

September 18, 2014

Nancy C. Andrews, MD, PhD
Dean, Duke University School of Medicine
Vice Chancellor for Academic Affairs
Duke University Medical Center
Davison Building, Room 125
Box 2927 Med Ctr
Durham, NC 27705

Dear Dean Andrews:

I would like to propose that the Division of Neurosurgery of the Department of Surgery be granted Departmental status within the Duke University School of Medicine. The Division of Neurosurgery has grown substantially over the past 15 years in faculty size, clinic volume, grant funded research, and educational initiatives. It has tripled its clinical volume, developed an internationally-recognized Brain Tumor Center which is recognized as a Program of Distinction within the Health System, established a global health program, enhanced its research program in a time when funding for research is tight, funded resident-based research, grown clinical programs in spine, pediatric, cerebrovascular, and functional neurosurgery, and spearheaded a viable neurosurgical practice at Duke Raleigh Hospital. The Division of Neurosurgery has little in common with the 11 other divisions within the Department of Surgery except that we share the operating theater. Departmental status will provide the neurosurgeons the direct access to the Medical School and Health System that it will need to continue neurosurgery's growth and maturation. Departmental status will also allow Neurosurgery to directly pursue its own goals of clinical care, research, and education in an unencumbered fashion.

Below I address the criteria for converting a Division into a Department for the Division of Neurosurgery.

1. Dean of the School of Medicine

The Division of Neurosurgery acknowledges that Dean of the School of Medicine has the responsibility to authorize an analysis to consider Division conversion to Departmental status.

2. Department Leadership

Current leadership is provided by the following:

- **John H. Sampson, MD, PhD, MBA, MHSc, Chief of Neurosurgery:**
Dr. Sampson is the Robert H. and Gloria Wilkins Distinguished Professor of Neurosurgery for the Duke University Medical Center. He has a leadership role in the Duke Cancer Institute's Neuro-Oncology Program and is a recognized leader in the surgical and experimental treatment of brain tumors with a focus on immunotherapy and drug delivery. He has authored more than 175 peer-reviewed publications in this field and serves on the Editorial Boards of all the major journals in the field. He has

received formal training in medicine, basic science research, clinical trial design and execution, and health sector management and leadership. He has proven his ability to educate, collaborate, and lead scientists locally and nationally. He has served as a sponsor on 4 Investigational New Drug (IND) applications submitted to the Food and Drug Administration (FDA) in support of several novel therapeutics being advanced into the clinic. He served in this role on the EGFRvIII-targeted vaccine which is now being evaluated in a worldwide Phase III randomized trial.

- **Katherine Stanley, MBA, Interim Executive Director, Department of Surgery:** Katherine Stanley has worked for Duke Medicine for more than 15 years. She has been the Interim Executive Director for the Department of Surgery since July 2013. Her prior roles include functioning as the Director of Clinical Operations and Divisional Administrator for the Divisions of Urology, Surgical Oncology and General and Advanced GI Surgery. She has also served as the director of operations for the Duke Health and Wellness programs at Duke Medicine as well as the director of the Community Private Diagnostic Clinic at Duke. She was responsible for the financials and operations of thirty (30) Duke-affiliated practices with revenues totaling \$33 million. She received her MBA at Kenan-Flagler Business School at the University of North Carolina, Chapel Hill, focusing in service operations.
- **Benjamin Pratt, MHA, Divisional Administrator, Department of Surgery:** Ben Pratt has been at Duke University Medical Center for more than 2 years in the Department of Surgery. He works with the divisions of Neurosurgery, OHNS, and Cardiothoracic Surgery. In addition, he provides departmental leadership for space administration, faculty compensation, and financial management. Prior to Duke, Ben spent 5 years in the Department of Medicine at Drexel University College of Medicine where he was the Finance Manager. In that role he worked closely with the Chair to provide financial management of a \$40 million budget, as well as leadership on operational and strategic initiatives. He received his Masters of Healthcare Administration from UNC-Chapel Hill with a concentration in Finance.

3. National Model

Duke has one of the few remaining Divisions of Neurosurgery in the United States. Most Divisions of Neurosurgery became Departments in the 1990s or already had Departments. At present, there are 103 Departments of Neurosurgery and 10 (9.7%) Divisions or Sections of Neurosurgery in the United States. Neurosurgery is a Department in all of our peer institutions. Since 2005, we have ranked in the top 25 of the *U.S. News & World Report* Best Hospital rankings for the Neurology & Neurosurgery category. Of those ranked in the top 25, all but Duke are independent Departments.

