In neurosurgery’s nascence at the turn of the 20th century, our profession’s pioneers were intrepid surgeons intent on improving outcomes for their patients. They defined what they needed—a reliable headlamp, an electrocautery knife, an effective training program—and worked with colleagues and industry to invent the solutions they sought. A century later, Duke Neurosurgery is continuing this laudable tradition of opportunity and innovation.

Our Neurosurgery Residency Program has always been very strong clinically. In order to stay that course, we are reinventing our training program to best address the needs of today, meet the challenges of tomorrow, and become the best program in the country. We have already made a significant investment in resident training, not only by offering supporting funds for books and conferences, but also in infrastructure. For example, we have a statistician and we will soon have an editor to assist with residents’ manuscripts. A research nurse is available to help with the logistics and the conduct of clinical trials. We also hired new faculty members in 2014 in pediatrics, tumor and spine, all of whom have an extraordinary dedication to education.

The training paradigm being implemented in 2015 is built on the principles of evidence-based medicine. Guided by those principles, we are incorporating a new methodology for clinical training and a new framework for scholarly experiences.

In Residency Program Director Michael Haglund’s new method for developing surgical autonomy, residents will advance through specific steps for every type of operation and utilize apps for training and testing in addition to hands on experience, culminating in their ability to do an entire procedure with minimal supervision.

In addition, each resident will be assigned a mentor to guide them along their career path. Mentors and residents will meet every three months and mentors will assign milestones for residents to develop during the Academic Day.

The Academic Day each Wednesday will feature clinically focused case conferences with additional opportunities for enrichment. For example, our Visiting Professor series often includes a cadaver lab experience in which residents participate. Charles Teo, Ziya Gokaslan, Lawrence Lenke, and Robert Spinner have visited in the last few months alone and Wael Asaad and Jim Rutka are scheduled. In addition, residents will be exposed to our faculty’s research activities, which really are unsurpassed in the nation.

We also are implementing a novel Biodesign Curriculum. Through this process, participants discern what is needed in neurosurgery and develop new devices or approaches to meet those needs. Residents will have the opportunity to participate in the biodesign process during the Academic Day, and I envision that they not only will develop new devices but also will obtain patents and start companies. Several faculty members have done all of these things and will serve as mentors. The Biodesign Curriculum is part of the Neurolnnovations program, which is going to revolutionize our field.

While presently a division of the Department of Surgery, in 2015 Duke Neurosurgery will become its own department in the School of Medicine. As a department we can better craft our destiny as a leader in developing how medicine and neurosurgery are conducted in the future. Both the Neurolnnovations and the Global Neurosurgery and Neuroscience programs will be divisions in the Department of Neurosurgery.

In 100 years, we have progressed light years in practice and come full circle in concept. By design, Duke-trained neurosurgeons are well-positioned to be the innovators and visionaries of our time.

John H. Sampson, MD, PhD, MHSc, MBA
Innovation and Opportunity
Expanding Horizons for the Duke Neurosurgery Residency Program

The Duke Neurosurgery Residency Program has long been recognized as one of clinical excellence in which trainees are exposed to a wide array of disorders and become proficient in a broad cross-section of neurosurgical procedures.

While the core aim of all neurosurgery training programs is excellent care of patients, technical and clinical skill alone are not sufficient training for a resident poised to enter the profession today. New technologies, an expanding range of therapies, an evolving practice environment, and a growing demand for work-home balance constitute a potent mix of challenges and opportunities, some already experienced and others foreseen.

These roiling conditions—plus a penchant for excellence—inspired Duke Neurosurgery faculty and residents in 2014 to review and assess the entire Residency Program.

“We knew we were already in an enviable position with our neurosurgery residency program,” said Dr. John H. Sampson, who became chief of Duke Neurosurgery in 2014. “That knowledge gave us a solid platform from which to imagine how we might optimize our program so that it also becomes known for exceptional innovation and unparalleled opportunity.”

Dr. Allan Friedman, who preceded Dr. Sampson as Duke Neurosurgery chief and served for 12 years as Residency Program director, agreed.

“Neurosurgeons of excellence must offer more than technical skills,” Dr. Friedman stated. “At Duke, we’re training neurosurgeons not just to be clinicians, but to be long-term leaders in neurosurgery who are well prepared to move the profession forward over the next 40 years.”

