

Neurosurgery at the University of Miami

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The Department of Neurological Surgery at the University of Miami/Jackson Memorial Hospital's legacy of patient care, teaching, and research in the neurosciences extends over a period of 50 years. The department's founder was Dr. David Reynolds. The subsequent chairman, Dr. Hubert Rosomoff, formed a solid foundation that helped put the department on the map. Drs. Barth Green and Roberto Heros, the immediate past chair and co-chairman, garnered both national and international attention for the department. Dr. Green focused his career on complex spine and spinal cord disorders, and was pivotal in creating the world's largest research center for spinal cord injuries. Dr. Heros is a master educator and pioneer neurovascular surgeon, as well as a former president of several neurosurgical national and international organizations. In aggregate, the department has made major contributions to the foundations of neurosurgery.

<http://thejns.org/doi/abs/10.3171/2016.4.JNS152356>

KEY WORDS history; University of Miami; The Miami Project; spinal cord injury

THE southern areas of Florida and the city of Miami had to await the establishment of the railway—created by Henry Flagler at the urging of Julia Tuttle—in 1896 for its development. The marshy swamps soon transformed into the cities of Miami and Miami Beach, and the population of South Florida rose exponentially. It is very important to remember that the city of Miami's history and its health system are barely a century old. The first neurosurgeon to set up practice in the state of Florida was James Lyerly in Jacksonville in 1934. In 1940, Dr. Lyerly brought in Dr. Tracey Haverfield as an associate. After serving in the military from 1942 to 1945, Dr. Haverfield decided to relocate to Miami. He opened the second neurosurgical office in Florida, and he was the first neurosurgeon to practice in Miami. The Department of Neurosurgery began at the University of Miami in 1959, and it became the state's first neurological surgery training program. The Department of Neurological Surgery at the University of Miami Miller School of Medicine commemorates more than half a century in patient care, teaching, and research by paying tribute to and reflecting on the accomplishments and achievements of its faculty. This article reviews the history of the University of Miami School of Medicine and the Department of Neurological Surgery, and the legacy of several of its innovative leaders, as well as the role they played in shaping the department's history and their contributions to the field of neurosurgery.

The Beginning

The University of Miami was established in 1926, and from its inception there was interest in including a medical school. However, the timing was not optimal; shortly after its opening, the campus was ravaged by the “great” hurricane of 1926, which remains the costliest US hurricane ever when adjusted for inflation, population, and wealth normalization—yielding a cost of nearly US\$165 billion in current dollars. The Great Depression and World War II followed this catastrophe. It would take another 2 decades before the University revisited the idea of a medical school. The university's announcement of its plan to build a medical school was greeted with a series of political conflicts. At issue was the location of the medical school and state support for a private institution such as the University of Miami.⁵ As a result of the disagreements, in May of 1947 the University of Miami voted to “postpone indefinitely” its plans to create a medical school. While continuing the political negotiations for state support for a medical school, the University of Miami leadership formed a partnership with the Miami Veterans Administration (VA) Hospital to develop the University of Miami/VA Hospital Medical Research Unit. This provided basic science infrastructure that could later be incorporated into a medical school. After state support was finally assured, on March 10, 1952, the University Board of Trustees established the University of Miami School of Medicine as the first medical school

ABBREVIATIONS AANS = American Association of Neurological Surgeons; ahSCs = autologous human Schwann cells; CNS = Congress of Neurological Surgeons; LIFE = Leaders in Furthering Education; SCI = spinal cord injury; VA = Veterans Administration; WFNS = World Federation of Neurosurgical Societies.

SUBMITTED October 14, 2015. **ACCEPTED** April 11, 2016.

INCLUDE WHEN CITING Published online June 24, 2016; DOI: 10.3171/2016.4.JNS152356.

in the state of Florida. Initial teaching was carried out in what had been servants' quarters of the Biltmore Hotel, which at that time was housing the VA Hospital. On December 18, 1952, Jackson Memorial Hospital was designated the teaching hospital for the medical school.

"By 1975, the University of Miami School of Medicine/Jackson Memorial Medical Center had grown to become the largest of its kind in the southeast and the fifth largest in the nation. The school was the tenth largest medical school with the twelfth largest faculty."²⁰ Today, the medical campus, located at the intersection of several inner-city metropolitan Miami communities, occupies almost 68 acres in the 153-acre University of Miami/Jackson Memorial Medical Center complex. It includes 3 University of Miami-owned hospitals: University of Miami Hospital, Sylvester Comprehensive Cancer Center, and Anne Bates Leach Eye Hospital. Jackson Memorial Hospital is now one of the largest and busiest hospitals in the US, with 1892 beds,²¹ and it is the only Level 1 adult and pediatric trauma center in Miami-Dade County. The leadership at the medical center was also instrumental in the creation of the Ryder Trauma Center, the largest and busiest trauma center in the nation. The University of Miami Medical Center, including Jackson Memorial Hospital and the University of Miami Hospital, collectively form the third largest medical center in the nation.² On December 1, 2004, with a historic gift of \$100 million from the family of the late Leonard Miller, the medical school was renamed the Leonard M. Miller School of Medicine.

In 1954, the Department of Surgery was established as one of the first 4 clinical departments at the medical school, and in 1959 neurosurgery became a division of the Department of Surgery. In 1959, shortly after obtaining divisional status, the Neurosurgical Training Program was established by Dr. David Reynolds, the first chairman of the Division of Neurosurgery. The division received accreditation in 1965, and by 1971, under the leadership of W. Dean Warren, the division was granted departmental status. Currently, the Department of Neurological Surgery performs more than 4500 major neurosurgical procedures annually, and is hoping to expand the surgical practice by using telemedicine to collaborate with global partners.

