2015-2016 DEPARTMENT PROFILE

Department of Anesthesiology

VANDERBILT UNIVERSITY

MEDICAL CENTER

Clinical Care Education Research

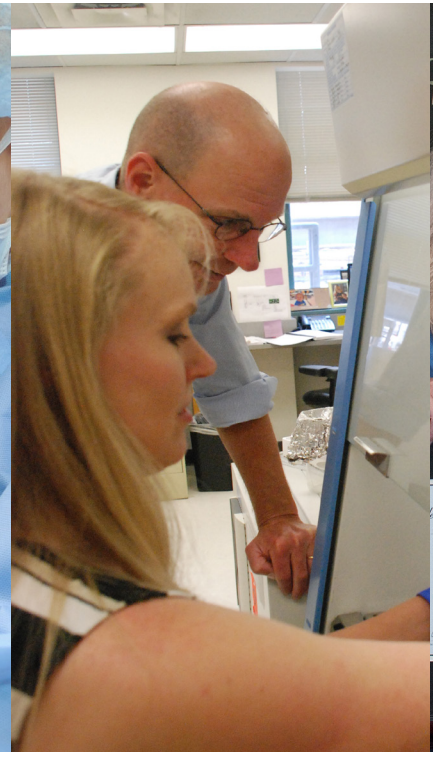
Clinical Care Education Research

*We provide **uncompromising quality** in clinical care, research and education. We are **compassionate** in patient care, **creative** in research and technology, **committed** to equipping future global leaders and **collaborative** within the department, with other departments throughout the university and with institutions across the country and around the world.*

Throughout this guide, our values - compassion, creativity, commitment and collaboration- emerge as the keystones of our story.

We are
Compassionate:

Offering exceptional perioperative care and pain management to a complex population.



We are
Creative:

Advancing the frontiers of science, healthcare and technology.

We are
Committed:

Equipping future global leaders with the latest knowledge and skills.

We are
Collaborative:

Working across Vanderbilt University Medical Center and beyond to achieve measurably improved outcomes.

Message from the Chair

Warren S. Sandberg, MD, PhD
Chair, Department of Anesthesiology
Vanderbilt University School of Medicine

Thank you for your interest in the Vanderbilt University Medical Center Department of Anesthesiology. Our growth and success stem from the foundation of Vanderbilt University Medical Center's five-pillar commitment to excellence, which consists of people, service, quality, growth & finance, and innovation. Our department follows the Vanderbilt credo, driving us to achieve excellence in healthcare, research and education; we treat others as we wish to be treated; and we continuously evaluate and improve our performance. As anesthesiology continues to evolve rapidly, our diverse team of experts remains at the forefront of knowledge and technology in patient care, research and education.

We play a leading role within and outside of the operating room. Our values - compassion, creativity, commitment, and collaboration - emerge as the keystones of our structure and systems, as seen throughout this guide. We are compassionate, not just based on our own assessment, but by what we are being told. Through a collaborative effort led by our faculty, our trainees and our surgical colleagues, our patients are recovering faster and with greater comfort through Enhanced Recovery After Surgery (ERAS), and they are telling us about it.

We are creative, advancing the frontiers of science, healthcare and technology. Our informatics infrastructure continues to increase patient safety and clinician effectiveness through innovative methods and novel use of both live and archived data. The highly accomplished teams are led by Drs. Jonathan Wanderer, Jesse Ehrenfeld and Brian Rothman.

Dr. Edward Sherwood, vice chair of Research, and our core research faculty create opportunities for and mentor investigators. Our total research portfolio has increased in funding by 15 percent to $7,983,712 per year. We have achieved a consistent climb in NIH funding, but have also diversified our funding to include major foundation grants.

The department has achieved accelerating increases in faculty academic output, with total publications almost tripling from 69 in 2010 to 197 in 2015. The total number of publications increased from 149 in 2014 to 197 in 2015, a 32 percent increase. Over the past four years, our NIH funding has improved from 19th to 8th among all U.S. anesthesiology departments. Twenty-four members of the department have been elected into the Association of University Anesthesiologists (AUA). At the 2014 Annual Meeting of the American Society of Anesthesiologists, department members contributed more than 100 entries, including oral presentations, medically challenging cases, poster presentations, problem-based learning discussions, workshops, panel discussions, and refresher courses.

Our dedicated faculty is committed to equipping graduates for a promising future in anesthesiology. We offer training using cutting edge technology along with opportunities to improve systems of care. We provide a closely guided mentorship program, balancing subspecialty training, clinical experience and a broad range of academics.

Much of our success can be attributed to the collaboration that occurs across Vanderbilt University Medical Center and beyond. Our clinical teams assisted patients in more than 80,000 encounters last year, spanning the entire spectrum of anesthesiology; for every age group, subspecialty and procedure, caring for patients along their journey to wellness. And we are moving beyond Vanderbilt's traditional walls. The Vanderbilt Health Affiliated Network is the largest of its kind and growing rapidly, and our department is leading telemedicine and remote presence projects to bring our skills and values to more patients.

As you read through the following pages, we invite you to contact us or visit our website at www.vandydreamteam.com to learn more about our progams.

Department Leadership

Vice Chairs

Suanne Daves, MD
Vice Chair, Pediatric Anesthesiology

Chief, Pediatric Cardiac Anesthesiology

Stephen Doherty
Department Administrator

Matthew McEvoy, MD
Vice Chair, Educational Affairs

William Furman, MD
Vice Chair, Clinical Affairs

Edward Sherwood, MD, PhD
Vice Chair, Research

Matthew Weinger, MD
Vice Chair, Faculty Affairs

Division Chiefs

David H. Chestnut, MD
Chief, Obstetric Anesthesiology

Eric Delpire, PhD
Chief, Basic Science Research

Katherine Dobie, MD
Chief, Ambulatory Anesthesiology

Brent Dunworth
Associate Director for Anesthesia Advanced Practice Nursing, Chief CRNA

Marc Huntoon, MD
Chief, Pain Medicine

Lorri Lee, MD
Chief, Neuroanesthesiology

Pratik Pandharipande, MD, MSCI, Chief, Anesthesiology Critical Care Medicine

Mark Rice, MD
Chief, Multispecialty Adult Anesthesiology

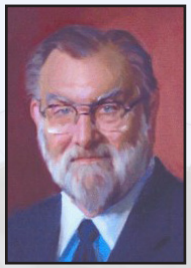
Andrew Shaw, MB, FRCA, FCCM, FFICM
Chief, Cardiothoracic Anesthesiology

Ann Walia, MBBS
Chief, VA Anesthesiology

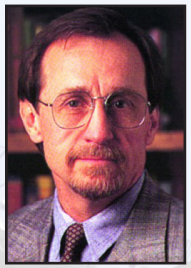
Previous Department Chairs

Dr. Benjamin H. Robbins
1946-1961

Dr. Charles B. Pittinger
1962-1969



Dr. Bradley E. Smith
1969-1993



Dr. Charles Beattie
1994-2001

Dr. Jeffrey R. Balser
2001-2004

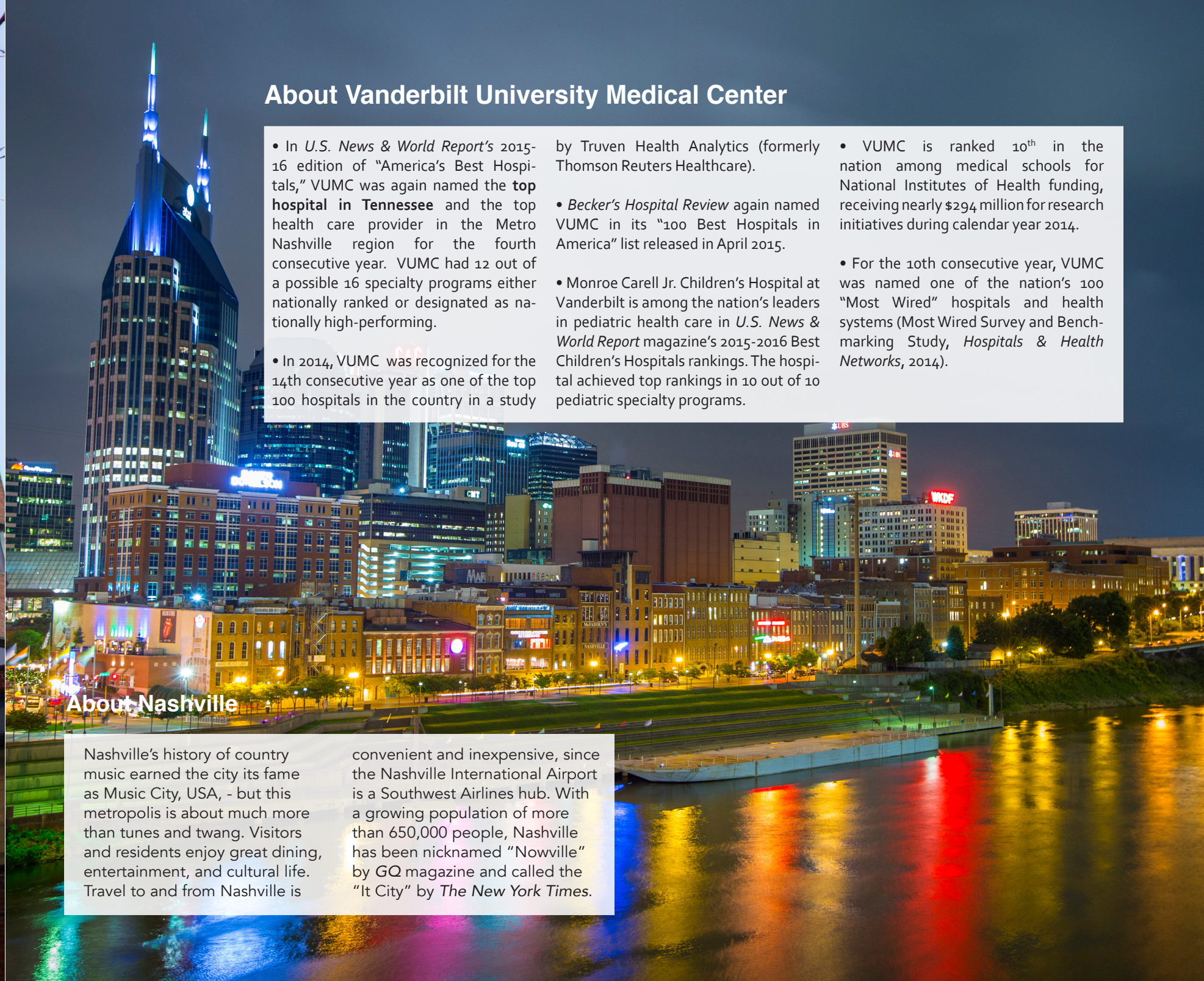
Dr. Michael S. Higgins
2004-2010

History

The Vanderbilt Department of Anesthesiology was one of the first independent departments of anesthesiology in the United States, established on December 12, 1945.

After observing that the battlefield-wounded of World War II were more likely to survive if they received immediate, skilled anesthesia care, Vanderbilt physicians advocated that anesthesiology be established as an autonomous department. At that time, few medical schools possessed an academic anesthesiology service of any type.

This tradition of pioneering in our specialty continues today. Our exemplary faculty provide top-quality clinical services for a full spectrum of medical specialties. Vanderbilt Anesthesiology is recognized as an innovator in perioperative management, healthcare information technology, clincial outcomes research, education and international capacity building. We also have high-caliber basic science and clinical research teams pursuing fundamental and translational knowledge to directly improve patient safety and care.



About Vanderbilt University Medical Center

• In *U.S. News & World Report's* 2015-16 edition of "America's Best Hospitals," VUMC was again named the **top hospital in Tennessee** and the top health care provider in the Metro Nashville region for the fourth consecutive year. VUMC had 12 out of a possible 16 specialty programs either nationally ranked or designated as nationally high-performing.

• In 2014, VUMC was recognized for the 14th consecutive year as one of the top 100 hospitals in the country in a study by Truven Health Analytics (formerly Thomson Reuters Healthcare).

• *Becker's Hospital Review* again named VUMC in its "100 Best Hospitals in America" list released in April 2015.

• Monroe Carell Jr. Children's Hospital at Vanderbilt is among the nation's leaders in pediatric health care in *U.S. News & World Report* magazine's 2015-2016 Best Children's Hospitals rankings. The hospital achieved top rankings in 10 out of 10 pediatric specialty programs.

• VUMC is ranked 10th in the nation among medical schools for National Institutes of Health funding, receiving nearly $294 million for research initiatives during calendar year 2014.

• For the 10th consecutive year, VUMC was named one of the nation's 100 "Most Wired" hospitals and health systems (Most Wired Survey and Benchmarking Study, *Hospitals & Health Networks*, 2014).

About Nashville

Nashville's history of country music earned the city its fame as Music City, USA, - but this metropolis is about much more than tunes and twang. Visitors and residents enjoy great dining, entertainment, and cultural life. Travel to and from Nashville is convenient and inexpensive, since the Nashville International Airport is a Southwest Airlines hub. With a growing population of more than 650,000 people, Nashville has been nicknamed "Nowville" by *GQ* magazine and called the "It City" by *The New York Times*.

Clinical Care

We are compassionate, offering exceptional perioperative care and pain management to a complex population.

Serving in one of the largest clinical programs in the nation, the Vanderbilt Department of Anesthesiology's clinicians provide procedural, critical care, pain management, and all perioperative anesthesia services for more than 90,000 adult and pediatric patient encounters annually at more than 100 anesthetizing locations. Of these, more than 10,000 patients are seen annually in the Vanderbilt Interventional Pain Clinic, and approximately 20,000 Vanderbilt adult and pediatric patients receive anesthetic care during a radiologic, gastrointestinal, or other diagnostic or therapeutic procedure.

The department's faculty, residents, fellows, certified registered nurse anesthetists (CRNAs), and nurse practitioners provide care in our operating rooms, five adult intensive care units, and the pediatric and neonatal intensive care units, and perform approximately 4,000 anesthetics per year in the labor and delivery suite.

Our trauma service, which includes the orthopedic trauma program, is among the busiest in the nation and ranked as a Level One trauma facility, with more than 1,700 LifeFlight helicopter transports this year.

