Stanford’s Department of Anesthesia Celebrates 50 Years

By Patricia I. Rohrs, Medical Editor and Writer, Department of Anesthesia, Stanford University, and Ronald G. Pearl, M.D., Ph.D., Chairman, Department of Anesthesia, Stanford University

In 1959, the Stanford Medical School moved from San Francisco to Palo Alto in order to take advantage of Stanford University’s strengths in basic science. The next year, 1960, the Department of Anesthesia was founded by Dr. John Bunker, who noted, “My job at the outset was to attract a research-oriented faculty.” And he did. However, over the next 50 years the department also has expanded its clinical care, education and leadership in our ever-more complex and challenging environment. The following is a small snapshot of some of today’s exciting areas, acknowledging our debt to the many who have built the department that we have become.

Research

Because anesthesiologists “own” all organ systems, the department’s research questions have explored interlocking themes: mechanisms, safety and toxicity, physiology, clinical pharmacology, monitoring technology, simulation training, and, more recently, the merger of neuroscience, pain, immunology, molecular biology, and genetics. Neuroscience and pain studies in the 1980s included neuronal ischemia, introduction of neuraxial opioids into obstetric anesthesia practice, characterization of nociceptors, and “pressure reversal of anesthesia,” which served as a precursor to studying anesthetic effects on synaptic circuits. In the 1990s, themes included models of cerebral ischemia that defined injury mechanisms and identified the responses of brain cells to stroke. In addition, the first human experimental pain laboratory was established. And then during
the 2000s, pain research exploded. Human studies included (1) systems neuroscience techniques—neuroimaging, psychophysics, and neurocognitive assessments—to characterize pain systems and to teach patients to control brain networks to reduce pain; (2) objective biomarkers of pain; (3) the interrelationship of persistent pain and opioid use after surgery; (4) pain mechanisms during pregnancy or after cesarean surgery; (5) clinical trials of glial cell modulators to treat chronic pain; (6) anesthetic effects on brain cells and neuronal circuits during deep brain stimulation; (7) opioid-induced hyperalgesia in chronic pain patients; and (8) the genetic heritability of opioid responses. In animals, studies included the role of heme oxygenase and other mediators in nociceptive mechanisms, pain mechanisms, and treatment of chronic pain with cell transplantation and gene therapy. Over the next decade, our biomedical research will use new data-intensive tools—computational genetic mapping, haplotype mapping, and pharmacogenetics—to study how genetic variation affects disease susceptibility and drug response.

**Education**

Following the early days of anesthesia apprenticeship training, Stanford anesthesia’s educational environment has grown more technology-intensive, innovative, and personal. We generate interest in medicine and anesthesiology by teaching undergraduate seminars and directing medical students’ scholarly concentrations (neuroscience, biomedical ethics and medical humanities). Through START, a 10-month online course, we engage and prepare interns from all over the country before they actually begin their residency training. Once at Stanford, first-year residents dive into a resident-designed and -led one-month mentorship program. During residency, they do cases in pediatric, cardiac, orthopedic, and ambulatory anesthesia, chronic pain, and perioperative medicine, including multidisciplinary and subspecialty-focused critical care. They learn the principles and practices underlying the management of crisis situations. Through the vehicle of laser capture technology, residents can download recorded, searchable lectures (such as Grand Rounds) to their iPods in order to learn and review at their convenience.
Residents benefit from exceptional faculty who develop in-depth learning experiences through our nationally recognized Teaching Scholars Program. Several departmental websites (ether.stanford.edu and med.stanford.edu/anesthesia/) and the MedHub system provide extensive resident resources. Research-oriented residents can jump-start their research careers by becoming Stanford FARM (Fellowship in Anesthesia Research and Medicine) scholars and joining the Stanford Society of Physician Scholars. Many of our residents and fellows participate in medical missions related to global health throughout the world. Residency graduates have the opportunity to pursue fellowship training, reflecting the increasing subspecialization within the field of anesthesia. Stanford is one of only two California departments (Loma Linda is the other) to offer all four ACGME-approved fellowships (pediatrics, cardiac, pain, and critical care), and additional fellowships are offered in areas such as OB, regional anesthesia, patient safety and crisis management, perioperative management, difficult airway/ENT, and basic or clinical research. In all stages of education, simulation and immersive learning are integral to training (see below). Finally, not to be missed is residency director Alex Macario’s blog, Ask Alex, in which he addresses any and all questions!