Formative Years of Neurosurgery

David H. Reynolds (1962–1971)

David Reynolds served as the interim chair for the Department of Surgery from 1961 to 1963 (Fig. 1). In 1962 he was named the first professor of neurological surgery, and in 1969 he was appointed as the first chairman of the Division of Neurosurgery. He had established the Neurosurgical Training Program in 1959, and continued to supervise patient care and the Neurosurgical Education Program until his retirement in 1971. He unfortunately died of a malignant brain tumor.

Hubert L. Rosomoff (1971–1994)

After the retirement of Dr. Reynolds in 1971, Dr. Hubert Rosomoff was recruited from the chairmanship at Albert Einstein College of Medicine to become a professor and the second chairman of the newly autonomous Depart-



FIG. 1. David H. Reynolds, the first chairman of the Division of Neurosurgery at the University of Miami School of Medicine. Copyright Department of Neurological Surgery, Miami Miller School of Medicine. Published with permission.

ment of Neurological Surgery at the University of Miami School of Medicine (Fig. 2). The creation of departmental status under his financial control was one of the main attractions in taking on this new challenge in Miami. Dr. Rosomoff served as departmental chairman and director of the residency program until 1994.

Dr. Rosomoff started his medical career in 1952, as a graduate of Hahnemann Medical College in Philadelphia, and is a 1959 graduate of the Columbia Presbyterian Medical Center and the Neurological Institute of New York neurosurgery training program. He later received a D.Med.Sc. degree in physiology from the Columbia University College of Physicians and Surgeons. In 1959, he joined the faculty of the University of Pittsburgh School of Medicine as clinical assistant professor, and chief of neurological surgery at the VA Hospital. He remained at the University of Pittsburgh until 1966, where he was promoted to professor.

Dr. Rosomoff's contributions to the field of neurosurgery are numerous, and he became an innovator in pain medicine. His early research focused on the field of head injury, and later added an emphasis on intracranial vascular surgery. While in Pittsburgh, he introduced the technique of hypothermia for the treatment of vascular lesions and brain injuries. Later on in his career Dr. Rosomoff



FIG. 2. Hubert L. Rosomoff, the second chairman of the Department of Neurological Surgery at the University of Miami School of Medicine. Copyright Department of Neurological Surgery, Miami Miller School of Medicine. Published with permission.

focused his research on pain, and introduced the technique of percutaneous radiofrequency cordotomy (Fig. 3) for intractable pain, which would later replace the slow and imprecise open surgical method. Some of the many faculty recruits who achieved national acclaim during Dr. Rosomoff's tenure included Dr. Larry Page, Dr. Barth Green, Dr. John Van Buren from the NIH, Dr. Howard Landy, Dr. Phillip Villanueva, Dr. Linda Sternau, and late in his career, Dr. Sydney Peerless. In 1974, Dr. Rosomoff founded the University of Miami's Comprehensive Pain and Rehabilitation Center, a Center of Excellence for the treatment of pain. The center's work is based on a multidisciplinary model of functional restoration and behavior modification.¹³ Dr. Rosomoff served as the center's medical director, and his wife Renee Rosomoff served as the program director.³

In 1994, Dr. Rosomoff retired as chairman to concentrate his efforts on the Pain Center, and was named professor and chairman emeritus of the Department of Neurological Surgery. In 2003, the center was renamed the Rosomoff Comprehensive Pain Center to pay tribute to him and his wife. In 1997, the Hubert Rosomoff Endowment Lectureship Fund was created to memorialize his work. The fund established the Rosomoff Research Day, an annual event held by the Department of Neurological Surgery, which includes presentations of original research by residents, fellows, clinical faculty, and visiting professors. A prize is awarded to the resident presenting the best paper of the day.



FIG. 3. Dr. Rosomoff performing a cordotomy in his early years. Copyright Department of Neurological Surgery, Miami Miller School of Medicine. Published with permission.

Larry K. Page (1971–1995)

Dr. Page joined the Department of Neurological Surgery in 1971, and served as vice chairman until 1995. A 1958 graduate of Louisiana State University School of Medicine, he completed his residency and served as faculty at the Children's Hospital Medical Center and Peter Bent Brigham Hospital in Boston before joining the faculty at the University of Miami. Dr. Page is credited with establishing the Division of Pediatric Neurosurgery a year after joining the faculty at the University of Miami. At the time, it was the only pediatric neurosurgery program in the state of Florida. Dr. Page also played an important role in establishing an additional clinical dimension to the department.

New Era in Neurosurgery

Barth A. Green (1995–present)

Dr. Green joined the faculty at the University of Miami in 1975, and was appointed chair of the department in 1994 (Fig. 4). A 1969 Alpha Omega Alpha graduate of Indiana University School of Medicine, his decision to enter neurosurgery was heavily influenced by his dear mentor Dr. Julius Goodman. He returned home to Chicago, and in 1975 graduated from Northwestern University Medical School's neurosurgery training program. His mentors included his chairs at Northwestern, Drs. Bucy and Rai-



FIG. 4. Barth A. Green, the third chairman of the Department of Neurological Surgery at the University of Miami Miller School of Medicine. Copyright Department of Neurological Surgery, Miami Miller School of Medicine. Published with permission.

mondi, and he was also deeply influenced by neurosurgical role models Edgar Siquerra and Ivan Ciric.

