

# 2021-2022 DEPARTMENT PROFILE



## DEPARTMENT OF ANESTHESIOLOGY

VANDERBILT  UNIVERSITY

MEDICAL CENTER

# Table of Contents

## Message from the Chair

PAGE 4

---

## Leadership

PAGE 5

---

## About VUMC and Nashville

PAGE 6

---

## About the Department

PAGE 7

---

## Clinical Care

PAGE 8

---

## Education

PAGE 22

---

## Research

PAGE 28

---

## Office of Anesthesiology Faculty Affairs

PAGE 40

---

## Publications

PAGE 44





**Clinical Care**

**Education**

**Research**

# Message from the Chair



Thank you for your interest in the Vanderbilt University Medical Center Department of Anesthesiology. Our growth and success stem from Vanderbilt University Medical Center's five-pillar commitment to excellence: people, service, quality, growth & finance, and innovation. Vanderbilt's credo drives 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 the role of the anesthesiologist evolves into that of a perioperative consultant, our diverse team of experts remains at the forefront of knowledge and technology in patient care, research and education.

Our values—compassion, creativity, commitment and collaboration—are the keystones of our structure and systems. You will see evidence of this throughout this guide. Our patients are recovering faster and with greater comfort through implementation of Enhanced Recovery After Surgery (ERAS) protocols, a collaborative effort led by our faculty, trainees and surgical colleagues. Our informatics infrastructure uses innovative data analyses to increase patient safety and clinician effectiveness.

COVID-19 has prompted many changes across the medical center. Despite all that is happening, Vanderbilt University Medical Center is dedicated to maintaining the same groundbreaking and outstanding care that our patients depend upon. And we are more committed than ever to all the extra missions that distinguish academic medical centers from other hospitals – education, discovery and leadership. That is a lot to ask, but I know we will not fail our patients. I have never been prouder to be the chair of our great department.

Our investigators brought in more than \$10 million in total extramural research funding in 2020-2021, including more than \$7.1 million in awarded NIH grants—placing Vanderbilt Anesthesiology 11th among U.S. academic anesthesiology departments for NIH funding. The department's research productivity, determined by publication in peer-reviewed journals, grant dollars and ongoing research studies, continues to be strong. Thirty-six members of the department have been elected into the Association of University Anesthesiologists (AUA).

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 clinical training and experience with a broad range of academics.

Our success can be attributed to the collaboration that occurs across Vanderbilt University Medical Center and beyond. Our clinical teams participated in more than 102,000 patient encounters last year; caring for patients along their journey to wellness within and 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 that bring our expertise to more patients.

I invite you to peruse this guide and visit [www.vumc.org/anesthesiology](http://www.vumc.org/anesthesiology) to learn more about our programs.

*Warren Sandberg MD PhD*

*Chair, Department of Anesthesiology  
Vanderbilt University Medical Center  
Chief of Staff, Vanderbilt University Adult Hospital  
Professor of Anesthesiology, Surgery and Biomedical Informatics  
Vanderbilt University School of Medicine*



# Leadership

## Executive Committee



Brian J. Gelfand, MD  
Associate Vice Chair,  
Educational Affairs



Matthew McEvoy, MD  
Vice Chair,  
Educational Affairs



Pratik Pandharipande,  
MD, MSCI  
Vice Chair, Faculty Affairs;  
James Tayloe Gwathmey  
Director in Anesthesiology



Mark Rice, MD  
Executive Vice Chair,  
Anesthesiology



Amy Robertson, MD  
Vice Chair, Clinical Affairs



Edward Sherwood,  
MD, PhD  
Vice Chair, Research;  
Cornelius Vanderbilt  
Chair in Anesthesiology



Stephen Doherty, MMHC  
Department Administrator

---

## Division Chiefs



Jeanette Bauchat, MD, MS  
Chief, Obstetric  
Anesthesiology



Christopher Canlas, MD  
Chief, Ambulatory  
Anesthesiology



Eric Delpire, PhD  
Director, Basic Science  
Research;  
BH Robbins Director in  
Anesthesiology Research



Brent Dunworth, CRNA,  
DNP, MBA  
Chief CRNA; Director,  
Advanced Practice,  
Anesthesiology



David A. Edwards, MD, PhD  
Chief, Pain Medicine



Robert Freundlich, MD,  
MS, MSCI  
Chief, Informatics  
Research Division



Christopher Hughes,  
MD, MS, FCCM  
Chief, Anesthesiology  
Critical Care Medicine



Bevan Londergan, MD  
Chief, Pediatric  
Cardiac Anesthesiology



Letha Mathews, MBBS  
Chief, Neuroanesthesiology



Michael Pilla, MD  
Chief, Multispecialty Adult  
Anesthesiology



Mias Pretorius,  
MBChB, MSCI  
Chief, Cardiothoracic  
Anesthesiology



Srijaya Reddy, MD, MBA  
Chief, Pediatric  
Anesthesiology



Ann Walia, MBBS  
Chief, Veterans Affairs  
Anesthesiology Service

# About VUMC and Nashville



VUMC NAMED ONE OF BECKER'S HEALTHCARE  
**100 GREAT HOSPITALS**  
IN AMERICA

---

VUMC NAMED A  
**LEADER IN LGBTQ**  
**HEALTHCARE EQUALITY**  
BY THE HUMAN RIGHTS CAMPAIGN  
HEALTHCARE EQUALITY INDEX

---

MONROE CARELL JR. CHILDREN'S HOSPITAL  
AT VANDERBILT NAMED A  
**TOP PEDIATRIC FACILITY**  
BY U.S. NEWS & WORLD REPORT

---

VUMC NAMED ONE OF THE  
**BEST EMPLOYERS**  
**FOR NEW GRADUATES**  
BY FORBES MAGAZINE

---

MORE THAN  
**39,000**  
SURGICAL PROCEDURES AT VUMC ANNUALLY

---

MORE THAN  
**24,000**  
VUMC EMPLOYEES



Nashville's history of country music has earned the city its fame as Music City, USA – but this metropolis is about more than tunes and twang. Visitors and residents enjoy great dining, entertainment and cultural life. Nashville typically enjoys a mild and pleasant climate, with only a few days a year having either very hot or very cold conditions and most rainfall occurring in the spring months.

---

NASHVILLE RANKED #17 FOR  
**BEST PLACES TO LIVE**  
**IN THE UNITED STATES**  
BY U.S. NEWS & WORLD REPORT

---

NASHVILLE RANKED #3 IN LIST OF  
**SOUTH'S BEST CITIES**  
BY SOUTHERN LIVING

---

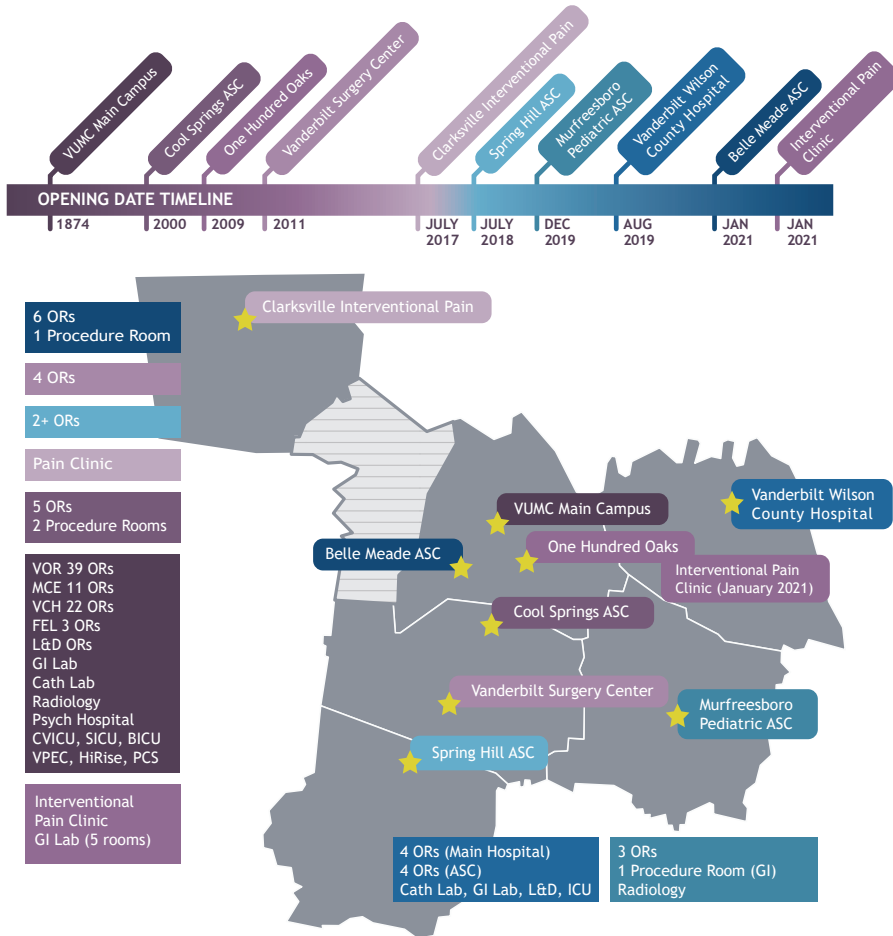
A GROWING POPULATION OF  
**1.9 MILLION**  
IN METROPOLITAN STATISTICAL AREA

---

NASHVILLE INTERNATIONAL AIRPORT IS A  
**SOUTHWEST**  
**AIRLINES HUB**  
MAKING TRAVEL CONVENIENT  
AND AFFORDABLE



# About the Department



## CRNAs

+ FY18 137  
+ FY21 209

## FACULTY

+ FY18 142  
+ FY21 161

## HOUSESTAFF

+ FY18 99  
+ FY21 108

## STAFF

+ FY18 78  
+ FY21 89

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, clinical 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.



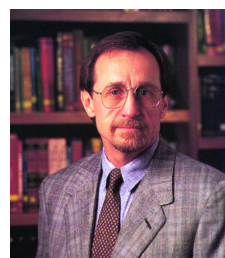
Dr. Benjamin H. Robbins  
1946-1961



Dr. Charles B. Pittinger  
1962-1969



Dr. Bradley E. Smith  
1969-1993



Dr. Charles Beattie  
1994-2001



Dr. Jeffrey R. Balsler  
2001-2004



Dr. Michael S. Higgins  
2004-2010



# CLINICAL CARE





Serving in one of the largest clinical programs in the nation, Vanderbilt University Medical Center Department of Anesthesiology's clinicians provide procedural, critical care, pain management and all perioperative anesthesia services for more than 102,000 adult and pediatric patient encounters annually at more than 100 anesthetizing locations. Of these, more than 8,500 patients are seen annually in the Vanderbilt Interventional Pain Clinic, and approximately 25,000 Vanderbilt adult and pediatric patients receive anesthetic care during a radiologic, gastrointestinal, interventional 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 and five adult intensive care units. All surgical specialties are represented, including adult and pediatric cardiac surgery, organ transplantation, robotic surgery, neurosurgery, and high-risk obstetrics. Anesthetics are provided by one of our highly skilled trainees or CRNAs under the direction of an anesthesiologist. We deliver the highest quality care in a safe and effective manner according to the Anesthesia Care Team model, using the unique skills of all team members.

Members of our department actively participate in the multidisciplinary perioperative care of complex patient populations, including trauma and organ transplantation. VUMC provides trauma care for patients within 80,000 square miles and manages close to 8,000 acute trauma cases, admitting 4,700 of those annually. Last year approximately 800 patients were transferred directly to the OR from the emergency department to receive care for their acute traumatic injuries. Performing 611 solid organ transplants in 2020 and more than 10,000 since 1962, VUMC ranks as the nation's sixth largest transplant program by volume.

The Vanderbilt Preoperative Evaluation Center (VPEC) offers preoperative evaluation before patients undergo procedures at VUMC. VPEC faculty, nurse practitioners and staff perform comprehensive preoperative assessment, including interfacing with primary care physicians, specialist consultants and surgeons, while also making direct decisions regarding preoperative testing. Offering both in-person and telehealth visits, the number of VPEC encounters exceeds 15,000 annually.

Launched in July 2019, the Department of Anesthesiology Hi-RiSE (High-Risk Surgical Encounter) Service focuses on providing personalized, evidence-based perioperative medical care, from preoperative evaluation and optimization of underlying comorbidities to postoperative recovery, for patients at the highest risk of perioperative morbidity and mortality.

As the role of the anesthesiologist evolves into that of a perioperative consultant, our diverse team of experts remains at the forefront of knowledge and is fully engaged in patient care, from diagnosis to operative recovery. A full-time perioperative teaching service is available 24/7 for consultation, utilizing 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.

Each of our anesthesiologists is a member of one of our nine divisions, with many providing care in a secondary division. Our divisions include ambulatory anesthesiology, anesthesiology critical care medicine, cardiothoracic anesthesiology, neuroanesthesiology, multispecialty adult anesthesiology, obstetric anesthesiology, pain medicine, pediatric anesthesiology, and pediatric cardiac anesthesiology. ♦

**9,000**  
IN-PERSON VPEC VISITS  
IN 2020

**4,100**  
REGISTERED NURSE PHONE  
CALL VPEC VISITS IN 2020

**2,700**  
NURSE PRACTITIONER PHONE  
CALL VPEC VISITS IN 2020

**3,000**  
Hi-RiSE VISITS ANNUALLY

**611**  
SOLID ORGAN TRANSPLANTS  
IN 2020

**10,000+**  
SOLID ORGAN TRANSPLANTS  
SINCE 1962

**161**  
FACULTY IN THE DEPARTMENT

**209**  
CRNAs IN THE DEPARTMENT

**72**  
RESIDENTS IN  
THE DEPARTMENT

**30**  
FELLOWS IN  
THE DEPARTMENT

# Ambulatory Anesthesiology

Division Chief: Christopher Canlas, MD

The faculty members and nurse anesthetists who make up the Division of Ambulatory Anesthesiology practice in several locations, including Cool Springs Surgery Center, Spring Hill Surgery Center, Vanderbilt Outpatient Surgery, Vanderbilt Surgery Center-Franklin, and the newest addition – Vanderbilt Health Belle Meade (VHBM), which opened in January 2021. Located in West Nashville, VHBM consists of seven operating rooms, featuring orthopedic and urologic surgeries. It has four extended recovery bays allowing for overnight observation. VHBM is one of the few surgery centers in Middle Tennessee routinely performing outpatient total joint surgery. The state-of-the-art facility also includes the first lithotripsy laser operating room table in the United States, the third in North America.

The Ambulatory faculty members are actively involved in the Society for Ambulatory Anesthesia (SAMBA) through committee service and presentation of abstracts at the society's annual meetings. Our Ambulatory Surgery Center Medical Directors also participate in the Association of Anesthesia Clinical Directors (AACD). Their abstract

describing a scheduling tool for Ambulatory Anesthesia won second place at the Spring AACD 2021 meeting.

Resident and fellow education are important missions of the division. Two regional anesthesia fellows spend a combined 32 weeks with the Ambulatory Division refining their procedural skills. They also help train two residents a month who learn a combination of nerve blocks – both single shot and catheter placement. As health care systems push traditional in-house surgeries like total knee replacements to outpatient surgery centers, our trainees learn how multimodal analgesia featuring regional anesthesia can allow for same-day discharge.

Outpatient surgery is often preferred to inpatient surgery for a variety of reasons. Lower costs and convenience are often popular advantages for the patient. The Ambulatory Division is committed to providing high quality patient care in an efficient ambulatory surgery center environment. In addition, it seeks to be a national leader in establishing Enhanced Recovery After Surgery (ERAS) protocols to streamline care for both its orthopedic and urologic patients. ♦



**23,000**  
AMBULATORY PROCEDURES

.....

**4,000+**  
PERIPHERAL NERVE BLOCKS ADMINISTERED

All stats based on annual numbers





# Anesthesiology Critical Care Medicine

**Division Chief: Christopher Hughes, MD, MS, FCCM**  
**Associate Chief: Liza Weavind, MBBCh, MMHC**

## Clinical

The Division of Anesthesiology Critical Care Medicine (ACCM) provides critical care services in the burn ICU, cardiovascular ICU, neurological ICU, and surgical ICU at Vanderbilt University Medical Center, in the surgical ICU at the Tennessee Valley Healthcare System (TVHS) Veterans Administration Medical Center in Nashville (Nashville VA), and in the medical/surgical ICU at Vanderbilt Wilson County Hospital. Additionally, division members provide intraoperative anesthetic care for diverse surgical specialties and perioperative consult service care for patients undergoing major surgeries. Clinical care includes proficiency in echocardiography, bedside procedures, shock resuscitation, advanced ventilator techniques, and management of patients with mechanical circulatory support.

## Education

Our ACGME-accredited ACCM fellowship provides an unparalleled innovative and in-depth critical care training opportunity. Rotations include VUMC and Nashville VA ICUs, critical care echo, and a diverse array of electives such as international experiences, medical subspecialties, and research. The teaching curriculum includes daily didactic sessions consisting of lectures, research studios, quality improvement training, echo case review, journal clubs, mortality and morbidity conferences, board preparation, simulation training, and many others.

## Leadership

Division faculty have leadership roles in organizations such as Society of Critical Care Medicine, American Society of Anesthesiologists, Society of Critical Care Anesthesiologists, Early-Stage Anesthesiology Scholars, Society for Technology in Anesthesia, and American Delirium Society. Division clinical administration leadership includes medical directorship of the burn, cardiovascular, neurological, and surgical ICUs at VUMC and the perioperative service and surgical ICU at Nashville VA. Additionally, division faculty are active in directorship of the Center for Experiential Learning and Assessment and the Critical Illness, Brain Dysfunction, and Survivorship Center at VUMC, in the Vanderbilt University School of Medicine critical care immersion programs, and in the VUMC Institutional Review Board.

## Research

Division faculty present at regional, national, and international academic conferences and publish in major general medical, critical care, anesthesiology, and surgery journals. Faculty have received funding for research from the NIH (R01 and K23 grants), FAER, and industry. Areas of investigation include mechanistic work (acute kidney injury, delirium, cognitive and functional impairment, sepsis), clinical management strategies (sedation, oxygen tension, rapid response teams, alarms and remote monitoring, cognitive and physical training, medication reconciliation), and education (simulation, evaluation processes). ♦



**4**

**R01 GRANTS**

**5**

**CAREER DEVELOPMENT AWARDS**

**60+**

**PUBLICATIONS**

## Fellowship Details

- ACGME-accredited program
- Ten positions available each year
- Core rotations include CVICU, SICU, NCU, Trauma ICU, Burn ICU, VA-SICU, ECHO/Ultrasound
- Electives include intraoperative TEE, MICU, PICU, perioperative medicine, international rotations, palliative care, medical subspecialties and research

# Cardiothoracic Anesthesiology

Division Chief: Mias Pretorius, MBChB, MSCI



The Division of Cardiothoracic Anesthesiology provides anesthetic care for adult cardiac surgery, thoracic surgery, interventional pulmonology, electrophysiology and structural heart disease at Vanderbilt University Medical Center (VUMC). A subset of the division's faculty members also provides anesthetic care for liver transplantation and critical care services in the adult cardiovascular intensive care unit.

The division provides anesthetic care for patients undergoing coronary artery bypass graft (on- and off-pump) surgery, valvular surgery, heart and lung transplantation, ECMO, adult congenital procedures, pulmonary endarterectomies, hybrid procedures, aortic surgery and ventricular assist device (VAD) insertions. VUMC tied for first place as the busiest heart transplant program by volume in the United States in 2019 and was the busiest program in the world in 2020.

