. Workshop is taught at a graduate level for users of Nikon widefield, confocal and multi-photon microscopes running Elements software. Workshop is taught by Nikon Field support staff and education specialists.

**iPSC Workshop: CRISPR-Cas9 Mediated Genome Editing:** A 4-day workshop, sponsored by the FAU College of Medicine Disease Modeling Facility, covers the use of CRISPR-Cas9 mediated genome editing in iPSC and transformed cell lines. This 6hr workshop, offered over 4 consecutive weeks with 1.5hrs each session, designed for trainees and faculty, introduces the history of CRISPR-Cas9 approaches and the strategies most often employed for the editing of cell lines and iPSC cells, including the design of gRNAs and rescue templates, the caveats that must be considered in editing experiments, the methods used to

verify targeted vs off-targeted editing and how CRISPR-based approaches are used *in vivo*. Hands on training is available at the end of the 4 workshop sessions. The workshop is of no cost to trainees.

**Max Planck Neuroimaging Course:** This competitive, 12-day annual course taught at Max Planck Florida by local and invited neuroscientists is an intensive and comprehensive laboratory-oriented course focuses on applying sophisticated imaging techniques to modern neuroscience research. The objective of this imaging course is for the trainee to gain exposure to modern imaging tools from the principles of optics to applications in modern neuroscience. The course is formatted to include lectures in the morning and laboratory sections in the afternoon and evening. Students rotate through all laboratory sections and focus on one section (and one optional section) for the remainder of the course.

**Max Planck Sunposium Conference:** The Max Planck Florida *Sunposium*, a biennial conference, brings hundreds of the world's most esteemed neuroscience researchers together for a meeting in West Palm Beach to highlight the challenges, latest findings, and advances that address some of the most complex issues at the forefront of understanding neural circuits. Researchers from all over the world attend *Sunposium* to collaborate in understanding neural circuits, which underlie sensory processing, memory, and more. Along with elucidating basic behaviors and processes, understanding neural circuits will help researchers develop and improve treatments for neurological diseases and disorders that arise when these circuits aren't working properly. While many speakers and attendees are neuroscientists, some come from other fields such as biochemistry and physics – disciplines that cross paths with and enhance basic neuroscience research. This basic neuroscience research has the potential to put the scientific world on track to dramatically change human health – and educational conferences such as Sunposium encourage a collaborative, problem-solving approach to some of the most pressing questions and challenges in the field. Graduate students and postdoctoral fellows are provided with discounted admission and present posters of their latest research for discussion with their peers, local scientists and other premier researchers, including Nobel Laureates.

**Scripps Florida Core Workshops:** Throughout the year, Scripps Research Florida Core Facilities offer workshops in use of the latest technologies in bioscience, including neuroscience. These events, held at the Scripps Research site on the FAU MacArthur campus in Jupiter, FL, are open to all FAU students and faculty. Workshops feature the tools and research assistance provided by the High-Throughput Screening Core, the Flow Cytometry Core, the Genomics Core, the Histology Core, the Mass Spectrometry and Proteomics Core, the Metabolic Core, and the X-ray Crystallography and Cryo-EM Facility. These high-technology resources provide significant additions to the thesis projects of current FAU graduate students that will remain a feature with the NGP.

**FAU-Memorial Health Systems (MHS) Partnership:** In November of 2020, FAU announced a formal Research Partnership to Advance Clinical Trials with MHS in Broward County. The partnership combines their expertise and resources in clinical research, clinical trials, basic research and translational biomedical research. Its mission: to develop state-of-the-art research tools and discover new knowledge to benefit patients and lead advances in patient care. Graduate students often benefit from short internships with clinical laboratories to learn about the translation of biomedical discoveries and to understand dimensions of clinical research, efforts that often enhance competitiveness for graduate fellowships. MHS has over 150 active clinical trials that can serve as opportunities for students to inspect and learn the clinical research process.

Source of Students (Non-duplicated headcount in any given year)*	Year 1 HC	Year 1 FTE	Year 2 HC	Year 2 FTE	Year 3 HC	Year 3 FTE	Year 4 HC	Year 4 FTE	Year 5 HC	Year 5 FTE
Upper-level students who are transferring from other majors within the university**	0	0	0	0	0	0	0	0	0	0
Students who initially entered the university as FTIC students and who are progressing from the lower to the upper level***	0	0	0	0	0	0	0	0	0	0
Florida College System transfers to the upper level***	0	0	0	0	0	0	0	0	0	0
Transfers to the upper level from other Florida colleges and universities***	0	0	0	0	0	0	0	0	0	0
Transfers from out of state colleges and universities***	0	0	0	0	0	0	0	0	0	0
Other (Explain)***	0	0	0	0	0	0	0	0	0	0
<b>Totals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

\* List projected annual headcount of students enrolled in the degree program. List projected yearly cumulative ENROLLMENTS instead of admissions.

\*\* If numbers appear in this category, they should go DOWN in later years.

\*\*\* Do not include individuals counted in any PRIOR CATEGORY in a given COLUMN.



<b>Source of Students (Non-duplicated headcount in any given year)*</b>	<b>Year 1 HC</b>	<b>Year 1 FTE</b>	<b>Year 2 HC</b>	<b>Year 2 FTE</b>	<b>Year 3 HC</b>	<b>Year 3 FTE</b>	<b>Year 4 HC</b>	<b>Year 4 FTE</b>	<b>Year 5 HC</b>	<b>Year 5 FTE</b>
Individuals drawn from agencies/industries in your service area (e.g., older returning students)	0	0	0	0	0	0	0	0	0	0
Students who transfer from other graduate programs within the university**	0	0	0	0	0	0	0	0	0	0
Individuals who have recently graduated from preceding degree programs at this university	1	1	2	2	3	3	4	4	5	5
Individuals who graduated from preceding degree programs at other Florida public universities	2	2	4	4	7	7	10	10	13	13
Individuals who graduated from preceding degree programs at non-public Florida institutions	1	1	2	2	3	3	4	4	6	6
Additional in-state residents***	0	0	0	0	0	0	0	0	0	0
Additional out-of-state residents***	0	0	0	0	0	0	0	0	0	0
Additional foreign residents***	0	0	0	0	0	0	0	0	0	0
Other (Explain)***	4	4	8	8	13	13	18	18	24	24
<b>Totals</b>	<b>8</b>	<b>8</b>	<b>16</b>	<b>16</b>	<b>26</b>	<b>26</b>	<b>36</b>	<b>36</b>	<b>48</b>	<b>48</b>

\* List projected annual headcount of students enrolled in the degree program. List projected yearly cumulative ENROLLMENTS instead of admissions.

\*\* If numbers appear in this category, they should go DOWN in later years.

\*\*\* Do not include individuals counted in any PRIOR category in a given COLUMN.

Faculty Code	Faculty Name or "New Hire" Highest Degree Held Academic Discipline or Specialty	Rank	Contract Status	Initial Date for Participation in Program	Mos. Contract Year 1	FTE Year 1	% Effort for Prg. Year 1	PY Year 1	Mos. Contract Year 5	FTE Year 5	% Effort for Prg. Year 5	PY Year 5
A	Khamoui, Andy, Ph.D. Exercise Sci & Health Promotion	Asst. Prof.	earning	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.0375	0.03
A	Vertes, Robert, Ph.D. Psychology	Professor	Tenured	Spring 2022	9	0.75	0.13	0.10	9	0.75	0.1625	0.12
A	Varela, Carmen, Ph.D. Psychology	Asst. Prof.	earning	Spring 2022	9	0.75	0.13	0.09	9	0.75	0.225	0.17
A	Maniaci, Michael, Ph.D. Psychology	Asst. Prof.	earning	Spring 2022	9	0.75	0.13	0.09	9	0.75	0.13	0.09
A	Godenschwege, Tanja, Ph.D. Biological Sciences	Professor	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.1725	0.13
A	Wu, Jang Yen Biomedical Science	Professor	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.13	0.13
A	Dawson-Scully, Ken Biological Science	Professor	Tenured	Spring 2022	9	0.75	0.11	0.08	9	0.75	0.11	0.08
A	Claiborne, Brenda, Ph.D Biological Science	Professor	Tenured	Spring 2022	9	0.75	0.06	0.05	9	0.75	0.06	0.05
A	Li, Zhongwei, Ph.D. Biomedical Science	Professor	Tenured	Spring 2022	12	1.00	0.01	0.01	12	1.00	0.07	0.07
A	Neelakantaswamy, P, Ph.D. Comp, Elec Eng & Comp Sci	Professor	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.06	0.05
A	Assis, Raquel, Ph.D. Comp, Elec Eng & Comp Sci	Assistant Prof.	Tenure-earning	Spring 2022	9	0.75	0.06	0.05	9	0.75	0.06	0.05
A	Dr. Andrew Oleinikov, Biomed Sci Bioemdcial Science	Professor	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.06	0.06
A	Guthrie, Kathleen, Ph.D. Biomedical Science	Assoc. Prof.	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.26	0.26
A	Shen, Wen, Ph.D.	Assoc. Prof.	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.06	0.06

	Biomedical Science											
A	Tao, Rui, D.D.M., Ph.D.Ph.D. Biomedical Science	Assoc Prof.	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.06	0.06
A	Isgor, Ceylan Biomedical Science	Assoc. Prof.	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.10	0.10
A	Wei, Jianning, Ph.D. Biomedical Science	Assoc. Prof.	Tenured	Spring 2022	12	1.00	0.04	0.04	12	1.00	0.0375	0.04
A	van Praag, Henriette, Ph.D. Biomedical Science	Assoc. Prof.	Tenured	Spring 2022	12	1.00	0.04	0.04	12	1.00	0.1	0.10
A	Quan, Ning, Ph.D. Biomedical Science	Professor	Tenured	Spring 2022	12	1.00	0.01	0.01	12	1.00	0.11	0.11
A	Bressler, Steven, Ph.D. Psychology	Professor	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.06	0.05
A	Hong, Sang, Ph.D. Psychology	Assoc. Prof.	Tenured	Spring 2022	9	0.75	0.06	0.05	9	0.75	0.1	0.08
A	Blakely, Randy Biomedical Science	Professor	Tenured	Spring 2022	12	1.00	0.05	0.05	12	0.75	0.125	0.09
A	Anzures, Gizelle, Ph.D. Psychology	Assist. Prof.	Tenure-earning	Spring 2022	9	0.75	0.04	0.03	9	0.75	0.10	0.08
A	Wolgin, David, Ph.D. Psychology	Professor	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.06	0.05
A	Sheremata, Summer, Ph.D. Psychology	Assist. Prof.	Tenure-earning	Spring 2022	9	0.75	0.06	0.05	9	0.75	0.10	0.08
A	Rosselli, Monica, Ph.D. Psychology	Professor	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.0475	0.04
A	Hahn, William, Ph.D. Mathematics	Assist. Prof.	Tenure-earning	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.10	0.08
A	Zhu, Xingquan, Ph.D. Comp, Elec Eng & Comp Sci	Professor	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.07	0.05

A	Alexander, William, Ph.D. Psychology	Assist. Prof.	Tenure-earning	Spring 2022	9	0.75	0.11	0.08	9	0.75	0.11	0.08
A	Pashaie, Ramin, Ph.D. Comp, Elec Eng & Comp Sci	Assoc Prof.	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.10	0.08
A	Marques, Oge, Ph.D. Comp, Elec Eng & Comp Sci	Professor	Tenured	Spring 2022	9	0.75	0.0625	0.05	9	0.75	0.06	0.05
A	Barenholtz, Elan, Ph.D. Psychology	Assoc Prof.	Tenured	Spring 2022	9	0.75	0.0725	0.05	9	0.75	0.11	0.08
A	Ghoraani, Behnaz, Ph.D. Comp, Elec Eng & Comp Sci	Assoc. Prof.	Tenured	Spring 2022	9	0.75	0.04	0.03	9	0.75	0.04	0.03
A	Danesh, Ali, Ph.D. Comm Sciences and Disorders	Professor	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.0475	0.11
A	Porcaro, Connie, Ph.D. Comm Sciences and Disorders	Assoc. Prof.	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.06	0.05
A	Wilcox, Teresa, Ph.D. Psychology	Professor	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.04	0.03
A	Murphey, Rod, Ph.D. Biological Sciences	Professor	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.04	0.03
A	Robishaw, Janet Biomedical Science	Professor	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.0375	0.04
A	Milton, Sarah, Ph.D. Biological Sciences	Assoc. Prof.	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.04	0.03
A	Toll, Lary, Ph.D. Biomedical Science	Assist. Prof.	Tenure-earning	Spring 2022	12	1.00	0.01	0.01	12	1.00	0.0475	0.05
A	Carvelli, Liucia, Ph.D. WHC Math and Sciences	Assoc. Prof.	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.05	0.04
A	Kowalko, Johanna, Ph.D. WHC Math and Sciences	Assist. Prof.	Tenure-earning	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.085	0.06
A	Duboue, Erik, Ph.D. WHC Math and Sciences	Assist. Prof.	Tenured	Spring 2022	9	0.75	0.04	0.03	9	0.75	0.0375	0.03
A	Keene, Alex, Ph.D. Biological Science	Professor	Tenured	Spring 2022	9	0.75	0.04	0.03	9	0.75	0.075	0.06

A	Stackman, Robert, Ph.D. Psychology	Ptofessor	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.04	0.03
A	Jia, Kailiang Biological Sciences	Assoc. Prof.	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.01	0.01
A	Andersen, Rindy, Ph.D. Biological Sciences	Assist. Prof.	Tenure- earning	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.04	0.03
A	Fields, Gregg, Ph.D. Chemistry and Biochemistry	Professor	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.04	0.04
A	Grant, Patrick, Ph.D. Biomedical Science	Assoc. Prof.	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.04	0.04
A	Prentice, Howard, Ph.D. Biomedical Science	Professor	Tenured	Spring 2022	12	1.00	0.01	0.01	12	1.00	0.01	0.01
A	Kelso, A.J. Scott, Ph.D. Psychology	Professor	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.01	0.01
A	Kersten, Alan, Ph.D. Psychology	Assoc. Prof.	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.04	0.03
A	Jones, Nancy, Ph.D. Psychology	Assoc. Prof.	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.0475	0.04
A	Cudic, Predrag, Ph.D. Chemistry and Biochemistry	Professor	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.04	0.03
A	Du, Deguo, Ph.D. Chemistry and Biochemistry	Assoc. Prof.	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.04	0.03
A	Macleod, Greg, Ph.D, WHC Math and Sciences	Assoc. Prof.	Tenured	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.0475	0.04
A	Ranji, Mahsa, Ph.D. Comp, Elec Eng & Comp Sci	Assoc. Prof.	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.0475	0.04
A	Engeberg, Erik, Ph.D. Ocean and Mech Engineering	Assoc. Prof.	Tenured	Spring 2023	9	0.00	0.00	0.00	9	0.75	0.0475	0.04
A	Emmanuelle Tognoli, Ph.D. Psychology	R. Assoc. Prof.	Research	Spring 2022	9	0.75	0.01	0.01	9	0.75	0.0475	0.04
A	Marc Kantorow, Ph.D. Biomedical Science	Professor	Tenured	Spring 2023	12	0.00	0.00	0.00	12	1.00	0.08	0.08
	<b>Total Person-Years (PY)</b>							<b>1.11</b>				<b>3.55</b>

Faculty Code	Code Description	Source of Funding	PY Workload by Budget Classification		
			Year 1		Year 5
A	Existing faculty on a regular line	Current Education & General Revenue	1.10		3.55
B	New faculty to be hired on a vacant line	Current Education & General Revenue	0.00		0.00
C	New faculty to be hired on a new line	New Education & General Revenue	0.00		0.00
D	Existing faculty hired on contracts/grants	Contracts/Grants	0.00		0.00
E	New faculty to be hired on contracts/grants	Contracts/Grants	0.00		0.00
F	Existing faculty on endowed lines	Philanthropy & Endowments	0.00		0.00
G	New faculty on endowed lines	Philanthropy & Endowments	0.00		0.00
H	Existing or New Faculty teaching outside of regular/tenure-track line course load	Enterprise Auxiliary Funds	0.00		0.00
Overall Totals for			1.10		3.55

Budget Line Item	Reallocated Base* (E&G) Year 1	Enrollment Growth (E&G) Year 1	New Recurring (E&G) Year 1	New Non-Recurring (E&G) Year 1	Contracts & Grants (C&G) Year 1	Philanthropy/Endowments Year 1	Enterprise Auxiliary Funds Year 1	Subtotal Year 1	Continuing Base** (E&G) Year 5	New Enrollment Growth (E&G) Year 5	Other*** (E&G) Year 5	Contracts & Grants (C&G) Year 5	Philanthropy/Endowments Year 5	Enterprise Auxiliary Funds Year 5	Subtotal Year 5
Faculty Salaries and Benefits	139,946	0	0	0	0	0	0	\$139,946	576,862	0	0	0	0	0	\$576,862
A & P Salaries and Benefits	66,738	0	0	0	0	0	0	\$66,738	66,738	0	0	0	0	0	\$66,738
USPS Salaries and Benefits	0	0	0	0	0	0	0	\$0	0	0	0	0	0	0	\$0
Other Personal Services	0	0	0	0	0	0	0	\$0	0	0	0	0	0	0	\$0
Assistantships & Fellowships	240,000	0	0	0	0	0	0	\$240,000	1,049,550	0	0	390,450	0	0	\$1,440,000
Library	0	0	0	0	0	0	0	\$0	0	0	0	0	0	0	\$0
Expenses	20,000	0	0	0	0	0	0	\$20,000	20,000	0	0	0	0	0	\$20,000
Operating Capital Outlay	0	0	0	0	0	0	0	\$0	0	0	0	0	0	0	\$0
Special Categories	0	0	0	0	0	0	0	\$0	0	0	0	0	0	0	\$0
<b>Total Costs</b>	<b>\$466,684</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$466,684</b>	<b>\$1,713,150</b>	<b>\$0</b>	<b>\$0</b>	<b>\$390,450</b>	<b>\$0</b>	<b>\$0</b>	<b>\$2,103,600</b>

\*Identify reallocation sources in Table 3.

\*\*Includes recurring E&G funded costs ("reallocated base," "enrollment growth," and "new recurring") from Years 1-4 that continue into Year 5.

\*\*\*Identify if non-recurring.

#### Faculty and Staff Summary

Total Positions	Year 1	Year 5
Faculty (person-years)	1.10	3.55
A & P (FTE)	1	1
USPS (FTE)	0	0

#### Calculated Cost per Student FTE

	Year 1	Year 5
Total E&G Funding	\$466,684	\$1,713,150
Annual Student FTE	8	48
E&G Cost per FTE	\$58,336	\$35,691



**Table 2 Column Explanations**

Reallocated Base* (E&G)	1	E&G funds that are already available in the university's budget and will be reallocated to support the new program. Please include these funds in the Table 3 – Anticipated reallocation of E&G funds and indicate their source.
Enrollment Growth (E&G)	2	Additional E&G funds allocated from the tuition and fees trust fund contingent on enrollment increases.
New Recurring (E&G)	3	Recurring funds appropriated by the Legislature to support implementation of the program.
New Non-Recurring (E&G)	4	Non-recurring funds appropriated by the Legislature to support implementation of the program. Please provide an explanation of the source of these funds in the budget section (section III. A.) of the proposal. These funds can include initial investments, such as infrastructure.
Contracts & Grants (C&G)	5	Contracts and grants funding available for the program.
Philanthropy Endowments	6	Funds provided through the foundation or other Direct Support Organizations (DSO) to support the program.
Enterprise Auxiliary Funds	7	Use this column for continuing education or market rate programs and provide a rationale in section III.B. in support of the selected tuition model.
Continuing Base** (E&G)	9	Includes the sum of columns 1, 2, and 3 over time.
New Enrollment Growth (E&G)	10	See explanation provided for column 2.
Other*** (E&G)	11	These are specific funds provided by the Legislature to support implementation of the program.
Contracts & Grants (C&G)	12	See explanation provided for column 5.
Philanthropy Endowments	13	See explanation provided for column 6.
Enterprise Auxiliary Funds	14	Use this column for continuing education or market rate programs and provide a rationale in section III.B. in support of the selected tuition model.

Program and/or E&G account from which current funds will be reallocated during Year 1	Base before reallocation	Amount to be reallocated	Base after reallocation
College of Science (faculty effort)	4,640,748	75,280	\$4,565,469
College of Medicine (faculty effort)	3,125,561	35,798	\$3,089,763
College of Engineering (faculty effort)	1,301,874	22,564	\$1,279,310
Wilkes Honors College (faculty effort)	531,486	5,359	\$526,127
College of Education (faculty effort)	216,181	944	\$215,236
Brain Institute (I-BRAIN) (admin + expenses)	86,738	86,738	\$0
College of Science (GTA)	30,000	30,000	\$0
I-Brain (GTA)	210,000	210,000	\$0
<b>Totals</b>	\$10,142,588	\$466,684	<b>\$9,675,904</b>

\* If not reallocating E&G funds, please submit a zeroed Table 4

## APPENDIX B

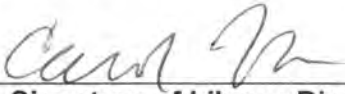
Please include the signature of the Equal Opportunity Officer and the Library Director.



\_\_\_\_\_  
**Signature of Equal Opportunity  
Officer**

11/12/2020

\_\_\_\_\_  
**Date**



\_\_\_\_\_  
**Signature of Library Director**

11/15/20

\_\_\_\_\_  
**Date**

This appendix was created to facilitate the collection of signatures in support of the proposal. Signatures in this section illustrate that the Equal Opportunity Officer has reviewed section II.E of the proposal and the Library Director has reviewed sections X.A and X.B.

**EXTERNAL REPORT  
FOR FLORIDA ATLANTIC UNIVERSITY  
NEUROSCIENCE GRADUATE PROGRAM PROPOSAL**

Daniel N. Cox, PhD

Professor of Neuroscience and Biology, Director of the Center for Neuromics, Director of Graduate Studies in Neuroscience, Georgia State University (GSU)

Lucas Pozzo-Miller, PhD

Professor of Neurobiology, Co-Director Comprehensive Neuroscience Center, Co-Director Neuroscience Theme, Graduate Biomedical Sciences, University of Alabama at Birmingham (UAB)

January 22, 2021

**OVERVIEW**

The team of Drs. Cox and Pozzo-Miller reviewed the proposal of a new PhD program in Neuroscience and met virtually with the following key personnel on January 21, 2021:

Dr. Bob Stackman, Dean of the Graduate College

Dr. Teresa Wilcox, Interim Dean of the College of Science

Dr. Randy Blakely, Executive Director, FAU Brain Institute

Dr. Dan Flynn, Vice President for Research

Dr. Bret Danilowicz, Provost

**INTRODUCTION**

The FAU Brain Institute has prepared a well-designed and detailed proposal to offer a state-of-the-art graduate program awarding a PhD in Neuroscience. The Neuroscience Graduate Program (NGP) will meet the demands of PhD-level graduates capable to contribute to local, regional, and national research efforts at the fundamental, translational, and clinical levels at academic medical centers and universities; private biotech companies; education sectors; and government sectors. Neuroscience research and education is of critical importance for the overall health of local, regional, and national communities as well as their economies. The field of Neuroscience has evolved into a highly interdisciplinary research activity bridging disciplines as diverse as molecular & cellular biology with computational modeling, and exploiting experimental models from invertebrates to non-human primates as well as humans. Training the next generation of Neuroscientists requires a modern pedagogical approach where the student is the centerpiece of the educational experience, that exposes students to diverse disciplines in intensive research environments where peer interactions promote cross-fertilization of ideas and approaches.