Dr. Green is from a family of physicians who were dedicated to serving the disadvantaged. Working as a research assistant in the spinal cord injury (SCI) research laboratory, Dr. Green was influenced by the courage displayed by paraplegics who volunteered in the lab. This experience helped shape his desire to find effective treatments and a cure for paralysis. Upon joining the faculty at the University of Miami he was tasked with creating an SCI center and enhancing the SCI program at the Miami VA Hospital.²² The idea of kinetic therapy for the treatment of SCI was fueled by the energy and synergy of Dr. Green.^{1,6,9,15} The RotoRest treatment table, as it was originally named, was essentially a bed with reinforced gowns and balls of yarn that would allow the patient to be turned and to lie in one position without being uncomfortable. Sir Ludwig Guttmann at Stoke Mandeville Hospital in England pioneered early versions of the static bed. After a visit to this renowned SCI center in the 1970s, Dr. Green encouraged his longtime colleague Jim Leininger, MD, to start a company (that began in a couch factory) to make the kinetic version of the bed. The original company founded in 1976, Kinetic Concepts, made the original bed that was used at Northwestern University, where Dr. Green was a resident at the time. The current RotoRest is manufactured by KCI Therapeutic Support Systems, San Antonio, Texas. Similarly, the Miami J collar, manufactured originally by Jerome Medical and now by Ossur, was initially tested and refined at the busy SCI unit at Jackson Memorial Hospital,

and the name Miami J (for Jackson) was initiated then and has remained to this day.

Dr. Green is a pioneer neurosurgeon who was one of the first in the field to focus on complex spine and spinal cord disorders. He is a founding member of the American Association of Neurological Surgeons (AANS)/Congress of Neurological Surgeons (CNS) Joint Section on Disorders of the Spine and Peripheral Nerves. In addition to establishing a very busy clinical practice, some of his many accomplishments in the surgical arena include the use of intraoperative ultrasound in spine surgery, the adoption of the cervical laminoplasty technique in the US for cervical spinal stenosis and myelopathy, describing the technique of spinal cord untethering and duraplasty for syringomyelia, and the use of intraoperative spinal angiography for Type I dural fistula. Finally, he gained recognition for the surgical treatment of intradural spinal tumors.^{4,10–12,14–16,19}

The Miami Project to Cure Paralysis

Ten years after arriving at the school of medicine, one of Dr. Green's many visions was soon to be realized. It took tragedy to start the momentum for the work to turn the tide against paralysis. Marc Buoniconti sustained a serious high cervical SCI while playing college football at The Citadel, the military college in South Carolina. While treating Mr. Buoniconti, Dr. Green and Marc's father, Nick Buoniconti (an NFL Hall of Fame middle linebacker for the Super Bowl champion Miami Dolphins—including the undefeated 1972 team), decided to partner to find a cure for paralysis. It was believed that the best chance for success was to create an institute whose sole focus was to bring bench-to-bedside research to patients living with SCI. In 1985, with the commitment and involvement of the Buoniconti family, the Miami Project to Cure Paralysis was established. The name came in part from the concept of the Manhattan Project, in which a group of scientists came together to create the world's first nuclear weapons during World War II. Although the goals are completely different, the process of bringing together a group of scientists for a common goal—to cure paralysis—was how the name evolved. Although the name and Miami Project logo, of a man getting up from a wheelchair in a series of steps, have been criticized as being overly ambitious, these have endured, and The Miami Project is now the world's largest and most comprehensive research center dedicated to research in the field of paralysis and SCI. The University of Miami Miller School of Medicine has designated the Miami Project to Cure Paralysis a Center of Excellence.

The Miami Project has been fortunate to attract some of the world's top neuroscientists. The original scientific director was Dr. Åke Sager (1985–1987), who came from the Karolinska Institute (Fig. 5A). Drs. Mary and Richard Bunge were recruited from Washington University in St. Louis, and Dr. Richard Bunge served as the second scientific director until his untimely death in 1996 (Fig. 5B). Their research on rat, primate, and autologous human Schwann cells (ahSCs), SCI, and the pathology of human SCI were among the many exciting areas of research that laid the foundation for later clinical trials with ahSCs. The current director, Dr. W. Dalton Dietrich (1997–present), was recruited to Miami from one of the preeminent labo-



FIG. 5. A: Åke Sager, the original scientific director of The Miami Project to Cure Paralysis. **B:** Richard Bunge, the second scientific director of The Miami Project to Cure Paralysis. **C:** W. Dalton Dietrich, the current scientific director of The Miami Project to Cure Paralysis. **D:** Lois Pope LIFE Center, home of The Miami Project to Cure Paralysis. Copyright Department of Neurological Surgery, Miami Miller School of Medicine. Published with permission. Figure is available in color online only.

ratories in neurotrauma at the University of Virginia (Fig. 5C). One of Dr. Dietrich's many contributions includes the establishment of modest hypothermia as a neuroprotective strategy for experimental SCI. Today, participants in the Miami Project to Cure Paralysis hope to revolutionize SCI research by evaluating the safety of transplanting ahSCs in patients with acute and chronic spinal cord and peripheral nerve injuries. Other clinical trials include the use of intravascular modest hypothermia after cervical SCI, neural stem cells for chronic SCI and ahSCs for peripheral nerve injuries with lengthy gaps.

In early 2016, The Christine E. Lynn Rehabilitation Center for The Miami Project to Cure Paralysis at the University of Miami/Jackson Memorial Medical Center broke ground, with the hospital expected to open in 2018. It will provide a state of the art rehabilitation facility for patients from South Florida and around the world who have SCIs

and who need other forms of rehabilitation services. The Lois Pope Leaders in Furthering Education (LIFE) Center is the home of the Miami Project to Cure Paralysis (Fig. 5D). It was named to honor the generosity of Lois Pope, who donated a \$10 million gift to the university to establish the Center. The Center is the most advanced research facility for SCIs and neurological diseases and disorders.