VUMC performed 148 heart transplants in 2020, the most of any transplant center in the world. Of the 148 transplants performed, 124 were adult hearts, 23 were pediatric hearts and one was the world's first heart-lung transplant in a COVID-19 patient. This growth in the heart transplant program is in part due to the innovative use of hearts from hepatitis C-positive donors, Donation after Circulatory Death (DCD), which expands the donor pool by 30 to 40 percent, and use of the TransMedics Organ Care System. The VAD program at Vanderbilt currently places about 50 devices per year.

The division's structural heart disease program employs the newest techniques involving transcatheter aortic valve replacement (TAVR), catheter-based repair of mitral regurgitation (Mitraclip) and left atrial appendage occlusion devices. Intraoperative transesophageal echocardiography (TEE) is an integral part of the division's clinical practice and is performed on all adult cardiac surgery patients, in electrophysiology to guide placement of left atrial appendage occlusion devices and to guide transcatheter valve procedures. With the addition of two additional state-of-art hybrid operating rooms in 2021, the division is set to further grow the structural heart disease program at VUMC.

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

**148**

TOTAL HEART TRANSPLANTS IN 2020

**124**

ADULT HEART TRANSPLANTS IN 2020

**23**

PEDIATRIC HEART TRANSPLANTS IN 2020

WORLD'S

**1st**

HEART-LUNG TRANSPLANT IN A COVID-19 PATIENT

## Fellowship Details

- ACGME-accredited program
- Five positions available each year
- Core rotations include adult cardiac, thoracic, pediatric cardiac, TEE and ICU
- Electives include heart failure, TEE, CT surgery and research



# Neuroanesthesiology

Division Chief: Letha Mathews, MBBS

The Neuroanesthesiology Division provides perioperative care for patients undergoing complex intracranial and spine surgeries and staffs 9 to 12 operating rooms daily. Neurosurgery and other neurologic services continue to expand at VUMC as well as the complexity of the patients and procedures.

Three neurointerventionalists run a busy neurovascular service in state-of-the-art interventional hybrid operating rooms dedicated solely to neurosurgical procedures. VUMC is certified as a comprehensive stroke center and provides care for patients requiring acute stroke interventions.

VUMC has designated neurosurgical operating rooms where anesthesia services are provided for operations, including brain tumors, 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 kept under sedation rather than general anesthesia to facilitate speech and motor mapping during surgery in order to preserve the most vital areas of the brain.

Development and practice of evidence-based perioperative ERAS pathways and guidelines have improved patient outcomes and reduced length of ICU stay and overall hospital length of stay. The division includes five full time faculty and six CRNAs, as well as CRNAs from other divisions. Additionally, several faculty from the CCM and MSA Divisions contribute significantly to the division’s work.

Faculty are actively engaged in resident, medical student and allied health professional education. The division offers one Neuroanesthesiology fellowship position each year, and it is certified by the International Council on Perioperative Neurosciences Training (ICPNT). The Neuroanesthesiology faculty make significant contributions at national and international meetings, such as SNACC, SEA, IARS, AACD and NCCS, and provide leadership in these organizations.

Neuroanesthesiologists face many unique challenges, including lengthy 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, as well as the faculty leading the training, discover that the ability to make an immediate impact on an operation and enhance the patient’s long-term outcome is both exciting and gratifying. ♦



**4,000+**  
NEUROSURGICAL CASES

**1,700**  
SPINE SURGERIES

**600+**  
CRANIOTOMIES FOR INTRACRANIAL  
TUMOR AND VASCULAR LESIONS

**600+**  
NEURO INTERVENTIONAL PROCEDURES

**160+**  
DEEP BRAIN STIMULATOR PLACEMENTS

All stats based on annual numbers

## Fellowship Details

- One year program (*accreditation not offered by ACGME; ICPNT certified*)
- One position available each year
- Core rotations include adult ORs, neuroICU, neuromonitoring and research
- Elective rotations include stroke neurology, neuroradiology and pediatric neuroanesthesia

# Multispecialty Adult Anesthesiology

Division Chief: Michael Pilla, MD



The Division of Multispecialty Adult Anesthesiology (MSA) is the Department of Anesthesiology's largest division, providing perioperative anesthetic care in 60 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 55 faculty members, most of whom have significant subspecialty training and expertise.

Since 2014, our Perioperative Consult Service (PCS) has provided co-management of surgical patients, beginning with the decision to operate and continuing throughout the period after hospital discharge. Starting from a pilot program involving colorectal surgical patients, the PCS has quickly grown to include care of orthopedic trauma, abdominal wall reconstruction, surgical weight loss, hepato-biliary-pancreatic/surgical oncology, gynecologic oncology and urology patients.

MSA division faculty provide our 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 members teach and supervise residents from other specialties, as well as student registered nurse anesthetists who rotate in the MSA division. Division faculty members pursue a wide range of academic interests, including perioperative cognitive dysfunction, echocardiography, ultrasound imaging, regional anesthesia, airway management, information technology, point-of-care diagnostics and perioperative medicine, with a common goal of providing safer and more efficient perioperative care and throughput.

VUMC COVERS TRAUMA CARE FOR PATIENTS WITHIN

**80,000**

SQUARE MILES

VUMC TRAUMA CENTER HAS APPROXIMATELY

**3,000**

ADMISSIONS PER YEAR

**60**

TOTAL NUMBER OF OPERATING ROOMS AND  
PROCEDURE SUITES IN WHICH MSA PROVIDES  
PERIOPERATIVE ANESTHETIC CARE



# Multispecialty Adult Anesthesiology

Division Chief: Michael Pilla, MD

The Vanderbilt Department of Anesthesiology provides both an Acute Pain Service (APS), and a Perioperative Consult Service (PCS). APS is led by Edward Yaghmour, MD, and PCS is led by Matthew McEvoy, MD. Together these services provide preoperative evaluation and preparation, intraoperative care, acute postoperative care and pain management to Vanderbilt University Hospital, Monroe Carell Jr. Children's Hospital at Vanderbilt and the Tennessee Valley Healthcare System (TVHS) Veterans Administration Medical Center in Nashville. By providing care before, during and after surgery, these services give patients better, more personalized care throughout the entire perioperative care period. With widespread use of regional anesthesia and other opioid-sparing pain management techniques, these services have led to a more than 80 percent reduction of in-hospital opioid use and a more than 66 percent reduction in opioids prescribed at discharge.

Enhanced Recovery After Surgery (ERAS) care pathways are evidence-based protocols designed to improve pain control and facilitate faster recovery for patients. PCS/APS is a national leader in ERAS implementation. Across the Adult, Children's and VA hospitals, the department cares for several thousand patients each year, and APS and PCS perform over 7,000 regional blocks (not including our ambulatory locations). PCS/APS continues to develop ERAS protocols that improve patient outcomes and address the common reasons for prolonged hospital length of stay. Beyond this clinical work, the clinicians routinely give presentations at national and international meetings related to ERAS and non-opioid pain management. APS and PCS at VUMC are staffed by 24 anesthesiologists, with representation from multiple divisions. APS and PCS also include 10 advanced practice providers, fellows and residents.

Developing and implementing pediatric ERAS protocols are also an important focus of the Pediatric Acute Pain Service, staffed by six pediatric anesthesiologists and one pediatric pain nurse within the Division of Pediatric Anesthesiology. Though the pediatric surgical patient is quite different from the adult patient, the basic concepts of ERAS are the same. "Setting expectations preoperatively and utilizing multimodal opioid-reducing perioperative strategies enhance the patient's experience, reduce perioperative complications and lead to earlier discharge from the hospital," states Drew Franklin, MD, MBA, Service Director of Pediatric Acute Pain at Children's Hospital.

At the TVHS Veterans Administration Medical Center in Nashville, a perioperative care service (VA-PCS) was started in 2016 through the collaboration of the TVHS's Department of Anesthesiology, Pain Management & Perioperative Medicine and VUMC's Anesthesiology Department and Anesthesiology Critical Care Medicine Division. The staff for this service includes seven critical care anesthesiologists and eight acute care nurse practitioners. Collaborations exist with multiple departments. Eight ERAS pathways have been developed since 2016. ♦

**7,000+**

**REGIONAL BLOCKS PERFORMED EACH YEAR BY APS AND PCS**

**3,500**

**PCS PATIENTS PER YEAR**

**80%+**

**REDUCTION OF IN-HOSPITAL OPIOID USE &**

**66%+**

**REDUCTION IN OPIOIDS PRESCRIBED AT DISCHARGE**

**15-20%**

**REDUCTION IN COST THROUGH PCS COLLABORATIONS**

## Perioperative Medicine Fellowship Details

- One year program (*accreditation not offered by ACGME*)
- Four positions available each year
- Core rotations include perioperative consult service, high-risk preoperative evaluation clinic, echocardiography and cardiac device management, geriatrics and research

## Regional Anesthesia & Acute Pain Medicine Fellowship Details

- ACGME-accredited program
- Two positions available each year
- Core rotations include anesthesiology perioperative consult service, OR anesthesia, oromaxillofacial surgery, addiction psychiatry, ambulatory regional anesthesia, pediatric pain management, inpatient chronic pain, and international anesthesia
- Electives include research and obstetric anesthesia

# Obstetric Anesthesiology

Division Chief: Jeanette Bauchat, MD, MS



**4,600+**  
DELIVERIES ANNUALLY

**2,800**  
GYNECOLOGICAL SURGICAL CASES ANNUALLY

**87%**  
CHOOSE NEURAXIAL LABOR ANALGESIA

**MORE THAN**  
**50%**  
OF DELIVERIES ARE HIGH-RISK

**20**  
ABNORMAL PLACENTATION CASES ANNUALLY

The Division of Obstetric Anesthesiology, led by Division Chief, Jeanette Bauchat, MD, MS, provides dedicated, 24-hour, in-house obstetric anesthesia care for over 4,600 deliveries at Vanderbilt University Medical Center annually—over half of the deliveries are considered high risk. The division provides a full complement of techniques for labor analgesia and operative deliveries. The faculty are consultants and critical care specialists for high-risk obstetric patients, abnormal placentation cases and intrauterine fetal surgeries. The division performs anesthesia services for gynecological surgeries in a suite of three operating rooms adjacent to the labor and delivery unit. The division faculty also assume leadership roles in quality initiatives to improve maternal health, including the use of multidisciplinary simulation training for obstetric emergencies.

The division works collaboratively with other medical specialties to ensure women in the perioperative period have optimal outcomes. The division collaborates with the VUMC maternal-fetal medicine (MFM) group in caring for mothers with congenital heart defects and other co-morbidities. The obstetric anesthesiologists work with the MFM, gynecologic oncology, urology and emergency general surgery physicians in the care of patients with abnormal placentation and fetal surgery. In conjunction with the department's perioperative consult service, division faculty and staff provide anesthesia care using multimodal, enhanced recovery after surgery (ERAS) protocols for gynecological cases and cesarean deliveries.

The division sponsors a highly regarded, ACGME-accredited obstetric anesthesia fellowship led by Fellowship Director Holly Ende, MD. Recent research projects include investigations on optimal analgesia in women with opioid use disorder, anemia treatments in pregnancy, genomics of uterine atony and outcomes using enhanced recovery after cesarean delivery and gynecological surgery. ♦

## Fellowship Details

- ACGME-accredited program
- Two positions available each year
- Core rotations include experiences in maternal-fetal medicine and neonatology, with abundant time for research and training



### Clinical

Clinicians from the Division of Pain Medicine come from multiple specialties including Anesthesiology, Physical Medicine and Rehabilitation, Neurology, Functional Neurosurgery, and Pain Psychology. Each clinic is setup to be multidisciplinary to provide a rich learning environment and to make incredible resources available to patients to manage their pain. Our specialty pain clinics include:

- The Vanderbilt Center for Neuromodulation
- Complex Cancer Pain Clinic
- Pediatric Pain Management Clinic
- Bridge Clinic (Addiction Medicine)
- Transitional Pain Services (Complex Perioperative Management for Patients with Chronic Pain or Use Disorders)
- Spine Clinic

We offer care in pain management centers at several locations: Nashville One Hundred Oaks, Clarksville, Franklin, Spring Hill, Vanderbilt Ingram Cancer Center, Belle Meade, The Village at Vanderbilt, Lebanon, Tullahoma, Monroe Carell Jr. Children's Hospital at Vanderbilt, and on inpatient Comprehensive Pain Services (Chronic Pain, Transitional Pain, and Cancer Pain).

### Education

Our ACGME-accredited Pain Medicine fellowship provides exceptional training and exposure to high

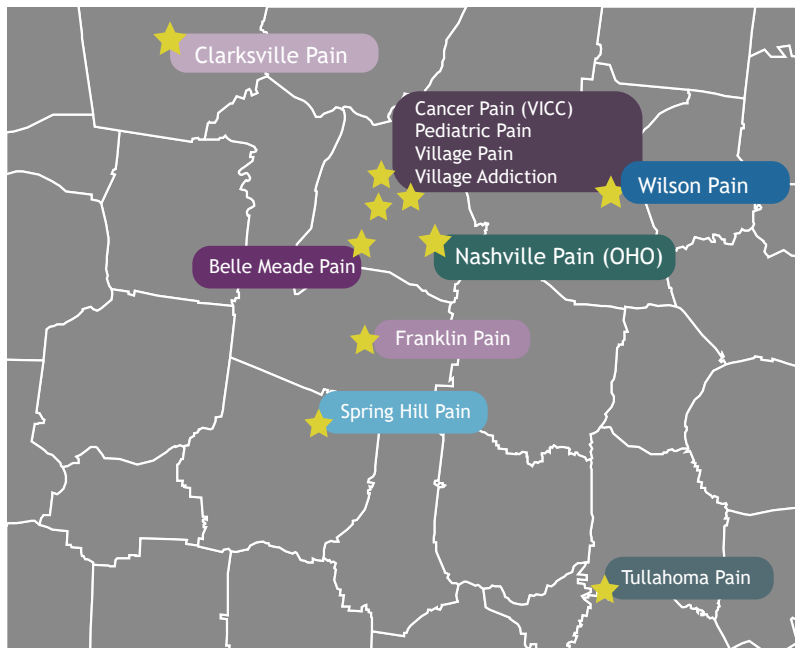
volume complex and common pain treatments/interventions, cancer pain, addiction medicine, pediatric pain, and complex spine. Members of the Pain Division teach approximately a third of the medical school class each year in a course entitled Pain, Policy, and Addiction, where students learn to be leaders and impact policy that affects patients. Residents and students from all specialties frequently rotate in our clinics.

### Leadership

Division faculty have leadership roles in national and local organizations, including the American Academy of Pain Medicine, the Tennessee Pain Society (President, Board of Directors), the Society of Pain Fellowship Directors, among others. At Vanderbilt, we are active leaders involved in oversight of controlled substances, teaching CME courses on prescribing, and development of hospital-wide policies.

### Research

The division is active in research encompassing clinical trials to develop new treatment modalities in peripheral ablation and neuromodulation, therapies for opioid use disorder, functional mapping of the spinal cord, safety with intrathecal drug delivery devices, acupuncture and acupressure, mindfulness, population health, drug development, perioperative acute and chronic pain transitions, opioid epidemiology, and more. Faculty have funding from the NIH (R01, U), AHRQ, RTI, and investigator designed industry funded trials. No faculty accept payment from industry outside of sponsorship for research that we design and carry out. ♦



### Fellowship Details

- ACGME-accredited program
- Five positions available each year
- Focus on comprehensive, multi-disciplinary treatment of acute, sub-acute, and chronic pain
- Rotations in interventional pain, psychiatry, addiction medicine, neurology, radiology, physical therapy, cancer pain, integrative medicine, and international pain delivery
- High volume training exposure with state of the art therapies such as implantable spinal and peripheral stimulators, ablative/lytic therapies, fluoroscopic and ultrasound-guided procedures, neurosurgical treatments, intrathecal drug delivery systems
- Completion of publishable academic projects

# Pediatric Cardiac Anesthesiology

Division Chief: Bevan Londergan, MD



The Division of Pediatric Cardiac Anesthesiology is made up of six faculty members and eight certified registered nurse anesthetists whose primary anesthesia care sites are the two cardiac operating rooms and three catheterization laboratories at the Monroe Carell Jr. Children's Hospital at Vanderbilt. The division's average yearly case volume is approximately 450 cardiac surgeries and 1,100 cardiac catheterizations and electrophysiologic procedures. Our program performed 23 pediatric heart transplants in 2020, ranking 3rd in the United States.

Our division oversees the care of the congenital cardiac population for noncardiac operations and procedures, providing or coordinating the appropriate anesthesia care for each child. The division also provides care for the growing and increasingly complex adult cardiac population in a collaborative effort with specialists at both VUMC and Children's Hospital.

Beyond the operating rooms, members of the division are involved in providing care for patients undergoing procedures in the pediatric cardiac intensive care unit and are called upon for their vascular access expertise and teaching throughout Children's Hospital.

The educational mission of the division is multifaceted. Pediatric anesthesiology and adult cardiothoracic anesthesiology fellows rotate on the service. Senior anesthesiology residents rotate with the service on an elective basis. The division additionally provides educational experiences to student nurse anesthetists, emergency medicine fellows, critical care fellows and pediatrics residents. Our faculty participates in departmental didactics including the pediatric anesthesia rotation lecture series, basic resident lecture series, pediatric fellow lecture series, resident and fellow journal clubs and mock oral board sessions.

Division faculty members are involved in a range of research activities, with Brian Donahue, MD, PhD, serving as research mentor in both the Pediatric Anesthesiology and the Pediatric Cardiac Anesthesiology Divisions. Heidi Smith, MD, MSCI, has been awarded an R01 grant for her pediatric delirium research. Division faculty work within the Pediatric Heart Institute at Children's Hospital on research and quality improvement initiatives, including care pathways, coagulation therapies and postoperative pain management, and with multi-institution research and quality initiatives in congenital cardiac care throughout the country. ♦

**3RD BUSIEST IN THE NATION FOR PEDIATRIC HEART TRANSPLANTS WITH**

**23**

**TRANSPLANTS IN 2020**

**9TH BUSIEST IN THE NATION FOR PEDIATRIC CARDIAC SURGERIES WITH**

**450**

**SURGERIES ANNUALLY**

**11TH BUSIEST IN THE NATION FOR PEDIATRIC CATH PROCEDURES WITH**

**1,100**

**PROCEDURES ANNUALLY**



# Pediatric Anesthesiology

## Division Chief: Srijaya Reddy, MD, MBA

The Division of Pediatric Anesthesiology provides perioperative care for more than 23,000 patients annually at the Monroe Carell Jr. Children's Hospital at Vanderbilt, middle Tennessee's only comprehensive regional pediatric center.

Academic interests of the division include situational awareness during induction of and emergence from anesthesia, best practice in handovers of care, outcomes research for pediatric craniofacial surgery, non-invasive monitoring of volume status in the pediatric population, perioperative anxiety in children, and international educational efforts to improve the care of children worldwide.

We have a robust fellowship program that trains four future pediatric anesthesiologists annually, with Jenna Sobey, MD, at the helm as Program Director.

The Pediatric Acute Pain Service, led by Drew Franklin, MD, MBA, is engaged in an increasing number of perioperative regional anesthesia techniques, has implemented multidisciplinary pediatric perioperative surgical home protocols with the goal of enhanced recovery after complex procedures, and handles a growing volume of both inpatient consultations and patients seen in our Pediatric Pain Clinic.

Some of the division's most complex patients are cared for by special clinical teams, including our pediatric liver transplant team led by Amanda Lorinc, MD, our craniofacial reconstruction team led by Srijaya Reddy, MD, MBA, and our pediatric spine fusion team led by Brian Emerson, MD.

