

# 2009-2010 ANNUAL REPORT

## Vanderbilt Department of Anesthesiology



### *Research*



### *Patient Care*



### *Outreach*



SCHOOL OF MEDICINE

# Table of Contents

Message from the Chair .....	i
Department Overview .....	1
Department Leadership.....	2
Administrative Staff .....	3
A Time of Positive Transition .....	4
Building Our Future .....	6

## CLINICAL CARE

Clinical Overview .....	8
VigiVU™ Brings Patients to Doctors.....	9
Nurse Anesthesia .....	10
Division of Ambulatory Anesthesia .....	11
Division of Cardiothoracic Anesthesia.....	12
Division of Critical Care Anesthesia .....	13
Grant Fosters Unique Partnership.....	14
Division of Multispecialty Anesthesia.....	15
Adult Acute Pain Service .....	16
Division of Obstetric Anesthesia.....	17
Division of Chronic Pain Management .....	18
Division of Pediatric Anesthesia .....	19
Pediatric Pain is Taken Seriously .....	20
Division of Pediatric Cardiothoracic Anesthesia .....	21
Vanderbilt Preoperative Evaluation Center (VPEC).....	22
Veteran’s Hospital Anesthesia Service.....	23

## EDUCATION

Office of Educational Affairs .....	24
Educational Courses and Conferences .....	25
Simulation Education Provides Invaluable Lessons .....	26
Department Excels in Critical Care Training.....	27
VIA Responds to Greatest Need .....	28

## RESEARCH

Research Overview .....	30
Basic Science Research Highlights .....	32
BH Robbins Scholars Prove Program’s Worth.....	34
Two Investigators Land FAER Grants .....	36
Clinical Research Studies .....	37
Research Symposium Highlights Investigations.....	38
Selected Publications, AY 2009-2010.....	39
Achieving Balance .....	42

# Message from the Chair

The Department of Anesthesiology at Vanderbilt University School of Medicine has a long tradition of innovation. This creative impulse has kept the Vanderbilt Anesthesiology Department in the vanguard of clinical discovery, basic science research, and translational application of new knowledge throughout perioperative medicine.

Anesthesiology is a dynamic and rapidly evolving medical specialty. Although the operating room anesthetic of today would be familiar to an anesthesiologist from 20 or 40 years ago, our technology has improved, and our scope of practice has expanded dramatically to incorporate the full arc of perioperative medicine. Simultaneously, the economic and regulatory landscape within which we care for our patients has been fundamentally changing beneath our feet for a generation.

Vanderbilt Anesthesiology has the intellectual agility to maintain equilibrium and thrive in this unstable environment. We get the right people onto the team, create the right systems of practice to provide optimum patient care, and develop innovative technology to improve the capabilities of our clinicians. We train the future leaders of perioperative medicine in research, clinical innovation and patient care, and we put those skills into practice every day.

The rate of change in anesthesiology is accelerating, while the scope of our responsibilities continues to enlarge. Care at the bedside is increasingly scrutinized for effectiveness and value, and proof of best practice and optimal outcome is expected. Meanwhile, patient acuity and comorbidities are constantly increasing. Finally, the requirement for considerate stewardship of precious healthcare resources is increasingly urgent.

We are ready to meet these challenges, but to meet them we must think of the healthcare system in general as we care for our individual patients, and we must bring new tools to bear on the problem of optimizing effectiveness, quality and safety. At Vanderbilt, we have the information technology and the scientific capability to actively develop hypotheses about how to improve patient care, to test those hypotheses and to disseminate the results so that others, and most importantly, patients, can benefit from these successes. We will extend the Vanderbilt Anesthesiology tradition of innovation and discovery from bench to bedside across the entire continuum of our specialty.

Our department is characterized by optimism, excitement, talent, and a commitment to work together to improve our knowledge and the care we provide to our patients. We welcome individuals at all levels who share this commitment and our passion for creating the best perioperative science and medicine.

*Warren Sandberg MD PhD*



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



# Department Overview

The Vanderbilt Department of Anesthesiology has a legacy of excellence and innovation in our specialty. Our exemplary academic faculty provide top-quality clinical services for a full spectrum of medical specialties. We also have high caliber basic science and clinical research teams pursuing translational knowledge to directly improve patient safety and care.

Recent accolades for Vanderbilt's medical program abound:

- In 2010, Vanderbilt University Medical Center was named one of the 30 Best Hospitals in America by *Becker's Hospital Review*.
- In April 2010, VUMC was recognized for the 11th consecutive year as one of the top 100 hospitals in the country in a study by *Thomson Reuters Healthcare*.
- In *U.S. News & World Report's* 2010 report ranking of America's Best Hospitals, VUMC posted an all-time high of 10 out of a possible 16 medical specialties receiving rankings in the top 50.
- The Monroe Carell Jr. Children's Hospital at Vanderbilt was ranked among the top 30 of America's Best Children's Hospitals by *U.S. News & World Report*.
- Children's Hospital was also recognized recently as one of the premier children's hospitals in the nation by *Parents* magazine and the Leapfrog Group.
- In the *U.S. News and World Report's* 2011 edition of America's Best Graduate Schools, Vanderbilt University School of Medicine stands at 15th out of 126 accredited U.S. medical schools.
- The Vanderbilt School of Medicine consistently holds a top 10 ranking in total National Institutes of Health research funding among U.S. medical schools, and the Vanderbilt Department of Anesthesiology ranks eighth in the nation in NIH funding, with more than \$3.6 million in awarded grants in federal fiscal year 2009.

The Department of Anesthesiology, an integral part of the Medical Center's achievements, carries the distinction of being one of the first independent departments of anesthesiology in the United States, having been 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. Sixty-five years after its founding, Vanderbilt Anesthesiology is:

- a national leader in developing and applying new technologies such as electronic medical record keeping, automated real-time decision support and smart phone based OR transparency software
- recognized nationally for the development and implementation of cutting-edge information technology - often developed in-house by our own physicians - to improve the effectiveness and safety of perioperative patient care.
- well-represented on the editorial boards of major anesthesia journals
- a noted presence among presenters at the Annual Meeting of the American Society of Anesthesiologists and other national conferences
- home to a number of NIH-funded principal investigators and six Board Examiners for the oral exams of the American Board of Anesthesiology.

Vanderbilt Anesthesiology is recognized as an innovator in perioperative management, healthcare information technology and scientific discovery. The department is exceptional for having a multifaceted approach to research: a strong basic molecular research division, the Perioperative Clinical Research Institute which fosters successful clinical research, and the Center for Perioperative Research in Quality (CPRQ) which serves as an institution-wide resource for human factors and systems design and improvement in healthcare. Through mentored programs that integrate clinical and investigative training, we equip our graduates and faculty for distinguished careers in medicine.



*Dr. Benjamin Howard Robbins (1946-61)*



*Dr. Charles Bernard Pittinger (1962-69)*



*Dr. Bradley Edgerton Smith (1969-93)*



*Dr. Charles Beattie (1994-01)*



*Dr. Jeffrey R. Balsler (2001-04)*



*Dr. Michael S. Higgins (2004-March 2010)*



*Dr. Warren S. Sandberg (April 2010-present)*

# Department Leadership



**Warren S. Sandberg**  
Chair, Department of  
Anesthesiology



**Frank Rosato**  
Vice-Chair for  
Administration



**William Furman**  
Vice-Chair for  
Clinical Affairs



**John Algren**  
Vice-Chair for  
Educational Affairs  
Acting Vice-Chair for  
Pediatric Affairs



**Matt Weinger**  
Vice-Chair for  
Faculty Affairs



**Jayant Deshpande**  
Vice-Chair for  
Pediatric Affairs  
(ex-officio)



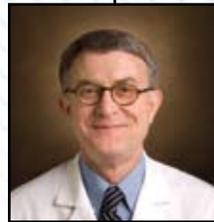
**Steve Blanks**  
Director of Nurse  
Anesthesia Services



**Shannon Hersey**  
Division of  
Ambulatory  
Anesthesia



**Robert Deegan**  
Division of  
Cardiothoracic  
Anesthesia



**Lee Parmley**  
Division of  
Critical Care  
Anesthesia



**James Berry**  
Division of Multi-  
specialty Anesthesia



**Curtis Baysinger**  
Division of Obstetric  
Anesthesia



**Sukdeb Datta**  
Division of Pain  
Management



**Ira Landsman**  
Division of Pediatric  
Anesthesia



**Suanne Daves**  
Division of Pediatric  
Cardiac Anesthesia

# Administrative Staff



*The Vanderbilt Department of Anesthesiology's administrative staff provides critical support for every division of the department.*

*Front row, left to right, Margaret-Ann Koontz, Kelen Taylor, Kristin Bell, Frank Rosato, Beverly Fletcher, Sue Walsh, Jennifer Harris-Brown. Second row, left to right, Sandra Holtzclaw, Dana Sylak, Marsha Moore, Jennifer Cook, Kristie Lee, Becky Mullen, Betsy DeMarcus, Rachel Herrmann, Jill Clendening (on higher step), Jennifer Smith, Angela Brown (on higher step). Third row, left to right, Mark Stevens, Princess Ferrand, Elisabeth Hudson, Eric Smith, Deborah Nelson-Rouse, Katie Nash, Melanie Little. Not pictured: Donna Ray Anthony, Sreedatta Banerjee, Edward Byrd, Elizabeth Card, Melissa Chont, Gail Hess, Sarah McDavid, Damon Michaels, Lori Kelly, Suzette Laws, Donna Nelson, Eric Porterfield, Joyce Speer, Kim Suttle, Lana Vandivier, Ronan Walker, Michelle Williams, Patricia Wright, Matthew Zimmerman.*

# A Time of Positive Transition

An organization's leadership – both the accomplished leaders that are drawn into its ranks and the well-polished leaders that move on to serve in notable roles outside the organization— speaks volumes about its quality and capabilities. The 2009-2010 academic year has heralded significant transitions for the VUMC Department of Anesthesiology, bringing several new faces into new roles, most notably, a new chairman.

In April 2010, **Warren S. Sandberg, MD, PhD**, formerly Associate Professor of Anaesthesia at Harvard Medical School and a Program Leader of the Massachusetts General Hospital OR of the Future Project, became the new Chair of the Department of Anesthesiology, with appointments as Professor of Anesthesiology, Surgery and Biomedical Informatics. Former department chairman, Michael Higgins, MD, MPH, returned to his clinical and faculty roles as Professor in the departments of Anesthesiology, Surgery and Biomedical Informatics.

Dr. Sandberg joined the Harvard faculty in the Department of Anesthesia, Critical Care and Pain Medicine at Massachusetts General Hospital in 1998. He received his PhD in Biochemistry and Molecular Biology from the University of Chicago in 1991, and his MD from the University of Chicago, Pritzker School of Medicine in 1994. He completed his internship at the University of Chicago Hospitals, and was a resident and fellow in the Department of Anesthesia and Critical Care at Massachusetts General Hospital. His clinical interests range from ambulatory surgery to anesthesia for liver transplantation. Sandberg's research career began in structural biology and mechanisms of anesthesia, but he has now developed broad research interests in medical technology, informatics, patient safety and OR & procedure suite operations. A particular focus is using medical information systems for real time process monitoring, decision support and process control. Sandberg's wife, Elisabeth H. Sandberg, PhD, also joined the Vanderbilt faculty, accepting a position as Senior Lecturer in the Department of Psychology in the College of Arts and Science.

## Departures

**Jayant Deshpande, MD, MPH**, Anesthesiologist-in-Chief at the Monroe Carell Jr. Children's Hospital at Vanderbilt, left Nashville in fall 2010 for Little Rock where he will be Senior Vice President/Chief Quality Officer and Associate Medical Director at Arkansas Children's Hospital. Deshpande, Professor of Anesthesiology and Pediatrics at Vanderbilt University Medical Center, served at Vanderbilt for 19 years where he established programs in Pediatric Critical Care, Anesthesia, Procedural Sedation and Quality and Safety at Children's Hospital. Deshpande, who



earned his Master's in Public Health from Vanderbilt, served as the president of the Society for Pediatric Anesthesiology while at Vanderbilt and co-edited editions of "The Pediatric Pain Handbook," and "Pediatric Pain Management for Primary Care."

While at Vanderbilt, Deshpande was instrumental in growing the Sedation Program, designing and opening the Children's Hospital, building the International Program and starting the Tennessee Emergency Medical Services for Children. He established programs in Pediatric Critical Care, Anesthesia and Quality and Safety at Children's Hospital. John Algren, MD, will act as Vice Chair for Pediatric Anesthesiology and Anesthesiologist-in-Chief at the Monroe Carell Jr. Children's Hospital at Vanderbilt during a national search to fill Deshpande's position.

**Bernhard Riedel, MD, PhD**, left the Division of Cardiothoracic Anesthesiology to become the Director of Anaesthetics (Chair) at the Peter McCallum Cancer Centre in Melbourne, Australia. In this role, he will be instrumental in a major move into a government-funded comprehensive cancer center, the Parkville Comprehensive Cancer Center, expected to open in 2015.



**Kevin Strange, PhD**, formerly the director of the research division for the Department of Anesthesiology, left in 2010 to become Director of Mt. Desert Island Biological Laboratory, an independent, non-profit research institution in Bar Harbor, Maine. The Mt. Desert Island Lab studies marine and non-marine organisms to learn about the basic biology of life. Dr. Strange was instrumental in growing the Anesthesiology Department's basic research program to be one of the most successful in the United States.



## New Roles, New Faces

**Suanne Daves, MD**, joined the department in January 2009 and has been named chief of the Division of Pediatric Cardiothoracic Anesthesiology. Daves previously was an Associate Professor of Anesthesia with the Department of Anesthesia & Critical Care and an Associate Professor of Pediatrics, Section of Critical Care, with the Department of Pediatrics at the University of Chicago. Daves also serves



as Clinical Director, Perioperative Services for the Pediatric Heart Institute at Monroe Carell Jr. Children's Hospital at Vanderbilt. Daves serves on the board of directors for the Congenital Cardiac Anesthesia Society, and is active in the Society of Cardiovascular Anesthesiologists, the Society for Pediatric Anesthesia and other professional societies.

**Tracy Jackson, MD, FIPP**, has been named Program Director of the Multidisciplinary Pain Medicine Fellowship. Dr. Jackson joined Vanderbilt as an assistant professor of Anesthesiology and Pain Management in 2007. She is also the department's Director of Residency Education, Division of Chronic Pain Management. She is board certified in Anesthesiology with subspecialty certification in Pain Medicine.



**Brian Rothman, MD**, Assistant Professor of Anesthesiology in the MSA Division, has been named Medical Director of Perioperative Informatics, and Medical Director of Access & Administrative Operations. Dr. Rothman received his medical degree from the University of Cincinnati and completed his residency training at The Johns Hopkins Hospital in Baltimore, MD. Dr. Rothman has been instrumental in developing un-tethered versions of Vanderbilt's OR Vigilance™ applications, allowing anesthesiologists to have high-level situational awareness of the activities in multiple ORs while on the go. The most successful of these is an application that runs on the iPhone and iPod Touch. Dr. Rothman has presented at numerous national meetings, and his research in mobile perioperative information management systems received both the Innovation and Clinical Application of Technology Awards at the 2010 annual meeting of the Society for Technology in Anesthesia (STA).



**Eric Delpire, PhD**, Professor of Anesthesiology & Molecular Physiology & Biophysics, has been named the department's Director of Basic Science Research. Delpire has been a member of the Vanderbilt University Medical School faculty since 1997. His laboratory creates and studies genetically-modified mouse models of Na-K-2Cl and K-Cl cotransporters and of the proteins



that regulate them. The work involves molecular biology, physiology, electrophysiology and behavior. These studies have significance in pain perception, hyper-excitability and epilepsy, nerve conduction, peripheral neuropathy and paraplegia.

**Jesse M. Ehrenfeld, MD, MPH**, joined the department in September 2010 as an Assistant Professor of Anesthesiology, Director of the Center for Evidence-Based Anesthesia and Director of Perioperative Data Research. Dr. Ehrenfeld formerly was an Assistant Professor of Anaesthesia at Harvard Medical School and a faculty member in the Department of Anesthesia, Critical Care and Pain Medicine at Massachusetts General Hospital. While at Harvard, he served as Director of the Anesthesia Informatics Fellowship and Director of the Anesthesia Clinical Research Center. Dr. Ehrenfeld received his medical degree from the University of Chicago Pritzker School of Medicine and his master of public health degree from the Harvard School of Public Health.



He has significant expertise in health services research and the real-time application of information technology to improve processes of care in the perioperative space. He is the co-author of five clinical textbooks, numerous peer-reviewed scientific articles, and serves as a reviewer for both Anesthesiology and Anesthesia and Analgesia. Dr. Ehrenfeld is active in the American Medical Association, the American Society of Anesthesiologists, the Institute for Safety in Office-Based Surgery, and is a founding member of Doctors and Lawyers for Healthcare Reform, a non-profit organization that brings together physicians and attorneys to reform the health care liability system. Among a number of honors, Dr. Ehrenfeld received the Partners in Excellence Award from Partners Healthcare, the Foundation Leadership Award from the American Medical Association, and several teaching awards from Harvard Medical School. He also is a three-time winner of the Clinical Research Presentation Award from the Chicago Medical Society and also received a Research Symposium Award from the Massachusetts Medical Society for his work in health care policy.



# Building Our Future

An academic medical department relies on philanthropic support to establish and strengthen programs; support innovative research endeavors; and advance the education and continued betterment of its faculty, staff and students. This has become especially critical in the current economic climate. Although our grant funding is strong, economic pressures have forced extramural granting agencies such as the NIH to reduce funding for even well-established Vanderbilt investigators. Governmental sources can only fund a select few innovative research and educational programs such as “discovery” grants and lectureships. Fortunately, such ‘seed’ funding is within the reach of many private donors, whose gifts materially improve the academic life of the Vanderbilt Department of Anesthesiology. Gifts large and small keep the department on the leading edge of world-class health care. Several endowed ventures within the department are perfect examples of such giving.



