VTC | Virginia Tech Carilion
School of Medicine

2 Riverside Circle, Suite M140
Roanoke, VA 24016
Telephone: (540) 526-2500
Fax: (540) 581-0741
www.vtc.vt.edu

February 2, 2023

Dear Colleagues:

I am writing in full support of the enclosed proposal requesting approval for the establishment of a new department of Neurosurgery at the Virginia Tech Carilion School of Medicine. As described more fully in our proposal, we seek approval to expand our current division of Neurosurgery, housed within our existing department of Surgery, and have it become an academic department within our school. We have undertaken this step after several years of careful study, and in collaboration with our health system partner, Carilion Clinic.

The current division of Neurosurgery has flourished since its establishment in 2003, with increasing demand for education for our medical students, visiting medical students from other schools, and resident physicians who are completing the final, 7-year residency required before beginning independent practice. The Neurosurgery faculty work collaboratively to support research and education with other colleges at Virginia Tech as well as the Fralin Biomedical Research Institute at VTC. In order for the current division to meet its ongoing academic goals as well as the increasing demand for clinical care in our region, we feel strongly that establishing a new academic department is both timely and necessary.

The proposed new department has been vetted in detail by the leadership and current faculty in Surgery and they are in full support. And, as required by our school's governance structure, the proposal has also been reviewed and endorsed by our faculty governance and academic committees, and by myself as Dean.

The new department of Neurosurgery will be fully funded by existing resources and will require no funding from Virginia Tech; Carilion Clinic will fully fund the new department. Further, the change will support Virginia Tech's commitment to "improving the quality of life and the human condition within the Commonwealth of Virginia and throughout the world" as reflected in our university mission statement.

Thank you for your consideration, and please allow me to answer any additional questions you may have.

Sincerely,

Lee A. Learman, MD, PhD
Dean, Virginia Tech Carilion School of Medicine

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Institution
Virginia Polytechnic Institute and State University

Nature of Proposed Change
Virginia Tech requests approval to establish the Department of Neurosurgery within the Virginia Tech Carilion School of Medicine.

Appendix A presents the existing organizational structure of the school.
Appendix B presents the organizational structure of the school after the addition of the Department of Neurosurgery.

Background
The Carilion Clinic Department of Surgery has contained a specialty area (i.e., section) in neurosurgery since its establishment in 2003. Upon the establishment of the partnership between Virginia Tech and Carilion Clinic and the subsequent creation of the Virginia Tech Carilion School of Medicine in 2007, the neurosurgery section continued to flourish as part of the Department of Surgery. Upon integration into Virginia Tech in summer 2018, the Virginia Tech Carilion School of Medicine was established as the 9th college of Virginia Tech. At that time and currently, there are 11 departments (9 clinical and 2 non-clinical) within the school, including the Department of Surgery. The Department of Surgery contains 11 sections, including neurosurgery. The term "section" refers to a specialty area within a department (e.g., general surgery, cardiovascular and thoracic surgery, plastic and reconstructive surgery) that requires specialized education and training.

In the fall of 2018, faculty and administrators began holding meetings to discuss the possibility of establishing a standalone department of neurosurgery. Virginia Tech Carilion School of Medicine faculty and administrators and Carilion Clinic leadership discussed the needs of the students, demand for the existing neurosurgery section and residency program, and the needs of the region. Additionally, the group discussed research conducted on the organizational structures of the neurosurgery discipline at medical schools at Virginia Tech's State Council for Higher Education in Virginia (SCHEV) peer institutions. After considerable discussion between 2019 and 2020, the group agreed that a standalone department for neurosurgery was needed. The proposed change was approved unanimously by the faculty in the current Department of Surgery, and was subsequently approved unanimously on November 4, 2020, by the chairs of the other eight (8) clinical departments at Virginia Tech Carilion School of Medicine and by the Board of Governors of Carilion Clinic. While the circumstances surrounding the COVID pandemic caused a delay in pursuing the proposed department, the project was revisited by the group in the spring of 2022 and determined it was time to move forward with proposing a new Department of Neurosurgery.

Purpose of Proposed Change
The purpose of the proposed organizational change is to establish an academic unit solely responsible for the administration and oversight of neurosurgery education and training in the Virginia Tech Carilion School of Medicine.

Mission
The proposed organizational change aligns with the mission of Virginia Tech. The mission states:

> "Inspired by our land-grant identity and guided by our motto, *Ut Prosim* (That I May Serve), Virginia Tech is an inclusive community of knowledge, discovery, and creativity dedicated to improving the quality of life and the human condition within the Commonwealth of Virginia and throughout the world."