Enhancement of the perioperative experience for our pediatric patients is guided by quality and safety initiatives, efficiency and patient-centered care. These efforts are led by Carrie Menser, MD, who serves as the Perioperative Medical Director as well as the Executive Medical Director of Quality and Safety at Vanderbilt Children's Hospital. In order to prepare children and their families for their perioperative experience and to ensure that they are optimized prior to surgery, the Preoperative Assessment and Teaching for Children's Hospital (PATCH) team, directed by Kat Modes, MD, makes sure procedures go smoothly. To provide the safest, best care practices for patients in the post-operative recovery room (PACU) area, the division has a robust nursing-anesthesia collaboration led by Christy Crockett, MD.

As of January 2020, pediatric anesthesiology efforts have widened to include a new facility in Rutherford County. This is the first free standing pediatric ambulatory surgery center with three operating rooms, a GI suite and sedated MRI capacity. ♦



### TOTAL ANESTHETICS

# 23,000+

IN OPERATING AND SEDATION ROOMS

# 225+

SPINE FUSIONS

# 96

CRANIOFACIAL SURGERIES

# 18

PEDIATRIC LIVER TRANSPLANTS

All stats based on annual numbers

### Fellowship Details

- ACGME-accredited program
- Four positions available each year
- Electives include ability to travel to Guatemala and/or Kenya for international care experiences
- Core rotations include Pediatric OR & Pediatric Cardiac OR, PICU, NICU, Pediatric Pain Service, Preoperative Evaluation Clinic, & Recovery Room Management
- Final month dedicated to 'supervisory' role to foster transition to the attending role

# Veterans Affairs Anesthesiology Service

Chief: Ann Walia, MBBS



The Anesthesiology Service at the Tennessee Valley Healthcare System (TVHS) provides a variety of anesthesia services for over 125,000 veterans every year across its three main campuses in Nashville, Clarksville and Murfreesboro. We plan to expand these services into the Chattanooga area in fall of 2021.

The service includes 20 full-time anesthesiologists, 7 part-time anesthesiologists, 20 CRNAs, 19 nurse practitioners, 2 anesthesiology residents, 1 fellow, 7 medical instrument technicians and 7 administrative support staff. The service is heavily engaged in educational activities within TVHS as well as nationally.

The TVHS Anesthesiology Service has been recognized nationally as best practice for its Perioperative Care Service, which was started in 2016. Since implementation, this service has been credited with savings in excess of \$10 million/year by decreasing patient ICU and hospital length of stay to below national benchmarks. This service has also been instrumental in decreasing in-hospital and long-term opioid use by greater than 80 percent of baseline in the surgical patient population.

TVHS has the only service in the Veterans Integrated Service Network (VISN) 9 that provides comprehensive complex pain management, including invasive procedures like radiofrequency ablation, spinal cord and peripheral stimulator implantation, suboxone implants and inpatient ketamine infusions for unremitting pain and detoxification. The ketamine clinic has been successful in many ways, including helping veterans wean themselves from their narcotics completely. We are working closely with the Psychiatry Service to expand the low dose ketamine infusion program for depression at our two main facilities.

The service is credited with over 6,000 surgical and 5,000 non-OR procedures, 6,000 pain clinic visits, 3,500 interventional procedures and 2,500 telehealth and videoconnect visits across three campuses. In addition, the Anesthesiology Service is responsible for oversight of the facility surgical intensive care, perioperative service, Rapid Response Team, moderate sedation program and resuscitation and airway management activities.

Faculty members teach at national conferences and the national simulation center, along with serving as a resource to several other facilities in key areas such as the ERAS protocols, ketamine infusion program for complex chronic pain and opioid detoxification, labor mapping and workload capture. ♦

PROVIDES ANESTHESIA SERVICES FOR OVER  
**125,000**  
VETERANS A YEAR

.....  
**9,500**  
PAIN CLINIC & INTERVENTIONAL VISITS

.....  
**6,000**  
OR PROCEDURES

.....  
**5,000**  
NON-OR PROCEDURES

.....  
**2,500**  
TELEHEALTH AND VIDEOCONNECT VISITS



# Certified Registered Nurse Anesthetists

Chief: Brent Dunworth, CRNA, DNP, MBA

The Vanderbilt University Medical Center Department of Anesthesiology continues to set the nationwide standard for true collaborative practice and innovation in its approach to patient care, involving anesthesiologists and residents, certified registered nurse anesthetists (CRNAs), student registered nurse anesthetists (SRNAs) and anesthesia technicians. Serving as Chief CRNA and Director of Advanced Practice in Anesthesiology, Brent Dunworth, CRNA, DNP, MBA, leads the division. Amanda Dickert, CRNA, DNAP, serves as the Associate Chief CRNA.

The past year was one of tremendous clinical growth for Vanderbilt University Medical Center. The opening of two new ambulatory locations led to significant growth in the CRNA team to create seamless and successful endeavors. Now, over 200 CRNAs in the nurse anesthesia division provide anesthesia for all types of surgical procedures, including cardiac, pediatrics, vascular, trauma, neurosurgery, plastics, radiologic and special procedures throughout the medical center. CRNAs administer general, regional and monitored anesthesia care for scheduled and emergency surgical, obstetric and diagnostic procedures. Our nurse anesthesia professionals have a “can-do” attitude and are always ready for the challenges that come from working in a complex academic medical center that cares for the most challenging patients in Tennessee and beyond.

Five CRNAs serve as divisional managers to facilitate practice evolution, education and professional development of their respective teams. Thus, the CRNAs are essential to many core endeavors, with a sharp focus on patient experience and outcomes. In terms of personnel, the CRNA Division is the largest within the Department of Anesthesiology. We have an active CRNA manager of education, who facilitates onboarding, student affiliations and professional development. Our Senior Quality and Patient Safety Advisor CRNA is an integral member of our quality team within the department.

Vanderbilt is proud to serve in a teaching capacity for three different nurse anesthesia programs that are clinical affiliates. Middle Tennessee School of Anesthesia (MTSA), based in Madison, Tennessee, is the second largest nurse anesthesia program in the country. Vanderbilt is also a clinical affiliate for Emory University Nurse Anesthesia Program in Atlanta, Georgia, and Marian University, based in Indianapolis, Indiana. Student nurse anesthetists participate in over 7,000 anesthetics per year while on Vanderbilt rotations. Both CRNAs and anesthesiologists provide expert clinical teaching to these learners, who are highly sought after in the marketplace upon graduation. CRNA leaders oversee and coordinate the student rotations through mentoring, orientation and evaluation. Additionally, CRNAs are involved in both onsite and remote teaching of nurse anesthesia students in Kijabe, Kenya, through the sustainable Vanderbilt International Anesthesia program.

VUMC is staffed by 39 anesthesia technicians who contribute to safe, efficient anesthesia care by providing highly skilled assistance to our anesthesia professionals at both on- and off-campus clinical locations. In recent years, we have partnered with the anesthesia technology program at Columbia State Community College in Columbia, Tennessee, as a clinical affiliate for student rotations in both adult and pediatric anesthesiology. ♦



SRNAs PARTICIPATE IN OVER  
**7,000**  
ANESTHETICS PER YEAR

MORE THAN  
**200**  
CRNAs PROVIDE  
DIRECT CARE FOR  
SURGICAL PROCEDURES

**39**  
ANESTHESIA TECHNICIANS  
AND TECHNOLOGISTS  
CONTRIBUTE TO SAFE,  
EFFICIENT ANESTHESIA CARE



# EDUCATION





## Residents

The Anesthesiology Department's residency program is highly sought after by the nation's top medical students.

The physician educators in the Anesthesiology Department 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. Peer-reviewed publications and the presentation of research by residents at national meetings are clear indications that the department's educational programs are creating physician-scholars who are prepared for medical practice, peer-education and scientific investigation.

The educational program for residents and fellows consists of a combination of comprehensive didactic conferences, hands-on workshops, 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 the Center for Experiential Learning and Assessment (CELA) is a nationally renowned, on-campus resource for this training.

The goal of ongoing curriculum development and revision in the Milestones era is to continue to reach the highest level of educational achievement using modern learning techniques. Accordingly, Leslie Fowler, EdD, Director of Educational Development and Research, is overseeing departmental curriculum advancements along with Associate Vice Chair for Educational Affairs Brian Gelfand, MD, and the core education faculty. Among other projects, Leslie and the VU School of Medicine Spark team have worked together utilizing VUSM's IT platform for education management to develop multimodal models of learning for anesthesiology education. This has been expanded across varying learner groups both within our institution and internationally.

## Fellows

Building from the department's strength in subspecialties, fellowships in 10 clinical areas, as well as a research fellowship, are offered to individuals seeking advanced, focused training.

### Clinical Fellowships Offered

- Adult Cardiothoracic Anesthesiology **5 fellowships**
- Anesthesiology Critical Care Medicine **10 fellowships**
- Clinical Informatics **1-2 fellowships**
- Global Anesthesiology\* **1-2 fellowships**
- Neuroanesthesiology\* **1 fellowship**
- Obstetric Anesthesiology **2 fellowships**
- Pain Medicine **5 fellowships**
- Pediatric Anesthesiology **4 fellowships**
- Regional Anesthesia and Acute Pain Medicine **2 fellowships**
- Perioperative Medicine\* **4 fellowships**

*\*Indicates ACGME accreditation not offered. All other fellowships listed are ACGME accredited.*

## Nurse Anesthetists

The continuing education of more than 200 certified registered nurse anesthetists (CRNAs) in the department is supported with recurring programs, including Grand Rounds and Mortality, Morbidity & Improvement (MM&I) Conferences. In addition, Vanderbilt is a clinical affiliate for Middle Tennessee School of Anesthesia, Emory University Nurse Anesthesia Program (Atlanta, Georgia) and Marian University (Indianapolis, Indiana). On-campus training is coordinated by CRNA leaders in the Department of Anesthesiology.

## 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

*Continued on page 24*

OVER

**\$1  
MILLION**

IN ACTIVE FUNDING  
FOR EDUCATIONAL  
RESEARCH

**100%**

BOARD PASS RATE

**33**

2020 ASA ANNUAL  
MEETING POSTERS  
PRESENTED

**18**

CATEGORICAL  
POSITIONS PER  
YEAR

**10**

CLINICAL  
FELLOWSHIP  
PROGRAMS

**6**

ADVANCED  
LEADERSHIP  
TRACKS IN THE  
AREAS OF:

- GLOBAL HEALTH
- CLINICAL/  
TRANSLATIONAL  
RESEARCH
- BUSINESS
- BIOMEDICAL  
INFORMATICS
- PERIOPERATIVE  
MEDICINE
- EDUCATION  
RESEARCH

*Continued from page 23*

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. The Division of Anesthesiology Critical Care Medicine has 30 acute care nurse practitioners who work in intensive care settings. The Preoperative Evaluation Clinic and Perioperative Consult Service include another 17 nurse practitioners as an integral part of these teams.

### **The Center for Experiential Learning and Assessment**

Under the leadership of Arna Banerjee, MBBS, CELA offers medical learners at all levels a simulation education on computerized, life-like mannequins. 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, which includes having strong leadership and the necessary equipment, facilities and personnel to provide consistent, effective training.

### **Multicenter Perioperative Outcomes Group (MPOG) ASPIRE (Anesthesiology Performance Improvement and Reporting Exchange) Quality Improvement Project**

ASPIRE is the quality improvement (QI) arm of the MPOG. The goal is to improve the care of patients undergoing anesthesia by reducing unexplained variation in practice and collaborating with anesthesia providers to define best practices. Participating sites work together to build quality measures, review best practices and exchange ideas for improving patient outcome. ASPIRE has developed numerous quality measures, spanning several anesthesia care domains.

The Department of Anesthesiology at VUMC joined MPOG ASPIRE in 2020 and has the full support of departmental leaders. In an effort to mobilize resources and develop a cohesive plan for implementation of ASPIRE quality measures department wide, the ASPIRE Task Force, led by Miklos Kertai, MD, PhD, was created. The task force

identified 3 Adult specific measures and 3 Pediatric specific measures on which a QI project would initially focus.

Of note, there are 22 ASPIRE measures that have been identified. A key component of ASPIRE includes monthly feedback emails showing departmental compliance with ASPIRE measures and then later provider level performance data. The project vision and timeline were introduced at Grand Rounds in January of 2021 to department groups: attending physicians, CRNAs, fellows, residents and SRNAs.

Ultimately, this QI project will improve patient care with the delivery of detailed feedback to anesthesia providers. In addition, the provision of education that is ASPIRE measure specific will further enhance best practices in anesthesia.

### **The Academy for Excellence in Education**

A collective of outstanding faculty educators in the School of Medicine, the AEE provides a forum to foster higher levels of participation and promote excellence and scholarship in the delivery of education to health professionals. The mission of the AEE is to enhance the educational environment in Vanderbilt University School of Medicine and VUMC by advocating for the development, support and recognition of dedicated educators, by sustaining a community of educators, and by fostering educational excellence, innovation, leadership and scholarship. The AEE elected 28 new members in 2021, four of whom are from our department: Nathan Ashby, MD, Clifford Bowens, MD, Douglas Hester, MD, and Jenna Sobey, MD.

### **Educational Research**

The department is a national leader in rigorous educational research, and numerous faculty are involved with the latest in pedagogical and educational implementation science research. Leslie Fowler, EdD, J. Matthew Kynes, MD, Matthew McEvoy, MD, Mark Newton, MD, Britany Raymond, MD, Brian Allen, MD, Amy Robertson, MD, Jonathan Wanderer, MD, MPhil, Brian Gelfand, MD, and Bantayehu Sileshi, MD, are the current education researchers.

Kynes's research focuses on the impact of high-fidelity simulation workshops on clinical skills for providers involved in obstetric care in Kenya. He also studies the preparation and experience of anesthesiology residents participating in international rotations and their impact on improving clinical exposure and long-term engagement in humanitarian activities. Kynes's research includes the FAER grant impact of and utilization of online curricula in pediatric anesthesiology by providers in low- and middle-income countries.

Sileshi has funded research investigating the effects of education capacity-building efforts and the implementation of a novel perioperative data collection tool in low- and middle-income countries, including Kenya and Ethiopia. ♦



# Special Lectureships and Awards

The department hosts special lectureships throughout the year and presents distinct recognitions to department members who have provided exemplary service both to their patients and to their 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. Funding is provided by private donors, whose gifts materially improve the academic life of the Vanderbilt Department of Anesthesiology.

## **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 department supporters.

## **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. Dr. Sandidge passed away in September 2018. Drew Franklin, MD, MBA, Service Director of Pediatric Acute Pain, is working closely with the family of Dr. Sandidge to establish an ongoing lecture series

at Vanderbilt to ensure that her genuine commitment to optimizing pain management in children lives on.

## **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 on Perioperative Medicine**

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. ♦



*On Friday, Oct. 16, 2020, RRK Coaching and Executive Development CEO Richard R. Kilburg, PhD, was the featured guest speaker for the 2nd annual Dr. Charles Beattie Endowed Lectureship on Perioperative Medicine. His presentation was titled "Preoccupation and the Complexities of Professional Performance."*



*On Friday, Feb. 19, 2021, ACGME Chief Diversity, Equity and Inclusion Officer William A. McDade, MD, PhD, was the featured guest speaker for the 12th annual Dr. Bradley E. Smith Endowed Lectureship on Medical Professionalism. His presentation was titled "Diversity and Inclusion in Graduate Medical Education."*



*On Friday, April 9, 2021, Franklyn P. Cladis, MD, FAAP, of UPMC Children's Hospital of Pittsburgh, was the featured guest speaker for the 15th annual Dr. James Phythyon Endowed Lectureship in Pediatric Anesthesiology. His presentation was titled "Fearless Education: Reframing the Education Experience."*

# Vanderbilt International Anesthesia

Five billion people around the world do not have access to safe surgery and anesthesia. Through Vanderbilt International Anesthesia (VIA), the Department of Anesthesiology is committed to improving perioperative and anesthetic care in underserved regions of the world to help close this gap through service, education and research. The commitment of our department is shown through the involvement of faculty, trainees and staff in a variety of innovative projects across 13 low- and middle-income countries. From long-established partnerships of educational capacity-building to short-term service trips to international advocacy and research, VIA has invested in improving anesthesia care to save lives, promote health and impact the healthcare systems of countries in need.

Among these initiatives is the ImPACT Africa (Improving Perioperative and Anesthesia Care and Training in Africa) program, which continues to expand. Supported by grants from GE Foundation and The ELMA Foundation and led by Mark Newton, MD, and Bantayehu Sileshi, MD, the program works with local institutions, hospitals and ministries of health to train physician and non-physician anesthesia providers and build capacity for education, empowering educators with tools and techniques to teach anesthesia in the classroom, simulation center and operating room.

A new departmental global education initiative, launched in 2021, is the Supporting Training for Anesthesia Residents in Africa (STAR Africa) program. STAR Africa is an online series of interactive, context-relevant subspecialty lectures created to support newly established residency programs across six institutions in three East African countries (Ethiopia, Kenya and Tanzania). In addition, the department will partner with the College of Anesthesiologists in East, Central and South Africa to provide these subspecialty modules to more residency programs over the coming years. Kaylyn Sachse, MD, leads this initiative, with the participation of department

faculty from the specialties of cardiothoracic, critical care, pediatric, obstetric and regional anesthesiology.

In addition to these educational programs, VIA offers an ACGME/ABA-accredited elective rotation to Kenya for the department's residents and fellows. Since the rotation began, VIA has sent 91 residents and fellows to AIC Kijabe Hospital in Kenya to provide anesthesia care and education. The rotation is a highlight for many of the department's trainees and helped pave the way for the Global LEAP (Global Leadership in Anesthesia Pathway) program, an advanced track for residents interested in developing in-depth global health expertise and extensive international experience. Co-directed by J. Matthew Kynes, MD, and Jon Niconchuk, MD, the track is now in its fourth year and boasts 12 Global LEAP Scholars.

The department is also proud of the on-going global health contributions of our CRNA team members. Over the past several years, numerous CRNAs have traveled to underserved countries of the world, including Guatemala, Kenya, Nigeria, Uganda and others, for teaching and service projects and have participated in tele-education lecture series for anesthesia providers and trainees in East Africa.

The Department of Anesthesiology's on-going global advocacy efforts include advising ministries of health in low- and middle-income countries in the development of National Surgery, Obstetric and Anesthesia Plans (NSOAPs). Through VIA, the Department of Anesthesiology also offers the Vanderbilt Global Anesthesiology Fellowship, hosts visiting ASA Global Scholars and convenes the quarterly Vanderbilt International Journal Club.

