RESOLUTION TO APPROVE DOCTOR OF PHILOSPHY DEGREE IN NEUROSCIENCE

Materials included:

- Resolution
- Overview of degree proposal
- Degree proposal

RESOLUTION TO APPROVE DOCTOR OF PHILOSOPHY DEGREE IN NEUROSCIENCE

WHEREAS, the mission of Virginia Tech is to discover and disseminate new knowledge through its focus on teaching and learning, research and discovery, and outreach and engagement; and

WHEREAS there is an urgent critical need for understanding the fundamental function of the brain from early development and across the lifespan, enabling scientists to develop treatments for neurological disorders and mental illness as well as inform advancements in the rapidly growing field of Neuroscience technology; and

WHEREAS, there is a growing demand in the Commonwealth of Virginia, nationally and internationally, in colleges and universities, in business, healthcare, the military, government agencies, and civilian communities; and

WHEREAS, the School of Neuroscience has the faculty and other resources for instructing and mentoring doctoral students to specialize in interdisciplinary research in molecular and computational neuroscience to understand and inform how the human brain functions, to develop treatment strategies and interventions for human neurological disease, and to develop neuroscience technologies to benefit society; and

WHEREAS, the Neuroscience program at Virginia Tech will join Virginia Commonwealth University, George Mason University and the University of Virginia in offering a doctorate in the fastest growing life science discipline, a fundamental component of graduate education;

THEREFORE BE IT RESOLVED, that the doctor of philosophy degree in neuroscience be established, effective Spring 2020 and the proposal forwarded to the State Council of Higher Education for Virginia (SCHEV) for approval.

RECOMMENDATION:

That the above resolution recommending the establishment of the doctor of philosophy degree in neuroscience be approved.

April 1, 2019

Ph.D. in NEUROSCIENCE

Background

- Interdisciplinary program focuses on emergent health and technological advances in Neuroscience
- Coursework spans cellular and molecular neuroscience, neurogenetics, developmental and cognitive neuroscience
- Thesis research enables hands-on application in current methodologies for studying neural system structure, function and disease

Justification

- Responsive to current needs in Virginia and nationally to exceptional growth resulting from an urgent need to develop treatment strategies and interventions for neurological disease
- Advances in neurotechnology fueling the the creation of new software, tools, and bioengineered products to benefit society

School of Neuroscience

VirginiaTech

Ph.D. in NEUROSCIENCE

Purpose

- Provide comprehensive graduate curriculum in classical and contemporary aspects of neuroscience
- Enable graduates to contribute to the development of novel treatments for neurological disorders
- Inform graduates of advancements in the rapidly growing field of Neuroscience technology
- Provide in-depth interdisciplinary research opportunities in molecular and computational neuroscience

Employment

- Opportunities exist in academia, government agencies, public policy, and both non- and for-profit business and research settings
- Any industry that seeks to understand, translate, implement, and communicate scientific principles in neuroscience at the local, national, and global levels.

School of Neuroscience

VirginiaTech

Virginia Tech Degree Proposal
Neuroscience, PhD

(CIP: 26.1501**)**

Type of degree action (circle one): **New** Spinoff Revision Discontinuance

Program Description

Virginia Polytechnic Institute and State University requests approval for a new Doctor of Philosophy (PhD) in Neuroscience with a planned implementation date of Spring 2020. The proposed PhD degree will be housed in the School of Neuroscience within the College of Science, located on the Blacksburg campus. The School of Neuroscience at Virginia Tech is staffed by newly hired world-class faculty as well as a strong complement of existing neuroscience research faculty on the Blacksburg campus and the affiliated Virginia Tech Carilion Research Institute.

Neuroscience has become a regular part of rigorous scientific training in the biological and psychological sciences due in part to the advent of sophisticated methods for studying neural system structure, function and disease. The theories, empirical methods, and laboratory techniques for analysis of neural systems are critical features of biomedical research and medicine. The School of Neuroscience has created a unique opportunity to develop a PhD graduate program with an infusion of newly hired faculty with active research in drug addiction, mood disorders, neuroimmunology, brain development, sexual differentiation, language production and linguistics, computational neuroscience, genetics, epigenetics, CNS trauma, and brain cancer. The neuroscience faculty will provide a comprehensive core curriculum for graduate students during the first year in the program along with the opportunity to perform research rotations to directly apply their newly acquired knowledge under the supervision of research mentors. Once a member of a laboratory, PhD students and their research mentors will shape their additional academic training based on each individual research project. Newly designed graduate courses in the School of Neuroscience complemented by unique strengths of Virginia Tech including Engineering, Bioinformatics, Computer Science, Biomedical Engineering and Psychology, will individualize each students academic training. The core and elective coursework offered as part of the Neuroscience PhD graduate program will serve as a rich resource to existing Virginia Tech graduate programs with an interest in Neuroscience, including Translational Biology, Medicine and Health Neuroscience Track, Psychology, Biomedical Engineering, and Biomedical and Veterinary Sciences graduate programs.