4. Clinical Practice

Duke's Division of Neurosurgery has a robust clinical practice with a national and international referral base and reputation. Our clinical practice has also grown considerably over the past decade. Our neurosurgical faculty has gone through a period of significant growth with a modest turnover. Over the past 6 years, we have added 11 faculty members (Dr. Gonzales, Dr. Bagley, Dr. Zomorodi, Dr. Gottfried, Dr. Lad, Dr. Muh, Dr. Keeler, Dr. Peter Grossi, Dr. Bronec, Dr. Murano, and Dr. Price) while losing a few faculty members (Drs. George, Alexander, Britz, and Grant). At the time this document is being prepared, our 3 most recent hires (Dr. Karikari, Dr. Thompson, and Dr. Fecci) still have capacity to expand their clinical

practice. The Division of Neurosurgery has maintained clinical productivity above the 95th percentile AAMC for the past 3 years. Our patient satisfaction is above the 85th percentile.

Total Clinic Volume and Total RVUs are shown below. Data on the number of neurosurgical cases performed over the past 5 years from the health system has not been available to-date.

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013 (Jul-Dec)	FY 2013 (Jul-Dec) Annualized
Total Clinic Visits						
Duke Medical Center	7651	7452	8447	9155	4538	9076
Duke Raleigh	1046	1475	2085	2547	1377	2754
Total Clinic Volume (Duke and Duke Raleigh)	8697	8927	10,532	11702	5915	11,830

Year	Total RVUs
2003	80,142
2004	84,735
2005	97,623
2006	94,745
2007	105,471
2008	159,891
2009	198,656
2010	229,336
2011	241,168
2012	244,063
2013*	233,561

* The transition to Epic had a negative impact on our 2013 RVUs.

The Division is completely engaged in all the clinical sub-specialties of Neurosurgery. In most sub-specialty areas, the Division not only provides high quality clinical service, but also explores new innovative therapies for neurosurgical diseases.

Intrinsic Brain Tumors:

The Preston Robert Tisch Brain Tumor Center employs an integrative approach for the treatment of malignant brain tumors. It is our best example of the “bench to bedside” approach of innovative therapies for the treatment of a neurosurgical disease. The Preston Robert Tisch Brain Tumor Center has been designated a Center of Excellence and a Program of Distinction by the Duke University Medical Center. It enjoys a national and international reputation. It has a 95% market share in the Triangle area and yet 80% of referrals come from outside North Carolina. In a recent review, the neurosurgical faculty was found to have published 200 articles on brain tumors in journals with an impact factor greater than 7. There have traditionally been 4 major umbrella grants in the Brain Tumor Center:

- Specialized Research Center (SRC) P50 Grant (Direct \$4,119,698 / 5 years). The NINDS has recently retired the SRC mechanism, but this grant will be renewed under the NINDS Pre-clinical P01 mechanism
- Pediatric Brain Tumor Foundation grant (Direct: \$1 million / year for 12 years)
- P01 in Translational and Clinical Neuro-Oncology (Direct: \$12,489,794 / 5 years)
- SPORE in Brain Cancer (Direct: \$7,451,387 / 5 years). This application is undergoing review in June 2014.

Cerebrovascular:

The cerebrovascular neurosurgeons, Drs. Ali Zomorodi and Fernando Gonzales have developed a very strong program in conjunction with the Departments of Neurology and Radiology. At a time when many neurosurgical practices have abandoned cranial surgery for the treatment of intracranial vascular malformations, one of the technically most complex areas of neurosurgery, the Duke program has significantly grown. Intracranial vascular abnormalities (AMVs, aneurysms) are as likely to be treated by an open craniotomy as by an endovascular approach at Duke. As such, the number of neurosurgical cerebrovascular cases tripled between 2007 and 2010. While local competition has decreased the number of cases referred to Duke over the past 3 years, the current patient population being treated is still more than double the 2007 rate. Moreover, our latest length of stay and mortality statistics ranks in the 99th percentile among academic medical centers.

The Division of Neurosurgery has also partnered with the Department of Neurology and the Health System to develop our stroke practice. This nascent endeavor is in an area which we will develop over the next few years by working closely with the Departments of Neurology and Radiology.

The cerebrovascular neurosurgical group has published 33 papers related to cerebrovascular surgery and 14 related to vascular surgery over the past 3 years, and has made a notable number of presentations at national and international meetings. A list of these publications is in the appendices. This year, Duke will host a CME course focused on novel endovascular techniques as well.