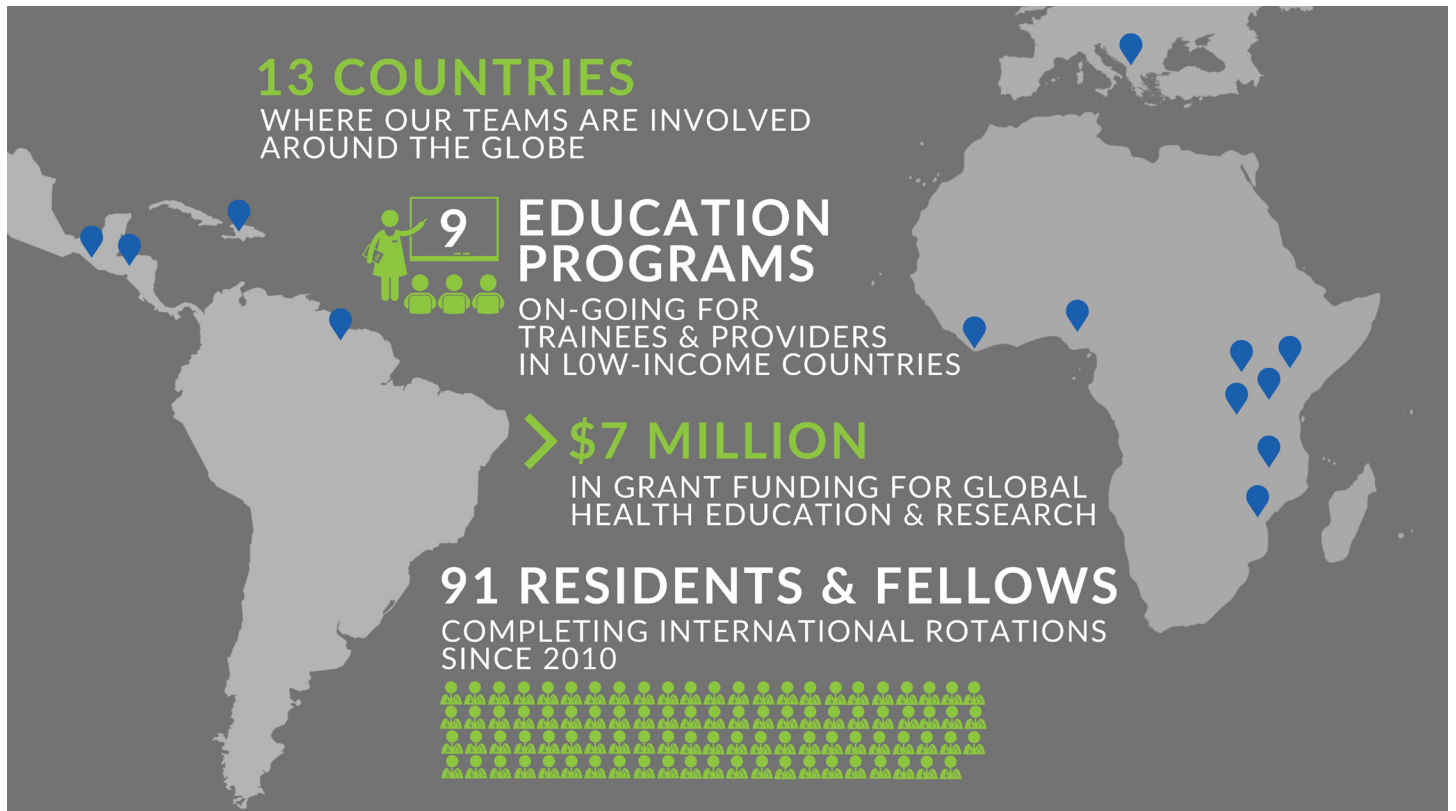
The department looks forward to continuing to expand efforts to improve anesthesia care across the globe in 2022 and beyond. ♦



*Bantayehu Sileshi, MD, demonstrates effective OR teaching methodology to anesthesia educators in Ethiopia. (Photo by Claire Posey)*



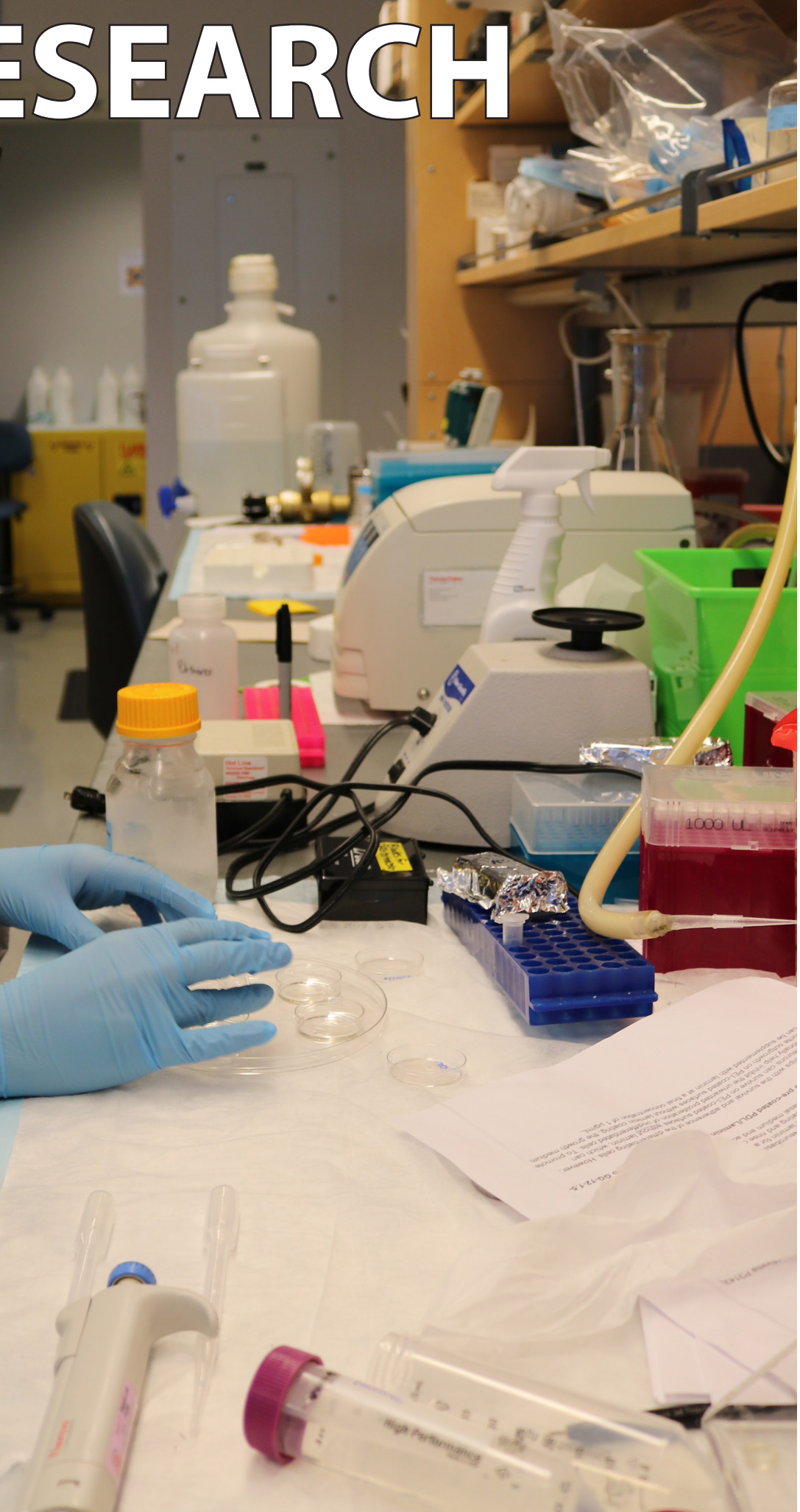
# Vanderbilt International Anesthesia



*Pediatric anesthesiology fellow Ben Roberts, MD, observes a procedure at AIC Kijabe Hospital in Kenya during his VIA elective rotation. (Photo by David Shirk)*



# RESEARCH





The vision of the Research Division is to advance knowledge in the fields of perioperative medicine, critical care, pain medicine and other related disciplines by fostering excellence, collaboration and the development of young investigators.

In federal fiscal year 2020, the Vanderbilt University School of Medicine (VUSM) ranked 9th among U.S. medical schools for National Institutes of Health (NIH) funding, with more than \$481 million in funding. VUSM funding from all sources has more than doubled since 2001.

Anesthesia investigators brought in more than \$10 million in total extramural research funding. This included more than \$7.1 million in awarded NIH grants, which placed Vanderbilt Anesthesiology 11th among U.S. academic anesthesiology departments in NIH funding.

Within the department, faculty published 261 papers in fiscal year 2020, up from 69 papers in fiscal year 2010, within the peer-reviewed literature.

The department's Clinical Research program focuses on improving healthcare through clinical research and education. The program includes both investigator-initiated and industry-sponsored clinical projects, including NIH-supported single center and multicenter clinical trials. The program is advancing medical practice in the fields of perioperative care, critical care, chronic pain and medical devices. Investigators are practicing physicians who use clinical expertise to develop research protocols that seek to answer clinically significant questions and test novel treatments.

Clinical research is supported and facilitated by the Perioperative Clinical Research Institute (PCRI), Vanderbilt Anesthesiology Clinical Research Advisory Committee (VACRAC) and Vanderbilt Anesthesiology & Perioperative Informatics Research (VAPIR).

PCRI provides a full range of services necessary for successful clinical research. These services include regulatory management, data management, contracts management,

biostatistics, bioinformatics, study execution and financial oversight. The PCRI oversees more than 155 active clinical trials, with many more studies in development. The PCRI is led by Medical Director David McIlroy, MB.BS., MD, MCLinEpi, Vice Chair for Research Edward Sherwood, MD, PhD, and Director of Clinical Trials Research Debra Craven, MSN, MMHC. The team consists of highly trained and broadly experienced research professionals, including four research nurses, four clinical trial coordinators, a regulatory specialist and an administrative assistant.

VACRAC is composed of a panel of experienced clinical investigators who review research protocols and discuss design and implementation with investigators. This process improves the design and execution of clinical research projects, resulting in more rapid and effective study origination and completion.

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. VAPIR is led by Director Robert Freundlich, MD, MS, MSCl.

The division collaborates internally with other departments at Vanderbilt to facilitate information analysis and dissemination, with the goal of improving outcomes for surgical patients. The division also supports access to the electronic medical record to allow for high quality data acquisition and analysis to support research and quality improvement initiatives.

Investigators in the Basic Science Division conduct high quality basic and translational research, with the goal of advancing current knowledge and improving patient care. Specific areas of interest include ion transport, cell signaling, drug discovery, organ protection, pain management, the neurobiology of addiction, innate immunity and fetoplacental circulation.

The Vanderbilt Department of Anesthesiology has a strong, multifaceted approach to research, which can be viewed on the following pages. ♦

WITH MORE THAN  
**\$481**  
**MILLION**  
IN NIH FUNDING

VUSM RANKED  
**9th**  
AMONG UNITED  
STATES MEDICAL  
SCHOOLS FOR  
NIH FUNDING

ANESTHESIA  
INVESTIGATORS  
BROUGHT IN MORE  
THAN  
**\$10**  
**MILLION**  
IN EXTRAMURAL  
FUNDING

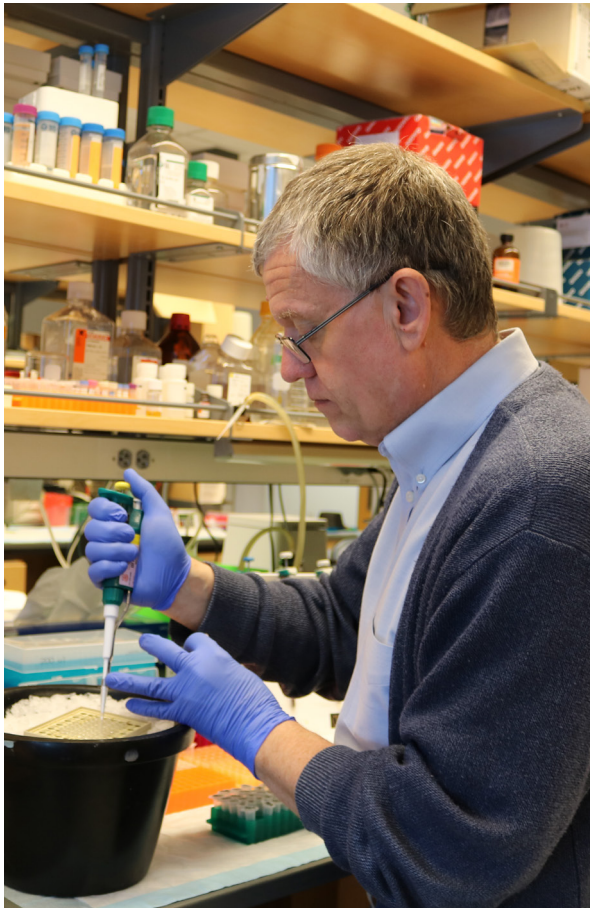
INCLUDING MORE  
THAN  
**\$7.1**  
**MILLION**  
IN NIH GRANTS

IN FY2020  
DEPARTMENT  
FACULTY  
PUBLISHED  
**261**  
PEER-REVIEWED  
PAPERS

THE PCRI OVERSEES  
**155**  
ACTIVE CLINICAL  
TRIALS

# Lab Research Advancing Medical Science

Director: Eric Delpire, PhD



The work of the Basic Science Research Division is diverse and ranges from ion channel physiology and pharmacology to immunology to pain. Multiple projects by investigators are sponsored by the National Institutes of Health. Brief descriptions of work within the Research Division and its core investigators are provided here.

Stephen Bruehl, PhD, Professor of Anesthesiology, has identified pain-related alterations in interacting cardiovascular-pain modulatory systems that contribute to enhanced pain responsiveness.

Eric Delpire, PhD, Professor of Anesthesiology, Molecular Physiology and Biophysics, Director of Basic Science Research and BH Robbins Director in Anesthesiology Research, utilizes genetically modified mouse models and a variety of molecular techniques to investigate how neuronal  $\text{Cl}^-$  transporters modulate inhibitory synaptic transmission and how renal  $\text{Na}^+$  transporters and associated proteins regulate salt reabsorption and blood pressure.

Jerod Denton, PhD, Professor of Anesthesiology and Pharmacology, 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.

Brad Grueter, PhD, and Carrie Grueter, PhD, Assistant Professors, are researching the neurobiology of addiction and reward-related behaviors. They utilize state-of-the-art electrophysiology techniques, including optogenetics, as well as a battery of specialized neurobehavioral tests performed in genetically modified mouse models.

Matthias Riess, MD, PhD, Professor of Anesthesiology and Pharmacology, 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.

Edward Sherwood, MD, PhD, Professor of Anesthesiology, Pathology, Microbiology and Immunology, Cornelius Vanderbilt Chair in Anesthesiology and Vice Chair for Research, Julia Bohannon, PhD, Assistant Professor of Anesthesiology, and Antonio Hernandez, MD, MSCI, Associate Professor of Anesthesiology, are studying several aspects of sepsis and burn injury and the application of immunotherapy in critically ill patients.

Josh Billings IV, MD, MSCI, Associate Professor of Anesthesiology and Medicine, is developing new therapy for perioperative organ injury by conducting clinical trials and evaluating mechanisms of surgery-induced organ injury. Broadly this includes studying and manipulating the patient response to acute surgical stress to reduce morbidity, but specifically he is investigating the impact of perioperative oxidative damage as a mechanism of acute kidney and brain injury in patients having surgery. ♦



# Advancing Technology & Improving Patient Care



The informatics groups work outside the operating room, advancing patient care through innovations in patient safety and quality. By harnessing innovative technology into clinical applications, **VAPIR** and **Perioperative Informatics** are advancing the frontiers of science and healthcare. Faculty members engage with students through mentorship and training programs, equipping the next generation of professionals.

## Perioperative Informatics

Perioperative Informatics, led by Jonathan Wanderer, MD, MPhil, designs, develops, and implements system enhancements for the periprocedural and inpatient care areas. The team supports vendor-based solutions and integrates them with the Epic unified application suite. Using health information technology solutions, the Perioperative Informatics group 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.

Recent accomplishments include:

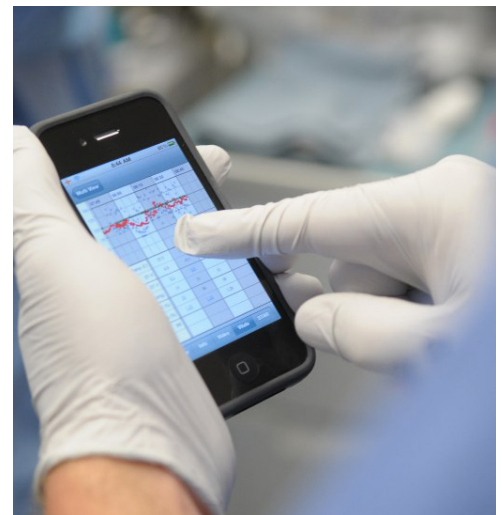
- Implementation of Epic at Vanderbilt Health Belle Meade and One Hundred Oaks North GI.
- Development of a new postoperative checklist.
- Participation in the VUMC/Epic Collaborative to extend notification and communication functionality within Epic.

## Vanderbilt Anesthesiology & Perioperative Informatics Research (VAPIR) Division

VAPIR, led by Robert Freundlich, MD, MS, MSCI, collaborates broadly to better understand perioperative care. 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 ongoing projects, VAPIR has:

- Created the informatics backbone that supports the Vanderbilt Perioperative Consult Service.
- Analyzed the impact of real-time decision support tools created by the Perioperative Informatics team.
- Worked closely with Perioperative Informatics to develop a common data architecture, enabling seamless data analysis from our legacy Electronic HealthRecord, VPIMS (Vanderbilt Perioperative Information Management System) and current eStar (Epic) system. ♦



INFORMATICS  
DATABASE SIZE

**19**  
TERABYTES

CURRENT  
ACTIVE PROJECTS

**24**

CASES CONTAINED  
IN THE  
PERIOPERATIVE  
DATA WAREHOUSE

**1,709,754**

# Perioperative Clinical Research Institute

The Perioperative Clinical Research Institute (PCRI) is led by David McIlroy, MB.BS., MD, MClInEpi, Edward Sherwood, MD, PhD, and Debra Craven, MSN, MMHC. The mission of PCRI is to:

- Promote a culture of large and robust clinical trials that would, in turn, provide high-quality evidence to inform perioperative practice nation-wide.
- Promote high-quality, high-impact clinical research tailored to the experience and expertise of individual clinicians and accessible to all members of the department.
- Create opportunities for junior investigators to learn the process of clinical research.
- Mentor investigators throughout the research development and implementation process.

- Promote Good Clinical Practice (GCP) and ensure regulatory compliance.

The PCRI team provides a full range of support services, including development and submission of IRB applications, contracts management, initiation and execution of clinical studies, regulatory and compliance oversight, data management, biostatistics and biomedical informatics support. The end-goal is execution and publication of well-designed clinical research studies that address important questions, from smaller studies designed to generate preliminary, pilot or feasibility data in support of subsequent grant applications through to multi-center investigator-initiated studies.