The proposed department will align with the mission of Virginia Tech. The proposed department will support the university's mission to be a "community of knowledge" and "discovery" by providing a centralized academic unit for the neurosurgery discipline. The proposed department would allow medical students, physicians, and faculty members to collaborate on pediatric and adult neurosurgeries and advance the field of neurosurgery to "…improv[e] the quality of life and the human condition within the Commonwealth of Virginia and throughout the world."

Institutional Nomenclature
Although the name of the Virginia Tech Carilion School of Medicine contains the term "school," the Virginia Tech Carilion School of Medicine is a college at the university and functions correspondingly to the other eight (8) colleges at Virginia Tech. The term "school" is in name only. Therefore, the Virginia Tech Carilion School of Medicine has departments as sub-units.

At the Virginia Tech Carilion School of Medicine, the term "department" is defined as an academic unit that functions in four (4) broad areas: (i) teaching/education; (ii) clinical patient care (except for two non-clinical departments); (iii) research/scholarly activity; and (iv) service. A department is housed within a college and is considered to be an academic unit. Departments at the Virginia Tech Carilion School of Medicine have consistent levels of budgetary, programmatic, and administrative independence, yet are also closely aligned with both the medical school and Carilion Clinic. However, the medical degree is administered at the school level.

Rationale for Proposed Change
The proposed organizational change to establish a new Department of Neurosurgery will provide a standalone clinical department needed to support neurosurgery education and training at the institution. The reorganization is needed for three (3) reasons: 1) elevate the visibility of the neurosurgery discipline, 2) to expand opportunities for medical students to receive clinical rotation training in neurosurgery, and 3) to enhance opportunities for medical students to receive residency training in neurosurgery.

<u>Elevate the Visibility of the Discipline</u>
In the summer of 2020, faculty and administrators in the Virginia Tech Carilion School of Medicine conducted research about the organizational structure of medical schools at Virginia Tech's State Council for Higher Education in Virginia (SCHEV) peer institutions. Specifically, the group investigated whether the peer institutions had a standalone department for the neurosurgery discipline rather than a section/specialty area within a larger department of surgery. Of the 21 SCHEV peer institutions with medical schools, 11 institutions had a standalone

academic unit titled “Department of Neurosurgery,” seven (7) institutions had a standalone academic unit titled “Department of Neurological Surgery,” and one (1) had a standalone academic unit titled “Division of Neurosurgery,” and two (2) peer institutions did not have standalone academic units for neurosurgery.

In order to remain competitive, it is important to elevate the neurosurgery discipline to equal standing with other departments in the Virginia Tech Carilion School of Medicine just as the SCHEV peer institutions have done. In doing so, the institution can establish neurosurgery as a vital part of the school’s offerings and publicly acknowledge Virginia Tech’s, Carilion Clinic’s, and the Virginia Tech Carilion School of Medicine’s commitment to the neurosurgery discipline.

If approved, the proposed new department would serve as the department of record for the Accreditation Council for Graduate Medical Education accredited Neurological Surgery residency training program at Virginia Tech Carilion School of Medicine. This credential, in conjunction with a standalone department dedicated to neurosurgery, would demonstrate the need for and commitment to the neurosurgery discipline. As an illustrative example of the impact of such a commitment, proposals under consideration for National Institutes of Health research grants in the neurosurgery discipline are viewed more competitively when submitted from faculty members in a free-standing neurosurgery department versus faculty members in a department of surgery. Further, establishing a standalone academic unit in neurosurgery will help to retain and recruit highly skilled neurosurgery physicians and affiliate faculty members.

The proposed organizational change to establish a new Department of Neurosurgery is needed to elevate the visibility of the neurosurgery discipline and ensure that the Virginia Tech Carilion School of Medicine remains competitive with its peer institutions.

Clinical Rotations for Medical Students

Expand Year 3 Clinical Rotations

Currently, Year 3 medical students participate in a Core Clinical Surgery Clerkship Rotation of six (6) weeks duration within the Department of Surgery. The focus of the 6-week Surgery Clerkship Rotation is to introduce students to the care of surgical patients, including initial patient assessment and perioperative management, as well as surgical intervention. This rotation allows students to explore surgical areas, develop knowledge of and relationships with the surgery physician faculty, and observe continuity of care for patients under the care of the various surgical teams. Students choose a Clerkship Rotation based on their interests and desired career trajectory. Due to the limited availability of the existing neurosurgery physician faculty, only two (2) weeks is available in the Core Clinical Surgery Clerkship Rotation for third year medical students interested in exploring neurosurgery and there are a very limited number of available slots.

The proposed department would allow the option for a Year 3 Core Clinical Surgery Clerkship Rotation in neurosurgery. If approved, additional neurosurgery physician faculty members can be recruited to the proposed department. The new physician faculty would be available to provide the oversight and coordination needed to expand the Clerkship Rotation in neurosurgery for the third-year medical students. The School could expand the duration of the neurosurgery Clerkship Rotation beyond two (2) weeks and could increase the number of Clerkship Rotations

in neurosurgery. Thus, allowing more medical students the opportunity to explore neurosurgery in a more in-depth and focused manner to determine whether the discipline is one that the student would like to pursue for further disciplinary training.