The Vanderbilt Preoperative Evaluation Center (VPEC) offers preoperative evaluation before patients undergo procedures at Vanderbilt University Medical Center. In 2015 – for the seventh year in a row – the Vanderbilt University Hospital location of VPEC received a Professional Research Consultants, Inc., patient satisfaction award, the coveted 5-Star Award for Overall Quality of Care. Our One Hundred Oaks location, which opened in 2009, has received the same award for four years in a row. The center scored in the 90th – 99th percentiles based on 2014 calendar year results, compared with similar centers nationwide.

Perioperative medicine is built on full engagement in patient care, from diagnosis to operative recovery. It includes a full-time teaching service with 24/7 consultative availability and extensive use of system-wide information technology and mobile applications to support clinical decision-making, capture data, and measure outcomes, such as the quality of recovery after surgery.

Vanderbilt is one of the few medical training centers with a 3-D transesophageal echocardiography (TEE) simulator, used to teach the essential skill of cardiac ultrasound.

Highlighted on the following pages are the services provided by the department's clinical divisions.

"Our highly skilled faculty and staff provide extraordinary clinical care to a diverse and complex patient population."

Dr. David Chestnut, division chief, Obstetric Anesthesiology, and professor of Anesthesiology

Our clinical staff provides services in three hospitals (Vanderbilt University Hospital, Monroe Carell Jr. Children's Hospital at Vanderbilt, and the Nashville Veterans Administration Hospital) and numerous outpatient facilities. Specialized clinicians provide the full range of anesthetic and perioperative medicine techniques. This includes consultative perioperative care in the inpatient units and procedures in the operating rooms, procedural suites, intensive care units, and pain management clinics.

"I am amazed with the treatment I received and especially having no pain after surgery…You all have made a mark on my heart that I never will forget."

Cindy Biggerstaff, patient

Dr. Matthew McEvoy, vice chair of educational affairs and associate professor of anesthesiology, and Dr. Timothy Geiger, assistant professor of surgery in the colon and rectal surgery center, launched a multidisciplinary treatment protocol to improve patient care. Through Enhanced Recovery After Surgery (ERAS), **patients are recovering faster… reducing hospital stays by 25 percent — about one day — and morphine use by 90 percent.**

Division of Ambulatory Anesthesiology

First Row L-R: Uma Shastri, MD, FRCPC, Lisa Jaeger, MD, Jane Brock, DO, Chris Canlas, MD, Vikram Bansal, MD
Second Row L-R: Eric Briggs, MD, Stephen Harvey, MD, Katherine Dobie, MD, John Corey, MD, Chris Sobey, MD, Michael Higgins, MD, MPH

The Division of Ambulatory Anesthesiology has grown from five anesthetizing locations to 26 anesthetizing locations in seven years, from two full time faculty to 12, and from five CRNAs to 30. For two years in a row in that five years, Cool Springs Surgery Center has been named Symbion's "Surgery Center of the Year" nationally.

The Division of Ambulatory Anesthesiology is led by Katherine Dobie, MD, and consists of 12 faculty members and 30 nurse anesthetists who practice in two on-campus locations and two off-campus locations. The trend in surgical healthcare continues toward significant growth for outpatient surgeries; it is now estimated that more than 70 percent of all surgeries are performed in the outpatient setting. The Division of Ambulatory Anesthesiology is committed to addressing this trend innovately as we explore how to safely care for sicker patients undergoing more complex surgeries across the entire episode of care within the outpatient surgical home. Ambulatory Anesthesiology is unique compared to other academic departments, with its high volume (estimated ~20,000 cases for FY 2015) and its joint venture with private physicians in the greater Nashville area. The Vanderbilt Outpatient Surgical Home (VOSH) was created within the division. Patient care within the home begins with a systematic preoperative screening selection and continues with prescription of care pathways and post-operative day one follow-up. Services are provided for Vanderbilt University Medical Center satellite locations that include Cool Springs Surgery Center, Medical Center East, Vanderbilt Bone and Joint Surgery Center, and Vanderbilt Outpatient Surgery. These centers provide for a broad base of cases, including spine, surgical oncology, pain, GI, orthopedic, pediatric, ENT, urologic, neurosurgical, general surgery, and higher-acuity plastic. The division houses three resident rotations where residents rotate to four centers. One of these rotations provides the majority of the acute pain and regional procedures for the residency, including management of an outpatient continuous peripheral nerve block (at-home catheter) program.

Division of Anesthesiology Critical Care Medicine

Dr. Pratik Pandharipande has been selected as a member of the FAER (Foundation for Anesthesia Education and Research) Academy of Research Mentors in Anesthesiology and joins academy members Dr. Warren Sandberg, and Dr. Edward Sherwood within our department.

First Row L-R: Anna Fong, ACNP, Lauren Nevels, ACNP, Christopher Hughes, MD, Patrick Henson, DO, Roy Neeley, MD, Pratik Pandharipande, MD, MSCI , Antonio Hernandez, MD, Avinash Kumar, MBBS
Second Row L-R: Frederic (Josh) Billings, MD, MSCI, Edmund Donahue, PA, Debra Cirone, ACNP, Nathan Ashby, MD, Christina Hayhurst, MD, Lee Parmley, MD, JD, MMHC, Liza Weavind, MBBCh, Ryan Truesdale, ACNP
Third Row: L-R Meredith Golden, PA, Tracy McGrane, MD, Hannah Maloney, ACNP, Sheena Weaver, MD, Arna Banerjee, MBBS, Merrick Miles, MD, Briana Witherspoon, ACNP, April Kapu, ACNP

The Division of Anesthesiology Critical Care Medicine (ACCM) is led by Pratik Pandharipande, MD, MSCI. The division provides critical care services in the burn ICU, cardiovascular ICU, neurological ICU and surgical ICU at Vanderbilt Medical Center, and in the surgical ICU at the VA Medical Center in Nashville. Additionally, division members provide perioperative anesthetic care for patients undergoing major surgery, and some participate in the perioperative consult service.

The division includes 24 anesthesiology-intensivists, along with more than 35 acute care nurse practitioners (ACNPs) and physician assistants (PAs), making it one of the largest anesthesiology critical care medicine divisions in the country. Additionally, there are eight neurointensivists, certified by the United Council for Neurologic Subspecialties. The ACNPs and PAs have faculty appointments in the department, and an ongoing alliance between the ACCM Division and the School of Nursing also supports an ACNP intensivist training program.

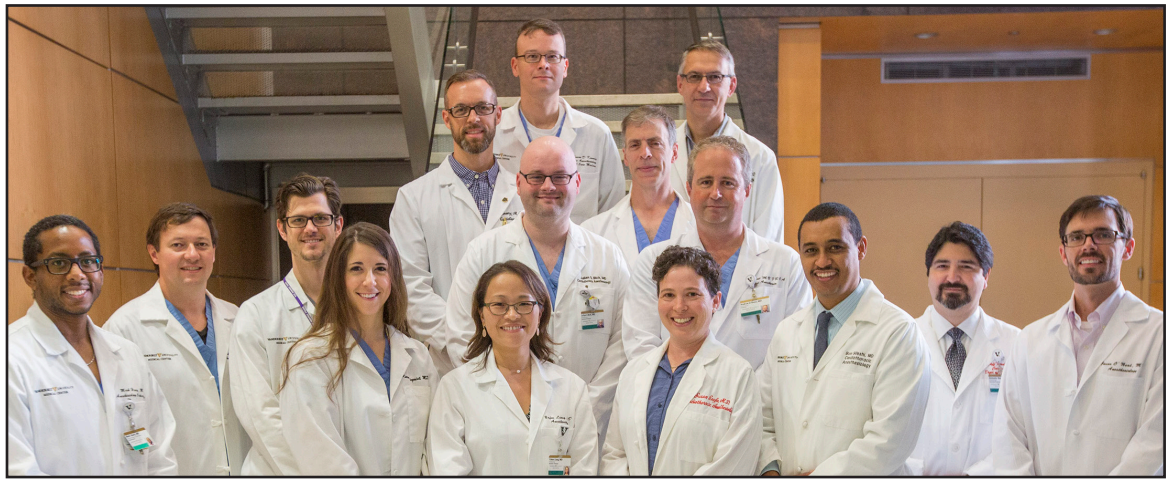
The division strives to provide excellent patient care, promote education, and engage in scholarly activity. Faculty and fellows keep abreast of modern technology and the changing spectrum of caring for the critically ill. This includes proficiency in ultrasound, echocardiography, and management of patients with ventricular assist devices or who are on ECMO.

The ACCM Fellowship has recently been approved for 10 ACGME-accredited fellowship positions per year and has received accreditation for five years. Fellows have a diverse clinical experience through our subspecialty ICUs and an innovative didactic program.

Division faculty frequently participate in regional, national and international educational activities and have taken on leadership roles in national organizations such as SCCM, ASA, SOCCA and the American Delirium Society; in VUH and VUMC administration including the directorship of the BICU, NCU, CVICU and CELA, and in the medical school curriculum redesign, via innovation immersion programs.

Active research programs encompass clinical and translational research that focuses on perioperative risk factors and mechanisms of cognitive impairment, kidney injury, sepsis and its monitoring, education and implementation science, health resource utilization, multisensory training, device development and quality improvement projects, including remote bedside monitoring and use of rapid response teams. Active grants in the division include two RO1s, a K23 training grant, an RO3 grant, and a FAER Research in Education grant, in addition to smaller industry and VICTR grants. Faculty have been involved in more than 20 peer-reviewed manuscripts and textbook chapters in the last academic year alone.

Division of Cardiothoracic Anesthesiology



First Row L-R: Mark Henry, MD, Fredrick (Josh) Billings, MD, MSCI, Adam Kingeter, MD, Kara Siegrist, MD, Yafen Liang, MD, Susan Eagle, MD, Ban Sileshi, MD, Antonio Hernandez, MD, and Jason O'Neal, MD
Second Row L-R: Julian Bick, MD, Andrew Shaw, MB, FRCA, FCCM, FFICM
Third Row L-R: Jeremy Bennett, MD, Robert Deegan, MB, ChB, BAO, PhD, FFARCSI *Top Row L-R* Jason Kennedy, MD and Mias Pretorius, MB, ChB, MSCI

Dr. Andrew Shaw was named recipient of the 2015 Vicenza Award. This award is given annually to a physician whose contributions are judged to be outstanding in the field of international critical care nephrology.

The Division of Cardiothoracic Anesthesiology is led by Dr. Andrew Shaw and includes 14 faculty members and 11 nurse anesthetists. Each month, three residents rotate through the service. The fellowship program, under the leadership of Dr. Mias Pretorius, currently trains three clinical fellows per year and will expand to 5 fellows in 2016.

The division provides perioperative care for approximately 1,500 adult cardiac procedures a year. These include CABG (on- and off-pump), valvular surgery, heart and lung transplantation, adult congenital procedures, hybrid procedures, aortic surgery, and ventricular assist device (VAD) insertions. The VAD program at Vanderbilt currently places about 100 devices per year for both bridge-to-transplant and destination therapy indications. The transcatheter aortic valve replacement (TAVR) program began in 2011 and has now grown to over 150 cases per year.

Members within the division provide anesthetic care to over 700 general thoracic cases annually. In addition, anesthesia services are also provided for interventional pulmonology, cardiology, and electrophysiology procedures, which together account for approximately 3,500 cases annually. A subset of the division's faculty rotate through the adult cardiovascular intensive care unit, under the medical direction of division faculty member Tony Hernandez, MD.

Intraoperative transesophageal echocardiography (TEE) is an integral part of our clinical practice and is performed on all adult cardiac patients. Our faculty also provide TEE in the EP suite to rule out thrombosis of the left atrial appendage, to guide trans-septal puncture, and to guide transcatheter valve procedures. All studies are performed and interpreted by a cardiothoracic anesthesiologist, and cases are digitally archived for future study. The division uses 4 Philips EPIQ and 3 CX50 consoles, and these machines were installed in 2015.

Division faculty conduct research in vascular biology, precision perioperative medicine, acute kidney injury, and the perioperative inflammatory response. Extramural grant support comes from the Department of Defense, National Institutes of Health and Industry.

The division has a significant education presence. Dr. Shaw serves as scientific program chair for the Society of Cardiovascular Anesthesiologists (SCA) annual meeting. Julian Bick, MD, recently received a $100,000 Research in Education Grant from the Foundation for Anesthesia Education and Research which is used to train CA-1 residents in TEE. Two simulators are available for training in the division's echocardiography lab and at Vanderbilt's Center for Experiential Learning and Assessment.

Division of Multispecialty Adult Anesthesiology

Dr. Mark Rice joined the leadership team earlier this year. Recent honors include Technology Innovator Recipient (2011, 2013), University of Florida Office of Technology and Licensing; Exemplary Teacher Award (2009-2012), University of Florida College of Medicine; and Customer Service Recognition Award (2010), Shands Hospital, University of Florida.

First Row L-R: Scott Hoffman, MD, Susan Calderwood, MD, Amy Robertson, MD, Shannon Dare, MD, Clifford Bowens, MD, Edward Sherwood, MD, PhD, Jason O'Neal, MD, Warren Sandberg, MD, PhD, Matthew Weinger, MD, Michael Pilla, MD, David Edwards, MD, PhD
Second Row L-R: Yandong Jiang, MD, PhD, Douglas Hester, MD, Paul St. Jacques, MD, Joseph Schlesinger, MD, James Berry, MD, James Blair, DO, Kenneth Holroyd, MD, Mark Rice, MD, Matthew McEvoy, MD, Travis Hamilton, DO, Shannon Kilkelly, DO, Matthew Riess, MD, PhD

The Division of Multispecialty Adult Anesthesiology is led by Mark Rice, MD. This is the department's largest division, providing perioperative anesthetic care for more than 12,000 patients annually in 45 operating rooms and procedure suites for a wide variety of surgical services, including general surgery, orthopedics, urology, plastic surgery, ophthalmology, vascular surgery, otolaryngology, hepatobiliary surgery, liver and renal transplantation, and oral/maxillofacial surgery. The division has 48 full- and part-time faculty members, most of whom have significant subspecialty training and expertise. As a Level 1 Trauma Center, MSA faculty and staff provide 24-hour coverage for emergency and trauma surgery for the region.