Most of the department's investigators are practicing physicians who use their clinical expertise to develop research protocols that answer clinically important questions. The PCRI team consists of highly trained and broadly experienced research professionals, including research nurses, clinical trial coordinators, a regulatory specialist and administrative support. ♦





# Key Clinical Research Studies

## **Brian Allen, MD**

A Randomized Controlled Trial of Regional versus General Anesthesia for Promoting Independence After Hip Fracture (REGAIN Trial)

## **Bret Alvis, MD**

Non-Invasive Venous waveform Analysis (NIVA)-a proof of concept study

## **Clayne Benson, MD**

Renal Venous Pressure Monitoring with IVC Clamping during Liver Transplantation

## **F. T. (Josh) Billings IV, MD, MSCI**

A Phase 2 Proof of Concept, Double-blind, Randomized, Placebo-controlled Study to Evaluate the Efficacy of ASP1128 (MA-0217) in Subjects at Risk for Acute Kidney Injury following Coronary Artery Bypass Graft (CABG) and/or Valve Surgery

## **Julia Bohannon, PhD**

Immunomodulation Strategies to Protect Against Nosocomial Infections after Severe Burn Injury Through Trained Immunity

## **Christy Crockett, MD**

Pediatric Difficult Intubation (PeDI) Registry – Improving Safety and Quality of Airway Management in Children with Difficult Airways

## **David A. Edwards, MD, PhD**

A Randomized, Double-Blind, 2-Way Crossover Trial to Assess the Efficacy of Guanfacine and Lidocaine Combination versus Lidocaine Alone in Trigeminal Nerve Block for Pain Management in Painful Trigeminal Neuropathy Patients

Evaluation of state-mandated acute and post-surgical pain-specific CDC opioid prescribing guidelines

Postoperative Pain Profiles, Analgesic Use, and Transition to Chronic Pain and Excessive and Prolonged Opioid Use Patterns (MPOG-UTAH)

TN Together and opioid prescribing at VUMC. A retrospective interrupted time series analysis of opioid prescribing data

## **Holly Ende, MD**

Effect of multimodal analgesia on postoperative pain control and opioid use following cesarean delivery in patients receiving buprenorphine

Implementation of a countdown timer for neuraxial labor analgesia assessments to improve anesthesia provider responsiveness and patient outcomes

Multicenter Genome-Wide Association Study of Postpartum Hemorrhage

## **Robert Freundlich, MD, MS, MSCI**

A retrospective chart review of the association between postoperative hypotension and ICU delirium in the cardiac surgery patient

Automated Emails to Improve Evening Staffing

Development of a Dynamic Predictive Model for Postoperative Respiratory Decompensation in non-Intensive Care Unit Patients

Multicenter perioperative outcomes group (MPOG) performance site

Natural Language Processing of Electrocardiogram Interpretations

Reducing Reintubation Risk in High-Risk Cardiac Surgery Patients with High-Flow Nasal Cannula

## **Antonio Hernandez, MD, MSCI**

A study analyzing human blood monocytes and macrophages upon stimulation of cells with TLR ligands

## **Christopher Hughes, MD**

Cognitive and Physical Exercise to improve Outcomes after Surgery (COPE-iOS) study

## **Miklos Kertai, MD, PhD**

Delineating Thromboembolic Complications After RBC Transfusion in Cardiac Surgery Patients

Multicenter Perioperative Outcomes Group (MPOG)

ASPIRE (Anesthesiology Performance Improvement and Reporting Exchange) Quality Improvement Project

Platelet Counts, Mean Platelet Volume and Acute Kidney Injury after Transcatheter Aortic Valve Replacement (TAVR)

Preemptive Pharmacogenetic-guided Metoprolol Management for Postoperative Atrial Fibrillation in Cardiac Surgery: the PREEMPTIVE-Pilot Trial.

## **J. Matthew Kynes, MD**

Determining the Perioperative Mortality Rate in Low-income Countries

## **Matthew McEvoy, MD**

Analysis of the Safety of Lidocaine Infusions within an Established Enhanced Recovery Program on Non-monitored Floor Patients

## **Marcos Lopez, MD**

Perioperative Vascular Reactivity

The role of the SOX6 gene in the development of aortic aneurysms

## **Amanda Lorinc, MD**

Process Outcomes in Pediatric Patients Undergoing Appendectomy during the COVID-19 Pandemic: A Meta-Analysis of Case-Control Studies

## **David McIlroy, MB.BS., MD, MClInEpi**

Is ERAS with opioid-minimizing anesthesia associated with perioperative outcomes and long-term opioid use? A retrospective analysis

## **Kelly Mishra, MD**

Combined Heart-Kidney Transplantation - A Retrospective Chart Review

## **Puneet Mishra, MD**

A Sequenced-Strategy for Improving Outcomes in People with Knee Osteoarthritis Pain (SKOAP)

## **David Moore, MD**

Outcomes and Health Care Resource Utilization in Congenital Heart Disease Patients Undergoing Noncardiac Procedures

## **Pratik Pandharipanda, MD, MSCI**

Human Factors Formative Study of Clarity-IA® Gas Delivery System

## **Britany Raymond, MD**

Perioperative Ketamine Infusion and Inpatient Opioid Consumption

## **Srijaya Reddy, MD, MBA**

Pediatric Craniofacial Surgery Perioperative Registry (PCSPR)

## **Brian Rothman, MD**

Preoperative COVID testing as a predictor of community disease burden

## **Joseph Schlesinger, MD**

A Prospective, Single Center Study of the Effects of Modulating Music in the Operating Room

## **Edward Sherwood, MD, PhD**

Macrophage Mitochondrial Reprogramming and Innate Immune Memory

## **Kara Siegrist, MD**

Erector Spinae Plane Catheter Analgesia in Minimally Invasive Mitral Valve Surgery: A Retrospective Analysis of a Single Center Experience

## **Bantayehu Sileshi, MD**

Defining Perioperative Morbidity and Mortality in Western Kenya: A Quality Improvement Project

Impact of Mobile Obstetric Simulation Training (MOST) on Ethiopian healthcare providers' adherence to delivery checklists and maternal outcomes

The use of portable ultrasound in low resource settings to aid in perioperative assessment of patients

## **Hedi Smith, MD, MSCI**

Maximizing Efficacy of Goal-Directed Sedation to Reduce Neurological Dysfunction in Mechanically Ventilated Infants and Children STUDY (mini-MENDS)

## **Loren Smith, MD, PhD**

High Density Lipoprotein Characteristics and the Risk of Acute Kidney Injury Following Cardiac and Vascular Surger

## **Amanda Stone, PhD**

Biopsychosocial predictors of opioid use for pediatric postsurgical pain

The influence of childhood chronic pain history on parenting and pain-related risk in offspring: A longitudinal cohort study

## **Michael Taylor, MD**

Effect of neuraxial clonidine during cesarean delivery in parturients receiving buprenorphine medication-assisted treatment: a retrospective study

## **Camila Walters, MD**

The Global Burden of Pain Evaluation Proposal

## **Jonathan Wanderer, MD, MPhil**

Machine Learning approach to optimizing preoperative pre-transfusion testing

National Practice Patterns for Postoperative Nausea and Vomiting Prophylaxis

Understanding the Accuracy of Clinician Provided Estimated Discharge Dates

# NIH Funded Research

## **Bret Alvis, MD**

Bret Alvis, was awarded a five year NIH grant for his study of non-invasive venous waveform analysis (NIVA). His group works to better understand the entire spectrum of volume status through translational research of venous waveforms and device development. NIVA developed to optimize hemodynamic assessment in three key ways: signal capture using non-invasive wrist sensor, signal deconstruction by mapping individual amplitudes within a patient's waveform, and signal decoding using NIVA.

## **Fredric T. (Josh) Billings IV, MD, MSCI**

The research program of Frederic T. (Josh) Billings IV is supported by several NIH grants. He is focused on developing new therapy for perioperative organ injury by evaluating and affecting mechanisms of surgery-induced organ injury. His research includes surgical patients and their tissues, preclinical models, and clinical trials. Broadly this includes studying and manipulating the patient response to acute surgical stress, but specifically he is investigating the impact of variable oxygen administration on putative mechanisms of organ injury. These mechanisms include excess production of reactive oxygen species, impaired vascular function, and heme-protein mediated tissue damage. His group studies the impact of oxygen on these processes so that they can determine the optimal oxygen administration throughout the perioperative period to reduce organ injury. This addresses a large unmet need for millions of patients, because oxygen administration during surgery is highly variable, unguided, often excessive, and potentially harmful.

## **Julia Bohannon, PhD**

Julia Bohannon's NIGMS-funded research seeks to understand how severe burn injury impacts innate immune cell metabolism and mitochondrial function, leading to greater susceptibility to infection in these patients. Her lab is investigating toll-like receptor signaling pathways and how these pathways can be harnessed for therapeutic benefit in restoring immunometabolic dysfunction after severe burn to enhance resistance to infection. Using mouse models of burn injury and infection, as well as immune cells collected from human burn patients, her lab is studying the therapeutic impact of toll-like receptor agonists on improving immune function and protection against infection after severe burn injury.

## **Stephen Bruehl, PhD**

Stephen Bruehl's lab is supported by NIH funding to study topics related to pain and opioid risks. Ongoing projects are examining the role of oxidative stress mechanisms in long-term pain outcomes following total knee arthroplasty (R01AG048915), evaluating the mechanisms underlying effects of mindfulness training and spinal manipulation therapy on chronic low back pain (R01AT009680), and testing whether endogenous opioid and endocannabinoid mechanisms

contribute to associations between stress and increased opioid misuse risk (R01DA050334).

## **Eric Delpire, PhD**

Eric Delpire's research is funded by two NIH grants and a Leducq Foundation network for excellence grant, the goal of which is to expand the NIH funded research. He studies the regulation of transporters involved in salt reabsorption in kidney by protein kinases and adaptor proteins. The kinases serve as rheostats stimulating sodium reabsorption in conditions of potassium deficiency. The research also involves cotransporters involved in the control and maintenance of cell volume.

## **Jerod Denton, PhD**

The Denton laboratory has several NIH-funded programs aimed broadly at the molecular pharmacology and structure-function relationships of ion channels. Three funded programs employ high-throughput screening of small-molecule libraries, medicinal chemistry, and voltage clamp electrophysiology to develop first-in-class inhibitors of potassium channels expressed in the kidney (Kir4.1/5.1), sperm (SLO3), and vascular smooth muscle cells (Kir6.1/SUR2B) to explore their therapeutic potential for hypertension/edema, contraceptive targets, and treatment of patent ductus arteriosus, respectively. A newly funded 5-year R01 will leverage LRRC8 channel chimeras to explore structure-function relations of volume regulated anion channels (VRAC) using electrophysiology and single-particle cry-EM microscopy.

## **Robert Freundlich, MD, MS, MSCI**

For his K23 award from the National Heart, Lung, and Blood Institute (NHLBI), Robert Freundlich is studying the use of novel clinical informatics tools to conduct pragmatic clinical trials. He is focusing on a pragmatic clinical trial to prevent reintubation after cardiac surgery. In addition to his research interests, he has completed his Master of Science in Clinical Investigation (MSCI) as well as obtained board certification in clinical informatics over the course of the K23 funding period. He plans to use these skills and experience in the future to conduct additional pragmatic clinical trials leveraging the electronic health record.

## **Brad Grueter, PhD**

The nucleus accumbens is an essential hub in the reward system, integrating cognitive, contextual, sensory, and affective information into behavioral outcomes. The proposed work will test the hypothesis that feed forward microcircuits within the nucleus accumbens regulate motivated behavior and are hijacked by drugs of abuse. By defining circuits and synaptic mechanisms recruited by drugs of abuse, the proposed research is relevant to the NIH and NIDA's mission that pertains to developing fundamental knowledge that will help reduce the burdens of addiction.



## **Antonio Hernandez, MD, MSCI, FCCM, FASE**

Antonio Hernandez is studying synthetic toll-like receptor 4 agonist to induce trained immunity for the purposes of augmenting the innate immune response against severe sepsis and nosocomial pneumonia and preserving organ function during renal ischemia. His work is focused on clinically relevant models of infection and injury, with a goal of reducing nosocomial infection in post-operative and critically ill patient populations, and preservation of organ function. These studies are funded by the NIH Institute of General Medical Sciences (NIGMS) K08 123345. He is mentored by Edward Sherwood.

## **Christopher Hughes, MD, MS, FCCM**

Christopher Hughes has funding from the National Institute on Aging to evaluate whether a pragmatic program combining computerized cognitive training and physical training throughout the perioperative period will improve long-term cognitive and disability outcomes in older patients having major surgery. Additionally, he will be evaluating mechanisms of impairment through blood biomarkers and brain magnetic resonance imaging. In separate funding from the National Institute on Aging, Dr. Hughes is evaluating the alpha2-agonist guanfacine as treatment for delirium in critically ill patients, including whether it can improve hospital course and post-discharge outcomes.

## **Marcos Lopez, MD, MS**

For his K23 award, Marcos Lopez has designed and performed experiments to measure vascular reactivity and oxidative damage in patients having cardiac surgery recruited into a randomized clinical trial of oxygen treatment during cardiac surgery. He is testing the hypotheses that 1) normoxia during cardiac surgery improves endothelial function compared to hyper-oxygenation and that intraoperative oxidative stress correlates with postoperative endothelial dysfunction, 2) arterioles isolated from mediastinal fat collected from subjects randomized to normoxia have superior endothelium-dependent and -independent vascular reactivity compared to those from hyperoxygenated subjects, and 3) that perioperative endothelial dysfunction is associated with postoperative kidney and brain injury. His goal is to identify novel mechanisms of perioperative organ injury in order to improve prevention and to identify novel treatments.

## **Edward Sherwood, MD, PhD**

Vaccines, which act by priming the adaptive immune system to induce highly specific, long-lived resistance to infection, are among the greatest advances in medicine. Recent studies show that the innate immune system also retains memory of prior pathogen exposure and becomes primed to elicit a robust, broad-spectrum antimicrobial response to subsequent infection. Research by the Sherwood lab shows that treatment with TLR4 ligands, such as monophosphoryl lipid A (MPLA), confers innate

immune memory and resistance to a broad array of clinically important pathogens. However, the cellular and molecular mechanisms driving innate immune memory are poorly understood. The Sherwood lab has shown that remodeling of macrophage metabolism is essential to generating innate immune memory. Ongoing NIH-funded research in the Sherwood lab is designed to determine how metabolic reprogramming drives innate immune memory in macrophages and determine the ability of diverse microbial ligands to induce innate immune memory. The goal of this research is to develop new drugs that can treat and prevent infections in vulnerable patient populations.

## **Heidi Smith, MD, MSCI, FAAP**

Heidi Smith has funding from the National Heart, Lung, and Blood Institute to determine whether sedation impacts the prevalence of delirium, length of mechanical ventilation, and development of long-term cognitive impairment or post-traumatic stress symptoms. Ventilated pediatric patients are frequently over-sedated, and the majority suffer from delirium, a form of acute brain dysfunction that is an independent predictor of increased risk of dying, length of stay, and hospital costs. Universally prescribed sedative medications—the GABA-ergic benzodiazepines—worsen this brain organ dysfunction and independently prolong duration of ventilation and ICU stay, and the available alternative sedation regimen using dexmedetomidine, an alpha-2 agonist, has been shown to be superior to benzodiazepines in adults and may mechanistically impact outcomes through positive effects on innate immunity, bacterial clearance, apoptosis, cognition, and delirium. The mini-MENDS trial will compare dexmedetomidine and midazolam and determine the best sedative medication to reduce delirium and improve duration of ventilation and functional, psychiatric, and cognitive recovery in our most vulnerable patients—survivors of pediatric critical illness.

## **Loren Smith, MD, PhD**

Loren Smith's long-term research goal is to diminish postoperative organ injury and improve patient outcomes by developing novel methods of perioperative protection, particularly lipoprotein-based therapies. Dr. Smith's research team demonstrated a novel association between preoperative high-density lipoprotein (HDL) cholesterol concentration and a decreased risk of acute kidney injury (AKI) after cardiac surgery and demonstrated that statin exposure strengthens the association between a high preoperative HDL concentration and a decreased risk of AKI after cardiac surgery. Smith continues to investigate the perioperative role of lipoproteins in the prevention of postoperative organ injury and as a systemic signaling mechanism during acute stress. Her translational research program utilizes clinical research studies in surgical patients, in vivo mouse models, and in vitro experimental techniques. ♦

# Center for Research and Innovation in Systems Safety

Director: Matthew Weinger, MD



VUMC's Center for Research and Innovation in Systems Safety (CRISS), directed by Matt Weinger, MD, is a highly interdisciplinary and collaborative center, with projects spanning numerous clinical domains and disciplines.

Using a range of human factors, usability and systems engineering, cognitive psychology, and implementation science techniques, CRISS studies performance during patient care and in realistic simulations to better understand how and why care deviates from optimal, then designs and studies interventions to improve care safety and quality.

CRISS investigators include anesthesiologists, PhD researchers, nursing and design staff, and faculty collaborators across Health Sciences and in the School of Engineering.

CRISS is particularly interested in designing and evaluating medical technologies and the use of electronically generated clinical data to identify evolving events and support decision-making.

CRISS explores the nature of expertise, clinician communication, situational awareness, the workload and stress of individual clinicians and of teams, teamwork, individual and group performance-shaping factors, alarms, human-technology interactions and novel methods of information presentation to improve care processes and outcomes.

CRISS provides internal and external consulting services for numerous customers. At VUMC, CRISS faculty and staff currently provide support for a number of health informatics and quality improvement initiatives. CRISS conducts formal usability testing of software applications and of medical devices.

Externally, CRISS is involved in numerous academic collaborations to re-engineer medical processes, improve clinician decision-making and enhance the usability and usefulness of clinical technology. For example, CRISS has provided more than a dozen years of support to the Department of Veterans Affairs to improve its national EHR system, including the development, testing and implementation of decision support tools in several clinical domains.

CRISS also helped to create a national standardized approach to human factors and user-centered design in VA healthcare. Further, CRISS conducts FDA-compliant human factors engineering consulting for proprietary medical devices. ♦

**\$1.8 MILLION**  
ANNUAL RESEARCH BUDGET

**56**  
EXTERNAL COLLABORATORS

**52**  
INTERNAL COLLABORATORS

**48**  
PEER-REVIEWED PUBLICATIONS

**15**  
INVITED PRESENTATIONS

**7**  
FACULTY MEMBERS

**10**  
STAFF MEMBERS



# Vanderbilt Anesthesiology Clinical Research Advisory Committee

VACRAC (Vanderbilt Anesthesiology Clinical Research Advisory Committee), in partnership with the Perioperative Clinical Research Institute (PCRI), supports new and established investigators as they develop clinical research projects, with the goal of optimizing study design and resource utilization. The committee oversees the development and conduct of industry-sponsored and investigator-initiated research by providing guidance to assure optimal study design and protocol development as well as managing essential research services and programs.

The mission of VACRAC is to:

- Promote a culture of large and robust clinical trials that would, in turn, provide high-quality evidence to inform perioperative practice nation-wide.
- Promote high-quality, high-impact clinical research tailored to the experience and expertise of individual clinicians and accessible to all members of the department.
- Create opportunities for junior investigators to learn the process of clinical research.
- Mentor investigators throughout the research development and implementation process.
- Promote Good Clinical Practice (GCP) and ensure regulatory compliance.

VACRAC is co-chaired by Edward Sherwood, MD, PhD (Vice Chair for Research), David McIlroy, MB.BS., MD, MClinEpi (Medical Director, Perioperative Clinical Research Institute),

Pratik Pandharipande, MD, MSCI (Vice Chair for Faculty Affairs), and Matthew Shotwell, PhD (Department of Biostatistics). The committee's membership is composed of established clinical investigators in the Department of Anesthesiology.

Any member of the Department of Anesthesiology may submit a clinical research proposal as a 1-page on-line submission including a brief background to the clinical problem, a primary hypothesis for testing, and the likely significance of the result of the proposed study. All proposals undergo rapid review by a small research committee, with written feedback provided, including a traffic-light style triage system and advice on what may be required to advance the project. Resource intensive projects are typically triaged into a more intensive VACRAC studio where investigators present their proposals to senior clinical researchers within the department for real-time discussion and dialogue aimed at refining the study methodology.

Currently active studies included a mix of funded and unfunded studies, investigator-initiated and industry-sponsored studies, single-center and multi-center clinical trials, observational and retrospective studies. The department and institution strongly support the initiation, development and execution of large pragmatic trials. Recent or current clinical trials with which we are involved include the multicenter REGAIN trial of general anesthesia vs regional anesthesia after hip fracture, the single-center COPE-iOS trial testing the effectiveness of cognitive and physical exercise to improve outcomes after surgery, a single-center study of pharmaco-genomic guided beta-blocker administration in patients undergoing cardiac surgery, large pragmatic trials of intraoperative ketamine and high-flow nasal cannula to reduce re-intubation after cardiac surgery. ♦



David McIlroy,  
MB.BS., MD, MClinEpi



Pratik Pandharipande,  
MD, MSCI



Edward Sherwood,  
MD, PhD



Matthew Shotwell,  
PhD

# Benjamin Howard Robbins Scholar Program

The Benjamin Howard Robbins Scholar Program was initiated in 2007 to support the professional development of department early-stage physician-scientists. The program builds critical research skills under direct mentorship of established scientists with the goal that all Robbins Scholars establish vigorous, independently funded research programs. The program is named in honor of the department's first chairman, a renowned physician-scientist. The BH Robbins Scholar Program is multidisciplinary, encouraging and supporting mentorships and collaborations that extend well beyond traditional boundaries of anesthesia. Scholars apply and are rewarded on a competitive basis.