The proposal provides a detailed description of the program, degree requirements, need of the program, supply/demand analysis of graduates from the program, and the financial support for students throughout their time in the program.

The proposed curriculum contains the standard elements of successful PhD-level graduate programs across the country: didactic course work, rotations during the 1<sup>st</sup> year prior to selecting a laboratory for the dissertation work, qualifying examination, and final defense of the dissertation. In addition, students are required to have their dissertation work published in peer-reviewed Neuroscience journals.

The FAU Brain Institute and its faculty members that will be mentors of students in the proposed Neuroscience Graduate Program are funded by extramural agencies as well as by FAU to support students and their research expenses throughout their time in the program. Having motivated graduate students actively engaged in a PhD-level program will help in faculty recruitment and retention, in addition to contribute to acquiring extramural and research expenditures. Moreover, the addition of this PhD-level program will raise the national profile of FAU as well as serve the state of Florida, particularly in the southeast.

This report provides our opinion on the rationale, design, and implementation of this new PhD-level Neuroscience Graduate Program, as well as our suggestions based on our combined experience at GSU and UAB.

### **Appropriateness of the Proposed Degree Program**

*1. In your professional opinion, please comment on perceived student demand for the proposed program. What type of student would be interested in this program? What type of employment would be available to the student following graduation? Is both the student demand for the program and potential job market sustainable for this degree program into the foreseeable future?*

There is a continued demand for PhD-level neuroscientists at the national, FL state, and local levels (including FAU Brain Institute, Max Planck Florida, and Scripps Florida): enrollment in Neuroscience programs increased 46% during 2010-2017, making it the fastest growing field of study in the life sciences. These PhD-level neuroscientists are supported in their research mentor labs by federal funding agencies (e.g. NIH, NSF, DoD, VA), which has kept pace with student enrollment in these type of programs. Student demand is also evident by the significant increase in undergraduate-level programs with a focus on Neuroscience across the country, including 3 in Florida (FAU, FSU, and FIU). Graduates from these undergraduate Neuroscience programs are a major source of students for the proposed PhD-level Neuroscience Graduate Program.

Graduates from the proposed PhD Neuroscience Program, like those from similar programs across the country, will be employed as postdoctoral researchers in academic medical centers or private biotech companies, as well as being attractive recruits as educators, government agencies, and healthcare consulting firms. Those advancing in the academic path, will be prepared to lead their independent laboratories funded by federal funding agencies, and those interested private biotech companies could advance to middle-to-upper management of their Research & Development activities.

The job market for PhD-level Neuroscientists has steadily grown since the Presidential Declaration of the “*Decade of the Brain*” in 1989, and the White House BRAIN Initiative (*Brain Research through Advancing Innovative Neurotechnologies*) of 2013. These US government initiatives have been reflected in a significant increase in federal funding for Neuroscience research, which support labs where the graduates of the proposed PhD Neuroscience Program will find a sustained source of PhD-level jobs. Furthermore, the establishment of the Scripps Florida and Max Planck Florida research institutes within the FAU Jupiter campus, in addition to the new building that will house the FAU Brain Institute, offers a sustained source of PhD-level jobs for graduates of the proposed PhD Neuroscience Program. The fact that both Scripps Florida and Max Planck Florida research institutes are partners of the with proposed PhD Neuroscience Program together the FAU Brain Institute will ensure that its graduates are trained to the expectations of those labs for PhD-level postdoctoral researchers.

*2. Is the proposed body of curriculum appropriate for the job skills needed for the professions referenced above? What unfilled need or gap would the degree program fill in the workforce?*

The Neuroscience Graduate Program (NGP) proposed curriculum is directly informed by best practices in graduate training in the discipline and well-aligned to the needs of the evolving neuroscience workforce as laid out by the Society for Neuroscience Training Committee. The curriculum addresses core competencies with emphases on foundational conceptual knowledge acquisition; research skill development; rigorous training in responsible conduct of research; communication skills; and professionalism. The proposed 72 credit hour degree program is organized around 21 credits of core course work; 9 elective credits specifically tailored to the trainee’s interest; 18 credits of flexible elective or research credits; and 24 dissertation credits. Students will consult with their faculty advisor(s) to select appropriate courses beyond the core requirements and dissertation credits. Within the 21 credits of required core coursework, all students will complete three 8-week research internships (rotations) in the laboratories of program faculty prior to selecting a faculty advisor for their dissertation research. In addition to formalized instruction in scientific communication, students will also develop a thesis proposal written in the format of fellowship/grant application and present this to their thesis committee in a seminar-style public forum open to all faculty and students as a key component of their advancement to PhD candidacy. The degree program culminates in the successful writing and public defense of their thesis by years 5-6. Finally, in addition to the formalized curriculum, trainee preparation for the workforce is further augmented by the breadth of relevant professional and technical skills workshops available to NGP students and offered on a regular basis to develop soft and technical skills critical to career preparation and advancement.

Industry-driven competencies were identified and incorporated into the curriculum through multiple sources. In a report prepared by an outside consultant (Hanover Research), an analysis of 2019 job postings revealed that communication and data

analysis skills were among the most important traits sought by employers in science and technology, together with collaborative team skills, strong organization skills, and high self-motivation. These findings are further corroborated by independent published works on “Neuroscience Training for the 21<sup>st</sup> century” (Akil et al., 2016, *Neuron* 90:971-926) and online publication on “20 Transferrable Skills for PhDs” by Hankel and Sur whose analyses emphasized skills needed in the biotechnology, biomedical, and biopharmaceutical industries. Skills identified in these works include data, time and project management, leadership/mentoring skills, creative problem solving, state-of-the-art technical skills, and strategic planning. NGP trainees develop these skills through a combination of formalized coursework, research training, and faculty mentorship.

The importance of neuroscience research and training, as well as advancing the pipeline of trainees in this field is evident at all levels. As highlighted in the report by Hanover Research, the proposed NGP program addresses an area of strong local, state and national need. Nationally, neurological diseases affect more than 100 million Americans at a cost of \$800 billion to society and with an ever-increasing prevalence of neurological conditions and age-related disorders, there has been major investments in federal funding in neuroscience-related research through programs such as the BRAIN Initiative and 21<sup>st</sup> Century Cures Act. The increased burden of neurological disease also dramatically impacts the Florida state population where the prevalence of diagnoses (at any age) was 4.88% compared to a national average of 2.79%.

The Hanover Research report on market analysis for neuroscience-related job availability revealed a strong market out to 2026 with increases projected at a faster than average rate whether evaluating state, regional, or national statistics with unemployment rates averaging 1.6% in both Florida and the U.S. for graduates in the neuroscience discipline. Job growth is also projected to grow by 6.1% between 2019 and 2029 thereby exceeding the national average of 3.7% for Medical Scientists. While the US Bureau of Labor Statistics does not explicitly survey neuroscience in their analyses (see Table 2), an analysis of 2700 Neuroscience Ph.D. graduates conducted in 2013 discovered that at 6-10 years post-graduation, 55% were employed in academic and 35% were employed in industry, government, and other areas of science (Akil et al., 2016, *Neuron*, 90:817-926). Florida Department of Employment Opportunity projects double-digit job growth between now and 2027 in neuroscience-related professions (e.g. medical scientists and post-secondary educators) and 67% of jobs in Florida created between 2018 and 2025 will require postsecondary degree training or special certification. These trends likewise hold true at the local level (Southeast Florida job market; Table 5 and 6 of proposal) and are further supported by data provided using the Burning Glass data analysis platform for neuroscience CIP codes revealing both significant demand and employment potential in the state of Florida for neuroscience graduates.

Student demand for PhD degrees in neuroscience is very strong. In the period from 2010-17, enrollment in Biological Sciences graduate programs increased by 8.8%, while enrollment in programs within the neuroscience subdiscipline increased by 46% during this same time period (see Table 7). For current neuroscience-relevant graduate programs at FAU (XPSY/IB-NS/CSBS/GNTP), over the past three years there were 344

applicants of which 94 were admitted and 46 students who enrolled among which nearly 40% were in the GNTP. Collectively, these data are indicative of significant student interest, and in particular strong growth in the GNTP which serves as the precursor program to the NGP which is the basis of the current proposal and which would fold in to that NGP degree program.

*3. Does the proposed degree program seem to fit with the institutional goals and mission (strategic plan) of the institution?*

The proposed PhD Neuroscience Program fits very well with FAU's overall goals and mission, as well as those of the FAU Brain Institute. In fact, the FAU Brain Institute was created to support research and educational activities in Neuroscience, one of the four Pillars for future research and educational investment as stated in FAU's 2015 Strategic Plan *Race to Excellence*. Therefore, the proposed PhD Neuroscience Program is a culmination of the educational mission envisioned for the FAU Brain Institute.

### **Institutional Readiness to Successfully Offer the Degree Program**

*4. Does FAU have adequate faculty numbers and expertise/credentials to successfully implement the program? Is the faculty research active enough to successfully mentor doctoral students?*

A total of 59 faculty will participate in the NGP and are stratified across multiple departments reflecting the interdisciplinary nature of neuroscience research and training as well as the three major program emphasis areas: (1) cellular, molecular and biomedical neuroscience; (2) sensorimotor, cognitive and behavioral neuroscience; and (3) theoretical and computational neuroscience.

Colleges/Departments of participating faculty include: Biomedical Science (16 faculty); Psychology (16 faculty); Biological Sciences (8 faculty); College of Electrical Engineering & Computer Science (7 faculty); Wilkes Honors College: Math & Sciences (4 faculty); Chemistry & Biochemistry (3 faculty); Communication Sciences & Disorders (2 faculty); Mathematics (1 faculty); Exercise Science & Health (1 faculty); and Ocean & Mechanical Engineering (1 faculty).

These faculty members provide adequate expertise and credentials to successfully implement the program and provide the requisite breadth of expertise to foster training in the three major program emphasis areas. The faculty are research active engaging in scholarly publishing, grant writing, and securing extramural grant funding.

*5. Are the institutional, College, and Department resources adequate to support the degree program? (i.e., Library, funding for students, research labs and equipment, etc.)*

Laboratory facilities committed to the proposed PhD Neuroscience Program include those of the FAU Brain Institute, Scripps Florida, and Max Planck Florida, all located in the Jupiter campus.



Research core facilities operated by the FAU Brain Institute, Scripps Florida, and Max Planck Florida include behavioral and neuroanatomical analyses of transgenic animals; electron, confocal, and super-resolution microscopy; optogenetic manipulations in freely moving transgenic animals; high-throughput drug screening to develop new brain disease medications; genomics and proteomics resources to uncover disease risk factors; and solving 3-D structures of neural proteins. Access to these state-of-the-art core facilities represents a unique, 3-way partnership that leverages millions of dollars of Florida state investments in the training of FAU's students. Technical workshops and regular use of these facilities will provide an outstanding training experience for students enrolled in the proposed PhD Neuroscience Program.

FAU has extensive libraries in each campus, including Jupiter, containing physical and electronic collections of books, book series, and peer-reviewed journals that students can access 24 hours a day. The Jupiter campus also has sufficient classrooms, teaching labs, and offices for program administrators and faculty.

*6. Do you feel strong support for the degree program from the College and upper-level administration?*

We felt strong support for the degree program at the College and upper-level administration. The Dean of the College of Science as well as Dean of the Graduate College expressed full-throated support for the program which was echoed in our conversations with the Vice President for Research and Provost. The program is a major priority and future strength of the FAU Brain Institute and has strong leadership and vision from the Executive Director of the FAU Brain Institute.

The program is clearly aligned to the University strategic plan and there is significant investment and resource allocation to support program implementation and success.

*7. What are the major strengths of FAU to successfully offer this degree program?*

The establishment of the Scripps Florida and Max Planck Florida research institutes within the FAU Jupiter campus, in addition to the new building that will house the FAU Brain Institute is the major strength of the proposed PhD Neuroscience Program. As mentioned in the letters of support, the presence of the Scripps Florida and Max Planck Florida research institutes across the street of the new FAU Brain Institute building in the FAU Jupiter campus is reminiscent of the highly successful campus of UCSD with the Scripps and Salk research institutes in close proximity and housing UCSD graduate students and employing UCSD graduates in their research labs.

FAU's undergraduate Neuroscience and Behavior major offered by the Department of Psychology is another major strength of FAU to offer this new

Neuroscience PhD. Enrollment in this undergraduate major has grown steadily, and its graduates will be a major source of students for the proposed PhD Neuroscience Program.

*8. What will be the major challenges of FAU to successfully offer this degree program?*

We did not identify any insurmountable challenges FAU will face in implementing the Neuroscience PhD degree program based upon our conversations with the executive director of the FAU Brain Institute, college administration and upper administration.

Challenges that the University is aware of, and has taken steps to address, include those of a distributed campus model (Jupiter, Boca Raton, Davie); faculty diversity/inclusion, including gender balance; and reputational challenges as FAU further ramps up their regional and national research standing. Each of these has potential impacts on recruiting top graduate talent and building a cohesive environment. To address the distributed campus challenge, FAU has established a free intercampus Wi-Fi enable shuttle service between the Jupiter and Boca Raton campuses which will enable NGP students to access courses and seminars as well as collaborate across campuses. The FAU Brain Institute has also developed a targeted marketing strategy with dedicated funding to advertise the program on a broad scale and to support the Neuroscience Seminar series which will bring leaders in the field to the FAU campus promoting important exchanges between students and faculty that enrich the intellectual and training environment.

## **SUGGESTIONS**

1. Add a written component to the Qualifying Examination, which can be used as the basis for an extramural funding submission by the student (e.g. NRSA from NIH). Offer a monetary reward for those students submitting their written proposals defended at the Qualifying Examination to a funding agency (e.g. \$500 at UAB)
2. Add clarity and details regarding the source of funding support for those students necessitating more time than the allotted 5 years.
3. Remove the requirement for the GRE entirely; i.e. making it optional still could give the impression that it will be used to evaluate candidates. This recommendation is based on evidence-based studies and best practices in holistic graduate recruitment and may further serve to enhance diversity and inclusion within the program.
4. Clarify that the requirement for published articles before the final defense also include papers “in press”.
5. Add clarity and details to the different options to exit the PhD-level program with an intermediate degree (e.g. Master’s).

6. Create a seminar series for just the students in the proposed PhD Neuroscience Program, or use the summer months of an existing seminar series to focus on student speakers (e.g. practicing short talks at meetings like the Annual Neuroscience Meeting of the SfN).

7. Negotiate a waiver of the application fee, at least for students in need or from minoritized groups in STEM.

8. Add clarity and details regarding the new proposal to integrate with Broward Health hospitals for their academic mission focused on Neuroscience, which will dovetail very well with FAU Brain Institute's mission on clinical and translational Neuroscience research (aka "bench-to-bedside").

### **CONCLUDING REMARKS**

FAU is ready to implement the proposed graduate program awarding a PhD in Neuroscience. The program will produce Neuroscientists that will contribute to the economic development of the state and improve the quality of life of Floridians.

# Market Analysis: PhD in Neuroscience

Prepared for Florida Atlantic University

December 2019

In the following report, Hanover assesses demand for PhD programs in neuroscience specifically highlighting demand trends in Florida. This report includes an examination of student and labor market demand, as well as an analysis of potential competitor programs.



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# Executive Summary

## Market Analysis: PhD in Neuroscience

### Recommendations

Based on an analysis of degree completions, labor market demand, and market competitors, Hanover recommends that Florida Atlantic University (FAU):

- Proceed with the proposed PhD in Neuroscience.** Student demand trends and growth in the neuroscience field indicate that the program will be viable. While professions in academia remain particularly competitive, relevant occupations are expected to grow.
- Ensure students receive sufficient training in statistics, data analysis, and communication to best prepare them for both academic and non-academic careers.** [Scientific American](#) notes that neuroscience graduates increasingly pursue non-academic career paths. Meanwhile, a 2016 article in the peer-reviewed journal *Neuron* "[Neuroscience Training for the 21<sup>st</sup> Century](#)" highlights educational gaps in statistics, data analytics, and communication. The prevalence of communication and data analysis as preferred skills among reviewed job postings confirms these findings.

### Key Findings and Program Demand Forecast

For neuroscience programs in Florida

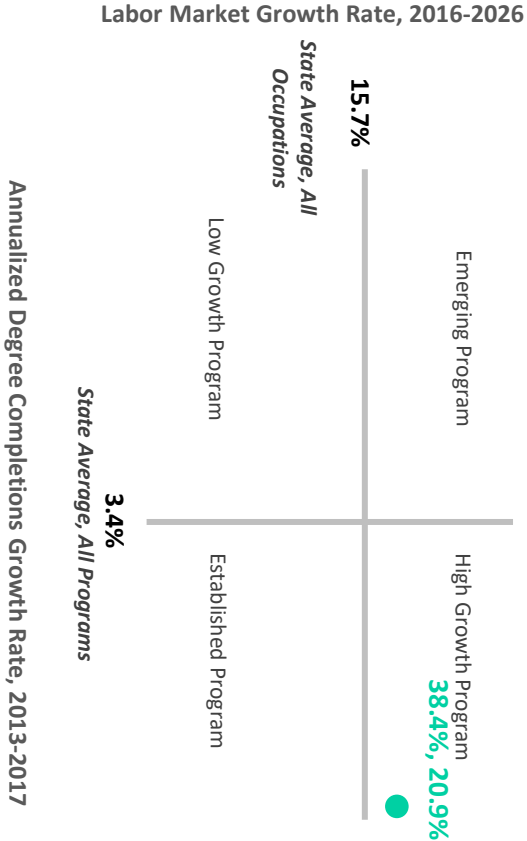
**Though neuroscience doctoral conferral volumes are low, the field is growing rapidly.** As of 2017, there were only 11 neuroscience PhD completions in Florida, but these grew from 3 completions in 2013. Coupled with expansion of the neuroscience field as a whole, FAU can anticipate a growing prospective student pool for a new neuroscience program.

**Jobs for program graduates are increasing, but the growing number of graduates has created a competitive labor market.** While the number of related positions are expected to increase at above-average rates from 2016 to 2026, the insecurity and limitations of academic funding have created new pressures for a growing number of job candidates. Demand for graduates, particularly those with strong analytical and communication skills, is high.




**FAU's proposed program features, particularly the delayed lab entry, will help distinguish the PhD to prospective students.** No reviewed institutions offer delayed lab entry, and only two provide master's pathways. This suggests FAU will be able to distinguish itself in a generally favorable market.

### Florida Benchmark Analysis

Comparison of neuroscience completions and relevant labor market to all completions and all occupations in Florida



### Fast Facts

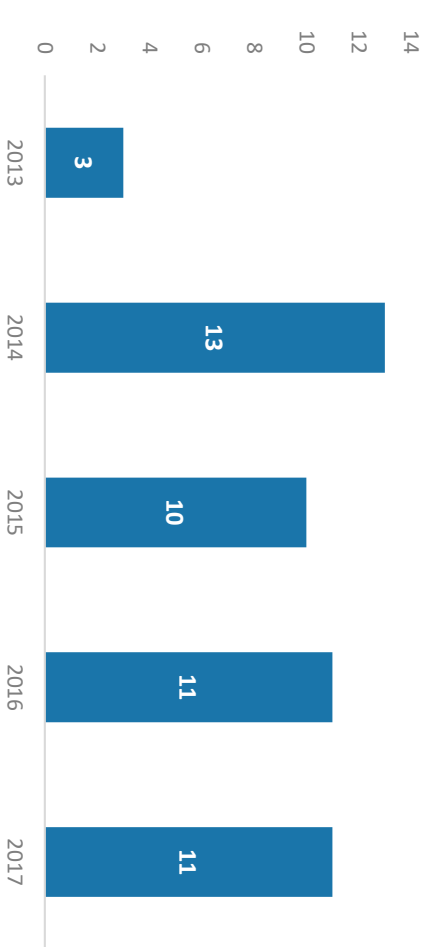
-  **4** Total number of neuroscience doctorate programs in Florida reporting conferrals in 2017
-  **30,000** Anticipated attendance for the Society for Neuroscience 2019 Convention
-  **4** Number of reviewed programs with guest speaker series

# Degree Completions Analysis

Market Analysis: PhD in Neuroscience

## Florida Degree Completions Volume

Distribution of doctoral research degree completions in Florida from 2013 to 2017 (Neuroscience Only)



## Total Degree Completions

Aggregate degree completions by geographic level (2017)

	Florida	Southeast	National
Neuroscience	11	83	651
Neurobiology and Neurosciences, Other	0	0	6
Neuroanatomy	0	0	--
Neurobiology and Anatomy	0	9	54
Neurobiology and Behavior	0	4	15
Neuropharmacology	0	0	--
Total	11	96	726
Average Annualized Growth Rate	38.4%	4.7%	2.4%

Source: [IPEDS](#)

Note: Southeast includes AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, and WV.

## Analysis of Findings

**PhD completions in fields related to neuroscience have grown above-average from 2013 to 2017.**

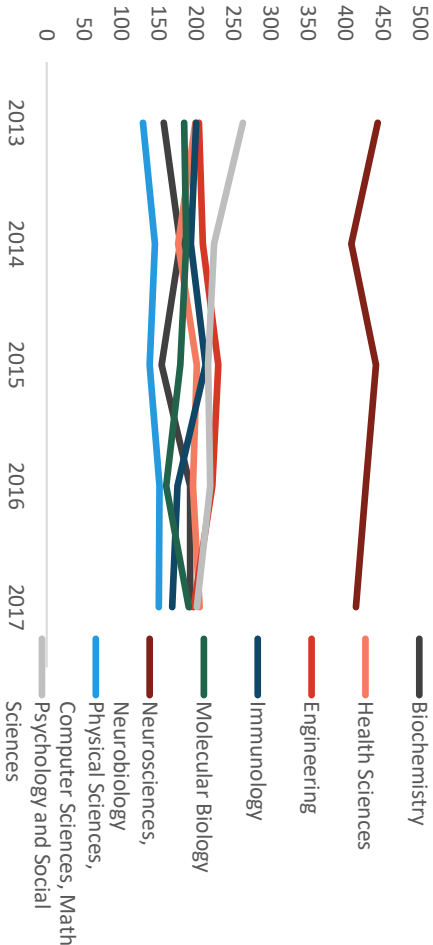
State-wide, regionally, and nationally, relevant completions volumes are low but growing quickly when compared to all programs at the doctoral level (38.4 vs. 3.4 percent in Florida, 4.7 vs. 4.0 percent in the Southeast, and 2.4 vs. 2.3 percent in the United States). Notably, neuroscience doctoral programs account for the majority of completions at each geographic level.