In July 2014, a Perioperative Consultative Service was created to provide co-management of surgical patients, from decision to operate until after discharge from the hospital. This started with a pilot program involving colorectal surgical patients and quickly grew to include abdominal wall reconstruction, surgical weight loss, and hepato-biliary-pancreatic/surgical oncology patients. Plans are underway with other surgical services to extend this coverage to another six services within the next year.

MSA division faculty provide anesthesiology residents a variety of both introductory and advanced clinical experiences and make numerous contributions to the department's educational programs for medical students, residents, and fellows. Additionally, MSA faculty teach and supervise residents from other specialties, as well as student registered nurse anesthetists who rotate in the MSA division. Division faculty pursue a wide range of academic interests, including regional anesthesia, airway management, information technology, perioperative cognitive dysfunction, echocardiography, ultrasound imaging, and perioperative medicine.

The division's members are also highly active in research, with numerous investigator-initiated clinical research projects currently in progress. Work is ongoing in informatics, regional anesthesia, airway management, perioperative medicine and drug protocols, in an effort to improve perioperative care and throughput.

Division of Neuroanesthesiology

First Row L-R: Avinash Kumar, MD, Sheena Weaver, MD, Letha Mathews, MD, Lorri Lee, MD, Jane Easdown, MD
Second Row L-R: Koffi Kla, MD, Joseph Schlesinger II, MD, Jesse Ehrenfeld, MD, MPH, James Blair, DO

Dr. Lori Lee leads the recently formed Division of Neuroanesthesiology. Additionally, Dr. Lee leads Vanderbilt Anesthesiology's Center for Evidence Based Anesthesia.

For the fifth year in a row, Vanderbilt's departments of Neurology and Neurological Surgery have ranked in the top 3 percent of *U.S. News & World Report's* "America's Best Hospitals."

The Division of Neuroanesthesiology is led by Lorri Lee, MD. Neurosurgery and other neurologic services continue to expand at Vanderbilt University Medical Center, and faculty specializing in neuroanesthesiology are providing increasingly complex anesthesia and sedation services.

The Vanderbilt Department of Neurological Surgery currently has the highest volume of deep brain stimulator implantations in North America. The Vanderbilt Brain Tumor Center provides comprehensive care for patients with brain tumors, and more than 400 major brain tumor operations are performed annually. Because of increasing case volumes, two new neurointerventional neurosurgeons have recently joined Vanderbilt, operating in our state-of-the-art interventional radiology rooms dedicated solely to neurosurgical procedures. The Joint Commission designated Vanderbilt as an Advanced Certification Comprehensive Stroke Center, where the most complex of stroke patients are treated. Annual surgical volume is approximately 4,800 neurologic cases per year.

The Division of Neuroanesthesiology engages in research aimed at improving patient outcomes and cost-effectiveness, as well as expanding the clinical knowledge of certain diseases. Paramount to the success of the division is the collegial working relationship among operating room and intensive care unit team members.

VUMC has seven designated neurosurgical operating rooms, where anesthesia services are provided for operations, including brain tumor, blood vessel malformation, aneurysms, stroke intervention, trauma, complex spinal procedures, functional neurosurgery, and chronic pain management. The Division of Neuroanesthesiology also provides specialized anesthesia services for "awake craniotomies," when patients are intermittently awake to facilitate speech and motor mapping during surgery in order to preserve the most vital areas of the brain. Additionally, anesthesia is provided by the division in neurointerventional radiology suites and at Monroe Carell Jr. Children's Hospital at Vanderbilt. Like their surgical colleagues, neuroanesthesiologists face many unique challenges, including the length of procedures (which may last more than 16 hours) unusual patient positioning, and unexpected intraoperative events, such as seizures or intracranial hemorrhage. Residents on the neuroanesthesia rotation discover that the ability to make an immediate impact on an operation is both exciting and gratifying, as do the faculty leading the training.

Division of Obstetric Anesthesiology

Dr. David Chestnut has been announced as the 2016 ASA Rovenstine Lecturer. The lecture is the premier event at the annual meeting of the American Society of Anesthesiologists (ASA).

Dr. Curtis Baysinger is co-editor of the second edition of *A Practical Approach to Obstetric Anesthesia*, which will be published in the summer of 2016.

Theresa McClung, MD, Michael Richardson, MD, John Downing, MB, ChB, Mary DiMiceli-Zsigmond, MD, Jill Boyle, MD, Curtis Baysinger, MD, David Chestnut, MD, Ray Paschall, MD

The Division of Obstetric Anesthesiology is led by David Chestnut, MD. Chestnut recently completed the fifth edition of *Chestnut's Obstetric Anesthesia: Principles and Practice*. This volume is considered to be the "bible" of OB anesthesia.

The division provides dedicated, 24-hour, in-house obstetric anesthesia care for approximately 4,500 deliveries at Vanderbilt University Medical Center (VUMC) annually - over half of which are considered high risk. The division also provides anesthesia services for approximately 2,500 gynecologic surgical procedures in a suite of three operating rooms adjacent to the labor and delivery unit. In addition to offering the full complement of techniques for labor analgesia, the division provides consultation and critical care management services for high-risk obstetric patients, as well as specialized anesthesia care for fetal surgery.

The resumption of in utero repair of fetal myelomeningocele, a procedure pioneered at VUMC in 1997, has brought an added dimension of specialized clinical service to the division. The results of a seven-year National Institutes of Health-funded trial, Management of Myelomeningocele Study (MOMS), demonstrated a clear benefit for babies who undergo fetal surgery for treatment of spina bifida. These surgeries resumed at VUMC in 2011, and patients are referred to VUMC from across the nation. Approximately 15 of these procedures are performed annually at VUMC.

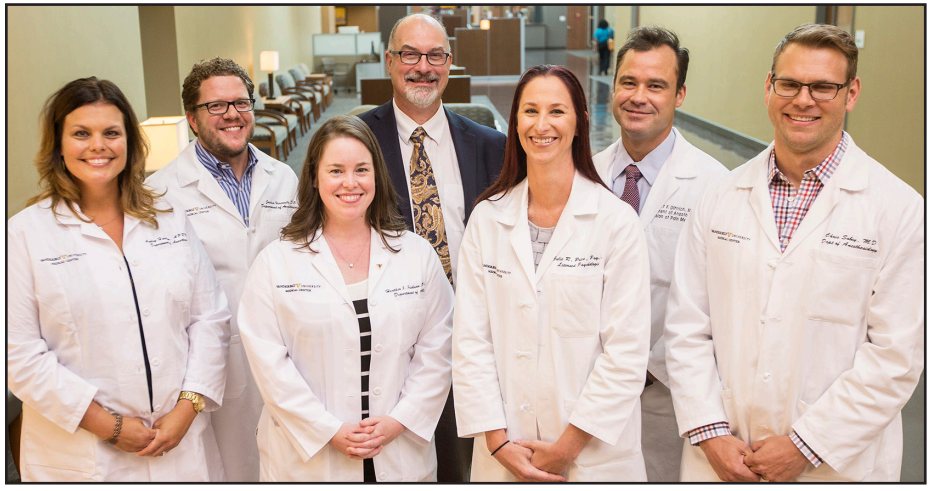
The division also collaborates with VUMC maternal-fetal medicine, gynecologic oncology, and urology physicians in an innovative approach to the care of patients with placenta accreta/percreta, which is a form of abnormal, invasive placentation that places the mother at high risk for massive blood loss and significant morbidity. During the past year, approximately 15 parturients with known placenta accreta/percreta have undergone a modified cesarean delivery through a fundal uterine incision, and the placenta was left in situ, with plans to perform hysterectomy six weeks postpartum. This multidisciplinary approach seems to result in decreased maternal blood loss and morbidity, and it is a focus of ongoing assessment.

The division is taking a leadership role in the use of in situ simulation training for obstetric emergencies. Ongoing clinical research projects include:

1) assessment of delayed delivery of the placenta and hysterectomy in patients with placenta accreta/percreta, and

2) assessment of resident and student communication skills in conversations with patients with limited English proficiency, which has led to better communication with patients with limited English proficiency.

Division of Pain Medicine



First Row L-R: Ashley Baker, NP, Heather Jackson, NP, Julie Price, PhD, Christopher Sobey, MD
Second Row L-R: Daniel Lonergan, MD, Marc Huntoon, MD, Kurt Dittrich, MD.

The impact factor for *Regional Anesthesia and Pain Medicine*, led by Editor-in-Chief Dr. Marc A. Huntoon, has risen to 3.089, an increase of 45.7% from the previous year. The journal is listed 7/30 within the Anesthesiology category.

The Division of Pain Medicine is led by Marc Huntoon, MD. Clinicians at VUMC's Interventional Pain Center utilize a multidisciplinary approach to pain care, offering thorough evaluations, consultations, and referrals in order to employ the most advantageous treatment modalities.

The Interventional Pain Center sees patients with all types of pain, including back, neck, abdominal, pelvic, nerve and joint pain, as well as chronic headache. During the first clinic visit, a patient's medical history is thoroughly reviewed, and his or her condition is evaluated by Vanderbilt pain specialists to develop a team-based treatment plan. This team includes specialists from anesthesiology, psychology, psychiatry, neurology, neurosurgery, orthopedics or rehabilitation. Interventional Pain Center physicians also work closely with a patient's primary care providers to close the loop effectively and foster shared responsibility for patient health.

Monroe Carell Jr. Children's Hospital at Vanderbilt is the site of a unique pediatric pain clinic, where Vanderbilt providers work with patients, their families, and their physicians to provide the best pain management for the pediatric patient's specific needs. The Neonatal Intensive Care Unit at the Children's Hospital also has its own specialized pain management program, and there is a regional anesthesia program to treat young patients as well.

The Comprehensive Pain Service (CPS) at VUMC also continues to grow, as patients benefit in increasing numbers from epidural catheters, peripheral nerve blocks, and peripheral nerve catheters for pain management for complex shoulder and arm surgery, lower extremity surgeries, and repeated burn debridements.

Division of Pediatric Anesthesiology

The Pediatric Division is the only anesthesia group in Tennessee to provide anesthesia for pediatric liver transplantation as well as complex craniofacial reconstruction. The division also provides specialized pediatric pain consultation services for inpatients and outpatients.

First Row L-R: Carrie Menser, MD, Thanh Nguyen, MD, Thomas Romanelli, MD, Elisabeth Hughes,MD
Second Row L-R: Jill Kilkelly, MD, Eric Stickles, MD, Peter Chin, MBBS, Brian Emerson, MD
Third Row L-R: Stephen Hays, MD, Laura Zeigler, MD, Amanda Lorinc, MD, Vikram Patel, MD
Fourth Row L-R: Camila Lyon, MD, Andrew Franklin, MD, MBA

The Division of Pediatric Anesthesiology is led by Suanne Daves, MD. The Division provides perioperative care for more than 13,000 patients annually at the Children's Hospital, making it the region's major pediatric referral center.

The Pediatric Pain Service provides an increasing number of inpatient consultations and works closely with the many surgical services at the Children's Hospital to provide a full spectrum of perioperative pain management strategies.

Education and training of medical students, anesthesia residents, nurses, and associated healthcare personnel is a major faculty commitment. Amanda Lorinc, MD, assistant professor of Anesthesiology, leads the newly-launched Pediatric Liver Transplant Program. Areas of academic interest for the division's faculty include safe transfusion practices, multidisciplinary approaches to decreasing surgical-site infections, situational awareness during hand-overs in care, difficult airway management, pediatric pain management, regional anesthesia, extracorporeal membrane oxygenation (ECMO), and perioperative care of cardiovascular patients.

The division is an active member of Wake Up Safe, a quality improvement initiative of the Society for Pediatric Anesthesia. Wake Up Safe is a Patient Safety Organization (PSO), as defined by The Patient Safety and Quality Improvement Act of 2005, and its participants are leading children's hospitals throughout the country. Through voluntary reporting from its member institutions, Wake Up Safe has developed the first-ever national registry of adverse perioperative events in pediatric patients. Its goal is to help define quality in pediatric anesthesia and develop quality improvement systems in an effort to help improve anesthetic care for children of all ages.

The division is also an active partner with the quality improvement office of the Children's Hospital and participates in Solutions for Patient Safety, a national network of more than 80 children's hospitals in 34 states that partners with Child Health Patient Safety Organization (PSO), the nation's only PSO dedicated to the safety of hospitalized pediatric patients.

Division of Pediatric Cardiac Anesthesiology

First Row L-R: Scott Watkins, MD, Claudia Benkwitz, MD, PhD, Heidi Smith, MD, MSCI, *Second Row L-R:* Brian Donahue, MD, PhD, Alex Hughes, MD, Suanne Daves, MD

The Division of Pediatric Cardiac Anesthesiology, led by Suanne Daves, MD, was formed in 2007 to support the Children's Hospital. Children with heart defects represent a complex group of patients who often require intensive surgical repairs to thrive or even survive into adulthood. The Pediatric Heart Institute at the Children's Hospital is a high-volume regional referral center and is ranked 17th in *US News and World Report's* list of top hospitals in the care of pediatric patients with congenital heart disease.

Two new areas of focus for the division's quality improvement efforts are decreasing the incidence of early surgical re-intervention in the cardiac surgical patient and identifying effective strategies in the prevention of catheter-related venous thrombosis in the pediatric cardiac population.

Training pediatric anesthesiology fellows in the care of the critically ill child undergoing cardiac surgery or catheterization is a core mission of the division. Fellows spend two months on the cardiac service, and many elect to spend part of their training in the cardiac critical care unit.

Madolyn Miller; Sarah Miller;Warren Sandberg, MD, PhD, chairman; guest lecturer C. Dean Kurth, MD; Suanne Daves ,MD, vice-chair for Pediatric Anesthesiology; and Elizabeth Donner

Dr. James Phythyon Endowed Lectureship in Pediatric Anesthesiology

Since 2005, the Dr. James Phythyon Endowed Lectureship in Pediatric Anesthesiology has brought renowned experts in the field to Vanderbilt's campus as visiting professors. The lectureship was established by the family of Dr. James Phythyon, a founding member of the Pediatric Anesthesiology Division. Dr. Phythyon's widow, Mrs. Marlin Sanders, and the couple's daughters, Mary Neal Meador, Elizabeth Donner, and Sarah Miller, are strong supporters of the department. Each year, they attend the lecture and other events in honor of Dr. Phythyon. In 2015, C. Dean Kurth, MD, presented a well-received Grand Rounds lecture on "How to Improve Quality in Anesthesia."