*The family of Dr. James Phythyon, at left, Anesthesiology Department Chairman Warren Sandberg, MD, PhD; and Vice-Chair of Pediatric Affairs Jayant Deshpande, MD, at far right, recognize honored guest Shobha Malvia, MD, for her Grand Rounds lecture.*

## **Dr. James Phythyon Endowed Lectureship in Pediatric Anesthesiology**

For the past five years, the Dr. James Phythyon Endowed Lectureship in Pediatric Anesthesiology has brought nationally and internationally renowned experts in the field to our campus as Visiting Professors. At a special Grand Rounds lecture, these experts share their research findings and unique expertise with the department. During their visit, the speakers also meet with residents and fellows for small group teaching sessions and informal discussions. The lectureship was established by the family of Dr. James Phythyon, a founding member of VUMC’s Pediatric Anesthesia Division. Dr. Phythyon’s widow, Mrs. Marlin Sanders, and the couple’s daughters, Mary Neal Meador, Elizabeth Donner and Sarah Miller, are strong supporters of the department. Each year, they attend the lecture and other events in honor of Dr. Phythyon.

In 2010, Dr. Shobha Malvia, director of Pediatric Anesthesiology Research for The University of Michigan Health System, presented a well-received Grand Rounds lecture on pain assessment and management in cognitively impaired children. Past Phythyon Lectureship speakers include: Dr. Philip Morgan of the University of Washington and Seattle Children’s Hospital; Dr. Francis X. McGowan Jr. of the Children’s Hospital Boston; Dr. Peter Davis of the Children’s Hospital of Pittsburgh; and Dr. Myron Yaster of Johns Hopkins University School of Medicine.



*Grand Rounds speakers Chris Lemelle, MD; Stephen Hays, MD; Brian Carter, MD; and Twila Luckett, RN, with Paula C. Sandidge, MD.*

## **Sandidge Pediatric Pain Management Endowed Fund**

Retired Vanderbilt anesthesiologist Dr. Paula C. Sandidge 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’s 30-year career as an anesthesiologist focused on keeping people asleep and out of pain during surgery, but she came to recognize how inadequate her early training had been in controlling pain for the youngest of patients. This point was driven home when her grandson was born with a painful and untreatable form of osteogenesis imperfecta. He lived just one day, but Sandidge realized that pain control offered infants like her grandson something irreplaceable: the opportunity to be touched and held comfortably by the people who love them for the few precious moments they have.

The first annual Sandidge Pediatric Pain Management Award recognized pediatric pain service nurse Twila Luckett, BSN, RN-BC, for her outstanding clinical work in pediatric pain management. A Grand Rounds on pediatric pain management was also held and featured four speakers: Dr. Brian S. Carter, Professor, Division of Neonatology; Dr. Stephen Hays, Associate Professor, Anesthesiology & Pediatrics and Director of Pediatric Pain Services; Dr. Christopher Lemelle, Asst. Professor, Anesthesiology Pediatric Division; and Luckett.

“We are learning now that any newborn who experiences serious pain can suffer lasting effects. It can even lead to behavioral problems later in childhood. I want to do what I can to encourage continued learning and discovery in this area,” said Sandidge.



*At left, Liz Lee, MD, received the first Dila Vuksanaj Award for her excellent performance in pediatric anesthesiology. Ira Landsman, MD, presented the award.*

#### **Dila Vuksanaj Memorial Fund for Resident Education**

Pediatric anesthesiologist Dr. Dila Vuksanaj practiced at the Children’s Hospital for 13 years, dedicating herself to both her patients and to the hundreds of trainees who came to appreciate her as a role model, mentor, and friend. Following her death in 2009, her family, including husband Dr. Jacques Heibig, founded the Dila Vuksanaj Memorial Fund for Resident Education. The fund is used to present an annual award to the anesthesiology resident who demonstrates the best overall performance in pediatric anesthesiology. In 2010, Dr. Elisabeth Lee received the first Vuksanaj Award.

“Dr. Vuksanaj was not only an exemplary anesthesiologist, but a dedicated educator,” said Lee after receiving the award. “My first encounter with her was when she was coordinating the pediatric anesthesia resident lectures. She held great review sessions and was always smiling and encouraging in the operating room. She often asked me, ‘See...isn’t this fun?’ It is only fitting that even after she is gone, she continues to teach and encourage by way of the award and memorial fund named for her. It is an honor to have received the first of these awards.”

“Through this fund in her memory, we are able to honor Dila’s work and dedication to our trainees,” said Jayant Deshpande, MD, anesthesiologist-in-chief at the Children’s Hospital and longtime friend of Dr. Vuksanaj. “This continues her legacy and is a lasting memorial to a great friend, colleague and educator.”



*Vanderbilt University School of Medicine Dean Jeffrey Balser, MD, PhD; and Bradley E. Smith, MD; with Joseph Gerald “Jerry” Reves, MD, Dean of the College of Medicine at the Medical University of South Carolina. Reves was the first presenter of the Dr. Bradley E. Smith Endowed Lectureship on Medical Professionalism.*

#### **Dr. Bradley E. Smith Endowed Lectureship on Medical Professionalism**

Throughout his more than four decades of practice and leadership, former Anesthesiology Department Chairman Dr. Bradley E. Smith has 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 Dr. Michael Higgins. The goal of the lectureship is to reflect on the characteristics, responsibilities, and rewards of professionalism as applied to the practice of anesthesiology. As chairman of the Vanderbilt Department of Anesthesiology for nearly 25 years, Dr. Smith was a national leader in the development of anesthesia subspecialties, and was a cofounder of the Society for Obstetric Anesthesia and Perinatology (SOAP), as well as the Society for Technology in Anesthesia (STA). He also represented the state of Tennessee on the ASA Board of Directors for many years.

Dr. Joseph Gerald “Jerry” Reves, Dean of the College of Medicine at the Medical University of South Carolina (MUSC), was the first guest speaker to present this annual lecture.

# Clinical Overview

As one of the largest clinical programs in the nation, the Vanderbilt Department of Anesthesiology provides clinical care for the full spectrum of procedural, critical care, pain management, and perioperative medicine needs for more than 60,000 adult and pediatric patient encounters annually at more than 90 anesthetizing locations. Each year, nearly 20,000 patients are seen in the Vanderbilt Preoperative Evaluation Clinic (VPEC). Approximately 3,000 patients are seen annually in our Vanderbilt Interventional Pain Center, and approximately 20,000 Vanderbilt adult and pediatric patients receive an anesthetic during a radiologic, gastrointestinal, or other diagnostic or therapeutic procedure. Our faculty, residents, fellows, Certified Registered Nurse Anesthetists (CRNAs), and nurse practitioners provide care in six adult intensive care units, the pediatric and neonatal intensive care units, and perform more than 3,100 anesthetics per year in the labor and delivery suite.



*Dr. Daniel Lonergan monitors a patient in the OR during a procedure.*

Our outstanding faculty, residents, fellows, nurse anesthetists, and nurse practitioners provide services in three hospitals (Vanderbilt University Hospital, Monroe Carell Jr. Children's Hospital at Vanderbilt, and the Nashville Veterans Administration Hospital) and five outpatient facilities. Our specialized clinicians are experts in providing the full range of anesthetic techniques and procedures in the operating rooms, procedural suites, intensive care units and the pain management clinic. All surgical specialties are represented, including adult and pediatric cardiac surgery and organ transplantation, abdominal solid-organ transplantation, robotic surgery, neurosurgery, and high-risk obstetrics. Our trauma service, which includes our orthopedic trauma program, is among the busiest in the nation.

We guide patient care throughout their time at Vanderbilt. Members of our clinical leadership team also provide on-site perioperative medical direction in each of our clinical locations, providing leadership and management services vital to the success of Vanderbilt University Medical Center.

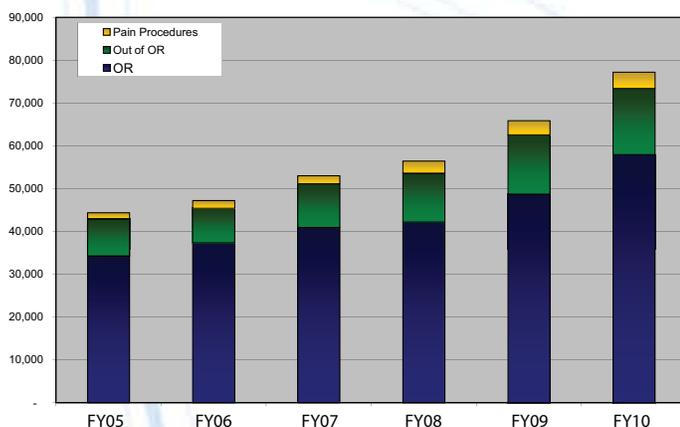
Our department is also known for innovation in the use and development of new technologies to both deliver and improve patient care and to improve our educational offerings. We use advanced

human patient simulators to teach basic anesthesia skills, critical event response, and team management in the operating rooms and intensive care units. We are one of the few medical training centers with a 3-D TEE simulator to safely teach the essential skill of cardiac ultrasound.

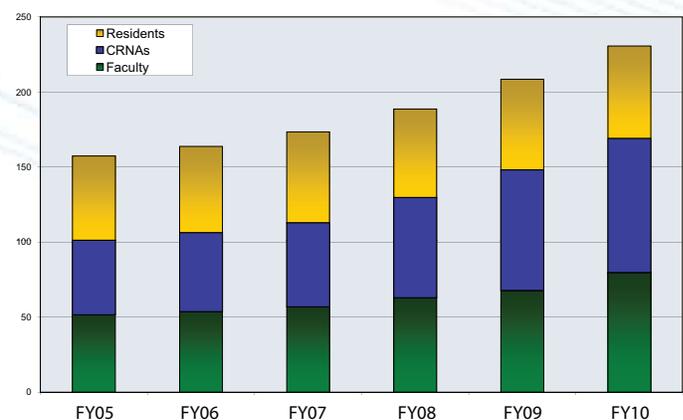
The computerized medical information systems at Vanderbilt are second to none and support the delivery of safe and efficient patient care. Perioperative record keeping is highly automated and managed through an anesthesia information management system developed by our department that not only enhances effective patient care, but also supports our clinical research program.

Highlighted on the following pages are the clinical services provided by the Vanderbilt Anesthesiology Department's clinical divisions.

**Department of Anesthesiology Clinical Volumes**



**Clinical Staff of the Department of Anesthesiology**



# VigiVU™ Brings Patients to Doctors

Vanderbilt anesthesiologists are making great use of new technology with the development of a mobile device application that allows doctors to continuously monitor their patients, even if their patients are several rooms away. VigiVU™, an iPhone app created by the VUMC Department of Anesthesiology, allows anesthesiologists and other clinicians to watch over up to four patients immediately before, during and after surgery – greatly increasing situational awareness. Additionally, the application allows secure expert consultation with live high resolution video and complete patient data available to consultants on the next floor or the next continent. In October 2009, Vanderbilt anesthesiologists and information technology specialists at the Medical Center launched the first version of VigiVU™ after just three weeks of development. The newest iteration of VigiVU™ is now in increasing use by VUMC healthcare providers.

VigiVU™ notifies caregivers of out-of-range vital signs and medication administration, as well as changes in admission, discharge and transfer status. It allows graphical vital sign review, promotes rapid communication with other providers, and provides a direct view into operating rooms during surgeries through a live, high-quality video feed, all from the convenience of the physicians' cell phones. The VigiVU™ application also functions on the iPod Touch and iPad, with the iPad providing users a larger, yet still mobile, information source.

"It brings the functions of our desktop computer programs onto the mobile device. Now, there is an app for Situational Awareness," said Dr. Brian Rothman, VUMC associate director of Perioperative Informatics. "There is no reason for us to be disconnected from our patients when current technology can bring them to us. As supervisors over a patient's care, we should know about changes and events with our patients as they happen. With this application, we can communicate with our staff to immediately start correcting the issue, either from another room or while we are on our way. We are continuously connected and can be even more proactive in our response to events."

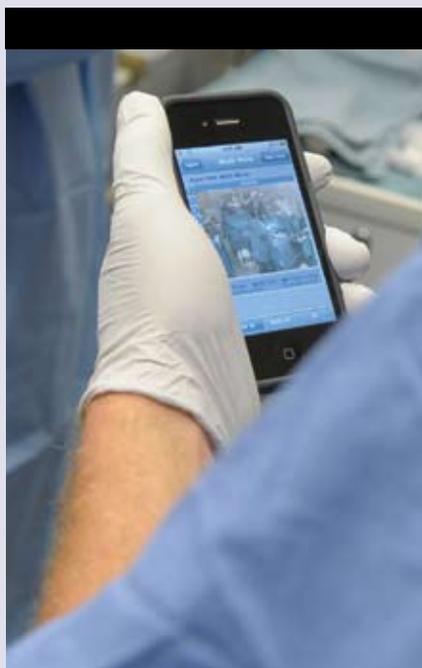
The iPhone application expands Vigilance™, Vanderbilt's in-house desktop situational awareness program, and makes monitoring patients more portable and efficient. The Vigilance™ software application visually integrates data from patient monitors, electronic medical records, and operating room video cameras, and securely transmits that information to clinicians' computers. All Vanderbilt operating rooms are connected to Vigilance™, including outpatient surgery sites within the medical center and off-site ambulatory surgery centers.

Clinicians use VigiVU™ case views to observe a patient's live operating room video with full pan, tilt, and zoom camera control, graphical vitals trends, a focused problem list or full electronic preoperative

history and physical, and electronic medical record access. GasChart™, Vanderbilt's Anesthesia Information Management System (AIMS) used to fully document a patient's anesthetic care, provides the names of staff signed into, and responsible for, the anesthetic. Site case boards for operating room management are also provided with customizable board views so medical providers know the status of all operating rooms without having to make a call or visit. VigiVU™ developers took security measures into consideration from the beginning. The mobile device does not store data. Layered security, such as user passwords and server-based assigned access, also blocks the unintended user.

While currently primarily VUMC anesthesia providers are using VigiVU™, other healthcare providers, such as the surgeons and nursing staff are requesting the application. It is expected that use of VigiVU™ will continue to expand, and there are planned studies to evaluate the application's impact on operating room efficiency and patient care.

*Handheld smartphones with the VigiVU™ application make patient monitoring and communication between care providers more efficient.*



## Multi View

Room	HR (bpm)	SpO2 (%)	BP (mmHg)	Vitals last taken at
VOR3 05	83	98%	70/42	14:01
VOR3 10	78	100%	82/40	14:01
VOR3 12	78	99%	102/58	14:01
VOR3 14	53	97%	108/60	13:59

# Nurse Anesthesia

Vanderbilt has an anesthesia care team approach to patient care, utilizing anesthesiologists, Certified Registered Nurse Anesthetists (CRNAs), and anesthesia technicians. The nearly 100 CRNAs at Vanderbilt provide anesthesia for all types of surgical procedures including vascular, trauma, neurosurgery, plastics, radiologic and special procedures. CRNAs allow anesthesiologists to manage complicated cases while focusing on resident/fellow education in the OR. Anesthesia technicians assist in operating equipment used to monitor and manage patients, as well as handle equipment maintenance and servicing. The CRNA Division is overseen by Chief CRNA Steve Blanks and Assistant Chief CRNA Buffy Krauser-Lupear. There are five designated lead CRNAs: Brian Reid in Ambulatory; Paul Wilson in OB/Gyn; Edith Newberry in Adult Cardiac; Robert Atwood in Pediatrics; and John Butorac in MSA.

Vanderbilt is the primary clinical affiliate of the second largest nurse anesthesia program in the country, Middle Tennessee School of Anesthesia (MTSA) in Madison, Tennessee, as well as the Union University Nurse Anesthesia program in Jackson, Tennessee. Student nurse anesthetists assist in approximately 7,000 anesthetics per year while on Vanderbilt rotations. SRNA coordinators are CRNAs Paul Wilson and Mariah Light.

In 2009, the CRNA Division was re-structured to better mirror the VUMC operating room pod organization, and the service specialist position was created to improve communication with pod members. Six service specialists were selected, five from the Multispecialty Anesthesia Division, and one representing the Pediatric Cardiothoracic Division. They are Neurosurgery Service Specialist Tammy Freehling; AOS/Ortho Service Specialist Kathy Mitchell; General Oncology/Urology Service Specialist Ken Donnell; Ophthalmology/Otolaryngology/Oral Surgery/Plastics Service Specialist Mark Haffey; Out-of-OR Service Specialist Ki Szymd-Hogan; and Pediatric Cardiothoracic Service Specialist Lewis McCarver.

“These service specialists are point people for the pods, and they attend the pod meetings,” said Chief CRNA Steve Blanks. “The addition of the service specialists has greatly improved the communication with the operating room staff and our medical directors. It has also helped our SRNA coordinators as they guide the education of students in those pods.”

Another improvement in the CRNA Division has been the selection of four CRNAs designated as C1s who provide support and interact with the first-call residents (R1s) to assist with breaks, coordinate pre-ops, and afternoon hand-offs to the R1s.

*Nurse Anesthetists play a critical role in anesthesia provision at Vanderbilt University Medical Center.*



# Division of Ambulatory Anesthesia

The Division of Ambulatory Anesthesia was formed in 2008 to provide services for a growing number of Vanderbilt Medical Center satellite locations including the Nashville Surgery Center (NSC), Vanderbilt Outpatient Surgery Center (VOS), and the Cool Springs Surgery Center (CSSC). Vanderbilt Bone & Joint is the newest ambulatory surgery location added to the division, and it is expected to be fully staffed by Vanderbilt providers by March 2011. The Vanderbilt Bone & Joint location specializes in orthopedic procedures and extends regional anesthesia services to Williamson County residents. In addition, the Ambulatory Anesthesia Division's faculty provide outpatient procedural services for the gastroenterology suite at Vanderbilt University Hospital. The Division of Ambulatory Anesthesia will anesthetize an estimated 13,500 patients in 2010.

New services have been added in the division as demand for ambulatory surgery procedures continues to grow. In October 2009, the Cool Springs Surgery Center began offering ambulatory neurological procedures and a surgical spine service, including anterior cervical discectomy and minimally invasive lumbar laminectomy. Outpatient bariatric surgery has also been added at CSSC.