The proposed organizational change to establish a new Department of Neurosurgery is needed to allow for the expansion of the Year 3 Core Clinical Surgery Clerkship Rotation offerings in the neurosurgery discipline.

Expand Year 4 Clinical Rotations
In Year 4, medical students build upon the clinical experiences of Year 3 and are required to complete clinical experiences in discipline areas of interest referred to as "Electives" at their primary (i.e., home) medical school. They are also required to complete clinical experiences at other medical schools in a "visiting student" capacity. Medical students across the nation apply for short-term (e.g., 2-4 weeks) clinical rotations to gain more extensive clinical experiences in the specialty area or discipline in which they would like to pursue residency training and eventually establish a medical practice. In addition to the learning experience itself, the primary purpose of these types of clinical rotations is to explore their residency options. For example, Year 4 medical students need to make a final decision about their residency track/specialty area; survey the availability of residencies in their desired discipline area; and explore the compatibility of the student and the leading physicians at different locations.

Between July 2011 and January 2022, the Virginia Tech Carilion School of Medicine's neurosurgery section has provided Year 4 medical students with 120 elective neurosurgery residency rotation experiences to 111 medical students from 39 medical schools. Due to the limited availability of the existing neurosurgery physician faculty, there is limited time and availability to provide the Clinical Rotations in neurosurgery to Year 4 Virginia Tech Carilion School of Medicine medical students or external Year 4 medical students in a "visiting student" capacity. If approved, establishing the proposed Department of Neurosurgery would offer the School the opportunity to recruit additional neurosurgery physician faculty and thereby, afford the School the ability to increase Year 4 Clinical Rotations in neurosurgery to the School's students as well as the visiting medical students. Further, for the School's students, this would allow the students to be more competitive when applying for additional neurosurgery clinical rotations as a visiting student and increase the likelihood of securing a residency in neurosurgery. The proposed organizational change to establish a new Department of Neurosurgery is needed to allow for the expansion of the Year 4 surgical rotation offerings in neurosurgery.

The proposed organizational change to establish a new Department of Neurosurgery is needed to allow for the Virginia Tech Carilion School of Medicine to expand the offering of the Year 4 Clinical Rotations in neurosurgery for medical students.

<u>Enhance Post-Medical School Residency Training</u>
For the neurosurgery discipline, 84 months of post-medical neurological surgery residency training is required[1] under the direction of the neurosurgery program director. The Virginia Tech Carilion School of Medicine's neurosurgery section has evolved into a highly sought-after

[1] The American Board of Neurological Surgery: Training Requirements. https://abns.org/training-requirements/

Residency Training program with specialized neurosurgeons. The activity level of and demand for the neurosurgery section has experienced significant growth over time to the current state.

The Virginia Tech Carilion School of Medicine currently offers one (1) Post-Medical School Residency Training neurosurgery residency position per year for a total of seven (7) medical residents at any given time. For the one (1) neurosurgery residency position that opens annually, the Virginia Tech Carilion School of Medicine receives exponentially more applications for Residency in neurosurgery than positions it can provide. For example, the School received 37 applications in 2009-2010. The applications remained at steady state until the 2017-2018 year, when the number of applications increased to 213. During the most recent year, 2021-2022, the School received a total of 245 applications for Post-Medical School Residency Training in neurosurgery.

The number of Post-Medical School Residency Training residency positions that a medical school can offer is dependent upon the systemic support (e.g., number of physician faculty members) in place to adequately provide the specialized and extensive training and supervision needed for a residency program. The proposed organizational change to establish a new Department of Neurosurgery is needed so that the Virginia Tech Carilion School of Medicine can offer additional Post-Medical School Residency Training residency positions for medical students.

Appendix C presents a list of departments at SCHEV peer institutions.

Academic Programs
The proposed organizational change will not impact the Medical Degree (M.D.) degree requirements currently administered by the Virginia Tech Carilion School of Medicine. The proposed new department will not offer any new undergraduate or graduate degree programs. The proposed Department of Neurosurgery would continue to contribute to the existing curriculum for the medical school leading to the M.D.. There will be no change to the M.D. program as a result of the relocation of the neurosurgery section to the proposed new department.

The proposed organizational change will alter the existing Department of Surgery in the Virginia Tech Carilion School of Medicine. If the proposed department is approved, the Department of Surgery will reallocate the neurosurgery section curriculum, the neurosurgical portion of the department's budget and resources, and the neurosurgery physician faculty to the new Department of Neurosurgery. The proposed organizational change will not alter or impact the other 10 existing academic units in the School.