Department Chair Warren Sandberg, MD, PhD, notes, "The BH Robbins Scholar Program provides a unique mentored research experience for early-stage investigators that includes a two-year multidisciplinary fellowship devoted to research. 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. The program is material evidence of our staunch commitment to identifying and developing future generations of anesthesiologist clinician-scientists, with a now 15-year track record of excellence."



The BH Robbins Scholar Program is directed by **F. T. (Josh) Billings IV, MD, MSCI**, who states, "We strive to mentor, develop and support physician-scientists so that they make discoveries that advance the care of perioperative and critically ill patients. This is a critical goal of academic anesthesiology and our department."

Two scholars completed the program June 2021, **Drs. Puneet Mishra and Kevin Manz**. **Dr. Mishra** is an assistant professor in the Division of Pain Medicine focusing on the development and evaluation of novel treatment options for patients suffering from chronic knee pain. His research is supported by several NIH and investigator-initiated industry grants. He recently completed a randomized clinical trial examining the efficacy of preoperative genicular nerve radiofrequency ablation in reducing pain and improving functional outcomes in patients undergoing total knee arthroplasty. He is now focused on an NIH supported multisite project exploring optimal conservative and interventional strategies for knee pain. Given the vast number of patients suffering from chronic knee pain, Dr.

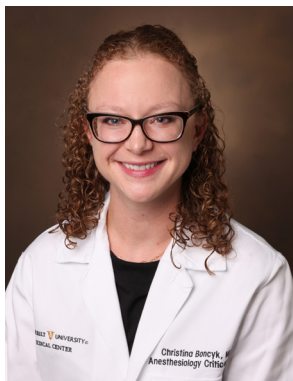
Mishra's research serves a critical role in helping patients improve their quality of life. He is mentored by Stephen Bruehl, PhD. **Dr. Manz** is an MSTP student who completed his doctorate and postdoctoral training in Dr. Brad Grueter's neuroscience research lab. His work focuses on mechanisms of synaptic plasticity in the nucleus accumbens, using patch-clamp electrophysiology, pharmacology, optogenetics and voltammetry to dissect the properties of microcircuits and monoamines in the brain's reward network. Dr. Manz is pursuing critical care medicine, and his long-term research goal is to understand the cellular, synaptic and behavioral dynamics in hypothalamic wake centers implicated in ICU-associated cognitive and affective states. Puneet and Kevin have completed excellent work and have exciting futures!

Areas of research for current scholars are briefly described herein.



**Matthew Barajas, MD** (Scholar 2020-2022) is a cardiothoracic anesthesiologist investigating ischemic post conditioning in a rat model of fibrillatory cardiac arrest. In addition, he is evaluating peripheral intravenous waveform analysis (PIVA) and its utility across several types of shock, including hemorrhage, respiratory arrest and acute obstructive shock.

His work on PIVA was honored with the Junior Faculty Research Award at this year's Association of University Anesthesiologists annual meeting and selected for presentation in the Best of Meeting section of the Society of Cardiovascular Anesthesiologists Annual Meeting. He is supported by the department's T32 training grant and an SCA starter grant. He looks forward to continuing his success under the mentorship of Matthias Riess, MD, PhD, and Susan Eagle, MD.

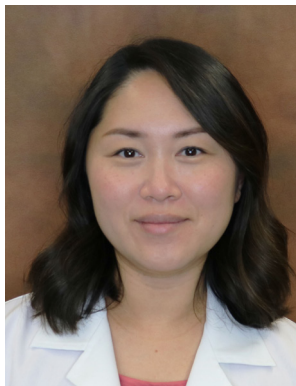


**Christina Boncyk, MD** (Scholar 2018-2022) is an assistant professor in the Division of Anesthesiology Critical Care Medicine investigating the impact of increased medication burden during acute hospitalization and following intensive care unit (ICU) survival on patient survival, cognitive impairment



# Benjamin Howard Robbins Scholar Program

and physical function. Her work is supported by a FAER Mentored Research Training Grant and the Society of Academic Associations of Anesthesiology & Perioperative Medicine (SAAAPM). Her T32 work included looking at the association of antipsychotic medications on in-hospital outcomes among delirious ICU patients. Her long-term research interests include improving ICU survivorship through identification of modifiable medication interventions and interactive ICU survivors' support services. Dr. Boncyk is mentored by Christopher Hughes, MD, MS, and Pratik Pandharipande, MD, MSCI.



**Dianne Lou, MD, PhD**  
(Scholar 2019-2022)

researches the phenomenon of widespread pain in head and neck cancer survivors, using functional and structural MRI, quantitative sensory testing and patient reported outcomes. She is the principal investigator of a randomized controlled trial using multimodal treatment for the prevention of chronic systemic symptoms after treatment,

such as widespread pain and cognitive dysfunction. She is mentored by Barbara Murphy, MD, Dept of Medicine, Division of Hematology/Oncology, and David A. Edwards, MD, PhD, Dept of Anesthesiology, Division of Pain Medicine. She completed her second year of the T32 in July 2021 and will continue her research during a Pain Medicine fellowship in 2021-2022.



**Naeem Patil, MBBS, PhD**  
(Scholar 2018-2022) is a research assistant professor investigating the molecular mechanisms leading to sepsis-induced immunosuppression and organ injury. His current studies are focused on elucidating the mechanisms driving cellular mitochondrial dysfunction as a key driver of sepsis pathology. Utilizing small molecules such as Toll-like receptor agonists and

therapeutics targeting the metabolic reprogramming pathways, Dr. Patil's studies aim to preserve and augment mitochondrial function as a novel approach to protect against sepsis-induced immunosuppression and organ

injury. He is a recipient of the US Shock Society Faculty Research Award and the Vanderbilt Faculty Research Scholars Award (career development award). He is mentored by Edward Sherwood MD, PhD.



**Kimberly Rengel, MD**  
(Scholar 2017-2022) is an assistant professor in the Division of Anesthesiology Critical Care Medicine interested in improving long-term recovery for patients after major surgery or critical illness and the role of skeletal muscle health in acquired disability. Her research program is focused on the use of ultrasound to examine skeletal muscle

health throughout critical illness and its relationship to long-term acquired disability. Further, working with her mentors, she plans to translate this research into the perioperative space identifying patients at risk for acquired disability and using interventions like prehabilitation to prevent physical decline after major surgery. Recently she was awarded a Vanderbilt Faculty Research Scholar mentored research training grant to support this work and will be completing the esteemed Master of Science in Clinical Investigation program over the next two years. Dr. Rengel is mentored by Christopher Hughes, MD, MS, and Pratik Pandharipande, MD, MSCI.



**Amanda Stone, PhD** (Scholar 2018-2022) is a research assistant professor and a clinical psychologist with primary interests in pediatric pain and intergenerational factors affecting children's health outcomes. After completing the T32 training period, Dr. Stone received a K23 from NICHD to evaluate biopsychosocial predictors of opioid use for pediatric postsurgical pain. She has also received

the Early Career Research Grant from the International Association for the Study of Pain to further her work on the intergenerational transmission of risk for chronic pain. Dr. Stone aims to optimize pediatric pain management and prevent adverse outcomes. She is mentored by Stephen Bruehl, PhD. ♦

**OFFICE OF  
ANESTHESIOLOGY  
FACULTY  
AFFAIRS**

**Development**

**Engagement**

**Wellness**



**Our Team**



Pratik Pandharipande, MD, MSCI  
Vice Chair, Faculty Affairs



Amanda Stone, PhD  
Faculty Wellness Director



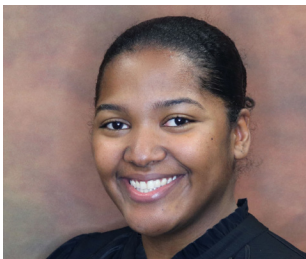
Catherine Clark  
Senior Program Manager



Lexi Anderson  
Associate Program Manager



Jasmine Gray  
Senior Administrative Assistant



Sharae Shipp  
Associate Program Manager



Martha Tanner  
Editorial Assistant III



Yvonne Poindexter  
Editor



**85**  
FACULTY ASSIGNED MENTORS

**28**  
PRESTIGIOUS NOMINATIONS  
PROCESSED

**7**  
PROMOTIONS FACILITATED

**2**  
PROGRAMS LAUNCHED



# Office of Anesthesiology Faculty Affairs

The office of Anesthesiology Faculty Affairs (AFA) in the Department of Anesthesiology seeks to facilitate the professional and academic development of its faculty, improve career satisfaction and instill a sense of meaning in our faculty from the practice of their vocation. The major pillars of AFA are faculty development, engagement and well-being through:

- Academic appointments and promotions
- The Career Development Award (CDA) and Academic Achievement Award (AAA) programs
- Annual faculty reviews
- Mentorship program
- Wellness and support initiatives
- Communication skills program (CLARITY)

## Our Mission

The mission of AFA is to encourage professional development and advancement, while supporting service to the

department, institution, specialty and society, and to advocate for and facilitate a fulfilling work experience. AFA's vision is that all faculty members in the department will attain their full potential in their professional careers.

We hope to achieve this vision ensuring that all faculty members are empowered to contribute to excellence according to their unique interests and roles across the tripartite mission of clinical, academic and educational practice. We aim to foster faculty members' sense of meaning and purpose, connection to their calling and sense of belonging in the VUMC professional community.

## Our Key Functions

Since its start in 2008, AFA has grown to encompass a broad range of functions in support of the department's faculty. Some AFA functions occur at specific times each academic year while other functions are ongoing, as shown in the Professional Development Cycle figure.

## PROFESSIONAL DEVELOPMENT CYCLE





# Office of Anesthesiology Faculty Affairs

## **Appointments and Promotions**

AFA oversees the critical functions of evaluating and approving initial faculty appointments as well as subsequent promotions and career track changes. This function is executed by the department's Appointments and Promotions Committee (APC), which annually assesses each faculty member's academic and career progress. The APC votes to recommend faculty to enter the promotion process that leads to the submission of a promotion packet to the School of Medicine for consideration. All full professors in the Educator or Scientist tracks are eligible to serve on the APC. The APC generally has 12–14 members who are selected by the AFA Vice Chair to serve staggered three-year terms to ensure fair representation across divisions.

## **Career Development Award (CDA) Program**

The CDA Program aims to provide clinical faculty with academic and administrative days, allowing dedicated time to advance their careers, achieve success in administrative roles and contribute to the missions of the department and institution beyond direct patient care. Each year, faculty submit CDA applications based on their planned administrative, educational, scholarship and academic service goals. The CDA Committee, consisting of APC members and the department's division chiefs, uses an NIH-style grant review process to evaluate the applications. After an initial review, the CDA Committee meets to discuss all applications via a transparent process based on published guidelines, considering prior success of faculty and alignment with departmental missions. The resulting CDA allocation recommendations are reviewed and approved by the department chair.

## **Academic Achievement Award (AAA) Program**

The AAA Program provides annual merit-based financial incentives to encourage professional development and academic achievement. It recognizes faculty contributions to the department's numerous missions beyond direct patient care, especially in the areas of education, scholarship and professional service.

## **Annual Faculty Reviews**

AFA coordinates annual faculty reviews, a time to celebrate faculty successes, identify challenges and

provide faculty an opportunity to discuss career goals with senior departmental leadership. An individual letter is generated based on the meeting that includes summative feedback and specific recommendations. The objective is to create individualized career development plans aligned with each faculty member's unique career goals and to maximize support for well-being of faculty.

## **Mentorship Program**

A new departmental mentorship program was introduced by AFA in FY21 to pair faculty with mentors aligned with their desired career development path. The mentorship program is based on approximately 50 scholarly hubs within the department, which are arranged thematically into affinity groups that cover broad areas of basic science, education, quality improvement, clinical research, systems engineering, informatics, clinical operations, genomics and clinical and administrative service. A tiered approach through which hub mentors are assigned senior mentors serves to boost the efficacy of the program. At time of publication, 53 faculty have had initial and follow-up quarterly meetings with their assigned mentors to outline steps for career advancement.

## **Wellness and Support Initiatives**

Faculty in an academic medical center have extremely demanding jobs with associated stressors that can degrade well-being and disrupt work-life integration. To address these pressures, our office is supported by Dr. Amanda Stone, PhD, clinical psychology, who serves as our Faculty Wellness Director. AFA works to identify and address issues related to the well-being of faculty and has designed wellness initiatives that include strategies to address burnout and a webpage of wellness resources and opportunities for support.

## **CLARITY**

CLARITY is a departmental program designed to enhance the written and oral communication skills of clinicians, researchers and staff—from faculty and fellows to managers and administrative staff. The program has three components: training to improve written and oral communication, structured editorial support (primarily for manuscripts and grants), and resources and support for publication and other scholarly processes. ♦

# 2020-2021 Selected Publications

## PEER-REVIEWED PUBLICATIONS

214

PEER-REVIEWED  
PUBLICATIONS

124

ORIGINAL RESEARCH  
PUBLICATIONS

21

EDITORIALS/  
COMMENTARIES

40

REVIEWS

13

LETTERS TO  
THE EDITOR

9

INFOGRAPHICS

## AUTHORS

6

RESEARCH  
STAFF

8

TRAINEES

87

FACULTY

4

ADVANCED PRACTICE  
NURSE PRACTITIONERS/CRNAs



# 2020-2021 Selected Publications

The Department of Anesthesiology places a strong emphasis on faculty, trainee and staff career development in academic anesthesiology. Active mentoring programs pair junior and mid-level investigators with experienced mentors in broad categories of scholarship, including basic and clinical research, education, global health, health services, patient safety, informatics and the humanities. Research productivity, determined by publication in peer-reviewed journals, grant dollars and ongoing research studies, continues to be strong. Selected publications, highlighting the breadth of research conducted, publication type and contributing authors, are provided on the next few pages. A complete list of departmental publications can be found at: [vumc.org/anesthesiology/communications](http://vumc.org/anesthesiology/communications) or by scanning the QR code provided here.



## BASIC SCIENCE

**Barajas M**, Wang A, Griffiths KK, Matsumoto K, Liu R, Homma S, Levy RJ: The newborn *Fmr1* knockout mouse: a novel model of excess ubiquinone and closed mitochondrial permeability transition pore in the developing heart. *Pediatr Res* 2021; 89(3):456-463

Ben-Ari Y, **Delpire E**: Phenobarbital, midazolam, bumetanide, and neonatal seizures: The devil is in the details. *Epilepsia* 2021; 62(4):935-940

Bi Y, Li C, Zhang Y, Wang Y, Chen S, Yue Q, Hoover RS, Wang XH, **Delpire E**, Eaton DC, Zhuang J, Cai H: Stimulatory Role of SPAK Signaling in the Regulation of Large Conductance  $Ca^{2+}$ -Activated Potassium (BK) Channel Protein Expression in Kidney. *Front Physiol* 2020; 11:638

Dikalova A, Mayorov V, Xiao L, Panov A, Amarnath V, Zagol-Ikapitte I, Vergeade A, Ao M, Yermalitsky V, Nazarewicz RR, Boutaud O, **Lopez MG**, **Billings FT 4th**, Davies S, Roberts LJ, 2nd, Harrison DG, Dikalov S: Mitochondrial Isolevuglandins Contribute to Vascular Oxidative Stress and Mitochondria-Targeted Scavenger of Isolevuglandins Reduces Mitochondrial Dysfunction and Hypertension. *Hypertension* 2020; 76(6):1980-1991

Divangahi M, Aaby P, Khader SA, Barreiro LB, Bekkering S, Chavakis T, van Crevel R, Curtis N, DiNardo AR, Dominguez-Andres J, Duivenvoorden R, Fanucchi S, Fayad Z, Fuchs E, Hamon M, Jeffrey KL, Khan N, Joosten LAB, Kaufmann E, Latz E, Matarese G, van der Meer JWM, Mhlanga M, Moorlag S, Mulder WJM, Naik S, Novakovic B, O'Neill L, Ochando J, Ozato K, Riksen NP, Sauerwein R, **Sherwood ER**, Schlitzer A, Schultze JL, Sieweke MH, Benn CS, Stunnenberg H, Sun J, van de Veerdonk FL, Weis S, Williams DL, Xavier R, Netea MG: Trained immunity, tolerance, priming and differentiation: distinct immunological processes. *Nat Immunol* 2021; 22(1):2-6

# 2020-2021 Selected Publications

**Hernandez A, Patil NK, Bohannon JK:** A Murine Model of Full-Thickness Scald Burn Injury with Subsequent Wound and Systemic Bacterial Infection. *Methods Mol Biol* 2021; 2321:111-120

Kamalova A, Futai K, **Delpire E**, Nakagawa T: AMPA Receptor Auxiliary Subunit GSG1L Suppresses Short-Term Facilitation in Corticothalamic Synapses and Determines Seizure Susceptibility. *Cell Rep* 2020; 32(3):107921

**Koumangoye R**, Bastarache L, **Delpire E:** NKCC1: Newly Found as a Human Disease-Causing Ion Transporter. *Function (Oxf)* 2021; 2(1):zqaa028

Manz KM, Becker JC, **Grueter CA, Grueter BA:** Histamine H3 Receptor Function Biases Excitatory Gain in the Nucleus Accumbens. *Biol Psychiatry* 2021; 89(6):588-599

Manz KM, Coleman BC, **Grueter CA**, Shields BC, Tadross MR, **Grueter BA:** Noradrenergic Signaling Disengages Feedforward Transmission in the Nucleus Accumbens Shell. *J Neurosci* 2021; 41(17):3752-3763

Manz KM, Ghose D, Turner BD, Taylor A, Becker J, **Grueter CA, Grueter BA:** Calcium-Permeable AMPA Receptors Promote Endocannabinoid Signaling at Parvalbumin Interneuron Synapses in the Nucleus Accumbens Core. *Cell Rep* 2020; 32(4):107971

McBride MA, **Patil TK, Bohannon JK, Hernandez A, Sherwood ER, Patil NK:** Immune Checkpoints: Novel Therapeutic Targets to Attenuate Sepsis-Induced Immunosuppression. *Front Immunol* 2020; 11:624272

McNeill A, Iovino E, Mansard L, Vache C, Baux D, Bedoukian E, Cox H, Dean J, Goudie D, Kumar A, Newbury-Ecob R, Fallerini C, Renieri A, Lopergolo D, Mari F, Blanchet C, Willems M, Roux AF, Pippucci T, **Delpire E:** SLC12A2 variants cause a neurodevelopmental disorder or cochleovestibular defect. *Brain* 2020; 143(8):2380-2387

**Owen AM**, Fults JB, **Patil NK, Hernandez A, Bohannon JK:** TLR Agonists as Mediators of Trained Immunity: Mechanistic Insight and Immunotherapeutic Potential to Combat Infection. *Front Immunol* 2020; 11:622614

Pille JA, **Riess ML:** Potential Effects of Poloxamer 188 on Rat Isolated Brain Mitochondria after Oxidative Stress In Vivo and In Vitro. *Brain Sci* 2021; 11(1)

Xie Y, Chang S, Zhao C, Wang F, Liu S, Wang J, **Delpire E**, Ye S, Guo J: Structures and an activation mechanism of human potassium-chloride cotransporters. *Sci Adv* 2020; 6(50)