Curriculum Summary

In the process of earning his/her degree, a PhD student gains a comprehensive knowledge of neuroscience subject matter and completes faculty-mentored research. Accordingly, each student's curriculum is tailored by an advisory committee comprising at least four members of the graduate faculty with the requirements listed below.

Earning the PhD in Neuroscience requires the completion of 90 credit hour program. A cumulative GPA of 3.0 (4.0 point scale) is required for all coursework taken at the University.

The 90 credit hours are made up of a minimum of 28 graded credits, which include a common core, restricted and free electives. The remaining credits fulfill the research requirement.

1) Core courses: 16 credits
NEUR 5004* Principles in Neuroscience (3 credits)
NEUR 5024* Neuroanatomy and Systems Neuroscience (3 credits)
NEUR 5014* Cellular and Molecular Neuroscience (3 credits)
NEUR 5074* Current topics in Neuroscience (4 x 1 credit = 4 credits)
STAT 5615 Statistics in Research (Statistics department) (3 credits)

2) Restricted Electives: a minimum of 6 credits from the following list
NEUR 5054* Developmental Neuroscience (3 credits)
NEUR 5064* Cognitive and Behavioral Neuroscience (3 credits)
NEUR 5914* Drug Development in Neuroscience (3 credits)
NEUR 5314G* Advanced Genetics of Neuroscience (3 credits)
NEUR 5814G* Advanced Nutritional Neuroscience (3 credits)
NEUR 5364G* Advanced Neuroscience of Language and Communication Disorders (3 credits)
NEUR 5514G* Advanced Neuroimmunology (3 credits)
NEUR 5034G* Advanced Diseases of the Nervous System (3 credits)
* denotes a new course

3) Free electives: A minimum of 6 graded credit hours consisting of graduate coursework (5000 level or higher), as approved by the student's thesis committee. These credits are tailored to the specific needs for the specific research topic and background of the students. Additional, in depth, courses related to the student's research area, if applicable, would fall into this category.

4) *Research Requirement*: up to 62 credits of independent research credit hours are required (NEUR 7994 Research and Dissertation, variable; up to 12 credits per semester).

Degree Requirements: Candidates are eligible for graduation upon successful completion of all core, elective, and research credits, as well as passing performance on the Preliminary Doctoral Examination (advancement to candidacy), and successful defense of a written dissertation.

Relevance to University Mission and Strategic Planning
Virginia Tech is a logical and ideal location for a new PhD Neuroscience program in the Commonwealth. The School of Neuroscience and the undergraduate degree program were recently established on the Virginia Tech campus (spring 2016). As such, neuroscience has undergone a tremendous growth phase over the last year. This growth includes the addition of 10 tenure track faculty which join three additional tenure track faculty in place in the neurosciences at VT. The faculty's expertise in neuroscience aligns well with each of the three organization sub themes of the 'adaptive brain and behavior destination area including 1) decision-making, 2) physical and psychological trauma and 3) healthy development across the lifespan. In total, these faculty members bring 64 years of teaching experience at the undergraduate and graduate level. They will be the core faculty responsible for the majority of the neuroscience graduate program curriculum.

The proposed PhD program in neuroscience is well aligned with the University mission. The mission of the newly proposed program in neuroscience is to cultivate inclusivity and advance scientific learning, basic and translational neuroscience research, as well as educate and train critical thinkers, innovators, scientists, policy makers, and tomorrow's neuroscience leaders. By engaging the scientific and lay communities regarding new discoveries made in laboratories at Virginia Tech, our students will disseminate new knowledge locally, nationally and internationally. The proposed Neuroscience PhD degree will better position Virginia Tech to become a leader in the field of neuroscience. In line with the University Strategic Plan (2012-2018), the new PhD program in Neuroscience will leverage the unique strengths of Virginia Tech in areas of engineering, computational science and informatics to create a 'distinctive profile of progressive and internationally recognized research'. It is anticipated that this new PhD program will increase the enrollment of graduate students at VT.