In addition to its clinical service activities, the Division also provides educational experiences for residents and fellows in ambulatory anesthesia and perioperative management. Residents are extensively involved in the critical issues of patient selection and perioperative care for this increasingly complex patient population. As the NSC is primarily an orthopedic/sports medicine center, a significant portion of training in regional anesthesia occurs here. This separate and distinct rotation allows resident to focus on learning the techniques of regional blockade including the use of ultrasound and the placement of regional catheters for home-based, post-operative pain management. Residents also learn how to manage an entire system of care to deliver safe and cost-effective care while achieving high patient and surgeon satisfaction. There are opportunities within the division for scholarship in clinical research related to optimal patient assessment and outcome management. Through a collaboration between Drs. Raj Gupta and Randall Malchow, a database of more than 2,500 patient cases in which regional anesthesia was utilized has been collected. This database will allow for future investigations into the efficacy of the modality.

The Division of Ambulatory Anesthesia is lead by Dr. Shannon Hersey and consists of four full time faculty, 15 CRNAs, and 2-3 rotating residents.

*Cool Springs Surgery Center is one of several Vanderbilt University Medical Center satellite locations providing ambulatory surgery services.*



# Division of Cardiothoracic Anesthesia

The Division of Cardiothoracic Anesthesiology is led by Dr. Robert Deegan, MD, PhD, and includes ten faculty members and ten nurse anesthetists. Each month, three residents rotate through the service. The fellowship program, under the leadership of Dr. Annemarie Thompson, has this year been expanded to three fellows trained annually. The Division works in tandem with the surgeons and cardiologists of the Vanderbilt Heart and Vascular Institute to perform approximately 1,200 adult cardiac procedures a year. These include cardiac bypass and valvular surgery, off-pump CABG procedures, cardiac transplantation, adult congenital procedures, hybrid bypass procedures, aortic aneurysm and dissection repair, and ventricular assist devices.

In addition, the division manages about 700 thoracic cases annually, including thoracotomy, mediastinoscopy, and esophageal procedures. A subset of the division's faculty is also board-certified in intensive care medicine. These individuals, led by Dr. Chad Wagner, rotate through the cardiovascular intensive care unit.

The CT Division also provides services for invasive cardiology procedures such as placement of internal cardiac defibrillators,

valvuloplasty, electrophysiology procedures, and septal ablations. This accounts for approximately 1,000 cases per year. The faculty demonstrates expertise with invasive physiologic monitoring, transesophageal echocardiography, and bypass management. Intraoperative transesophageal echocardiography (TEE) is an integral part of the clinical practice. The program was established in 1996, and has since become the standard in adult cardiac patients. TEE is now performed on nearly 100 percent of all adult cardiac patients. State-of-the-art, 3-D imaging systems are readily available. All studies are performed and interpreted by the cardiothoracic anesthesiologist, and all cases are digitally archived.

The cardiothoracic anesthesiology faculty conduct research in vascular system function, cardiopulmonary conditioning, renal failure, and perioperative inflammatory response. Faculty members have grant support from the AHA and NIH. In Sept 2009 and May 2010, the division hosted workshops in perioperative transesophageal echocardiography and in pacemaker management, which drew anesthesiology residents, fellows, faculty and private practitioners from throughout the region. It is hoped that these will become annual events.

*Division of Cardiothoracic Anesthesia: Front row, left to right: Annemarie Thompson, MD; Susan Eagle, MD; Robert Deegan, MD, PhD; Oksana Kantor, MD (Fellow). Back row, left to right: Chad Wagner, MD; Mias Pretorius, MD; Jason Kennedy, MD; Aaron Anderson, MD (Fellow); Frederick "Josh" Billings, MD. Not pictured: Julian Bick, MD; Justin Wilson, MD (Fellow)*



# Division of Critical Care Anesthesia

The November 2009 opening of the new Critical Care Tower at Vanderbilt University Hospital brought dramatic expansion in the ranks of the Division of Critical Care Anesthesia. The 11-story, \$169 million Critical Care Tower houses 12 new operating rooms and 102 patient beds in the medical, surgical and neurological intensive care units. Directed by Lee Parmley, MD, JD, the Division of Critical Care Anesthesia has grown to include 16 faculty members, four fellows, 16 nurse practitioner faculty and one faculty physician's assistant.

Vanderbilt University Hospital is the region's only Level I Trauma Center and is home to the Vanderbilt Transplant Center, one of the south's main providers of solid organ and stem cell transplantation. Because of this, the patient population is diverse, often presenting with high acuity. The Department of Anesthesiology's Critical Care Division plays a vital role in providing outstanding care to even the most complex of cases. The Critical Care Division cares for patients in the Surgical ICU (23 beds); Cardiovascular ICU (26 beds); Neurological ICU (26 beds); and Burn Unit (24 beds) at Vanderbilt University Medical Center. The patient populations served include neurosurgical, neurological, trauma, burns, cardiothoracic, transplant and

elective surgical cases. Residents and fellows in the Critical Care Division may also rotate at the Monroe Carell Jr. Children's Hospital at Vanderbilt Pediatric Critical Care Unit (36 beds) and Neonatal ICU (78 beds), as well as the Veteran's Administration ICU.

In addition to patient care, education is a key commitment of the Critical Care Division, and all levels of trainees from medical students to fellows receive training with the Critical Care faculty. The Division is approved to offer six Critical Care fellowship positions annually. Vanderbilt's wide variety of cases and high level of acuity provide an excellent source for training a broad spectrum of critical care skills. The faculty include board certified anesthesiology, neurology, and surgical critical care attendings. Critical Care Anesthesia Division Chief Dr. Lee Parmley and Dr. Liza Weavind were both selected to be fellows of the American College of Critical Care Medicine (ACCM). This prestigious fellowship honors practitioners, researchers, administrators and educators who have made outstanding contributions to the collaborative field of critical care.

*Division of Critical Care Anesthesia: Front row, left to right: Christopher Hughes, MD; Megan Shifrin, NP; April Kapu, NP; Anna Fong, NP; Sheena Howson, MD; Pratik Pandharipande, MD; Lauren Nevels, NP; Dorothy Fogerty, MD; Arna Banerjee, MD; Edmund Donahue, NP; Chad Wagner, MD; Roy Neeley, MD; Liza Weavind, MD. Back row, left to right: Nahel Saied, MD; Nathan Ashby, MD; John Selby, MD; Jason Kennedy, MD; C. Lee Parmley, MD; Will Costello, MD; Stuart McGrane, MD; Jayme Gibson, NP; Josh Squiers, NP; Derek Bowers, NP; David Hall, MD. Not pictured: Dee Chapman, NP; Justin Calabrace, NP; Amanda Hill, NP; Lindsay Trantum, NP; Ryan Truesdale, NP; Ryan Henderson, NP; Olga Dayts, NP; John Barwise, MD; Josh Billings, MD; Bill O'Byrne, MD; Elizabeth Heitman, PhD.*



# Grant Fosters Unique Partnership

Vanderbilt University School of Nursing and the Division of Critical Care Anesthesia are joining in an innovative partnership to prepare acute care nurse practitioner (ACNP) students for expanded roles in caring for intensive care unit patients thanks to a three-year, \$800,000 Health Research Services Administration grant.

The grant funds a new specialty track within the ACNP program to train acute care nurse practitioners as tertiary level intensivists, after which they will become part of the multidisciplinary teams managing ICU patients. This is one approach to solving the anticipated national shortfall of physician intensivists in the coming years and will allow nurse practitioner students to expand their clinical expertise.

“Historically, we’ve taken a less integrated approach to training like this,” said Josh Squiers, PhD(c), RN, project coordinator. “For this project, we have pulled together the best resources from our physician critical care colleagues, our nurse practitioner faculty colleagues and the School of Nursing into one package and are delivering the curriculum as one integrated program.”

In the new project, acute care nurse practitioner students will learn from physician and nurse practitioner faculty teaching side-by-side in the classroom, in clinical rotations and in the Center for Experiential Learning and Assessment (CELA), where much of the training will take place. CELA, which offers a wide range of simulation technologies, includes computerized mannequins that can reproduce real-world scenarios that frequently present themselves in the

Intensive Care Unit setting. Simulation training provides students with the opportunity to participate at a more heightened level than they could with actual patients and provides an educational opportunity with structured debriefing sessions. Simulations scenarios cover everything from what to do when a patient presents with specific symptoms to how to effectively communicate with the patient’s family members.

“This program allows us to take care of the complex patients that are filling the ICUs,” said C. Lee Parmley, MD, JD, executive medical director of the VUMC Critical Care Units. “You see student comfort levels go up and their skill sets improve dramatically. Then, when the students start their careers, they have clinical expertise and are up to speed.”

The students who participated in the pilot testing phase leading up to the expanded program had an overwhelmingly positive response to the integrated learning.

“We are fortunate to have a progressive critical care practice here at Vanderbilt with integrated physicians and nurse practitioners providing critical care services,” said Joan King, Ph.D., ACNP-BC, professor and program director for the Acute Care Nurse Practitioner program at VUSN and principle investigator for the grant. “That, and having the educational partnership of Critical Care Anesthesia, CELA and the School of Nursing, is the most unique feature of this grant.”

*Project Coordinator Joshua Squiers, PhD, RN, left, observes VUSN students Ariel Waters, center, and Dalton Pickney go through a simulated critical care scenario. The Division of Critical Care Anesthesia and the School of Nursing are partnering on a \$800,000 grant to fund training of acute care nurse practitioners.*



# Division of Multispecialty Anesthesia

The Division of Multispecialty Anesthesia (MSA) is the department's largest division, providing perioperative anesthetic care for more than 15,000 patients annually in 46 operating rooms and procedure suites for a wide variety of surgical services, including General Surgery, Orthopedics, Neurosurgery, Urology, Plastic Surgery, Ophthalmology, Vascular Surgery, Otolaryngology, Hepatobiliary, Renal Transplantation, and Maxillofacial/Oral Surgery. MSA faculty and staff also provide 24-hour coverage for emergency and trauma surgery for the region. The division is led by Dr. James Berry and has 33 full-time and 13 part-time clinical faculty, most of whom have significant subspecialty training and expertise.

Adult ophthalmologic surgery is performed five days per week in one of the ORs in the Vanderbilt Clinic Building. MSA faculty also staff two office-based operating rooms in the ambulatory Cosmetic Surgery Center located in Medical Center East. MSA anesthesiologists increasingly provide out-of-OR anesthetic care for a variety of challenging surgical and non-surgical procedures.

Additional important MSA activities include support of the Vanderbilt Preoperative Evaluation Center (VPEC) and the Adult Acute Pain Service which provides all modalities of postoperative pain management, including nerve and plexus blocks, in-dwelling catheters, and neuraxial techniques.

The MSA Division faculty provide anesthesiology residents a wide variety of introductory and advanced clinical experiences and make many contributions to the educational programs for medical students, residents, and fellows. Additionally, MSA faculty teach and supervise residents from other specialties as well as student nurse anesthetists who rotate in the MSA Division. MSA faculty provide daily teaching conferences, lead departmental conferences, and mentor residents in academic endeavors. Divisional faculty pursue a wide range of academic interests including regional anesthesia, airway management, information technology, perioperative cognitive dysfunction, echocardiography and ultrasound imaging. Numerous investigator-initiated clinical research projects are in progress at any given time.

*Division of Multispecialty Anesthesia: Front row, left to right: Brian Rothman, MD; Staci Ridner, MD; Stephen Harvey, MD; James Berry, MD; Kofi Kla, MD; William Furman, MD; Matthew Weinger, MD; Brian Allen, MD; Michael Pilla, MD; Christopher Canlas, MD; Clifford Bowens, MD. Second row: Jane Easdown, MD; Ramprasad Sripada, MD; Steve Hyman, MD; Letha Mathews, MD; Raj Gupta, MD; Marc Hayes, MD; James Blair, MD; James Ramsey MD; Susan Calderwood, MD; Thomas Shultz, MD. Not pictured: Eswara Botta, MD; Eric Briggs, MD; William Byrd III, MD; Meera Chandrashekar, MD; OK Yung Chung, MD; Katherine Dobie, MD; Stefan Erceg, MD; Jean-Terese Fischer, MD; Patrick Henson, DO; Douglas Hester, MD; Michael Higgins, MD, MPH; Scott Hoffman, MD; Kenneth Holroyd, MD; Lisa Jaeger, MD; Shannon Kilkelly, MD; Jason Lane, MD; Tracy McGrane, MD; Ram Pai, MD; Jason Pope, MD; Vidya Rao, MD; Stephanie Rasmussen, MD; Amy Robertson, MD; Ricky Sierra-Anderson, MD; Martha Jane Smith, MD; Bradley Smith, MD; Kenneth Smithson, MD, PhD; Paul St. Jacques, MD; Jeffrey Waldman, MD; Ann Walia, MD; Roland Watts, NP.*

# Adult Acute Pain Service

The past year was a pivotal year of growth and maturity for the Adult Acute Pain Service at Vanderbilt University Medical Center. A major advancement coincided with the move of the Holding Room to the old SICU. In addition to the increased space and better privacy for patients, coordination with the Holding Room staff was improved to provide a more streamlined process for patients receiving regional anesthesia. The goal was to improve success rates while reducing delays and enhancing efficiency. This new space and the teamwork of APS with the Holding Room have facilitated more opportunities to help patients that can benefit from epidurals, peripheral nerve blocks, and peripheral nerve catheters.

A major evolution of services over the last year has been the increased interest and appreciation for peripheral nerve catheters, by both the surgeons and the patients receiving post-operative care. These continuous infusions of local anesthetic are used for complex shoulder and arm surgery, knee arthroplasties, extensive ankle restorations, and repeated burn debridements. The ability to provide targeted pain control in the area of injury has produced better pain control, better patient and surgeon satisfaction, and the ability to reduce patients' time in the hospital. Patients who were staying in the hospital for

days requiring postoperative IV pain medication are now often discharged after a one-night stay. In fact, many operations that previously required extensive hospital stays have now been moved to the outpatient surgery centers where patients are discharged directly home after surgery with a small disposable pain pump.

An ambitious endeavor over this last year has been the addition of the first Regional Anesthesia and Acute Pain Fellowship under the leadership of Dr. Randall Malchow. The fellowship was begun with one position for 2009-2010. For this coming year, the fellowship has been increased to two positions, for which there were more than 50 applicants. The fellows have the opportunity to enhance their procedural skills in advanced Regional Anesthesia, learn the complexities of acute pain management with multimodal analgesia, become educators for the residents at the bedside and in the lecture hall, and grow to be scholars by developing a research study for publication.

This next year holds a lot of promise with the division of the service into the Acute Pain Service and a separate Regional Block Service, the inclusion of more faculty, and the involvement of our service in more aspects of patient care.

*Vanderbilt Anesthesiology Chief Resident Shane Volney performs an ultrasound-guided regional nerve block at the Nashville Surgery Center, one of VUMC's satellite clinical service sites.*



# Division of Obstetric Anesthesia

*Division of Obstetric Anesthesia: Front row, left to right: Sarah Starr, MD; Jessica Wolin, MD; Curtis Baysinger, MD; Tekuila Carter, MD. Second row, left to right: John Downing, MD; Ray Paschall, MD; Michael Richardson, MD; Jill Boyle, MD.*



The Division of Obstetric Anesthesia provides dedicated, 24-hour in-house obstetric care for approximately 3,600 deliveries annually, half of which are considered high risk. The team also provides anesthesia services for approximately 2,500 gynecologic and other surgical procedures for primarily women in a separate operating room suite of three operating rooms. In addition to offering the full complement of techniques for labor analgesia, the division provides consultation and critical care management services for high risk obstetric patients. The division also provides specialized anesthesia care for fetal surgery.

Our trainees, including both residents (three each month) and fellows (1-2 per year), receive extensive experience in the

care of clinically challenging patients. The Division of Obstetric Anesthesia also has a number of on-going clinical research projects, including studies on various anesthetic techniques on patient outcomes. Research projects concerning transversus abdominis block for the relief of pain following Cesarean delivery, factors affecting the choice of pain relief during labor, and the effects of low-molecular-weight heparin on thromboelastographic measurements are ongoing.

The Division of Obstetric Anesthesia is directed by Dr. Curtis Baysinger and includes six other faculty members, two CRNAs, and one administrative assistant. The division's faculty members are fellowship-trained and have extensive experience in obstetric care, regional anesthesia, and acute pain management.

# Division of Chronic Pain Management



*Fluoroscopic-guided nerve blocks are among the many treatments for chronic pain offered at the Vanderbilt Interventional Pain Center.*

Since the Division of Chronic Pain Management began providing clinical services at the Vanderbilt Interventional Pain Center in 2007, the number of patients seen and the procedures available to those patients has continued to grow. From fiscal year 2009 to fiscal year 2010, overall total patient volume increased by 23%, procedure volume increased by 21% and billable charges increased by 51%.

The Vanderbilt Interventional Pain Center is the first comprehensive, multidisciplinary pain center in the southern region of the United States, and the Center offers a wide range of diagnostic, therapeutic and minimally invasive surgical procedures. Patients seen at the center may be suffering from chronic back and neck pain, cancer-related and neuropathic pain. In order to provide holistic, interventional care to meet the full range of patient needs, the center partners with neurosurgery, orthopaedics, psychiatry and physical therapy to provide comprehensive, progressive and innovative pain management services.

In April 2009, the pain center relocated to a 7,000-square-foot space at Vanderbilt Health at One Hundred Oaks. The location includes two procedure rooms, five exam rooms, and four recovery bays, with the ability to perform procedures under both

fluoroscopy and ultrasound guidance in the clinic. Two fellowship-trained pain interventionalists have recently been hired, and the faculty is continuing to expand in order to meet the high demand for specialized pain services at Vanderbilt and the surrounding areas.

The Division is actively involved in pain research with grant-funded investigations studying basic mechanisms in pain formation, non-opiate therapies for pain management, and educational methods. Division faculty include Dr. Sukdeb Datta, Dr. Tracy Jackson, and Dr. Meenal Patil, as well as two fellows, Dr. R. David Todd and Dr. Dan Lonergan.

The Division of Pain Management offers an excellent educational experience for medical students, resident physicians, fellows, and referring physicians. In 2008, the Division established the only ACGME-accredited pain medicine fellowship in Tennessee, with two fellows currently training in the program. The Division conducts grand rounds conferences and journal clubs that review the latest knowledge in the field. Dr. Jackson has recently developed a web-based module detailing appropriate opioid-prescribing practices, which can be accessed by physicians throughout the state who require continuing medical education on this topic for re-licensure.