**Over the last decade, interest in neuroscience PhDs has outpaced other biomedical and scientific fields.**

As demonstrated in the chart below, neuroscience is now the most popular field among National Institutes of Health (NIH)-supported PhD recipients. In fact, [Scientific American](#) refers to a “flood of doctoral students choosing neuroscience.”

While this upswing in demand bodes well for future programs, neuroscience graduates may face some gaps in their education. Key areas where graduates require more training are quantitative and statistical skills, data analytics, and verbal/communication skills (“[Neuroscience Training for the 21<sup>st</sup> Century](#)”).

## Major Fields of Study for NIH-Supported PhDs



Source: Adapted directly from [NIH Data Book](#)



## Florida Current and Projected Job Availability

Neuroscience-related positions in Florida as of 2016 and 2026 (projected)



## Total Labor Market

Aggregate neuroscience-related job availability by geographic level

	Florida	Southeast	National
Estimated Employment (2016)	6,970	38,930	277,700
Projected Employment (2026)	8,430	45,300	311,900
Employment Growth	20.9%	16.4%	12.3%
Total Annual Openings	750	3,980	27,000

Source: [Projections Central](#)

Note: Southeast includes AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, and WV.

## Analysis of Findings

**Associated occupations are projected to increase at a faster-than-average rate over the next 10 years.**

From 2016 to 2026, the Bureau of Labor Statistics (BLS) projects professions for PhDs in neuroscience will grow faster than the average rate for all occupations at the state, regional, and national levels. In addition to significant employer demand for these roles, students with this credential will enjoy a positive job outlook.

**Uncertain funding will increase the competitiveness of the labor market.**

[Scientific American](#) notes that many neuroscience doctoral candidates become discouraged by fluctuations in grants and funding; while “actual demand for understanding the brain is huge... there isn’t an infinite amount of money.” Students are beginning to choose career paths outside of academia, with fewer neuroscience PhD graduates working in universities. Students are likely recognizing the high levels of competition within academia and are attracted to the careers related to their degree – for example, those related to scientific writing, public policy, and industry (“[Neuroscience Training for the 21st Century](#)”).

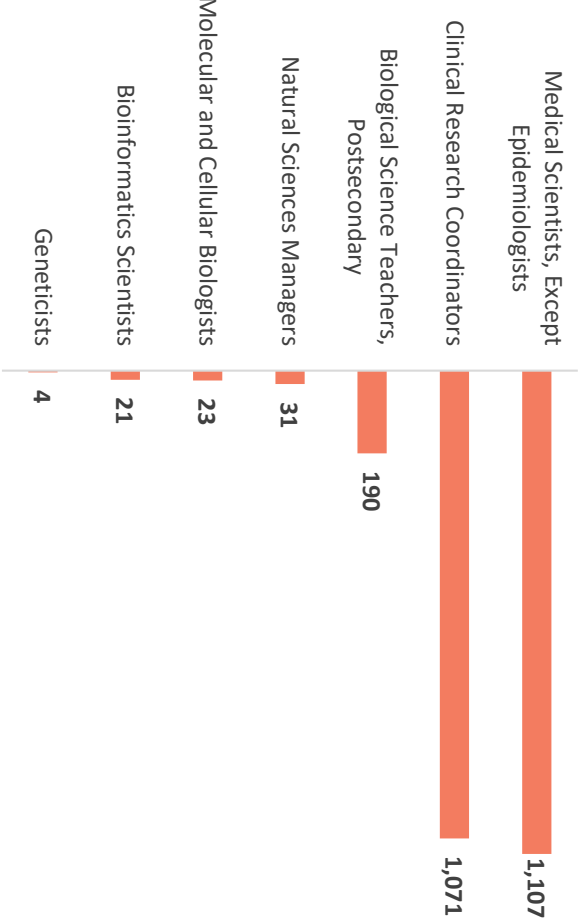
**The Society for Neuroscience (SfN) has grown significantly over the last 50 years and remains committed to pursuing funding for the neuroscience field.**

[SfN](#) currently represents over 37,000 neuroscientists of over 80 nationalities. While the Society’s first convention attracted only 1,395 participants, the 2019 convention is anticipated to reach almost 30,000 attendees. Furthermore, this event is “one of the world’s largest annual scientific meetings.” This expansion has allowed SfN to push for greater funding, such as the Neuroscience Scholars Program (a travel grant) the Trainee Professional Development Award (also a travel grant) and the Increasing Women in Neuroscience Initiative (funding to recruit and maintain female and other underserved students).



## Florida Job Postings Analysis

Neuroscience-related positions in Florida by occupational group during the past 180 days as of November 2019. Includes detailed occupational codes for which long-term projections are unavailable.



## Florida Employment Facts

Neuroscience-related positions in Florida by occupational group

Occupation	Average Salary Florida	Average Salary U.S.	Unemployment Rate Florida	Unemployment Rate U.S.
Natural Sciences Managers	\$126,200	\$139,700	1.1%	1.2%
Biological Scientists, All Other	\$71,200	\$83,600	1.5%	1.7%
Medical Scientists, Except Epidemiologists	\$83,000	\$96,400	1.5%	1.7%
Biological Science Teachers, Postsecondary	\$90,800	\$97,300	2.2%	2.5%

Source: JobSEQ and BLS; Skills lists exclude Microsoft proficiencies

## Analysis of Findings

Florida employers posted nearly 2,500 jobs related to neuroscience over the last six months.

Medical Scientists, Except Epidemiologists compose the highest number of postings, followed by Clinical Research Coordinators. Most positions are in labs, and the frequency of Clinical Research Coordinators implies many roles also include administrative or managerial tasks in addition to research. Scientific American supports this finding by reporting that labs will need more “coordination and oversight of neuroscience research cores” to synthesize findings in such a highly interdisciplinary field.

### Employers seek applicants with communication and data analysis skills.

These skills frequently appear in postings, confirming that statistics, data analysis, and communication are desired attributes for neuroscience PhD graduates (“Neuroscience Training for the 21<sup>st</sup> Century”).

Top Hard Skills in Reviewed Postings	Top Soft Skills in Reviewed Postings
<ul style="list-style-type: none"><li>•Clinical Research – 708</li><li>•Health/Wellness – 277</li><li>•Molecular Biology – 274</li><li>•Teaching/Training, School – 165</li><li>•Data Analysis – 156</li></ul>	<ul style="list-style-type: none"><li>•Communication (Verbal and Written) – 1,142</li><li>•Cooperative/Team Player – 1,008</li><li>•Accountable/Responsible – 545</li><li>•Self-Motivated – 533</li><li>•Organization – 479</li></ul>

### The Society for Neuroscience returned eight results for “neurojobs” in Florida.

Six positions are doctoral or postdoctoral roles. There are two positions in Tallahassee and Miami, and one position Boca Raton, Gainesville, Jacksonville, and Tampa, respectively. Though neuroscience is not specifically mentioned in Florida’s 2018-2023 Strategic Plan for Economic Development, healthcare and life sciences is listed as one of the “state’s growing and diverse industries.” Similarly, Investopedia ranks life sciences, which includes “biomedical research institutes, pharmaceutical and medical device companies, and more than 46,000 healthcare establishments” as one of Florida’s six primary industries.

# Competitor Analysis

Market Analysis: PhD in Neuroscience

## Competitor Analysis

Based on an analysis of state peers, Hanover concludes the following:

### Market conditions favor a new neuroscience PhD.

Relevant conferrals and growth in student demand have increased over the last five years. Though overall conferral volume is relatively low and no new programs opened from 2013 to 2017, conferral growth and FAU's existing resources in the field suggest the proposed neuroscience program is viable. Moreover, data from [Scientific American](#) and the [NIH](#) demonstrate that neuroscience is currently one of the most popular PhD programs in the sciences.

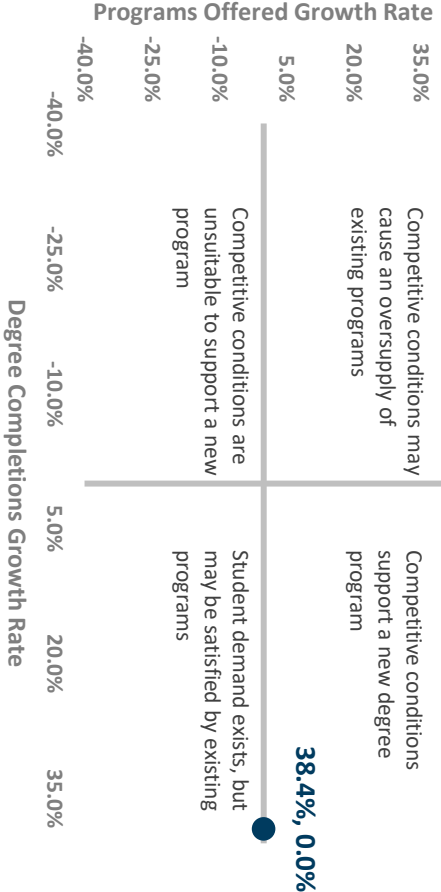
To provide a detailed analysis of the competitive landscape, Hanover reviewed all neuroscience PhD programs in Florida as well as programs in the Southeast region reporting the highest 2017 conferrals. Of the ten reviewed programs, the review revealed only four competitor programs located in Florida.

## List of Reviewed Programs

Institution	Location	Notable Features
Duke University	NC	<a href="#">PhD in Neurobiology</a>
Florida International University	FL	<a href="#">PhD in Cognitive Neuroscience</a>
Florida State University	FL	<a href="#">PhD in Neuroscience</a>
Georgia State University	GA	<a href="#">PhD in Neuroscience</a>
University of Alabama - Birmingham	AL	<a href="#">PhD Neuroscience</a>
University of Miami	FL	<a href="#">PhD in Neuroscience</a>
University of North Carolina - Chapel Hill	NC	<a href="#">PhD in Neuroscience</a>
University of South Florida	FL	<a href="#">PhD in Medical Sciences: Neuroscience Concentration</a>
University of Virginia	VA	<a href="#">PhD in Neuroscience</a>
Vanderbilt University	TN	<a href="#">PhD in Neuroscience</a>

## Florida Market Saturation (2013-2017)

Do competitive conditions in Florida support an additional neuroscience program?



100 of 179

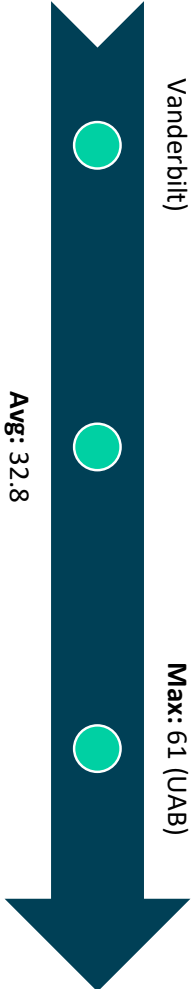
## Non-Research Credits

Reviewed programs require between 24 and 61 non-research credits, averaging nearly 33 total credits.

All but one competitor program (University of Alabama-Birmingham) requires 36 or fewer classroom credits. FAU should plan for a similar focus on research rather than coursework in its proposed program.

Min: 24 (UNC, UVA, Vanderbilt)

Max: 61 (UAB)



## Academic Housing

The majority of reviewed programs are housed in schools of medicine, confirming FAU's multi-college approach is a differentiating feature.

FSU is the only other institution to explicitly mention cross-college collaboration, which draws neuroscience PhD faculty from both the College of Arts and Sciences and the College of Medicine. While [UNC Chapel Hill](#) notes that its neuroscience PhD faculty encompass 15 various departments and research centers, all are from the School of Medicine.

6	• Schools of Medicine
2	• Schools of Arts and Sciences
1	• School of Integrated Science and Humanity
1	• School of Medicine AND School of Arts and Sciences

## Specializations

Georgia State University, University of Virginia, and Vanderbilt University offer specializations in their neuroscience doctorates.

More common than cross-college collaboration, concentrations are still relatively rare. Furthermore, no reviewed institution offers FAU's proposed concentrations.

Georgia State	UVA	Vanderbilt
• Neuroethics	• Molecular, Cellular & Developmental • Synapses and Circuits • Neuroimmunology	• Cellular and Molecular • Cognitive and Systems

## Master's Pathways

Only two reviewed programs offer master's pathways—Florida State University and Georgia State University.



FSU's master's pathway is optional and requires approval from the student's major professor and supervisory committee. Only Georgia State has a guaranteed master's path similar to FAU's planned structure.

## Notable Features

The most commonly advertised notable features among reviewed programs are **lecture series**, **unique facilities**, and **interdisciplinary program structure**. FAU's proposed program is highly interdisciplinary, and the [FAU Brain Institute](#) provides opportunities to advertise facilities. FAU should consider leveraging relationships with Max Planck and Scripps Florida to develop a guest speaker series.

101 of 6

### Lecture Series



- Four institutions provide seminar or lecture series with guest speakers

### Unique Facilities



- UAB notes students' access to the Dauphin Island Sea Lab, USF markets connects to the USF Neuroscience Institute and Center of Excellence for Aging and Brain Repair

### Interdisciplinary



- USF highlights its cross-college and cross-departmental structure, and UAB notes that students have access to all labs in the Graduate Biomedical Sciences program, regardless of their chosen theme

# Program Benchmarking

Market Analysis: PhD in Neuroscience

## Market Analysis: PhD in Neuroscience Benchmarking

Hanover has reviewed all neuroscience PhD programs in Florida as identified through IPEDS and an internet scan as well as programs in the Southeast reporting high 2017 conferral volumes.

Institution	Location	Program	Specializations	Academic Housing	Master's Pathway?	Non-Research Credits	Notable Features
Duke University	NC	<a href="#">PhD in Neurobiology</a>	--	School of Medicine	No	<a href="#">33*</a>	<ul style="list-style-type: none"><li>• Collaboration with other departments</li><li>• Annual retreat</li><li>• Weekly seminars and lunches with guest speakers</li></ul>
Florida International University	FL	<a href="#">PhD in Cognitive Neuroscience</a>	--	School of Integrated Science and Humanity	No**	<a href="#">36</a>	<ul style="list-style-type: none"><li>• Emphasis on grant-writing skills</li></ul>
Florida State University	FL	<a href="#">PhD in Neuroscience</a>	--	College of Arts and Sciences and College of Medicine	Yes (optional, subject to approval)	<a href="#">30***</a>	<ul style="list-style-type: none"><li>• Interdisciplinary: faculty are from the biological science, psychology, mathematics, and biomedical science departments</li></ul>
Georgia State University	GA	<a href="#">PhD in Neuroscience</a>	Neuroethics	College of Arts and Sciences	Yes	<a href="#">28</a>	<ul style="list-style-type: none"><li>• Brains and Behavior program offers access to a graduate fellowship, lecture series, and seed grants</li></ul>
University of Alabama - Birmingham	AL	<a href="#">PhD Neuroscience</a>	--	School of Medicine	No	<a href="#">61***</a>	<ul style="list-style-type: none"><li>• One of eight themes available in biomedical graduate sciences; students choose a theme prior to entering the program, but have access to all faculty labs regardless of theme</li><li>• Introductory course at Dauphin Island Sea Lab</li></ul>

Source: Institutional Websites (see embedded hyperlinks)

\*Assumes 3 credits per course

\*\*Students are required to complete a master's project, but apparently do not receive master's degrees

\*\*\*Total credits minus dissertation research credits

# Program Benchmarking

Market Analysis: PhD in Neuroscience

## Market Analysis: PhD in Neuroscience Benchmarking

Hanover has reviewed all neuroscience PhD programs in Florida as identified through IPEDS and an internet scan as well as programs in the Southeast reporting high 2017 conferral volumes.

Institution	Location	Program	Specializations	Academic Housing	Master's Pathway?	Non-Research Credits	Notable Features
University of Miami	FL	<a href="#">PhD in Neuroscience</a>	--	School of Medicine	No*	<a href="#">36</a>	--
University of North Carolina - Chapel Hill	NC	<a href="#">PhD in Neuroscience</a>	--	School of Medicine	No	<a href="#">24</a> **	<ul style="list-style-type: none"><li>Weekly seminars and lunches</li></ul>
University of South Florida	FL	<a href="#">PhD in Medical Sciences: Neuroscience Concentration</a>	--	College of Medicine	No	<a href="#">24</a>	<ul style="list-style-type: none"><li>Affiliated with the USF Neuroscience Institute and Center of Excellence for Aging and Brain Repair</li></ul>
University of Virginia	VA	<a href="#">PhD in Neuroscience</a>	<ul style="list-style-type: none"><li>Molecular, Cellular &amp; Developmental Synapses and Circuits</li><li>Neuroimmunology</li></ul>	College and Graduate School of Arts and Sciences	No	<a href="#">31-34</a>	<ul style="list-style-type: none"><li>Biweekly journal club</li><li>Weekly student seminar</li></ul>
Vanderbilt University	TN	<a href="#">PhD in Neuroscience</a>	<ul style="list-style-type: none"><li>Cellular and Molecular Cognitive and Systems</li></ul>	School of Medicine	No	<a href="#">24</a>	<ul style="list-style-type: none"><li>Additional PhD programs in Educational Neuroscience and Law and Neuroscience</li></ul>

Source: Institutional Websites (see embedded hyperlinks)

\*Not typical, but master's may be granted "under special circumstances at the discretion of the Steering Committee."

\*\*Credit values found in the Graduate Course Catalog; assumes the two required electives are worth three credits





# VALIDATE: EMPLOYMENT POTENTIAL

## PROJECT CRITERIA

Validate	Programs
States	Florida
Degree Level	Doctoral degree
Time Period	10/1/2019 - 9/30/2020
Selected Programs	Neuroanatomy (26.1502), Neurobiology and Anatomy (26.1503), Neurobiology and Behavior (26.1504), Neurobiology and Neurosciences, Other (26.1599), Neuroscience (26.1501)
Career Outcomes mapped to Selected Programs of Study	Medical Scientist, Biologist

## HOW MANY JOBS ARE THERE FOR YOUR GRADUATES?

For your project criteria, there were **1,191** job postings in the last 12 months.

Compared to:

- 2,167,753 total job postings in your selected location
- 82,603 total job postings requesting a Doctoral degree in your selected location

The number of jobs is expected to **grow** over the next 10 years.

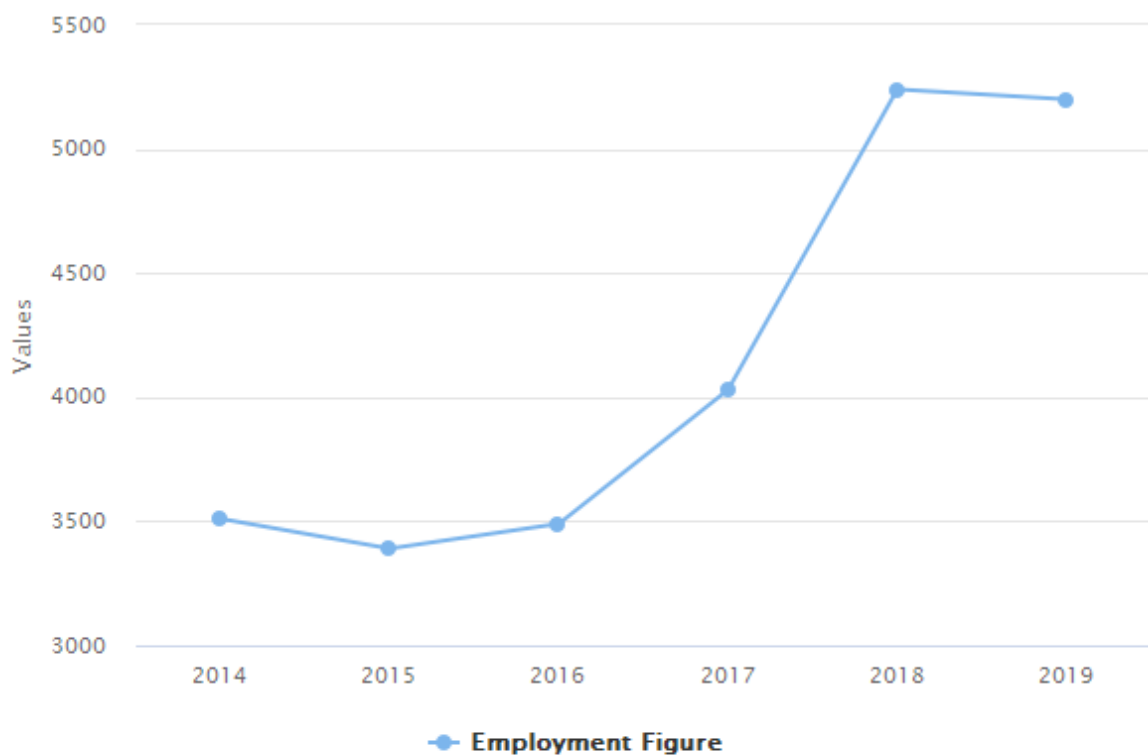
## GROWTH BY GEOGRAPHY

Geography	Selected Occupations	Total Labor Market	Relative Growth
Florida	23.75 %	10.77 %	High

Nationwide	9.09 %	4.24 %	Average
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#### HOW HAS EMPLOYMENT CHANGED FOR CAREER OUTCOMES OF YOUR PROGRAM?