Veterans Affairs Anesthesiology Service

The Veterans Affairs Anesthesiology Service has a rate of 90 percent for on-time first-case starts, and a day-of-surgery case cancellation rate of less than 1 percent. For the past five years, the area has achieved 100 percent compliance with all national performance measures.

First Row L-R: Jeffrey Waldman, MD, Rigoberto Sierra-Anderson, MD, Tracy McGrane, MD, Ann Walia, MBBS, Vidya Rao, MD, Pratik Pandharipande, MD
Second Row L-R: John Barwise, MD, Kevin Preece, MD, Michael Chester, MD, Amr Waly, MD, Ramanchander Pai, MD

The Veterans Affairs Anesthesiology Service is led by Ann Walia, MBBS. The division provides perioperative patient care services for more than 10,000 procedures annually at the Veterans Administration Medical Center in Nashville and the medical center at the Alvin C. York campus in Murfreesboro, Tennessee. These two facilities make up the core of the Tennessee Valley Healthcare System (TVHS), which also includes 11 community-based health clinics.

Areas of particular clinical interest in the division include airway management and ultrasound-guided regional anesthesia. The group also supports an active Pre-Anesthesia Evaluation Clinic, with an annual workload of more than 5,000 visits. The service also provides primary coverage for the VA Surgical Intensive Care Unit, acute and chronic pain management, and emergency airway management. This year, the Division initiated a Perioperative Care service for selected surgical services, with the goals of decreasing ICU and hospital length of stay, improving patient satisfaction and improving coordination of care. The Chronic Pain Management center is located at the Murfreesboro campus, and the team there provides a comprehensive set of services.

"Even though 80 percent of our surgical patients are classified as ASA3 and 4, our morbidity and mortality rate is lower than the national average," said Veterans Affairs Anesthesiology Service Chief Ann Walia, MBBS. "We have a great team here, and they work hard to provide excellent care to our veterans."

The TVHS Anesthesiology Service was one of the first in the nation to implement e-Consults for preoperative anesthesia evaluations. This initiative saves the patient's travel cost incurred by the VA, and decreases unnecessary testing. This has increased both patient and provider satisfaction. The TVHS has also been selected as a beta test site for the National Surgical Quality and Workflow Management initiative.

Certified Registered Nurse Anesthetists

Brent Dunworth is the newest member of the leadership team. Dunworth has received the Agatha Hodgins Award for outstanding nurse anesthesia student, the Pennsylvania Association of Nurse Anesthetists' Didactic Instructor of the Year Award, and the University of Pittsburgh School of Nursing's Outstanding Young Alumnus Award. Dunworth has lectured nationally on a variety of topics in nurse anesthesia, and has maintained clinical practice at the University of Pittsburgh Medical Center.

The Vanderbilt Department of Anesthesiology embraces the anesthesia care team approach to patient care, involving anesthesiologists and residents, certified registered nurse anesthetists (CRNAs), student registered nurse anesthetists (SRNAs), and anesthesia technicians. Brent Dunworth, MSN, MBA, APN, CRNA, leads the CRNA division.

The more than 120 CRNAs provide anesthesia for all types of surgical procedures, including cardiac, pediatrics, vascular, trauma, neurosurgery, plastics, radiologic, and special procedures. CRNAs administer general, regional, and monitored anesthesia care for scheduled and emergency surgical, obstetric, and diagnostic procedures.

CRNAs' key responsibilities include preoperative patient evaluation, management of the patient through completion of the operative procedure, safe transport of the patient to the recovery area, and assurance of the appropriate postoperative care. Additionally, CRNAs provide instruction and education for student nurse anesthetists (SRNAs). They also support the residency education mission by providing service coverage to allow residents to attend educational activities and participate in elective rotations. Thus, the CRNAs are essential to many core endeavors. In terms of personnel, the CRNA Division is the largest within the Department of Anesthesiology.

Vanderbilt is the primary clinical affiliate of the Middle Tennessee School of Anesthesia (MTSA) in Madison, Tennessee, which is the second largest nurse anesthesia program in the country. Vanderbilt is also a clinical affiliate for the Union University Nurse Anesthesia program in Jackson, Tennessee. Student nurse anesthetists assist in approximately 7,000 anesthetics per year while on Vanderbilt rotations.

The CRNA Division mirrors the VUMC operating room organization. CRNAs who serve in a lead or service specialist position facilitate communication with all members of the patient care team. In addition to SRNA training, the CRNA division has developed strong continuing education unit-eligible educational programs designed specifically for CRNAs.

Anesthesia Technicians

VUMC is staffed by 38 anesthesia technicians who contribute to safe, efficient anesthesia care by providing highly skilled assistance to anesthesiologists and nurse anesthetists at both on- and off-campus clinical locations.

Anesthesia Technicians

Education

We are committed, equipping future global leaders with the latest knowledge and skills.

"The complexity of cases taught by leading experts in anesthesia and innovative research opportunities make Vanderbilt an unparalleled program."

Daltry Dott, chief resident

The Office of Educational Affairs supports and oversees undergraduate medical education, graduate medical education for residents and fellows, and continuing education for faculty and advanced practice nurses. The extensive education and training programs offered by the Department of Anesthesiology prepare medical students, residents, fellows, nurses, and faculty for productive careers as clinicians, academicians, and scientists. We offer ACGME-accredited fellowships in Adult Cardiothoracic Anesthesiology, Anesthesiology Critical Care Medicine, Pain Medicine, Pediatric Anesthesiology, Obstetric Anesthesiology and Clinical Informatics. We also offer fellowships in Regional Anesthesiology and Global Anesthesiology.

Residents and fellows benefit from in-depth training in all subspecialty disciplines of clinical anesthesiology, critical care, and pain medicine. A full calendar of continuing medical education opportunities for faculty, residents, fellows, nurse anesthetists, and nurse practitioners is in place, including:

•Grand Rounds, which features leading experts from around the world;

•Mortality, Morbidity & Improvement (MM&I) Conferences, which focus on recent cases with the goal of improving patient care;

•ABA BASIC and ADVANCED EXAM Prep Series, which are designed to prepare CA-1s and CA2/3s, respectively, for their high-stakes exams as part of the sequence of board certification;

•Mock Oral Board Exams, which are given twice a year to CA1, 2, and 3 residents in order to prepare them for this portion of the ABA APPLIED exam;

•Simulation Training Program, which includes Milestone-based assessment in order to give residents training in rare, high-stakes events, as well as to prepare them for the OSCE portion of the APPLIED Exam;

•BH Robbins Scholar Program, which offers one-on-one mentorship and collaboration for aspiring physician-scientists preparing for careers as academic anesthesiologists;

•Faculty Development Seminars, which provide targeted training for professional development;

•Combined Integrative Health and Pain Medicine Quarterly Rounds, which focus on issues related to the management and treatment of pain.

We offer a wide-range of learning opportunities that parallels our excellent clinical training and development. As a result, the average score of Vanderbilt anesthesiology residents on in-training exams is in the 75-80th percentile when compared to the nation.

Office of Educational Affairs Faculty and Staff

First Row L-R: Michael Pilla, MD, Cindy Cannon, Joyce Speer, Robin Snyder
Second Row L-R: Debbie Nelson-Rouse, Leslie Fowler, MEd, Matt McEvoy, MD, Liz Hughes, MD, Danielle Brentson

Dr. Matt McEvoy has been selected as a member of the FAER (Foundation for Anesthesia Education and Research) Academy of Education Mentors in Anesthesiology. Dr. McEvoy is one of only 15 academy members and the first from the department.

Residents

The department's fully accredited residency program is highly sought after by the nation's top medical students. Proof of this is in the numbers: in the 2015 National Residency Match, the department received more than 800 applications for 18 positions.

Vanderbilt Anesthesiology's four-year residency program currently enrolls 18 resident physicians per year. Our physician educators are nationally and internationally recognized as leaders in their fields, and the department successfully supports residents interested in academic anesthesiology so they can develop careers focused on advancing knowledge in the specialty. The department typically has 25-30 residents who present original research and overviews of challenging cases at national meetings every year, a clear indication that the department's educational programs are creating physician-scholars who are prepared for medical practice, peer-education, and scientific investigation.

The department's educational program for residents and fellows consists of a combination of comprehensive didactic conferences, mentored clinical training by subspecialists in every domain of anesthesiology, simulation training, and self-study. Simulation training features prominently in the cognitive, procedural, and teamwork aspects of anesthesia education, and Vanderbilt University School of Medicine's Center for Experiential Learning and Assessment is a nationally renowned, on-campus resource for this training. The Accreditation Council for Graduate Medical Education (ACGME) core competencies form a framework for the training program, and a major curricular revision is underway that is targeting the new ACGME Milestones system, as well as the recent changes to the ABA Certification process.

The goal of ongoing curriculum development and revision in the Milestones era is to continue to achieve or exceed this level of academic achievement. Director of Educational Research and Curriculum Development Leslie Fowler, MEd, is overseeing the department's curriculum improvements. Among other projects, Leslie is working with the School of Medicine's VStar team to develop a "flipped classroom" model of learning for anesthesiology education. VStar is the school's new IT platform for learning management, launched in 2014. The flipped classroom is a learning environment in which course content is accessed by learners outside of the classroom, and classroom time is used for interactive projects and discussion. Once the flipped classroom is complete, anesthesiology residents at every level of training will have access to rotation-specific curriculum and learning modules 24 hours a day. Our faculty are also developing the same concept for nurse anesthetist training in East Africa.

Fellows

Building from the department's strength in subspecialties, seven clinical fellowships, as well as a research fellowship, are offered to individuals seeking advanced, focused training. The following clinical fellowships are offered at Vanderbilt:

The Anesthesia Summer Internship Program provides an opportunity for undergraduate and medical students to participate in research projects with our faculty. The program receives funding from FAER and NIH to support summer student interns and is a part of the NIH Short Term Training Program for Minority Students (STTP)

Adult Cardiothoracic Anesthesiology* – 3 fellows
Clinical Informatics-1-2 fellows*
Anesthesiology-Critical Care Medicine* – 10 fellows
Global Anesthesiology** – 1-2 fellows (first fellowship to be awarded in 2016)
Obstetric Anesthesiology* – 2 fellows
Pain Medicine* – 3 fellows
Pediatric Anesthesiology* – 4 fellows
Regional Anesthesiology** – 2 fellows

ACGME Accredited

***ACGME Accreditation not offered*

Advanced Practice Nurses

The Department of Anesthesiology has a unique partnership with the Vanderbilt University School of Nursing to offer an Acute Care Nurse Practitioner (ACNP) Intensivist track as part of the ACNP master's degree program. The program combines the didactic training of the School of Nursing's ACNP Program with supplemental specialty lectures in critical care medicine. Students perform their clinical rotations in seven of the Vanderbilt and VA ICUs. Students also receive additional exposure to ICU medicine through twice-monthly simulation sessions and weekly clinical case conferences, taught jointly by members of both faculties. Additional partnership programs between the Anesthesiology Department and the School of Nursing are being planned. Vanderbilt University Medical Center is one of the largest employers of nurse practitioners in the country, and the Division of Anesthesiology Critical Care Medicine has 35 Acute Care Nurse Practitioners who work in intensive care settings.

Nurse Anesthetists

The continuing education of more than 100 Certified Registered Nurse Anesthetists in the department is supported with recurring programs, including Grand Rounds and Mortality, Morbidity & Improvement (MM&I) Conferences. In addition, Vanderbilt is a primary clinical affiliate of the Middle Tennessee School of Anesthesia (MTSA) in Madison, Tennessee, and of the Union University Nurse Anesthesia program in Jackson, Tennessee. Student nurse anesthetists participate in approximately 7,000 anesthetics per year while on Vanderbilt rotations, and their on-campus training is coordinated by the Department of Anesthesiology.

The Center for Experiential Learning and Assessment (CELA)

CELA offers medical learners at all levels a simulation education on computerized, life-like mannequins. Participants get hands-on training in anesthesiology airway management, critical care, perioperative management, and transesophageal echocardiogram procedures.

CELA was endorsed by the American Society of Anesthesiologists (ASA) as one of approximately 40 centers in the nation officially approved to deliver certified educational programs. Anesthesiologists can receive continuing medical education (CME) simulation training at CELA that qualifies for American Board of Anesthesiology Maintenance of Certification in Anesthesiology (MOCA®) credit. To achieve the ASA endorsement, the CELA program met strict criteria, including having strong leadership and the necessary equipment, facilities, and personnel to provide consistent, effective training.

Maintenance of Certification in Anesthesiology (MOCA®)

MOCA® simulation courses are taught at Vanderbilt's Center for Experiential Learning and Assessment (CELA), where state of the art immersive patient simulation training is offered.

Arna Banerjee, MBBS, assistant dean for Simulation in Medical Education and Administration and associate professor of Anesthesiology, Surgery and Medical Education

Vanderbilt International Anesthesia Fundraiser

The annual Vanderbilt International Anesthesia Fundraiser draws together business and community leaders, students, faculty, staff and their families for an evening of food and festivities. The goal of the event is to raise funds to provide ongoing support for VIA in order to sustain resident and fellow involvement in global health and to allow for development of future initiatives.

One of the highlights during the 2015 auction at the VIA fundraiser was to give Dr. Alex Greene a haircut of choice. The highest bidder was Dr. Lee Parmley, who purchased the haircut for $6,000.00 Both Dr. Alex Greene *(left)* and Dr. Reid Phelps *(right)* , class of 2015 - are now Anesthesiology Critical Care Medicine fellows at Vanderbilt.

Building Safe Anesthesia Capacity Around the World

Mark Newton, MD, in Kijabe

According to the *World Journal of Surgery*, it is estimated that in rural areas of Kenya, there is only one anesthesiologist for every 13 surgeons. Vanderbilt's Department of Anesthesiology is commited to improving perioperative and anesthetic care in medically underserved regions of the world. The department is developing an interactive curriculum to train anesthesia providers who will practice in rural Kenya and other regions of the world.