# Division of Pediatric Anesthesia

The Division of Pediatric Anesthesia provides the perioperative care for more than 13,000 patients per year at the Monroe Carell Jr. Children's Hospital at Vanderbilt, the region's major pediatric referral center. The division's 21 attendings, 22 CRNAs and four fellows are led by Dr. Ira Landsman and provide services for a variety of pediatric surgical procedures including general surgery, ENT, neurologic, urologic, orthopedic, and liver transplantation. The division provides anesthesia services for procedural services outside the operating room, including oncology, gastroenterology, and diagnostic and therapeutic radiologic procedures. The faculty also provide both acute and chronic pain management services.

Education and training of medical students, anesthesia residents, nurses, and associated healthcare personnel is a major commitment of the faculty. Several anesthesiology residents rotate on pediatric anesthesiology services each month and gain experience in the management of patients undergoing both routine and complex surgical procedures, as well as diagnostic and interventional procedures performed outside the operating room. The Pediatric Anesthesiology Fellowship Program offers twelve months of subspecialty training in all aspects of pediatric anesthesia and perioperative care, including critical care and pain management. Areas of academic interest to the division's faculty include airway management, pediatric pain management, regional anesthesia, ECMO, and perioperative care of cardiovascular patients.



*Division of Pediatric Anesthesia:  
Front row, left to right: Thanh Nguyen, MD; Christopher Karsanac, MD; Jill Kilkelly, MD; Ira Landsman, MD; Laura Zeigler, MD; Kevin Saunders, MD.  
Second row, left to right: Andrew Franklin, MD; Brian Donahue, MD; Mark Newton, MD; Silvio Sitarich, MD; Peter Chin, MBBS; Steven Samoya, MD. Third row, left to right: Sean Benton, DO; Jason Daume, MD; John Algren, MD; Jay Deshpande, MD. Not pictured: Daniel Roke, MD; Stephen Hays, MD; Vikram Patel, MD; Kimberly Nesbitt, MD.*

# Pediatric Pain is Taken Seriously

When a pediatric pain service at Monroe Carell Jr. Children's Hospital at Vanderbilt first began more than a decade ago, the service was covered by a single physician. By the time the current free-standing facility opened in 2004, the service had expanded to include three physicians. A dedicated pediatric pain service nurse was soon added. The service is currently covered by as many as six physicians, two of whom also staff the outpatient pediatric pain clinic. Fellows in pediatric anesthesia, regional anesthesia and acute pain, and interventional pain management also rotate through the pediatric pain service.

The Neonatal Intensive Care Unit has its own specialized pain management program, to which the pediatric pain service actively contributes. The inpatient pediatric pain service provides coverage for children receiving various regional anesthetics including continuous epidural and peripheral nerve catheters, and offers consultative assistance in pain management for pediatric inpatients on a wide range of medical and surgical services. The outpatient pediatric chronic pain clinic has been growing steadily as a treatment resource for children with long-term, recurrent, or unremitting pain. Pediatric pain services at Monroe Carell Jr. Children's Hospital at Vanderbilt are directed by Associate Professor of Anesthesiology and Pediatrics Stephen R. Hays, MD, FAAP.

The clinic sees two to three new patients every week, and pediatric pain service nurse Twila Lockett, RN, monitors additional patients by telephone, working with the patients, their families and their physicians to provide the best, consistent pain management for their needs. She also receives pages from throughout the hospital to summon a consultation for pain control or to bring the pain team to a young patient to provide relief. The first annual Sandidge Pediatric Pain Management Award recognized Lockett for her outstanding work to advance the practice of pediatric pain management.

"We have sicker and more complex patients today," Lockett said. "Our team responds to any request for assistance with pain management. Efforts are evolving rapidly to

improve pain management for neonates and children with acute and chronic pain."

"Years ago, medicine held that infants or children either didn't feel pain or that young children wouldn't remember pain," said Jayant K. Deshpande, M.D., Professor of Pediatrics and Anesthesiology. "Today we emphasize pain control at every age, even in newborn babies. That is only possible because of the team we have built, and the communication we have developed between team members."

*Twila Lockett, RN, at left, received the first annual Sandidge Pediatric Pain Management Award. Former Vanderbilt Anesthesiologist Dr. Paula Sandidge, at right, presented the award in recognition of Lockett's exceptional work in advancing the practice of pediatric pain management.*



# Division of Pediatric Cardiothoracic Anesthesia

Children with heart defects represent a complex group of patients whom often require intensive surgical repairs to thrive or even survive into adulthood. The Division of Pediatric Cardiothoracic Anesthesia was formed in 2007 to support the growth of the program that cares for these patients at the Monroe Carell Jr. Children's Hospital at Vanderbilt. Led by Dr. Suanne Daves, the division's faculty provide intraoperative and catheterization laboratory anesthesia care, in addition to participating in the postoperative ICU management.

The pediatric cardiothoracic anesthesiologists work closely with nurse anesthetists who have been extensively trained in cardiac care, and who have many years' experience working with these patients. The division also trains pediatric and cardiothoracic clinical fellows how to care for these unique and challenging patients. Research interests of the faculty include the physiology and management of patients with congenital heart disease, airway management, perioperative genomics, and perioperative quality and safety impact of team communication. The division also provides expert assistance and consultative services for children with congenital heart disease and undergoing non-cardiac surgery/procedures.

In May 2010, members of the Pediatric Cardiothoracic Anesthesia Division were part of a team that successfully placed a Berlin Heart device in an 11-month-old child, the first time such a device had been used in Tennessee. The device is similar to other left ventricular devices (LVADs) used in adults, but is much smaller.

In the 2009-2010 academic year, several faculty members participated in the annual meetings of the Society of Cardiovascular Anesthesia, the Society for Pediatric Anesthesia, and the Congenital Cardiac Anesthesia Society, and the division's members are actively involved in education and quality improvement at the national level.

*Division of Pediatric Cardiothoracic Anesthesia: Front row: Gina Whitney, MD; Suanne Daves, MD. Back row: Scott Watkins, MD; Brian Donahue, MD; Alexander Hughes, MD. Not pictured: Marsha Peterson, MD.*



# Vanderbilt Preoperative Evaluation Center (VPEC)

In 2009, Vanderbilt clinics had more than 1,266,000 patient visits and more than 51,600 patients were admitted to the Vanderbilt hospitals. Procedure delays due to patient cancellation, missing labs or incomplete patient records would be a headache at any medical center with this volume, but here, the Vanderbilt Preoperative Evaluation Center (VPEC) is a critical tool for reducing those delays. VPEC offers a free evaluation and consultation service for surgical patients in order to ensure their safety and prevent surgical delays and cancellations. VPEC staff evaluate 80-100 patients daily, or approximately 65% of all adult surgical patients.

VPEC faculty and staff perform comprehensive preoperative assessments, including interfacing with primary care physicians, specialist consultants, and surgeons while also making direct decisions regarding preoperative testing. Once the patient report is complete, it becomes part of the patient's electronic medical record and is viewable by any Vanderbilt provider with Internet access.

As clear evidence that VPEC works, in 2010 – for the 2nd year in a row – the center received a Professional Research Consultants, Inc. patient satisfaction award, the coveted 5-Star Award for Overall Quality of Care. This means the center scored at the 90th

– 99th percentile based on 2009 calendar year results and as compared to similar centers nationwide.

VPEC has grown rapidly since its inception in 1996. Its main campus location currently has 10 exam rooms and is adjacent to outpatient lab and radiology on the 1st floor of the TVC. VPEC added a second location in 2009 at the Vanderbilt Health at One Hundred Oaks campus. This location has seven exam rooms and is adjacent to outpatient lab and radiology services.

VPEC has received several significant industry accolades and was included in the February 2007 Hanover Research Council Report on Preoperative Assessment Practices. VPEC also received the 2009 Top Performer Award given by Professional Research Consultants, Inc. VPEC is frequently consulted by other hospitals wanting to improve their preoperative processes. Medical co-directors are Dr. Susan Calderwood and Dr. Annemarie Thompson. Russ Kunic, FNP-BC, is the manager of patient care services.

*The Vanderbilt Preoperative Evaluation Center (VPEC) staff excels in providing services with a high level of patient satisfaction, and for the second year in a row, the center has received the 5-Star Award for Overall Quality of Care from Professional Research Consultants.*



# Veteran's Hospital Anesthesia Service



*A full range of sedation services, as well as acute and chronic pain management, is provided through the Veteran's Affairs Anesthesia Service.*

The Veteran's Affairs Anesthesia Service provides perioperative patient care services for the Veterans Administration Medical Center in Nashville and the Alvin C. York campus in Murfreesboro, Tennessee. Nine anesthesiologists on staff, assisted by nurse anesthetists, provide anesthesia care for the full range of surgical procedures including cardiac and thoracic surgery, orthopedic procedures including joint replacements, major vascular, neurosurgical, ENT, ophthalmic, urologic, plastic, bone marrow, and transplant surgeries. In addition, sedation services are provided in several out-of-OR sites, including radiology and MRI suites, pulmonary, cardiac catheterization, and gastroenterology suites. The service also provides primary coverage for acute and chronic pain management, emergency airway management, cardioversion, and diagnostic transesophageal echocardiography.

Senior anesthesiology residents rotate through the VA Anesthesiology Service, participating primarily in major vascular, hepatobiliary, cardiac, and thoracic procedures. Surgical and medical residents also rotate through the VA Anesthesiology Service to gain experience in airway management. The VA anesthesiology physicians also teach the Introduction to Anesthesia and Basic Airway Course for third-year medical students throughout the year. Additionally, first year medical students are provided summer internship opportunities where they gain their first exposure to patients and learn to establish intravenous access, airway management, and invasive pressure monitoring techniques.

# Office of Educational Affairs

The extensive education and training programs offered by the Vanderbilt Department of Anesthesiology integrate scientific and clinical advances with current clinical practice to prepare students, residents, fellows, and faculty for productive careers as clinicians, academicians, and scientists. Our physician educators are nationally and internationally recognized as leaders in their fields, and the department successfully encourages residents to enter academic anesthesia and develop careers focused on advancing knowledge in the specialty.

Our training program is highly sought after, and our recruitment statistics are evidence of our reputation. For 2009-2010, 762 applications were received, and 113 applicants were interviewed. According to the National Residency Matching Program Report, we matched 15/15 positions. Our program is in the top quartile of anesthesia programs with regard to number of positions offered, ranks of applicants to fill positions (4.3), AOA membership (27%), mean USMLE Step 1 score (240) and mean USMLE Step 2 score (249.)

The department's educational program consists of a combination of comprehensive didactic conferences, mentored clinical training, simulation training and self study. The ACGME core competencies - patient care, medical knowledge, interpersonal and communication skills, professionalism, practice based learning, and systems-based practice - form a framework for our programs. Simulation training features prominently in the cognitive and procedural aspects of anesthesia education.

In 2009-2010, our training program enrolled 61 resident physicians, 14 clinical fellows and two research fellows. Our anesthesiology clerkships introduce medical students to anesthesiology and critical care, as well as provide valuable critical skills training. Residents and fellows benefit from comprehensive training in all subspecialty disciplines of clinical anesthesiology, critical care, and pain management. Our residency training program includes the following experiences:

- Perioperative Patient Management
- Regional Anesthesia & Acute Pain Management
- Critical Care
- Comprehensive experiences in anesthesiology subspecialties including:
  - Anesthesia for General Surgery
  - Anesthesia for Orthopedic Surgery
  - Anesthesia for Urologic Surgery
  - Anesthesia for Gynecological Surgery
  - Anesthesia for Plastic & Burn Surgery
  - Anesthesia for Endocrine

## Surgery

- Anesthesia for ENT & Ophthalmologic Surgery
- Transplantation Anesthesia

Vanderbilt Anesthesiology also offers additional resident and fellowship training in the following subspecialties:

- Cardiac Anesthesiology
- Vascular/Thoracic Anesthesiology
- Critical Care Management
- Pediatric Anesthesiology
- Pediatric Cardiac Anesthesiology
- Regional Anesthesia and Acute Pain Management
- Chronic Pain Management
- Ambulatory Anesthesiology
- Obstetric Anesthesiology
- Neuroanesthesia
- Anesthesia Informatics

Vanderbilt University School of Medicine offers a spectrum of research training programs for residents, fellows, and junior faculty. A wide range of continuing medical education (CME) programs are offered for faculty and community physicians. All faculty of the department are actively engaged in clinical and academic training programs.

In 2009, the Office of Educational Affairs was consolidated into one suite at 2301 VUH. The move also allowed the offices of the program director, associate program directors, chief residents and administrative staff to be housed in the same suite. The central location makes the office's services more accessible. The renovated office suite includes an expanded resident library and the establishment of the Resident Scholarship Center where residents have a reserved space for their work. The Office of Educational Affairs is led by Dr. John Algren and a team of Associate Directors.

*Residency class of 2010: Front, left to right: Dan Lonergan, MD; Liz Lee, MD; Associate Program Director Jane Easdown, MD; Residency Program Director John Algren, MD; Chairman Warren Sandberg, MD; Sheena Howson, MD; Tracy McGrane, MD; Brian Allen, MD. Back, left to right: David Todd, MD; Scott Johnstone, MD; Patrick Henson, DO; Will Costello, MD; Marc Hayes, MD; Kristalynne Godwin, MD; Jason Lane, MD. Not pictured: Associate Program Director Michael Pilla, MD; Nancy Dubuisson, MD; Justin Wilson, MD.*



# Educational Courses and Conferences

The Vanderbilt Anesthesiology Department provides a full calendar of educational opportunities for anesthesiologists and other medical professionals. Our medical education offerings include:

## For Medical Students:

**Critical Care Skills Week:** weeklong workshop conducted quarterly for third-year medical students to prepare them to recognize and manage critical problems encountered in clinical practice. This training includes hands-on education using simulation skill stations at Vanderbilt Medical School's Center for Experiential Learning and Assessment (CELA). Critical Care Skills Week also includes lectures by departmental faculty.

**Medical Student Conferences:** daily discussions lead by faculty members on selected topics for third- and fourth-year medical students assigned to anesthesiology clerkships.

## For Interns:

**Boot Camp:** workshops held during orientation, as well as periodically throughout the year, focusing on developing specialized skill sets essential to anesthesia and perioperative care.

**Intern Conferences:** Introduction to Anesthesia Seminars, Matrix Seminars, practice-improvement discussions, organized using the Healthcare Matrix, and Basics of Anesthesia lectures.

## For Residents:

**Fundamentals of Anesthesia:** daily conferences for CA-1 residents on fundamental concepts and principles of anesthesiology.

**Subspecialty Conferences:** conferences coordinated by individual divisions of the department, including Pediatric, Obstetric, Cardiothoracic, Critical Care and Multispecialty Anesthesia.

**Senior Seminars:** seminar series for senior residents focused on problem-based learning and preparation for Oral Exams.

**Professional Development Conferences:** resident conferences focused on elements of subspecialty selection, career paths, and business practices related to perioperative anesthesia.

**Resident Practice Assessment & Improvement:** monthly conferences focused on developing an understanding and application of quality improvement processes to group, as well as individual, clinical anesthesia practice.

## For All:

**Journal Clubs:** informal meetings in which current medical articles pertaining to the specialty are summarized and reviewed. Journal Clubs are held by specific divisions of the department, including Multispecialty, Pediatric, Cardiothoracic, Critical Care and Pain Medicine.



*Trainees at all levels receive instruction through simulation workshops.*

**Academic Development Conferences:** for fellows, residents and faculty on topics related to educational theory and practical aspects of classroom and clinical teaching, mentorship, etc.

**Grand Rounds:** formal lectures held on Friday mornings featuring recognized experts in the field of anesthesiology, perioperative medicine or pain medicine.

**Mortality & Morbidity Conferences:** monthly conferences focused on case studies with the goal of improving future patient care. Each quarter, Perioperative M&M Conferences also include surgical specialties and nursing services to better facilitate the exploration of cases and the exchange of ideas.

## Special Courses & Workshops

**Fundamentals of Critical Care Support (FCCS):** a multidisciplinary, two-day comprehensive course addressing fundamental management principles for the first 24 hours of critical care. This course is held at CELA and sponsored by the Society of Critical Care Medicine. The course is directed by members of the Anesthesiology Department's Critical Care Division and includes instructors from multiple specialties at Vanderbilt University Medical School.

**Regional Anesthesia Workshops:** taught by faculty members with particular expertise in regional anesthesia, these lectures and demonstrations teach regional anesthetic techniques, with an emphasis on ambulatory surgical procedures. In addition to neuraxial anesthetics, attendees gain proficiency in peripheral nerve block techniques, such as brachial plexus, interscalene, ankle, and popliteal blocks.

**Pediatric and Adult Airway Workshops:** taught as weekend CME courses at the Center for Experiential Learning and Assessment (CELA). Partial task airway trainers are provided, as well as full-scale simulations of difficult airway management situations.

**Transesophageal Echocardiogram Workshops:** feature individualized and group instruction using cardiac and TEE simulation tools and intraoperative recordings to improve the understanding of real-time monitoring of cardiac function.

# Simulation Education Provides Invaluable Lessons

Vanderbilt University School of Medicine has a remarkable on-campus resource for training medical professionals, the Center for Experiential Learning and Assessment (CELA), and our Anesthesiology Department faculty are national leaders in providing training at the facility in anesthesiology airway management, critical care, perioperative management and transesophageal echocardiogram procedures.

CELA, which opened in 2007, is a \$6 million, 11,000-square-foot facility that is home to both the Program in Human Simulation and the Simulation Technologies Program. The center offers advanced simulation technologies, including computerized mannequins that can reproduce routine and critical clinical situations. One floor of the facility includes flexible space that triples as a six-bed ED, a four-bed ICU, or a pair of operating rooms — all monitored and actuated by computer-controlled audio/video equipment.

In May 2009, the Vanderbilt Simulation Technologies Program, under the direction of Matthew B. Weinger, MD, was endorsed by the American Society of Anesthesiologists (ASA) as one of fewer than 20 centers in the nation officially approved to deliver certified educational programs. Anesthesiologists from Vanderbilt and the surrounding community can receive Continuing Medical Education (CME) simulation training that qualifies for American Board of Anesthesiology Maintenance of

Certification in Anesthesiology (MOCA) credit. To achieve the ASA endorsement, the CELA program met strict criteria, including having strong leadership, and the necessary equipment, facilities, and personnel to provide consistent, effective training.