Humanitarian Efforts

In 1994, Dr. Green helped to found Project Medishare, the main goal of which is to provide sustainable health care in Haiti. The mission took on an even stronger role on January 12, 2010, when a massive 7.0-magnitude earthquake struck Haiti, leaving a quarter of a million people dead, 1.5 million people homeless, and the nation's already shaky infrastructure devastated. Project Medishare transitioned the field hospital in June of 2010 into an ex-

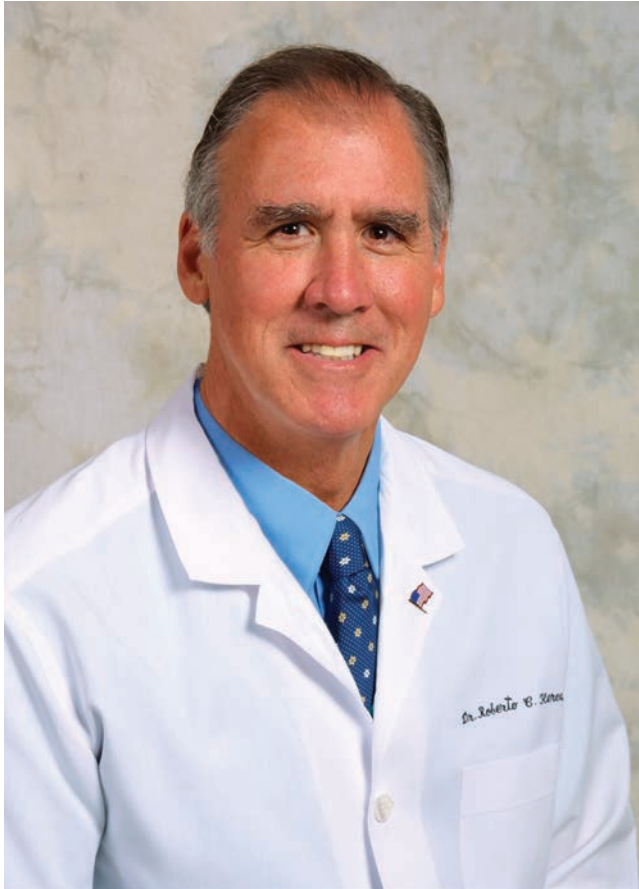


FIG. 6. Roberto C. Heros, former co-chairman of the Department of Neurological Surgery at the University of Miami Miller School of Medicine. Copyright Department of Neurological Surgery, Miami Miller School of Medicine. Published with permission. Figure is available in color online only.

isting small community nonprofit hospital and upgraded the equipment and operating rooms to create the first critical care, trauma, and rehabilitation hospital in Haiti. Dr. Green also cofounded the University of Miami Global Institute for Community Health and Development, a university-wide program that focuses on improving health care in the Western hemisphere and beyond. Drs. Green and Ragheb are focused on creating a neurosurgical training program for Haiti as well. Dr. Green has been awarded several humanitarian awards; one of the most important was the 2011 Humanitarian Award from the AANS. Another very important humanitarian effort cofounded by Dr. Green and Harry Horgan was the creation of Shake-A-Leg Miami in 1990. Shake-A-Leg was originally a summer recreation program in Newport, Rhode Island, and it is now an important part of the South Florida community.²² Shake-A-Leg provides education along with recreation for adults and children with physical, mental, and financial challenges.

Roberto C. Heros (1995–present)

Roberto C. Heros joined the University of Miami in 1995 as professor and co-chairman of the Department of

Neurological Surgery, as well as the residency program director (Fig. 6). Dr. Heros was born in Havana, Cuba, and participated as a paratrooper in the Bay of Pigs invasion. After spending 2 years in a Cuban prison he was released as part of an exchange with the US government. A 1968 graduate of the University of Tennessee Medical School, he graduated first in his class.

Dr. Heros completed his internship and neurosurgical residency at Massachusetts General Hospital, and after completion of his residency in 1977, he moved to the University of Pittsburgh as an assistant professor. In 1980 he returned to Harvard/Massachusetts General Hospital, where he became director of cerebrovascular surgery and professor of neurosurgery. In 1989 he moved to the University of Minnesota as the Lyle A. French Professor and chairman of the Department of Neurosurgery. While at the University of Minnesota, he served as acting chairman of the Departments of Neurology and Urology, and as vice chair of the Medical School Practice Plan.

Interestingly, both Drs. Heros and Green competed for the same chairman position at the University of Miami in 1994. Although Dr. Green was selected by the search committee to become chairman, he realized that mastering each aspect of running the department, including education and development of a top-notch residency program, would be difficult to do on his own, and that the new departmental structure would be best served with Dr. Heros working alongside him. In luring Dr. Heros from Minnesota, the creation of a co-chair position was key. Dr. Heros saw the University of Miami as an opportunity to return to his Cuban/Latin American roots, and to focus on scholarly pursuits and neurosurgical education. Therefore, the partnership between Drs. Green and Heros was ideal; the strengths of one covered for the weaknesses of the other. Together they achieved more than what they could have achieved individually. It should be noted that a similar model had already developed at the Barrow Neurological Institute under the leadership of Drs. Spetzler and Sonntag. This model also insures both strong spinal and cranial representation in the department.