Justification for the Proposed Program

Neuroscience has traditionally been classified as a subdivision of biology. In the past 20 years neuroscience has evolved into an interdisciplinary science, which liaises closely with other disciplines, including mathematics, linguistics, engineering, computer science, chemistry, philosophy, psychology, engineering and medicine. Increasing understanding of the brain and improved methods to study brain function across development will enable scientists to develop treatments for neurological disorders and mental illnesses and may inform normal human behavior and psychological well-being. Furthermore, when applied with emerging tools in other sectors of the community, such as business, healthcare, the military, and civilian communities, neuroscience research may provide significant benefits for society and have implications for a diverse range of public policy areas such as health, education, law, and security.

Public Health Challenges

The growing importance of neuroscience to modern society is seen in growing awareness that more than 1,000 disorders of the brain and nervous system exist. These disorders affect, an estimated, 100 million Americans every year with the most common nine neurological disorders and costing American society a staggering 789 billion dollars per year.[1] The National Science and Technology Council's Interagency Working Group on Neuroscience (IWGN) and the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative of the National Institutes of Health represent a $3 billion ($300 million per year for 10 years) effort to increase brain research and innovation across multiple disciplines.[2] The goal of these initiatives is to increase our understanding of the fundamental function of the brain and the effects that learning, cognition, and education might have on society, behavior and the economy writ large. Both of these federal initiatives aim to accelerate the development of innovative technologies to understand brain function. Similar large-scale investments by the European Union ($1 billion) in the Human Brain Project, which aims to provide information computing technology infrastructure for neuroscience, indicate the global scope of this growth.[3] Only by bringing together classical and emerging concepts in neuroscience, molecular biology, genetics, computational science, engineering, and physics can scientists develop technologies to

1 https://www.sciencedaily.com/releases/2017/03/170330165002.htm

2 https://obamawhitehouse.archives.gov/the-press-office/2013/04/02/fact-sheet-brain-initiative

3 https://www.humanbrainproject.eu/en/

understand how the human brain functions and develop treatment strategies and interventions for human neurological disease.

Neuroscience Technology
Neuroscience is not just about disease but also about rapidly evolving technology in all sectors of the community, including business, healthcare, the military and civilian communities. Artificial intelligence, smart cities, neuromarketing and bionic limbs are just a few of the emerging neuroscience technologies. For instance, high priority opportunities for Army investment for neuroscience technologies include field deployable biomarkers of neural state, fatigue prediction models, models for head impact protection and threat assessment augmentation.[4] 'Commanders on the battlefield could benefit from decision support that alerts them in near real time to issues with personnel neural readiness, such as unexpectedly high levels of fatigue or sleep-deprivation deficits in individuals or across units.'[4] In the civilian world, tracking reactions of humans as they navigate cities with mobile EEG devices may allow for the development of smart cities, which 'may work to mitigate stress and anxiety disorders.'[4]

The global neuroscience market was valued at over >$24 billion in 2014, a value that is expected to increase by nearly 3% per year. North America constitutes 50% of the global market. [5] The overall worldwide market for neurotechnology products (neuroprosthetics, neuromodulation, neurorehabilitation, and neurosensing) was projected to be $7.6 billion in 2016 and reach $12.0 billion in 2020.[6] Areas of market growth include neuromodulation devices (i.e. for the treatment of obesity) and emerging applications for neurotechnology devices (i.e. migraine pain, and depression). This massive growth indicates a rapidly evolving field with high wage positions for PhD trained neuroscientists. These growth areas demand comprehensive knowledge from a neuroscience educated workforce – a knowledge our program will provide.

"The Brain State"
On May 6, 2016 Virginia Governor Terry McAuliffe signed a historic $2.2 Billion Bond Package Bill that includes $46.7 million dedicated to the Virginia Tech Carilion Research Institute to jumpstart a far-reaching Health Sciences and Technology Innovation District in Roanoke. "We are building a foundation for biotechnology and medical research that will establish Virginia as a hotbed for companies who want to be shoulder-to-shoulder with world-class collaborators and a highly trained technical workforce," said Virginia Gov. Terry McAuliffe. "This is a cornerstone of a new Virginia economy and will position the Commonwealth as a national leader in advanced research."[7] Officials hope to see this partnership with Carilion Clinic and Virginia Tech as a launching point so that the commonwealth can more easily attract investors and partnerships as it earns its new reputation of being the "Brain State."