Duke Neurosurgery Residency Program
The Duke Neurosurgery Residency Program is now a seven-year program with at least one year devoted to research or other special training. This research year in turn prepares residents for a fellowship of their choice in their seventh, final year. The fellowship is enfolded in the final year so that the most complicated cases can be performed or additional time can be dedicated to research or other specialized education in a variety of fields.
The keystone of the program is the new Academic Day: Every Wednesday, in addition to attending surgeon teaching rounds, a block of time is devoted to scholarly activity that is tailored to each resident. The Academic Day framework also features the NeuroInnovations program, an incubator for bringing needed devices and pharmacotherapies to market, as well as a guest speaker series and opportunities to learn about and participate in global health initiatives.

Residents gain operative experience in multiple settings: academic at Duke University Hospital, government at the VA Medical Center, and community and outpatient at Duke Regional Hospital. Some faculty members also operate at Duke Raleigh Hospital, where residents can elect to complete a fellowship during their seventh year.

A truly innovative approach to resident education is represented by the Surgical Autonomy Project. In this training paradigm, the traditional master-apprentice model is replaced by one of collaborative mentorship. Modern learning theories, namely Vygotsky’s Social Development Theory and the Zwisch model for teaching and assessment in the OR, are applied specifically to neurosurgical education.

“This is an exciting time for Duke Neurosurgery,” said Dr. Michael Haglund, who succeeded Dr. Allan Friedman as Residency Program director in 2008. “We have the infrastructure and momentum to positively impact our profession and our patients here at Duke, nationally, globally, and well into the future through our innovative training program.”
Dr. Haglund’s interest in creating appropriate quality neurosurgical education methods found fertile ground recently while he studied for his master’s degree in academic medicine at the University of Southern California. “The Surgical Autonomy Project grew in part out of this concentrated study, and in part to answer our residents’ desire for increased autonomy in the OR, a preference expressed during our evaluation of the program,” he said.

**Surgical Autonomy Project**

The purpose of the Surgical Autonomy Project at Duke is to increase educational quality through thoughtful application of evidence-based teaching methods. The model applies the Social Development Theory of learning, described by psychologist Lev Vygotsky, to the Zwisch model for training and assessment in the OR, developed by thoracic surgeon Joseph Zwischenberger.

In the Vygotsky model, optimal learning takes place in an environment of reciprocity between a learner and a “more knowledgeable other,” where the teacher facilitates learning, guided by the actively engaged student. This scenario is the antithesis of the traditional “I say, you do” master-apprentice model. Learning optimally takes place in the zone of proximal development, or ZPD, where residents are most motivated to learn. The ZPD is essentially the process of a learner moving from performance of a task with the supervision of a teacher to problem solving and performance of the task alone.

The Zwisch model describes four stages of operative development: (1) Show and Tell; (2) Smart Help; (3) Dumb Help; and (4) No Help. The resident progresses through these stages, from acting as first assistant and observing while the attending physician narrates the case, to performing the case safely without the attending and with an inexperienced first assistant. The model describes specific behaviors at each stage for the attending and the resident.

These learning models are being applied to 15 junior and 15 senior/chief level neurosurgical cases in clinical areas of tumor, vascular/skull base, spine, pediatrics and functional.

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**NeuroInnovations**

The revolutionary NeuroInnovations program is designed to teach, study and drive surgical innovation; facilitate translation of new and emerging technologies through interdisciplinary research, development and commercialization; and train the next generation of residents to be innovators. All residents and faculty members participate in the biodesign process during the Academic Day. The NeuroInnovations program serves as an educational opportunity for clinician-innovators to learn the ropes of preclinical development and commercialization. After partnering with engineers and entrepreneurs, physician-innovators will find an energetic team ready to learn the intricacies of new technologies and how they impact existing clinical practices.

Each module is designed to lead residents through the stages of learning, preparing them for each new step.

For example, the first module, for release in February 2015, covers anterior cervical discectomy and fusion, the ACDF procedure. Residents first lay the foundation for evidence-based learning by reviewing and discussing journal articles related to the procedure, including discussion of complications. They then review a PowerPoint presentation showing anatomy and ACDF approach. In the third step they engage in simulations of the procedure developed by Touch Surgery, a company with roots in Pixar-like animation. The residents then view a condensed, 15-minute video of the ACDF procedure with a knowledgeable other. In this fourth step, residents identify what they want to learn; this movement from what they have learned to what they are ready to learn next is proximal development. In the fifth and final step, their proficiency with ACDF is evaluated using the Zwisch scale.