Skull Base Surgery:

We are fortunate to have recruited a world-renowned skull base surgeon, Dr. Takanori Fukushima, in 1998. Three years ago, Dr. Zomorodi joined our faculty and in 2011 our Skull Base Surgery Center was formally inaugurated as a collaborative effort between the Duke Health System and the Divisions of Neurosurgery and Otolaryngology, Head & Neck surgery. Since 2008, the Division of Neurosurgery's operative skull base cases has grown from 240 to 390. We presently rank in the 99th percentile of academic medical centers for observed length of stay versus expected length of stay. We continue to attract patients from all over the world seeking treatment for difficult skull base tumors.

Drs. Fukushima and Zomorodi continue to run a biannual international dissection course and are invited to lecture around the world. In 2011, Dr. Fukushima's "Manual of Skull Base Dissection" came out with its 3rd edition. The papers published by the neurosurgeons in our skull base group are listed in the appendices.

Spine:

The Division of Neurosurgery cooperates with the Department of Orthopedics in treating patients with diseases of the spine. The newly formed interdisciplinary Spine Center has led to the incorporation of physiatrists and pain specialists into the Division of Neurosurgery. Our surgeons are doing pioneering work in extensive reconstructive surgery for the treatment of spinal tumors and spinal deformity and minimally invasive surgery for more limited spinal disorders.

Over the past 5 years, the Neurosurgery Spine Program has seen tremendous growth, both clinically and in research productivity. The overall surgical case volume has increased steadily from 565 cases in fiscal year 2008 to over 850 surgical procedures in fiscal year 2012 at Duke University Medical Center. The Duke Neurosurgery Spine Program at Duke Raleigh Hospital, which began in 2008, now performs over 500 procedures annually. When combined with the growth in cases at the Durham VA Hospital, the Duke Neurosurgery Spine Group has had a

three-fold growth in the number of operative cases over the past 5 years. The complexity of the case mix and the safety of our patient care have continued to improve. Patients seen in the Neurosurgery Spine Program come from all over the region due to the strong reputation that our program has developed. Our Spinal Oncology and Deformity Programs are the busiest, both in North Carolina and overall in this region of the country. We have 3 full-time faculty who are fellowship trained in complex spine surgery in the Division of Neurosurgery.

Led by Dr. Robert Isaacs, the spine surgeons at Duke have developed an expertise in minimally invasive spine surgery. They use minimally invasive techniques to tackle complex spine reconstructions. Dr. Isaacs does not just perform minimally invasive procedures, but is an innovator introducing new technologies to minimally invasive surgery. He has performed 4 first-in-human procedures at Duke over the past 24 months. This translates into our patients and residents getting early exposure to these new technologies. Dr. Isaacs is well recognized for his leadership directing clinical trials and courses in minimally invasive spine surgery.

Along with the increase in clinical volume, the Neurosurgical Spine Team has been academically productive. The large number of manuscripts published by our Spine team is included in the appendices. Their research has been recognized by the spine community, winning the 2012 AO North America Young Investigator Award and the 2012 International Society for the Study of the Lumbar Spine Young Investigator Award. In collaboration with the Division in Biomedical Engineering, the Spine Team has successfully isolated and developed a chordoma tumor cell line for research purposes, which is one of a handful that have been developed in the world. The Spine Group has secured research grant funding from AO North America as well as industry sponsored research funding from Orthofix, NuVasive, Medtronic, and Stryker.

The Duke Neurosurgery Spine Program has remained very active in continuing our mission of teaching and education, both at Duke and nationally. Our faculty has mentored dozens of residents, medical students, and undergraduates who have expressed an interest in spinal neurosurgery. Dr. Bagley is the neurophysiology course director for the summer medical and dental education program (SMDEP) for premed undergraduate students held here at Duke each summer and teaches a number of local and national courses in spine related topics. Dr. Robert Isaacs has served on national committees of the North American Spine Society and the Lumbar Spine Study Group. The Duke Neurosurgery Spine Program also participates in national patient outcomes registries of the Complex Spine Study Group (CSSG) and National Neurosurgery Qualify Outcomes Database (N2QOD). Dr. Gottfried serves as a mentor/instructor/adviser for multiple biomedical engineering courses. In this capacity, Dr. Gottfried meets with the undergraduate and masters' students on a regular basis individually and in study groups providing guidance, project ideas, clinical applicability, and continuous feedback. Dr. Gottfried is primary investigator for 2 unique spine-focused randomized controlled clinical trials and is working to develop a new online outcomes database in cooperation with Apple, Inc. to collect patient data via HIPAA-compliant patient e-mails for all 10 other spine specialists from the Duke Spine Center. He is also leading our Quality Initiative.