CELA is also the host facility for Teamwork Day, a program in which first-year medical students have their teamwork skills and quick thinking put to the test during a full day of demanding, simulated exercises. The simulations are part of the two-week “Foundations of the Profession” course added to the curriculum for first-year medical students in 2007. The Foundations Course prepares students for their entry into the medical profession by introducing them to core skills in a concentrated time frame. During the CELA exercises, more than 100 students interact with “standardized patients,” individuals paid to rehearse their scripts and create difficult situations for the students. Following each exercise, students are debriefed about their actions and given feedback by many of the School of Medicine’s top anesthesiology and surgical faculty who serve as facilitators during the event.

“Our Medical School curriculum has been greatly enhanced by the addition of CELA, and this day is a perfect example,” says Weinger. “We can create simulated, real-world scenarios in a protected environment, debrief the students immediately afterward, and have them walk away with invaluable lessons.”



*At Vanderbilt’s Center for Experiential Learning and Assessment (CELA), computerized mannequins, including the obstetric and infant mannequins shown here, are used to reproduce routine and critical care clinical situations.*

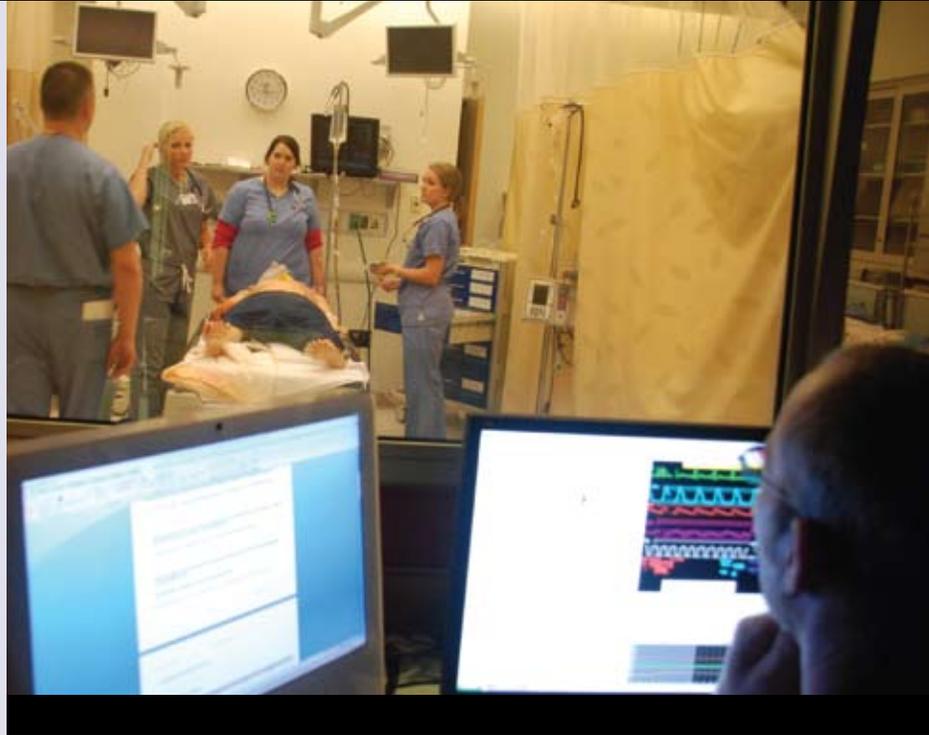
# Department Excels in Critical Care Training

Multidisciplinary critical care skills training at Vanderbilt is supported by the faculty of the Critical Care Anesthesiology Division, teaching medical students proper procedures and techniques early in the educational process, as well as communicating standardized care to physicians and medical staff across specialties and levels of training, with the end goal of greatly improving patient care. That dedication is paying off. Vanderbilt's critical care training offerings have grown dramatically over the past 10 years, and our institution is now recognized nationally as a leader in this specialized training. The availability of the simulation training at the Center for Experiential Learning and Assessment (CELA), as well as increased faculty time dedicated to leading this training, have been a crucial factor in this growth.

In 2008, Vanderbilt University School of Medicine offered its first year of multidisciplinary clinical orientation for surgery and anesthesia interns to teach basic skills that all interns would ideally possess when they "hit the wards." In July 2009, the session extended to medicine interns and incorporated institutional efforts to standardize approaches to procedures such as vascular access, airway management and patient hand-offs. In 2010, the sessions will include Emergency Medicine Interns as well as the Pediatric Medicine Interns in a two-day "Boot Camp" led by Critical Care anesthesiologists in collaboration with the Division of Trauma and Surgical Critical Care, and the Division of Allergy, Pulmonary and Critical Care Medicine, emphasizing best-practices and standardized care to improve patient safety. The program was spearheaded by Arna Banerjee, MD, Assistant Professor of Anesthesiology and Residency Simulation Director and then General Surgery Chief Resident Kyla Terhune, MD.

"Hopefully, now that we're teaching everyone the correct way, and they're doing it the same way, we're going to see an improvement in outcome," said Banerjee. "We teach them how a code should be run, how important teamwork and communication are, and how to do a patient handover using SBAR (Situation, Background, Assessment, Recommendation). When you catch medical students early enough, when they haven't even started their internships, they're going to remember these things. We want them to start thinking and talking in the same language."

Boot Camp joins a long list of critical care training offered by our faculty. In 2005, Vanderbilt Critical Care anesthesiologists began teaching Fundamental Critical Care Support (FCCS), a two-day national course developed by the Society of Critical Care Medicine (SCCM). These courses are increasingly popular, and in March 2009 the weekend workshop had 33 attendees, including physicians, respiratory therapists, pharmacists, registered nurses



*Simulation training at Vanderbilt's Center for Experiential Learning and Assessment (CELA) features hands-on instruction in fully-monitored OR settings.*

and nurse practitioners from across the US. Because of internal demand, the course was spread over a month so that any medical student or resident rotating through a Vanderbilt ICU can receive their FCCS certification.

Critical Care Skills Week, originally developed in 2007, is now offered quarterly to third-year medical students. The program covers pre-operative assessments, airway management, acute pain management, basics of EKG, invasive monitoring, management of respiratory failure, myocardial infarction, shock, anesthesia monitoring, trauma/burn fluid management, electrolyte/acid-base disorders, ventilators, ethical topics in critical care and other topics. Participants are also exposed to patients during their training. Paired with a resident or physician on an actual case, participants follow a patient from pre-operative assessment to post-anesthetic care or Critical Care, contributing their newly acquired skills to patient care, when appropriate. In 2009, the FCCS curriculum was incorporated into the course so that upon successful completion of the program, third-year medical students receive FCCS certification.

"This is fairly unique at medical schools," said Banerjee. "Last year when I was presenting this course at ASA, a program director at another medical school said, 'I lost my top two candidates on my rank order list to Vanderbilt because they wanted to be at Vanderbilt because of this course.' They talked about the class during their interview with her. That says we're doing something right."

# VIA Responds to Greatest Need

Vanderbilt has a long tradition of international outreach, and under the auspices of Vanderbilt International Anesthesia (VIA), our department sends clinicians and trainees all over the world, not merely to provide service, but more importantly to teach local clinicians to provide safe, effective anesthesia care. While our outreach crosses many borders, two of the most compelling stories of our faculty's international outreach in 2009-2010 were in Kenya and Haiti.

When the earth shook and crumbled Haiti in January 2010, Dr. Jane Easdown, Associate Professor of Anesthesiology, already had her bags packed for a planned trip to provide primary care to northern Haiti. As that trip was cancelled, she quickly volunteered to travel to Haiti with a group from Operation Smile to provide post-earthquake medical aid to victims. With five tons of medical supplies, five surgeons, three anesthesiologists, and 10 nurses in a donated plane, the mission headed out. Once in Haiti, they went to work at Fond Parisien, one hour from Port-au-Prince at the "Love a Child" orphanage and school. Most of the earthquake victims had upper or lower-limb injuries, including amputations or external fixation devices hastily placed in whatever health facilities were in operation after the quake. Many had unsuspected fractures and injuries. Almost all had serious wound infections. Two operating rooms were quickly assembled, and 10 days of surgical procedures began with the primary goal of saving limbs.

"What I will remember most is the huge smile we would see when they awoke to see a limb with a clean dressing — no amputation," said Dr. Easdown following her return. "All of us that were able to help in Haiti have been humbled by the experience. Despite the loss of their homes, communities, family and friends, these Haitians were just getting on with it. Each morning you could see them helping each other with dressing and washing since many could not walk. When entering a tent, we were always greeted with smiles, never a complaint of pain or distress.

"Those of us who have worked in Haiti and care deeply for its future hope that this catastrophe will focus a lasting international energy on Haiti that will overcome the overwhelming obstacles it faces in the future, especially in Port-au-Prince. Every part of Haiti will be affected by the events of this quake so I am hopeful that we can evolve our VIA activities in Haiti."

It wasn't an earthquake, but an unrelenting conviction to teach new skills and deliver new technology that drove Dr. Randall Malchow, Associate Professor of Clinical Anesthesiology, to volunteer his services to VIA efforts in Kijabe, Kenya. Vanderbilt's program in Kenya is led by Vanderbilt Pediatric Anesthesiologist and VIA Director Dr. Mark Newton who, along with his family, have lived and worked for several years at Kijabe Hospital. Located in the highlands of Kenya on the edge of the Great Rift Valley, Kijabe Hospital is one of the few tertiary care centers in

the country. Dr. Newton returns there for several months each year, serving as the first member of the department to work as a physician overseas in a long-term capacity.

Malchow, who has passion for regional anesthesia, felt the modality could benefit patients in Kijabe where general anesthesia is riskier, in part due to poor anesthesia machines and monitors. Dr. Malchow established a Regional and Acute Pain Initiative for Kijabe, and he began a fundraising drive to purchase a mobile, high-resolution ultrasound machine. Just months after he began, Malchow went to Kenya in July 2010 with the machine in hand. More than \$14,000 had been donated by faculty members, friends and family for the effort.

The ultrasound machine, a Sonosite NanoMaxx, was immediately put to use. Previously, Kijabe had only a small, poorly functioning machine, so the new machine significantly expanded their ability to diagnose and treat patients. Sonosite also donated a mounting arm for stability, and other corporations donated to the effort, including B. Braun which provided 500 stimulating needles and Americares/Hospira which donated 200 vials of Bupivacaine. More than 200 endotracheal tubes and stylets from Vanderbilt University Medical Center also were delivered to the hospital. The eight Kenyan staff anesthesiologists and 11 student anesthesiologists were eager to learn a new anesthesia modality as Malchow trained them on how to use the new machine, which was left behind as a donation. Time will tell if regional anesthesia can become an effective alternative or supplement to general anesthesia in Kenya, or at least decrease the pain and suffering there.

Participation in VIA is open to residents, CRNAs and attending anesthesiologists. Residents can rotate for a month of training in anesthesiology under austere conditions, and 5-6 residents a year have been taking part in this educational experience through VIA. Other participants donate academic and vacation time to participate. The program is supported entirely by philanthropy.

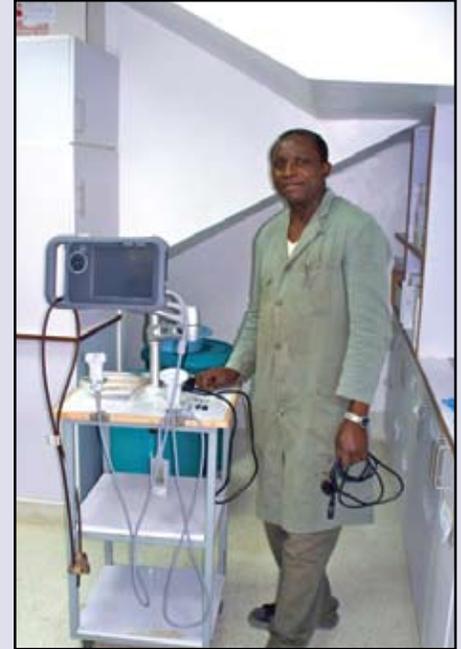


*A reassuring hand provides comfort to a Haitian earthquake victim.*



*Dr. Jane Easdown boards her plane to Haiti to provide medical aid following the massive earthquake in late January 2010.*

*Through donations to the VIA program, a new ultrasound machine was delivered to Kijabe, Kenya, and was immediately put to use.*



*Teams of volunteer medical professionals, including Dr. Jane Easdown, provided urgent care to those injured by the earthquake in Haiti.*



*Anesthesia students in Kenya benefit from training through VIA.*



*Tent cities sprang up overnight in rural Haiti, housing both volunteers and those displaced by the earthquake.*



*Medical staff at Kijabe Hospital in Kenya learn how to use the new ultrasound machine to perform a leg block.*

# Research Overview

Major translational research initiatives at Vanderbilt are moving discoveries from the bench to the bedside, and our scientists are working to transform both health care and health care delivery. In federal fiscal year 2009, the Vanderbilt University School of Medicine ranked 10<sup>th</sup> among U.S. medical schools for National Institutes of Health (NIH) funding, and VUSM funding from all sources has doubled since 2001. In academic year 2009, faculty across all disciplines received more than \$423 million in external funding for research. The Vanderbilt Department of Anesthesiology is a key contributor to the institution's standing as it is consistently ranked one of the top 10 extramurally funded research programs in the nation. The Anesthesiology Department is ranked 8th in the nation in NIH funding, with more than \$3.6 million in awarded grants in federal fiscal year 2009.

The department is unique in our field for having a multifaceted approach to research:

- We have a strong basic molecular research division focusing on ion channel physiology and pain mechanisms.
- The Department has a Perioperative Clinical Research Institute which provides all services needed for successful clinical research.
- We field best-in-class anesthesia and perioperative information systems, with complete control of application development and a dedicated team of analysts devoted to making electronic data widely available to investigators and quality improvement teams.
- The department has several statisticians with expertise in experimental design and complex analyses of large datasets on its faculty.
- The Center for Perioperative Research in Quality (CPRQ) serves as an institution-wide resource for human factors and systems design and improvement in healthcare.

As a result of the many excellent research support services, as well as new grants and award programs at Vanderbilt, the department has tripled the number of ongoing investigator-initiated research projects over the past three years.

In addition to providing a solid research infrastructure, the Department of Anesthesiology places a strong emphasis on faculty and fellow career development in academic anesthesiology. Active mentoring programs pair young investigators with experienced scientists in both basic and clinical research. For example, the department's B.H. Robbins Scholars Program provides a mentored research experience that culminates in a two-year clinical fellowship experience. Scholars may request to participate in clinical or basic science fellowship training or pursue additional formal education (e.g., Masters of Science in Clinical Investigation, Master of Public Health, or other degree programs) offered at Vanderbilt during the latter part of the program.

## Basic Science Research

The Vanderbilt Anesthesiology Basic Molecular Research program was established to build bridges between clinical and basic sciences. Anesthesiologists and intensivists are confronted with a vast array of patient disease during the process of surgical and intensive care. Modern anesthesiology and critical care medicine depends upon translational knowledge derived at the interface between patient care and the basic research laboratory.

Basic scientists in the department have extensive expertise in electrophysiology, digital microscopy, molecular biology, neurophysiology, genetics and cellular-, organ system-, and integrative physiology. Our scientists are well-funded by the National Institutes of Health, American Heart Association, and other extramural sources. The philosophy of the Department's basic research program is to define fundamental aspects of physiology at the molecular and cellular level, and where appropriate, to ensure that this knowledge is translated into improved patient care.

Basic research activities in the department focus broadly on cell membrane physiology, neuroscience and cardiovascular physiology. Current research efforts include drug discovery for ion channels; structure/function analysis of voltage-gated Cl<sup>-</sup>, Na<sup>+</sup> and K<sup>+</sup> channels; molecular physiology of cation-coupled chloride cotransporters and their role in GABAergic neurotransmission; and physiological and molecular characterization of neurosecretion and its regulation by G proteins and Ca<sup>2+</sup>. Eric Delpire, PhD, Professor of Anesthesiology & Molecular Physiology & Biophysics, was named the department's Director of Basic Science Research in 2010. Delpire has been a member of the Vanderbilt University Medical School faculty since 1997.

## Perioperative Clinical Research Institute (PCRI)

The Perioperative Clinical Research Institute provides a full range of services necessary for successful clinical research. These services include regulatory management, data management, contracts management, biostatistics, bioinformatics, and financial oversight.

Improving healthcare through clinical research and education is our primary goal. Our research includes both industry-sponsored and investigator-initiated clinical projects and focuses on the advancement of medical practice in the fields of perioperative care, chronic pain and medical devices. Our investigators are practicing physicians who use their clinical expertise to develop research protocols that seek to answer clinically significant questions.

Current studies focus on a wide variety of clinical issues including the use of wireless vital sign monitors for early detection of adverse events on post-surgical floors, the effects of anesthesia on the developing brain of a child, post-operative pain, nausea, vomiting, inflammation, obstructive sleep apnea and delirium. Newer projects include:

- testing the utility and accuracy of software designed to automate gathering of patient medication lists and development of medical problem lists over the web

- participation in the POISE-2 trial
- founding membership in the Multicenter Perioperative Outcomes Group (MPOG), a large registry of anesthetic cases contributed, along with functional data definitions, by hospitals with electronic anesthesia information management systems, all with the goal of facilitating large data-set research in anesthesia outcomes

The PCRI is overseeing more than 40 active clinical trials, with many more studies now in the process of approval.

PCRI is directed by Dr. James Berry and Clinical Trials Manager Damon Michaels. The team consists of highly trained and broadly experienced research professionals, including three research nurse specialists, two research assistants and one clinical trials associate.

### **Vanderbilt Anesthesiology Clinical Research Advisory Committee (VACRAC)**

The Vanderbilt Anesthesiology Clinical Research Advisory Committee (VACRAC) was formed in 2009 to promote clinical research within the Department of Anesthesiology. The committee supports new investigators in developing clinical research projects that will lead to publication and, if possible, extramural funding. The committee also oversees the development and conduct of industry sponsored and investigator-initiated research by developing and managing essential research support services and programs.