ImPACT Africa (Improving Perioperative & Anesthesia Care and Training in Africa) is a sustainable training program that aims to improve perioperative outcomes related to surgical interventions through the ongoing training of skilled anesthesia providers. This program has a particular focus on improving maternal, infant, and trauma-related morbidity and mortality in the perioperative period.

As part of the ImPACT program, the department has received over $4 million in grant funding from the GE Foundation's Developing Health Globally program to support research in curriculum development and capacity-building in Kenya and other low-resource regions of the world. Dr. Mark Newton and Dr. Matt McEvoy serve as co-PIs.

Newton directs the Vanderbilt International Anesthesia (VIA) program and divides his time between being a pediatric anesthesiologist at Vanderbilt and serving as chief anesthesiologist for Kijabe Hospital in rural Kenya. Under his guidance, Vanderbilt anesthesiologists, residents, fellows, and nurse anesthetists in the training program travel to Kenya for training and educate medical staff in anesthesia and pain management services.

Vanderbilt Anesthesia Global Health and Development

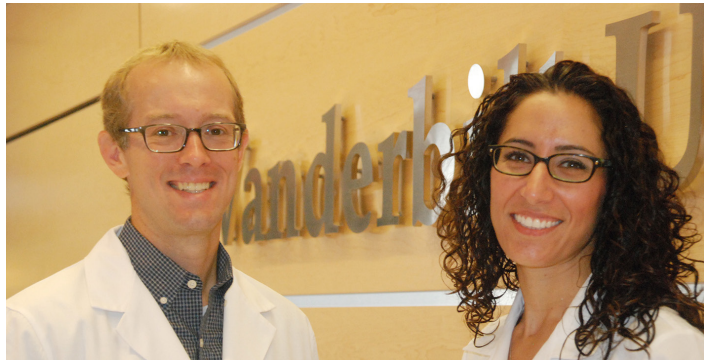
Dr. Kelly McQueen is director of Vanderbilt Anesthesia Global Health and Development and is the program director for the global anesthesiology fellowship. She is an internationally recognized expert and has ongoing research projects in Ethiopia and Mozambique. She recently participated in an Essential Surgery Chapter from the World Bank, the Lancet Commission on Global Surgery and the World Health Assembly, where a resolution on surgery and safe anesthesia was passed.

Kelly McQueen, MD, MPH, (*front center*) at the World Congress of Surgery, serves as president of the Alliance for Surgery and Anesthesia Presence.

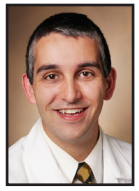
Drs. Jessica and Tucker Mudrick, 2015 graduates, in Kijabe Hospital with medical staff

Educational Research

The department is a national leader in rigorous educational research. Dr. Scott Watkins (APSF), Dr. Chris Cropsey (FAER), and Dr. Mary DiMiceli-Zsigmond (GE Foundation) all have grant-funded educational research investigating the use of decision support tools to improve team-based care delivery in high-stakes perioperative events in pediatric, general adult, and obstetric populations, respectively. Dr. Julian Bick (FAER) investigates the effect of near real-time feedback on the rate of competency acquisition in basic TEE. Dr. Bantayehu Sileshi (GE Foundation) focuses on the implementation of a novel perioperative data collection tool in low and middle income countries and the development of anesthesia curricula for nonphysician anesthesia providers.



Scott Watkins, MD and Mary DiMiceli-Zsigmond, MD



Left: Bantayehu Sileshi, MD
Center: Julian Bick, MD
Right: Chris Cropsey, MD

New Apps Improving Clinical Efficiency

Dr. Rajnish Gupta and Dr. Matthew McEvoy collaborated with the American Society of Regional Anesthesia and Pain Medicine (ASRA) to develop **smartphone apps** that provide guidelines for user-friendly and easily accessible apps for iOS and Android.

The entire ASRA guideline, which is published every five years, can now be downloaded as a PDF at any facility where Wi-Fi may not be available. Users can also get real time data on updates within the ASRA publication. The ASRA Coags app has had 7,000 downloads internationally.

Left: Rajnish Gupta, MD, assistant professor of Anesthesiology and associate director of the Adult Comprehensive Pain Service

Right: Matthew McEvoy, MD, vice-chair for Educational Affairs and associate professor of Anesthesiology

Research

We are creative, advancing the frontiers of science, healthcare and technology.

The vision of the Research Division, is to improve upon the department's currently successful program by fostering excellence, collaboration, and the development of young investigators in anesthesiology.

In federal fiscal year 2014, the Vanderbilt University School of Medicine (VUSM) ranked 10th among U.S. medical schools for National Institutes of Health (NIH) funding, and VUSM funding from all sources has more than doubled since 2001.

Investigators brought in more than $7.9 million in total extramural research funding. This includes more than $4.2 million in awarded NIH grants, which placed Vanderbilt Anesthesiology 8th among U.S. academic anesthesiology departments in NIH funding.

Within the department, faculty published 197 papers in 2015, up from 149 papers in fiscal year 2014, within peer-reviewed literature.

Anesthesia clincal research centers include Vanderbilt Anesthesiology Clinical Research Advisory Committee (VACRAC) and Vanderbilt Anesthesiology & Perioperative Informatics Research (VAPIR).

VACRAC reviews research protocols with a panel of experienced investigators. This process has improved the design and execution of clinical research projects, resulting in more rapid and effective study origination and completion.

VAPIR, led by Chief of the Informatics Research Division, Dr. Jonathan Wanderer, has strengthened internal communication and plays a vital role in providing superior perioperative care. The Division collaborates internally with colorectal surgeons to understand the relationship between interoperative hypothermia and surgical site infections.

The team also creates innovative techniques for efficient communication with clinicians to improve patient care. Through the development of automated email systems and dashboards, VAPIR has strengthened internal communication and plays a vital role in providing near real time feedback to clinicians to help them improve perioperative care.

The Vanderbilt Department of Anesthesiology has a strong, multifaceted approach to research, which can be viewed on the following pages. View more at www.vandydreamteam.com.

"A huge factor in my decision to come to Vanderbilt was the clinical research infrastructure, including the historical database, informatics experts, and the well-developed department research office."

Dr. Mark Rice, division chief, Multispecialty Adult Anesthesiology, and professor of Anesthesiology

Lab Research Advancing Medical Science

The annual Anesthesiology Research Symposium highlights the current research of clinical and translational investigators and basic scientists

The major focus of the Basic Science Research Division is the study of the physiology, pharmacology, and cell biology of ion channels, transporters, and receptors.

Multiple projects by investigators are heavily sponsored by the National Institutes of Health Molecular Libraries Probe Center Network. Work within the Research Division and core investigators include:

Dr. Frederic T. (Josh) Billings, IV, is focusing on mechanisms of surgery-induced organ injury, specifically the impact of perioperative oxidative damage on kidney, brain, and heart injury, and developing new therapy for perioperative organ injury in humans.

Dr. Stephen Bruehl has identified pain-related alterations in interacting cardiovascular-pain modulatory systems that contribute to enhanced pain responsiveness.

Dr. Kevin Currie, associate professor of Anesthesiology & Pharmacology, is currently investigating G protein-coupled receptors (including opioid and prostanoid receptors) and the serotonin transporter (an important target for antidepressants) control catecholamine secretion and the sympathoadrenal stress response.

Dr. Eric Delpire, chief of the Basic Science Research Division, utilizes genetically-modified mouse models and a variety of molecular techniques to investigate how neuronal Cl- transporters modulate inhibitory synaptic transmission and how renal Na+ transporters and associated proteins regulate salt reabsorption and blood pressure. The laboratory utilizes high throughput screening and protein modeling to identify novel compounds/drugs that target these transporters and regulators.

Dr. Jerod Denton, associate professor of Anesthesiology & Pharmacology Division of Research, is doing early-stage drug discovery for a family of potassium channels involved in renal, endocrine, cardiac, and brain function. The goal is to develop sharp pharmacological tools for exploring the integrative physiology and, ultimately, druggability of these channels.

Drs. Brad and Carrie Grueter are researching the neurobiology of addiction and reward-related behaviors.

Dr. Matthias Riess is investigating the mechanisms of cardio- and neuroprotection following cardiac arrest, myocardial infarction and stroke in various translationally relevant cell, isolated organ and animal models.

Dr. Andrew Shaw, chief of Cardiothoracic Anesthesiology, is researching common mechanistic factors leading to organ failure after cardiothoracic surgery.

Dr. Edward Sherwood, vice chair of Research, is studying several aspects of sepsis and the systemic inflammatory response syndrome, as well as burn injury.

Advancing Technology to Improve Patient Care

Vanderbilt Anesthesiology and Perioperative Informatics Research Division (VAPIR)

VAPIR is responsible for managing the Perioperative Data Warehouse (PDW), which contains full data from more than 880,000 procedures. The division collaborates internally and externally to strengthen its mission to improve patient care here and abroad. Students, residents and fellows can participate in seminars, journal clubs and a structured summer research training program. Experts in biomedical informatics and clinical research share their research at monthly seminars as visiting scholars. Among its many achievements, VAPIR has:

- Created the informatics backbone that launched the Vanderbilt Perioperative Surgical Home model of care delivery.

- Developed a suite of real-time data visualization tools, to enable clinicians to effortlessly view quality and performance metrics via automated email systems and online tracking dashboards.

- Enabled substantial reductions in surgical site infections and in institutional supply costs through cross-disciplinary collaborations.

VAPIR and Perioperative Informatics work beyond the walls of the operating room, advancing patient care through innovations in patient safety and quality. By integrating active research, state of the art technologies and clinical applications, VAPIR and Perioperative Informatics are advancing the frontiers of science and healthcare. Both have achieved measurable outcomes of success in patient care, infrastructure and educational programs. Faculty members engage with students through mentorship and training programs, equipping the next generation of professionals.

Jesse Ehrenfeld, MD, MPH, associate director of the Informatics Research Division, member American Medical Association (AMA) Board of Trustees, editor-in-chief of the *Journal of Medical Systems*, advisory board member SMART Health IT, representative to the Physician Consortium for Performance Improvement (PCPI), U.S. Navy Commander (reserve)

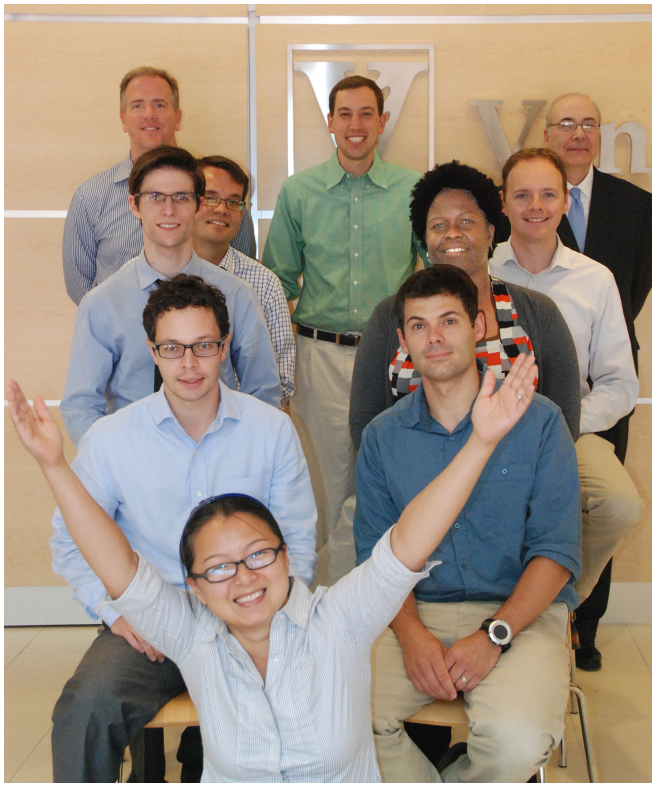
Dr. Jonathan Wanderer, MD, MPhil, chief of the Informatics Research Division, director of the Vanderbilt Preoperative Evaluation Center, Associate Medical Director, Perioperative Informatics

"Together, we have published more than one-hundred original peer reviewed articles as a result of work done by VAPIR*."*

Dr. Jesse Ehrenfeld and Dr. Jonathan Wanderer

"The interoperability within the institution is essential. Because we have such a large volume of Vanderbilt patients passing through our area, we see it as our vital mission to communicate data we collect to other care providers across the institution. Likewise, the availability of important care information when a patient receives care in the perioperative space is equally vital."

Dr. Brian Rothman



Left Row: Hongjuan Blazer, PhD , Max Terekhov, Frank Aline, Jon Wanderer, MD, Jay Hansen, *Center Back:* Jesse Ehrenfeld, MD, MPH, *Right Row:* Michael Plante, Karen McCarthy, Teus Kappen, MD, PhD, Damon Michaels

Brian Rothman, MD, associate professor of Anesthesiology and medical director of Perioperative Informatics at Vanderbilt University Medical Center, American Society of Anesthesiologists Electronic Media and Information Technology Chairperson, Society for Technology in Anesthesia President-Elect, and Health Information Management Systems Society Connected Health Committee Co-Chairperson

Perioperative Informatics, led by Dr. Brian Rothman, designs, develops, and implements enhancements to Vanderbilt's Perioperative Information Management System (VPIMS). Using health information technology solutions, the area supports best practice care and workflows to improve patient safety, care quality, efficiency, and communication through accurate and reliable real-time data acquisition and delivery.

Under Rothman's leadership, Perioperative Informatics has recently implemented web-based solutions for situational awareness (SAGA), postoperative anesthesia note documentation (PAV), intraoperative decision support, and the case board (eORBoard), which is due for release very soon. Perioperative nursing now uses electronic checklists to support perioperative Enhanced Recovery After Surgery (ERAS) protocols that are reducing lengths of stay. Perioperative Informatic's new Post Anesthesia Care Unit oriented case board was created in collaboration with bed management to deliver transparent, real time, patient status data for efficient enterprise-wide patient flow. Other collaborations include Integrated Presence and Bedside Monitoring that are bringing perioperative, real-time monitoring and decision support to the ICUs and to surgical patients on general care floors.