A partnership between the Virginia Tech Carilion Research Institute (VTCRI) with ground breaking translational Neuroscience research and the substantial investment in the School of Neuroscience promises to raise awareness of Neuroscience research occurring in southern central

4 *Opportunities in neuroscience for future army applications*, National Research Council, 2008

5 http://www.grandviewresearch.com/industry-analysis/neuroscience-market

6 http://www.neurotechreports.com/pages/execsum.html

7 http://wsls.com/2016/05/06/gov-mcauliffe-signs-bond-bill-works-to-dub-va-as-brain-state/

Virginia, again aligning with the University Strategic Plan to create 'a distinctive profile of progressive and internationally recognized research.' Furthermore, the increased density of Neuroscientists between the two locations will enhance the experience of graduate students with an interest in neuroscience across the two campuses by:

1) a larger breadth of Neuroscience research
2) increasing opportunities for access to external experts invited as speakers
3) increase the number of Neuroscience related seminars, journal clubs and graduate elective courses
4) finally and most importantly, provide a strong sense of community between a group of individuals which as future colleagues are likely to contribute to the future of Neuroscience research, policy and healthcare.

Student Demand

Graduate Education

On a national level, the field of neuroscience finds itself in an era of exceptional growth and popularity. Therefore, it is not surprising that for the past decade, the number of new neuroscience PhD graduates has outpaced every other life sciences discipline.[8] This demand is reflected on the Virginia Tech campus. Student demand for the new PhD program in Neuroscience at Virginia Tech is high. This is evidenced by 1) the tremendous growth of the Neuroscience undergraduate student body at Virginia Tech and 2) the high volume of email communication between our faculty/staff and potential PhD applicants interested in information regarding a Neuroscience PhD degree from Virginia Tech.

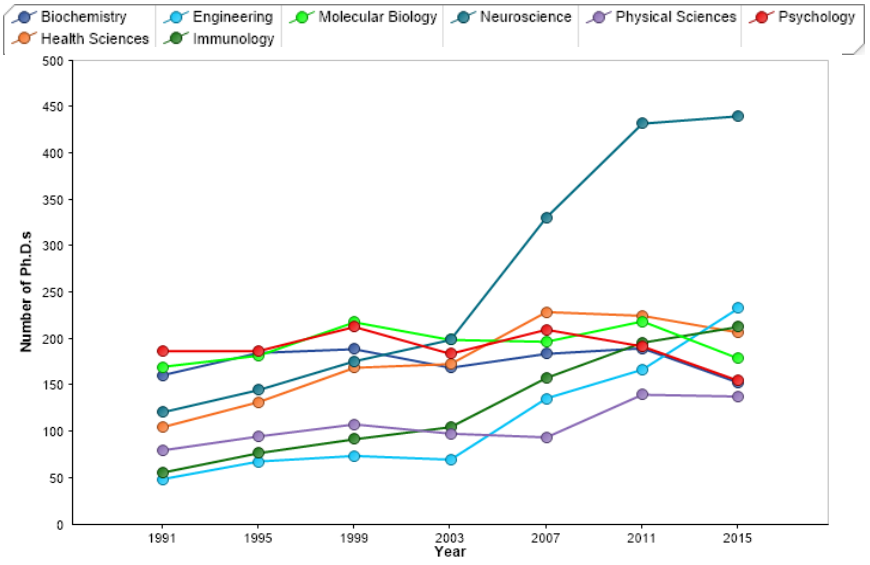

Figure 1. NIH-supported PhD recipients, trends in major fields of study (1991-2015).

Neuroscience growth at Virginia Tech: The first undergraduate Introduction to Neuroscience course was offered at Virginia Tech in 2013 before the establishment of the School of Neuroscience. This course had 33 registered undergraduate students. The demand for this course has increased exponentially since the approval of the Neuroscience undergraduate degree with 242 registrants in the Fall 2017 and over 600 current declared Neuroscience majors as of January 2018. Notably, many neuroscience undergraduate students are actively engaging in research opportunities in preparation for graduate study. In the Fall 2017, nearly 60 undergraduate students registered for 'Undergraduate Research' with Neuroscience research faculty in the

[8] https://report.nih.gov/nihdatabook/charts/Default.aspx?chartId=267&catId=21

School of Neuroscience, Biological Sciences, Animal Poultry Sciences, Biomedical and Veterinary Sciences and the Carilion Research Institute. The vast majority of these students (53) have declared Experimental Neuroscience as their major which prepares students for a 'hands-on' career in academic science with a primary goal to matriculate students into graduate studies.

