Neurosurgeons Supporting Neurosurgical Education: Meet the NREF

Neurosurgery Research & Education Foundation

Members of the American Association of Neurological Surgeons (AANS) established the Neurosurgery Research and Education Foundation (NREF) in 1980 to support research and education efforts for neurosurgeons at all stages of their careers. Since its inception, the specialty of neurosurgery has been supported by mentorship. All seasoned, successful neurosurgeons can point back to the mentors who helped them achieve their career goals, and many of those neurosurgeons pay it forward by either working with medical students, financially supporting the foundation or, as is often the case, doing both.

The foundation has supported many careers, and a considerable amount of cutting-edge research over the years, but the story of the foundation’s impact can best be heard when speaking to those who have received support. G. Edward Vates, MD, PhD, FAANS, received NREF funding as a young investigator. Now, working in the department of neurosurgery at the University of Rochester Medical Center as an associate professor, he points his students to NREF resources, which have been leveraged into fascinating research.

Dr. Vates’ students have contributed ground-breaking research. All of whom have been supported by a grant from the NREF. In their stories, the role of their mentor is apparent. What follows are profiles of three of Dr. Vates’ students, as well as a conversation with him on his dual role as both mentor and mentee.

David Paul

In December of 2014, David Paul, a third-year medical student, was first author on an article published in the journal Science Translational Medicine. He studied reversible white matter injury, specifically patients with compression of the optic chiasm by pituitary gland tumors. The data gathered indicate that rapid regeneration of the myelin in the human brain is a component of the normalization of cortical activity, and ultimately the recovery of sensory and cognitive function after surgery.

Paul commented, “[By] awarding me this fellowship, NREF provided me with an opportunity to take ownership of a research project that has direct clinical implications. For the first time, I saw how surgeon scientists serve as a bridge between basic science and surgical practice. This experience has transformed my career goals to now include research as a much larger component. I am inspired to continue this journey, and I deeply appreciate NREF’s support.”

“As first author,” he continued. “I transitioned from being a timid student to being a seasoned investigator, expert in evaluating and assessing plasticity in the human visual system using neuroimaging and psychophysics. With support from the NREF and my mentors, doors opened for me to participate in a variety of scientific and patient care experiences that I could never have had otherwise. I plan to pursue a
career in academic neurosurgery and I will be applying for residency programs this fall. Having completed the NREF fellowship, as well as a master’s in neurobiology and anatomy, I am focused on becoming a surgeon scientist that bridges the gap between basic science and the care of patients with neurosurgical diseases.”

**Benjamin Plog**

Currently in his third year of graduate school in his MD/PhD program, the NREF grant afforded Benjamin Plog the opportunity to spend the summer in a basic science lab, working with Dr. Vates. They explored the response of microglia to subarachnoid hemorrhage in mice, characterizing the reactivity of the microglia based on morphology (size and shape). Through developing a software to track these changes, they hoped to better understand the time course of the response of these cells following subarachnoid hemorrhage in order to ultimately target therapies to treat this inflammatory response. The findings were promising and published in 2014.

“The AANS medical student summer research fellowship has been such a rewarding experience for so many students year after year here at Rochester. Those who successfully complete the program one summer will mentor the younger medical students in following years to be able to keep up the tradition. We want each new generation to share this rare experience, which can really solidify a student’s passion for neurosurgery. Rochester is a really cool institution and all of its students embrace both the history and continuity, provided — in part — by people like Dr. Vates.”

Plog understands the importance of and appreciates the mentorship that goes into successful research. “Perhaps more than in any other specialty, the mentor system is critical to neurosurgery. The training for this field is both long and challenging. Students need good strong mentorship and support to be able to navigate it and work through the process, a step at a time.”

Plog credits Dr. Vates for outstanding mentorship, to both himself and numerous other students at the University of Rochester. “Dr. Vates is the centerpiece of the medical student neurosurgical education here at Rochester. He has served as a mentor to all of us — for some much longer than others. Dr. Vates encourages students to explore individual interests, even if those interests lead to a specialty outside of neurosurgery. When I went to him with my idea to join the MD/PhD program, Dr. Vates was very supportive. He has helped me secure projects and publications that will support my path towards becoming an academic neurosurgeon.”