Pediatric Neurosurgery:

The Pediatric Neurosurgery Team at Duke is highly regarded in the Southeastern United States with a well-established referral base. There are currently 2 pediatric neurosurgeons at Duke, Dr. Herbert Fuchs, Chief of the service, and Dr. Carrie Muh, and we recently recruited Dr. Eric Thompson from Sick Kids Hospital at the University of Toronto, perhaps the premier Pediatric Neurosurgery Program in North America. Dr. Fuchs is board certified by the American Board of Neurological Surgeons and also Pediatric Board Certified by the American Board of Pediatric Neurological Surgery. Dr. Muh is board eligible. There are only 8 full-time pediatric neurosurgeons in the state of North Carolina, and soon 3 will be at Duke as part of the Division

of Neurosurgery. All 3 faculty have academic pursuits and national recognition. Dr. Fuchs teaches the pediatric neurosurgery modules for the national Maintenance of Certification board review course every year. Dr. Muh is currently completing her Masters in Clinical Science at Duke and is also a national educational leader within the Council of State Neurological Surgeons.

The expertise at Duke Pediatric Neurosurgery is diverse. Expertise within our program exists for treating patients with all cranial and spinal disorders of childhood. The operative case volume is consistently over 1,200 cases per year (1,262 in FY12) and 6,849 clinic outpatient visits were logged last year in a combined pediatric neurosurgery and pediatric neurology clinic. Multidisciplinary programs have been established to care for children with brain tumors, intractable epilepsy, spasticity, congenital brachial plexopathies, Chiari I malformations, hydrocephalus, craniosynostosis, and spina bifida. These multidisciplinary clinics facilitate research efforts and draw patients with complex neurological problems from across the Southeastern United States. The pediatric neurosurgical service has increased its patient volume from 19,500 wRVUs in 2006 to 23,700 wRVUs in 2012.

The Pediatric Neurosurgical Team has expanded its practice into Raleigh over the last 2 years. The attending neurosurgeons alternate at attending the Raleigh Neurology clinic every month. This initiative has been very important in maintaining regional patient referrals. The pediatric neurosurgery team also sees a clinic at Duke Health Raleigh once or twice a month. Early next year, the clinic at Duke Health Raleigh will be moving to the Wake Med Campus. This move will facilitate growth into Raleigh and allow for inpatient consultation at Wake Med.

The pediatric component of the Preston Robert Tisch Brain Tumor Center is nationally recognized as a Research Institute funded by the Pediatric Brain Tumor Foundation. This foundation is critical to providing the necessary seed funding for several promising translational projects focusing on novel treatments of pediatric brain tumors. An example is a Phase I/II dendritic cell based vaccine trial (REMATCH) for recurrent medulloblastoma funded by the Department of Defense. Duke also participates as one of 8 sites in the Pediatric Brain Tumor Consortium (PBTC) funded by the National Cancer Institute. This consortium is charged with developing and executing phase I and phase II clinical protocols to treat pediatric brain tumors.

Functional Neurosurgery:

Duke Neurosurgery has a growing interest in functional neurosurgery involving deep brain stimulation, epilepsy surgery and surgery to treat chronic pain. Current surgical treatment for movement disorders includes deep brain stimulation (DBS) for Parkinson's disease, tremor, and dystonia. This treatment is now considered the "gold standard" for refractory movement disorders. Beginning with a few cases per year in 1998 and 1999, the volume of these procedures has steadily increased, so that over the last 3 years, we are now averaging over 50 cases per year are performed by Drs. Turner and Lad. With Dr. Lad now more clinically active in deep brain stimulation treatment, this number should increase to >60 cases per year in 2014; last year Duke ranked 12th in number of DBS procedures performed at medical centers across the United States. The initial assessment and post-operative management is considerably facilitated by our excellent movement disorders group at Duke, now including 4 neurologists at Duke University as well as several neurologists that focus on this area at Raleigh Neurology.

The functional neurosurgeons are involved with multiple clinical trials in Parkinson's disease. This includes 3 randomized, sham-controlled trials for Ceregene Neurturin gene therapy, beginning with a phase IIa trial and recent completion of a phase III pivotal trial awaiting outcome data for possible FDA approval in the near future. Additional randomized clinical trials in which our functional neurosurgeons are involved include Medtronic/Amgen GDNF infusions for Parkinson's disease, Medtronic/Alnylam siRNA infusion for Huntington's disease, NGF

gene therapy for Alzheimer's disease, and St. Jude's DBS for depression (Area 25 target), currently underway. Further DBS targets are nearing FDA approval (likely 2014) including anterior thalamic DBS for epilepsy. Additional translational research in movement disorders focuses on assessing DBS mechanisms of action to improve DBS efficacy are being done in collaboration with Dr. Warren Grill of the Engineering School. This effort is currently funded by 3 NIH grants and includes 5 IRB-approved protocols. Further research includes NIH funding for innovative translational studies into sensory substitution using thalamic microstimulation and reward mechanisms in basal ganglia utilizing intraoperative recordings.