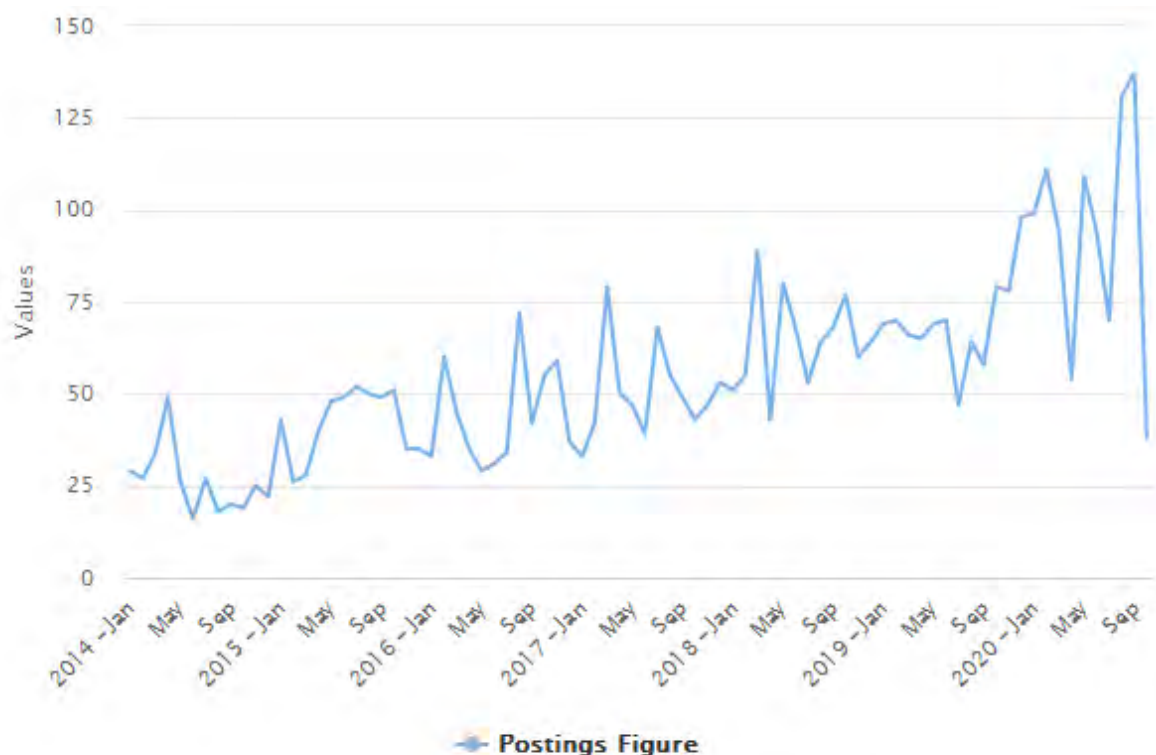
	2014	2015	2016	2017	2018	2019
Employment (BLS)	3,510	3,390	3,490	4,030	5,240	5,200



Employment data between years 2019 and 2028 are projected figures.

POSTINGS TRENDS





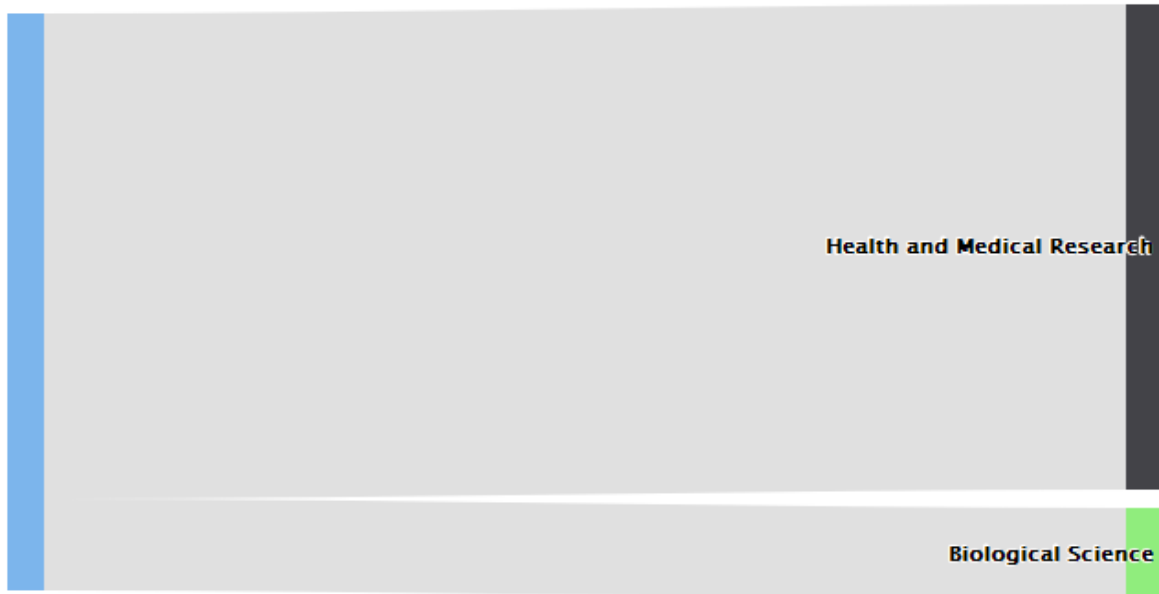
#### DETAILS BY OCCUPATION

Occupation Group	Postings	LQ	Employment (2019)	Employment Growth (2018 - 2019)	Projected Employment Growth (2019-2028)
Health and Medical Research	1,002	0.7	3,530	1.7%	25.5%
Biological Science	189	0.5	1,670	-5.6%	20.0%

#### HOW VERSATILE IS MY PROGRAM?

Graduates of this program usually transition into any of the 2 different occupation groups:

Occupations Group	Market Size (postings)	Percentage of Career Outcome demand
Health and Medical Research	1,002	84.1%
Biological Science	189	15.9%



#### WHAT SALARY WILL MY GRADUATES MAKE?

The average salary in **Florida** for graduates of your program is **\$78,882**

This average salary is **Above** the average living wage for Florida of **\$29,619**



Salary numbers are based on Burning Glass models that consider advertised job posting salary, BLS data, and other proprietary and public sources of information.

Occupation Group	0-2 Years	3-5 Years	6+ Years
Health and Medical Research	\$85116	\$95076	\$112893





# VALIDATE: COMPETITIVE LANDSCAPE

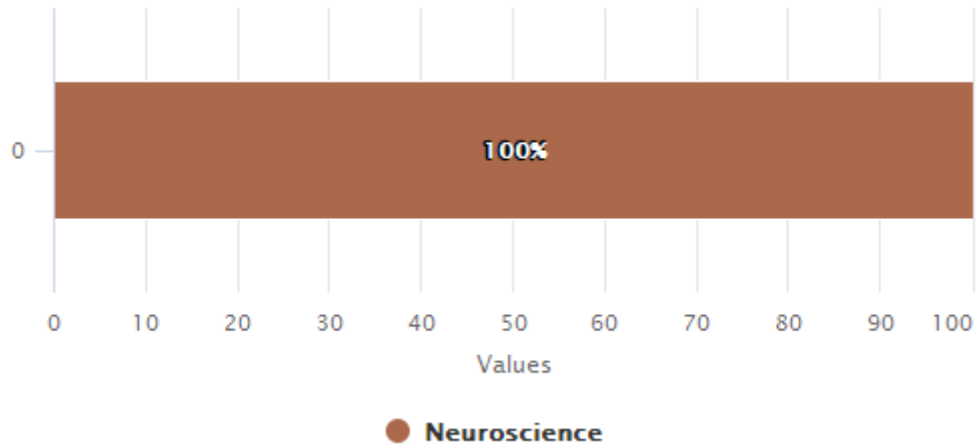
## PROJECT CRITERIA

Validate	Programs
States	Florida
Degree Level	Doctoral degree
Time Period	10/1/2019 - 9/30/2020
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Career Outcomes mapped to Selected Programs of Study	Medical Scientist, Biologist

## OVERVIEW

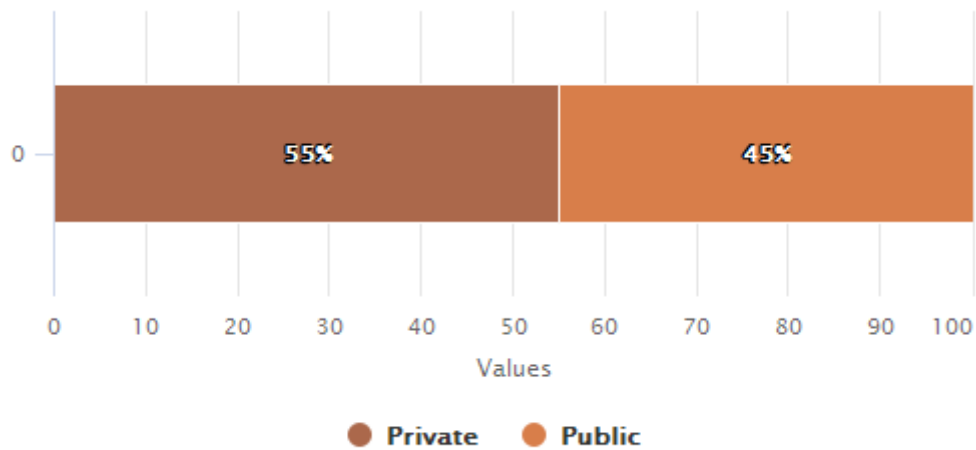
	#	% Change (2014-2018)
Degrees Conferred	11	-15%
Number of Institutions	2	0%
Average Conferrals by Institution	6	0.00%
Median Conferrals by Institution	6	0.00%

## MARKET SHARE BY PROGRAM



Program	Conferrals (2018)	Market Share (%)
Neuroscience	11	100.00%

#### MARKET SHARE BY INSTITUTION TYPE



Institution Type	Conferrals (2018)	Market Share (%)
Private	6	54.55%
Public	5	45.45%

#### TOP INSTITUTIONS

Institution	School Type	Market Share (2018)	Market Share Change	Conferrals (2018)	Conferrals Change (2014-2018)
University of Miami	Private	54.55%	8.40%	6	0.00%
Florida State University	Public	45.45%	-8.40%	5	-28.60%

#### TOP PROGRAMS

Program	Market Share (2018)	Market Share Change	Conferrals (2018)	Conferrals Change (2014-2018)
Neuroscience	100.00%	0.00%	11	-15.40%

#### ACTIVE COMPETITORS

Institution	School Type	Market Share (2018)	Market Share Change	Conferrals (2018)	Conferrals Change (2014-2018)
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# VALIDATE: MARKET ALIGNMENT

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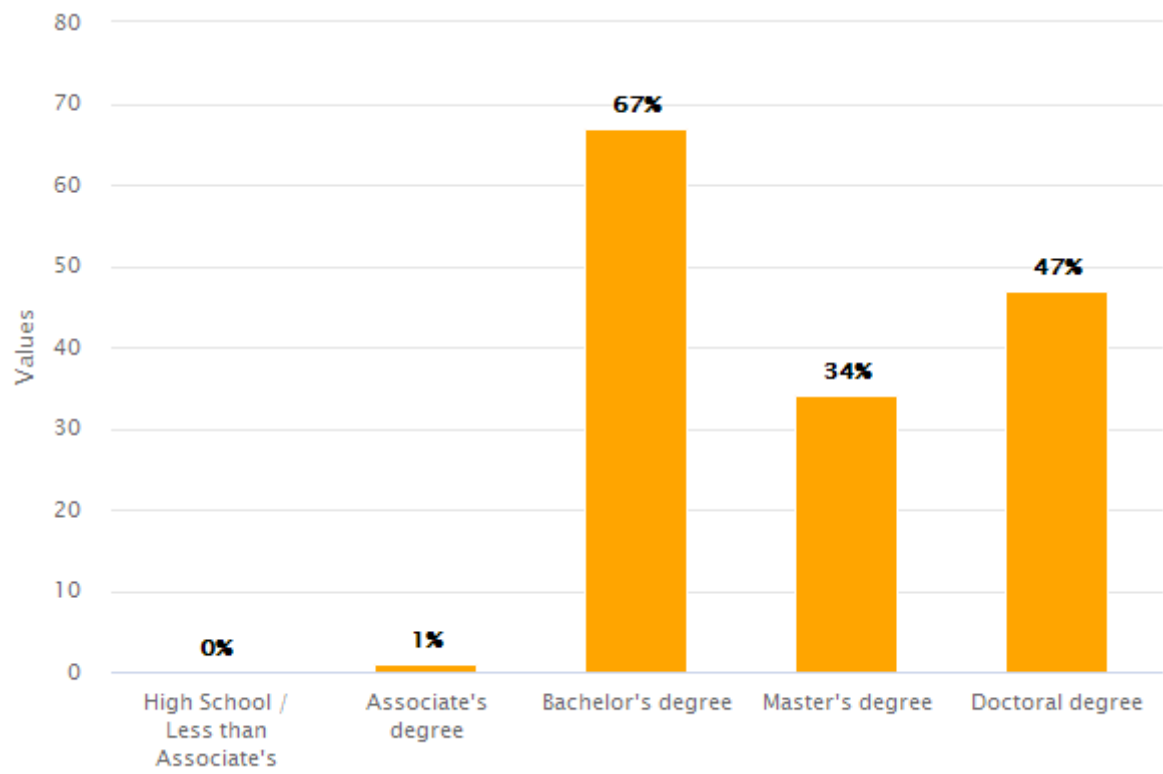
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Degree Level	Doctoral degree
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Selected Programs	Neuroanatomy (26.1502), Neurobiology and Anatomy (26.1503), Neurobiology and Behavior (26.1504), Neurobiology and Neurosciences, Other (26.1599), Neuroscience (26.1501)
Career Outcomes mapped to Selected Programs of Study	Medical Scientist, Biologist

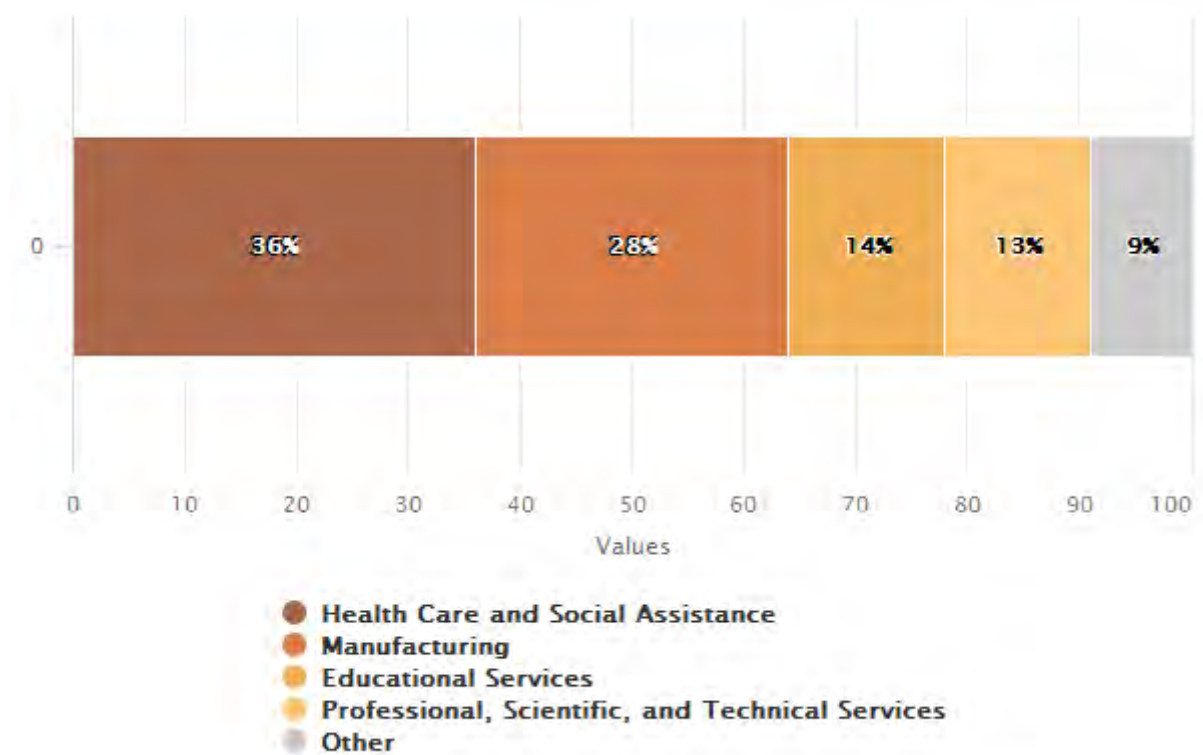
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## JOB POSTINGS BY ADVERTISED EDUCATION (%)

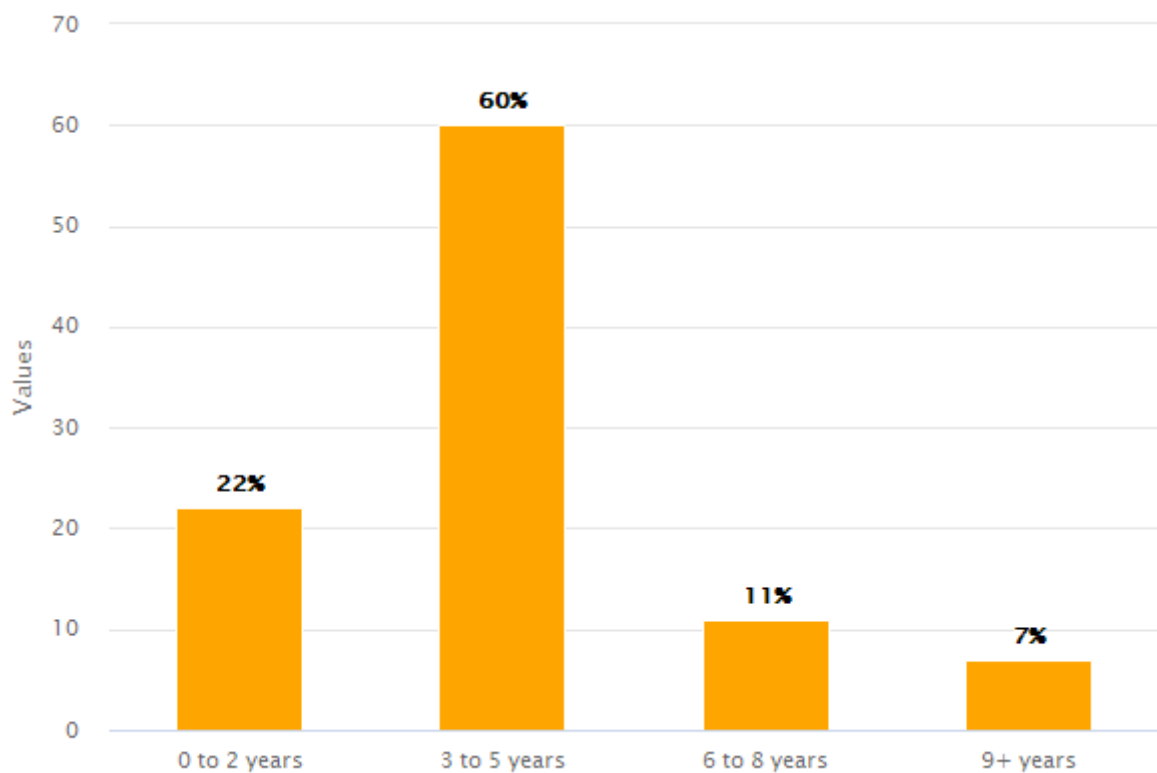




#### JOB POSTINGS BY INDUSTRY (%)



#### JOB POSTINGS BY EXPERIENCE REQUESTED (%)



## TOP TITLES

**Experience Level:** All Experience

Title	Postings	Market Share (%)
Medical Science Liaison	39	5.16%
Medical Science Liaison II, Cardiovascular & Renal	28	3.70%
Msl II	18	2.38%
Research Entomologist	17	2.25%
Director Medical Science Liaison Msl - Hematology	11	1.46%
Medical Science Liaison III- Radiology	11	1.46%
Post-Doctoral Fellow	11	1.46%
Regional Director Medical Science Liaison Msl - Cardiorenal	11	1.46%

Senior Medical Science Liaison	11	1.46%
Senior Director Medical Science Liaison Msl - Cardioresenal	9	1.19%
Oncology Medical Science Liaison	8	1.06%
Applied Post-Doctoral Fellow	7	0.93%
Biological Scientist II	7	0.93%
Biological Scientist III	7	0.93%
Assistant Or Associate Professor Genitourinary Malignancy Research Center	6	0.79%

## TOP EMPLOYERS HIRING

**Experience Level:** All Experience

Employer	Postings	Market Share (%)
Bayer Corporation	88	11.64%
Moffitt Cancer Center	65	8.60%
University of Florida	47	6.22%
University of Miami	34	4.50%
Sanofi Aventis	21	2.78%
H Lee Moffitt Cancer Center	20	2.65%
Amplify Health	19	2.51%
Iqvia	19	2.51%
Genentech	17	2.25%
Bestmsls	13	1.72%
Cleveland Clinic	12	1.59%
Baptist Health	11	1.46%
Johnson & Johnson	11	1.46%
Nemours	10	1.32%
Astrazeneca	9	1.19%



# VALIDATE: KEY COMPETENCIES

## PROJECT CRITERIA

Validate	Programs
States	Florida
Degree Level	Doctoral degree
Time Period	10/1/2019 - 9/30/2020
Selected Programs	Neuroanatomy (26.1502), Neurobiology and Anatomy (26.1503), Neurobiology and Behavior (26.1504), Neurobiology and Neurosciences, Other (26.1599), Neuroscience (26.1501)
Career Outcomes mapped to Selected Programs of Study	Medical Scientist, Biologist

## TOP 15 SPECIALIZED SKILLS

Skill	Postings	Projected Growth	Salary Premium	Competitive Advantage
Medical Science	319 (28%)	5.6%	Yes	Yes
Clinical Research	212 (18%)	-22.47%	No	No
Cancer knowledge	209 (18%)	17.96%	No	No
Biology	174 (15%)	-20.99%	No	No

Clinical Trials	171 (15%)	2.37%	No	No
Project Management	159 (14%)	-19.74%	Yes	No
Budgeting	154 (13%)	-10.04%	Yes	No
Oncology	142 (12%)	15.67%	Yes	No
Experiments	130 (11%)	3.17%	No	No
Clinical Development	126 (11%)	3.78%	Yes	Yes
Molecular Biology	124 (11%)	-19.19%	No	Yes
Pharmaceutical Industry Knowledge	119 (10%)	-32.42%	No	Yes
Managed Care	115 (10%)	-6.25%	No	No
Patient Care	113 (10%)	15.79%	No	No
Training Programs	89 (8%)	-11.54%	No	No

## TOP 15 BASELINES SKILLS

Skill	Postings
Research	714 (62%)
Communication Skills	460 (40%)
Teamwork / Collaboration	362 (31%)
Organizational Skills	194 (17%)
Detail-Oriented	168 (14%)
Problem Solving	165 (14%)
Microsoft Excel	156 (13%)
Written Communication	155 (13%)
Presentation Skills	152 (13%)
Building Effective Relationships	149 (13%)



Computer Literacy	148 (13%)
Planning	141 (12%)
Writing	131 (11%)
Microsoft Powerpoint	121 (10%)
Time Management	76 (7%)

#### TOP 15 SOFTWARE PROGRAMMING SKILLS

Skill	Postings	Projected Growth	Salary Premium	Competitive Advantage
Microsoft Excel	156 (13%)	17.03%	No	No
Microsoft Powerpoint	121 (10%)	-8.52%	No	No
Microsoft Office	74 (6%)	-10.2%	No	No
Lotus Applications	68 (6%)	-100%	No	No

Lotus Notes	68 (6%)	-100%	No	No
Microsoft Word	47 (4%)	-13.39%	No	No
Python	29 (2%)	61.12%	No	No
Customer Relationship Management (CRM)	22 (2%)	15.03%	No	No
R	17 (1%)	40.61%	No	No
MATLAB	16 (1%)	-7.53%	No	No
PERL Scripting Language	16 (1%)	-36.55%	No	No
Linux	13 (1%)	-12.57%	No	No
Data Visualization	13 (1%)	72.42%	No	No
UNIX	12 (1%)	-61.89%	No	No
Word Processing	10 (1%)	-19.34%	No	No