“Dr. Vates is in it for the long haul,” Plog continued. “He oversees a person’s development throughout their whole time at Rochester and then follows them throughout their career. It seems both rare and special to have someone who is so willing to engage with medical students, especially a surgeon as busy as Dr. Vates.”

Plog, Dr. Vates and many others including Plog’s PhD mentor, Dr. Maiken Nedergaard, have done pioneering work, demonstrating a previously unrecognized pathway for fluid movement and waste management in the brain, known as the “glymphatic pathway.” In a 2012 paper published in the journal *Science Translational Medicine*, the glymphatic pathway was first described, and since then Plog has been involved in many projects, some with direct neurosurgical implications, under the guidance of Dr. Vates.

Plog credits the NREF grant he received in 2010 for truly exposing him to research and unlocking that passion. “Before the NREF grant, I had done some research as an undergrad, but it was limited. Thanks to the summer research that NREF made possible, I fell in love with neuroscience and working to
understand neurosurgical pathology. I know that I wouldn’t be where I am today without the experience of my summer fellowship. I look forward to a career that includes scientific research that will help to push the specialty forward.”

Stephen Miranda

Stephen Miranda, currently in the process of completing his third year of medical school at the University of Rochester School of Medicine and Dentistry, will be applying for a neurosurgical residency in the near future. According to Miranda, his decision to apply for a neurosurgical residency ties directly to support he received from the NREF. Early in his medical school career, at the suggestion of his mentor Dr. Vates, Miranda applied for and received NREF’s Medical Student Summer Research Fellowship (MSSRF) in 2013.

With the growing interest in chronic, neurological degenerative diseases among professional athletes and military personnel, Miranda wanted to investigate the effects of multiple sub-concussive hits to the head. He designed an experiment to evaluate whether there might be dose-dependent consequences of multiple head injuries. During the study he was able to demonstrate that the more hits that mice received, the more dramatic the results. The results of the study found that both behaviorally, and histologically, mice who received more head impacts exhibited more cognitive impairment, depression and risk-taking behaviors, which correlated with greater degrees of neuro-inflammation. Miranda presented his work at the 2014 AANS Annual Scientific Meeting, as part of the American Association of Neurological Surgeons (AANS)/Congress of Neurological Surgeons (CNS) Section on Neurotrauma and Critical Care.

Although his research was conducted a year and a half ago, Miranda’s interest in traumatic brain injury (TBI) continues. He is currently working on a research project that is involved in the search for diagnostic tools — in this case, biomarkers — to aid in clearly and definitively identifying TBI cases. “The grant was truly pivotal for me. Before the NREF grant, I wasn’t sure that neurosurgery was what I wanted. I can’t tell you how much I learned about myself and what I want from my career during that summer. Between the research and the opportunity to present at and attend the AANS Annual Scientific Meeting, I find myself firmly on the path towards a neurosurgical career.”

"Dr. Vates has been a mentor to countless students over the years,” Miranda continued. “His enthusiasm for surgery, research and teaching is contagious; and it is admirable how often he will take time out of his busy schedule to meet with students, teach them in the operating room and advise them on their career choices — even if they don't know anything about neurosurgery. Moreover, he is a fantastic advocate for the surgical student interest groups at our medical school, going above and beyond to recruit faculty and residents for our events. I know that I wouldn't be where I am today without his guidance, and I look forward to maintaining a relationship with him as a mentor as I move forward into the world of neurosurgery."

G. Edward Vates, MD, PhD, FAANS

The mentor speaks of his mentors, career

After speaking with the students, it seemed natural to speak with Dr. Vates himself, and find out how he got interested in neurosurgery.

“The brain is absolutely fascinating. No disrespect to other colleagues in the house of medicine, but the body is not a democracy. Some things are more important; across the entire human body we have a way of transplanting or creating a prosthetic for everything except the nervous system. Why? I tell all my first-year students that brain surgery is playing in God’s sandbox.”
“My father, a neurologist, was the first person who helped me realize the importance of the brain,” Dr. Vates noted. “I remember seeing how much satisfaction my dad took from his work, whether he was curing someone or shepherding them on their journey.”

