

## Protecting the Ulnar Nerve and Brain during Surgery *Current Investigations by Two Research Teams*

**A**s a sampling of research underway in this department, this report highlights two areas worthy of special mention among the many active grants with extra-departmental funding. (To review the range of departmental research supported by NIH, private agency, and industry funding, please see the list of research grants on our Web site at [www.wfubmc.edu/anesthesia](http://www.wfubmc.edu/anesthesia).)

### New Insight into Ulnar Nerve Injury

Perioperative nerve injury occurs most frequently to the ulnar nerve, which originates from the brachial plexus and extends the length of the arm to the hand. The ulnar nerve appears particularly susceptible to external pressure as it courses through the superficial condylar groove at the elbow, which renders it vulnerable to direct compression and ischemia. Ulnar nerve injuries account for 28% of all perioperative nerve injuries, and perioperative nerve injuries are involved in 16% of adverse events reported in the American Society of Anesthesiologists Closed Claims Database.

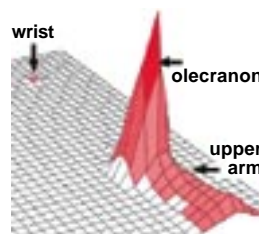
Numerous cases involving ulnar nerve injury have led to lawsuits. In courts, the doctrine of *res ipsa loquitur* (the thing speaks for itself) has often been invoked to claim that the fact of ulnar nerve injury itself is proof of negligence. However, examination of the Closed Claims Database has shown that in only a very small percentage of Closed Claims relating to ulnar nerve injury has the mechanism of injury been identifiable.

Robert Morell, M.D., associate professor in this department, heads a research effort to better define the mechanisms of this malady and reduce its occurrence. The study, funded by an Anesthesia Patient Safety Foundation Grant (APSF) for the period 2000-2002, is entitled "Effect of Gender on Ulnar Nerve Dysfunction Induced by Stretch, Pressure, Ischemia, or Positioning."

This present work grows out of an initial study on ulnar nerve injury directed by Richard Prielipp, M.D., also funded by an APSF grant (1997-1999), whose findings were summarized in the following article: Prielipp RC, Morell RC, Walker FO, Santos CC, Bennett J, Butterworth J: Ulnar nerve pressure: influence of arm position and relationship to somatosensory evoked potentials. *Anesthesiology* 1999; 91:345-54. These researchers concluded that in the clinical setting, "The supinated arm position is likely to minimize pressure over the ulnar nerve. With the forearm in neutral orientation, pressure over the ulnar nerve decreases as the arm is abducted between 30 degrees and 90 degrees. In addition, up to one half of male patients may fail to per-

ceive or experience clinical symptoms of ulnar nerve compression sufficient to elicit somatosensory evoked potential (SSEP) electrophysiologic changes."

The discovery that the male volunteers are relatively insensitive to ulnar nerve compression, and reports that 75% of ulnar nerve injuries occur in males, led Morell and this research group to study gender differences in ulnar nerve injury. Morell explains, "We are assessing differences in the physiologic response of the ulnar nerve between men and women to alterations in function induced by different insults, including ischemia, flexion, stretch, and pressure. Our hypothesis is that there is a gender difference." This grant, just awarded in January 2000, had enrolled approximately 80 volunteers as of May, and will involve a total of 320, half of them women, half men.



A 3-dimensional image representing the pronated arm resting on a pressure sensitive pad. Maximum pressure (shown by the spike) occurs at the olecranon, the bony prominence of the elbow, close to the ulnar nerve.

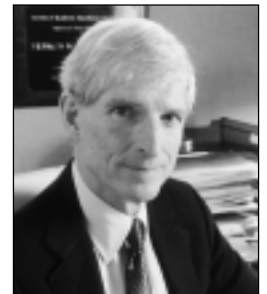
Michelle Vriesema, clinical studies coordinator, is a hospital electroneurodiagnostic technician hired for the project. She directs volunteers in a series of tests that measure current perception thresholds (CPTs), which are measurements of the minimum electrical current that can be perceived when minimal currents are applied to the little finger. The CPT tests check the activity of three different populations of nerves (small and large myelinated fibers and unmyelinated fibers) using three different current frequencies. Morell elaborates, "We are looking at effect of gender on alterations in CPT thresholds induced by ischemia, by flexion of the arm to 120 degrees, and by direct pressure. We will also look at gender differences in the pressure produced over the ulnar nerve in varying degrees of supination, pronation, and abduction, which is the natural extension of that first grant."