The Duke Epilepsy Surgery Program is led by Dr. Michael Haglund for adults and Dr. Carrie Muh for Pediatrics and is fully integrated with the parallel medical programs in the new Department of Neurology. The program screens over 125 possible surgical cases per year. The cases are reviewed at the multi-disciplinary weekly Epilepsy Surgery conference that includes the 2 neurosurgeons, 5 epileptologists, epilepsy fellows, and neuropsychologists. The availability of hard wired epilepsy monitoring rooms, 3T MRI, PET, SPECT, and ictal SPECT allow localization of epileptic foci and has led to a large increase in both the pediatric and adult epilepsy surgeries. The Duke Epilepsy Surgery Program leads the nation in using Multi-modality Language mapping that allows for more precise localization of language areas for preservation of language function and improved outcomes. Our epilepsy program is well known on the national level with Dr. Haglund leading the Epilepsy Surgery Special Interest Group at the annual American Epilepsy Society meeting and regularly participating in the national AANS and CNS Functional Mapping Courses. The number of cases of epilepsy treated by surgery has grown significantly compared to previous benchmarks.

The Duke Pain Neurosurgery Program provides a comprehensive and technologically advanced approach to the treatment of pain. Led by Dr. Nandan Lad, MD, PhD, the program brings together a multidisciplinary team that builds upon Duke's rich history in treating a variety of pain syndromes and offers patients a customized treatment approach. The program performed more than 200 surgical cases last year including a variety of traditional ablative procedures such as the Dorsal Root Entry Zone (DREZ) procedure that was pioneered at Duke as well as a variety of cutting-edge neuromodulation techniques such as frameless Deep Brain Stimulation (DBS), Spinal Cord Stimulation (SCS), Peripheral Nerve Stimulation (PNS) and Intrathecal Therapies (ITT). Patients with uncontrolled pain due to cancer, nerve and nervous system injury, stroke, failed back surgery, limb amputation, trigeminal neuralgia and other causes may all be candidates for these advanced pain therapies. There is a tremendous need to establish the scientific rationale and clinical management of chronic pain and devising new approaches to alleviating and preventing it. Dr. Lad co-directs a national Neuro-Outcomes Consortium, funded by an NIH K-award, addressing key health economic and policy questions in neurosurgery that has produced > 50 manuscripts to date. In addition, he established the Duke NeuroInnovations Program, garnering corporate interest and sponsorship, in an RTP-wide collaboration that teaches the process of surgical innovation and develops novel solutions to address large, unmet clinical needs. The program is involved in a number of clinical research studies and basic science collaborations to better understand the pathophysiological mechanisms underlying the regulation of pain and how novel approaches can contribute to the advancement of the field.

VA Practice:

The Division of Neurosurgery provides all neurosurgical patient care for veterans throughout the Southeast region at the Durham Veterans Administration Medical Center (DVAMC). Over the past 4 years, the Neurosurgery Program at the DVAMC has grown tremendously in all of its major missions: patient care, resident education, research and administration. Under the leadership of Dr. Cory Adamson, resources have been secured to almost triple the attending and

mid-level support staff in order to cover all sub-specialty areas of neurosurgery for veterans. The attendings include Drs. Cory Adamson (neuro-oncology), Dennis Turner (functional), Bruce Kihlstrom (peripheral nerve), Ali Zomorodi (cerebrovascular and skull base), Oren Gottfried (complex spine), Nandan Lad (pain), and David Kaylie (skull base). Efficient and timely patient care is the primary area of focus of the program serving veterans from a large regional network including North Carolina, Virginia, West Virginia, and northern South Carolina. The outpatient clinic has increased by 380% in patient visits since 2000 due to increased efficiency. Currently, the DVAMC evaluates 6,000 patients and performs 850 procedures per year. The DVAMC neurosurgery service has made access a goal. Despite traveling an average distance of 150 miles, more than 85% of all new patients and more than 95% of returning patients are seen in less than 14 days, above national VA benchmarks. The operative caseload has increased to 375% of the number of cases performed in 2000 with more than 700 neurological surgeries now performed per year. Over this same time period, the total surgical service has increased its surgical volume 160%. Morbidity and mortality remain below national VA averages for neurosurgery. Neurosurgery operating room utilization rates consistently remain above average, with the average UR for the past 5 years the highest of all the 15 surgical sub-specialties represented at the DVAMC (82%).