## TOP 15 SKILL CLUSTERS

Skill	Postings
Clinical Research	442 (38%)
Medical Research	439 (38%)
Oncology	281 (24%)
Project Management	197 (17%)
Molecular Biology	190 (16%)
Laboratory Research	175 (15%)
Genetics	171 (15%)
Cellular Biology	168 (14%)
Budget Management	154 (13%)
Chemistry	145 (12%)
Drug Development	132 (11%)

Pharmaceutical Industry Knowledge	119 (10%)
Medical Support	107 (9%)
Pathology	81 (7%)
Medical Procedure and Regulation	78 (7%)

#### TOP 15 SALARY PREMIUM SKILLS

Skill	Postings	Projected Growth	Salary Premium	Competitive Advantage
Medical Science	319 (28%)	5.6%	Yes	Yes
Project Management	159 (14%)	-19.74%	Yes	No
Budgeting	154 (13%)	-10.04%	Yes	No
Oncology	142 (12%)	15.67%	Yes	No
Clinical Development	126 (11%)	3.78%	Yes	Yes
Thought Leadership	70 (6%)	5.96%	Yes	Yes

Genetics	60 (5%)	0.38%	Yes	Yes
Data Analysis	55 (5%)	81.86%	Yes	No
Flow Cytometry	51 (4%)	18.84%	Yes	No
Good Clinical Practices (GCP)	42 (4%)	20.42%	Yes	Yes
Infectious Disease	36 (3%)	6.08%	Yes	Yes
Drug Development	30 (3%)	0.43%	Yes	No
Drug Discovery	30 (3%)	-6.02%	Yes	No
Quality Management	27 (2%)	-10.99%	Yes	No

#### TOP 15 COMPETITIVE ADVANTAGE SKILLS

Skill	Postings	Projected Growth	Salary Premium	Competitive Advantage
Medical Science	319 (28%)	5.6%	Yes	Yes
Clinical Development	126 (11%)	3.78%	Yes	Yes

Molecular Biology	124 (11%)	-19.19%	No	Yes
Pharmaceutical Industry Knowledge	119 (10%)	-32.42%	No	Yes
Thought Leadership	70 (6%)	5.96%	Yes	Yes
Genetics	60 (5%)	0.38%	Yes	Yes
Teaching	56 (5%)	-12.75%	No	Yes
Pathology	48 (4%)	1.34%	No	Yes
Good Clinical Practices (GCP)	42 (4%)	20.42%	Yes	Yes
Infectious Disease	36 (3%)	6.08%	Yes	Yes
Laboratory Testing	33 (3%)	16.76%	No	Yes
Medical Management	9 (1%)	20.64%	No	Yes
Acute Care	8 (1%)	44.69%	No	Yes

Patient Safety	6 (1%)	7.76%	No	Yes
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## TOP 15 CERTIFICATIONS

Skill	Postings	Salary Premium	Competitive Advantage
Driver's License	130 (11%)	No	No
Board Certified/Board Eligible	97 (8%)	No	No
Certified Registered Nurse Practitioner	80 (7%)	No	No
Registered Nurse	45 (4%)	No	No
Pharmacist License	13 (1%)	No	No
Certified Financial Planner (CFP)	9 (1%)	No	No
American Society For Clinical Pathology (ASCP) Certification	7 (1%)	No	No
Basic Life Saving (BLS)	7 (1%)	No	No
Security Clearance	7 (1%)	No	No

Certified Career Development Facilitator	5 (0%)	No	No
Clinical Laboratory Technologist	4 (0%)	No	No
Certified Clinical Research Professional	3 (0%)	No	No
Basic Cardiac Life Support Certification	3 (0%)	No	No
Microsoft Certified Professional (MCP)	2 (0%)	No	No
Certified Diabetes Educator (CDE)	2 (0%)	No	No

#### TOP 15 SALARY PREMIUM CERTIFICATIONS

Skill	Postings	Salary Premium	Competitive Advantage
No certificates available			

#### TOP 15 COMPETITIVE ADVANTAGE CERTIFICATIONS

Skill	Postings	Salary Premium	Competitive Advantage
No certificates available			



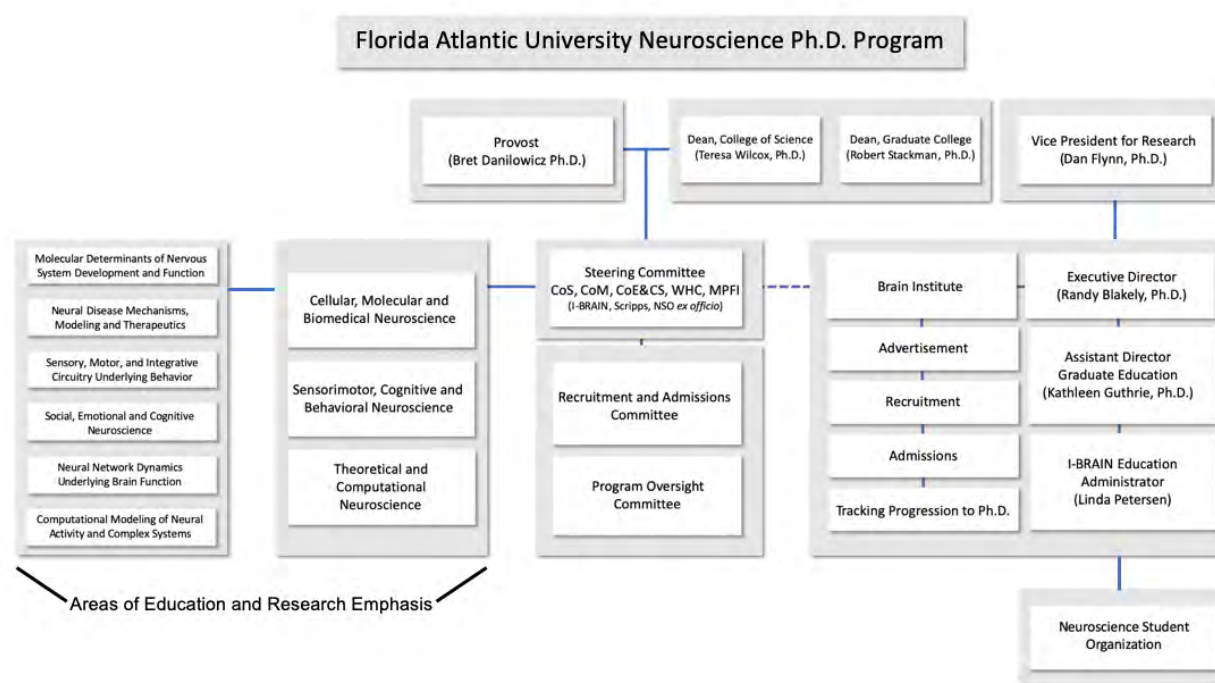
## I. FAU Neuroscience Graduate Program (NGP) Participating Units

The diagram illustrates the structure of the Florida Atlantic University Neuroscience Graduate Program. At the center is a large white circle containing a stylized illustration of a neuron (top) and a human brain (bottom). The text "Florida Atlantic University Neuroscience Graduate Program" is centered within this circle. Surrounding the central circle are eight smaller, light gray circles, each connected to the center by a blue line. These peripheral circles represent the constituent departments or colleges of the program:

- FAU College of Science (top)
- Scripps Research Florida (top-right)
- Max Planck Neuroscience Florida (right)
- FAU Brain Institute (bottom-right)
- FAU Wilkes Honors College (bottom)
- FAU College of Education (bottom-left)
- FAU College of Medicine (left)
- FAU College of Engineering (top-left)

## II. Overview of NGP Organization and Administrative Structure

The activities of the FAU NGP are supported through the collaborative participation of the Division of Academic Affairs and the Division of Research as shown in Figure 1. The Division of Research, through its support for the Brain Institute (I-BRAIN), supports the administration of the program and provides support for trainee stipends as well as for the research infrastructure needed for students to pursue research. The Division of Academic Affairs, through its support for Colleges and Departments provides support for trainee stipends and the educational infrastructure characteristic of a modern university. The Graduate College, which ultimately awards the Neuroscience PhD, provides support for program tuition and for professional development activities that help students to develop communication skills, to pursue professional networking opportunities, and to identify career options. The Neuroscience Student Organization (NSO) enhances the educational experience by increasing student awareness of research and professional opportunities via peer-driven networking events, informal science gatherings, hosting of speakers, program leadership, and community engagement activities.



The Division of Research (currently headed by Vice President for Research Daniel Flynn, PhD), provides all support for I-BRAIN to administer the NGP. The I-BRAIN Executive Director (currently Randy Blakely, Ph.D.) serves as Director of the NGP. The NGP Director coordinates the funding of the NGP and works with the Vice President of Research and the Deans of the Colleges, (who then report to the Provost (currently Bret Danilowicz, PhD)), to-determine each year the number of trainees that can be recruited and supported in the subsequent year. The NGP Director is also the Director of NGP-specific Training Grants and oversees NGP marketing and other modes of program visibility. The NGP Director works closely with the Chair of the Steering Committee and its members to receive annual faculty input regarding I-BRAIN's management of the program,

and the distribution of students among the major Areas of Education and Research Emphasis. The Director does not select program faculty, nor select students for interviews or acceptance.

The Director's administration of the NGP is supported by the I-BRAIN Assistant Director for Graduate Education (currently Kathleen Guthrie, Ph.D.) who is appointed by the I-BRAIN Executive Director and who receives effort support from I-BRAIN. The Assistant Director for Graduate Education assists with student recruitment and serves as coordinator and student advisor during the 1<sup>st</sup> year of the program, when students are engaged in laboratory rotations. The Assistant Director also assists with orientation of new students, documents student completion of required compliance training, and verifies completion of an initial Plan of Study which is provided to the Curriculum Committee for approval, followed by submission to the Graduate College. The Assistant Director also oversees the Fall and Spring Semester Neuroscience Seminar Series, and coordinates guest speaker invitations with program faculty in order to achieve a balanced representation of speakers across the three major Areas of Education and the multiple FAU campuses. The Assistant Director also serves as an Advisor to the Neuroscience Student Organization (NSO), a Graduate Student Association-approved organization that is student governed supports the professional development of trainees pursuing education and research in multiple FAU graduate programs. The Assistant Director and the three NGP Committees are assisted by a dedicated Education Administrator (currently Ms. Linda Petersen) who is supported by I-BRAIN and appointed by the I-BRAIN Executive Director. The Administrator oversees the overall administrative operations of the NGP, including NGP advertising, the hosting of applicants for interviews and other recruitment events, ensures timely submission of application materials and faculty reviews to the Recruitment Committee, coordinates new student orientation, schedules NGP Committee meetings, and takes/distributes minutes for NGP Committee meetings. The Administrator works with the I-BRAIN Assistant Director of Administrative Operations (currently Gala Pierce) to coordinate student stipend payments and benefits. The Assistant collects information related to the academic progression of students and communicates these to NGP Committees as requested.

### **III. NGP Committee Responsibilities and Member Selection**

**Steering Committee:** NGP oversight is the responsibility of the NGP Steering Committee. The Steering Committee is responsible for the program By-Laws and its potential modifications which can be suggested at any time by NGP training faculty and then reviewed at regularly scheduled Committee meetings. If voted meritorious by the Steering Committee, By-Law modifications can be made, provided majority support by the NGP training faculty. The Steering Committee receives and votes on the addition or dismissal of faculty as NGP training mentors and reviews any issues related to program operations or to faculty/student interactions, forwarding relevant information and opinions to the Dean of the College of Science, who serves as the reporting officer within Academic Affairs. Any faculty or student issues that are reported to the Dean of the College of Science are communicated in parallel to the Dean and Department Chair of the faculty involved and the Dean of the Graduate College. The Steering Committee meets annually with the Program Director to review the distribution of recruitment slots to the three Areas of Education and Research Emphasis. This distribution will be determined annually by the NGP Director based on the prior distribution of students admitted the previous year, the funding needs of the existing students, and the availability of positions funded by the Colleges and the Division of Research.

The Steering Committee will be made up of 11 members, appointed by the Deans of the represented Colleges, with the input of NGP faculty from the College. Proportional representation of faculty in relation to College participation is a guiding goal in forming the committee. Colleges contributing at least 4 faculty to the program will be represented by at least 1 voting member on

the committee. Based on the projected College representation of faculty, 6 faculty from the College of Science, 3 faculty from the College of Medicine, 1 faculty from the Wilkes Honors College, and 1 faculty from the College of Engineering and Computer Science will comprise the voting members of the committee. The NGP Director and a faculty member from both Max Planck Florida and Scripps Florida will be invited to join Steering Committee meetings in a non-voting capacity, as will the President of the Graduate Neuroscience Student Organization (NSO). Chairs of the Curriculum and Recruitment Committees will also be invited to attend committee meetings in a non-voting capacity. Total number of faculty needed to achieve proportionality, while maintaining an odd number for voting, may lead to a change in the number of faculty on the committee. Committee number and representation will be reviewed annually by the Chair of the Committee, in consultation with the NGP Director and Dean of the College of Science. College representatives on the Steering Committee will be selected by the Dean of each College or their designee based on a vote of the training faculty, with adjustments allowed based on conflicting assignments or a need to achieve balance across areas of representation. Committee members serve renewable 3 Yr terms. The Chair of the Committee is selected by a vote of the Committee prior to the first committee meeting, serving a 3 Yr term.

The Steering Committee, in consultation with the Dean of the College of Science and the NGP Director, drafts the initial NGP By-Laws document that serves as guiding rules for the operation of the program. Creation and amendment of By-Laws for this program shall be approved by a vote of the NGP training faculty. Annually, the NGP Director and the Chair of the Steering Committee hold a Program Faculty Assembly to review any proposed changes to By-Laws and to discuss recruitment results in the past year, program metrics, program finances and program recruitment or any other issues of relevance to the NGP in the coming year. These bylaws shall be reviewed periodically, generally every three years, and readopted by the NGP training faculty.

To further ensure that maximum opportunities are taken to ensure the application, recruitment and success of trainees from underrepresented groups, a subcommittee of the Steering Committee will be formed that is focused on Diversity Opportunities. The members of the subcommittee will report on ongoing and potential changes to NGP practices to optimize program diversity. Actions recommended by the subcommittee will be voted on by the full committee for implementation.

**Recruitment Committee:** The NGP Recruitment Committee ranks applicants for interviews and admission with the number of slots determined annually based on available institutional resources and faculty support for trainee stipends. Rankings for offers of admission to the NGP in the subsequent Fall semester are determined by representatives of each Area of Emphasis based on feedback from faculty after interviews are completed. The NGP Director works with the Steering Committee to establish the distribution of students to be ultimately accepted among the different Areas of Emphasis based on total number of positions that can be funded, the representation of Areas of Emphasis by program faculty, and prior patterns of trainee recruitment in these Areas. Faculty are provided with the files of all applicants who meet minimum program requirements, as established each year by the Steering Committee and according to Graduate College requirements. The Recruitment Committee works with staff of the Brain Institute to coordinate interviews, reviews faculty feedback after interviews, and ranks students for offers of admission. Regardless of participation in interviews, all faculty associated with the NGP will be able to view applications and provide input as desired. Members of the Recruitment Committee are appointed by the Steering Committee based on a vote of faculty in the specific Area of Emphasis for 3 Yr terms and is composed of 3 faculty from each Area of Emphasis. A Chair of the Recruitment Committee rotates between representatives of the different Emphasis Area. The Chair of the

Recruitment Committee is invited to attend Steering Committee meetings as a non-voting member and reports to the Committee on the Recruitment Committees plans and activities at least once annually.

The Chair of the Recruitment Committee will work with the Directors of the Experimental Psychology and Integrative Biology Graduate Program, as well as the FAU-Max Planck Florida IMPRS Program to share information concerning applicants so as to consider whether students might be more appropriate for one of the other programs or should be interviewed by the different programs in parallel or collaboratively. Advanced students already in the NGP can apply to join the FAU-Max Planck Florida IMPRS Program, but will continue with the NGP as the home for their degrees. Similarly, students applying to the IMPRS program from other FAU graduate programs will remain a student of the same program for the completion of their Ph.D. Students who are accepted to the FAU-Max Planck Florida IMPRS Program from other institutions can apply to join the NGP and receive academic credit for courses taken elsewhere, with approval from the Curriculum Committee and up to limits established for other students in the NGP. Students who enter the NGP from the FAU- Max Planck Florida IMPRS Program can be approved to enter directly into a faculty member's laboratory if suitably advanced and fully supported by IMPRS mentor funds. These students will complete an NGP Plan of Study, complete Core and Elective Coursework, and complete all requirements for graduation prior to awarding of the Ph.D.

Several mechanisms are designed into the NGP to promote a fair distribution of students across the breadth of faculty programs. First, faculty we allowed a maximum of two students supported by program resources at any one time. A third student may rotate in a lab where 2 students are still pursuing dissertation work so long as one of the existing student's plans to defend their thesis in the next 6 months. Second, in order to spread invitations for interviews and offers of admission as broadly as possible, training faculty will self-define their primary Area of Emphasis so that the results of past recruitments in terms of Areas served can be considered by the NGP Director and Steering Committee in developing the next year's recruiting plan. The Emphasis Area that best defines a faculty member's research program will no doubt change for some faculty or the faculty member may wish to shift priority area. Prior to recruitment of each class, faculty will be asked to define the Emphasis Area that best defines their existing students. With this information, the NGP Director, in consultation with the Steering Committee will develop the recruitment distribution to be used by the Recruitment Committee. The NGP Director will communicate the planned distribution to the training faculty in advance and solicit feedback prior to initiation of recruitment. Regardless of Area representation, all training faculty will be expected to participate in recruitment visits and student interviews when asked, as their schedules permit.

**Curriculum Committee:** The NGP Curriculum Committee reviews and approves/declines course additions to the curriculum, approves Thesis committee members selected by the student and mentor, approves Plans of Study and any needed changes therein including the substitution of Course credits for Research credits, as well as the awarding of program credit given for graduate-level coursework taken before entering the program. The Curriculum Committee is comprised of 3 NGP-affiliated faculty, one from each Area of Emphasis, and are appointed by the Steering Committee based on faculty vote for 3 Yr terms. A Chair of the Committee rotates annually between representatives of the different Emphasis Areas. The Chair of the Committee is invited to attend Steering Committee meetings as a non-voting member and reports to the Steering Committee at least once annually on any curriculum changes and student performance issues and is assisted in Committee activities by the I-BRAIN Education Assistant. The Committee reviews Plans of Study and all forms related to admission to candidacy, change forms, request for exceptions, dismissal or other student misconduct accusations. The Committee forwards properly completed forms related to plans of study and advancement to candidacy directly to the

Graduate College. After admission to candidacy, these forms will be forwarded to the Dean of the College in which the mentor holds their primary appointment. Any issues related to faculty or student misconduct will be brought to the attention of the Steering Committee and communicated to the College of Science Dean and the College where the faculty holds their primary appointment for evaluation.

#### **IV. Proposed Curriculum:**

##### Fall Year 1

1. Cell and Molecular Neuroscience – 3 Credits (Core)
2. Experimental Design I or Computational Neuroscience I – 3 Credits (Core)
3. Neuroscience Laboratory Rotations (1<sup>st</sup> and 2<sup>nd</sup> Rotation) – 2 Credits (Core)
4. Neuroscience Seminar – 1 Credit

##### Spring Year 1

1. Systems and Integrative Neuroscience – 3 Credits (Core)
2. Elective 1 – 3 Credits
3. Neuroscience Laboratory Rotations (3<sup>rd</sup> and 4<sup>th</sup> Rotation) – 2 Credits (Core)
4. Neuroscience Seminar – 1 Credit

##### Summer Year 1

1. Advanced Research – 1 Credit

##### Fall Year 2

1. Brain Disorders and Therapeutics– 3 Credits (Core)
2. Elective - 3 Credits
3. Advanced Research – 3 Credits
4. Neuroscience Seminar – 0 Credits

##### Spring Year 2

1. Elective 3 – 3 Credits
2. Scientific Communications– 3 Credits (Core)
3. Advanced Research – 3 Credits
4. Neuroscience Seminar – 0 Credits

##### Summer Year 2 (Write Thesis proposal)

1. Advanced Research – 1 Credit

##### Year 3 Fall (Defend Proposal)

1. Advanced Research – 9 Credits
2. Neuroscience Seminar – 0 Credits

##### Years 3-5 Fall, Spring and Summer

1. Dissertation Research – 1-9 Credits each semester
2. Neuroscience Seminar – 0 Credits

#### **V. Training Faculty Representation in Areas of Education and Research Emphasis**

Several mechanisms are designed into the NGP to promote a fair distribution of students across the breadth of faculty programs. First, faculty we allowed a maximum of two students supported

by program resources at any one time. A third student may rotate in a lab where 2 students are still pursuing thesis efforts so long as one of the existing student's plans to defend their thesis in the next 6 months. Second, in order to spread invitations for interview and offers of admission as broadly as possible, training faculty will self-define their primary Emphasis Areas so that the results of past recruitments in terms of Areas served can be considered by the NGP Director and Steering Committee in developing the next year's recruiting plan. The Emphasis Area that best defines a faculty member's research program will no doubt change for some faculty or the faculty member may wish to shift priority area if they have already successfully recruited to another Emphasis Area and wish not to attract a student with distinct interests and aptitudes. Prior to recruitment of our class, faculty will be asked to define the Emphasis Area that best defines their existing students. With this information, the NGP Director, in consultation with the Steering Committee will establish the recruitment distribution used by the Recruitment Committee. The NGP Director will communicate the planned distribution to the training faculty in advance and solicit feedback prior to initiation of recruitment. Regardless of Emphasis Area representation, all training faculty will be expected to participate in recruitment visits when asked and their schedules permit. The Emphasis Areas designated with the initiation of the program may be redefined over time by the Steering Committee and with faculty input to capture changes in field delineation, though Areas should remain representative of the full breadth of the discipline as best possible. Below, we provide a projected distribution of tenure-track and tenured faculty among Emphasis Areas.