Yang B, Sanches-Padilla J, Kondapalli J, Morison SL, **Delpire E**, Awatramani R, Surmeier DJ: Locus coeruleus anchors a trisynaptic circuit controlling fear-induced suppression of feeding. *Neuron* 2021; 109(5):823-838 e826

Zaborska KE, Dadi PK, Dickerson MT, Nakhe AY, Thorson AS, Schaub CM, Graff SM, Stanley JE, Kondapavuluru RS, **Denton JS**, Jacobson DA: Lactate activation of alpha-cell KATP channels inhibits glucagon secretion by hyperpolarizing the membrane potential and reducing Ca(2+) entry. *Mol Metab* 2020; 42:101056



# 2020-2021 Selected Publications

## CLINICAL AND TRANSLATIONAL SCIENCE

Akushevich I, Yashkin AP, Kravchenko J, **Kertai MD**: Chemotherapy and the Risk of Alzheimer's Disease in Colorectal Cancer Survivors: Evidence From the Medicare System. *JCO Oncol Pract* 2021:OP2000729

Bellomy ML, Engoren MC, Martin BJ, Shi Y, Shotwell MS, **Hughes CG, Freundlich RE**: The Attributable Mortality of Postoperative Bleeding Exceeds the Attributable Mortality of Postoperative Venous Thromboembolism. *Anesth Analg* 2021; 132(1):82-88

Bettors KA, Le TM, Gong W, Lindsell CJ, **Smith HA, Smith AH**: Utilization of ICU Rehabilitation Services in Pediatric Patients With a Prolonged ICU Stay. *Crit Care Med* 2021 Apr [Epub]

Beveridge JK, Dobson KS, Madigan S, Yeates KO, **Stone AL, Wilson AC, Salberg S, Mychasiuk R, Noel M**: Adverse childhood experiences in parents of youth with chronic pain: prevalence and comparison with a community-based sample. *Pain Rep* 2020; 5(6):e866

**Boncyk CS, Farrin E, Stollings JL, Rumbaugh K, Wilson JE, Marshall M, Feng X, Shotwell MS, Pandharipande PP, Hughes CG**: Pharmacologic Management of Intensive Care Unit Delirium: Clinical Prescribing Practices and Outcomes in More Than 8500 Patient Encounters. *Anesth Analg* 2021 Jan [Epub]

Borst AJ, Bonfield CM, Deenadayalan PS, Le CH, Xu M, **Sobey JH, Reddy SK**:  $\epsilon$ -Aminocaproic acid versus tranexamic acid in children undergoing complex cranial vault reconstruction for repair of craniosynostosis. *Pediatr Blood Cancer* 2021; 68(8):e29093

**Bruehl S, Burns JW, Koltyn K, Gupta R, Buvanendran A, Edwards D, Chont M, Wu YH, Stone A**: Does aerobic exercise training alter responses to opioid analgesics in individuals with chronic low back pain? A randomized controlled trial. *Pain* 2020 Dec [Epub]

Brummel NE, **Hughes CG, Thompson JL, Jackson JC, Pandharipande P, McNeil JB, Raman R, Orun OM, Ware LB, Bernard GR, Ely EW, Girard TD**: Inflammation and Coagulation during Critical Illness and Long-Term Cognitive Impairment and Disability. *Am J Respir Crit Care Med* 2021; 203(6):699-706

Canter MO, Tanguturi YC, Ellen Wilson J, Williams SR, Exum SA, Umrana HM, Bettors KA, Raman R, Ely EW, **Pandharipande PP, Fuchs DC, Smith HAB**: Prospective Validation of the Preschool Confusion Assessment Method for the ICU to Screen for Delirium in Infants Less Than 6 Months Old. *Crit Care Med* 2021 Jun [Epub]

**Crawford L, Mueller D, Mathews L**: Anesthetic Considerations for Functional Neurosurgery. *Anesthesiol Clin* 2021; 39(1):227-243

Dunham WC, **Lombard FW, Edwards DA, Shi Y, Shotwell MS, Siegrist K, Eagle SS, Pretorius M, McEvoy MD, Gillaspie EA, Nesbitt JC, Wanderer JP, Kertai MD**: Effect of Regional Analgesia Techniques on Opioid Consumption and Length of Stay After Thoracic Surgery. *Semin Cardiothorac Vasc Anesth* 2020; 1089253220949434

# 2020-2021 Selected Publications

Dwan RL, **Raymond BL**, **Richardson MG**: Unanticipated Consequences of Switching to Sugammadex: Anesthesia Provider Survey on the Hormone Contraceptive Drug Interaction. *Anesth Analg* 2021 Mar [Epub]

**Ende HB**, Lozada MJ, **Chestnut DH**, Osmundson SS, Walden RL, Shotwell MS, **Bauchat JR**: Risk Factors for Atonic Postpartum Hemorrhage: A Systematic Review and Meta-analysis. *Obstet Gynecol* 2021; 137(2):305-323

**Ende HB**, Lumberras-Marquez MI, Farber MK, Fields KG, Tsen LC: A cluster quasi-randomized controlled trial of an interactive, monthly obstetric anesthesiology curriculum: impact on resident satisfaction and knowledge retention. *Int J Obstet Anesth* 2021; 45:124-129

Eskaf J, Cleveland WJ, **Riess ML**: No Direct Postconditioning Effect of Poloxamer 188 on Mitochondrial Function after Ischemia Reperfusion Injury in Rat Isolated Hearts. *Int J Mol Sci* 2021; 22(9)

Figuroa EE, **Denton JS**: Zinc pyrithione activates the volume-regulated anion channel through an antioxidant-sensitive mechanism. *Am J Physiol Cell Physiol* 2021; 320(6):C1088-C1098

Goebel A, Birklein F, Brunner F, Clark JD, Gierthmuhlen J, Harden N, Huygen F, Knudsen L, McCabe C, Lewis J, Maihofner C, Magerl W, Moseley GL, Terkelsen A, Thomassen I, **Bruhl S**: The Valencia consensus-based adaptation of the IASP complex regional pain syndrome diagnostic criteria. *Pain* 2021 Mar [Epub]

Haddad DN, Mart MF, Wang L, Lindsell CJ, Raman R, Nordness MF, Sharp KW, **Pandharipande PP**, Girard TD, Ely EW, Patel MB: Socioeconomic Factors and Intensive Care Unit-Related Cognitive Impairment. *Ann Surg* 2020; 272(4):596-602

**Hayhurst CJ**, **Hughes CG**, **Pandharipande PP**: The Conundrum of Pain, Opiate Use and Delirium: Analgosedation or Analgesia-first Approach? *Am J Respir Crit Care Med* 2021 May [Epub]

**Hughes CG**, Mailloux PT, Devlin JW, Swan JT, Sanders RD, Anzueto A, Jackson JC, Hoskins AS, Pun BT, Orun OM, Raman R, Stollings JL, Kiehl AL, Duprey MS, Bui LN, O'Neal HR, Jr, Snyder A, Gropper MA, Guntupalli KK, Stashenko GJ, Patel MB, Brummel NE, Girard TD, Dittus RS, Bernard GR, Ely EW, **Pandharipande PP**, MENDS2 Study Investigators: Dexmedetomidine or Propofol for Sedation in Mechanically Ventilated Adults with Sepsis. *N Engl J Med* 2021; 384(15):1424-1436

**Lefevre RJ**, Balzer C, Baudenbacher FJ, **Riess ML**, **Hernandez A**, **Eagle SS**: Venous Waveform Analysis Correlates With Echocardiography in Detecting Hypovolemia in a Rat Hemorrhage Model. *Semin Cardiothorac Vasc Anesth* 2021; 25(1):11-18

**Li G**, **Freundlich RE**, **Gupta RK**, **Hayhurst CJ**, Le CH, Martin BJ, Shotwell MS, **Wanderer JP**: Postoperative Pulmonary Complications' Association with Sugammadex versus Neostigmine: A Retrospective Registry Analysis. *Anesthesiology* 2021; 134(6):862-873

**Lopez MG**, Shotwell MS, Morse J, Liang Y, **Wanderer JP**, Absi TS, Balsara KR, Levack MM, Shah AS, **Hernandez A**, **Billings FT 4th**: Intraoperative venous congestion and acute kidney injury in cardiac surgery: an observational cohort study. *Br J Anaesth* 2021; 126(3):599-607

Nelson JH, Brackett SL, Oluigbo CO, **Reddy SK**: Robotic Stereotactic Assistance (ROSA) for Pediatric Epilepsy: A Single-Center Experience of 23 Consecutive Cases. *Children (Basel)* 2020; 7(8)



# 2020-2021 Selected Publications

Pun BT, Badenes R, Heras La Calle G, Orun OM, Chen W, Raman R, Simpson BK, Wilson-Linville S, Hinojal Olmedillo B, Vallejo de la Cueva A, van der Jagt M, Navarro Casado R, Leal Sanz P, Orhun G, Ferrer Gomez C, Nunez Vazquez K, Pineiro Otero P, Taccone FS, Gallego Curto E, Caricato A, Woien H, Lacave G, O'Neal HR, Jr., Peterson SJ, Brummel NE, Girard TD, Ely EW, **Pandharipande PP**, COVID-Intensive Care International Study Group: Prevalence and risk factors for delirium in critically ill patients with COVID-19 (COVID-D): a multicentre cohort study. *Lancet Respir Med* 2021; 9(3):239-250

**Rengel KF, Hayhurst CJ**, Jackson JC, **Boncyk CS**, Patel MB, Brummel NE, Shi Y, Shotwell MS, Ely EW, **Pandharipande PP, Hughes CG**: Motoric Subtypes of Delirium and Long-Term Functional and Mental Health Outcomes in Adults After Critical Illness. *Crit Care Med* 2021; 49(5):e521-e532

Sreetharan S, **Schlesinger JJ**, Schutz M: Decaying amplitude envelopes reduce alarm annoyance: Exploring new approaches to improving auditory interfaces. *Appl Ergon* 2021; 96:103432

Taenzer AH, Herrick M, Hoyt M, Ramamurthi RJ, Walker B, Flack SH, Bosenberg A, **Franklin A**, Polaner DM, PRAN investigators: Variation in pediatric local anesthetic dosing for peripheral nerve blocks: an analysis from the Pediatric Regional Anesthesia Network (PRAN). *Reg Anesth Pain Med* 2020; 45(12):964-969

Toporek AH, Semler MW, Self WH, Bernard GR, Wang L, Siew ED, Stollings JL, **Wanderer JP**, Rice TW, Casey JD, Smart Investigators and the Pragmatic Critical Care Research Group: Balanced Crystalloids versus Saline in Critically Ill Adults with Hyperkalemia or Acute Kidney Injury: Secondary Analysis of a Clinical Trial. *Am J Respir Crit Care Med* 2021; 203(10):1322-1325

**Wanderer JP**, Lasko TA, Coco JR, **Fowler LC, McEvoy MD**, Feng X, Shotwell MS, **Li G, Gelfand BJ**, Novak LL, Owens DA, Fabbri DV: Visualization of aggregate perioperative data improves anesthesia case planning: A randomized, cross-over trial. *J Clin Anesth* 2021; 68:110114

## CLINICAL PRACTICE

**Adams CD, Reddy SK**, Phillips JD, **Emerson BR**: Hypoglossal nerve stimulator placement in a child with severe refractory OSA: a novel procedure in the paediatric population. *BMJ Case Rep* 2021; 14(5):e242592

**Balakrishna A**, Walsh EC, Hamidi A, Berg S, Austin D, Pino RM, Hanidziar D, Chang MG, Bittner EA: An examination of sedation requirements and practices for mechanically ventilated critically ill patients with COVID-19. *Am J Health-Syst Pharm* 2021 May [Epub]

**Boncyk CS, Brennan KA**, Guillaumondegui O, **Benson C**: Continuous Intrathecal Morphine Infusion for Pain Management in a Polytrauma Patient: A Case Report. *A A Pract* 2020; 14(13):e01338

Hopkins MB, Hawkins AT, **Tiwari V**, Soda M, Martin BJ, Muldoon RL, Ford MM, Beck D, Geiger TM: Is newer always better? Comparing cost and short-term outcomes between laparoscopic and robotic right hemicolectomy. *Surg Endosc* 2021 Jun [Epub]

# 2020-2021 Selected Publications

**Menser C, Smith H:** Emergence Agitation and Delirium: Considerations for Epidemiology and Routine Monitoring in Pediatric Patients. *Local Reg Anesth* 2020; 13:73-83

**Siegrist KK, Deegan RJ, Dumas SD, Eagle SS:** Severe Cardiopulmonary Disease in a Parturient With Noonan Syndrome. *Semin Cardiothorac Vasc Anesth* 2020; 24(4):364-368

Ward MJ, Chavis B, Banerjee R, Katz S, **Anders S:** User-Centered Design in Pediatric Acute Care Settings Antimicrobial Stewardship. *Appl Clin Inform* 2021; 12(1):34-40

Wilson AC, **Stone AL,** Poppert Cordts KM, Holley AL, Mackey S, Darnall BD, Palermo TM: Baseline Characteristics of a Dyadic Cohort of Mothers With Chronic Pain and Their Children. *Clin J Pain* 2020; 36(10):782-792

Wise ES, Hocking KM, Polcz ME, Beilman GJ, Brophy CM, **Sobey JH, Leisy PJ,** Kiberenge RK, **Alvis BD:** Hemodynamic Parameters in the Assessment of Fluid Status in a Porcine Hemorrhage and Resuscitation Model. *Anesthesiology* 2021; 134(4):607-616

## EDUCATION

**Ende HB,** Lozada MJ, Micevych PS, Pennycuff J, Vadhera RB, Peralta FM, **Bauchat JR:** A survey of USA anesthesiology residents regarding their perceptions of, and barriers to, fellowship training in obstetric anesthesia. *Int J Obstet Anesth* 2021; 46:103159

**Gupta RK,** Horlocker T, **McEvoy MD:** Initiative to accelerate guideline distribution using the smartphone app ASRA Coags V.2.0. *Reg Anesth Pain Med* 2021; 46(4):354-355

Huth HB, Skeens R, **Anders S,** Herzberg S, Simpson C, Novak L, Jackson GP: Health Management in the Home: A Qualitative Study of Pregnant Women and Their Caregivers. *J Patient Exp* 2020; 7(6):1227-1233

**Niconchuk JA, Hyman SA:** Physician Burnout: Achieving Wellness for Providers and Patients. *Curr Anesthesiol Rep* 2020; 1-6

Panebianco NL, Mayo PH, Arntfield RT, Brown SM, Diaz-Gomez J, **Hernandez A,** Koenig SJ, Noble V, Sekiguchi H, Subhiyah RG, Mulvagh S, Saric M, Troianos CA, Labovitz AJ: Assessing Competence in Critical Care Echocardiography: Development and Initial Results of an Examination and Certification Processes. *Crit Care Med* 2021 Mar [Epub]

**Robertson AC, Fowler LC,** Kimball TS, **Niconchuk JA,** Kreger MT, Brovman EY, Rickerson E, Sadovnikoff N, Hepner DL, **McEvoy MD,** Bader AM, Urman RD: Efficacy of an Online Curriculum for Perioperative Goals of Care and Code Status Discussions: A Randomized Controlled Trial. *Anesth Analg* 2021; 132(6):1738-1747

## GLOBAL HEALTH

COVIDSurg Collaborative, GlobalSurg Collaborative: Timing of surgery following SARS-CoV-2 infection: an international prospective cohort study. *Anaesthesia* 2021; 76(6):748-758 (**Kynes JM and Walters C** are COVIDSurg and GlobalSurg Collaborative authors)



# 2020-2021 Selected Publications

**Kynes JM**, Kauffmann R, **Walters CB**, Sizemore C, **Banerjee A**: The Preparing Residents for International Medical Experiences (PRIME) Simulation Workshop: Equipping Surgery and Anesthesia Trainees for International Rotations. *MedEdPORTAL* 2021; 17:11088

Nthumba PM, **Newton MW**, Gathuya Z: Global surgery in the 21st century: The voice from Africa - We need a new model. *Paediatr Anaesth* 2021; 31(5):510-512

Odinkemelu DS, Sonah AK, Nsereko ET, Dahn BT, Martin MH, Moon TD, **Niconchuk JA**, **Walters CB**, **Kynes JM**: An Assessment of Anesthesia Capacity in Liberia: Opportunities for Rebuilding Post-Ebola. *Anesth Analg* 2021; 132(6):1727-1737

Pinto E, Marcos G, **Walters C**, Goncalves F, Sacarlal J, Castro L, Rego G: Palliative care in Mozambique: Physicians' knowledge, attitudes and practices. *PLoS One* 2020; 15(8):e0238023

## HEALTH SERVICES

Ahmed ST, Akeroyd JM, Mahtta D, Street R, **Slagle J**, Navar AM, Stone NJ, Ballantyne CM, Petersen LA, Virani SS: Shared Decisions: A Qualitative Study on Clinician and Patient Perspectives on Statin Therapy and Statin-Associated Side Effects. *J Am Heart Assoc* 2020; 9(22):e017915

**Alvis BD**, Amsler RG, **Leisy PJ**, Feng X, Shotwell MS, **Pandharipande PP**, Ajmal M, McHugh M, **Walia A**, **Hughes CG**: Effects of an anesthesia perioperative surgical home for total knee and hip arthroplasty at a Veterans Affairs Hospital: a quality improvement before-and-after cohort study. *Can J Anaesth* 2021; 68(3):367-375

**Franklin AD**, **Sobey JH**, **Brenn BR**, Johnson SR, Schoenecker JG, Gartley AC, Shotwell MS, Gay JC, **Wanderer JP**: Financial and Clinical Ramifications of Introducing a Novel Pediatric Enhanced Recovery After Surgery Pathway for Pediatric Complex Hip Reconstructive Surgery. *Anesth Analg* 2021; 132(1):182-193

**Hyman SA**, Card EB, De Leon-Casasola O, Shotwell MS, Shi Y, **Weinger MB**: Prevalence of burnout and its relationship to health status and social support in more than 1000 subspecialty anesthesiologists. *Reg Anesth Pain Med* 2021; 46(5):381-387

**McEvoy MD**, Dear ML, Buie R, **Fowler LC**, Miller B, Fleming GM, Moore D, Rice TW, Bernard GR, Lindsell CJ, Vanderbilt Learning Healthcare System Investigators: Embedding Learning in a Learning Health Care System to Improve Clinical Practice. *Acad Med* 2021 Feb [Epub]

Militello LG, Hurley RW, Cook RL, Danielson EC, DiIulio J, Downs SM, **Anders S**, Harle CA: Primary Care Clinicians' Beliefs and Strategies for Managing Chronic Pain in an Era of a National Opioid Epidemic. *J Gen Intern Med* 2020; 35(12):3542-3548

Yan C, Zhang X, Gao C, Wilfong E, Casey J, **France D**, Gong Y, Patel M, Malin B, Chen Y: Collaboration Structures in COVID-19 Critical Care: Retrospective Network Analysis Study. *JMIR Hum Factors* 2021; 8(1):e25724

# 2020-2021 Selected Publications

## HUMANITIES

**Hester D:** Spraying Cotton in Bolivar County, Mississippi, the Summer Following My First Year of Medical School. *JAMA* 2021; 325(3):310-310

**Hyman SA:** Burnout: The "Other" Pandemic. *Anesthesiology* 2021; 134(5):673-675

## INFORMATICS

Buell KG, Casey JD, Wang L, **Wanderer JP**, Self WH, Rice TW, Semler MW: Big Data for Clinical Trials: Automated Collection of SpO<sub>2</sub> for a Trial of Oxygen Targets during Mechanical Ventilation. *J Med Syst* 2020; 44(9):153