The proposed new department will administer the neurosurgery section:

Year Four Neurosurgery Electives

Appendix D presents neurosurgery elective descriptions.

Resources/Budget

The proposed Department of Neurosurgery budget will be comprised of all current physical, financial, and personnel resources of the existing section of Neurosurgery at Virginia Tech Carilion School of Medicine/Carilion Clinic. As with other clinical departments of the medical school, the new Department of Neurosurgery faculty will be comprised of physicians and administrative staff who are employed by Carilion Clinic. Establishment of the corresponding academic department at the medical school will require no funding from Virginia Tech. Carilion Clinic, a private organization, will provide all funding needed to initiate and sustain the proposed new department, including all salary and fringe benefits costs for new hires (clinical faculty/physicians and staff), and all departmental costs (e.g., budget/operating costs, materials/supplies, other costs, and miscellaneous costs).

The departmental budget will be managed in the existing processes for all academic departments in the School of Medicine. All personnel in the department are employees of Carilion Clinic and are not classified as Virginia Tech employees. All budgetary components, including operating, equipment, materials, and personnel, are funded by Carilion Clinic. Carilion Clinic will be responsible for all funds needed to establish and operate the proposed department.

Administration

The proposed Department of Neurosurgery will be led by a physician Department Chair/Head. The proposed department will also have a Vice President of Neurosurgery and a Research Associate.

New Hire 1

In year one, a full-time physician Department Chair/Head will be hired. The Department Chair/Head will be a Carilion Clinic employee and will have a faculty member appointment in the proposed department. The Department Chair/Head will report to the Chief Medical Officer of Carilion Clinic as well as the Dean of the Virginia Tech Carilion School of Medicine and will oversee the entire scope of activities of the proposed department to include clinical operations, academic offerings, research activities, personnel, and clinical faculty appointments. The Department Chair/Head position will require a medical doctor degree with a specialization in neurosurgery; at least five years of progressive neurosurgery leadership in an academic setting with a rank of at least associate professor; evidence of strong organizational, communication and leadership skills; and physician leadership experience with emphasis on team building as well as development of integrated collaborative models of care, education and research. Typically, a physician Department Chair/Head in the neurosurgery discipline receives an approximate salary of $800,000 and $200,000 in fringe benefits for total of approximately $1,000,000.

New Hire 2

In year one, a full-time non-physician Vice President of Neurosurgery will be hired. The Vice President of Neurosurgery will be a Carilion Clinic employee and is not anticipated to have a faculty member appointment in the proposed department. The Vice President of Neurosurgery will report to the physician Department Chair/Head and be responsible for the daily functions of the department, the budget, and personnel matters. The non-physician Vice President of Neurosurgery position will require a minimum of a master's degree in a health sciences, business

or health administration field and significant prior experience in all aspects of clinical administration and operations. Typically, a Vice President in the neurosurgery discipline receives an approximate salary of $265,000 and $66,250 in fringe benefits for a total of approximately $331,250.

New Hire 3
In year one, a full-time Research Associate will be hired and will be a Carilion Clinic employee. The Research Associate will report to the Vice President of Neurosurgery and will be responsible for collaborating with departmental faculty to advance the research mission of the department. Typically, a Research Associate in the neurosurgery discipline receives an approximate salary of $100,000 and $25,000 in fringe benefits for a total of approximately $125,000.

Classified Staff

The proposed department will not have classified staff in the first three (3) years of operation. No costs for classified staff positions are anticipated in the first three (3) years of operation.

Faculty

The proposed department would be established with a total of nine (9) physician neurosurgery faculty members, consisting of eight (8) existing physician neurosurgery faculty members currently housed in the Department of Surgery and one new administrative position which will include a faculty member appointment (i.e., new Department Chair/Head) to be hired in the first year. The eight (8) existing faculty members are current Carilion Clinic employees in the Department of Surgery with affiliate faculty appointments at Virginia Tech and are funded solely by Carilion Clinic. The eight existing (8) positions will be reallocated from the Department of Surgery to the proposed new department, if approved. The salary for each physician faculty member will not change as a result of the proposed organizational change. The salaries for the eight (8) existing faculty members range from approximately $500,000 to $800,000; average of $762,000. Fringe benefits for the physician faculty members range from approximately $125,000 to $200,000; average of $162,500. The total average salary for the eight (8) existing faculty members equals approximately $6,096,000 and total fringe benefits equals approximately $1,300,000. The combined total for the salary and fringe benefits for the eight (8) existing physician faculty members is approximately $7,396,000.

No adjunct faculty line is budgeted for the first three (3) years of operation.

Graduate Assistants

The proposed department will not have graduate assistants in the first three (3) years of operation. No costs for graduate teaching or graduate research assistants are anticipated in the first three (3) years of operation.