Shaping Tomorrow's Leaders through Mentorship

The VACRAC (Vanderbilt Anesthesiology Clinical Research Advisory Committee), in partnership with the Perioperative Clinical Research Institute, **supports new investigators** in developing clinical research projects that will lead to publication and, if possible, extramural funding. The committee oversees the development and conduct of industry-sponsored and investigator-initiated research by developing and managing essential research services and programs.

The committee:

• Mentors potential investigators throughout the research development process.

• Creates opportunities for ongoing learning about research methods, proposal writing, IRB applications, data management and analysis, and presentation/publication skills.

• Reviews new research proposals and regularly audits ongoing investigations for effectiveness and compliance with regulatory and safety guidelines.

VACRAC members are Edward Sherwood, MD, PhD (chair); Pratik Pandharipande, MD, MSCI (co-chair); Matt Shotwell, PhD (co-chair); Josh Billings, MD, MSCI; Brian Donahue, MD, PhD; Matthew McEvoy, MD; Damon Michaels; Andrew Shaw, MB, FRCA, FCCM, FFICM , Yandong Jiang, MD; Mark Rice, MD, and Matthew Weinger, MD.

Left-**Edward Sherwood,** MD, PhD, vice chair of Research, First Cornelius Vanderbilt Chair in Anesthesiology, associate examiner for the American Board of Anesthesiology, on editorial boards of *Anesthesia & Analgesia* and *Shock*, permanent member of the National Institutes of Health Surgery, Anesthesia and Trauma (SAT) Study Section and author of more than 70 peer-reviewed articles

Right-**Pratik Pandharipande**, MD, MSCI, division chief of Critical Care, president elect of The American Delirum Society, conference chair for 2016 for ADS 2016 meeting, co-director of Clinical and Tranaslational Immersion for Vanderbilt Medical Student Research

Center for Research and Innovation in Systems Safety

Front Row L-R: Ashley Clayton, Alyna Pradhan, George Malty, Matthew Weinger, MD, Carrie Reale, MSN, RN, Russ Beebe
Back Row L-R: Jason Slagle, PhD, Shilo Anders, PhD, Joseph Schlesinger, MD, Jayson Ingram, Daniel France, PhD, Andrew Kline

VUMC's Center for Research and Innovation in Systems Safety (CRISS), directed by Matthew B. Weinger, MD, is an institution-wide resource for human factors, usability, and systems engineering and design, located within the Department of Anesthesiology. CRISS is an integral part of Vanderbilt's Institute for Medicine and Public Health (IMPH), led by Robert Dittus, MD, MPH.

CRISS consists of anesthesiologists and PhD researchers who conduct basic and applied research in healthcare informatics, patient safety, and clinical quality; design, assess, and improve care processes, medical technology and electronic health record (EHR) user interfaces; and utilize state-of-the-art simulation facilities to test and analyze medical equipment and procedures. CRISS has other faculty and collaborators across Health Sciences and in the School of Engineering.

CRISS involvement with VUMC operational initiatives in quality improvement range from participating in the review and analysis of serious clinical events to re-engineering blood transfusion processes, improving clinician handovers, and enhancing compliance with perioperative time-outs and checklists.

CRISS faculty and staff are integrally involved in user interface design and evaluation for VUMC's Health IT program. CRISS is helping design several Vanderbilt Perioperative Information Management System (VPIMS) modules. CRISS conducts formal usability testing of VUMC software applications under development and of medical devices being considered for purchase.

"The commitment from the faculty and staff has far exceeded my expectations. The education I am getting has boosted my confidence and excites me about a future in anesthesiology."

Alyna Pradhan

CENTER FOR RESEARCH AND INNOVATION IN SYSTEMS SAFETY

In October 2014, CRISS, in partnership with faculty in the School of Engineering, was the recipient of a three-year Department of Energy grant to help older nuclear power plants improve their control room's usability and safety.

CRISS was also the recipient of one of only 50 pilot grants (out of 1,400 applicants) from the Patient Centered Outcomes Research Institute (PCORI).

Behind the Scenes Tours

PCRI Lab Tours are offered to anyone interested in what happens during the research process. Participants include VU faculty and staff and will soon open externally to the community. The tours include:

Dr. Edward Sherwood, who focuses on translational research in sepsis. He is planning a study that will test Interleukin-7 (IL-7) to see if it will reverse low absolute lymphocyte count (ALC), which is a marker of immunosuppression and which correlates with mortality.

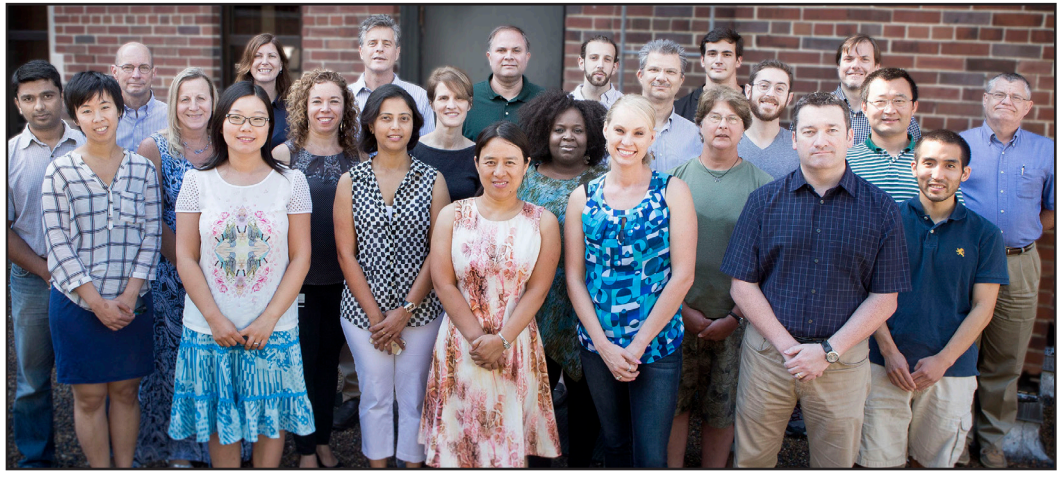
Steve Klintworth, RN, who provides demonstrations on how blood, urine and tissue are processed and prepared for analysis. This includes how a centrifuge is used, how blood smears are made and why blood collection tubes have different colored tops, etc.

Dr. Jerod Denton, recipient of a grant from the Gates foundation, who shares his research in locating new compounds that will kill insecticide resistant mosquitos.

Ray Johnson, who shares on his study of a human placental model and how drugs cross between the mother and a developing fetus.

Coined the deadliest animal in the world, the mosquito kills a child every 40 seconds through malaria, dengue and yellow fever

Research Faculty and Staff



First Row L-R: Olivia Liem, MD, PhD, Yin Guo, Dipanwita Ghose, PhD, Jingbin Wang, Julia Bohannon, PhD, Kevin Currie, PhD, Daniel Kashima *Second Row L-R:* Sujay Kharade, PhD, Kristie Lee, Carrie Grueter, PhD, Mary Beth Bauer, PhD, Christine Goldsberry, Michele Salzman, Liming Luan, PhD *Third Row L-R:* Edward Sherwood, MD, PhD, Melissa Chont, MLAS, Stephen Bruehl, PhD, Jerod Denton, PhD, Max Joffe, Matt Riess, MD, PhD, Brandon Turner, Ben Fensterheim, Brad Grueter, PhD, Eric Delpire, PhD

Perioperative Clinical Research Institute

First Row L-R: Kristie Lee, Susan Taylor, MSN, RN, Jennifer Morse, MS, CCRP, Gail Mayo, RN, CCRP, CIP, Brad Puckett, *Second Row L-R:* Travis Spain, CerAT,Steven Klintworth RN,CCRP, Damon Michaels, CCRP, Robin Hipes, Mary Hamilton Chestnut, APRN

The Perioperative Clinical Research Institute (PCRI) is led by Edward Sherwood, MD, PhD, and Damon Michaels. The division provides a full range of support services, including regulatory management, data management, contracts management, biostatistics, biomedical informatics, and financial oversight. The group also trains new investigators so they achieve their own funded research that leads to major publications. The end goal is stronger clinical research, with an eye toward publication in leading journals and changing practice.

Clinical research within the department includes both industry-sponsored and investigator-initiated clinical projects and focuses on the advancement of medical practice in the fields of perioperative care, chronic pain, and medical devices. Most of the department's investigators are practicing physicians who use their clinical expertise to develop research protocols that seek to answer clinically significant questions.

The PCRI oversees more than 114 active clinical trials, with many more studies in development. The team consists of highly trained and broadly experienced research professionals, including five research nurses, one research assistant, one clinical trials associate, one senior clinical trials associate, one senior regulatory specialist, and one administrative assistant.

Clinical Trials Research Director Damon Michaels was honored with the distinguished Five Pillar Leader Award for leadership in service, quality, growth/finance, innovation and the promotion of staff and faculty satisfaction and commitment.

"I treat every study patient as my own parent, sibling, aunt, uncle or child..."

Steven Klintworth, RN, CCRP, Research Nurse IV, Perioperative Clinical Research Institute

Key Clinical Research Studies

Bret Alvis, MD: Continuous Supraglottic pH Monitoring in Prolonged Intubated Intensive Care Patients and High Risk Aspiration Intraoperative Patients

Curtis Baysinger, MD: Effects of Tadalafil (Cialis), a Long-acting PDE5 Inhibitor, on the Human Fetoplacental Microcirculation: A Study Using the in Vitro, Dual-perfused, Single-isolated Cotyledon, Human Placental Model

Claudia Benkwitz, MD, PhD: Validation of the FORE-SIGHT Elite Tissue Oximeter in Pediatric Subjects for Cerebral and Somatic Applications

Frederic T. Billings, MD: The Effect of Maintaining Physiologic Oxygenation on Oxidative Stress During Cardiac Surgery

The Effect of Short-term Atorvastatin Use on Acute Kidney Injury Following Cardiac Surgery

A Phase II Multicenter, Parallel-group, Randomized, Double-blind, Proof-of-Concept, Adaptive Study Investigating the Safety and Efficacy of THR-184 Administered via Intravenous Infusion in Patients at Increased Risk of Developing Cardiac Surgery Associated-Acute Kidney Injury (CSA-AKI)

James L. Blair, DO: Does Continuous Perioperative Dexmedetomidine Infusion Reduce Time to Discharge in Patients Undergoing Major Lumbar Fusion? A Double-blind, Placebo-controlled Study

Peri-anesthetic Imaging of Cognitive Decline (PAICOD) – A Prospective Pilot Study

Clifford Bowens, MD: Comparison of Perineural Catheter Depth for the Continuous Popliteal Nerve Block Using Ultrasound Guidance and Dermabond

Jill Boyle, MD: Inhaled Nitrous Oxide for Labor: A Prospective, Randomized, Double-Blind Trial

Nathan Brummel, MD: ACT-ICU: Activity and Cognitive Therapy in the Intensive Care Unit

Christopher Canlas, MD: Perioperative Pulse Oximetry in Obstructive Sleep Apnea Patients in the Ambulatory Setting

Elizabeth Card, MSN, APRN, FNP-BC: Prevalence of Delirium in the Post Anesthesia Care Unit

A Randomized controlled trail of 2% chlorhexidine gluconate skin preparation cloths for the prevention of post op surgical site infections in spine patients

"A Survey Evaluating Burnout, Depression, Alcohol and Substance Use, and Social Support Among ASPAN members"

Michael Chi, MD: Reducing Serious Peripheral Intravenous Catheter Infiltrations Intraoperatively with Electronic Reminders

Katherine Dobie, MD: Ultrasound-guided Isolation and Blockade of the Upper Trunk for Shoulder Surgery: Time to Replace the Traditional Interscalene Approach?

Susan Eagle, MD: Measurement of the Pressures at Which Intravenous Fluids are Electromechanically Infused

Non-invasive device to compare peripheral venous pressure with standard invasive monitoring during resuscitation of hemorrhagic shock

Jesse M. Ehrenfeld, MD, MPH: Dynamic Data Visualization of Deidentified Data as a Clinical Support Tool

Usability of Novel Patient Data Visualizations Using Department of Defense and Civilian Medical Treatment Facility Data

Defining the Impact of Patients with High Utilization of Healthcare Services

Propofol, Race, and Ethnicity: Examining current dosing practices and their effects on patient outcomes

Risk Factors for Carotid Artery Puncture During Central Line Placement

Exploring the impact of hypokalemia on surgical and perioperative outcomes

Intraoperative Medications Associated with Clinically Significant Anaphylaxis

Genomics and Perioperative Medicine

Risk Factors for Postoperative Pneumonia

Preoperative Laboratory Testing

External validation of the Risk Quantification Index

Using Natural Language Processing to Identify LGBTI Patients in the VUMC EMR and determine how LGBTI status affects diagnosis, treatment, and health outcomes

Does Use of Non-depolarizing Neuromuscular Blocking Agents Predict Postoperative Respiratory Complications

Impact of Vigilance / VigiVu on Perioperative Throughput

Impact of Centralized Bed Management on OR Throughout

Impact of Attending Surgical Case Coverage on Perioperative Outcomes

Impact of On Time OR Starts on Workflow Perceptions

Incidence of Hypoxemia During Surgery & Anesthesia

Central line-associated bloodstream infections after landmark versus ultrasound guided placement

Prevalence of Red-Green Colorblind Healthcare Providers: A Pilot Study

Evaluation of Mobile Clinical Information System on Surgical Workflow

Impact of Diabetes Quality Improvement Protocol

Health Literacy and Perioperative Outcomes

Normothermia and The Risk of Surgical Site Infection

Awareness of Risk of Acute Lung Injury

Analysis of Operating Room Video Feed

A Retrospective Study Examining Progression of Anesthesia Resident's Skills

United States Critical Illness and Injury Trials Group (USCIITG) Informatics Working Group (IWG) Multicenter Performance Site (MPS)

Central Line Placement Under Ultrasound: Is Routine Chest X-ray Warranted?