Resident education has been enhanced by the addition of a second neurosurgical resident, increased operative and outpatient clinic caseload, an increase in the number of attending neurosurgeons, and more breadth of cases. In addition to a robust patient population suffering from surgical and non-surgical degenerative spine disease, the DVAMC treats a significant population of patients requiring brain tumor, peripheral nerve, functional, and pain modulating procedures.

The DVAMC neurosurgery service and neuroscience section research programs are some of the most active of all programs at the VA as measured by dedicated research space and grant funding. The DVAMC comprehensive brain tumor program is supported by a dedicated research lab, brain tumor biorepository, and collaborations with national oncology leaders and radiation oncologists. The DVAMC neurosurgery division has been awarded more than \$3 million in research dollars, 2011-2014. Due to its success in fostering research, the neurosurgery and neuroscience investigators will occupy 50% of a new research building opening in July 2013. DVAMC neurosurgeons play significant roles in numerous local (e.g., represents entire surgical section on committees) and national administrative roles (e.g., committees for developing national treatment guidelines).

Trauma:

The Duke Division of Neurosurgery provides trauma coverage for Duke University Medical Center, Duke Raleigh Hospital, and the Durham VA Medical Center 24 hours a day, 7 days a week. The volume of cranial trauma is limited by the size of our indigenous patient population in a non-metropolitan area and competition from surrounding hospitals. Based in Durham, North Carolina, Duke admits fewer head injured patients than most university hospitals that are based in large cities. We continue to participate in research aimed at improving outcomes following closed head trauma and treating post-traumatic stress disorder (PTSD). Because Duke has an active LifeFlight helicopter transport program we are able to medevac head trauma patients to Duke.

The neurosurgeons at Duke play an active role in neurotrauma and are very engaged in Duke to keep its prestigious Level 1 trauma status. In each of the past 3 years, approximately 600 patients suffering a head injury were admitted to Duke University Medical Center. The neuro-intensivists work closely with the neurosurgeons as a team to provide highest quality of care to

this population. Dr. Carlos Bagley attends the monthly trauma mortality conference to continually strive to improve the quality of care and trauma system at Duke.

Duke was awarded a multi-million dollar grant from the Department of Defense to participate in the Post-Traumatic Stress Disorder (PTSD) – Traumatic Brain Injury (TBI) INTRuST Consortium which is made up of 10 sites around the U.S. (academic, VA, and active duty). This consortium has initiated several clinical trials. Five of these trials are being conducted at Duke and recruit subjects with a history of TBI and PTSD from Duke Medical Center, the Durham VA Medical Center, and Fort Bragg. Based on our performance during this 5 year grant period, Duke was invited to submit an application to become the National Center for Chronic Effects of Neurotrauma Consortium (CENC).

The Division of Neurosurgery is also participating in 2 large trials of severe TBI. One is a phase II Boost II study (Brain Tissue Oxygen Monitoring in TBI) funded by the NIH. The second is a phase III pivotal study of Progesterone in Severe TBI sponsored by BHR Pharma LLC. This is the largest head injury study to date and could lead to the first ever treatment for severe TBI (PI: Laskowitz; co-PI: Grant). Participation in these trials elevates Duke's status as a trauma center and enhances education for the fellows and residents in neurotrauma.

5. Research

The Division of Neurosurgery research is led by a very productive group of clinically active neurosurgeons, neuro-oncologists, surgeon-scientists, and a small number of dedicated PhDs researchers. This has resulted in the Division of Neurosurgery having the most grant funding of any Division in the Department of Surgery. There is currently \$21,153,775 in grants within the Division of Neurosurgery including Neuro-Oncology. Neurosurgery makes up \$12.5 million and the remaining \$8.5 million is in Neuro-Oncology. See Appendix A.

In addition, at present the Preston Robert Tisch Brain Tumor Center has \$13.5 million dollars of clinical research funding. This does not include grants held in the name of individual investigators. There is also additional grant funding in the Brain Tumor Center of \$22 million, which includes Drs. Bigner, Yan, and Ali-Osman, all of whom are key collaborators. Neurosurgery also has a SPORE grant currently undergoing peer review.

Becoming a department will allow the neurosurgeons to direct more funding to our research mission. As shown in our organizational chart, these funds are to be directed toward assistance for our busy clinician scientists. Under the direction of Dr. John Sampson, our director for research, we will put into place an infrastructure to facilitate the writing and administering of grants.