Student Workers

The proposed department will not have student workers in the first three (3) years of operation. No costs for student workers are anticipated in the first three (3) years of operation.

Space

There is adequate office space to accommodate the proposed department. Upon establishment, the proposed department would be located within office space in the Carilion Clinic Medical Center in Roanoke, VA. No new space is needed for the three (3) new hires. There is adequate existing space for the new hires.

Other Costs

The costs associated with medical supplies (e.g., laboratory, surgical) are approximately $381,000 annually for the first three (3) years of operation. All costs associated with the proposed department are currently and will remain fully funded by Carilion Clinic. No equipment purchases will be needed for the three (3) new hires. There is adequate existing equipment to support the new hires.

Miscellaneous

There will be an initial one-time expenditure of $2,500 to be utilized for the purchasing of stationery, business cards, signage (internal and external to the building), and for publicity and promotional activities associated with the creation of the new department. All miscellaneous costs for the proposed department will be funded by Carilion Clinic.

Print materials (stationery, business cards)	$200
Publicity and Promotion	$2000
Signage (internal and external)	$300
Total	**$2,500**

Sustainability

Resources to support the proposed department will be reallocated from the current neurosurgery portion of the Department of Surgery budget and funded solely by Carilion Clinic. Existing resources from the Department of Surgery budget will be reallocated to cover all costs associated with the establishment of the proposed new department. Website changes will be made as a part of duties and responsibilities of existing staff. Resources for all other costs associated with establishing the proposed department including operating costs will be funded by Carilion Clinic. Carilion Clinic has adequate resources to establish and operate the proposed department. No resources will be requested from the state to establish or maintain the proposed organizational change for a new Department of Neurosurgery.

Budget

The departmental budget presents the proposed expenditures for the first three (3) years of the proposed Department of Neurosurgery. Personnel costs will include eight (8) existing physician

faculty members and three (3) new administrative positions, one of which will also have a faculty member appointment in the proposed department. All costs associated with the eight (8) existing physician faculty member positions are currently and will remain funded solely by Carilion Clinic. The three (3) new administrative positions will also be funded solely by Carilion Clinic. No university or state funding are needed or utilized for the positions.

In year one, the cost for the salaries and fringe benefits for the three (3) new administrative positions is estimated at a total of $1,456,250. Carilion Clinic will cover all costs for the salaries and fringe benefits of the new positions. No university or state funding is needed for the new positions.

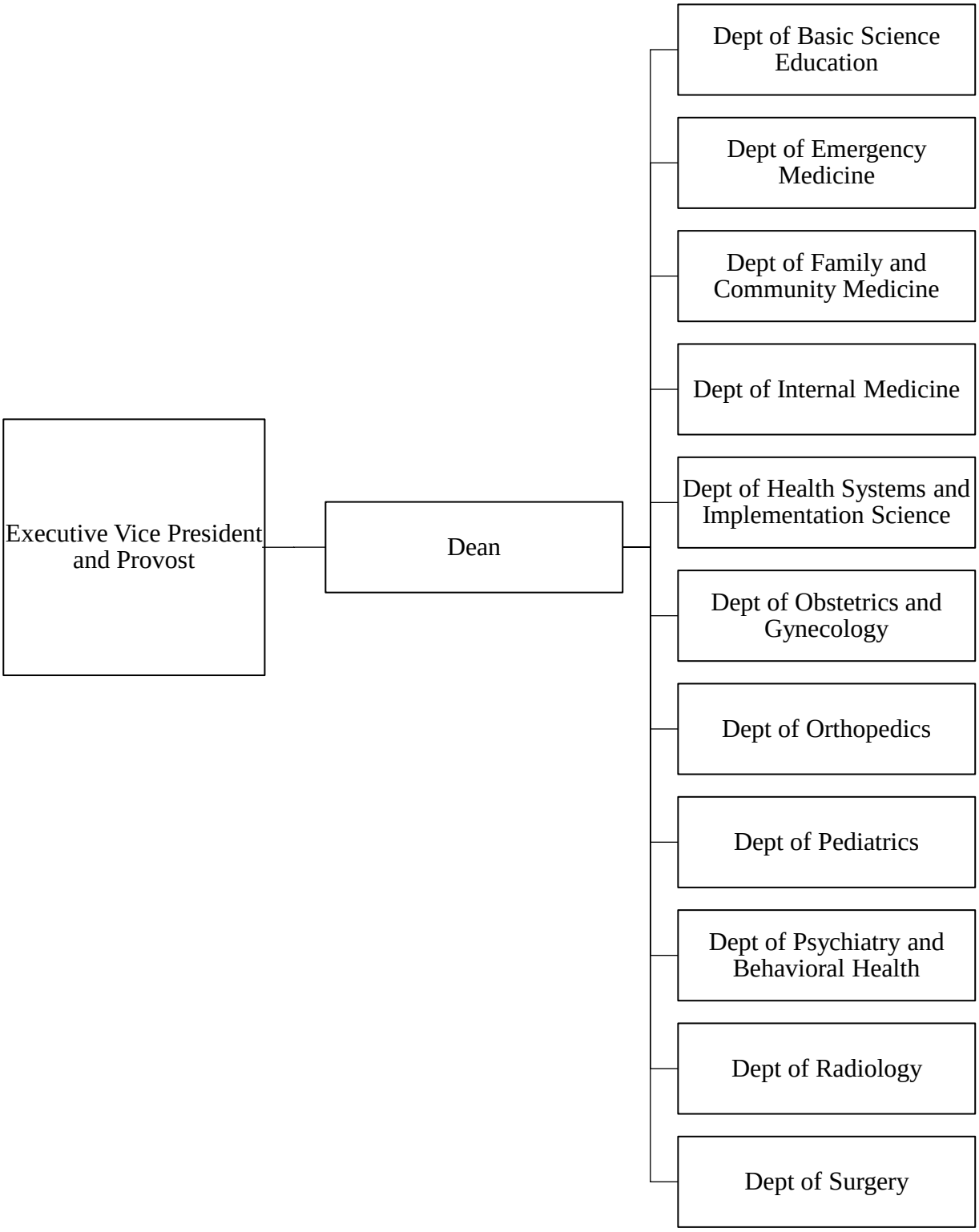
Operating expenses to establish the department in the amount of approximately $505,000 are indicated for office and instructional supplies, travel, marketing, and professional development. The operating expenses are expected to remain stable for the first three (3) years of operation. Existing funding from the Department of Surgery will be reallocated to the new department, if approved. Reallocations will not negatively impact the Department of Surgery's resources. Miscellaneous items that do not have a designated line item in the budget form are included in the line item for "Other Costs."