By examining the variables involved in ulnar nerve sensitivity to stresses, especially as they are manifested differently in men and women, Morell and those in this research group hope to define the factors predisposing to injury and improve perioperative protection of the ulnar nerve.

*continued on page 3*

## NOVEMBER 11 CELEBRATION SET FOR FRANK JAMES

Francis M. James III, M.D., professor, former chair, and presently associate dean for graduate medical education in addition to his anesthesiology post, will be retiring at the end of 2000 after 32 years in the department.



Francis M. James III, M.D.

To honor Frank James and celebrate his career, the department has planned a symposium and dinner for November 11. Guest lecturers at the symposium will be Lawrence J. Saidman, Robert D'Angelo, Donald S. Prough, Phillip E. Scuderi, and Charles H. McLeskey. Those attending the symposium will qualify for CME credit.

Invitations have recently gone out to current and former faculty, residents, and fellows, and others from the medical community. To all those invited, please return the RSVP card indicating your plans. For further information, please contact:

Jan Killmeier at 336-716-2712, Fax: 336-716-8190, or e-mail: [killmeier@wfubmc.edu](mailto:killmeier@wfubmc.edu).

# Manpower Issues at Academic Medical Centers



By Raymond C. Roy, Ph.D., M.D.  
Professor and Chair

We do live in interesting times. A confluence of forces traditionally considered mutually exclusive is occurring. The number of surgical and non-surgical procedures requiring anesthesia is increasing regionally and nationally. At the Wake Forest University Baptist Medical Center, the increasing surgical case load has led to our securing certificate of need approval to add four more operating rooms within two years. The availability of anesthesia providers, both anesthesiologists and certified registered nurse anesthetists (CRNAs) is decreasing regionally and nationally. The reimbursement rate for medical, surgical, anesthesia, and hospital services is decreasing. When there is a shortage of providers, the salary offered to them increases. The entry-level salaries of academic anesthesiologists at this medical center have consequently been increased. The costs of carrying out the clinical, teaching, and research activities of the department are increasing. "Excess clinical revenue," *i.e.*, the money left over after faculty salary and benefits are paid, is shrinking at a rate that will jeopardize the teaching and research missions of the department if alternative funding sources are not found and overhead is not efficiently managed. "Excess clinical time," *i.e.*, the clinical time in excess of 40 to 45 hours per week including call, is increasing and eroding the amount of non-clinical time used for teaching, writing, or research outside the operating room or clinic.

Anesthesiologists join and remain on this faculty primarily because they need, use, and value teaching and research time. The less this time is provided, the more private-practice-like the faculty position becomes, and the less fulfilled the faculty member feels. Intellectual stimulation and promotion are frequently manifested by, and based on, what is accomplished outside the clinical arena. When the position becomes a job and not a passion, academic anesthesia becomes private practice at a salary lower than that currently offered to private practitioners. The choice becomes, move to another academic medical center with the promise of more time (not many of these left), or give up academic anesthesia and enter private practice. We have to preserve faculty academic time to remain the top program we are.

There is a shortage of CRNAs locally, regionally, and nationally. In the inpatient operating rooms at North Carolina Baptist Hospital we have positions for 36 CRNAs. But we only have 18 salaried CRNAs with 18 vacancies. Five of these vacancies are temporarily filled with *locum tenens* or contract CRNAs. Each one of these CRNAs costs the hospital twice what a salaried CRNA costs. Interestingly, we have 8 positions for CRNAs in the outpatient surgery center and all of these are filled. We rely heavily on CRNAs in our didactic programs to: 1) reduce late and night call frequency for faculty and residents; 2) relieve residents and SNRAs to attend conferences; 3) concentrate operating room faculty teaching efforts on the resident room when coverage is 1:2 with 2 being a resident room plus a CRNA room; 4) be the anesthetists for some of the less interesting or more repetitious surgical or diagnostic procedures to enable the residents and SNRAs first choice at the required or more interesting anesthetics; 5) enable a regional anesthesia rotation; and 6) relieve residents and

SNRAs for lunches and breaks. The CRNA numbers have dropped below the threshold necessary to take advantage of these six benefits. All three academic medical centers in North Carolina are currently using *locum tenens* CRNAs to keep operating rooms open. Developing an attractive salary, benefit, and bonus package for CRNAs has been difficult because it is a moving target. As soon as one major hospital in an area creates an attractive package, other regional competitors make theirs better.