Chen B, Alrifai W, Gao C, Jones B, Novak L, Lorenzi N, **France D**, Malin B, Chen Y: Mining tasks and task characteristics from electronic health record audit logs with unsupervised machine learning. *J Am Med Inform Assoc* 2021; 28(6):1168-1177

**Ende HB, Richardson MG**, Lopez BM, **Wanderer JP:** Improving ACGME Compliance for Obstetric Anesthesiology Fellows Using an Automated Email Notification System. *Appl Clin Inform* 2021; 12(3):479-483

**Schirle LM**, Dietrich MS, Lam L, **Stone AL, Bruehl S**, Osmundson SS: Accuracy of patient-reported versus real-time electronic postoperative opioid use outcomes. *Am J Obstet Gynecol MFM* 2021; 3(4):100347

## SAFETY AND QUALITY

Bauer ME, Arendt K, Beilin Y, Gernsheimer T, Perez Botero J, James AH, **Yagmour E**, Toledano RD, Turrentine M, Houle T, MacEachern M, Madden H, Rajasekhar A, Segal S, Wu C, Cooper JP, Landau R, Leffert L: The Society for Obstetric Anesthesia and Perinatology Interdisciplinary Consensus Statement on Neuraxial Procedures in Obstetric Patients With Thrombocytopenia. *Anesth Analg* 2021; 132(6):1531-1544

Dobie KH, **Tiwari V**, Shi Y, Shotwell MS, **Sandberg WS:** Transition from Private to Academic Anesthesia Provision Changes Process and Patient Centered Outcomes in an Ambulatory Surgery Center. *J Med Syst* 2020; 44(12):204

**Donahue BS:** Commentary: Coagulation Testing in Pediatric Cardiac Surgery: The Small Picture and the Big Picture. *Semin Thorac Cardiovasc Surg* 2021 Mar [Epub]

Fitzsimons MG, **Rice MJ**, Baker K: Drug Testing in Anesthesia: "Prevention and Protection" or "Major Risk for Minimal Gain." *Anesth Analg* 2021; 132(3):916-919

Haché M, Sun LS, Gadi G, Busse J, Lee AC, **Lorinc A**, Rampersad S: Outcomes from wake up safe, the pediatric anesthesia quality improvement initiative. *Paediatr Anaesth* 2020; 30(12):1348-1354

## 2020-2021 Selected Publications

**McEvoy MD, Wanderer JP, Shi Y, Ramanujan KS, Geiger TM, Shotwell MS, Shaw AD, Hawkins AT, Martin BJ, Mythen MG, Sandberg WS:** The effect of adding goal-directed hemodynamic management for elective patients in an established enhanced recovery program for colorectal surgery: results of quasi-experimental pragmatic trial. *Perioper Med (Lond)* 2020; 9(1):35

Rodney JP, Shinn JR, Amin SN, Portney DS, Mitchell MB, Chopra Z, Rees AB, Kupfer RA, Hogikyan ND, Casper KA, Tate A, Vinson KN, Fletcher KC, Gelbard A, **St Jacques PJ, Higgins MS, Morrison RJ, Garrett CG:** Multi-Institutional Analysis of Outcomes in Supraglottic Jet Ventilation with a Team-Based Approach. *Laryngoscope* 2021 Feb [Epub]

Smith MC, Evans PT, Prendergast KM, Schneeberger SJ, **Henson CP, McGrane S, Kopp EB, Collins NE, Guillamondegui OD, Dennis BM:** Surgical outcomes and complications of bedside tracheostomy in the ICU for patients on ECMO. *Perfusion* 2020; 267659120979564

**Weinger MB:** Time out! Rethinking surgical safety: more than just a checklist. *BMJ Qual Saf* 2021 Mar [Epub]



# New approach helps conserve blood products for liver transplant patients



The Liver Transplant Anesthesia team includes, from left, Clayne Benson, MD, Kevin Furman, DO, Philip Leisy, MD, and Kara Siegrist, MD. (Photo by Erin O. Smith)

**By Matt Batcheldor**

*Originally published in the VUMC Reporter on Dec. 10, 2020*

Liver transplants have traditionally required a high volume of transfusions of blood products, which comes with several downsides. The products are costly to patients — as high as \$15,000 on top of the expense of a transplant. And they are sometimes not well accepted in patients because they degrade over time and are derived from multiple patients.

The best blood, of course, is always one's own, said **Clayne Benson, MD**, director of liver transplant anesthesia at the Vanderbilt Transplant Center. Benson is pioneering new approaches to conserve blood products by better utilizing a patient's own blood, which has the potential to improve outcomes in patients, cut health care costs and conserve the limited supply of donated blood — especially important in the time of COVID-19, when occasional shortages of products have occurred.

One approach Benson is studying is Acute Normovolemic Hemodilution (ANH), which is used for liver transplant patients who come into the operating room with adequate red blood cell and platelet counts and whose blood is clotting properly.

"We will take their own blood out of them and replace that blood with other fluids, like generic fluids we use," said Benson, assistant professor of Clinical Anesthesiology. "You dilute out the blood that is left and so when they bleed that diluted blood, you're not wasting much. And when they need their own blood back, you give it back to them. That allows you to give a smaller amount of blood products from the blood banks, so less foreign blood is used.

"We've been able to show that you can do that, and you can save money and foreign blood."

Though it is being studied in the liver transplant population, the method could also be useful for other organ transplants and trauma cases requiring large blood transfusions, Benson said.

**Kara Siegrist, MD**, assistant professor, Cardiothoracic Anesthesiology Division, has been working alongside Benson in the ANH research.

"The ANH project is just one example of the advancements in exemplary patient care we strive to achieve to provide the best, safest and most cost-effective health care to some of the sickest patients in the hospital," she said. "With the volume of liver transplants we do at VUMC, even little cost savings on an individual level can add up to big savings for the hospital system. I'm proud to be part of such a wonderful multidisciplinary team of physicians and nurses all working together for the good of our patients."

Benson's interest in blood product conservation was inspired by necessity, when he served in the Special Operations Surgical Team (SOST) in the Air Force about a decade ago. The team served injured military personnel in the field, such as in Afghanistan, where the traditional assortment of blood products are not available. In that situation, medics would take blood from other soldiers whose blood matched the injured, which is fresh and not degraded.

That experience piqued his interest in applying those lessons to the hospital setting. Another area of study is retrieving the blood of organ donors to go along with organs at the time they are retrieved, then transfusing the blood into donors' bodies, which is not typically done today.

Benson noted that VUMC is part of a multicenter study of a device called TransMedics, affectionately known as Heart in a Box. Blood from heart transplant patients is retrieved at the time the heart is removed and then perfused into the organ en route to VUMC for transplant. Preliminary data shows the hearts can be preserved longer before transplant, expanding the supply of organs. Benson foresees expanding that program to livers.

"All these things require a team," Benson said. "I've been lucky to have on the surgical side, Sopaclis Alexopoulos, MD, chief of Liver Transplantation, who has been very supportive of all of these things, in addition to all the surgeons on the team. When I first became the director of liver transplant anesthesia, we didn't do ANH, but some team members on the anesthesia side were enthusiastic about it, as well as some of the surgeons. But it took some time and once they saw the benefit of it, then they were all on board." ♦

# Residents, fellows step up to help care for COVID patients

From article by **Nancy Humphrey** originally published in the VUMC Reporter on Jan. 14, 2021

Following a Thanksgiving surge that led to record numbers of admissions of patients with COVID-19, residents and fellows from multiple disciplines have come together under the direction and supervision of critical care attendings to provide the best care to critically ill patients in Vanderbilt University Medical Center's COVID-19 Intensive Care Unit.

In addition to the physicians and nurses staffing the unit on the eighth floor of Medical Center East, fellows and residents from at least 12 programs, including Pulmonary Critical Care, Cardiovascular Medicine, Anesthesiology Critical Care, Anesthesiology and Surgery, as well as residents from other programs provide additional support to the Medical Intensive Care Surge Team.

"As physicians we are trained to meet patients where patient needs are, and we don't always get to define that. I've been very proud of these residents and fellows who have stepped up to care for patients in a global crisis," said Kyla Terhune, MD, MBA, associate professor of Surgery and Anesthesiology, vice president of Educational Affairs and associate dean for Graduate Medical Education.

"In some ways it's a historical opportunity to serve as a physician and provides a great deal of learning, but it's certainly also a tragedy and not what anyone anticipated or wanted. For those residents and fellows where it falls within their educational curriculum and skills, they are appropriately contributing the most – but they need support when the patient numbers surge like this," she said.

**Greg Roop, MD**, a third-year Anesthesiology resident, left his pediatric anesthesia rotation when he was asked by a chief resident to



*Anesthesiology resident Greg Roop, MD, is among the group of fellows and residents from numerous programs to provide additional support to the Medical Intensive Care Surge Team. (Photo by Donn Jones)*

help staff the COVID-19 ICU during Thanksgiving week. He was paired first with a Pulmonary Critical Care fellow, then with a Cardiology fellow after that.

"Anesthesiology residents are uniquely positioned to transfer into this type of care — so much of what we do in the OR can be transitioned to the ICU setting particularly in terms of ventilator management and hemodynamics," Roop said.

"The transition was great. I have to give a lot of credit to the pulmonary critical care faculty and staff and the entire internal medicine department. They realize that residents from other specialties don't necessarily care for these patients all the time and they were very patient as they taught us how to manage them. The credit goes to them for their patience and being willing to share their knowledge with us."

Roop said his experience left a positive impact upon his training as a physician. Working with others from

other specialties and seeing how they approach a situation was invaluable. It was an opportunity to learn in ways he never imagined.

"It was really interesting for me to interact with Pulmonary Critical Care faculty and fellows. While every specialty has the best interest of the patient in mind, we all approach these problems from different perspectives."

Roop said while there was "some fear of the unknown" in caring for patients critically ill with COVID-19, he feels grateful to have contributed to their care.

"It's a very unique situation and it was definitely a challenge. We're navigating the unknown and we have to put our heads together and try to come up with different ways to treat these patients," he said.

"The clinical course of some of them was unlike anything I had seen previously, and it's like our hands were tied a bit. But I am very honored to participate in their care." ♦



# The impact of Delpire's NKCC1 research



Eric Delpire's lab studies biological membranes and their impermeability to water, small molecules, and ions. (Photo by Jenelle Grewell)

## By Jenelle Grewell

For over 30 years, basic science researcher **Eric Delpire, PhD**, has studied biological membranes and their impermeability to water, small molecules, and ions. His research has focused on a small number of proteins that carry ions across the membranes of cells. This is relevant to the way neurons communicate with each other and the transport of molecules between different body compartments across epithelia. His latest efforts involve understanding the structure and relevant features of these transporters.

In 2015, a mother of a young girl suffering from many ailments reached out to Delpire. The young girl had a mutation in NKCC1, which is one of the transporters he is studying. She discovered Delpire's name associated with many publications when she googled the transporter.

"For her, I was providing many pieces of information that possibly explained her daughter's condition. For me, she was introducing me to an opportunity to expand my research," he said.

This expanded research focused on understanding the mutation's effect on the transporter. This led to NIH funding, the creation of new mouse models, and a half dozen publications. Delpire has met the family on two occasions to connect.

"They know the basic research I do is unlikely to cure or save their daughter, but they are grateful for the research

that tries to better understand the relationship between the mutant transporter and the disease," he said.

He is now in contact with many mothers since uncovering several additional cases after the release of his first report in 2016. Delpire said he is grateful for this recognition and his association with research that focuses on human health.

Delpire said the Department of Anesthesiology and its leadership do a lot to make him feel supported in his research. Even though the department is a clinical one, a majority of faculty support the mission of basic science.

The institution also supports basic science research. Delpire holds the first BH Robbins Directorship in Anesthesiology Research, which was awarded by the institution in 2017.

"I am also very grateful for the endowed directorship given to me knowing that it took commitment, time, and energy for the department to accumulate the necessary funds for the directorship to be established. This allows me to expand my funded research and to investigate new research avenues," Delpire said.

Rather than point to a specific high point, he is most proud of the expertise he has accumulated. His career is a slow progression with well-defined interests and goals.

"The beauty of science is that nothing is ever completed. Even as an expert, I still learn every day, and that keeps me going with both strength and humility." ♦



# Faculty Profile: Amanda Stone

## *Research faculty member and the department's Wellness Director*

*By Jenelle Grewell*

Amanda Stone, PhD, joined the Department of Anesthesiology at Vanderbilt University Medical Center in 2018 as research faculty investigating psychological factors influencing pediatric pain. Since then, she has also taken on the role of the department's Wellness Director.

In May of 2021, the National Institute of Child Health and Human Development awarded Stone a K23, which will last until April 2026. This mentored career development award funds both advanced training and a research project evaluating parent and child factors, such as beliefs about medications or anxiety that may influence opioid use at home following pediatric adenotonsillectomy procedures.

"This award will allow me to further my training in advanced statistical models, pediatric acute pain care, communicating research results to public audiences, and leading an interdisciplinary research team," she said.

The Department of Anesthesiology supported Stone in earning her K23 in several ways. Her primary mentor, Stephen Bruehl, PhD, provided guidance, training in a new research area (individual differences in responses to opioid analgesics), publication opportunities, and critical feedback throughout the grant writing process. The department provided her training opportunities such as the B.H. Robbins Program and T32. The Perioperative Clinical Research Institute collected pilot data for her K23 applications and provided administrative support for the grant submission process.

Stone earned both her master of science and her doctorate at Vanderbilt University. When Stone was a graduate student, her mentor was Lynn Walker, PhD, who at the time was the division director for Adolescent and Young Adult Health in the Department of Pediatrics. She has one of the longest running NIH funded research careers in the U.S. for pediatric pain. Bruehl was involved as a co-investigator on her last few grants, which allowed him to serve as a second mentor.

"At my dissertation defense, Walker made it clear to the committee that she would like to find a way for me to come back to VUMC on faculty. She was planning to retire and wanted someone to continue her legacy. Bruehl saw this as a potential opportunity to grow his lab in the Department of Anesthesiology," she said.

She has several responsibilities in her role as Wellness Director for the department. She provides consultation to faculty and leadership on ways to facilitate wellness in the professional environment,



*Amanda Stone, PhD, serves as the department's Wellness Director while investigating psychological factors influencing pediatric pain.*

serves as a liaison with VUMC wellness initiatives, helps facilitate quarterly trainings in conjunction with the Office of Anesthesiology Faculty Affairs, and is available to provide resources to department members who have wellness related questions.

"By definition, wellness refers to the quality or state of being healthy in body and mind, especially as the result of deliberate effort. It is important to recognize and intentionally address both systems level factors and individual factors contributing to wellness," she said.

Stone's background as a pediatric psychologist trained her at the intersection of healthcare, family systems, and mental health. She thinks about how social and environmental contexts people operate within influence health. In turn, people exert influence on these social and environmental contexts, affecting the health of the system or organization.

Catherine Clark, Senior Program Manager, Office of Anesthesiology Faculty Affairs, said Stone's role has allowed the office to expand on the enhancement of the engagement and development of the department's faculty.

"Our mission involves considering the impact of our programs and decisions from multiple perspectives," Clark said. "So, it is important to have Stone's lens for the ways we can account for the mental and emotional health and well-being of our faculty. Not only mitigating stress and burnout but providing support that translates to higher job satisfaction and realization of career goals, including that of ever-improving patient outcomes."

Stone has also facilitated and helped equip others to facilitate a number of group discussions within the department over the past year related to wellness during COVID-19 and important department initiatives like diversity and inclusion. ♦

# Leadership in the Profession



## Association of University Anesthesiologists

The mission of the AUA is to promote excellence in academic anesthesiology through mentorship of academics in anesthesiology; promotion of diversity and inclusivity in academic anesthesiology; professional growth throughout the careers of educators, academic leaders, and researchers in anesthesiology; and organization of an outstanding annual meeting and provision of networking opportunities to academics in anesthesiology.

\* indicates associate member



## Foundation for Anesthesia Education and Research

### Foundation for Anesthesia Education and Research

For over 30 years, FAER has been dedicated to developing the next generation of physician-scientists in anesthesiology. Charitable contributions and support to FAER help fuel the future of anesthesiology through scientific discovery. Funding priorities include research, education, and training.



## The American Board of Anesthesiology

The American Board of Anesthesiology® is committed to advancing excellence in the practice of anesthesiology. Since 1938, the ABA has defined practice standards that instill confidence that board-certified anesthesiologists have the knowledge and skills to provide high-quality patient care. As the certifying body for anesthesiologists since 1938, their team of dedicated anesthesiologist volunteers and staff administer initial and subspecialty certification assessments as well as their continuing certification program, which promotes lifelong learning, a commitment to quality clinical outcomes and patient safety. Based in Raleigh, NC, the ABA is a nonprofit organization and a member board of the American Board of Medical Specialties.

## VUMC Department of Anesthesiology Members of AUA

Bret Alvis, MD  
Arna Banerjee, MBBS  
Curtis Baysinger, MD  
Frederic T. Billings IV, MD, MSCI  
Stephen Bruehl, PhD  
David Chestnut, MD  
Brian Donahue, MD, PhD  
Susan Eagle, MD  
Jane Easdown, MD  
David Edwards, MD, PhD  
Brian Gelfand, MD  
Rajnish Gupta, MD  
Antonio Hernandez, MD  
Michael Higgins, MD, MPH  
Christopher Hughes, MD  
Avinash Kumar, MD  
Amanda Lorinc, MD\*  
Matthew McEvoy, MD

David McIlroy, MB.BS., MD, MClInEpi  
Mark Newton, MD  
Pratik Pandharipande, MD, MSCI  
Srijaya Reddy, MD, MBA\*  
Mark Rice, MD  
Michael Richardson, MD  
Matthias Riess, MD, PhD  
Amy Robertson, MD  
Brian Rothman, MD  
Warren Sandberg, MD, PhD  
Joseph Schlesinger, MD  
Edward Sherwood, MD, PhD  
Heidi Smith, MD, MSCI  
Paul St. Jacques, MD  
Vikram Tiwari, PhD\*  
Jonathan Wanderer, MD, MPhil  
Liza Weavind, MBBCh, MMHC  
Matthew Weinger, MD

## VUMC Department of Anesthesiology Members of FAER Academy of Research Mentors

Frederic T. Billings IV, MD, MSCI  
Pratik Pandharipande, MD, MSCI  
Matthias Riess, MD, PhD  
Warren Sandberg, MD, PhD  
Edward Sherwood, MD, PhD  
Matthew Weinger, MD

## VUMC Department of Anesthesiology Member of FAER Academy of Education Mentors

Matthew McEvoy, MD

## VUMC Department of Anesthesiology American Board of Anesthesiology Examiners and Contributors

Brian Allen, MD <sup>a</sup>  
David Chestnut, MD <sup>b</sup>  
Brian Gelfand, MD <sup>c, d</sup>  
Antonio Hernandez, MD <sup>c</sup>  
Mark Rice, MD <sup>a, e</sup>  
Edward Sherwood, MD, PhD <sup>b</sup>  
Jonathan Wanderer, MD, MPhil <sup>c</sup>  
Liza Weavind, MBBCh, MMHC <sup>f</sup>  
Matthew Weinger, MD <sup>b, g</sup>

<sup>a</sup> MOCA Minute Writer  
<sup>b</sup> Senior Examiner, Oral ABA Exam  
<sup>c</sup> Examiner, Oral ABA Exam  
<sup>d</sup> Basic and Advanced Examination Standard Setting Groups  
<sup>e</sup> MOCA Minute Editor  
<sup>f</sup> Critical Care Question Writer  
<sup>g</sup> Objective Structured Clinical Examination (OSCE) Scenario Developer



# Achieving Balance





# DEPARTMENT OF ANESTHESIOLOGY

VANDERBILT  UNIVERSITY  
MEDICAL CENTER



## 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