New Academic Unit - Proposed Name: Department of Neurosurgery

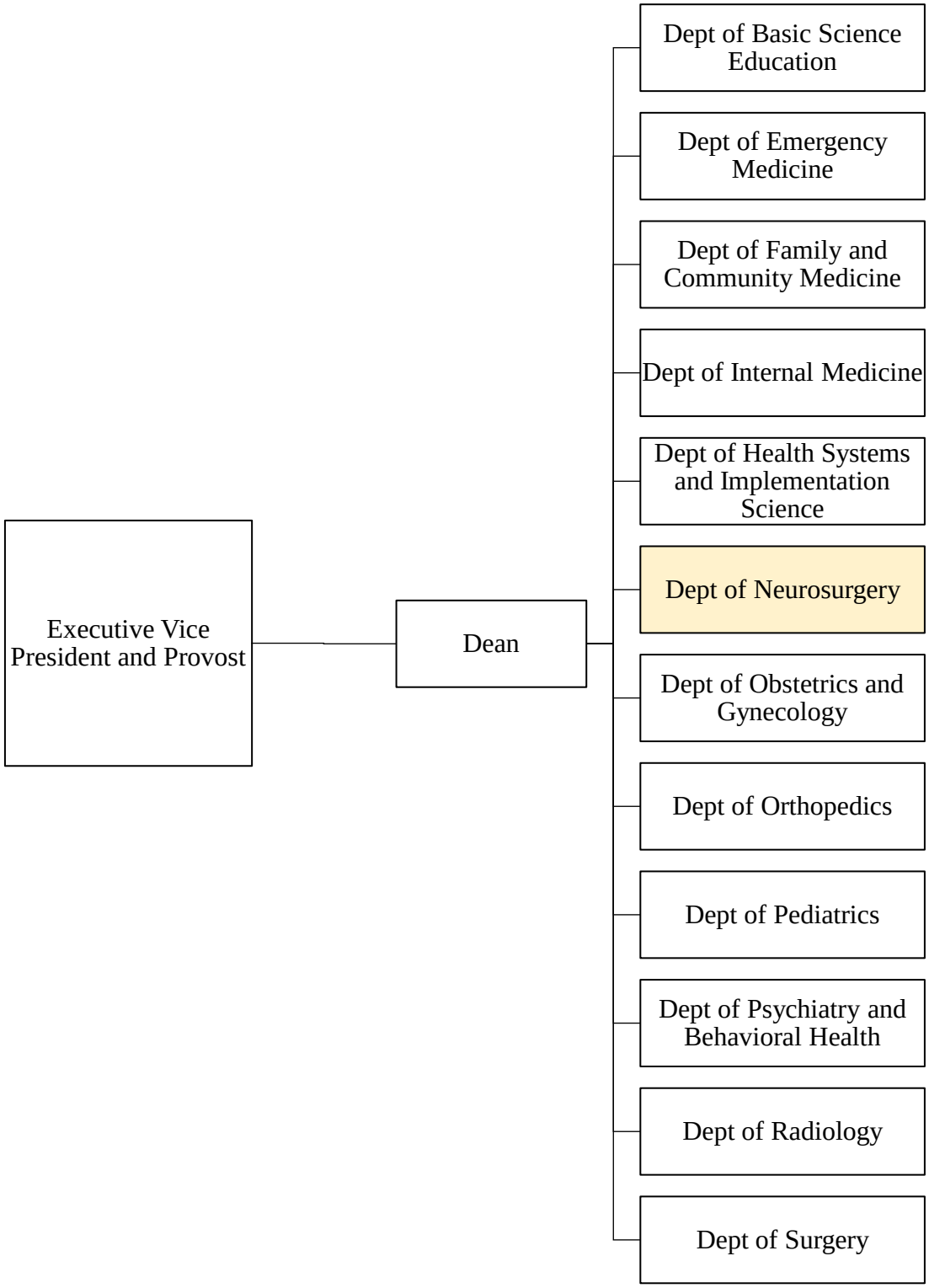
Expenditure Category	Proposed Budget			
	HDCT	2023 - 2024	2024 - 2025	2025 - 2026
Personnel Salary				
Department Chair/Head	1	$800,000	$800,000	$800,000
Fringe Benefits		$200,000	$200,000	$200,000
Vice President of Neurosurgery	1	$265,000	$265,000	$265,000
Fringe Benefits		$66,250	$66,250	$66,250
Research Associate	1	$100,000	$100,000	$100,000
Fringe Benefits		$25,000	$25,000	$25,000
Position Title				
Fringe Benefits				
Faculty	8	$6,096,000	$6,096,000	$6,096,000
Fringe Benefits		$1,300,000	$1,300,000	$1,300,000
Personnel Subtotal	11	$8,852,250	$8,852,250	$8,852,250
Student Support				
Student HelpersWorkers				
Graduate Teaching Assistant				
Graduate Research Assistant				
Student Support Subtotal	0	$0	$0	$0
Operating Expenses				
Office Supplies		$25,000	$25,000	$25,000
Instructional Supplies		$250,000	$250,000	$250,000
Travel		$75,000	$75,000	$75,000
Marketing		$55,000	$55,000	$55,000
Conference/Professional Development		$100,000	$100,000	$100,000
Other Costs		$383,500	$381,000	$381,000
Operating Expenses Subtotal		$888,500	$886,000	$886,000
Total	**11**	**$9,740,750**	**$9,738,250**	**$9,738,250**