During his tenure at the University of Miami, Dr. Heros developed and founded the University of Miami's International Health Center. His expertise in cerebrovascular disease has earned him international status. Dr. Heros is a member of more than 50 international and national associations, and is chairman of the Neurovascular Committee of the World Federation of Neurosurgical Societies (WFNS). He has also served as president of the AANS, and has founded and served as past chairman of the National "Brain Attack" Coalition and the Neurovascular Committee of the WFNS. Dr. Heros has also served as vice president of the CNS and as president of the AANS, the American Academy of Neurological Surgeons, and the World Congress of the WFNS. In 2007, he was awarded the Parker J. Palmer "Courage to Teach" award of the Accreditation Council for Graduate Medical Education (ACGME), and in 2010 he won the Cor Vitae Award of the American Heart Association for his contributions to stroke care. He is also the recipient of the 2010 AANS Cushing Medal, the highest award given to a neurosurgeon by the AANS.

Dr. Heros will always be recognized for his honesty and



FIG. 7. Current Department of Neurological Surgery faculty at the University of Miami Miller School of Medicine. Copyright Department of Neurological Surgery, Miami Miller School of Medicine. Published with permission. Figure is available in color online only.

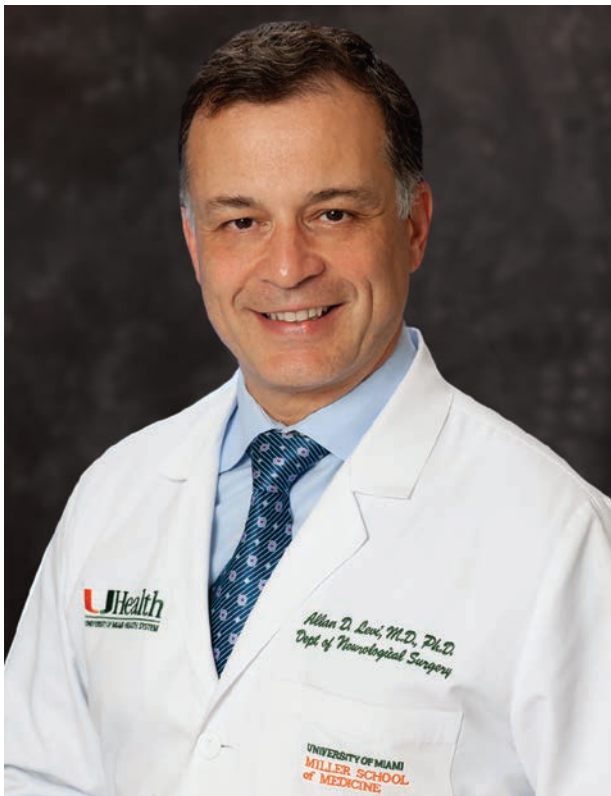


FIG. 8. Allan D. Levi, the new chairman of the Department of Neurological Surgery at the University of Miami Miller School of Medicine. Copyright Department of Neurological Surgery, Miami Miller School of Medicine. Published with permission. Figure is available in color online only.

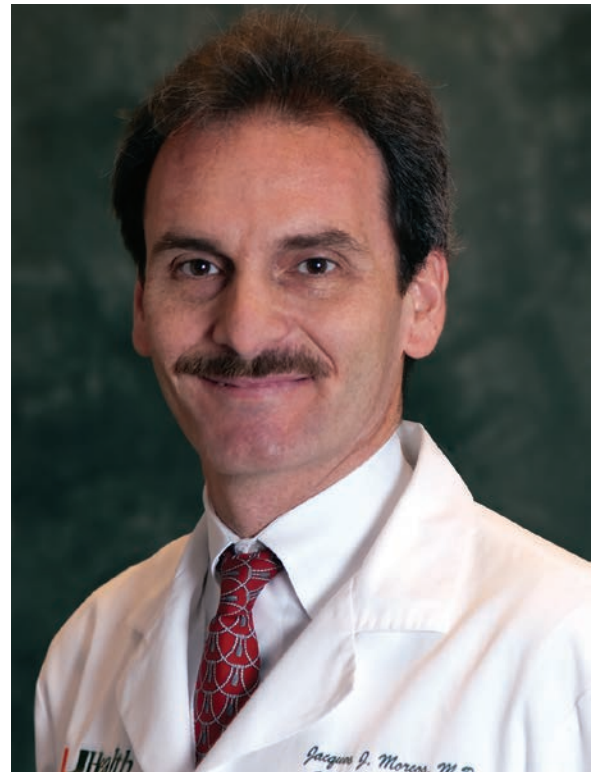


FIG. 9. Jacques J. Morcos, the new co-chairman of the Department of Neurological Surgery at the University of Miami Miller School of Medicine. Copyright Department of Neurological Surgery, Miami Miller School of Medicine. Published with permission. Figure is available in color online only.

TABLE 1. Residents trained at the University of Miami Miller School of Medicine's neurosurgery residency program