“To paraphrase William Osler, a founder of neurosurgery who famously said, Listen to your patient. He is telling you the diagnosis, we say: Listen to the residents; they will tell us what they want to learn,” observed Dr. Haglund. “We expect that this self-directed but guided and supervised learning will prepare residents more fully for the complicated procedures that we perform, but they will learn in less time than in the traditional apprenticeship model.”

**Academic Day**

While the Surgical Autonomy Project is a model for clinical instruction, the Academic Day acts as a scaffold for the residency and research educational program, incorporating the many parts into a cohesive whole. The Academic Day was conceived to ensure that each resident becomes a well-rounded neurosurgeon who is also an expert in an area of neurosurgery of their interest.

The day’s schedule spans 6 a.m. to 7:30 p.m., with more than six hours free for developing individual interests. Working with their mentors, residents can work in a research laboratory, develop surgical skill in the cadaver lab, develop new surgical technologies through industry collaboration, or devise another type of project that will give them an edge in the marketplace.
The structured time in the morning and evening is geared toward exposing residents to things they might not otherwise encounter, for example, lectures by guest speakers. These could be researchers, clinicians with a particular expertise, or inventors. Activities like Journal Club, conferences in neuroradiology, neuropathology and case complications help residents train their minds, while faculty and working group meetings help prepare them for professional life.

“We reimagined the Residency Program from the foundation up, first evaluating its relative strengths and weaknesses, threats and opportunities,” said Dr. Peter Fecci, associate director of the Residency Program. “Our goal is to train neurosurgeons who have an enviable breadth and depth of experience and who are exceptionally prepared to excel in and lead any type of practice they may choose.”

**Additional Highlights**

Clinical Services Redesigned: Each service is assigned a senior and a junior resident.

Clinical Service Rotations Lengthened: Residents partner with attending neurosurgeons on a single service for a four-month period. The dedicated block of time working together encourages a positive and effective learning environment, maximizes technical achievement in the OR, and provides better continuity of care for patients.

Night Float System Replaced by Call Schedule: Increases availability of operative time and eliminates blocks of time when not operating.

Time Scheduled for Community and Government Hospitals: Facilities include Duke Regional Hospital and the VA Medical Center.

“*The No. 1 thing that Duke offers is the opportunity to be part of a team, a family, at one of the best universities in the world, where we can be involved in ground-breaking research and science. We also have the chance to live in a place that has great weather and inexpensive housing with accessibility to the mountains, the Atlantic ocean, and some of the most exciting cities in the country.*”

Kyle Halvorson, MD, PGY5

Duke Global Neurosurgery and Neuroscience

Led by Dr. Michael Haglund, Distinguished Professor of Neurosurgery, Neurobiology and Global Health, this program focuses on treating patients and building neurosurgical capacity in Africa. Since 2007 the efforts have focused on Uganda, where through the four T’s—technology, twinning, training and a top-down approach—the project has been a driving force for bringing neurosurgery to the area, and there are plans to expand the program’s focus to Ghana. The program functions under the auspices of the Duke Global Health Institute and will be housed as a formal division within the new Department of Neurosurgery. Exposure to global health issues is part of the Academic Day experience for residents.
**Lifestyle: Durham** Located in the N.C. Research Triangle, a major U.S. center for high-tech and biotech research, Durham ranked fourth on Livability’s 2014 “Best Places to Live” list. Known as a foodie’s paradise, in 2014 *Southern Living* recognized Durham as one of the 10 “South’s Tastiest Towns” with four James Beard Foundation Award semifinalist nods, including one for Best Chef Southeast. The same year, Durham was included in *Deep South Magazine*’s picks for “8 of the South’s Best Foodie Cities.” Durham was No. 18 on Nerdwallet’s 2014 list of “Best Cities for Young Entrepreneurs,” and it earned a No. 13 spot on Trivago’s list of “U.S. Best Value Cities for 2015.” The Durham-Chapel Hill metropolitan area recently ranked 15th on the Forbes list of “America’s Smartest Cities,” while neighboring Raleigh was the No. 1 pick for the 2014 Forbes list of “Best Places for Business and Careers.”