Total NIH Research Funding

Neurosurgery*

Rank	Name	Neurosurgery*
1	UNIVERSITY OF CALIFORNIA SAN FRANCISCO	\$18,792,820
2	DUKE UNIVERSITY**	\$6,777,204
3	YALE UNIVERSITY	\$5,435,394
4	STANFORD	\$4,434,412
5	UNIVERSITY OF MIAMI SCHOOL OF MEDICINE	\$3,930,246
6	UNIVERSITY OF CALIFORNIA LOS ANGELES	\$3,700,623
7	UNIVERSITY OF MICHIGAN	\$3,404,611
8	UNIVERSITY OF PITTSBURGH AT PITTSBURGH	\$3,156,347
9	UNIVERSITY OF WASHINGTON	\$2,880,689
10	UNIVERSITY OF LOUISVILLE RES FDN	\$2,145,879

* Neurosurgery and Neuro-Oncology

** Pending U01 funding (Sampson, PI); Score = 13

Neurosurgery with Brain Tumor Center*

Rank	Name	Neurosurgery*
1	UNIVERSITY OF CALIFORNIA SAN FRANCISCO	\$18,792,820
2	DUKE UNIVERSITY**	\$15,289,137
3	YALE UNIVERSITY	\$5,435,394
4	STANFORD	\$4,434,412
5	UNIVERSITY OF MIAMI SCHOOL OF MEDICINE	\$3,930,246
6	UNIVERSITY OF CALIFORNIA LOS ANGELES	\$3,700,623
7	UNIVERSITY OF MICHIGAN	\$3,404,611
8	UNIVERSITY OF PITTSBURGH AT PITTSBURGH	\$3,156,347
9	UNIVERSITY OF WASHINGTON	\$2,880,689
10	UNIVERSITY OF LOUISVILLE RES FDN	\$2,145,879

* Neurosurgery, Neuro-Oncology, and BTC (Bigner, Ali-Osman and Yan)

** Pending U01 funding (Sampson, PI); Score = 13

Duke neurosurgeons have been cited as authors nearly 7,400 times just since 2012 in the peer reviewed literature. See Appendix B.

Author	Cited 2012	Cited 2013	Cited 2014*	Total
Dr. Adamson	93	90	12	195
Dr. Bagley	8	29	5	42
Dr. Britz	23	47	10	80
Dr. Friedman	1,179	987	161	2,327
Dr. Fuchs	85	77	17	179
Dr. Gottfried	3	13	4	20
Dr. Grant	32	79	28	139
Dr. Gromeier	89	97	9	195
Dr. Grossi	28	37	4	69
Dr. Haglund	84	86	17	187
Dr. Isaacs	99	121	13	233
Dr. Lad	1	7	6	14
Dr. Madison	91	126	18	235
Dr. Mitchell	335	295	56	686
Dr. Muh	0	0	0	0
Dr. Sampson	1,172	904	181	2,257
Dr. Turner	210	262	40	512
Dr. Zomorodi	8	13	4	25
TOTAL	3,540	3,270	585	7,395**

* 2014 citations are as of April 15, 2014.

** Please note, the total number has not accounted for any overlap in article authorship.

6. Education

The Division of Neurosurgery has had a neurosurgical residency training program for the past 60 years. The residency program has never been suspended or placed on probation. Since the ACGME established its 5 year review cycle, the neurosurgical residency program has received a 5 year renewal at each review.

We maintain a clinical conference schedule that meets all of the benchmarks set by the ACGME for resident training in the non-cognitive competencies, reviews interesting cases, and teaches basic sciences relevant to the practice of neurosurgery, and reviews deaths and complications. Of note are the ad hoc sub-specialty seminars in spine, skull base, functional, and cerebrovascular neurosurgery in the form of evening lectures and journal clubs. In these seminars, our faculty and residents monitor advances in their field and plot strategies for future research.

The neurosurgical residency program is now completed in 7 years including 1-2 years of research. It should be noted that salary support for the years of research is not provided by the Duke Health system and is guaranteed by revenues generated by the Division's clinical activities. This allows our residents to pursue research for 1 to 2 years with minimal clinical obligations.

Dr. Sampson has secured an NIH R25 Research Educational Grant to enable Neurosurgery Residents to broaden their skills and enhance their career development opportunities in order to contribute significantly to basic, clinical or translational neuroscience research. Funding support should lead to increased recruitment, mentoring, and training in the scientific and technology workforce. Areas of study include basic science, clinical trial design, global health, and health sector management.