The total yearly cost for a *locum tenens* CRNA is greater than salary plus benefits for assistant and associate professor faculty. We could hire more anesthesiologists. Because the hospital employs the CRNAs, paying anesthesiologists to administer anesthesia would shift salary costs from the hospital to the department and increase our need to collect more revenue. I am certainly not opposed to anesthesiologists administering, rather than directing or supervising, anesthesia. Ideally we should have one or two faculty-only operating rooms each day. But, the cost of doing this and the shortage of anesthesiologists makes this an impractical option presently at our medical center.

We have increased the number of residents we seek through the match from 10 to 14. We have accepted several residents in transfer from other programs and outside the match so that we currently have 12 at the CA-1, CA-2, and CA-3 levels. In July 2000, we will have 15 CA-1s. The hospital readily approved the increases in part because of the shortage of CRNAs. The residents now provide anesthesia to more than sixty percent of the surgical inpatients. We are actually considering closing operating rooms if our CRNA numbers do not improve, because we cannot ask the residents to cover any more anesthetizing sites previously covered by CRNAs than they already are. In fact, we need to reduce the resident clinical service workload in order to enable the didactic activity that we cherish and about which we are so proud. The resident classes have consistently scored above the 90<sup>th</sup> percentile on the written examination, passed the oral board examinations on the first try, secured excellent positions after training, and been well appreciated wherever they have gone. We do not want this to change.

The School of Nurse Anesthesia, sponsored by North Carolina Baptist Hospital and the University of North Carolina Greensboro (Master's program), has increased its class size to 18 per year. Most of their clinical experience is obtained at hospitals other than North Carolina Baptist Hospital. It is hoped that an increasing percentage of the graduating class each year will consider staying on here. The hospital currently pays tuition for those who do, plus a signing bonus.

We are responding to the manpower crunch by aggressively recruiting faculty. Drs. Randy Calicott, Gavin Elliott, and Chuck Tong will be joining us this summer. We would like to recruit two more. We are aggressively shifting core research activity to funded activity. We have privatized some of our chronic pain activity. We are working with the hospital to recruit CRNAs. Finally, we are planning to create a residency education endowment to make residency education funds independent of clinical revenues.

## The Anesthesia Monitor

Vol. IX No. 1  
Spring/Summer 2000

Published by the  
Department of Anesthesiology  
and Wake Forest University  
Baptist Medical Center

Raymond C. Roy, Ph.D., M.D.,  
Chair

Wilson Somerville, Ph.D.,  
Editor

Biomedical Communications  
Design and Production

For more information  
please write or call:

The Department  
of Anesthesiology  
Wake Forest University  
School of Medicine  
Medical Center Boulevard  
Winston-Salem, NC  
27157-1009  
(336) 716-4498  
FAX: (336) 716-8190

<http://www.wfubmc.edu/anesthesia>

## Current Investigations

*continued from page 1*

### Neuroprotection Team Examines Practice of Reinfusing Shed Blood

For over a decade, David Stump, Ph.D., has been a leader in the Cardiovascular Neuroprotection Study team that has done much work on cerebral blood flow, and most recently on the nature, effects, and prevention of emboli that can shower the brain during cardiopulmonary bypass (CPB). Stump and Tim Jones, FRCS, Fellow in Neuroprotection, have recently compiled a summary report on the topic, "The Role of Reinfused Shed Blood in Postoperative Morbidity: Contribution to Adverse Neurologic Outcome."