The committee mentors potential investigators throughout the research development process and creates opportunities for ongoing learning about research methods, proposal writing, IRB applications, data management and analysis, and presentation/publication skills. The committee also reviews new research proposals and regularly audits ongoing investigations for effectiveness and compliance with regulatory and safety guidelines. Committee members are James Berry (chair), Jonathan Schildcrout (co-chair), Pratik Pandharipande, Paul St Jacques, Brian Donahue, Curtis Baysinger, Jason Lane, Dan France, and Damon Michaels.

### **Center for Perioperative Research in Quality (CPRQ)**

Founded in 2005 and directed by Dr. Matthew Weinger, the Center for Perioperative Research in Quality (CPRQ) is located within the Department of Anesthesiology. Because of increasing scope and impact outside the operating room and across multiple healthcare domains, CPRQ now serves as an institution-wide resource for human factors and systems design and improvement in healthcare.

The Center, which is part of Vanderbilt's Institute for Medicine and Public Health (IMPH), lead by Dr. Robert Dittus, serves two primary functions:

- 1) Basic and applied research with the goal of improving patient safety and clinical quality
- 2) Design and evaluation of informatics user interfaces, care processes, and medical technology across Vanderbilt University Medical Center

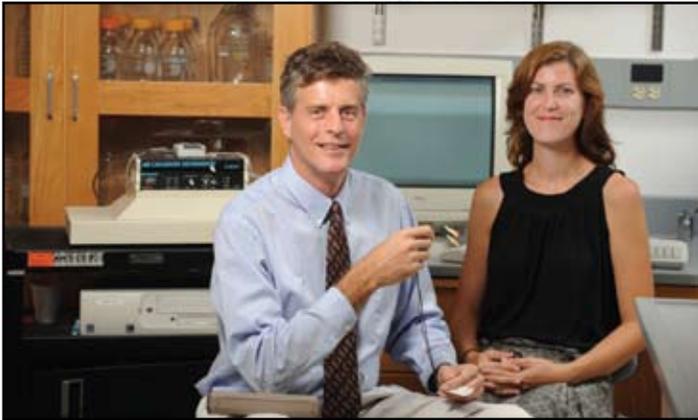
Using a range of human factors engineering, cognitive psychology, and biomedical informatics techniques, CPRQ studies clinical performance during patient care and in realistic simulations to better understand how and why care deviates from optimal. Interventions are then designed and evaluated to improve safety and quality. CPRQ is actively involved in improving the user interfaces of Vanderbilt's custom clinical information systems as well as in evaluating and redesigning patient safety and quality care processes and tools.

Of particular interest to CPRQ faculty are the effects of the introduction of new medical technology on clinical care processes. Specific studies examine human-technology interactions, as well as individual and group performance-shaping factors such as fatigue, workload, divided attention, and novel methods of information presentation. In addition to generating practical benefits in terms of improved clinical care processes, the Center's research addresses fundamental questions about the nature of expertise, interpersonal communication, situation awareness, and decision-making under stress.

*Our basic science research labs are pursuing grant-supported investigations to ultimately improve patient care.*

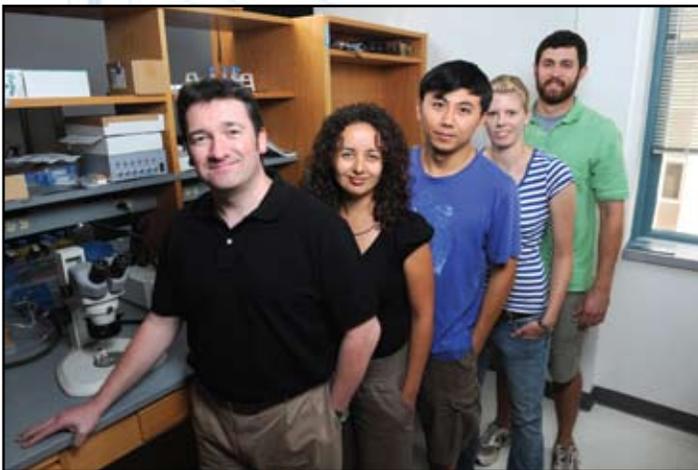


# Basic Science Research Highlights



## Stephen Bruehl Laboratory

The work in Dr. Bruehl's lab is focused on the general topic of pain. One current project is evaluating chronic pain-related dysfunction in natural pain inhibitory systems, and how this dysfunction affects normal interactions between the cardiovascular and pain regulatory systems. This work addresses possible contributors to chronic pain, and also seeks to better understand the causes of increased hypertension risk in chronic pain sufferers. Other current projects are examining the impact of anger expression on both acute and chronic pain, and the role of morphine-like substances produced by the body (endogenous opioids) in these relationships between emotional regulation and pain. A third area of research is the genetics of pain, including genetic variations in opioid receptors that can alter the pain-related effects of both endogenous opioids and opioid pain medications. Finally, we have begun exploring mechanisms underlying chronic pain that develops following total knee arthroplasty, in particular the condition known as Complex Regional Pain Syndrome. The goal of the research in Dr. Bruehl's lab is to better understand the psychophysiological factors contributing to chronic pain and its related health risks, and ultimately, to improve treatment of chronic pain.



## Kevin Currie Laboratory

Calcium is an important intracellular messenger that regulates cellular processes such as gene expression, enzyme activity,

muscle contraction, and neurotransmitter/hormone release. Voltage-gated calcium channels ( $\text{Ca}^{2+}$ -channels) are one of the main routes of calcium entry into neurons and other excitable cells, so they play pivotal roles in these many diverse biochemical and molecular events. The Currie lab investigates the properties and regulation of  $\text{Ca}^{2+}$ -channels, and the mechanisms that control neurotransmitter and hormone secretion (stimulus-secretion coupling). Under physiological conditions, changes in the efficacy of stimulus-secretion coupling are important in neuronal communication and contribute to synaptic plasticity. Conversely, disruption of stimulus-secretion coupling has been linked to several neurological disorders and can also have serious consequences in the endocrine system including impaired insulin release associated with diabetes. There are a number of projects in the lab that focus on different facets of  $\text{Ca}^{2+}$ -channels and stimulus-secretion coupling. The goal is to understand the regulation of  $\text{Ca}^{2+}$ -channels and transmitter release under physiological conditions, and identify potential therapeutic targets for treatment of nervous and endocrine system disorders in which these finely tuned processes are disrupted.



## Eric Delpire Laboratory

GABAergic neurotransmission depends upon the transmembrane  $\text{Cl}^-$  concentration gradient that exists at the synapse. The intracellular  $\text{Cl}^-$  concentration in CNS and PNS neurons is regulated, in part, by cation-chloride cotransport mechanisms such as  $\text{Na}^+\text{-K}^+\text{-2Cl}^-$  and  $\text{K}^+\text{-Cl}^-$  cotransporters. For example, the inward  $\text{Na}^+\text{-K}^+\text{-2Cl}^-$  cotransporter is highly expressed in immature CNS neurons, resulting in a high intracellular  $\text{Cl}^-$  concentration and GABA depolarizing or excitatory responses. In contrast, mature CNS neurons have low  $\text{Na}^+\text{-K}^+\text{-2Cl}^-$  cotransporter and high  $\text{K}^+\text{-Cl}^-$  cotransporter leading to low intracellular  $\text{Cl}^-$  and GABA hyperpolarizing or inhibitory responses. This laboratory is creating and studying genetically-modified mouse models of the cotransporters and of proteins that regulate them. The work involves molecular biology, physiology, electrophysiology and behavior. These studies have significance in pain perception, hyper-excitability and epilepsy, nerve conduction, peripheral neuropathy and paraplegia. This past year, the laboratory has

graduated one student in the neuroscience program, published nine research articles, two scientific reviews, nine meeting abstracts, a book, and four book chapters. The laboratory, with the support of the departments of Anesthesiology and Molecular Physiology & Biophysics, also hosted the first annual meeting of the Tennessee Physiological Society.



### **Jerod Denton Laboratory**

This lab's primary focus is on developing small-molecule probes for members of the inward rectifier family of potassium ( $K_{ir}$ ) channels, which play key physiological roles in cardiac, neuronal, endocrine and epithelial cell function. An emerging body of genetic evidence suggests that certain members of the  $K_{ir}$  channel family represent novel drug targets for hypertension, cardiac arrhythmias, secretory diarrhea and pain. However, it has not been possible to assess their therapeutic potential due to the lack of drug-like molecules capable of modulating the function of specific  $K_{ir}$  channels *in vivo*. Over the last three years, the Denton laboratory has worked closely with researchers in Vanderbilt's High-throughput Screening Center for GPCRs, Ion Channels and Transporters, and the Center for Accelerated Probe Development to deploy a National Institutes of Health-funded drug discovery campaign directed toward the founding member of the  $K_{ir}$  channel family and putative diuretic target  $K_{ir}1.1$ . From a primary screen of 225,000 small molecules, and secondary screens of a 300-member "focus library" of  $K_{ir}1.1$  channel antagonists, some of the first selective of  $K_{ir}1.1$ ,  $K_{ir}3.X$  and  $K_{ir}7.1$  channels have been discovered. Medicinal chemistry is being used to refine the potency and selectivity of these compounds. Recently, the investigators rationally designed a highly selective  $K_{ir}1.1$  channel inhibitor that will be used in animal studies to assess the therapeutic potential of  $K_{ir}1.1$  as a diuretic target. Molecular modeling, X-ray structure-guided mutagenesis and electrophysiology are being used to define the atomic features of small-molecule binding sites in  $K_{ir}$  channels. This work is expected to provide critically needed pharmacological tools with which to probe the structure, integrative physiology and therapeutic potential of clinically important inward rectifying potassium channels.



### **Sabina Kupersmidt Laboratory**

The Kupersmidt lab focuses on the complex and dynamic factors contributing to sudden cardiac death due to cardiac arrhythmias. One major research area is the re-polarizing cardiac potassium channels, including HERG ( $I_{Kr}$ ) and gene products that regulate HERG activity in the heart. HERG dysfunction leads to cardiac arrhythmias, including the congenital and acquired/drug induced Long QT Syndromes (LQTS). The lab is particularly focused on mechanisms whereby HERG C-terminal sequence variants impact the function of HERG in a chamber-specific manner and influence susceptibility for atrial fibrillation versus the acquired LQTS. An improved understanding of these processes will reveal whether HERG sequence variants may put AF patients at risk for therapeutic failure, or alternatively for drug toxicity (aLQTS), when undergoing therapy with  $I_{Kr}$  blockers. In collaboration with the NIH Molecular Library Screening Center Network, the Kupersmidt laboratory has completed a high-throughput chemical screen, testing > 300,000 compounds for the ability to diminish block of  $I_{Kr}$  by dofetilide using a fluorescent  $TI^+$  flux assay. The results of this screen are currently being evaluated. Another major contributor to arrhythmia generation under investigation in this lab is reactive oxygen species (ROS) that are a result of myocardial infarction and can lead to dysfunction/dysregulation of cardiac ion channels. The lab is testing whether oxidative stress occurring in cells surviving a myocardial infarct leads to alterations in sodium channel function as a direct consequence of Nav1.5-adduction by specific products of lipid peroxidation, called  $\gamma$ -Ketoaldehydes ( $\gamma$ KA). In this context, we are also investigating the effects of rising intracellular calcium observed during cardiac ischemia on sodium channel function. Our group is investigating whether two cytoplasmic domains of Nav1.5 act in concert as calcium sensors. These projects will impact the development of novel therapeutic options in arrhythmia treatment.

# BH Robbins Scholars Prove Program's Worth



*Benjamin Howard Robbins, MD*

Exposing young scholars to critical academic research skills, with the guidance of a knowledgeable mentor's hand, builds strong future investigators. This was the motive behind the development of the Benjamin Howard Robbins Scholars Program in 2007, named in honor of the Anesthesiology Department's first chairman, a renowned physician-scientist.

The program provides a

mentored research experience that culminates in a two-year multidisciplinary fellowship, with at least one year devoted to research. Robbins Scholars benefit from personalized mentorship and career development, research and educational support resources, protected research time, and a stipend during residency and fellowship.

There are several possible tracks for clinical specialization, and the opportunity to conduct mentored clinical, translational or basic research. Scholars can also be sponsored to participate in the Masters of Science in Clinical Investigation or Masters of Public Health degree programs at Vanderbilt. The BH Robbins Scholars program is co-directed by Jerod Denton, PhD, and Pratik Pandharipande, MD, and has 10 participating scholars. A major strength of the program is the scholars' close mentoring by one of the department's many experienced research scientists. Mentors and scholars meet regularly to discuss their project, develop public presentations and prepare publications based on their findings. It is a unique experience that sets Vanderbilt's anesthesia residency apart from others.

**During the 2009-10 academic year, several scholars realized the rewards of their diligence.**

**Stuart McGrane, MBChB, MD**, presented at the 2009 ASA Annual Meeting on his work titled "Procalcitonin and C - reactive Protein Levels at Admission as Predictors of Duration of Acute Brain Dysfunction in Critically Ill Patients." McGrane also published a commentary in *Future Neurology*, an editorial in *Critical Care* titled "Liberation and Animation for Ventilated ICU Patients: the ABCDE Bundle for the Back-end of Critical Care," and original research titled "Effect of Dexmedetomidine Versus Lorazepam on Outcome in Patients with Sepsis: A Priori-designed Analysis of the MENDS Randomized Controlled Trial" in *Critical Care*.

**Christopher Hughes, MD**, a BH Robbins Scholar since 2007, was awarded a two-year Foundation for Anesthesia Education and Research (FAER) Mentored Research Grant for his project, "The Role of Endothelial Dysfunction in Intensive Care Unit Delirium and Long-term Cognitive Impairment." Hughes also

*Chris Hughes, MD, a BH Robbins Scholar since 2007, has received a two-year FAER grant, co-authored original research in *Anesthesia & Analgesia*, and presented his research at national meetings.*



published original research, "Intraoperative Risk Factors for Acute Respiratory Distress Syndrome in Critically Ill Patients," with co-authors Liza Weavind, MD; Arna Banerjee, MD; Nate Mercaldo, Jonathan Schildcrout and Pratik Pandharipande, in *Anesthesia & Analgesia*. Hughes also presented at the 2009 ASA and AUA meetings.



*BH Robbins Scholar Daniel Lonergan, MD, received the AUA Resident Travel Award as a result of his research.*

**Daniel Lonergan, MD**, a BH Robbins Scholar since 2008, was the second author on a review titled "Small-Molecule Modulators of Inward Rectifier K<sup>+</sup> Channels: Recent Advances and Future Possibilities" published in *Future Medicinal Chemistry*. Co-authors of the review article were Research Fellow Gautam "Jay" Bhave, MD, Brian A Chauder, PhD (Department of Pharmacology); and Jerod S Denton, PhD, who is Lonergan's mentor. Lonergan also gave an oral presentation at the AUA meeting and won the Resident Travel Award. For his scholarly activities, Lonergan received the Vice Chairs' Scholarship Award for 2009-2010.

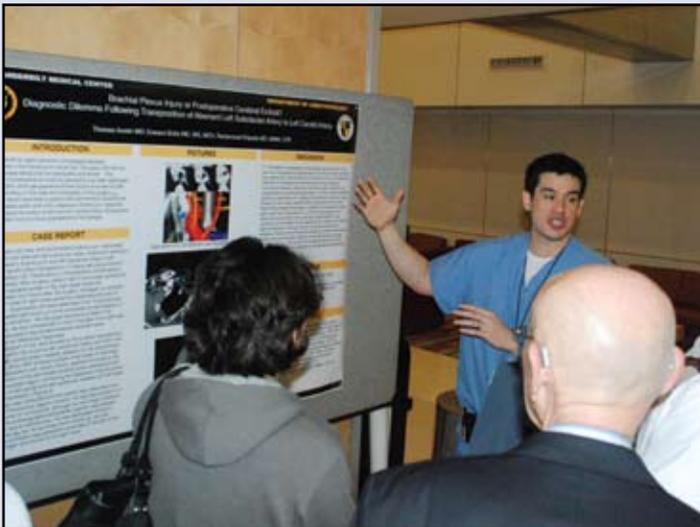
**Patrick Henson, DO**, recently published a review titled Complex Regional Pain Syndrome: State-of-the-Art Update in Current Treatment Options in *Cardiovascular Medicine* with his mentor Stephen Bruehl, PhD. Henson also received a CTSA grant for his project studying the fMRI findings in pain.

**David Todd, MD**, gave an oral presentation at the 2010 meeting of the American Society of Interventional Pain Physicians (ASIPP) on the mechanisms of action of gabapentin.



*BH Robbins Scholar David Todd, MD, at left, explains the findings of his research on the mechanisms of gabapentin (neurontin) action.*

**Heidi Smith MD, MSCI**, gave an oral presentation at the Society of Critical Care Medicine (SCCM) on the validation of the pCAM-ICU, a pediatric delirium monitoring instrument.



*BH Robbins Scholar Thomas Austin, MD, presents his research on the connection between KCC2 and pain.*

## Current BH Robbins Scholars

**Thomas Austin, MD**, is conducting research in the connection between KCC2 and pain. He is mentored by Eric Delpire, PhD.

**Christopher Hughes, MD**, is researching the role of endothelial dysfunction in intensive care unit delirium. He is mentored by Pratik Pandharipande, MD.

**Patrick Henson, DO**, is investigating fMRI findings in chronic pain. His mentor is Stephen Bruehl, PhD.

**Elizabeth Lee, MD**, is investigating how major medical interventions impact adolescents and pre-teens socially, cognitively and behaviorally. She is mentored by Jay Deshpande, MD and Ira Landsman, MD.

**Daniel Lonergan, MD**, is researching small-molecule modulators of inward rectifier K<sup>+</sup> channels. He is mentored by Jerod Denton, PhD.

**Amanda Lorinc, MD**, is conducting research in ERG channel pharmacology. She is mentored by Sabina Kupersmidt, PhD.

**Stuart McGrane, MBChB**, is researching the role of inflammation in delirium and development of out-of-OR airway programs and measuring outcomes. His mentors are Pratik Pandharipande, MD, and Michael Higgins, MD, MPH.

**Carrie Menser, MD**, will soon begin her BH Robbins Scholars project. Her academic interests are in the impact of the perioperative environment on children with autism spectrum disorders.

**Justin Sandall, DO**, is studying the effects of statins on perioperative morbidity and lung cancer mortality in the thoracic surgery population. He is mentored by Mias Pretorius, MD.