<b>Cellular, Molecular and Biomedical Neuroscience</b>	<b>Sensorimotor, Cognitive and Behavioral Neuroscience</b>	<b>Theoretical and Computational Neuroscience</b>
Randy Blakely	Rindy Anderson	William Alexander
McLean Bolton	Gizelle Anzures	Raquel Assis
Lucia Carvelli	Salil Bidaye	Elan Barenholz
Predrag Cudic	Jason Christie	Stephen Bressler
Ken Dawson-Scully	Ali Danesh	Lun-Ching Chang
Gregg Fields	Chad Forbes	Erik Engeberg
Deguo Du	David Fitzpatrick	Behnaz Ghorani
Erik Duboue	Sang Hong	William Hahn
Tanja Godenschwege	Nancy Jones	Hidehiko Inagaki
Patrick Grant	Alan Kersten	Scott Kelso
Kathleen Guthrie	Johanna Kwalko	Zongwei Li
Ceylan Isgor	Connie Porcaro	Ramin Pashaie
Kailiang Jia	Shaefali Rogers	Mahsa Ranji
Marc Kantorow	Monica Roselli	Emmanuelle Tognoli
Alex Keene	Wen Shen	
Andy Khamoui	Summer Sheremata	
Greg Macleod	Robert Stackman	
Sarah Milton	Sarah Stern	
Rod Murphey	Hiroki Tanaguchi	
Howard Prentice	Teresa Wilcox	
Ning Quan	Henriette van Praag	
Vidya Ranaraju	Carmen Varela	
Janet Robishaw	Robert Vertes	
Rui Tao	Yingxue Wang	
Larry Toll		

Jenny Wei		
John Wu		
Ryohei Yasuda		

## VI. Student Support:

**Funds from Division of Academic Affairs:** Each year, based on existing financial circumstances and the need to support of the full spectrum of university education, the Division of Academic Affairs, via its Colleges and Departments, provides funds to support Graduate Teaching Assistantships (GTAs) to help–cover the stipends of NGP trainees. The commitment to the program provides for funds that can cover 4 GTAs in Yr 1, monies that are allotted to the College of Science. The Dean of the College of Science assigns the teaching commitments of the students who hold these GTAs to College of Science Departments who then match the student to specific teaching assignments in keeping with the needs of their undergraduate educational programs. Growth in GTA numbers are currently projected for the first 5 years of the program reaching 20 GTAs total by 5 Yrs. These GTAs may be augmented or substituted by GTAs provided by other Colleges at their discretion. The students who hold the latter types of GTAs, if contributed, will be assigned by the Dean of the College to the Departments that will match the student to specific teaching assignments in keeping with the needs of their undergraduate educational programs.

**Funds from Division of Research:** Each year, based on existing financial circumstances and the need to invest in infrastructure supporting university research, the Division of Research, via I-BRAIN, provides funds for Graduate Teaching Assistantships (GTAs) to help support the stipends of NGP trainees. The initial commitment to the program provides funds that can cover 4 GTAs in Yr 1, monies that are provided via I-BRAIN to the College where the student’s mentor holds their primary academic appointment. The Dean of the respective College assigns the teaching commitments of the students who hold these GTAs to College Departments who then match the student to specific teaching assignments in keeping with the needs of their undergraduate educational programs. Growth in Division of Research-funded GTAs is currently projected for the first 5 Yrs of the program so that 20 GTAs will be funded by Yr 5 of the program, with funds for any additional GTAs identified through the activities of I-BRAIN in securing discretionary funds based on IDC recovery from I-BRAIN faculty recruitments, training grants, or gifts targeted to I-BRAIN-sponsored educational programs. The students who hold the latter GTAs, if contributed, will be assigned to the College where the student’s mentor holds their primary academic appointment. The Dean of that College assigns the teaching commitments of the students who hold these GTAs to College Departments who then match the student to specific teaching assignments in keeping with the needs of their undergraduate educational programs. For the students holding GTAs sponsored either by I-BRAIN or the College of Science, I-BRAIN will provide a top-up of stipend to achieve a nationally-competitive stipend (top up currently set to achieve a total salary of \$30,000) as well as cover health insurance costs that are unmet by the Graduate College (up to \$3,000). Support for stipends, top-ups and insurance, unless these can be covered by investigator grants, student fellowships, MPFI fund or other funding, are guaranteed by I-BRAIN for 5 years.

GTAs that are liberated by faculty or trainee grants or other sources (e.g. philanthropy) will return to the program to allow for growth. The use of these GTAs will remain associated with either the College of Science or Division of Research via I-BRAIN depending on the source of original provision.



**Funds from Graduate College:** The Graduate College provides support for tuition waivers for NGP trainees throughout the course of their education, unless substituted by other sources, such as faculty grants or student fellowships.

**Additional Support:** For students whose stipend is supported by faculty grants, I-BRAIN will continue to provide a top-up, if needed, above the amount the grant can support to maintain the trainee's salary at the level provided upon entry to the program. Both stipend and top-up costs are provided from MPFI-based funds if a student pursues their PhD thesis under an MPFI mentor.

**Support to Grow Program Trainee Numbers:** Currently, our budget model provides for funds derived from the Division of Academic Affairs and the Division of Research to cover 8 trainees recruited in Yrs 1 and 2 of the NGP. Based on a conservative estimate of the ability of faculty to support trainee salaries, of students to secure external fellowships that cover most or all of the cost of their education, and of the program to obtain Training Grant funds, we project that we can grow the NGP to admit 10 students in Yrs 3 and 4, and to 12 students in Yr 5. These numbers may increase or decrease depending on the financial circumstances of both Divisions. It is expected that the monies obtained will convert GTAs into Graduate Research Assistantships (GRAs) that allow students to pursue research.



JOSEPH T. COYLE, M.D.  
Eben S. Draper Professor of Psychiatry  
and of Neuroscience

Randy D. Blakely, Ph.D.  
Executive Director, Brain Institute, and  
Professor, Department of Biomedical Science  
Charles E. Schmidt Colleges of Medicine

November 11, 2020

Dear Randy,

Thank you for the opportunity to review a draft summary of your proposal to form a Neuroscience Graduate Program (NGP) at Florida Atlantic University. It looks really terrific! As you know, I have extensive experience with neuroscience graduate education and firmly believe that a multidisciplinary program that engages basic and translational researchers is key to our future progress in combating the devastating brain disorders that plague so many of our citizens. I was part of the creation of the first such program at John Hopkins, now nearly 40 years ago. The program has trained many luminaries in the field, including our first graduate, now Executive Director of the FAU Brain Institute! Since that time,

Neuroscience graduate programs have become a key feature of every top-ranked university in the country. When I was President of the Society for Neuroscience, I had many conversations, then and since, with the leaders of these programs and most are structured much like the one that you propose. Yours reminds me a lot of the highly successful UC San Diego program, with its association with two premier research institutes – yours being Max Planck Florida and Scripps Research in Jupiter, Florida, and theirs being the Salk Institute and Scripps Research in La Jolla, California.

I think it is very important that your program is structured to engage faculty from different colleges and departments in education, research mentorships and governance. Additionally, it is clear that the neuroscientist of today needs to think across levels of analysis so that the results of our research can advance beyond the descriptive and have a more meaningful impact for Society. Someone with your career long immersion in multiple subfields of the discipline, from genetics and molecular neuroscience to the development of therapeutic agents for brain disorders, is just what the program needs. Students need to have role models. Having your example as the NGP Director should pay dividends in program execution and recruitment.

Thanks for allowing me to comment on the proposal. Get going!  
Sincerely,

Joseph T. Coyle, MD  
Eben S. Draper Professor of Psychiatry and Neuroscience  
Harvard Medical School/McLean Hospital



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November 11, 2020

Randy D. Blakely, Ph.D.  
Executive Director, Brain Institute, and  
Professor, Department of Biomedical Science  
Charles E. Schmidt Colleges of Medicine

Dear Randy,

It's always wonderful to hear from you! I am pleased that you reached out to me for input on your draft proposal for a Neuroscience Graduate Program (NGP) at FAU. You bring so much experience to this effort, having developed, together with Elaine Sanders-Bush, the highly regarded Vanderbilt Neuroscience Graduate Program when you were the Director of the Vanderbilt Center for Molecular Neuroscience. The program you built there, which I see strong parallels to the FAU NGP, bridges molecular, systems and clinical neuroscience and has churned out extraordinary talent, many of whom now hold positions in academia, the pharmaceutical industry, government and other aligned career paths. The engagement of faculty from multiple colleges and departments is essential for the training of neuroscientists today, something I was proud to champion when I was Chair of the Neurobiology and Co-chair of the Center for Neuroscience at the University of Pittsburgh, and later as President of the Society for Neuroscience, the world's largest organization devoted to neuroscience research, education and public policy. I am very happy again to espouse these values as President-Elect of AAAS.

With respect to your proposal, I was struck by the strong governance structure you have in place and that it draws from faculty from all participating colleges and institutes. Faculty can sometimes see themselves as outsiders in the process; with the careful attention you have given to faculty representation in steering, recruitment and curriculum, you will undoubtedly foster an atmosphere of commitment, fairness and inclusion. There are outstanding scientists and educators at FAU and the NGP will give those interested in neuroscience and its collaborative disciplines many reasons to feel a part of the process. The coursework looks sound and flexible, allowing students significant opportunities to tailor their education to the changing landscape of neuroscience research. Also, we both know that technological advances are key to the success of our field and students, and the investments that FAU has made in neuroscience research infrastructure via the Brain Institute are substantial. The millions of dollars in research resources present at Scripps and Max Planck should provide even greater opportunities for your trainees. Ultimately, success will come down to the strength of the faculty trainers for the program and the mechanisms in place for them to train your students. Your ambition and passion to build a world class Brain Institute that works across departments, colleges and institutes is key to this effort.

Such a program is not only key to your efforts in education, but also for your ability to recruit research-intensive faculty to FAU and high-tech industry to the region. Access to bright, well-trained graduate students is crucial to attracting the best faculty from leading universities where interdisciplinary neuroscience graduate programs have been established for decades.

I have also followed closely your significant work in bridging the academy and the lay communities we ultimately serve. The fantastic "Journey Through the Human Brain" exhibit you helped craft at the South Florida Science Center is but one example of your tireless commitment to outreach. Exhibits of this kind make the mysteries of the brain accessible to all and are opportunities to engage the public and promote brain health for hundreds of thousands of local youth and adults, as well as visitors to the area. Such activities also will provide terrific opportunities for your trainees to practice their speaking and teaching skills and constantly remind them of a broader mission to impact the health of our citizens, so many of whom suffer from brain disorders. I look forward to seeing in person the results of these compelling outreach activities, which I know will serve as a model for neuroscience centers throughout the country.

Thanks again sharing your plans for the FAU NGP in its formative period. It looks truly remarkable and is the critical next step for FAU to advance as a leader in neuroscience education and research.

With all good wishes for the success of this exciting initiative,

A handwritten signature in black ink, appearing to read "Susan G. Amara". The signature is fluid and cursive, with a long horizontal stroke at the end.

Susan G. Amara, PhD  
Scientific Director, Intramural Research Program  
National Institute of Mental Health



NEW YORK UNIVERSITY SCHOOL OF MEDICINE

Moses V. Chao  
Molecular Neurobiology Program  
Skirball Institute of Biomolecular Medicine  
Department of Cell Biology  
Department of Physiology and Neuroscience

540 First Avenue, New York, NY 10016  
Telephone: (212) 263-0761  
Fax: (212) 263-0723  
E-Mail: [chao@saturn.med.nyu.edu](mailto:chao@saturn.med.nyu.edu)

November 12, 2020

Randy D. Blakely, Ph.D.  
Executive Director, Brain Institute, and  
Professor, Department of Biomedical Science  
Charles E. Schmidt Colleges of Medicine

Dear Randy,

I am very pleased to provide my strongest support for your **Neuroscience Graduate Program** application at FAU. I fondly recall my visit to the Brain Institute a year and a half ago when this proposal was in its early stages. I could clearly see your enthusiasm for the many opportunities for students and faculty inherent in the program and reading over your draft summary, I feel your vision has generated something of truly lasting value for your community, and for many of those in society who suffer from brain disorders.

As you know, I have held many positions in the field of neuroscience, including serving from 2011-2012 as president of the Society for Neuroscience, the nation's largest organization of neuroscience faculty and students. I have also had significant experience training and leading neuroscience educational initiatives, on campus and for the community. It is from that context that I can attest that the program you have generated is quite special. Your engagement of faculty from multiple colleges, departments and institutes is impressive. Clearly, your experience with the generation of the graduate program at Vanderbilt shines through the construction of the program. Also, your prior experience of teaching at Cold Spring Harbor Laboratory is invaluable. The engagement with Scripps Florida and Max Planck Institutes adds intellectual and technological depth to the significant resources that FAU has committed to the program. You should be applauded for bringing these institutions together.

On my visit, I was not only impressed of your vision for the Brain Institute and the forthcoming program, but also by your commitment to community education. Public exposure to science is of great benefit to our society. In addition, this is quite an effective and impactful way to deliver training to graduate students,



2020 Nov 13th

Randy D. Blakely, Ph.D.  
Executive Director, FAU Brain Institute  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

Dear Randy,

I am writing to provide strong support for your proposal to establish the Ph.D. granting Neuroscience Graduate Program (NGP) at FAU. As you know, the leadership, faculty and trainees at the Max Planck Florida Institute for Neuroscience have worked in close partnership with FAU for over a decade to establish a world-class ecosystem for neuroscience research and education. It was exciting to see FAU's commitment to neuroscience research and education embodied by your recruitment as Executive Director of the FAU Brain Institute. Like you, I see the effort to establish the NGP as critical step for the growth of neuroscience education at FAU. The broad, cross-college curriculum you make available to these students, their access to the labs and facilities at FAU, Max Planck and Scripps, and the rotation opportunity they have to explore laboratory research options before matching with a mentor will no doubt be very attractive for applicants. I am also pleased that you have developed a path for the more advanced students of the International Max Planck Research School (IMPRS) for Brain and Behavior to join the NGP. We look forward to working with you and your colleagues at FAU to develop unique educational experiences for graduate students that can ensure them a bright future. Although the program looks exceptionally well-constructed, do not hesitate to contact me if I may further support this effort.

All the best,

Ryohei

Ryohei Yasuda, PhD  
Scientific Director  
Head of education committee  
Max Planck Florida Institute for Neuroscience

encouraging them to hone their speaking skills and to tap that youthful creativity that leads to transformative experiences for kids just beginning to think about the paths for their future. The *Journey Through the Human Brain* exhibit your team helped develop at the South Florida Science Center is truly one of a kind. I know you worked hard to bring this to reality, even before you moved to FAU. That effort clearly shows your enthusiasm for community engagement and your ability to work with teams of students and faculty toward a common goal. I look forward to seeing a touring version of the exhibit come to NYC!

Your draft summary regarding the curriculum is meaningful and right on target. Students today need a broad, early training and an opportunity to share that learning experience via Core courses that they take together, followed by a flexible Elective curriculum that can be tailored to the needs of their research. We really cannot predict where the next advances in our field will come from and having this flexibility will ensure that the training of your students can take advantage of these swings in concepts and technologies. What is more, it is clear that you have embedded a substantial amount of time in the research experience itself. Your trainees will have many career choices, between academia, biotech, computational science, artificial intelligence and many other new fields.

The training at FAU will provide self-confidence that comes from probing the unknown and being fearless in tackling problems. Asking questions is key to an appreciation for what makes us human and to develop communication skills. Mentoring will be highly emphasized, which will lead to lasting career success. I suspect that you will recruit students, postdocs, and faculty from the top institutions. Having this program in place will be critical as many expect these kinds of initiatives are from the best universities. The publicity you generate from your integration of multiple institutes will enable the recruitment of top student talent and will increase the visibility of your institution as a center for advanced research and education.

Overall, this is a remarkable and timely program. I give my unequivocal support for your efforts. You bring a lot of energy and experience to the field of neuroscience and your higher administration is deeply committed to its success. I look forward to seeing the products of the program. Send your trainees to my lab!

With best wishes,



Moses V. Chao, PhD  
Professor



**Kirill A. Martemyanov, PhD**

Professor and Chair  
Department of Neuroscience  
130 Scripps Way C347  
Jupiter, Florida 33458-5284  
Telephone: (561) 228-2770  
Facsimile: (561) 228-2775  
E-mail: [kirill@scripps.edu](mailto:kirill@scripps.edu)

11-13-2020

Randy D. Blakely, Ph.D.  
Executive Director, FAU Brain Institute  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University  
**RE: Letter of support**

Dear Randy,

I am pleased to support your proposal for a Neuroscience Graduate Program at FAU. As you know, Scripps Research here in Jupiter, FL has enjoyed a terrific partnership with the faculty and students at FAU since our arrival and the interactions fostered by our neuroscientists is particularly strong, including the co-mentorship of graduate students. Many FAU graduate and postdoctoral trainees already take advantage of our Core Facilities, join lab meetings and publish collaboratively with our faculty and I see these activities growing nicely as you launch your new program. Our annual SYNAPSE Retreat and its associated poster session, conducted in collaboration with the Max Planck Florida Institute for Neuroscience, has been quite a success and I am sure that many of the NGP trainees will attend, just as ours have joined your Neuroscience Retreat and outreach activities. All in all, I couldn't be more pleased with the formation of this training program, a feature of all top universities in the country. Please call on me and my faculty once you launch the program. You can count on our continued engagement.

Sincerely,

Kirill Martemyanov

A handwritten signature in purple ink, appearing to read "Kirill Martemyanov", with a long horizontal flourish underneath.





## The Florida State University

### Department of Psychology

1107 West Call Street  
Tallahassee, Florida 32306-4301

### Lisa A. Eckel, Ph.D.

Professor of Psychology and Neuroscience  
Director, Program in Neuroscience  
eckel@psy.fsu.edu  
850 644-3480

Randy D. Blakely, Ph.D.  
Executive Director, FAU Brain Institute  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University  
Jupiter, FL 33458

November 29, 2020

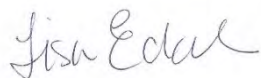
Dear Randy:

I have reviewed your proposal to develop the FAU Neuroscience Graduate Program (NGP), a collaborative, multi-college and multi-institute doctoral training program in Neuroscience. As we have discussed, I believe the program is very well thought out. It will provide a broad array of training opportunities in state-of-the-art facilities, a flexible curriculum with an eye on professional development, opportunities to get involved in community outreach events, and ample funding for students. While this new graduate program will share the same CIP Code (26.1501) as our doctoral Program in Neuroscience at FSU, it differs from our program in several ways. Three key differences include (i) the scope of the program, with FAU having a greater number of participating faculty from a wider base of Colleges and Institutes and thus a more complex administration, (ii) the scope of research opportunities, with FAU offering training opportunities in biosensory engineering, machine learning and artificial intelligence, and cognitive robotics, and (iii) the process by which newly admitted students select an advisor/department, with FAU requiring three research rotations during the students' first year. In comparison, FSU offers a somewhat smaller program located on a single campus with the participating departments in very close proximity in adjacent buildings. We promote interdisciplinary basic and applied research into neural processes underlying behavior within five research areas, and we adopt a mentorship model in which entering students begin research in their home lab without delay. Thus, our respective programs will provide complimentary, but not overlapping, training in Neuroscience, and increase the breadth of research opportunities within the state for students who want to pursue graduate training in Neuroscience. The addition of a second doctoral training program in Neuroscience is also likely to increase the number of applicants from outside the state and serve to increase the stature of both of our programs.

As outlined in your proposal, the demand for PhD training programs in Neuroscience is very high and has consistently outpaced demand for training in closely related fields, including Molecular Biology, Biochemistry, and Health Sciences. Any concern about adding a second graduate training program operating under CIP 26.1500 is mitigated by the historical record of FSU's limited-access program, which receives many times the number of qualified applicants than students admitted yearly, as well as clear indicators that FAU will enjoy similar demand as FSU. Thus, the available data suggest there is sufficient interest in Neuroscience at the state level to yield a greater number of applicants than either program can accommodate.

I am very pleased to offer my support of your new graduate training program in Neuroscience, and I look forward to working with you in the future and sharing insights and new initiatives to facilitate training in both of our programs.

Sincerely,

A handwritten signature in cursive script, reading "Lisa Eckel".

Lisa A. Eckel, Ph.D.  
Professor of Psychology and Neuroscience  
Director, FSU Program in Neuroscience

November 16, 2020

Randy D. Blakely, PhD  
Executive Director, FAU Brain Institute  
Professor, Department of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University (FAU)  
777 Glades Road  
Boca Raton, FL 33431

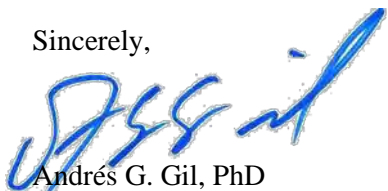
Dear Randy,

I am writing in support of your application for a new Neuroscience Graduate Program (NGP) at FAU. I use FIU as an example of the statewide opportunities that exist for employment for those graduating with your planned degree. As you know, FIU is a site of significant research and education in neuroscience, nicely complementing the activities at FAU in this area. Indeed, there are many fruitful collaborations, past and ongoing, that have relied on talent produced by the other. Like FAU, our neuroscientists regularly hire Postdoctoral Research Associates who further develop their skills in preparation for independent careers. Given the depth of their training, I believe our neuroscience faculty will find the FAU NGP graduates as highly competitive candidates for employment as postdoctoral research staff. Some of your graduates may also compete well for adjunct faculty appointments to assist with our undergraduate teaching mission.

One sign of a healthy research enterprise is the presence of postdoctoral fellows in training, as this denotes a funded research base significant enough to support them. Hiring these graduates can in turn accelerate research given the specialized research training they will have received as graduate students. Both FIU and FAU have seen their research enterprises expand significantly in the past 5 years and our needs for PhD-trained associates, like yours, are growing rapidly. In addition to FIU, significant postdoctoral opportunities in neuroscience also exist at the University of Miami, University of Central Florida, the University of Florida and Florida State University. Moreover, these graduates will also identify many out-of-state sites for employment. I am sure your trainees will obtain excellent positions following graduate school.

I look forward to meeting your team at the Brain Institute and discussing how our two universities can further grow our research and educational collaborations. Best wishes with the new application.

Sincerely,



Andrés G. Gil, PhD  
Vice President for Research & Economic Development  
Dean, University Graduate School



Center for Complex Systems and Brain Sciences  
& Department of Psychology  
Charles E. Schmidt College of Science  
777 Glades Road  
Boca Raton, FL 33431-0991

Gary W. Perry, PhD  
Behavioral Science (BS 12); Room 309  
Email: perryg@fau.edu

## MEMORANDUM

To: William Kalies, Associate Dean for Graduate Studies, Charles E. Schmidt College of Science

From: Gary W. Perry, Director, Center for Complex Systems and Brain Sciences

Cc: Teresa Wilcox, Interim Dean, Charles E. Schmidt College of Science  
Randy Blakely, Executive Director, FAU Brain Institute  
Robin Vallacher, Interim Chair, Department of Psychology  
Sarah Milton, Chair, Department of Biological Sciences

Date: January 29<sup>th</sup>, 2021

Re: Neuroscience PhD proposal

Dear Bill,

Following extensive discussions over the past 18 months, the faculty of the Center for Complex Systems and Brain Sciences has voted to support the proposal to create a new PhD program in Neuroscience at Florida Atlantic University.

The faculty look forward to actively participating in the success of this new PhD program.