Cognitive impairment, from stroke to substantial or temporary mental dysfunction, has been a well-recognized risk after CPB. Although the mechanisms contributing to post-CPB neuropsychological deficits remain uncertain, Stump and Jones see lipid microemboli (LME) as a major culprit in this problem. They observe in their report that during CPB, "Macroemboli can occlude arteries 200 µm or greater in diameter; microemboli obstruct flow in smaller arteries, arterioles, and capillaries." Microembolic agents, whose sources have not yet been completely determined, could range from platelet aggregates to silicone antifoam materials from the blood bypass circuit, or, as these researchers suggest, be "phospholipid remnants of damaged red blood cells or LME from the surgical field returned to the patient via cardiomy suction."

Studies performed at Wake Forest University School of Medicine have shown that certain methods of scavenging shed blood from the mediastinum through

cardiotomy suction and eventually returning it to the patient are a source of LME. Stump and Jones hypothesized that "reducing shed blood production would lessen the need to return it during CPB and would protect patients from LME." In a study in dogs, they found that the use of aprotinin, which curtails blood loss and transfusion requirements, reduced shed blood by 25% during CPB. In a preliminary analysis of 1600 patients undergoing CPB, they discovered a striking difference in the neurologic complication rate between those in the study who received shed blood and those who received none (see table). The group receiving shed blood had "more than three times the number of strokes and cerebrovascular accidents."

#### Stroke/CVA IMAGE Study

	Placebo p=.04*	Aprotinin
No reinfusion	0/134 (0.0%)*	2/162 (1.2%)
Reinfusion	21/685 (3.1%)*	7/643 (1.1%)
Overall p=0.02†	21/819 (2.6%)†	9/805 (1.5%)†

CVA=Cerebrovascular Accident. Strokes were less common when shed blood was not reinfused during coronary artery bypass graft surgery.

Stump and Jones also observed, "Only 18% of patients receiving aprotinin had more than 300 mL of shed blood compared with 46% of the placebo group." They concluded, "These data further support the premise that the return of shed blood has a negative effect on patient outcome" and that "strategies to reduce bleeding and avoid reinfusion of shed blood are neuroprotective by preventing lipid microembolization."

## SIXTH ANNUAL PHYSIOLOGY AND PHARMACOLOGY MEETING

The Department of Anesthesiology will host its sixth annual meeting of "Advances in Physiology and Pharmacology in Anesthesia and Critical Care," October 29-November 1, 2000, at the Greenbrier, White Sulphur Springs, West Virginia. Nationally recognized speakers will address such topics as cardiac anesthesia, perioperative management of metabolic abnormalities, infectious dangers to the physician and patient, obstetric medicine, and new information on pharmacologic agents. Slated to give this year's special lectures, a popular conference feature, are Lawrence Egbert, M.D., M.P.H., whose topic is "Doctors without Borders—Anesthesia in a War Zone" and Gregory Davis, M.D., who will offer "Halloween Musings on Problems in Forensic Medicine."

Participants may earn CME credits for the meeting, as well as for an ACLS course offered October 28-29 at the Greenbrier. For additional information contact Jan Killmeier at (336) 716-2712 or visit the department's Web site at <http://www.wfubmc.edu/anesthesia>.



The Greenbrier

## Overseas Rotation Gives the Right Test

By Alan Carter, M.D., Chief Resident



As I applied for residency, my goal was to become the best anesthesiologist I could be. I wanted to find a residency program that would push me toward that goal. In my personal statement for this department's residency application, I wrote that I aspired not just to be an anesthesiologist but a consultant in anesthesiology. A consultant is a problem solver. In the field of anesthesiology, I define a consultant as someone who can see trouble before it approaches, who is flexible and able to change his or her anesthetic plan when things don't go as expected, and who is quick acting and levelheaded when emergencies do come without warning. Although the entire residency here develops these traits, one experience has been particularly edifying.

I spent December of my CA-3 year in South Africa on an optional rotation that allows our senior residents to function as anesthesiologists in a third-world country. I volunteered for this rotation for several reasons. I thought it would be very interesting to participate in the medical care of people with many different medical problems not found in this country. I wanted to see what some of the anesthetic practices were in a place without some of our modern equipment. I also wanted to have a taste of complete responsibility for my patients. This is something you really can't get in an American anesthesiology residency. Here there is always an attending anesthesiologist a stone's throw away. In Africa, I knew there would be many times when I was the only anesthesiologist in the hospital. I'll mention a few of the patient scenarios I encountered.