Our neurosurgical residency training program has tremendous depth and breadth compared to our peer institutions. The program includes extensive experience in all sub-specialties within

neurosurgery at Duke, as well as its community affiliates at Duke Regional Hospital and the Durham VA Medical Center. This clinical training accompanied with robust research experiences has resulted in more than half of our graduates obtaining positions in academia.

Our residents actively participate in Dr. Haglund's neurosurgical educational program in Uganda and Rwanda. Each resident spends one month performing surgeries and educating the physicians at hospitals as part of the Duke residency program.

We have a well-developed a medical student curriculum for 2nd and 4th year students who are doing a neurosurgery sub-internship at Duke. This has been well received since it combines didactic lectures with operating room and clinic experience in addition to Brain School (Journal club with Dr. Friedman). The students also participate in the medical student neurosurgery curriculum which is both practical and comprehensive and was developed for students by the Congress of Neurological Surgeons. A list of medical students mentored by Duke faculty is included in [Appendix C](#).

The Division of Neurosurgery plays numerous educational and committee roles in the School of Medicine. Dr. Adamson serves as a co-director of the primary neuroscience course (Brain and Behavior) for our first year medical students, Director of the Molecular Medicine Study Program (Oncological Sciences Track) for third year medical students, Director of a recently proposed course for fourth year medical students (Neurological Diseases in Veterans), and Faculty Advisor for the Student Interest Group in Neurology/Neurosurgery. Half of the neurosurgery faculty lecture in these courses. Drs. Adamson and Sampson have directly mentored/hosted many third year medical students in their laboratories during their year of research.

7. Impact of the Separation on Department of Surgery

Finance:

- **Balanced rolling budget for past 3 years:** The Division of Neurosurgery has had a positive net balance for at least past 16 years despite fees paid to the Department of Surgery and the withholding of indirects generated by our research.
- **Commitment to Financial Transparency:** The Division's finances are completely transparent to the PDC/Department of Surgery/School of Medicine. All income in the form of earnings, grants, and gifts have been processed through one of those 3 bodies. All expenses have been paid through the Department of Surgery.
- **Faculty Salary Structure:** Eight years ago, we developed a salary structure for our faculty that has been widely adopted around the Medical Center. The formula recognizes that the Division has several missions other than fee for service patient care. It recognizes that surgeons should expect payment in proportion to the work he or she does. It also recognizes that funds should be available to explore new opportunities. Thus each faculty is guaranteed a salary at the AAMC 25th percentile for neurosurgeons. Of additional funds received by the division generated by the practitioner, 50% will be returned to the practitioner. The practitioner is eligible to receive an additional 25% based on their publishing, participation in resident and medical school education, research activities, citizenship, program development administration, and activities that improve the division's national and international reputation. The final 25% of excess income is directed to the Division of Neurosurgery and is used to make up for shortfalls in the salaries of faculty members heavily involved in research or with a lower number of RVUs earned per workload and also to fund new ventures which support our above

mission. Salaries in pediatric neurosurgery are supplemented by a purchase of service agreement with the Health System. It is also used to create a reserve for unexpected decreases in neurosurgical revenues.

The Division of Neurosurgery has a long history of supporting the School of Medicine and the Health System mission. Collaboration with these 2 entities has been an important factor in our growth and maturation.

The Division of Neurosurgery is very interested in providing leadership in Duke Hospital service lines. We have benefited in the past from our partnership with the Health System in expanding our practice. The goal of the nascent Spine Center is to decrease costs while improving patient access and shortening length of stay. The skull base group has streamlined access and developed management templates which have result in an increase in patient volume and shorter length of stay. This chart shows the early results from the skull base group on shortening hospital stays while attracting more patients.

	Year			
	2011		2012	
LesionType	N	ALOS	N	ALOS
VestibularSchwannoma	51	5.8	67	4.5
Trigeminal Neuroma	2	6.5	3	6.7
Petroclival Meningioma	4	18	9	7
Trigeminal Neuralgia	28	3.2	41	2.9
Foramen Magnum Meningioma	4	4	9	4.2
Pituitary Adenoma + Craniopharyngioma	57	4.8	62	3.6
Paraganglioma	4	8.8	6	4.2

Finally, through the Preston Robert Tisch Brain Tumor Center, we have been able to secure gifts from our patients to support research carried out in the School of Medicine basic research departments. Our spine surgeons have a similar relationship with the School of Engineering.

I sincerely hope this request meets with your approval.

Sincerely,



John H. Sampson, M.D., Ph.D.
Robert H. and Gloria Wilkins Professor
Chief of Neurosurgery