**Heidi Smith, MD**, is researching pediatric delirium in the critically ill and postoperative emergence delirium. She is mentored by Pratik Pandharipande, MD, MSCI and Wes Ely, MD, MPH.

**David Todd, MD**, is researching the mechanisms of gabapentin (neurontin) action. His mentor is Kevin Currie, PhD.

# Two Investigators Land FAER Grants

Exemplifying the department's pursuit and success in securing grant support for translational research, two Vanderbilt anesthesiologists received national, two-year grants from the Foundation for Anesthesia Education and Research (FAER) in 2010. Julian Bick, MD, an anesthesiologist in the Cardiothoracic Anesthesia Division received a \$100,000 Research in Education Grant focused on developing innovative techniques for educating anesthesiologists. Chris Hughes, MD, an anesthesiologist in the Critical Care Division and a BH Robbins Scholar, received a \$175,000 Mentored Research Training Grant (MRTG) focused on developing the skills and preliminary data physicians need to become competitive independent investigators.



*Julian Bick, MD, received a FAER Research in Education Grant to further the training of residents in transesophageal echocardiography (TEE).*

Dr. Bick created a comprehensive, two-year training program in perioperative transesophageal echocardiography (TEE), designed to run in tandem with anesthesiology residency. This program was developed through collaboration with the Anesthesiology Department at Duke University which also has a strong perioperative TEE program. The Vanderbilt Department of Anesthesiology recognizes the need for anesthesiologists proficient in basic perioperative transesophageal echocardiography (TEE). TEE is a valuable tool in the detection of blood clots, masses and tumors inside the heart, and can detect the severity of valve problems, congenital heart diseases, and tears (dissections) of the aorta. TEE is an integral part of Vanderbilt's Cardiothoracic Anesthesia practice, with TEE now being standard in all adult cardiac patients.

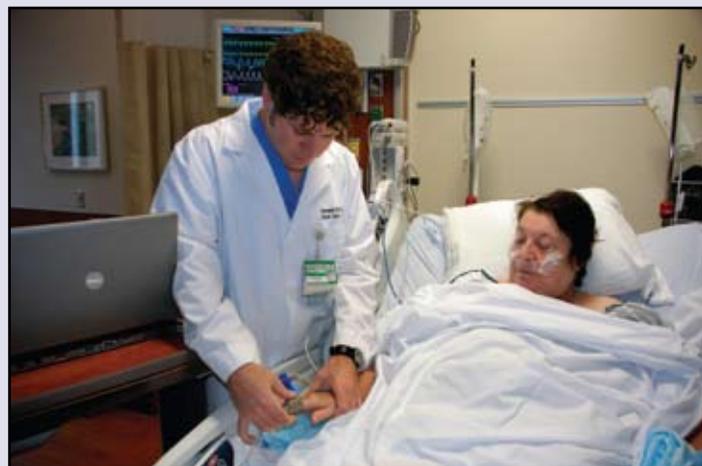
To better train anesthesiologists as echocardiographers, a TEE Heartworks simulator, which provides 3-D, computer-generated views of the heart as a probe is guided through a mannequin, was purchased by the Vanderbilt Department of Anesthesiology and is housed at Vanderbilt's Center for Experiential Learning & Assessment (CELA). Dr. Bick's research and the training of our residents in TEE will be conducted with the simulator as the centerpiece.

Dr. Bick's \$100,000 FAER grant will fund the basic TEE training program for two years. The proposed program is comprehensive,

complete with web-based didactics; an online question and answer forum; supervised clinical TEE training; supervised TEE simulator training; and independent TEE simulator training. The success of the pilot program will be evaluated, with hopes that the training model will serve as a platform for other anesthesiology programs.

Dr. Hughes received a two-year mentored research training grant for clinical research from the FAER for his research to clarify the role of endothelial dysfunction, as measured by peripheral artery tonometry and endothelial progenitor cell enumeration, in delirium and long-term cognitive impairment (LTCl) in critically ill patients. Delirium and LTCl are costly forms of brain organ dysfunction commonly seen in the critically ill, and a significant overlap exists between co-morbid states that promote endothelial dysfunction and those considered risk factors for delirium and LTCl. Endothelial function reflects the integrated effects of environmental and genetic risk factors, and endothelial dysfunction may be a final common pathway for various organ dysfunctions, including delirium and LTCl. Dr. Hughes' research will utilize validated state-of-the-art techniques to study endothelial function, delirium, cognitive impairment, and their interrelationships in critically ill patients. Subsequent investigations and interventions can then be designed to examine clinical outcomes after endothelial function modulation. The FAER grant provides \$175,000 over two years to support Dr. Hughes' research.

FAER provides early grant support and useful experience with the process of securing peer-reviewed extramural funding for gifted young academic anesthesiologists. Many members of the department, including the current Chair, are past FAER grant recipients. The Vanderbilt Department of Anesthesiology matches FAER's award by assuring that the recipient earns a competitive salary while 75% of their time is protected to pursue their project. FAER's support has fostered the academic aspirations of hundreds of anesthesiologists who are leading the development of the future of our specialty. FAER provides this support entirely through philanthropy.



*Chris Hughes, MD, received a FAER Mentored Research Training Grant to study endothelial function, delirium, and cognitive impairment in critically ill patients.*

# Clinical Research Studies

July 2005-April 2011: Data Repository for Quality Improvement Purposes; **PI: Jayant Deshpande, MD, MPH**

Jan. 2007-Present: A Series of National Surveys focusing on Anesthetic and Perioperative Care Given to Patients Undergoing Liver Transplantation; **PI: Ann Walia, MD**

Jan. 2007-Present: Comparison of Central Versus Peripheral Placement of Local Anesthetic Using the Infraclavicular Approach and Ultrasound Guidance; **PI: Clifford Bowens, MD**

March 2007-June 2010: Questionnaire Evaluating Burnout and Social Support Among Perioperative Service Providers; **PI: Steve Hyman, MD**

Nov. 2008 – Present: The Effect of Short-term Atorvastatin Use on Acute Kidney Injury Following Cardiac Surgery; **PI: Josh Billings, MD**

Dec. 2008 – Dec. 2010: Does Continuous Perioperative Dexmedetomidine Infusion Reduce Time to Discharge in Patients Undergoing Major Lumbar Fusion? A Double-Blind, Placebo-Controlled Study; **PI: James Blair, DO**

Dec. 2008- March 2011: A Multi-site RCT Comparing Regional and General Anesthesia for Effects on Neurodevelopmental Outcome and Apnea in Infants; **PI: Jay Deshpande, MD, MPH**

Feb. 2008-Present: A Validation of the NTX Wireless Patient Monitoring System in Combination With a Novel Computer Interface to Generate Medical Responses to Patient-specific Events; **PI: Daniel France, PhD**

March 2008 – Present: F2 Isoprostanes and Ischemic Kidney Injury During Liver Transplantation Surgery; **PI: Jeffrey Waldman, MD**

May 2008 – May 2011: Pediatric Anesthesia NeuroDevelopment Assessment Study (PANDAS); **PI: Jay Deshpande, MD, MPH**

Jan. 2009 – Jan. 2010: An Evaluation of Educational and Clinical Outcomes After Implementation of an Innovative Multidisciplinary Pain Management Fellowship; **PI: Tracy Jackson, MD**

Feb. 2009-March 2011: An Open-Label, Ascending, Two-Part, Single- and Multiple-Dose Evaluation of the Safety, Pharmacokinetics, and Effectiveness of Oxymorphone for Acute Postoperative Pain in Pediatric Subjects; **PI: Stephen Hays, MD**

June 2009- Present: A Survey of Facet Joint Interventional Techniques; **PI: Arun Kandra, MD**

June 2009-June 2011: Evaluation of Delirium in Pediatric Critically Ill Patients: Validation of the Intensive Care Unit (pCAM-ICU); **PI: Heidi Smith, MD, MSCI**

June 2009-June 2011: Pediatric Critical Illness: Implications for Long-Term Cognitive Dysfunction and PTSD; **PI: Heidi Smith, MD, MSCI**

June 2009-Dec. 2010: Multicenter Perioperative Outcomes Group (MPOG) Performance Site; **PI: Paul St. Jacques, MD**

July 2009-Present: Review of Perioperative Management and Outcome Following Transsphenoidal Hypophysyctomy at VUH; **PI: Letha Mathews, MD**

August 2009-Present: Racial and Ethnic Disparities in Perioperative Care; **PI: Paul St. Jacques, MD**

Aug. 2009-Sep. 2010: Trans-Abdominis Plane Block Efficacy for Post-Cesarean Section Pain: A Randomized Double-Blinded Case Control Trial; **PI: Sarah Starr, MD**

Sep. 2009-Nov. 2010: Epidural Hematomas and Abscesses: Incidence, Risk Factors, and Outcomes; **PI: Paul St. Jacques, MD**

Jan. 2010 – Jan. 2011: Improving Needle Visualization By Novice Residents During An In-Plane Ultrasound Nerve Block Simulation Using the CIVCO Inifiniti™ Needle Guide; **PI: Rajnish Gupta, MD**

Jan. 2010 – Jan. 2011: A Randomized Comparison of the Neuropen® Versus a Compact (3), Disposable Plastic Neurological Pinwheel for Assessing Loss of Touch Sensation and Level of Spinal Block at Cesarean Section; **PI: Tekuila Carter, MD**

Feb. 2010- Feb. 2011: Anesthesiology Resident Perspectives on Perioperative Mishaps; **PI: Michael Richardson, MD**

March 2010 – April 2011: Ischemic Kidney Injury During Liver Transplantation Surgery; **PI: Ann Walia, MD**

March 2010-Present: Duration of Analgesia from Peripheral Nerve Blockade is Prolonged with Dexamethasone: A Retrospective Database Analysis; **PI: Stephanie Rasmussen, MD**

April 2010 – April 2011: Pilot Implementation and Assessment of a Computerized Preanesthetic Assessment Tool; **PI: Warren Sandberg, MD**

May 2010 – May 2011: Perioperative Pulse Oximetry in Obstructive Sleep Apnea Patients in the Ambulatory Setting; **PI: Shannon Hersey, MD**

May 2010-June 2011: Comparative Effects of Vasopressin and Oxytocin on the Human Fetoplacental Circulation: A Study Using the In-vitro, Dual-perfused, Single-isolated Cotyledon, Human Placental Model; **PI: Curtis Baysinger, MD**

May 2010-June 2011: Incorporation of Basic Transesophageal Echocardiography Training into Anesthesiology Residency; **PI: Julian Bick, MD**

July 2010-Present: Peri-Anesthetic Imaging of Cognitive Decline (PAICOD) - A Prospective Pilot Study; **PI: James Blair, DO**

July 2010-Present: Anesthetic Management for Combined Thoracoscopic and Catheter Approaches for the Treatment of Atrial Fibrillation; **PI: Julian Bick, MD**

July 2010- Present: Post-Operative Tonsillectomy and/or Adenoidectomy Patient Outcome QI Project; **PI: Jayant Deshpande, MD, MPH**

July 2010- Present: Accuracy of Malignant Hyperthermia Diagnosis in Hospital Discharge Records; **PI: Jayant Deshpande, MD, MPH**

# Research Symposium Highlights Investigations

 On May 7, the Vanderbilt Department of Anesthesiology gathered for the Sixth Annual Anesthesiology Research Symposium, a day-long forum during which basic science investigators, physician-scientists, clinicians, research nurses and medical students conducting research within the department presented their findings.

The annual Benjamin Howard Robbins Lecture, held in conjunction with the symposium, was also presented that morning by noted research physician-scientist Jeanine Wiener-Kronish, MD, Anesthetist-in-Chief at the Department of Anesthesia and Critical Care at Massachusetts General Hospital. Dr. Wiener-Kronish's primary research involves aspects of pulmonary infections in intensive care patients, as well as in asthmatics and patients with cystic fibrosis. For her Vanderbilt lecture, she spoke on "Infection Versus Colonization in the ICU," an overview of her work on determining whether critically ill patients are truly infected with VAP and should be treated with broad-spectrum antibiotics or whether the patients are just colonized with bacteria.

Following Dr. Wiener-Kronish's lecture, poster sessions and oral presentations were held, representing the department's diverse research programs and the unique contributions that anesthesiology investigators make to science and medicine. At the conclusion of the oral presentations, annual research awards were presented. These awards publicly recognize exceptional research teams for work published in the prior year that demonstrates the potential to achieve the department's fundamental goal of transforming science and healthcare.

Two awards for published research, one in basic science investigation and the other in clinical/translational investigation, were established in honor of Charles Bernard Pittinger, MD, an accomplished anesthesiologist and pharmacology investigator who served as the second chair of Department from 1962 to 1968. The Charles Bernard Pittinger Prize for Excellence in Basic Clinical/Translational Research was awarded to Jason Slagle, PhD, and Matt Weinger, MD, for their publication, "Effects of Intraoperative Reading on Vigilance and Workload During Anesthesia Care in an Academic Medical Center," published in *Anesthesiology* in February 2009. The Charles Bernard Pittinger Prize for Excellence in Basic Science Research was awarded to Eric Delpire, PhD, for his publication, "Small-molecule Screen Identifies Inhibitors of the Neuronal K-Cl cotransporter KCC2," published in the *Proceedings of the National Academy of Sciences USA* in March 2009.

An essential aspect of any research program is the ability to effectively present the work of the team. At the Symposium, excellence in these skills was recognized through two awards, the Best Poster Presentation Award in Research and the Best Oral Presentation Award in Research. Arna Banerjee, MD, won the award for Best Poster Presentation for her poster, "Introducing Fundamentals of Critical Care Support (FCCS) into the Undergraduate Medical Curriculum – An Innovative Pilot Curriculum Program." Dan Lonergan, MD, won for the Best Oral Presentation Award in Research on the topic, "Targeted Discovery of a Novel Small Molecule Inhibitor of G Protein-coupled Inward Rectifier Potassium Channels."



Arna Banerjee, MD (at left)



Matt Weinger, MD (at left)



Dan Lonergan, MD (at left)



Eric Delpire, PhD (at left)

# Selected Publications, Academic Year 2009-2010

The Vanderbilt Department of Anesthesiology produced nearly 100 publications during AY 2009-2010. Selected publications are listed, with department authors denoted in bold.

## Books & Book Chapters

Alvarez-Leefmans FJ, **Delpire E**: Thermodynamics and kinetics of chloride transport in neurons: An outline. In: Alvarez-Leffmans, Delpire E, eds. *Physiology and Pathology of Chloride Transporters and Channels in the Nervous System: From Molecules to Diseases*. London: Elsevier;2009:81-108.

**Banerjee A, Pandharipande P**. Delirium. In: Rakel R, Bope E, Kellerman R, eds. *Conn's Current Therapy*. 62nd Edition. Saunders. 2010:1117-1120.

**Furman W**, Endocrine Emergencies In: Rosenblatt MA, Butterworth JF IV, Gross JB (eds). *ASA Refresher Courses in Anesthesiology*. Philadelphia: LW&W. 2009; 37:57-68.

Gamba G, Garbarini N, **Delpire E**: Regulation of cation-chloride cotransporters. In: Alvarez-Leffmans, Delpire E, eds. *Physiology and Pathology of Chloride Transporters and Channels in the Nervous System: From Molecules to Diseases*. London: Elsevier;2009:81-108.

Garbarini N, **Delpire E**: Knockout Models of cation-chloride cotransporters. In: Alvarez-Leffmans, Delpire E, eds. *Physiology and Pathology of Chloride Transporters and Channels in the Nervous System: From Molecules to Diseases*. London: Elsevier;2009:159-166.

Leacche M, Thompson A, Zhao D, **Riedel B**, Byrne J. A new horizon for coronary surgery: Hybrid coronary revascularization and routine intra-operative completion angiography. In: Hammond R, Alton, J, eds. *Coronary Artery Bypasses*, Nova Science Publishers, New York; 2009: 51-68.

**Pandharipande P**, Ely EW, eds. *Sedation and analgesia in the ICU: Pharmacology, protocolization, and clinical consequences, An issue of critical care clinics*. New York, NY: Elsevier; 2009.

Terhune K, **Weavind L, Pandharipande P**. In: Deutschman C, Neligan P, eds. How does one prevent, diagnose, and treat delirium in the intensive care unit? *Evidence-Based Practice of Critical Care*. NY: Elsevier 2010.

## Original Manuscripts

Agarwal V, O'Neill P, Cotton B, Pun B, Haney S, Thompson J, Kassebaum N, Shintani A, Guy J, Ely W, **Pandharipande P**. Prevalence and risk factors for development of delirium in burn intensive care unit patients. *Journal of Burn Care & Research*. 2010;31(5): 706-715. Epub June 2010.

Antevil JL, Karavas AN, Byrne JG, **Riedel BJ**, Petracek MR. Pulmonary artery catheter deviation on chest roentgenogram after cardiac operation: A sign of tamponade. *Annals of Thoracic Surgery*. 2010;89:281-283.

**Banerjee A, McGrane S, Pandharipande P**. Minimizing perioperative sedation to reduce delirium (Priority Paper Eval) *Future Neurology*. May 2010, 5(3):357-361.

**Baysinger CL**. Imaging during pregnancy. *Anesthesia and Analgesia*. 2010 Mar 1;110 (3):863-7. Review.

**Baysinger, CL**. Book Review: Chestnut's Obstetric Anesthesia: Principles and Practice. 4th edition. *International Journal of Obstetric Anesthesia*, June 2010.

Benyamin RM, **Datta S**, Falco FJ. A perfect storm in interventional pain management: regulated, but unbalanced. *Pain Physician* 2010 Mar; 13(2):109-16.

Body S, Collard C, Shernan S, Fox, A, Liu K, Ritchie M, Perry T, Muehlschlegel J, Aranki S, **Donahue B, Pretorius M**, et al. Variation in the 4q25 chromosomal locus predicts atrial fibrillation after coronary artery bypass graft surgery. *Circulation: Cardiovascular Genetics*. 2(5):499-506.

**Bowens C Jr, Gupta RK, O'Byrne WT, Schildcrout JS**, Shi Y, Hawkins JJ, **Michaels DR, Berry JM**. Selective local anesthetic placement using ultrasound guidance and neurostimulation for infraclavicular brachial plexus block. *Anesthesia & Analgesia*. 2010 May 1;110(5):1480-5.