Sincerely,

A handwritten signature in black ink, appearing to read "G. W. Perry", is located below the word "Sincerely,".

Gary W. Perry, PhD  
Professor of Neuroscience & Director

September 4, 2021

Randy D. Blakely, Ph.D.  
Executive Director, FAU Stiles-Nicholson Brain Institute  
David J. S. Nicholson Distinguished Professor in Neuroscience  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

Dear Randy,

As the voice of Florida's life sciences industry, representing 6,700 establishments and research organizations in the biopharmaceuticals, medical technology, healthIT and bioagriculture sectors that collectively employ 94,000 Floridians, BioFlorida is eager to support the establishment of the Florida Atlantic University Neuroscience Ph.D. Program.

Florida is in need of the type of talent your program will generate. Florida is seeing double digit growth in the Research & Biopharmaceuticals fields – doubling national averages – and these organizations value and hire Ph.D. level scientists and staff to pursue their activities vital to success.

The program's integration of academia and industry is beneficial to your students and the industry they will support. The partnerships from neuroscience researchers and educators from the FAU Colleges of Science, Medicine, Engineering and Computer Science, Education, the FAU Wilkes Honors College, Scripps Research Florida and Max Planck Florida will deliver a one-of-a-kind, technologically-sophisticated training opportunity.

The addition of the Neuroscience Ph.D. Program to Florida Atlantic University's curriculum broadens the pathway for Florida's future employees to contribute to Florida's robust life sciences industry. A rich research-centered educational framework, with broad training in topics attractive to the health sciences, computer sciences, and engineering sectors, will attract the best and brightest trainees in the field. This is important to the more than 300 member companies that BioFlorida supports and is consistent with our initiative to provide a strong workforce and business climate for the advancement of innovative products and technology that improves lives and promotes economic benefits to the state.

We will stay in touch as your project develops and will be happy to work with you to identify career opportunities and internships for your trainees. Such partnerships generate a pipeline of talent from "bench to bedside" and can help retain these talented young people to pursue careers in Florida.

Sincerely,



Nancy K. Bryan  
President & CEO, BioFlorida, Inc.



**Matthew D. Disney, Ph.D.**

Founder

Expansion Therapeutics

Jupiter, FL 33458

Tel 561-228-2203

Fax 561-228-2147

Email: [mdisney@expansionrx.com](mailto:mdisney@expansionrx.com)

September 14, 2021

Randy D. Blakely, Ph.D.

Executive Director, FAU Stiles-Nicholson Brain Institute

David J. S. Nicholson Distinguished Professor in Neuroscience

Professor of Biomedical Science

Charles E. Schmidt College of Medicine

Florida Atlantic University

Dear Randy,

I am writing to support your proposal for a Neuroscience Ph.D. program at FAU. I am Professor of Chemistry at Scripps Research and Founder of and Chairman of the Scientific Advisory Board of Expansion Therapeutics. Expansion is headquartered in Boston, Massachusetts, with its research facilities located in Jupiter, Florida. Expansion is a drug discovery and development company pursuing the vast potential of small molecule medicines for RNA-mediated diseases. Expansion has assembled the intellectual property, know-how, and proprietary enabling technologies and tools necessary to facilitate the creation of potent and specific small molecule binders of RNA. Through this unique platform, Expansion is building a portfolio of novel RNA-targeted drug candidates with activity across a broad number of disease indications. The company's initial development focus is on therapies for patients with expansion repeat diseases who currently have limited and unsatisfactory treatment options. This past May, Expansion announced the in-licensing of programs that targets tau, a key driver of dementia disorders, and another crucial protein related to neurodegeneration. The tau program builds on the observation that defective pre-mRNA encoding the production of tau protein is involved in the formation of neurofibrillary tangles and has been linked to tauopathies such as Alzheimer's Disease, Frontotemporal Dementias, Progressive Supranuclear Palsy and other neurodegenerative diseases.

The Neuroscience PhD program that you are advancing looks to be a terrific opportunity for students to be trained in advanced concepts in molecular and systems level neuroscience, and how these brain molecules and circuits are impacted by brain disorders. The molecules that Expansion is developing must be optimized and tested extensively using in vitro and in vivo methods that one does not become a master of as undergraduate. The opportunities provided to the students in the Neuroscience PhD program to dive deep into the research literature and to take on advanced research projects of their own are vital experiences to be prepared to join companies like Expansion. And we need them! Our company is growing rapidly, and we will likely need dozens of Ph.D. level scientists at multiple levels of our company in the coming years. It's great to see that the students will be exposed to the science being pursued at Scripps and Max Planck and having an opportunity to meet with outstanding visiting scientists. These experiences can provide key networking aspects of career development and provide role model engagement

that can encourage them to reach further than they thought possible. Frankly, we could use four of your programs, such is the need state and nationwide. Importantly, the research these students will do to acquire the Ph.D. will give them the experience needed to drive mission-critical research in the commercial sector. Without this effort, shepherded by senior scientists and mentors, the trainees would be far less likely to turn our science into medicine. We are seeing rapid advances in neuroscience technologies, but there are many practical issues to deal with in moving from bench to bedside. The experience of a PhD level scientist is vital to making that travel a reality.

Best of luck to you in your efforts!

Sincerely,

A handwritten signature in purple ink that reads "Matthew D. Disney". The signature is written in a cursive, flowing style with a large initial 'M'.

Matthew D. Disney  
Founder, Expansion Therapeutics

Randy D. Blakely, Ph.D.  
Executive Director, FAU Stiles-Nicholson Brain Institute  
David J. S. Nicholson Distinguished Professor in Neuroscience  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

Dear Dr. Blakely,

I am writing as Co-Founder, Director and Chief Executive Officer of TherapeuticsMD a Nasdaq listed and publicly traded company and Vice Chairman of Bio-Florida, and on behalf of the Honorable Tommy Thompson, previous United States Secretary of Health and Human Services and Chairman of TherapeuticsMD to provide my input on the employability of graduates from the Neuroscience PhD program proposal that you and others at FAU have developed in the South Florida market.

First, I wish to describe TherapeuticsMD as a leader in women's health with a focus on developing and commercializing FDA approved pharmaceutical products for the treatment of Menopause, Prenatal Care, Birth Control and multiple other indications that values PhD level talent. As you know, menopause is associated with mood swings, changes in body temperature - hot flashes, and poor sleep, among other behavioral effects, all a result of changes in brain function."

South Florida has a large growing unmet need related to clinical scientist, chemists, research scientist and a growing pharmaceutical company footprint that needs additional professionals at the PhD level. We strongly encourage your considered expansion in this area that will help local life science companies drive new product innovation and have the local talent needed for success.

Please feel free to contact Governor Thompson or me with any questions.

Thank you,



Robert Finizio



Sept 14, 2021



Randy D. Blakely, Ph.D.  
Executive Director, FAU Stiles-Nicholson Brain Institute  
David J. S. Nicholson Distinguished Professor in Neuroscience  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

Dear Dr. Blakely,

I am writing in my role as Senior Bioscience Specialist of Nikon Instruments, Inc to add career training perspective on the Neuroscience PhD training program that you have submitted for consideration by the Board of Governors this Fall. I have worked for Nikon at various levels for over the past 30 years and as you know, I support the Florida region and work closely with the faculty and trainees of multiple universities in the state, including yours. Your PhD proposal, with its combination of broad didactic exposure to the concepts, technologies and applications relevant to basic and clinical research in neuroscience, plus extensive research prior to obtaining the Ph.D., should give your trainees outstanding experience in the field and ready them for next steps in their career, whether that be academia, industry or the private sector. At Nikon Instruments, a company considered by many to be the top imaging instruments company in the world, we employ hundreds of scientists worldwide with Ph.D. level training such as offered by your program.

At FAU, superior training in cellular neuroimaging is possible due to the establishment in 2006 at the Stiles-Nicholson Brain Institute of a Nikon Center of Excellence. Your unit's designation as a site for a Nikon Co places FAU among the elite universities in the world (e.g. Princeton, Columbia University, Harvard, UCSD, the Karolinska and University College London) pursuing advanced cellular imaging, and is the only one in the state of Florida. The CoE designation is a statement of great confidence by Nikon that superior research and training is being pursued at FAU. With the CoE designation, your faculty and students have early access to the most advanced technology produced by Nikon and "under the hood" opportunities to explore as yet unreleased platforms, not to mention significantly reduced costs for instrumentation, accessories and service. The core management structure that oversees the CoE at FAU also offers significant training opportunities for students in the proposed program.

As to employability, when we hire staff at Nikon, we look for the kind of experience your program will provide – a broad yet deep understanding of biological mechanisms and a practical training in the imaging platforms we provide. We are always on the lookout for the kind of talent to be generated by the Neuroscience Ph.D. as neuroscience features some of the most important and elegant work in imaging science and has a breadth that allows trainees to work in other areas such as cancer biology, immunology, or preclinical drug evaluation.

As we have done in past years, we will plan to bring our educational offerings to your campus and provide your trainees with outstanding hands-on training with our hardware and software platforms. From your beachhead in Jupiter and located in proximity to other outstanding research institutes (e.g. Max Planck and Scripps), I can't imagine a better training opportunity for your students, nor can I think of a better place to recruit the next members of our operations team.

Please keep an eye out for this talent for us. I look forward to getting together soon and hearing of the success of your application.

Best of Luck,  
Larry



Lawrence A Kordon  
Bioscience Sales Account Manager

Nikon Instruments Inc.  
1300 Walt Whitman Road  
Melville NY 11747-3064  
Office: 631-547-8657  
Mobile: 919-931-1188  
[larry.kordon@nikon.com](mailto:larry.kordon@nikon.com)  
[www.microscope.healthcare.nikon.com](http://www.microscope.healthcare.nikon.com)



STILES  
NICHOLSON  
FOUNDATION

4600 Military Trail, Ste 222  
Jupiter, FL 33458  
Tel (561) 296-7000  
Fax (561) 296-7477

September 8, 2021

Randy D. Blakely, Ph.D.  
Executive Director, FAU Stiles-Nicholson Brain Institute  
David J. S. Nicholson Distinguished Professor in Neuroscience  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

Dear Randy,

I am pleased to provide my thoughts on the employability of the graduates of the exciting Neuroscience Ph.D. proposal you hope to launch in 2022, with particular reference to the need for employees with advanced training in the equity investment sector of our economy.

I am the Chair and Founder of York Management & Research, a firm initiated more than 30 years ago as an investment counseling and management service, which early on specialized in adaptive modeling of financial markets. We are proud to have applied these techniques to the successful management of endowment funds such as Harvard University, and 5 hedge funds including ALPHA MAX, LP and A. W. Jones, LP. During these past few decades, the research process has become increasingly more complex due to major advances in a multitude of disciplines. As such, the need for more focused knowledgeable research analysts has mushroomed. This has evolved to a growing need to employ PhD level graduates who have significant discipline-specific experience related to areas of high investment potential.

The portfolio of start-ups and major biotechnology companies in the U.S. is exploding. Nowhere is this more important than in neuroscience. Areas such as neurodegenerative disease, brain trauma and brain cancer therapeutics are particularly hot right now and are drawing much investment attention.

Investment firms and corporations alike need individuals with experience in a breadth of neuroscience-related areas to successfully advise on neuro-medical ventures, ranging from an understanding of molecular biology and genetics to translational neuroscience and the scaling of discoveries from in vitro models with cultured cells to living humans with brain disease. Your program, with its breadth of curriculum and opportunities to spend years in competitive research laboratories, should be a great source for those many firms which explore potential investments in brain science and health.

With the small number of academic positions available each year, many of your graduates will look to industry and the business sector to steer their future careers. The professional workshops you plan to introduce for the trainees to learn entrepreneurship and lab management will facilitate their transition to the private sector should place them in an advantageous position to join equity firms interested in neuroscience investment fields including neuro-engineering, computer science related to brain mechanisms and AI, and pharmaceutical development.

Florida has a significant pool of wealthy individuals and who, through equity firms, can invest in the future of brain science and health. Jupiter is gaining a reputation as a neuroscience hub with the presence of Max Planck, Scripps and the FAU Stiles-Nicholson Brain Institute. Bridging the gap between neuroscience academia and the private sector is super important and timely. I know that these are early days with the planning of your program, but you have the experience and drive to push this program to deliver the sorely needed talent for this rapidly expanding neuroscience field.

I clearly support your vision, and this “advancing employability” proposal.

Sincerely,



David J. S. Nicholson (djsn@Stiles-Nicholson.org)  
Chairman and Trustee  
The Stiles-Nicholson Foundation

Randy D. Blakely, Ph.D., Executive Director, FAU Stiles-Nicholson Brain Institute  
Florida Atlantic University

Dear Dr. Blakely;

I am pleased to support the creation of the FAU Neuroscience PhD Program. Neuroscience is a vibrant and fast-moving field. Hesperos, Inc is a biotechnology and advanced research-enabling company located in Orlando, FL. I am the co-founder and Chief Scientist of Hesperos as well as the founding Director and Professor in the NanoScience Technology Center at the University of Central Florida. Hesperos was spun out of my academic research group in collaboration with Professor Michael Shuler from Cornell University. One of the primary research areas of my academic group and with Hesperos is in the area of neurological research, which sits well with the objectives of your program. The company has moved from the UCF Incubator to a new 14,000 square foot facility that has about 35 employees and is growing rapidly. The mission of Hesperos is to accelerate drug discovery through the use of scalable, multi-organ, microphysiological systems (also known as: Human-on-a-Chip®) that provide analytic services for the pharmaceutical, cosmetic, and food industries. These services allow research teams to determine how the human body will respond when new drug compounds are introduced – something that previously required costly animal testing and human trials to determine. Hesperos systems will reduce the cost of drug development and bring better therapies to patients faster than ever, while eliminating the need for animal testing. Hesperos continues to expand the limits of this technology by allowing drug and cosmetic researchers to observe the effects of their compounds on multiple organs within a system for both parent compounds and their metabolites. We offer four human-on-a-chip systems for disease modeling and investigate preventable drug-induced Alzheimer's drug testing. These benchmark, multi-organ, human-based screening platforms are ideal for identifying first-in-class drugs and developing novel medicines for incompletely understood, complex diseases. In addition, we can customize our systems by allowing customers to choose which organs to use in the model or to even build the model from organ tissues from a specific patient. These customizations make our systems especially appropriate for rare disease efficacy models. Our technology can be utilized for all organ systems and with reference to your proposal, our technology is being used to study diseases of the brain, including Amyotrophic Lateral Sclerosis (ALS), which as you know, is a fatal neurodegenerative disease with no effective treatments. Our technology has also been applied to studies of Alzheimer's disease. Recently, Hesperos and Tabula Rasa were awarded a \$1.9M grant to investigate preventable drug-induced Alzheimer's disease.

With over 40 years of experience in biomedical research, I well understand that a student graduating from college is not yet prepared at the level needed by industry to contribute directly to frontline R&D for companies seeking to remedy brain disorders. Your PhD program will provide them with both the exposure to the literature and the hands-on experience in research that is needed to make breakthroughs. I think graduates from this program would do well at Hesperos, as the majority of the PhDs and many of the technical staff were trained in my academic group and their experience with interdisciplinary neurological research has helped transform the company into one of the leading microphysiological based companies in the world. The breadth of your training program and the opportunity your students will have to pursue internships in multiple labs before matching with a mentor should be very attractive to recent college graduates, many of whom have only a small understanding of the breadth of the field and thus where their talents can best be put to use. That all students have to take a semester-long course in brain disease

mechanisms is also a strategic plus, one that can help them see that advances such as we have made at Hesperos, can drive careers forward and lead to much needed biomedical advances. The engagement offered to your students with the scientists at Scripps, FL and the Max Planck Florida Institute for Neuroscience is another terrific opportunity for them to see science pursued at the highest level.

If you have any additional questions, please do not hesitate to contact me.

Best Regards,

A handwritten signature in black ink, appearing to read 'J. Hickman', with a stylized flourish at the end.

James Hickman, Ph.D.

Chief Scientist, Hesperos, Inc.

Professor of NanoScience Technology, Chemistry, Biomolecular Science and Electrical Engineering and  
Head, Hybrid Systems Laboratory, University of Central Florida



Dr. Randy Blakely  
Florida Atlantic University  
Room 109, MC-17  
5353 Parkside Drive  
Jupiter, FL. 33458

Dear Dr. Blakely,

Thank you for the opportunity to provide input on your proposed Neuroscience Ph.D. program. It is just this kind of pipeline that my company, DNALabs, for which I serve as CEO, needs across multiple levels, from research on genetic mechanisms supporting brain disorders, to administration and marketing, as well as interfacing with scientists such as those noted as faculty in your program.

As you know, DNALabs is a DNA testing company that provides state-of-the-art genetic testing services to clinicians and researchers across North America. Given that our focus includes research, development, and commercialization of new genetic testing panels, we are always looking for high quality individuals to fill various research and development roles, and thus I am excited by the potential partnership opportunities afforded by your PhD program. We have already established multiple research collaborations with various world-class hospitals in Canada, including a research study with the Hospital for Sick Children in Toronto that was recently published in the [Journal of the American Medical Association](#).

The Neuroscience PhD program at Florida Atlantic University is of keen interest to us as a major focus for DNALabs has been, and will continue to be, related to disorders of the brain and behavior. We are currently working with Sunnybrook Hospital in Toronto on a research study looking at the clinical utility of pharmacogenetics in stroke patients; we are working with a network of clinics and hospitals across Canada to assess the clinical impact of pharmacogenetics in military veterans with post traumatic stress disorder; we are exploring a research study related to multiple sclerosis with a major teaching hospital in Ontario; and we are in advanced discussions with a large foundation regarding the creation of a Center of Excellence for aging and brain health.

As we look to expand our business into the United States, we are excited by the opportunity to expand on these research programs. In considering a location for our new U.S. office, south Florida, and specifically FAU, checked off many boxes, most importantly for access to the type of talent pool that your program will produce. We believe that the internships we can offer to your trainees will represent a significant 'win-win' scenario, as together we can advance research, publish articles which will boost the employability of your graduates and attract additional grant funding, will entice your trainees to consider lifelong careers in neuroscience, and will allow for collaborative links to be established with your campus neuroscientists.

As you know, and as we have discussed, there are currently many more positions to fill in the US and Canada than there are Ph.D. level scientists available to fill them. We believe that this is also true in south Florida and thus we heartily encourage and support your efforts.

We very much look forward to working with you as the program develops.

Sincerely,  
DNALabs Corp.

Moni Lustig  
President & Chief Executive Officer





6714 NW 16<sup>th</sup> Street, Suite B  
Gainesville, FL 32653-3975  
Phone: (386) 418-8060  
Fax: (321) 244-8351  
[info@cyclotherapeutics.com](mailto:info@cyclotherapeutics.com)

September 13, 2021

Randy D. Blakely, Ph.D.  
Executive Director, FAU Stiles-Nicholson Brain Institute  
David J. S. Nicholson Distinguished Professor in Neuroscience  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

Dear Dr. Blakely,

I am very pleased to support your application for a Neuroscience Ph.D. program at Florida Atlantic University. As you know, I am the Director, Chief Operating Officer and Chief Quality Officer at Cyclo Therapeutics, located in Gainesville, Florida. Cyclo Therapeutics is a clinical-stage biotechnology company dedicated to developing life-changing medicines through science and innovation for patients and families living with challenging diseases. Currently, we are pursuing clinical trials of our proprietary drug product in two neurodegenerative diseases, Niemann-Pick Disease and Alzheimer's Disease.

I have more than 30 years of experience in the biotechnology, pharmaceutical and nutritional supplements industries. Additionally, I have also volunteered with Local Workforce Development Boards for more than 30 years and currently serve as Board Chair of CareerSource North Central Florida, so am well aware of the workforce needs of biopharmaceutical companies, including those like Cyclo Therapeutic, located in Florida. I can assert with confidence that, across the breadth of this industry, Ph.D. trained scientists, staff and administrative leadership are key to our success. Whether it is understanding the mechanistic basis of disease, the translation of in vitro findings to real world human applications, the oversight of clinical trials, or the management of research and production teams, the advanced training provided through a graduate experience in a topflight research university is priceless, and much in demand.

Your program, with its breadth of training in cell, molecular, systems, behavioral and computational neuroscience, as well as its emphasis on translational research activity, will be a valuable source of talent for the needs of the growing biotechnology sector in our state. I was pleased to learn that a requirement for your degree is a semester long course in brain diseases, with a significant focus on neurodegenerative disease mechanism. With the launch this year of the David and Lynn Nicholson Center for Neurodegenerative Disease Research at the Stiles-Nicholson Brain Institute on FAU's Jupiter campus, I know that these students will have significant exposure to the questions, models and treatments for the disorders that our company aims to treat. Our industry's need for talent such as you will generate is critical to tackle disorders like NPC and Alzheimer's disease. We would be pleased to discuss the path from lab to clinic in the treatment of brain disorders with your trainees as part of the professional development workshops you offer during their training.

Best of luck with establishing your program!

Sincerely,

A handwritten signature in blue ink, appearing to read "Jeffrey L. Tate".

Jeffrey L. Tate  
COO, CQO & Director



Randy D. Blakely, Ph.D.  
Executive Director, FAU Brain Institute  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

November 10, 2020

Dear Dr. Blakely,

I am writing in support of creation of the Neuroscience Graduate Program (NGP) at Florida Atlantic University.

As Associate Dean, Academic Affairs, of STEM and Health Sciences at Palm Beach State College's Palm Beach Gardens Campus, I supervise our Biological and Physical Sciences Departments, as well as the Biotechnology Program, among others. Our College registers over 42,000 students (our campus over 10,000) and a significant number pursue STEM degrees, including professional (pre-medical, pre-dental) and allied health careers (Nursing, Respiratory Therapy, Ophthalmic, Diagnostic Medical Sonography, and Radiography Technician, the latter with advanced training in CT and MRI). These disciplines are in constant need of knowledgeable adjunct and full-time faculty able to provide high-quality instruction to our students. Specifically, PBSC is continuously looking for recent graduates in the hard sciences, particularly those with a doctoral degree, a history of teaching experience, and diverse backgrounds. We would look favorably upon applicants with a PhD. over a Master's degree for the additional training, knowledge, rigor, and experience (both classroom and research) that the doctoral degree encompasses. This experience can only serve to benefit PBSC students.

I welcome an opportunity to have your NPG graduates apply for teaching positions at PBSC.

Please feel free to contact me if you need additional information regarding our programs. I look forward to the success of the program!