Additional evidence of interest in a Neuroscience PhD program at Virginia Tech stems from applicants for the new Molecular and Cellular Biology Program at Virginia Tech (mcb.vt.edu). This is an interdisciplinary PhD graduate program with four regions of specialization; Cell Signaling and Cancer, Inflammation and Immunity; Microbiology; and Neurobiology. Over 50% of applicants for the start of the 2018 fall class declared Neurobiology as their primary interest.
Finally, the faculty in the School of Neuroscience have written a large number of letters of recommendation for Neuroscience majors (graduation date spring 2018) whom are seeking PhD graduate studies in the field of Neuroscience.

Market/Employer Demand

Neuroscience is a discipline that ascends conventional disciplinary boundaries, generating students that provide modern solutions to the most important questions in the life sciences. Employment opportunities for Neuroscience students are therefore widespread and include a number of careers in the life sciences that range from software design, publishing, consulting, public policy, and communication, the rapidly growing fields of neurotechnology and neuroinformatics and opportunities to specialize in conventional disciplines such as genetics, and psychology.

Moreover, there is an increasing need to communicate neuroscience information at all levels, from editing scholarly journals to educating the public. On a national level, there is an increasing need for informed regulators and policy makers. The growth of the field, together with commercialization of new products and services, will result in the expansion of career opportunities in the public and private sector, including bench scientists, entrepreneurs, analysts, consultants, and intellectual property experts. Graduates of the program will be qualified for a number of positions where a PhD in neuroscience is required or preferred, including:

- Postdoctoral Fellow or Instructor at a College, University, or Academic Health Center
- Research Scientist in the Pharmaceutical or Biotechnology Industry
- Research Scientist or Health Science Administrator in a Government Agency
- Non-research position where biomedical/health expertise and excellent communication skills are required, such as: science writer, editor, or journalist; patent agent; health science administrator at a university/government/hospital or other non-profit; public policy analyst; scientific consultant

On a national level: The U.S. Bureau of Labor Statistics (BLS) does not currently have a separate designation for PhD in Neuroscience. Nonetheless, other relevant employment categories in the BLS are appropriate for graduates holding a PhD in neuroscience.[9] The projected job growth for all categories listed below, except Biomedical Engineer's, exceeds average national job growth which is 7%, indicating increasing demand in each of these fields. PhD's in neuroscience may fall into any of the categories listed below.

[9] https://www.bls.gov/ooh/ (once on the site, enter the job title or the SOC code) accessed February 2018

Job Title	SOC Code	Employment 2016	Projected Employment 2026	Percent Change 2016-2026	2016 Median Pay
Medical scientists	19-1042	120,000	136,100	13%	$80,530
Computer and information research scientists	15-1111	27,900	28,300	19%	$111,840
Natural sciences managers	11-9121	56,700	62,300	10%	$119,850
Biological Science Post-secondary teachers	25-1042	62,300	71,700	15%	$75,430
Education administrators, postsecondary	11-9033	180,100	198,300	10%	$90,760
Biochemists and biophysicists	19-1021	31,500	35,100	11%	$82,180
Biomedical engineers	17-2031	31,300	22,800	7%	$85,620

Table 1. Employment Projections 2010 - 2020 (U.S. Bureau of Labor Statistics)

These statistics are born out in data from popular national job search engines. Current data from Indeed.com and Simplyhired.com indicates 500 - 600 current positions using the key words 'Neuroscience and PhD' with a mean income of $82,325 (data obtained February 2018).

In the Commonwealth: According to the Virginia Economic Development Partnership (VEDP), Virginia's Life Sciences Industry employs over 25,400 people at more than 1,000 businesses. Research, Testing, and Medical Laboratories account for 46% of Virginia's Life Sciences employment and 32% of its businesses.[10] Competitive operating costs, a business-friendly environment and a highly skilled workforce are driving Virginia's growing bioscience sector and fostering discoveries every day. Progressively, leading pharmaceutical, medical device and biotechnology firms are choosing to locate or develop their businesses in Virginia. This is likely due to the innovative research universities, numerous federally funded facilities, and renowned research institutes, as well as major manufacturers including Merck, Abbott, Teva, Novozymes Biologicals and Fareva.