My first day, after a short tour around the OR, and observation of various cases, I was left in charge of the obstetrical and gynecological room for the remainder of the afternoon. I did a couple of short cases without event. Around 5 pm one of the obstetricians brought a patient over from casualty (their version of an ED) for urgent cesarean section. After doing my best to explain to her that I thought a spinal would be the best anesthetic for her, she promptly refused a regional technique and asked me to put her to sleep. Noting a normal airway exam, I carried out the standard rapid

*continued on page 4*

# New Residents in 2000

Ray Roy, department chair, offered these comments on this year's Match process: "We are very pleased with the Match results and are looking forward to the new residents coming to town, finding a home, and joining us. Our success was due in part to the hard work of the interview committee, including Drs. Bogard, Foreman, Petrozza, Royster, and Smith from the faculty and Drs. Cavanagh, Camps, Pociask, and Thill from the residency, and all those who had lunch and dinner with the applicants. The residents really are the core of the process. But all of us agree that very special thanks must go to Ms. Carrol Stuart. She is the facilitator for the entire process. Her energy, enthusiasm, and organizational ability make it work. She loves doing this and it shows."

### Accepted through the Match:

#### PGY-1, 2000

Ralph C. Bethea, M.D.	University of Oklahoma at Tulsa
Jeffrey B. Cazier, M.D.	Medical College of Georgia
David M. Delahay, Jr., M.D.	University of Oklahoma at Tulsa
Daniel M. d'Hulst, M.D.	Medical College of Wisconsin
W. Edmond Fitzgerald, Jr., M.D.	Louisiana State University – New Orleans
Brian E. Grace, M.D.	University of Kentucky
Raj K. Mehta, M.D.	Ross University
Monica L. Rice, M.D.	MCP Hahnemann University
Matthew M. Salomone, M.D.	Columbia College of Physicians and Surgeons
Mark S. Seifer, M.D.	University of Texas at Houston

#### CA-1, 2001

Tracey J. Cole, M.D.	University of South Carolina
Ramesh Kethavath, M.D.	Loma Linda University
A. Scott Morales, M.D.	University of Texas at Dallas
M. James Smishek, M.D.	University of Texas at Houston

### Accepted outside the Match:

#### PGY-1, 2000

Brittany G. Clyne, M.D. (will do Med/Peds Year)	Wake Forest University School of Medicine
--	---

#### CA-1, 2000

Thomas M. "Quinn" McCutchen V, M.D.	Wake Forest University School of Medicine
Stacie D. Sanders, M.D.	University of Louisville
Kenneth L. Wade, M.D.	University of Arkansas College of Medicine

## Overseas Rotation

*continued from page 3*

sequence induction only to discover that I couldn't intubate the patient's trachea. I thought to myself, here's the responsibility I'd been waiting for. Now what?

I was on call the first Saturday of the month, and about midnight a trauma patient was sent over from casualty with multiple abdominal stab wounds. After an uneventful induction, the surgery had proceeded to the point that the patient's abdomen was open and intestinal repairs were underway. I was feeling very lucky about how remarkably stable this patient had been when it dawned on me how dark and dismal the ORs were in this African hospital. With it being night and with the thunder and lightning going on outside, it was almost like being in a dungeon. With that thought, all the electrical power in the hospital suddenly was lost. I don't think it gets any darker in Kentucky's Mammoth Caves than it was at that moment!

One of my last nights on call, a teenage girl was brought in with a severe gunshot wound to the head. After sitting in casualty for 12 hours essentially unattended, she arrived in my care without so much as an IV and with a head swollen to basketball size. She was responsive or, should I say, combative to touch. I felt like....hmmm....a paramedic! Unbelievable!

I encountered and learned many new things while I was in Africa. What were my answers for the above scenarios? While discovering that a small esophageal dilator works as a gum bougie and that a laryngoscope makes a pretty good flashlight, I realized something more important. I was capable of doing complicated anesthesia cases completely from start to finish alone.

As residency is coming quickly to an end, I've asked myself, has the Wake Forest University Baptist Medical Center's Anesthesiology Residency Program started me down the right path to accomplish my goals? The answer is an emphatic YES!