Dr. Vates’ next mentor was Fernando Nottebohm, PhD, who was his PhD mentor. Although Nottebohm is not a physician, he had a profound effect on Dr. Vates’ thinking. Nottebohm studied how birds learn to sing because the process is very similar to how humans learn to talk. Nottebohm’s work with birds created an understanding that “language” acquisition across very different species is also a process of mimicry. Babies, whether avian or human, learn from elders; each species has a small window during development to pick up these skills.

Nottebohm also realized that, in many birds, the left side of the brain controls singing similar to how it controls speech in most humans. Nottebohm followed this bit of fascinating research and it lead to stem cell and brain research that confirmed humans, birds and mice do continue to create brain cells throughout their lives. “From Nottebohm I realized that one can discover important and lovely things in any corner of science and that these lovely things can ultimately have a significant impact on how doctors will treat their patients. He was a great mentor,” said Dr. Vates.

 “[Those] who want to study the brain need to decide if they want to fix people or stare at a petri dish. Neurosurgery’s founder, Harvey Cushing, was most eloquent on this topic and pioneered the model of ‘surgeon scientist,’ someone who does both. What Cushing started, others have continued. Neurosurgeons really move the ball from kick-off into the end zone,” commented Dr. Vates. Cushing’s research into hormones and the brain opened up the world of neuroendocrinology, and our current (and burgeoning) understanding of traumatic brain injury in being led by neurosurgeons as is ground-breaking work with both infants and the aging population.

“Neurosurgeons are those who see, touch and alter the brain; how could they not be in the driver’s seat?” said Dr. Vates. “I was blessed to have great educators in my life. People who have that kind of experience as a student often become educators themselves. If you want people to be inspired, you have to be inspiring; surrounded by those who are inspiring, you will be inspired: this is the beautifully wonderful, self-fulfilling prophesy of education.”

“If a neurosurgeon operates on maybe 250 to 300 people a year, then over a 30-year career, that surgeon will have significantly impacted 9,000 lives,” Dr. Vates added. “In contrast, a neurosurgeon who works in a training program that educates two residents each year, over 30 years will influence 60 residents, who then will go on to each impact 9,000 lives. The magnitude of one’s efforts grows and grows. But the pursuit of science allows a single person to exponentially improve the human condition … think of how many people Fleming saved when he discovered penicillin. In my life, science has been the lever that Archimedes spoke of when he said, ‘give me a place to stand, and I shall move the world.’”

“My relationship with NREF is a no-brainer, pun intended,” Dr. Vates continued. “It is, in fact, a simple equation. I wanted to do research, NREF helped me do that; I want those who follow me to have the same opportunity to do research, made possible by NREF’s financial support. Any dollar invested in NREF today has a huge, exponential impact on where the field will be in 10 or 20 years down the road. I’m looking forward to seeing where that road takes us. In fact, when I send my students off, I tell them not to do what I do. They should learn what I do, leave this place, find a better way to do it and then come back and share it with me.”

**Neurosurgical Awareness Week**: As a precursor to AANS’ annual Neurosurgery Awareness Month —
observed each August — Neurosurgery Awareness Week offers a preview of the event during the 2015 AANS Annual Scientific Meeting. This year, in 2015, the AANS Neurosurgery Awareness Week and Month will highlight neurosurgeons themselves. This year’s awareness campaign will offer a focused look at the men and women who are involved in the neurosurgical practice, forming a broader picture of those who have committed their lives to the specialty practice.

Advance copies of some of the materials for this year’s observance will be posted under the “Media” area on the 2015 AANS Annual Scientific Meeting website.

Founded in 1931 as the Harvey Cushing Society, the American Association of Neurological Surgeons (AANS) is a scientific and educational association with more than 9,000 members worldwide. The AANS is dedicated to advancing the specialty of neurological surgery in order to provide the highest quality of neurosurgical care to the public. Fellows of the AANS are board-certified by the American Board of Neurological Surgery, the Royal College of Physicians and Surgeons of Canada, or the Mexican Council of Neurological Surgery, A.C. Neurosurgery is the medical specialty concerned with the prevention, diagnosis, treatment and rehabilitation of disorders that affect the spinal column, spinal cord, brain, nervous system and peripheral nerves.

For more information, visit www.AANS.org.

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