Effect of A Novel Electronic Blood Ordering System on Patient Outcomes

Conscious Sedation Management with Mixed Patient Simulators

Preoperative Hyperglycemia in Undiagnosed Diabetics

Role of B Blockers in Stroke after Non-cardiac Surgery: An Observational Study from the Multicenter Perioperative Outcomes Group

Utility of the Surgical Apgar Score on Postoperative Outcomes in Pediatrics

Leslie Fowler, MEd: Ongoing Professional Performance Evaluation (OPPE) Using ACGME Six Core Competencies for Anesthesiology Residents

Anesthesiology Residency Program Testing Policy Survey

Andrew Franklin, MD:A Phase IV Study to Evaluate the Pharmacokinetics and Safety of Oxycodone Oral Solution in Pediatric and Adolescent Subjects

Stephen R. Hays, MD: An evaluation of the efficacy and safety of tapentadol oral solution in the treatment of post-operative

acute pain requiring opioid treatment in pediatric subjects aged from birth to less than 18 years old.

A Randomized, Placebo Controlled, Multi-Center Study of the Efficacy, Pharmacokinetics (PK) and Pharmacodynamics (PD) of Intravenous (IV) Acetaminophen for the Treatment of Acute Pain in Pediatric Patients

Multicenter Study of the Safety, Tolerability, Effectiveness, and Pharmacokinetics of Oxymorphone HCl Extended-Release Tablets in Pediatric Subjects Requiring an Around-the-Clock Opioid for an Extended Period of Time

Multisite RCT Comparing Regional and General Anesthesia for Effects on Neurodevelopmental Outcome and Apnea in Infants

Open-label, Non-randomized, Multicenter, Ascending Dose by Age, Single- and Multiple-dose Evaluation of the Effectiveness, Safety, and Tolerability of Oral Liquid Oxymorphone HCl Immediate-release Oral Liquid for Acute Postoperative Pain in Pediatric Subjects

Pediatric Anesthesia NeuroDevelopment Assessment Study (PANDAS)

Patrick Henson, DO: Study Evaluating the Expression of Effectors of Immune Tolerance and Associated Infectious Outcomes in Burn Patients

Antonio Hernandez, MD: Comparison of Endotracheal Intubation Over the Aintree via the I-gel and Laryngeal Mask Airway Supreme

Douglas Hester, MD: Cost Containment of Anesthetic-related Intra-operative Costs

King Vision Video Laryngoscope vs. Glidescope Video Laryngoscope: A Comparative Study in Ambulatory Surgery Center Patients

Michael Higgins, MD: Nasopharyngeal versus Nasal Cannula Oxygen Supplementation in Oral Surgery Patients

Marc Huntoon, MD: Controlled, Two-arm, Parallel Group, Randomized Withdrawal Study to Assess the Safety and Efficacy of Hydromorphone Hydrochloride Delivered by Intrathecal Administration Using a Programmable Implantable Pump

Phase 3, Open-Label, Single-Arm Study To Assess The Safety Of Hydromorphone Hydrochloride Delivered By Intrathecal Administration **Steve Klintworth, RN:** A Randomized Controlled Trial of 2% Chlorhexidine Gluconate Skin Preparation Cloths for the Prevention of Post-Operative Surgical Site Infections in Colorectal Patients

Avinash Kumar, MD: Risk Factors for New Onset Acute Kidney Injury Following Aneurysmal Subarachnoid Hemorrhage: A Single-center Retrospective Cohort Study.

A study comparing the results of a "question of the day" module with MCCKAP scores

Lorri Lee, MD: Moyamoya in Non-Asian North Americans

Letha Mathews, MBBS: The Effects of Dexmedetomidine and Remifentanil on Microelectrode Recordings During Deep Brain Stimulation Surgery: A Retrospective Analysis of the Vanderbilt Experience

Radiographically Measured Neck Motion During Intubation with MILS by Two Different Video Laryngoscopes

Matthew McEvoy, MD: Enhanced Recovery After Surgery in Colorectal Surgery: A Large-Scale Quality I mprovement Project

Assessment of Intraoperative Temperature and Postoperative Delirium in the HIPEC Surgical Population

Effect of a Cognitive Aid on Adherence to the American Society of Regional Anesthesia Guidelines for Management of Patients on Anticoagulation

Assessing the Reliability of Applicant Commitment Statements and How They Correlate to a Successful Match

Teaching CA-1 Anesthesia Residents by "Flipping the Classroom" Improves Knowledge Acquisition and Resident Satisfaction

Kelly McQueen, MD, MPH: Determining the Perioperative Mortality Rate in Low-income Countries

Impacting the Global Trauma Crisis: Pilot Study in Mozambique

The Global Burden of Pain Evaluation Proposal

Thanh Nguyen, MD: Pediatric Craniofacial Surgery Perioperative Registry (PCSPR)

What is the Prevalence of Vitamin D Deficiency Among Children Undergoing Posterior Spinal Fusion?

Brian O'Hara, MD: Procedures and Outcomes of Airway Management

A Survey Assessing the Comfort Level of Residents in Performing Emergency Airway Techniques, Cricothyrotomy, and Thoracoscopy Before and After ATLS Training

Edward Sherwood, MD, PhD: Baseline Quantitative Neuromuscular Monitoring in the PACU

The Impact of Quantitative Neuromuscular Monitoring in the PACU on Residual Blockade and Postoperative Recovery

A Study Evaluating Gene Expression Response to TLR4 Agonists

Chad Edward Wagner, MD: Multicenter Retrospective hTEE Review

Delirium and pain in the postoperative cardiac surgery patient: a retrospective review

Jonathan P. Wanderer, MD, MPhil: Evaluation of ACS NSQIP Surgical Risk Calculator Implementation in Preoperative Informed Consent Conversations

Monitoring and Improving Resident Duty Hours

A Retrospective Review "Take-Back" Surgeries in a Large Academic Center

Prediction models for acute lung injury

Perioperative Type and Screen: Utilization Patterns and Clinical Decision Support Performance

Prediction of Airway Management Difficulty from Patient Photographs

Perioperative Management and Neurological Outcomes for Thoracic and Thoracoabdominal Aortic Stent Grafting: A Case Series

Impact of GasChart Notifications on Anesthesia Provider Behavior

Vanderbilt Anemia Management Program for Preoperative Intervention, Research and Education: A Feasibility Study

Development and Validation of Prediction Models for Hospital Morbidity and Mortality

Evaluation of Electronic Screening Tools for Functional Status Assessment

Evaluation of Electronic Screening Tools for Preoperative Assessment
Perioperative Outcomes Awareness Project

Quantification of Variability in Anesthesia Residency Training

The Electronic Medical Record Habits of Highly Effective Anesthesia Residents

The Use of Electronic Pre-operative Notes

Sheena Weaver, MD: Characterizing Palliative Care Presence in Acute Stroke Patients Admitted to the Neurological & Neurosurgical ICU

Liza Weavind, MB BCh: Does Anemia Contribute to End-organ Dysfunction in ICU Patients?

Advancing Medical Education through Endowments

Special Lectureships & Awards

The department hosts special lectureships throughout the year and presents distinct recognitions to department members who have provided exemplary service to both their patients and colleagues.

Many of these are a direct result of philanthropic support from our alumni, as well as from current department members and other program supporters. Fortunately, such "seed" funding is provided by private donors, whose gifts materially improve the academic life of the Vanderbilt Department of Anesthesiology. These include:

Dr. James Phythyon Endowed Lectureship in Pediatric Anesthesiology

The Sandidge Pediatric Pain Management Endowed Fund

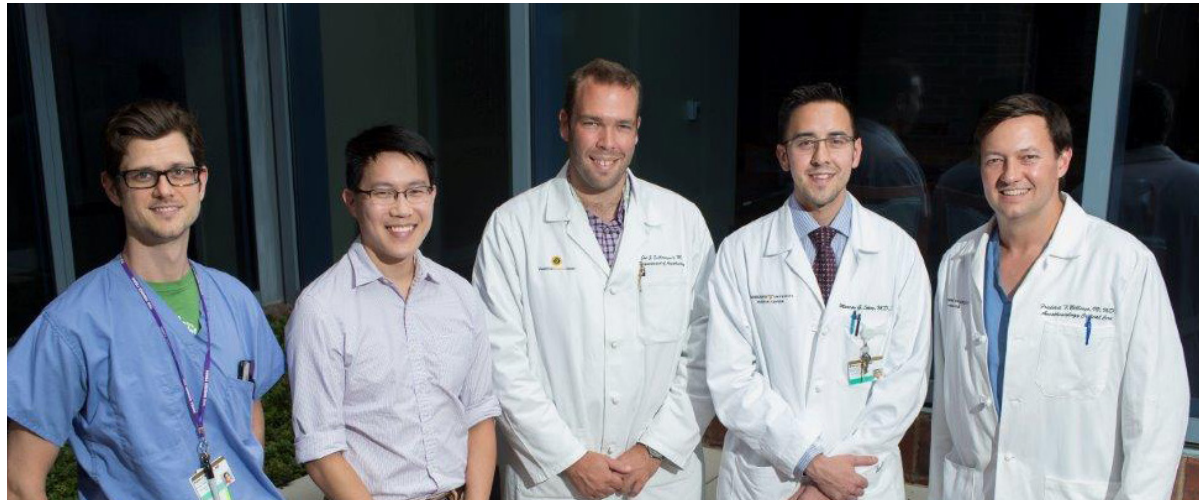
The Dila Vuksanaj Memorial Fund for Resident Education

Dr. Bradley E. Smith Endowed Lectureship on Medical Professionalism

Dr. Charles Beattie Endowed Lectureship

The Benjamin Howard Robbins Scholar Program

BH Robbins Scholars



Adam Kingeter, MD, Michael Chi, MD, Joseph Schlesinger, MD, Marcos Lopez, MD, Frederic T. (Josh) Billings, MD, MSCI

Building critical research skills under the mentorship of an established scientist helps prepare young investigators to eventually establish a vigorous, independently funded research program. With this goal in mind, the Benjamin Howard Robbins Scholar Program began in 2007 to support the professional development of young clinician-scientists within the department. The program is named in honor of the the department's first chairman, himself a renowned physician-scientist. The BH Robbins Scholar Program is multidisciplinary, encouraging and supporting mentorships and collaborations that extend far beyond the traditional boundaries of anesthesia.

"This program provides a unique mentored research experience for young scholars that culminates in a two-year multidisciplinary fellowship, with at least one year devoted to research," said Department Chair Warren Sandberg, MD, PhD.

"Our Robbins scholars benefit from one-on-one mentorship, a wealth of research and educational resources, protected research time, and a stipend during their residency and fellowship."

"Through these gifts, we are able to establish and strengthen programs, support innovative research endeavors, and advance the education and continued betterment of our faculty, staff, and students."

Dr. Warren Sandberg, department chair and professor of Anesthesiology, Surgery and Biomedical Informatics

Jerod Denton, PhD

The BH Robbins Scholar Program is co-directed by Jerod Denton, PhD, and Frederic T. (Josh) Billings, IV, MD, MSCI. Current scholars include:

Adam Kingeter, MD, (Scholar 2013-2019), who has developed a charge dashboard in collaboration with the VUMC Department of Finance that allows for the real-time tracking of expenses on any patient admitted to an intensive care unit. He is mentored by Chief of Staff of Vanderbilt University Hospital C. Lee Parmley, MD, JD, as well as members of the Department of Health Policy.

Marc Lopez, MD, MSCI, (Scholar 2014-2019), who is currently investigating the impact of intraoperative oxidative stress on postoperative endothelial dysfunction in patients randomized to hyperoxia or normoxia during cardiac surgery. Dr. Lopez is mentored by Josh Billings, MD, MSCI.

Joseph Schlesinger, MD, (Scholar 2011-2016), who is currently examining multisensory perceptual training, specifically improving unisensory pulse oximetry pitch perception and attentional load processing. Dr. Schlesinger is mentored by Mark Wallace, PhD, Director of the Vanderbilt Brain Institute, and Matthew Weinger, MD. Schlesinger has presented his work at the American Society of Anesthesiologists, the Society for Neuroscience, the American Society of Critical Care Anesthesiologists, and the American Medical Association. His original research articles have been published in *Anesthesiology* and *Anesthesia & Analgesia.*

Michael Chi, MD, (Scholar 2015-2019), who is currently studying the application of reactive oxygen species (ROS)-responsive microspheres for on demand anti-inflammatory therapy of neuropathic pain. Dr. Chi is mentored by Craig Duvall, PhD, Jerod Denton, PhD, Ronald Wiley, MD, PhD, and Edward Sherwood, MD, PhD.

Heidi Smith, MD, MSCI, a BH Robbins Scholar (2011-2016) and assistant professor of Anesthesiology, is the principal investigator of groundbreaking research on pediatric delirium. The initiative monitors children hospitalized in Pediatric Critical Care Units (PCCUs) for delirium. Dr. Smith is mentored by Pratik Pandharipande, MD, MSCI .

"I came to Vanderbilt as a resident and chose to stay on as faculty so I could continue to work with top experts in a number of disciplines, from critical care to neuroscience to global health to music cognition."

Dr. Joseph Schlesinger, assistant professor, Division of Anesthesiology Critical Care Medicine

Dr. James Phythyon Endowed Lectureship in Pediatric Anesthesiology

The lectureship was established by the family of Dr. James Phythyon, a founding member of the Pediatric Anesthesiology Division. Dr. Phythyon's widow, Mrs. Marlin Sanders, and the couple's daughters, Mary Neal Meador, Elizabeth Donner, and Sarah Miller, are strong supporters of the department.

The Sandidge Pediatric Pain Management Endowed Fund

Retired Vanderbilt anesthesiologist Paula C. Sandidge, MD, created The Sandidge Pediatric Pain Management Endowed Fund at Monroe Carell Jr. Children's Hospital at Vanderbilt in 2010 to recognize and encourage progress in pain management for children.

The Dila Vuksanaj Memorial Fund for Resident Education

Pediatric anesthesiologist Dila Vuksanaj, MD, practiced at Children's Hospital for 13 years, dedicating herself to her patients and to the hundreds of trainees who looked to her as a role model, mentor, and friend. Following her death in 2009, her family, including her husband Jacques Heibig, MD, founded the Dila Vuksanaj Memorial Fund for Resident Education.