Appendices

Appendix A
Current Organizational Structure



Appendix B
Proposed Organizational Structure of the Virginia Tech Carilion School of Medicine



Appendix C
SCHEV Peer Institutions

Institutions	Department
University of California, Davis	Department of Neurological Surgery
University of Colorado Boulder	Department of Neurosurgery
Cornell University	Department of Neurological Surgery
University of Florida	Lillian S. Wells Department of Neurosurgery
University of Illinois at Urbana-Champaign	No department
University of Maryland, College Park	Department of Neurosurgery
University of Michigan, Ann Arbor	Department of Neurosurgery
Michigan State University	Division of Neurosurgery
University of Minnesota – Twin Cities	Department of Neurosurgery
University of Missouri – Columbia	Department of Neurosurgery
The Ohio State University	Department of Neurosurgery
Pennsylvania State University	Department of Neurosurgery
University of Pittsburgh	Department of Neurological Surgery
Rutgers, The State University of New Jersey	Department of Neurological Surgery
State University of New York at Buffalo	Department of Neurosurgery
University of Southern California	Department of Neurological Surgery
Stony Brook University	Department of Neurosurgery
Texas A&M University	No department
The University of Texas at Austin	Department of Neurosurgery
The University of Washington – Seattle	Department of Neurological Surgery
University of Wisconsin - Madison	Department of Neurological Surgery

Appendix D
Current Fourth Year Electives in Neurosurgery

9901 – Neurosurgery Spine Track (2 or 4 credits)
Students in this elective will experience 40% time in the Neurosurgery and/or Spine Center Clinic and 60% time in the operating room and on inpatient floors. Students will gain knowledge and skills for the evaluation and management of degenerative spinal disorders, radiculopathy, myelopathy, spinal column tumors, spinal column fracture, spinal column deformity, chronic spinal pain, scoliosis, and more. Surgical experiences will vary (e.g., opening and closing of large spinal wounds, pedicle screw placement, laminectomy, fusion, kyphoplasty). Students will participate in Tuesday afternoon academic sessions and will always be welcome on rounds and in the operating room. The locations are the Institute for Orthopaedics and Neurosciences and Carilion Roanoke Memorial Hospital.