Name	Yr of Graduation	Current Location
Dale Johns	1966	Fort Walton Beach, FL; PP
Theodore Sarafoglu	1967	Retired; PP
Pedro Albanes	1967	Hialeah, FL; PP
Alfred Murrle	1967	Deceased
Jesus Hiromato	1972	Retired; PP
Raul V. Rivet	1973	Retired; PP
Gary J. Lustgarten	1973	Miami, FL; PP
Robert Jacobson	1975	Coral Gables, FL; PP
Mihai D. Dimancescu	1976	Retired; PP
Franklin T. Welch	1978	Retired; PP
Joseph P. Coladonato	1978	Retired; PP
William C. Bergman	1979	San Jose, CA; PP
Jaime Rosenthal	1980	Retired; PP
Lewis S. Snitzer	1980	Retired; PP
Aldo F. Berti	1980	Miami, FL; PP
Phillip A. Villanueva	1982	Philadelphia, PA; Ac
Judith Murovic	1983	Stanford, CA; Ac
Jorge L. Acevedo	1983	Fargo, ND; PP
Gustavo J. Arriola	1984	Kissimmee, FL; PP
Mark N. Weissman	1985	Marshfield, WI; PP
Sergio M. Gonzalez-Arias	1985	Miami, FL; PP
Arnold C. Lang	1986	Hollywood, FL; PP
Luis R. Pagan	1987	Hialeah, FL; PP
Howard J. Landy	1987	Miami, FL; Ac
Ignacio A. Magana	1988	Retired; PP
Abraham Mintz	1989	Trumbull, CT; PP
John C. Amann	1989	Winter Haven, FL; PP
Dirk G. Franzen	1990	Unknown
Michael R. Egnor	1991	Stony Brook, NY; Ac
Keith Anthony Tucci	1992	Greenville, NC; PP
Charles H. Bill	1992	East Lansing, MI; PP
George C. Ibars	1993	Miami, FL; PP
Guillermo A. Pasarin	1993	Sunrise, FL; PP
Richard S. Kyle	1994	Bentonville, AR; PP
Frederick B. Gutman	1994	Stony Brook, NY; Ac
John F. Keller	1995	Grand Rapids, MI; PP
Anthony James Hall	1995	Miami, FL; PP
Carlos A. David	1996	Burlington, MA; Ac
Paul K. Ratzker	1996	Union, NJ; PP
Brian Wieder	1997	Casper, WY; PP
Nizam Razack	1997	Orlando, FL; PP
Katshiro Kure	1998	Tokyo, Japan; PP
Kurt D. Bangerter	1998	Ogden, UT; PP
Thomas T. Lee	1999	Tarrytown, NY; PP
Ran Vijai P. Singh	2000	Norfolk, VA; PP
Omar F. Jimenez	2000	Scottsbluff, NE; PP
Jose M. Arias	2000	Owensboro, KY; PP

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TABLE 1. Residents trained at the University of Miami Miller School of Medicine's neurosurgery residency program

Name	Yr of Graduation	Current Location
Jonathan Jagid	2001	Miami, FL; Ac
Philipp R. Aldana	2001	Jacksonville, FL; Ac
Chad Prusmack	2002	Lone Tree, CO; PP
Hisham Al-Khayat	2003	Salmiya, Kuwait; PP
Imad Abumeri	2003	Bakersfield, CA; PP
Elizabeth Vitarbo	2004	Jacksonville, FL; Ac
Kapil Moza	2004	Thousand Oaks, CA; PP
Sanjiv Bhatia	2004	Miami, FL; Ac
Ramin Javahary	2005	Long Beach, CA; PP
Mustafa Baskaya	2005	Madison, WI; Ac
Andrew Jea	2006	Houston, TX; Ac
Mohammad Aziz-Sultan	2006	Boston, MA; Ac
Joseph Wehman	2007	Orlando, FL; PP
Rishi Sheth	2007	Delray Beach, FL; PP
Stacey Quintero-Wolfe	2008	Winston-Salem, NC; Ac
Ryan Trombly	2008	Oakwood, IL; PP
Glen Manzano	2009	Miami, FL; Ac
Anitha Nimmagada	2009	Rockford, IL; PP
Hamad Farhat	2010	Chicago, IL; PP/Ac
Ted Brindle	2010	Roseville, CA; PP
David Benglis	2011	Atlanta, GA; PP
Christopher Demassi	2011	Hollywood, FL; PP
Asterios Tsimpas	2012	Maywood, IL; Ac
M. Samy Elhamady	2012	Miami/Tampa, FL; Ac/PP
Garrett Zoeller	2012	Portland, OR; PP
Charles Bowie	2013	Baton Rouge, LA; PP
Brian Hood	2013	Houston, TX; Mil
Faiz Ahmad	2014	Atlanta, GA; Ac
Ramzi Ashour	2014	Austin, TX; Ac
Jeremiah Johnson	2014	San Antonio, TX; Ac
Gabriel Widi	2015	Miami, FL; PP
Mohammed F. Khan	2015	Oradell, NJ; PP
Michael Thambuswamy	2015	Tulsa, OK; PP
Seth Hayes	2016	Raleigh, NC; Ac
Brandon Gaynor	2016	Chicago, IL; PP
Giancarlo Perez	2017	Current resident
Andrew Middleton	2017	Current resident
John Serak	2017	Current resident
Nicholas Ferraro	2018	Current resident
Brian Snelling	2018	Current resident
Joanna Gernsback	2018	Current resident
Walter Jermakowicz	2019	Current resident
Samir Sur	2019	Current resident
Timur Urakov	2019	Current resident
Simon Buttrick	2020	Current resident
Karthik Madhavan	2020	Current resident

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TABLE 1. Residents trained at the University of Miami Miller School of Medicine's neurosurgery residency program

Name	Yr of Graduation	Current Location
Angela Richardson	2020	Current resident
Stephen Shelby Burks	2021	Current resident
Iahn Cajigas	2021	Current resident
Ashish Shah	2021	Current resident
Gregory Basil	2022	Current resident
Stephanie Chen	2022	Current resident
Jason Liounakos	2022	Current resident

Ac = academic; Mil = military; PP = private practice.

integrity in neurosurgery, and is never fearful to speak his mind or “do what is right.” In recognition of his dedication to teaching, a book written by Dr. Chad Prusmack and colleagues summarizes his morning teachings.¹⁸ Dr. Heros was one of the first neurosurgeons to appreciate the threat posed by interventionalists in both neurology and radiology in the neuroendovascular treatment of cerebrovascular disorders, and strongly encouraged neurosurgical trainees to pursue fellowship training in interventional neuroradiology so that these types of treatment would be under the control of neurosurgery. His many accomplishments in neurosurgery include basic research on the effects of hemodilution on experimental brain ischemia; an authoritative description of the excellent surgical results in resecting low-grade arteriovenous malformations; a description of numerous microsurgical approaches to intracranial vascular lesions, including the far-lateral approach to the skull base; the superior parietal lobule approach; and the superior temporal gyrus approach for evacuating hematomas and clipping ruptured middle cerebral artery aneurysms; as well as his long-standing relationship with the *Journal of Neurosurgery*, including his position as former co-chairman of the Editorial Board.^{7,8,17}