The U.S. Bureau of Labor Statistics (BLS) provides occupation profile by state.[11] Again, the projected job growth for many of these careers that an individual holding a PhD in Neuroscience might chose show substantial positive projections.

Job Title	*2014 Employment*	*2024 Employment*	*Percent Change 2014-2024*	*Annual Median Wages 2014*
Medical Scientists, Except Epidemiologists	1,990	2,280	15%	$94,420
Computer and Information Research Scientists	1,800	1,880	4%	$119,810
Natural Sciences Managers	1,370	1,400	3%	$120,630

[10] http://www.yesvirginia.org/KeyIndustries/LifeSciences

[11] https://www.careeronestop.org/Toolkit/Careers/Occupations/occupation-profile.aspx (at site, enter SOC code or job title and state)- accessed February 2018

Biological Science Teachers, Postsecondary	1,590	1,940	22%	$61,010
Education Administrators, Postsecondary	2,690	3,080	14%	$90,760
Biochemists and Biophysicists	620	720	16%	$85,360
Biomedical Engineers	370	460	25%	$77,720

Table 2: Employment Projections 2010 - 2020 (Virginia Employment Commission)

Issues of Duplication

Statewide duplication

Three PhD programs in the state of Virginia offer PhD programs in Neuroscience with CIP 26.1501. These include the Neuroscience graduate program at Virginia Commonwealth University (VCU), the Neuroscience PhD graduate program at George Mason University (GMU) and the Neuroscience PhD program at the University of Virginia (UVA). Given the strong interest over the last two decades in the field of Neuroscience, it makes sense at this time, with the massive growth of the undergraduate program on the Virginia Tech campus, that VT would develop a competitive Neuroscience PhD program. Like Biology, Biochemistry, Psychology, the Physical Sciences and Engineering, which are all represented at the PhD level at UVA, VCU and GMU, so Neuroscience has become a fundamental component of undergraduate and graduate education.

Enrollments[12]	**Fall 2013**	**Fall 2014**	**Fall 2015**	**Fall 2016**	**Fall 2017**
George Mason University	26	22	16	13	14
University of Virginia	35	32	30	32	32
Virginia Commonwealth University	25	23	23	24	19
Degrees Awarded[13]	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**
George Mason University	3	3	6	3	3
University of Virginia	6	7	5	4	7
Virginia Commonwealth University	3	2	3	3	4

Table. 3 Enrollments and Degrees Awarded at Comparable Programs in the Commonwealth

While there are similarities between the existing Neuroscience PhD programs in Virginia and the proposed program, several attributes of the proposed program render it unique.

1) Students entering the proposed program enter directly into the Neuroscience PhD program, enabling the core coursework to focus exclusively on Neuroscience. Additional restricted neuroscience electives chosen by the student and their committee enable unique neuroscience curriculum for each student.
2) The Neuroscience faculty in the School of Neuroscience and their specific areas of research are unique to these faculty.

[12] State Council of Higher Education for Virginia (SCHEV). *Fall Headcount Enrollment by Race/Ethnicity, Gender and Program Detail.* http://research.schev.edu/enrollment/E16_Report.asp. (Accessed [February 2018]).

[13] State Council of Higher Education for Virginia (SCHEV). *Completion, Program Detail C1.2.* http://research.schev.edu/Completions/C1Level2_Report.asp. (Accessed [February 2018]).

3) Of the programs listed above, Virginia Tech is the only campus with a Neuroscience department (in this case, the School of Neuroscience). Instead faculty are interspersed in Pharmacology, Biology, Biochemistry, Psychology, etc. The large concentration of faculty, post-doctoral fellows, research technicians and support staff in the School of Neuroscience, coupled with the substantial undergraduate Neuroscience program will provide a distinctive experience for Neuroscience PhD seeking students.

Virginia Commonwealth University (VCU) PhD seeking students enter into a Biomedical Sciences Doctoral program at VCU. These students take Biochemistry, Cell and Molecular Biology during the first and second semester of the program. Students with a primary interest in Neuroscience also participate in Cellular and Molecular Neuroscience during the fall semester and Systems Neuroscience during the spring semester during year one. Research rotations are performed during the first year and can be in any discipline in Biomedical science. At the end of year one students formally transition to the PhD program in Neuroscience. The core curriculum in Neuroscience at VCU includes only two required graduate Neuroscience courses, differentiating VCU's Neuroscience PhD program from the proposed program.