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**Duke Neurosurgery Faculty and Residents 2013-2014**

*Front row –* T. Ryan Owens, MD; John Sampson, MD, PhD, MHSc, MBA; Jonathan Choi, MD; Amitoz Manhas, MD; Owoicho Adogwa, MD; Kimberly Hoang, MD; and Tiffany Hodges, MD

*Second row –* Allan Friedman, MD; Carrie Muh, MD; Nandan Lad, MD, PhD; Timothy Miller, Jr, MD; Adam Back, MD; and Vijay Agarwal, MD

*Third row –* Michael Haglund, MD, PhD; Dennis Turner, MD; Oren Gottfried, MD; Carlos Bagley, MD; Kyle Halvorson, MD; Mary Cobb, MD; and Jordan Komisarow, MD

*Fourth row –* Fernando Gonzalez, MD; Ali Zomorodi, MD; Herbert Fuchs, MD, PhD; Andrew Marky, MD; Steven Cook, MD; Cory Adamson, MD, PhD; and Max Krucoff, MD
HOSPITAL FACILITIES
Duke University Hospital
Duke Raleigh Hospital
Duke Regional Hospital
Durham VA Medical Center

RESEARCH LABORATORIES
Duke Brain Tumor Immunotherapy Program
John Sampson, MD, PhD, MHSc, MBA
Epilepsy Lab
Michael Haglund, MD, PhD
Functional Neurosurgery/Neurophysiology Lab
Dennis Turner, MD
Laboratory of Nerve Regeneration
Roger Madison, PhD
Targeting Protein Synthesis Control for Cancer Therapy
Matthias Gromeier, MD

RELATED CENTERS AND INSTITUTES
Brain Imaging and Analysis Center
Duke Cancer Institute
Duke Clinical Research Institute
Duke Global Health Institute
Duke Human Vaccine Institute
Duke Institute for Brain Sciences
Duke Pain Clinic
Duke Skull Base Center
Duke Spine Center
Duke Translational Institutes (Medicine and Research)
Institute for Genome Sciences and Policy
Pediatric Brain Tumor Foundation Institute at Duke
The Preston Robert Tisch Brain Tumor Center

FACULTY
Gerald Edward Archer, PhD
Carlos A. Bagley, MD
Peter R. Bronec, MD (Duke Regional)
James Harvey Carter Jr., MHS, PA-C
Peter Fecci, MD, PhD
Allan H. Friedman, MD
Henry S. Friedman, MD
Herbert E. Fuchs, MD, PhD
Takanori Fukushima, MD
Oren N. Gottfried, MD
L. Fernando Gonzalez, MD
Matthias Gromeier, MD
Peter M. Grossi, MD (Duke Raleigh)
Michael M. Haglund, MD, PhD
Robert E. Isaacs, MD
Isaac O. Karikari, MD
Carolyn E. Keeler, DO
Stephen Thomas Keir, DrPH, MPH
Nandan Lad, MD, PhD
Roger D. Madison, PhD
Rowena B. Mariano, MD
Carrie Muh, MD, MS
Robert D. Pearlstein, PhD, MS
Kenneth O. Price, MD (Duke Regional)
Elizabeth Reap, PhD
Grant Alan Robinson, PhD
John H. Sampson, MD, PhD, MHSc, MBA
Luis Ariel Sanchez-Perez, PhD
Sandra Serafini, PhD, MA
Eric M. Thompson, MD
Dennis A. Turner, MD
Thomas J. Weber, DO (Duke Raleigh)
Ali R. Zomorodi, MD
Blaine S. Nashold Jr., MD (Emeritus)
Robert H. Wilkins, MD (Emeritus)

CLINICAL PRACTICE AREAS
Duke Neurosurgery is completely engaged in all clinical subspecialties of neurosurgery, providing not only high quality clinical service, but also exploring innovative therapies for neurosurgical diseases.

Intrinsic Brain Tumors: The nationally and internationally recognized Preston Robert Tisch Brain Tumor Center employs an integrative approach for the treatment of malignant brain tumors.

Cerebrovascular: Strong cerebrovascular and stroke programs thrive in conjunction with the Departments of Neurology and Radiology.

Skull Base Surgery: The Skull Base Surgery Center was formally inaugurated in 2011 as a collaborative effort between Duke Health System and the Divisions of Neurosurgery and Otolaryngology, Head & Neck Surgery.

Spine: Duke 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. The new interdisciplinary Spine Center also offers physiatrists and pain specialists.


Trauma: Duke Neurosurgery provides Level I trauma coverage for Duke University Medical Center, Duke Raleigh Hospital, and the Durham VA Medical Center, 24 hours a day, 7 days a week.

Visit neuro.surgery.duke.edu for more information about Duke Neurosurgery.

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