Neurosurgical Education

The neurosurgical training program at the University of Miami Miller School of Medicine exposes residents and fellows to a diverse patient population with a wide range of neurosurgical diseases and injuries, and is designed to provide preparation for a career in academic neurosurgery. It is one of the largest neurosurgical training programs, with 21 residents and 10 fellows; 3 residents are graduated annually. The department now ranks 4th in the country in 2015 NIH research funding, in addition to other extensive research funding (http://www.brimr.org/NIH_Awards/2015/NIH_Awards_2015.htm). The program primarily services a 3-county referral area of 4.5 million people, in addition to referrals from Latin America, the Caribbean, and Europe. The neurosurgical training program is a 7-year program structured into 4-month blocks, with rotations at Jackson Memorial Hospital, the VA Medical Center, the University of Miami Hospital, and Nicklaus Children's Hospital (formerly Miami Children's Hospital). These rotations provide residents with the opportunity to become

TABLE 2. External fellows trained at the University of Miami Miller School of Medicine neurosurgery program since 1993

Name	Yr of Graduation	Location
Vascular & skull base fellows		
Harold Pikus	1998	Lebanon, NH; PP
Gabriel Gonzales-Portillo	1999	Tampa, FL; PP
Michael Fritsch	2000	Kiel, Germany; Ac
Mustafa Baskaya	2001	Madison, WI; Ac
Amit Schwartz	2002	Brooklyn, NY; Ac
Chad Prusmack	2003	Lone Tree, CO; PP
Greg Zipfel	2004	St. Louis, MO; Ac
Ramachandra Tummala	2005	Minneapolis, MN; Ac
Taro Kaibara	2006	Phoenix, AZ; Ac
Eric Deshais	2007	Syracuse, NY; Ac
Thomas Kretschmer	2008	Ulm, Germany; Ac
Nilesh Vyas	2009	Fairfax, VA; Ac
Roham Moftakhar	2010	Camas, WA; Ac
Albert Kim	2011	St. Louis, MO; Ac
Samy Elhammady	2012	Miami/Tampa, FL; PP/Ac
Gustavo Pradilla	2013	Atlanta, GA; Ac
Peter Amenta	2014	Philadelphia, PA; Ac
Anthony Wang	2015	Seattle, WA; Ac
Osaama Khan	2016	Current fellow
Endovascular fellows		
Ali Aziz-Sultan	2004	Boston, MA; Ac
Nils Mueller-Kronast	2006	West Palm Beach, FL; PP
Babak Jahromi	2006	Rochester, NY; Ac
Eric Deshaies	2007	Syracuse, NY; PP
Joseph Salame	2007	Beirut, Lebanon; Ac
Hamad Farhat	2008	Chicago, IL; PP/Ac
Stacey Quintero-Wolfe	2009	Winston-Salem, NC; Ac
Roham Moftakhar	2009	Columbia, SC; Ac
Eric Peterson	2010	Miami, FL; Ac
Samy Elhammady	2010	Miami/Tampa, FL; PP/Ac
Koji Ebersole	2011	Kansas City, KS; Ac
Jeremiah Johnson	2012	San Antonio, TX; Ac
Diogo Haussen	2013	Atlanta, GA; Ac
Charles Bowie	2014	Baton Rouge, LA; PP
Sudheer Ambekar	2015	India; Ac
Trauma fellows		
Hunaldo Villalobos	2001	Orlando, FL; PP
Richard Rodgers	2005	Indianapolis, IN; Ac
Joseph Chris Zacko	2010	Hershey, PA; Ac
Jose Sanchez Chavez	2011	Miami, FL; Ac
Ryan Kitagawa	2013	Houston, TX; Ac
Kentaro Shimoda	2014	Tokyo, Japan; Ac
Zachary Hickman	2015	New York, NY; Ac
Ignacio Jusue Torres	2016	Current fellow
Neurooncology fellows		
Simon Hanft	2014	New Brunswick, NJ; Ac

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TABLE 2. External fellows trained at the University of Miami Miller School of Medicine neurosurgery program since 1993