University of Virginia (UVA) Students entering the PhD program in Neuroscience at UVA participate in an intensive course in integrative biosciences (BIMS 6000), laboratory rotations, and a seminar in Neuroscience during the first semester of year one. The core neuroscience curriculum begins during the second semester of year one and includes eight graded Neuroscience core credits. No other neuroscience courses, including electives are required.

George Mason University (GMU) The PhD program in Neuroscience at GMU is a 72 credit PhD program focusing on cognition and higher brain function. Students in this program take a core of 9 Neuroscience credits, a required statistics course (3-4 credits) and a research methods course (3 credits). Unlike the proposed program, students at GMU take an additional 20-21 credits of free electives graduate courses and only 24 credits of dissertation research.

Relationship to existing Virginia Tech programs
The Translational Biology Medicine and Health PhD (TBMH) program at VT is an integrative, research intensive, PhD program with a focus on translational science. The flagship first semester course for TBMH students is an 8 credit course training students in the general principles of a translational approach to basic biomedical and health sciences, biomedical interventions and health behavior and health care systems and delivery. At the end of the first semester students, choose a focus area (an additional 8 credits), which may include neuroscience, cancer, immunity and infectious disease, metabolic and cardiovascular science, development aging and repair or health implementation science. The TBMH program targets students with a broad interest in translational science. Strengths of the TBMH program include a strong foundation in principles of translational biology, medicine and health research, preparing their students to tackle some of the most challenging aspects of healthcare today. A similarity between the newly proposed program and a TBMH student that chooses a neuroscience track include an intensive, independent research project with a mentor whose research focus falls broadly into the field of Neuroscience. However, the two programs target different populations of students. Namely, the proposed program seeks students with a focused interest exclusively in Neuroscience. The core curriculum provides a comprehensive foundation in current aspects of

neuroscience. The series of core courses span from structure and function of cells to anatomy and systems neuroscience, development of the nervous system, and behavior. Upon completion of the core coursework, students will be prepared to investigate the genetic aspects of neurologic disease or the neural bases of various brain-behavior relationships including sensation, memory, attention, motivation and reward, emotion, decision-making, sleep, language and social cognition. No program in the state of Virginia and few across the nation that provide this holistic, 360-degree view of current topics in Neuroscience. All core and elective coursework offered as part of the Neuroscience PhD graduate program are unrestricted to students of existing VT graduate programs with an interest in Neuroscience, including TBMH Neuroscience Track, Psychology, Biomedical Engineering, and Biomedical Veterinary Sciences graduate programs.

Resource Needs/Savings

*Program Director: T*he Neuroscience PhD graduate program will be managed by the program Director. The Director of the program will be a tenured faculty member in the School of Neuroscience. The director will oversee all aspects of program management but will work closely with committees comprising groups of tenure track faculty. Working together, the Director and committees will coordinate the curriculum, student advising, student research, marketing and recruitment, review application material and oversee the steering committee. The Program Director and all members of committees will be on a three-year rotation.

Faculty: The School of Neuroscience and the undergraduate major were recently established on the Virginia Tech campus (spring 2016). As such, it has undergone a tremendous growth phase over the last 18 months. This includes the addition of 10 tenure track faculty (1 full professor, 2 associate professors, 7 assistant professors). The School of Neuroscience is slated to hire an additional 5 tenure track faculty. Together, these faculty will provide research laboratories for PhD seeking students, instruct the proposed curriculum, and provide the majority of financial resources for stipends, tuition and healthcare.

Administrative Needs: The increased administrative duties for the proposed PhD in Neuroscience will be coordinated and managed within the existing framework and support of the School of Neuroscience. It is anticipated that one full time program administrator will be sufficient to manage the day to day activities for Neuroscience graduate programs. Web design and social media presence will be administered by the current School of Neuroscience web designer. Instruction will take place on the Blacksburg campus.

RESOURCE	ESTIMATED COSTS (use NA if not applicable)
Faculty	5 FTE by target enrollment year 2024-2025
Program Administrator	1 FTE by target enrollment year 2024-2025
Graduate Teaching/ Graduate Research Assistants	GRA's will be supported by grants and contracts written by faculty, and by faculty start up funds. Neuroscience PhD students may also supported by School of Neuroscience allocated GTA positions.
Space	N/A
Library	N/A
Equipment	N/A
Other	N/A