Butterly A, Bittner E, George E, **Sandberg W**, Eikermann M, Schmidt, U. Postoperative residual curarisation from intermediate-acting neuromuscular blocking agents delays recovery room discharge. *British Journal of Anaesthesia*. 2010;105(3):304-309.

Candiotti K, Bergese S, Bokesch P, Feldman M, Wisemandle W, Bekker A, **Riedel B**, et al. Monitored anesthesia care with dexmedetomidine: a prospective, randomized, double-blind, multicenter trial. *Anesthesia and Analgesia*. 2010;110(1): 47-56. Epub August 2009.

Chatterjee S, **Eagle S**, Adler D, Byrne J. Incidental discovery of an ascending aortic thrombus: Should this patient undergo surgical intervention? *Journal of Thoracic Cardiovascular Surgery*. 2010 Jul;140(1):e14-6. Epub August 2009.

Cohen SP, Hayek SM, **Datta S**, et al. Incidence and root cause analysis of wrong-site pain management procedures: A multicenter study. *Anesthesiology*. 2010;112:711-18.

Cotton B, Dossett L, Au B, Nunez T, **Robertson A**, Young P. Room for (performance) improvement: provider-related factors associated with poor outcomes in massive transfusion. *Journal of Trauma*. 2009;67(5):1004-12.

**Datta S**, Benyamin RM, Manchikanti L. Evidence based practice of lumbar epidural injections. *Technology in Regional Anesthesia and Pain Medicine*. 2009;13(4):281-287.

**Datta S**, Chatterjee K, Kline R, Wiley R. Behavioral and anatomical characterization of the bilateral sciatic nerve constriction (bCCI) injury: correlation of anatomic changes and responses to cold stimuli. *Molecular Pain*. 2010;6:7.

**Eagle S, Thompson A, Fong P, Pretorius M, Deegan R, Hairr J, Riedel B**. Takotsubo cardiomyopathy and coronary vasospasm during orthotopic liver transplantation: separate entities or common mechanism? *Journal of Cardiothoracic Vascular Anesthesia*. 2010 Aug;24(4)629-32. Epub October 2009.

**Easdown L**, Pang L, Souter K. Report on the Society for Education in Anesthesia Spring Meeting 2009: Educating about safety: Educating safely. *Anesthesia & Analgesia*. Feb 2010 110: 647-649.

**Ehrenfeld J**, Seim A, Berger D, **Sandberg W**: Implementation of a direct-from-recovery-room discharge pathway: A process improvement effort. *Surgical Innovation* 2009;16(3):258-65. Epub July 2009.

**Ehrenfeld J**, Mulvoy W, **Sandberg W**. Performance Comparison of Right and Left-Sided Double Lumen Tubes Among Infrequent Users. *Journal of Cardiothoracic and Vascular Anesthesia* 2010;24 (4) 598-601.

**Ehrenfeld J**, Funk L, Van Schalkwyk J, Merry A, **Sandberg W**, Gawande, A. The Incidence of Hypoxemia During Surgery: Evidence from Two Institutions. *Canadian Journal of Anesthesia*. Epub July 2010.

Fong P, Stafforini DM, Brown NJ, MD, **Pretorius M**. Increased blood flow induces oxidative stress through an endothelium- and nitric oxide-independent mechanism. *Free Radical Biology and Medicine*. July 2010;49(2):301-305.

**France D, Throop P, Joers B, Allen L, Parekh A, Rickard D, Deshpande J**. Adapting to family-centered hospital design: Changes in providers' attitudes over a two-year period. *Health Environments Research and Design Journal*. Fall 2009.

**France D**, Greevy R, Liu X, Burgess H, Dittus R, **Weinger M**, Speroff T. Measuring and comparing safety climate in intensive care units. *Medical Care*. 2010; 48(3): 279-284.

Frenzel J, Kee S, Ensor J, **Riedel B**, Ruiz J. Ongoing provision of individual clinician performance data improves practice behavior. *Anesthesia and Analgesia*, 2010 Aug;111(2):515-9. Epub June 2010.

**Gagnon K, Delpire E**: Molecular determinants of hyperosmotically activated NKCC1-mediated K<sup>+</sup>/K<sup>+</sup> exchange. *The Journal of Physiology*. Epub June 2010.

**Gagnon K, Delpire E**. On the substrate recognition and negative regulation of SPAK, a kinase modulating Na<sup>+</sup>-K<sup>+</sup>-2Cl<sup>-</sup> cotransport activity. *American Journal of Physiology, Cell Physiology*. 2010;299(3):C614-C620.

Girard T, **Pandharipande P**, Carson S, Schmidt G, Wright P, Canonico A, Pun B, Thompson J, Shintani A, Meltzer H, Bernard G, Dittus R, Ely E; MIND Trial Investigators. Feasibility, efficacy, and safety of antipsychotics for intensive care unit delirium: the MIND randomized, placebo-controlled trial. *Critical Care Medicine*. 2010 Feb;38(2):428-37.

Girard T, Jackson J, **Pandharipande P**, Pun B, Thompson J, Shintani A, Gordon S, Canonico A, Dittus R, Bernard G, Wesley E. Delirium as a predictor of long-term cognitive impairment in survivors of critical illness. *Critical Care Medicine*. 2010; 38:1513-1520.

Hain P, Joers B, Rush M, Slayton J, Throop P, Hoagg S, Allen L, Grantham J, **Deshpande J**. An intervention to decrease patient identification band errors in a children's hospital. *British Medical Journal (online): Quality and Safety in Health Care* 2010; 19:244-247.

Han J, **France D**, Levin S, Jones I, Storrow A, Aronsky D: The effect of physician triage on emergency department length of stay. *Journal of Emergency Medicine*. 2009; 39(2):227-233.

Heir J, Gottumukkala V, Singh M, Yusuf S, **Riedel B**. Coronary stents and noncardiac surgery: Current clinical challenges and conundrums. *Preventative Cardiology*. 2010;13(1):8-13. Epub July 2009.

Hightower C, **Riedel B**, Feig B, et al. A pilot study evaluating predictors of postoperative outcomes after major abdominal surgery: physiological capacity compared with the ASA physical status classification system. *British Journal of Anesthesia*. 2010; 104: 465-471.

Hooper M, Martin J, **Weavind L**, et al. Automated surveillance of modified SIRS criteria is an effective tool for detection of sepsis in the medical intensive care unit. *American Journal of Respiratory and Critical Care Medicine*. 2010;181:A6137.

**Hughes C, Weavind L, Banerjee A, Mercaldo N, Schildcrout J, Pandharipande P**. Intraoperative risk factors for acute respiratory distress syndrome in critically ill patients. *Anesthesia & Analgesia*. 2010 Aug;111(2):464-7. Epub April 2010.

Levin R, Leacche M, Petracek M, **Deegan R, Eagle S, Thompson A, Pretorius M**, et al. Extending the use of the pacing pulmonary artery catheter for safe minimally invasive cardiac surgery. *Journal of Cardiothoracic and Vascular Anesthesia*. 2010 Aug;24(4):568-73. Epub March 2010.

Lewis L, **Bhave G**, Chauder BA, **Banerjee S**, Lornsen K, Redha R, Fallen K, Lindsley C, Weaver C, **Denton J**. High-throughput screening reveals a small-molecule inhibitor of the renal outer medullary potassium channel and Kir7.1. *Molecular Pharmacology*. 2009 Nov;76(5):1094-103. Epub August 2009.

Manchikanti L, Benyamin R, **Datta S**, et al. Opioids in chronic non-cancer pain. *Expert Review of Neurotherapeutics*. 2010;10(5):775-789.

Manchikanti L, **Datta S**, et al. A critical review of the American Pain Society Clinical Practice Guidelines for Interventional Techniques: Part 1: diagnostic interventions *Pain Physician* 2010; 13(3):E141-74.

Manchikanti L, Shah R, **Datta S**, Singh V. Critical evaluation of interventional pain management literature provides inaccurate conclusions. *Spine*. 2009;9(8):706-708.

Manchikanti L, Boswell M, Singh V, Derby R, Fellows B, Falco F, **Datta S**, Smith H, Hirsch J. Comprehensive review of neurophysiologic basis and diagnostic interventions in managing chronic spinal pain. *Pain Physician*. 2009 Jul-Aug;12(4):E71-120.

Manchikanti L, Singh V, **Datta S**, Cohen S, Hirsch J. Comprehensive review of epidemiology, scope, and impact of spinal pain. *Pain Physician*. 2009 Jul-Aug;12(4):E35-70.

Manchikanti L, Helm S, Singh V, Benyamin R, **Datta S**, et al. An algorithmic approach for clinical management of chronic spinal pain. *Pain Physician*. 2009 Jul-Aug;12(4):E225-264.

Manchikanti L, Boswell M, **Datta S**, Fellows B, Abdi S, Singh V, Benyamin R, Falco F, Helm S, Hayek S, Smith H. Comprehensive review of therapeutic interventions in managing chronic spinal pain. *Pain Physician*. 2009 Jul-Aug;12(4):E123-98.

Manchikanti L, Singh V, Cash K, Pampati V, **Datta S**. A comparative effectiveness evaluation of percutaneous adhesiolysis and epidural steroid injections in managing lumbar post surgery syndrome: a randomized, equivalence controlled trial. *Pain Physician*. 2009 Nov-Dec;12(6):E355-368.

Manchikanti L, Derby R, Wolfer L, Singh V, **Datta S**, Hirsch J. Evidence-based medicine, systematic reviews, and guidelines in interventional pain management: Part 7: systematic reviews and meta-analyses of diagnostic accuracy studies. *Pain Physician*. 2009 Nov-Dec;12(6):929-63.

Manchikanti L, **Datta S**, Smith H, Hirsch J. Evidence-based medicine, systematic reviews, and guidelines in interventional pain management: Part 6: systematic reviews and meta-analyses of observational studies. *Pain Physician*. 2009 Sep-Oct; 12(5):819-50.

Mathe J, Martin J, Miller P, Ledeczi A, **Weavind L**, Nadas A, **Miller A**, Maron D, Sztipanovits J: A Model-Integrated, Guideline-Driven, Clinical Decision-Support System. *IEEE Software*. 2009: 54-61.

Morath J, Hain P, **Deshpande J**, Gitlin J, Churchwell K, Patient safety as an academic discipline, *Journal of Pediatrics*. 2009; 115(3): 303-304.

**Newton M**, Bird P. Impact of parallel anesthesia and surgical provider training in sub-Saharan Africa: A model for a resource-poor setting. *World Journal of Surgery*. 2010;34(3):445-452.

- Niemann C, **Walia A**, **Waldman J**, Davio M, Roberts J, Hirose R, Feiner J. Acute kidney injury during liver transplantation as determined by neutrophil gelatinase-associated lipocalin. *Liver Transplantation*. 2009;15(12):1852–1860.
- Pandharipande P**, **Banerjee A**, **McGrane S**, Ely EW. Liberation and animation for ventilated ICU patients: the ABCDE bundle for the back-end of critical care. *Critical Care*. 2010;14(3):157. Epub May 2010.
- Pandharipande P**, Sanders R, Girard T, **McGrane S**, Thompson J, Shintani A, Herr L, Maze M, Ely EW; MENDS investigators. Effect of dexmedetomidine versus lorazepam on outcome in patients with sepsis: An *a priori*-designed analysis of the MENDS randomized controlled trial. *Critical Care*. 2010;14(2):R38. Epub March 2010.
- Pandharipande P**, Morandi A, Adams JR, Girard T, Thompson J, Shintani A, Ely EW. Plasma tryptophan and tyrosine levels are independent risk factors for delirium in critically ill patients. *Intensive Care Medicine*. 2009 Nov;35(11):1886-92. Epub July 2009.
- Pretorius M**, Brown NJ. Endogenous nitric oxide contributes to bradykinin-stimulated glucose uptake but attenuates vascular t-PA release. *Journal of Pharmacology and Experimental Therapeutics*. 2009;332(1):291-297.
- Reynolds P, Quinn D, **Easdown LJ**, **Lorinc A**, McNaughton C. Using the Healthcare Matrix with interns and medical students as a tool to effect change. *Southern Medical Journal*. 2009;102(8):816-822.
- Riedel B**, Schier R. Endothelial dysfunction in the perioperative setting. *Seminars in Cardiothoracic and Vascular Anesthesia*. 2010; 14:41-43.
- Riedel B**, Endothelial dysfunction in the perioperative setting. *South African Journal of Anaesthesiology and Analgesia*. 2010;16(1): 47-48.
- Riviello R, Ozgediz D, Hsia R, Azzie G, **Newton M**, Tarpley J. Role of collaborative academic partnerships in surgical training, education, and provision. *World Journal of Surgery*. 2010; 34(3):459-465.
- Ruiz J, Kee S, Frenzel J, Ensor J, Selvan M, **Riedel B**, Apfel C. The effect of an anatomically classified procedure on antiemetic administration in the post anesthesia care unit. *Anesthesia and Analgesia*. 2010;110:403-409.
- Robertson A**. Intraoperative management of liver transplantation in patients with hypertrophic cardiomyopathy: A review. *Transplantation Proceedings*. 2010 Jun;42(5):1721-3.
- Rothman B**. Mobile Devices - The Next Generation of Situational Awareness Technology in Perioperative Care. American Society of Anesthesiologists newsletter. April 2010; 74(4): 16-18.
- Sandberg E, Paul D, **Sandberg W**: A controlled study of the effects of patient information-elicitation style on clinician information-giving. *Communication & Medicine*. 2009; 6:73.
- Schier R, Guerra D, Aguilar J, Pratt G, Hernandez M, Boddu K, **Riedel B**: Epidural space identification: A meta-analysis of complications after air versus liquid as the medium for loss of resistance. *Anesthesia & Analgesia*. 2009; 109: 2012.
- Shapiro L, Alfille P, **Sandberg W**. Robots with a Social Memory. (2010) *Anesthesia & Analgesia* 111 (1) 19-20.
- Sierra R**, **Lee E**, **Pilla M**. Aberrant right subclavian artery occlusion from insertion of a TEE probe. *Journal of Cardiothoracic and Vascular Anesthesia*. Epub Feb 2010.
- Slagle J**, **Anders S**, Calderwood C, **Weinger M**: Significant Physiological Disturbances in Cases With and Without Non-Routine Events: An Analysis of Videotaped Anesthetics, Human Factors and Ergonomics Society, 2009, pp 674-678.
- Slagle J**, **Anders S**, Calderwood C, **Weinger M**. Significant physiological disturbances in cases with and without non-routine events: An analysis of videotaped anesthetics. *Human Factors and Ergonomics Society Annual Meeting Proceedings*. 2009; 53(11): 674-678.
- Smith H, Fuchs DC, **Pandharipande P**, Barr F, Ely EW. Delirium: An emerging frontier in the management of critically ill children. *Critical Care Clinics*. 2009 Jul;25(3):593-614.
- Spratt D, **Richardson M**. Locked-in: Listening to Save a Life. *Academic Medicine*. January 2010; 85:62.
- Stoelting R, **Weinger M**. Dangers of postoperative opioids – Is there a cure? *APSF Newsletter*. Summer 2009 (Reprinted in *Bulletin of the American College of Surgeons*. February 2010).
- Sun Y, Lin T, Tzeng S, **Delpire E**, Shen M. Deficiency of electroneutral K<sup>+</sup>-Cl<sup>-</sup> cotransporter 3 causes a disruption in impulse propagation along peripheral nerves. *Glia*. 2010; 58: 1544-52.
- Tejani N, Dresselhaus T, **Weinger M**. Development of a hand-held computer platform for real-time behavioral assessment of physicians and nurses. *Journal of Biomedical Informatics*. 2010;43(1): 75-80.
- Thomas E, Lucke J, Wueste L, **Weavind L**, Patel B. Association of telemedicine for remote monitoring of intensive care patients with mortality complications, and length of stay. *Journal of the American Medical Association*. 2009;302(24):2671-2678.
- Umakanthan R, Petracek M, Leacche M, Solenkova N, **Eagle S**, **Thompson A**, et al. Minimally invasive right lateral thoracotomy without aortic cross-clamping: an attractive alternative to repeat sternotomy for reoperative mitral valve surgery. *The Journal of Heart Valve Disease* 2010; 19:236-43.
- Unertl K, **Weinger M**, Johnson K, Lorenzi N. Describing and modeling workflow and information flow in chronic disease care. *Journal of the American Medical Informatics Association*. 2009;16(6):826-836.
- Weinger M**. The pharmacology of simulation: A conceptual framework to inform progress in simulation research. *Simulation in Healthcare*. 2010;5(1):8-15.
- Weinhouse G, Schwab R, Watson P, Patil N, Vaccaro B, **Pandharipande P**, Ely EW. Bench-to-bedside review: Delirium in ICU patients - importance of sleep deprivation. *Critical Care*. 2009;13(6):234.
- Welling P, Chang Y, **Delpire E**, and Wade J. Multigene kinase network, kidney transport and salt in essential hypertension. *Kidney International*. 2010;77(12): 1063-1069.
- Zhao D, Leacche M, Balaguer J, Boudoulas K, Damp J, Greelish J, Byrne J, Ahmad R, Ball S, Cleator J, **Deegan R**, **Eagle S**, Fong P, Fredi J, Hoff S, Jennings H 3rd, McPherson J, Piana R, **Pretorius M**, Robbins M, Slosky D, **Thompson A**. Routine intraoperative completion angiography after coronary artery bypass grafting and 1-stop hybrid revascularization results from a fully integrated hybrid catheterization laboratory/operating room. *Journal of American College of Cardiology*. 2009;53(3):232-241.

# Achieving Balance



*The Vanderbilt Department of Anesthesiology is a dynamic, proactive group when it comes to providing the very best in patient care, developing challenging, new educational programs and pushing forward in investigational research. But we also know how to take that same energy and have a good time.*



*We gather regularly for family-friendly events, including picnics to welcome new residents, fundraisers for our Vanderbilt International Anesthesia program, and after-work challenges at the local bowling alley to blow off some steam. Here are just a few images from our events during the academic year. To view images of past departmental events, visit [www.vandydreamteam.com/events](http://www.vandydreamteam.com/events) and select event titles.*





Vanderbilt Department of Anesthesiology  
1211 21st Avenue South  
Medical Arts Building #701  
Nashville, TN 37212

## *Training*



## *Education*



## *Technology*