Dr. Bradley E. Smith Endowed Lectureship on Medical Professionalism

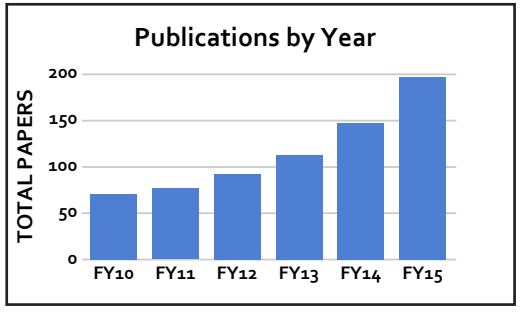
Former chairman Bradley E. Smith, MD, defined what it means to be a true professional, and in 2009 a lectureship on medical professionalism was established in his name by then Department Chairman Michael Higgins, MD. The goal of the lectureship is to reflect on the characteristics, responsibilities, and rewards of professionalism as applied to the practice of anesthesiology.

Dr. Charles Beattie Endowed Lectureship

Established by Dr. Warren Sandberg, the lectureship is intended to bring innovators in anesthesiology from unique backgrounds and compelling world views to Vanderbilt as visiting professors.

Spotlighting our Publications

Since 2010, the department has acheived accelerating growth in academic output, with total publications almost tripling from 69 in 2010 to 197 in 2015. The total number of publications increased from 149 in 2014 to 197 in 2015, a 32 percent increase.



"The number and quality of manuscripts that are being published reflect the department's productivity and visibility, with a steady growth in the past five years."

Dr. Eric Delpire, division chief, Basic Science Research, and professor of Anesthesiology, Molecular Physiology and Biophysics

Selected Publications, 2014-2015

Peer-reviewed Original and Review Articles

Agarwal HS, Wolfram KB, Saville BR, **Donahue BS,** Bichell DP: Postoperative complications and association with outcomes in pediatric cardiac surgery. J Thorac Cardiovasc Surg 2014; 148:609-16.e1

Allen BF, Sandberg WS: Assessment Tools: Searching for Purpose. Reg Anesth Pain Med 2015; 40:299-300

Alvis BD, **Hester D,** Watson D, **Higgins M, St. Jacques P:** Randomized controlled trial comparing the McGrath MAC video laryngoscope with the King Vision video laryngoscope in adult patients. Minerva Anestesiol 2015 Apr 18 [Epub]

Alvis BD, King AB, Hester D, Hughes CG, Higgins M: Randomized controlled pilot trial of the Rigid and Flexing Laryngoscope versus the fiber-optic bronchoscope for intubation of potentially difficult airway. Minerva Anestesiol 2014

Andresen JM, Girard TD, **Pandharipande PP,** Davidson MA, Ely EW, Watson PL: Burst suppression on processed electroencephalography as a predictor of postcoma delirium in mechanically ventilated ICU patients. Crit Care Med 2014; 42:2244-51

Ashby N, Squiers J: A historical perspective on the development of modern concepts of tissue perfusion: prehistory to the twentieth century. Crit Care Nurs Clin North Am 2014; 26:297-309

Austin TM, Lam HV, Shin NS, Daily BJ, Dunn PF, **Sandberg WS:** Elective change of surgeon during the OR day has an operationally negligible impact on turnover time. J Clin Anesth 2014; 26:343-9

Austin TM, Nannemann DP, Deluca SL, Meiler J, **Delpire E:** In silico analysis and experimental verification of OSR1 kinase - Peptide interaction. J Struct Biol 2014; 187:58-65

Avilucea FR, Sathiyakumar V, Greenberg SE, Ghiam M, Thakore RV, Francois E, Benvenuti MA, Siuta M, Smith AK, **Ehrenfeld JM**, Evans JM, Obremskey WT, Sethi MK: Open distal tibial shaft fractures: a retrospective comparison of medial plate versus nail fixation. Eur J Trauma Emerg Surg 2015 Mar [Epub]

Bartos JA, Matsuura TR, Sarraf M, Youngquist ST, McKnite SH, Rees JN, Sloper DT, Bates FS, Segal N, Debaty G, Lurie KG, Neumar RW, Metzger JM, **Riess ML,** Yannopoulos D: Bundled postconditioning therapies improve hemodynamics and neurologic recovery after 17 min of untreated cardiac arrest. Resuscitation 2015; 87:7-13

Bateman BT, **Sandberg WS:** In response. Anesth Analg 2014; 119:1452

Baucom RB, Phillips SE, **Ehrenfeld JM,** Holzman MD, Nealon WH, Sharp KW, Kaiser JL, Poulose BK: Defining intraoperative hypothermia in ventral hernia repair. J Surg Res 2014; 190:385-90

Baucom RB, Phillips SE, **Ehrenfeld JM,** Muldoon RL, Poulose BK, Herline AJ, Wise PE, Geiger TM: Association of Perioperative Hypothermia During Colectomy With Surgical Site Infection. JAMA Surg 2015; 150:570-5

Baysinger CL: Accidental dural puncture and postdural puncture headache management. Int Anesthesiol Clin 2014; 52:18-39

Bennett JM, Estrada JC, Shoemaker MB, **Pretorius M:** Twinkling Artifact Associated with Guidewire Placement. Anesth Analg 2015; 121:69-71

Bennett JM, Pretorius M, Ahmad RM, **Eagle SS:** Hemodynamic instability in patients undergoing pulmonary embolectomy: institutional experience. J Clin Anesth 2015; 27:207-13

Bennett KA, Carroll MA, Shannon CN, Braun SA, Dabrowiak ME, Crum AK, **Paschall RL,** Kavanaugh-McHugh AL, Wellons JC, 3rd, Tulipan NB: Reducing perinatal complications and preterm delivery for patients undergoing in utero closure of fetal myelomeningocele: further modifications to the multidisciplinary

surgical technique. J Neurosurg Pediatr 2014; 14:108-14

Benzon HT, **Huntoon MA,** Rathmell JP: Improving the safety of epidural steroid injections. JAMA 2015; 313:1713-4

Billings FT 4th, Petracek MR, Roberts LJ, 2nd, **Pretorius M:** Perioperative intravenous acetaminophen attenuates lipid peroxidation in adults undergoing cardiopulmonary bypass: a randomized clinical trial. PLoS One 2015; 10:e0117625

Billings FT 4th, Shaw AD: Clinical trial endpoints in acute kidney injury. Nephron Clin Pract 2014; 127:89-93

Brown Z, Edworthy J, Sneyd JR, **Schlesinger J:** A comparison of linear and logarithmic auditory tones in pulse oximeters. Appl Ergon 2015; 51:350-7

Bruehl S, Burns JW, Passik SD, **Gupta R,** Buvanendran A, **Chont M,** Schuster E, Orlowska D, France CR: The Contribution of Differential Opioid Responsiveness to Identification of Opioid Risk in Chronic Pain Patients. J Pain 2015; 16:666-75

Bruehl S: Personalized pain medicine: pipe dream or reality? Anesthesiology 2015; 122:967-8

Bulka CM, Shotwell MS, **Gupta RK, Sandberg WS, Ehrenfeld JM:** Regional anesthesia, time to hospital discharge, and in-hospital mortality: a propensity score matched analysis. Reg Anesth Pain Med 2014; 39:381-6

Burns JW, Gerhart JI, **Bruehl S,** Peterson KM, Smith DA, Porter LS, Schuster E, Kinner E, Buvanendran A, Fras AM, Keefe FJ: Anger arousal and behavioral anger regulation in everyday life among patients with chronic low back pain: Relationships to patient pain and function. Health Psychol 2015; 34:547-55

Carayon P, Wetterneck TB, Alyousef B, Brown RL, Cartmill RS, McGuire K, Hoonakker PL, **Slagle J,** Van Roy KS, Walker JM, **Weinger MB,** Xie A, Wood KE: Impact of electronic health record technology on the work and workflow of physicians in the intensive care unit. Int J Med Inform 2015; 84:578-94

Card E, **Pandharipande P,** Tomes C, Lee C, Wood J, Nelson D, Graves A, Shintani A, Ely EW, **Hughes C:** Emergence from general anaesthesia and evolution of delirium signs in the post-anaesthesia care unit. Br J Anaesth 2014

Chawla LS, Ince C, Chappell D, Gan TJ, Kellum JA, Mythen M, **Shaw AD:** Vascular content, tone, integrity, and haemodynamics for guiding fluid therapy: a conceptual approach. Br J Anaesth 2014; 113:748-55

Chester SD, **Ehrenfeld JM**, Eckstrand KL: Results of an institutional LGBT climate survey at an academic medical center. LGBT Health 2014; 1:327-30

Ching CB, **Hays SR,** Kaffenberger SD, Stephany HA, Luckett TR, Clayton DB, Tanaka ST, Thomas JC, Adams MC, Brock JW, 3rd, Pope JC 4th: Pediatric chronic orchialgia: patient population and patterns of care. J Pediatr Urol 2014; 10:799-803

Ching CB, **Hays SR,** Luckett TR, Mason MD, Clayton DB, Tanaka ST, Thomas JC, Adams MC, Brock JW, 3rd, Pope JC 4th: Interdisciplinary pain management is beneficial for refractory orchialgia in children. J Pediatr Urol 2015; 11:123 e1-6

Coletta C, Modis K, Olah G, Bruyanszki A, Herzig D, **Sherwood E,** Ungvari Z, Szabo C: Endothelial dysfunction is an independent contributor and predictor of multiple organ failure and mortality in aged mice subjected to septic shock: preclinical studies in a murine model of cecal ligation and puncture. Critical Care 2014; 18:511

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Achievements through Collaboration

Susan Eagle, MD, along with biomedical engineer Franz Baudenbacher, PhD, have founded InvisionHeart, one of 10 finalists for **Google's Demo Day**. InvisionHeart received a $100,000 equity commitment from AOL co-founder Steve Case for a product that uses mobile devices to transmit cardiac data.

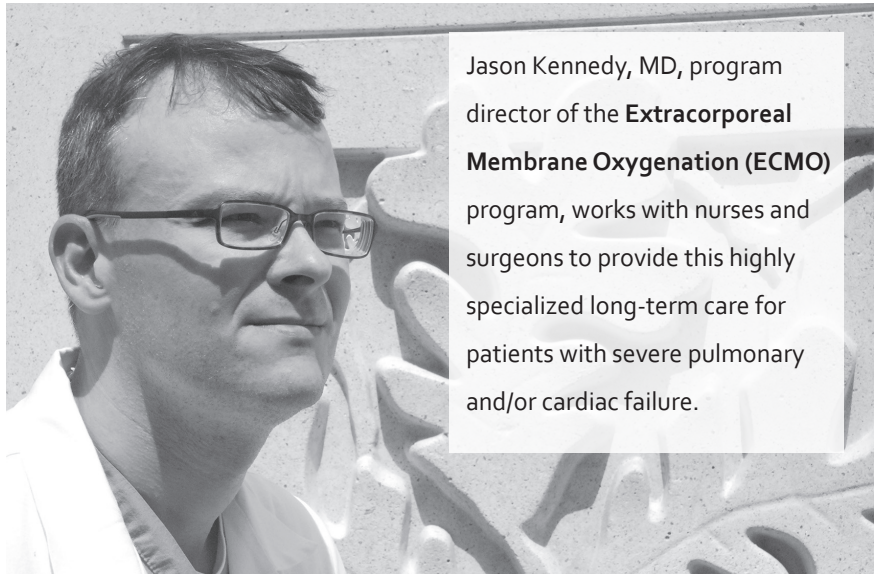
Susan Eagle, MD, associate professor of Anesthesiology
Division of Cardiothoracic Anesthesiology

Vikram Tiwari, PhD, MBA, **program chair** of the Institute for Operations Research and the Management Sciences (INFORMS) 2015 healthcare conference, collaborated with leadership within Vanderbilt University Medical Center and Vanderbilt Owen Graduate School of Management. The conference had participants from 16 countries and 450 abstracts/posters/panels.

Vikram Tiwari, PhD, MBA, director of Surgical Business Analytics, assistant professor of Anesthesiology and Biomedical Informatics

Liza Weavind, MB, BCh, MMHC, clinical leader of multidisciplinary teams, led two **remote bedside monitoring programs** - Integrated Presence and Bedside Monitoring. Both offer real-time clinical information, early recognition and preemptive intervention to mitigate complications and improve patient outcomes.

Liza Weavind, MB, BCh, associate professor of Anesthesiology
Division of Anesthesiology Critical Care Medicine



Jason Kennedy, MD, program director of the **Extracorporeal Membrane Oxygenation (ECMO)** program, works with nurses and surgeons to provide this highly specialized long-term care for patients with severe pulmonary and/or cardiac failure.

Jason Kennedy, MD, assistant professor of Clinical Anesthesiology
Division of Anesthesiology Critical Care Medicine

Recognizing our Leadership

First Row L-R: Edward Sherwood, MD, PhD, Eric Delpire, PhD, Renuka Christoph, MBA, Ann Walia, MBBS, Lorri Lee, MD, William Furman, MD, Matthew Weinger, MD, Pratik Pandharipande, MD, MSCI, Brian Rothman, MD and Jonathan Dulong, MBA
Back Row L-R: Brent Dunworth, MSN, MBA, RN, CRNA, David Chestnut, MD, Matthew McEvoy, MD, Katherine Dobie, MD, Andrew Shaw, MB, FRCA, FCCM, FFICM, Suanne Daves, MD, Mark Rice, MD, Jonathan Wanderer, MD, Warren Sandberg, MD, PhD and Stephen Doherty, MMHC

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David Chestnut, MD
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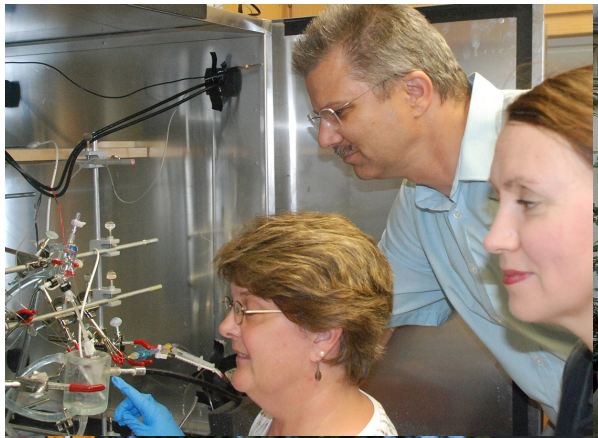

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