Name	Yr of Graduation	Location
Neurooncology fellows (continued)		
Michael Ivan	2015	Miami, FL; Ac
Roberto Diaz	2016	Montreal, QC; Ac
Pediatric fellows		
Sanjiv Bhatia	2004	Miami, FL; Ac
Tadashi Miyagawa	2005	Japan; Ac
Ernesto Coscarella	2007	Houston, TX; Ac
Ernesto Coscarella	2008	Houston, TX; Ac
Faiz Ahmad	2009	Atlanta, GA; Ac
Samy Elhammady	2011	Miami/Tampa, FL; Ac/PP
Parthasarathi Chamiraju	2012	Detroit, MI; Ac
O. Adetola Roberts	2013	New Orleans, LA; Ac
Alexander Weil	2014	Canada; Ac
Aria Fallah	2015	Los Angeles, CA; Ac
Travis Tierney	2016	Current fellow
Spine fellows		
Parley Madsen	1994	Visalia, CA; PP
Nick Vrodos	1997	North Adelaide, Australia; PP
Ehud Salmon	1998	Israel; PP
Brian Weider	1998	Casper, WY; PP
Eric Belanger	1999	Bismarck, ND; PP
William Choi	2000	Centennial, CO; PP
Juan Jimenez	2000	Kankakee, IL; PP
Juan Santiago Uribe	2001	Tampa, FL; Ac
Steven Vanni	2001	Miami, FL; Ac
Matthew McDonald	2002	Adelaide, Australia; PP
Michael Wang	2002	Miami, FL; Ac
Iftiqhar Haq	2003	Thunder Bay, Ontario; PP
Ramon Navarro	2004	Abu Dhabi; PP
Nitising Akkapong	2005	Bangkok, Thailand; PP
Claudio Tatsui	2005	Houston, TX; Ac
Andrew Cannestra	2005	Jacksonville, FL; PP
Ricardo Cortez	2006	Houston, TX; PP
Andrew Nataraj	2006	Edmonton, Canada; Ac
Brad Hall	2007	Alcoa, TN; PP
Ajay Pandey	2008	Miami, FL; PP
Howard Levene	2009	Miami, FL; Ac
Riki Trivedi	2009	Cambridge, UK; Ac
Sarah Woodrow	2009	Kansas City, KS; Ac
Frank Farhadi	2009	Columbus, OH; Ac
Ann Parr	2010	Minneapolis, MN; Ac
Vartan Tashjian	2010	Fontana, CA; PP
Joseph Martinez	2010	Houston, TX; Ac
Shah Sachin	2011	Rockville Centre, NY; PP

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TABLE 2. External fellows trained at the University of Miami Miller School of Medicine neurosurgery program since 1993

Name	Yr of Graduation	Location
Spine fellows (continued)		
Harshpal Singh	2011	Oradell, NJ; PP
Guarav Jain	2012	Wynnewood, PA; Ac
Kevin Cahill	2012	Charlotte, NC; Ac
Yi Lu	2013	Boston, MA; Ac
Mohamed Abdulhamid	2013	Scottsdale, AZ; PP
Yoav Ritter	2013	Pontiac, MI; PP
Vasillios Dimopoulos	2014	Buffalo, NY; Ac
Seth Molloy	2014	Columbia, SC; PP
Ivan Stoev	2014	Pembroke Pines, FL; PP
Chris Hofstetter	2014	Seattle, WA; Ac
Michael Thomas	2015	Orlando, FL; PP
Ian Cote	2015	Miami, FL; Ac
Luis Romero	2015	Miami, FL; Ac
Matthew Gary	2016	Atlanta, GA; Ac
Basheer Shakir	2016	Oklahoma City, OK; PP
Julius Ebinu	2016	New York, NY; Ac
Rajiv Saigal	2016	Seattle, WA; Ac

competent in a wide range of subspecialties, such as neurotrauma, neuroendovascular disease, neurooncology, pediatric neurosurgery, functional neurosurgery, cerebrovascular and skull-base disease, spine and peripheral nerve disorders, stereotactic surgery, and deep brain stimulation; fellowships are offered in each of these areas.

Key hires by Drs. Green and Heros that served to enhance the national reputation and educational mission early on in the program are listed chronologically. These hires included Drs. Morcos, Ragheb, Levi, Guest, Vanni, Zauner (now in private practice), Jagid, Bhatia, Sultan (now at Brigham), Sandberg (now at Memorial Hermann), Bullock, Benveniste, Levene, Wang, Komotar, Elhammady, Manzano, Peterson, Niazi, and Jernigan (Fig. 7). Additional key hires early on in the program were Nurse Practitioners Sherri Patchen and Cathy Rosenberg. These 2 original advanced registered nurse practitioners (ARNPs) are role models for the now more than 15 physician extenders who cover the 4 hospitals in the teaching system, and who have served in modified versions of their original roles for more than 50 years combined. The program has trained nearly 80 residents since its inception in 1965 (Table 1), and approximately 100 specialized fellows in spine (> 50), vascular and skull base (> 20), endovascular (> 10), brain tumors (3), pediatrics (> 10), and neurotrauma (> 10), particularly after 1997 (Table 2). Many of its graduates have gone on to important teaching and leadership positions throughout the US and abroad. Educational opportunities abound, with grand rounds, formal lectures, and teaching rounds. There are numerous visiting professorship opportunities; the most established is the Rosomoff visiting professorship (Table 3).

TABLE 3. Rosomoff Research Day visiting professors

Visiting Professor	Yr
Robert Spinner, MD	2016
Robert L. Martuza, MD	2015
Michael Tymianski, MD, PhD	2014
E. Antonio Chiocca, MD, PhD	2013
Mark Bilsky, MD	2012
Edward R. Laws, MD	2011
Mark M. Souweidane, MD	2010
Andres Lozano, MD, PhD	2009
Kim Burchiel, MD	2008
Henry Brem, MD	2007
Edward H. Oldfield, MD	2006
David G. Kline, MD	2005
Mitchel S. Berger, MD	2004
James T. Rutka, MD, PhD	2003

The Future

Dr. Allan D. Levi (Fig. 8) was named as the fourth chairman of the Department of Neurological Surgery in 2015. In keeping with the prior model of leadership with both strong spinal and cranial representation, Dr. Jacques J. Morcos, a longtime colleague and friend of Dr. Levi, was subsequently named co-chairman (Fig. 9). Both individuals will serve to lead the department into the future.

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Disclosures

Dr. Levi receives a teaching honorarium from Medtronic and grant support from the Department of Defense.

Author Contributions

Conception and design: all authors. Acquisition of data: all authors. Drafting the article: all authors. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Levi.

Supplemental Information

Online-Only Content

Supplemental material is available with the online version of the article.

Appendix. <http://thejns.org/doi/suppl/10.3171/2016.4.JNS152356>.

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