Sincerely,

*Becky A. Mercer*

Becky A. Mercer, Ph.D.  
Associate Dean, Academic Affairs  
Palm Beach Gardens Campus  
Palm Beach State College  
[mercerb@palmbeachstate.edu](mailto:mercerb@palmbeachstate.edu)



November 12, 2020

Randy D. Blakely, Ph.D.  
Executive Director, FAU Brain Institute  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

Dear Randy,

It was delightful meeting you a few weeks ago and learning of the exciting programs you have underway at the FAU Brain Institute, including your new proposal for a Neuroscience PhD program. Having held leadership positions at the University of Iowa prior to my arrival at Palm Beach Atlantic University, including the creation of the cross-campus Iowa Neuroscience Institute, I well know the impact of interdisciplinary research and education in neuroscience and think your program can have a transformative impact on neuroscience training that will lead to highly employable graduates. In particular, I am sure the academic leaders at Palm Beach Atlantic University would be quite excited to consider graduates of your program for postdoctoral, staff and faculty positions as we grow our academic enterprise. In contrast to most Master's degree level graduates, those who graduate with PhDs have had an experience of pursuing research projects of significant complexity with a variety of approaches over the course of a number of years, gaining maturity and independence. Additionally, programs such as yours, which feature significant opportunities to teach undergraduates, and speak to scientific and lay communities regarding their research, will have well-honed skills that should make them excellent communicators; this is a key skill we look for in hiring our faculty.

I look forward to the launch of your program and hope you will call on me and my faculty should we be able to assist you and your students in this marvelous pursuit. Best wishes.

Warm regards,

Debra A. Schwinn, MD  
*President*  
*& Professor of Health Sciences*  
*Palm Beach Atlantic University*

*Emeritus Professor, Dean Carver College of Medicine & Associate VP for Medical Affairs*  
*University of Iowa*



**Scripps  
Research**



**Douglas A. Bingham**  
Executive Vice President, Florida  
[dbingham@scripps.edu](mailto:dbingham@scripps.edu)

120 Scripps Way  
Jupiter, FL 33458  
tel 561-288-2001

November 16, 2020

Randy D. Blakely, Ph.D.  
Executive Director, FAU Brain Institute  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

Dear Randy,

Thanks for apprising me of your proposal for a new Neuroscience Ph.D. program at FAU. This sounds like a timely and important development in the growth of FAU in general, and with the growing FAU neuroscience presence in Jupiter, one that can promote further growth and collaborations between FAU and Scripps Research. You have requested that I specifically comment on the employability of the graduates from this program and I am happy to do so. Every year, research-intensive faculty in all disciplines hire Ph.D. graduates who continue their training, both accelerating the mentor's research programs and providing essential training that can lead to an independent career trajectory. Scripps Research is no exception to this. Annually, we hire hundreds of postdoctoral fellows across our Jupiter and La Jolla sites, many of whom go on to become top researchers in their field. Here in Jupiter, we have an outstanding Neuroscience department with many postdoctoral fellows present in the labs of each faculty member. In the past, we have been delighted to host postdoctoral fellows who have pursued their graduate studies at FAU, one of whom, Dr. Melissa Borgen, recently departed to take a faculty position at the Florida Institute of Technology. I am sure this pattern will accelerate in the future with the initiation of your program. Your students will have an advantage over others in competing for these positions as they will have many opportunities to interact and collaborate with our neuroscience faculty during their dissertation studies, raising their profile with our faculty. Many already engage in joint lab meetings and co-publish with our faculty. In summary, we welcome the creation of the new program and look forward to working with the talent you recruit to it, during and after their graduation.

Sincerely,

Doug Bingham, Executive Vice President  
Scripps Research Institute, FL Campus





Randy D. Blakely, Ph.D.  
Executive Director, FAU Brain Institute  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University

Jupiter, November 15, 2020

Dear Randy,

I am pleased to learn of your application for a Neuroscience Ph.D. program at Florida Atlantic University. We have trained a number of highly productive graduate students from FAU and know that your program will continue to pursue excellence in neuroscience at the doctoral level and bring additional visibility to FAU and the FAU-MPFI partnership. I am writing to acknowledge that trainees from your program should be of significant interest to our faculty when they finish their Ph.D.s and seek postdoctoral opportunities. As you know, MPFI currently hosts 10 research labs where postdoctoral fellows and research staff make key contributions to their research programs. Graduates with doctoral degrees from FAU have in the past filled a number of these positions, and with regular turnover of these fellows as they move on to other positions, or with the comings and goings of faculty, there is a continual need for Ph.D. level talent. I know that with your significant history in graduate training at Vanderbilt, you will establish a very successful program at FAU, preceded by the well-run GNTP program that has led to a number of graduate students pursuing their thesis work at MPFI.

Best of luck with your application!

Matthias Haury, PhD  
Chief Operating Officer  
Max Planck Florida Institute for Neuroscience

November 16, 2020

Randy D. Blakely, Ph.D.  
Executive Director, FAU Brain Institute  
Professor of Biomedical Science  
Charles E. Schmidt College of Medicine  
Florida Atlantic University  
Jupiter, FL 33458


Dear Randy,

It was very nice having you down last year for a seminar at the College of Pharmacy and discussing the many aspects of program building in an academic environment. Your Neuroscience Graduate Program sounds quite impressive and, based on your efforts in building the Neuroscience Graduate Program before coming to FAU and your commitment to research and education, I am sure it will be a success.

You have asked me to comment on whether your program's graduates would be one that would be competitive for postdoctoral positions in the College of Pharmacy, or more broadly in the labs of bioscientists at Nova Southeastern University (NSU). The answer is a resounding yes! Graduate students and postdoctoral fellows are the lifeblood of a modern biomedical research enterprise, and aspiring postdocs with the didactic and research training that your graduate program provides should be highly sought after upon graduation. The integration of multiple colleges, from Science to Medicine to Engineering, and the deep, technologically rich experience your students will obtain, is particularly appealing to me as we cannot well guess where the next breakthroughs in diagnosis and treatment of brain disorders will come from. Further, the ability of your students to work across traditional boundaries and utilize the latest in research tools be key to future advances. I know we agree that the questions being posed in today's research labs are far more complex than when we were aspiring young scientists. Programs that foster independence, creativity, and a mature understanding of both challenges and opportunities give the best chance of success. It is that "eyes wide open" approach to career-long learning that we all desire in our postdocs so that they can act as leaders in their own right. Your program seems designed to accomplish this. When our faculty hire postdocs, I would expect that they would pay attention to when they see an application from your program.

I hope we get the chance to get together again soon. Please let me know how I might help in any other way with your application. Best of luck!

Sincerely,



Peter M. Gannett  
Professor and Associate Dean for Research and Graduate Education

## **Doctorate in Neuroscience**

(Minimum of 72 credits required)

The Doctorate in Neuroscience is a multi-college, multi-institute interdisciplinary degree program organized in partnership with the FAU Brain Institute. Graduate level instruction is provided by faculty from the College of Science, the College of Medicine, the College of Engineering and Computer Science, and the College of Education. These faculty hold appointments in the Department of Biological Sciences, the Department of Biomedical Science, the Department of Psychology, the Department of Computer and Electrical Engineering and Computer Science, the Department of Ocean and Mechanical Engineering, and the Department of Communication Science and Disorders. Faculty from the Max Planck Florida Institute for Neuroscience and Scripps Research Florida also participate in the program as research mentors and co-mentors, respectively. The program aims to equip students with the advanced conceptual and technical skills needed to forge productive, neuroscience-oriented careers in industry, academia, and government. To allow for maximum flexibility in career aspirations, students have the opportunity to pursue thesis research in laboratories located in any of the Colleges and Institutes noted above. Program faculty have expertise in a broad range of research areas, including cellular and molecular neuroscience, cognitive and behavioral neuroscience, computational neuroscience, synaptic plasticity, brain development, learning and memory, neuroimmunology, auditory and speech neuroscience, visual neuroscience, and brain-related biomedical areas that seek to understand mechanisms and paths to the treatment of neurodegeneration, stroke, autism, epilepsy, depression, sleep disorders, and drug addiction, to name a few.

### **Admission Standards:**

The program seeks to admit applicants who are academically excellent and have completed an undergraduate or M.S. degree demonstrating substantial training in the biological sciences, psychology, or engineering and computer sciences. Recommended preparation includes upper division courses in biology (molecular/cellular biology, genetics, physiology), psychology (animal and human behavior, learning and memory, cognition), chemistry (organic chemistry, biochemistry), mathematics (statistics and calculus), and computer engineering and programming. Prior coursework neuroscience is desirable, and evidence of prior research experience is particularly important. A competitive applicant usually will have prior research experience and should describe their research experience in the Statement of Purpose/Personal Statement.

### **Admission Requirements:**

All students must meet the minimum graduate admission requirements of the University. Please refer to the Admissions section of this catalog. Additional requirements are:

- Completion of a Bachelor's or M.S. degree from a regionally accredited institution in an appropriate major, prior to anticipated start date in the PhD Program.
- Minimum grade point average of 3.40 as an undergraduate and/or M.S. student.
- Complete sets of transcripts from previous institutions(s) attended.
- A minimum of 3 letters of recommendation, preferably from instructors and advisors who are familiar with the applicant's recent academic or research experience.
- An essay of Purpose/Interests in the form of a Personal Statement
- Graduate Record Examination scores are optional
- International students whose native language is not English must score at least 79-80 (Internet-based test) on the Test of English as a Foreign Language (TOEFL). Satisfactory

TOEFL scores can offset verbal GRE scores at the discretion of the program's admission committee. Additionally, international students whose transcripts are from non-U.S. institutions must have their credentials evaluated course-by-course. International students must also demonstrate competency in spoken English.

Previous Graduate coursework may be applied toward the course requirements of the Neuroscience Ph.D. Students may receive up to 15 credits earned beyond the baccalaureate degree, including up to 9 credits of Core course credit, not to include Laboratory Rotations and Neuroscience Seminar, based on comparable courses taken prior to admission. Transfer credits must be approved by the Program Curriculum Committee and the Graduate College. Evaluation of transfer credits will be based on content and will require an official copy of each course syllabus for assessment.

### **Degree Requirements:**

The Doctor of Philosophy in Neuroscience is a research-intensive degree requiring a minimum of 72 credits beyond the baccalaureate degree.

The following are specific requirements for the Neuroscience Ph.D. degree:

1. Completion of 21 Core credits listed in the table below.
2. Completion of 9 Elective credits from the courses listed in the table below.
3. Completion of 24 dissertation credits.
4. The remaining 18 credits may include elective coursework at the 6000-level or above, Advanced Research, or Dissertation Research credits that support the student's research plan with approval of the student's Ph.D. supervisor.
5. Completion of 4 Research Rotations of 1 credit each, representing an ~8-week research internships in at least 3 different laboratories in the Fall and Spring semesters of Year 1. The 4<sup>th</sup> rotation may be a second rotation back in a lab where the student previously rotated, and where by mutual agreement the student is likely to pursue their Ph.D. studies, or a 4<sup>th</sup> Research Rotation if the student has not matched with a mentor.
6. Acceptance into the laboratory of an approved program faculty member for thesis research by the end of the Spring Semester of Year 1.
7. Achievement of a "B" or higher grade in all courses, with an overall GPA of at or above 3.0 maintained.
8. With the exception of Neuroscience Seminar and Laboratory Rotations, no Core or Elective courses can be taken as Satisfactory/Unsatisfactory.
9. Students must enroll in the Neuroscience Seminar each Fall and Spring semester for the entire time they remain in program, with the expectation that most students will graduate in 5 years. Starting in Year 2, the Neuroscience Seminar will be taken for 0 credit.
10. Admission to PhD candidacy requires the writing and successful public defense of an original dissertation research proposal.
11. Degree completion requires the writing and successful public defense of a dissertation describing the context, approach, results and impact of thesis research.
12. Students are expected to publish at least one peer-reviewed research paper as first author involving research activities described in their thesis proposal prior to degree completion.

### **Table of Required Core Courses:**

Cellular and Molecular Neuroscience	PSB 6345	3
Systems and Integrative Neuroscience	PSB 6346	3



Experimental Design 1 or Computational Neuroscience	PSY 6206 or ISC 6460	3
Scientific Communication	BSC 6846	3
Neuroscience Laboratory Rotations (2 in Fall, 2 in Spring)	PSB 6977 <sup>t</sup>	4
Neuroscience Seminar (1 in Fall, 1 in Spring, 0 thereafter)	BSC 6938	2
Brain Diseases: Mechanisms and Therapy	BMS 6736	3
<b>Required Core credits:</b>	<b>21</b>	
<b>Required Dissertation credits:</b>	PSB 7980 <sup>t</sup>	<b>24</b>

<b>Free Electives</b>		
<b>CHOOSE AT LEAST 3 COURSES FROM THE TABLE OF ELECTIVE COURSES</b>		
Free Elective Credits:	9	

#### Table of Elective Courses:

Experimental Design 2	PSY 6297	3
Biostatistics	STA 5195	3
Human Neuroanatomy	BSC 6748	3
Functional Neuroanatomy*	PSB 6930	3
Neurophysiology	PCB 6835C	3
Practical Cell Neuroscience	BSC 6417C	3
Advanced Neurophysiology Lab	PCB 6937L	3
Neuroimmunology*	PCB 6933	3
Advanced Molecular and Cellular Biology	PCB 5532	3
Advanced Cell Physiology	PCB 6207	3
Developmental Neurobiology	PSB 6515	3
Neurobiology of Addiction	PCB 5844	3
Neuroscience of Sleep*	PSY 6930	3
Neuroplasticity*	PCB 6933	3
Adult Neurogenesis	PCB 6848	3
Pharmacology*	PCB 6933	3
Cognitive Neuroscience	ISC 5465	3
Principles of Neurobiological Signal Processing	ISC 6466	3
Biosignal Processing	COT 5930	3
Seminar in Cognition	EXP 6609	3
Attention and Consciousness*	EXP 6930*	3
Seminar in Behavioral Neuroscience	PSB 6058	3
Seminar in Sensory Processes	PSB 6609	3
Foundations of Vision	CAP 6411	3
Seminar in Human Perception	EXP 6208	3
Developmental Neuropsychology	PSB 6516	3
Methods in Complex Systems	ISC 6450	3

Nonlinear Dynamical Systems	ISC 5453	3
Introduction to Neural Networks	CAP 5615	3
Computational Neuroscience 1	ISC 6460	3
Brain Modeling	EEL 6035	3
Artificial Intelligence	CAP 6635	3
Machine Perception and Cognitive Robotics	EXP 6930	3
Introduction to Data Science	CAP 5768	3
Data Mining and Machine Learning	CAP 6673	3
Data Mining for Bioinformatics	CAP 6546	3
Biomedical Data and Informatics	BSC 6459	3
Bioinformatics: Bioengineering Perspectives	BME 6762	3
Neural Basis of Human Communication	SPA 5107	3
Adult Language Disorders	SPA 6410	3
Genetics of Communication Disorders	SPA 6438	3
Advanced Research (spring year 1)	PSB 7978 <sup>t</sup>	1-6

\* Special topics courses.

<sup>t</sup>Three course codes created for this degree that will be used only following university review and approval. All courses not yet approved by the Florida Statewide Course Numbering System that will be used to satisfy degree requirements will be evaluated individually on the basis of content and will require a Catalog Course description and a copy of the syllabus for assessment.

### **Supervisory Committee Requirements:**

By mutual agreement, students identify their final Ph.D. supervisor and research lab before the end of the spring semester of Year 1. A Supervisory Committee, including the PhD supervisor and 3 other graduate faculty, knowledgeable in aspects of the project, is assembled during the fall of year 2. Students are encouraged to include on their Committee one faculty-level member who is not a member of the NGP Program, including graduate faculty from other institutions. The Ph.D. supervisor serves as the Chair of the Supervisory/Dissertation Advisory Committee, except when the supervisor is an affiliate FAU faculty member at the Max Plank Florida Institute or the Scripps Research Institute Florida. The Chair of the Committee must have a full-time appointment at FAU, with affiliate faculty serving as Co-Chairs.

### **Qualifying Exam and Proposal Defense:**

NGP students must prepare a written grant proposal modeled on NIH or NSF templates for predoctoral fellowship applications. The proposal will be targeted to their chosen area of research. Students will present their proposal orally in an open forum advertised to the university community, followed by an oral examination consisting of questions from the student's Supervisory Committee. Following the defense, committee members vote to either Pass, Pass with Conditions, or Fail the student. If Passed with Conditions, students must be able to satisfy any conditions set by the Committee within 3 months prior to resubmission of their proposal for a second oral examination.

**Doctoral Dissertation Defense:**

NGP students will develop a written dissertation following the format required by the Graduate College, present the findings of their research orally in a forum open and advertised to the public, followed by an oral examination by the student's Dissertation Committee. Following the defense, committee members vote to either Pass, Pass with Conditions, or Fail the student. Students must satisfy any conditions imposed by the committee within 3 months, prior to resubmission of their proposal for a second oral examination. The Committee shall determine whether the student Passes or Fails the thesis defense examination and allow for a re-examination following the rules of the Graduate College.

<b>PackageName</b>
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ABI/INFORM Global  
ABI/INFORM Trade & Industry  
Academic Search Complete  
Academic Search Premier  
Academic Search Ultimate  
ACM Digital Library  
Agricultural & Environmental Science Database  
American Society of Mechanical Engineers (COUPERIN)  
Applied Science & Technology Source  
ATLA Religion Database with ATLASerials (EBSCO)  
Bioline International  
Biological Science Database  
Black Studies Center  
Business Source Premier  
Business Source Ultimate  
CINAHL Plus with Full Text  
Criminal Justice Database  
De Gruyter Open Journals  
Dialnet  
DOAJ: Directory of Open Access Journals  
EBSCO Open Access Journals  
EDP Open Access  
Education Database  
Education Source  
Emerald Backfiles  
Gale Academic OneFile  
Gale Academic OneFile Select  
Gale General OneFile  
Gale OneFile: Computer Science  
Gale OneFile: Health and Medicine  
Gale OneFile: High School Edition  
Gale OneFile: Informe Académico  
Gender Watch (ProQuest)  
General Reference Center Gold  
Health & Wellness Resource Center (w/alt health module)  
Humanities Source  
IEEE/IET Electronic Library (IEL)  
JBC Thematic Minireview Series  
J-STAGE Journals (Open Access)  
JSTOR Life Sciences Archive Collection  
LWW Nursing and Health Professions Premier Collection  
Math-Net.RU  
Nexis Uni  
OECD-iLibrary Books, Papers & Statistics  
Persee  
Political Science Database

Portico  
Primary Search  
ProQuest American Periodicals  
ProQuest Aquatic Science Journals  
ProQuest Earth Science Journals  
ProQuest Environmental Science Journals  
Proquest Periodicals Archive Online Collection 1  
ProQuest SciTech Collection  
PsycARTICLES (APA)  
PubMed Central (PMC)  
Royal Society of Chemistry Gold  
Social Science Database  
SocINDEX with Full Text  
Sociology Database  
SPORTDiscus with Full Text

## Updates to PhD document

1. Noted in section II.B, that we did not pursue a formal survey of potential applicants to the program as the Neuroscience PhD is an outgrowth of existing programs where demand is already well-established, namely the Ph.D. in Complex Systems, and tracks in the doctoral programs in Integrative Biology and Experimental Psychology. These have a clear track record of success, having filled all available slots every AY. We also extensive verbal conversations with the existing students in these programs to ensure even greater success in recruitment for the Neuroscience Ph.D. moving forward New text highlighted in revised document.

2. Appendix A, Table 3, Projected Costs and Funding Sources.

The increased costs for Faculty Salary and Benefits associated with growth of the program in Year 5 had been entered inappropriately under New Enrollment Growth. As these costs are derived from a reallocation of existing program costs, these costs were moved to the Continuing Base entry for year 5. Table 3 in Appendix A and the corresponding narratives in III.A were edited appropriately. New text highlighted in revised document.

The entry for growth in Assistantships and Fellowships was placed in error in Table 3 under New Enrollment Growth, rather than as part of the Continuing Base. Table 3 in Appendix A and the corresponding narratives in III.A were edited appropriately New text highlighted.

3. Edited III.B, We have updated the document to note that the students will be charged FAU's current In-state student and out of state graduate student tuition rates according to their residency status. New text highlighted
4. Appendix A, Table 4, Faculty – We have revised the participation start date of faculty in the table to note a later start date for those not contributing to the program in the 1<sup>st</sup> year of the program. Some faculty teach second year elective courses or do not accept students until year 2 or after, and thus their start date is now noted as Spring of 2023.
5. Link corrected for Florida Statewide Employment Projections with Table 4, page 20. New link highlighted.
6. A file is included as a supplement to Appendix G, providing additional evidence of support by potential employers outside academia.

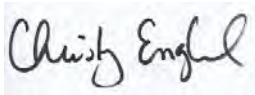
- a. Nancy Bryan, President and CEO of BioFlorida
- b. Matthew Disney, Founder, Expansion Therapeutics

- c. Robert Finizio, CEO of TherapeuticsMD
- d. David Nicholson, Founder and Director of York Management & Research
- e. Jeff Tate, COO & SCQO of Cyclo Therapeutics
- f. James J Hickman, Chief Scientist, Hesperos
- g. Larry Kordon, Senior Product Manager and Bioscience Sales Specialist, Nikon Instruments, Inc.
- h. Moni Lustig, CEO of DNA Labs

September 2, 2021

## MEMORANDUM

TO: Dr. Bret Danilowicz  
Provost and Vice President for Academic Affairs  
Florida Atlantic University

FROM: Dr. Christy England   
Vice Chancellor for Academic and Student Affairs

SUBJECT: Ph.D. in Neuroscience, CIP 26.1501

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The initial review of the Ph.D. in Neuroscience, CIP 26.1501, at Florida Atlantic University has been completed. The following clarifications and revisions are required.

- Pursuant to Section II.B. of the proposal, please provide descriptions of surveys or other communication with prospective students.
- Pursuant to Section III.A. of the proposal, please identify the source of funding listed under new enrollment growth in year five of Appendix A—Table 3. If the funding source is anything other than the tuition and fee trust, please list the funding under the continuing base and update the narrative accordingly.
- Pursuant to Section III.B. of the proposal, please provide the expected rate of tuition the university plans to charge for resident and non-resident students.
- Appendix A—Table 4 - indicates all faculty will have an initial participation term of spring 2022; however, some faculty who are listed as starting in spring 2022 do not have person year and percent effort in year one. Please clarify the anticipated start, person year, and percent effort for all faculty listed in the table for years 1 and 5. Please revise Appendix A—Table 2 and the proposal narrative to reflect any changes.
- On page 20, please provide the correct link to the Florida Department of Economic Opportunity provided under Table 4.



- In Appendix G, please provide additional evidence of employability from potential employers outside of academia.

Please submit your response to this memo no later than **September 17, 2021**. Please note that a substantive delay in responding to these issues and/or failure to adequately address the issues in the initial response may result in a delay in the implementation of this program. Should you have any questions, please contact Dr. Disraelly Cruz at (850) 245-9681 or [Disraelly.Cruz@flbog.edu](mailto:Disraelly.Cruz@flbog.edu).

CE/bkg

c: Dr. Russ Ivy  
Dr. Disraelly Cruz  
Ms. Brittanian Gamble