9902 – Neurosurgery Pediatrics Track (2 or 4 credits)
In this elective, students will work closely with two pediatric neurosurgery attending surgeons. Students on this rotation will not only learn the nuts and bolts of pediatric neurosurgery but will also gain a deep appreciation for how to relate to critically ill children and their families. This will involve both outpatient clinic work and inpatient evaluations and surgeries. Students will experience patients with disorders such as hydrocephalus, spina bifida, tethered spinal cord, head trauma, spine trauma, brain tumors, non-accidental trauma, chiari malformation, skull masses, craniofacial synostosis and deformity, and more. The pediatric volume of the service is variable, and a healthy mix of adult neurosurgery may be mixed into the rotation. Students will participate in Tuesday afternoon academic sessions and will always be welcome on rounds and in the operating room. The locations are the Institute for Orthopaedics and Neurosciences and Carilion Roanoke Memorial Hospital.

9903 – Neurosurgery ICU Track (2 or 4 credits)
In this track, students will spend a lot of time in the emergency room evaluating acute neurosurgical issues and interweaving their work with the trauma team. They also will spend time in the intensive care unit (ICU) setting once the acute situation has been initially identified and evaluated. The preceptor is the neurosurgery faculty and the location is Carilion Roanoke Memorial Hospital.

9904 – Neurosurgery Operating Room Track (2 or 4 credits)
In this track, students will spend the vast majority of their time in the operating room. They will participate in the daily operating schedule. They will be expected to evaluate the patients and their radiographs in the pre-op area and then discuss the choice and execution of procedures with attending surgeons and residents involved in the procedure. They can anticipate the development of skills in sterile technique, prepping and draping, operative positioning, opening and closing of surgical wounds, control of bleeding, tying, suturing, drain placement, burr hole placement, pedicle screw insertion, laminectomy, ventricular catheter placement, lumbar catheter placement, craniotomy, bone drilling, and more. They will develop an appreciation for the fragility of the nervous system and will develop skills in the delicate manipulation of such tissues. Students will participate in Tuesday afternoon academic sessions and will always be welcome on rounds and

in the operating room. The preceptor is the neurosurgery faculty and the location is Carilion Roanoke Memorial Hospital.

9905 – Neurosurgery Research Track (2 or 4 credits)
Students on the research track work predominately on ongoing projects of the team (although we are open to initiating novel proposed projects). They will still participate in Tuesday afternoon academic sessions and will always be welcome on rounds and in the operating room. Students will work with a faculty mentor and a resident mentor/partner. Skills will be built in study design, literature search, data accumulation, and synthesis. They will share authorship of finished research projects with team members (posters, presentations, papers). The preceptor will be the chosen faculty member/mentor and the location is Carilion Roanoke Memorial Hospital.

9906 – Neurosurgery Consultation Track (2 or 4 credits)
Students will spend the majority of their rotation evaluating neurosurgery and Spine Center outpatients. They will develop an exceptional acumen in neurological history taking, exam, differential diagnosis, synthesis, and treatment planning. They will learn how to efficiently move a number of patients through a clinic. They will develop patient interaction skills. They will develop a strong background in neuroradiologic evaluation. They will gain an in-depth appreciation for the evaluation and management of spinal disorders and also various brain and peripheral nerve disorders. They will partner with attending neurosurgeons and residents each day. They will independently evaluate each of their patients, review the patient's studies, and formulate a diagnosis and treatment plan prior to discussing with their neurosurgical partners. Students will be encouraged to follow their patients through their entire neurosurgical experience including inpatient care and surgery. Students will participate in Tuesday afternoon academic sessions and will always be welcome on rounds and in the operating room. The preceptor is the neurosurgery faculty attending and the locations are the Institute for Orthopaedics and Neurosciences and Carilion Roanoke Memorial Hospital.

9907 – Acting Internship in Neurosurgery (4 credits)
This track is the most demanding and rigorous offered by the Carilion Clinic Neurosurgery team. In this rotation, the medical student acts essentially as a neurosurgical intern. They are assigned inpatients with whom they care for and follow throughout the patients' hospitalizations. They will spend a sizable amount of time in the intensive care units (ICUs), on the floors, and in the operating room. They will write regular notes and will interact intimately with patients and their families. They will take neurosurgical call with a resident one in every four nights. They will participate in resident clinic every Tuesday morning. They will gain an appreciation of the full gamut of neurosurgical issues encountered in a busy academic/clinic practice. They will acquire skills in inpatient and outpatient neurosurgical evaluation, the neurologic exam, surgical tissue manipulation, neurological critical care, neuroradiology, patient and family interaction, and much more. The location is Carilion Roanoke Memorial Hospital.

Appendix E
Organizational Structure of Proposed Department