**Simulation and Immersive Learning**

According to Dr. David Gaba, Professor of Anesthesia, Associate Dean for Immersive and Simulation-Based Learning, and the developer of realistic medical simulation in anesthesia, “The goal is to have experiential learning completely embedded, starting at the beginning of students' education and maintained through their careers”\(^2\) to help the trainee “go from being under supervision to being it.”\(^3\) In the 1980s, noting the parallels between skills development, dynamic decision-making, and teamwork on an aircraft’s flight deck and the same factors in an operating room, Dr. Gaba and colleagues built the first mannequin-based, realistic anesthesia patient simulator. The simulator incorporated monitoring, lifelike physiological responses, clinical pharmacology, and anesthesia effects. Standardized skills training resulted and expanded to include anesthesia crisis resource management, which focuses on communicating with—and leading—the medical team in an emergency. Now, in the medical school’s brand-new, 28,000-square-foot Center for Simulation and Immersive Learning, trainees can work within a simulated OR, ICU, or ER as well as large-disaster environments.

Trainees also participate in pediatric and OB simulation at the Lucille Packard Children’s Hospital (LPCH). These environments contain computerized mannequins simulating standard patients, a mock clinic in which patient-actors interact with trainees, rooms for learning hands-on medical and surgical
procedures, and virtual-reality worlds in which trainees’ avatars solve patient crises. Dr. Gaba and colleagues plan to add more simulations to the working environment throughout the School of Medicine. For instance, residents may answer an emergency call only to find an in situ, simulated crisis with which to deal. The objective for learners within these high-fidelity simulation situations is to hone skills, get fully debriefed, incorporate expert feedback, continuously improve performance, and build confidence.

Pain Management

As the field of anesthesiology has evolved into perioperative medicine, we have begun to study why chronic pain develops after injury or surgery and how to prevent or reverse it. The department’s Pain Management and Pediatric Anesthesia divisions have pursued multidisciplinary approaches to researching, treating, and managing chronic pain in adults and children. “The subspecialty of pain medicine has developed its own identity over the last decade or two,” says Dr. Sean Mackey, chief of the adult, 24-physician Pain Division. Dr. Elliot Krane, head of the pediatric pain management clinic, concurs. A single-physician approach has evolved into a collaborative team that includes physicians, psychologists, physical therapists, nurses, and, in pediatric pain, even a golden retriever, who together seek to “predict, prevent, and alleviate pain.” One overarching goal is to teach patients self-management techniques, such as cognitive behavioral change, distraction, relaxation, breathing, meditation, massage, exercise, and functional MRI neurofeedback, which trains the mind to change its response to pain, thereby modulating the pain itself.

The new Stanford Medicine Outpatient Center (shown on the facing page) is a perfect venue for Pain Division doctors to team up with neurologists (headaches), gastroenterologists (abdominal pain), ENT physicians (orofacial pain) and other specialists who practice in the center. The Pain Division offers two residency rotations—acute pain and chronic pain—and seven multidisciplinary fellowship positions. The division receives significant support from the National Institutes of Health (NIH) and other research sponsors and publishes widely...
cited papers. In 2008, the American Pain Society recognized the Pain Division’s clinical and research excellence with one of the first Clinical Center of Excellence Awards.

**Pediatric Anesthesiology**\(^4,5\)

In 1970, long before pediatric anesthesiology was a formal subspecialty, Dr. Alvin Hackel invented an infant transport incubator/monitor to transfer critically ill neonates to centers equipped to treat them. Today, Division Chief Dr. Anita Honkanen states, “The physiology of every organ system differs, depending on a child’s development, including a child’s emotional needs, which change dramatically with age.” Pediatric patient complexity, combined with the fact that LPCH has the highest acuity index of any U.S. children’s hospital, has resulted in pediatric anesthesia’s explosive growth. The 30 fellowship-trained pediatric anesthesiologists practice in a variety of locations, including LPCH’s new OR suite, several out-of-OR facilities (Procedure, Preop, PICU suites), a post-anesthesia care unit suite for pediatric oncology patients and their families, an outpatient chronic pain clinic, and an in-patient palliative care service.

Fellowships have grown, too, including the popular pediatric pain and cardiac anesthesia super-fellowships. The pediatric in situ simulator (SimBaby) can be wheeled to any pediatric location, where trainees learn to manage crises, identify system errors, and create safer patient environments.\(^6\) With LPCH’s planned expansion, anesthetizing locations will double in the next few years. NIH-funded pediatric anesthesia research has expanded, particularly with Dr. Greg Hammer’s clinical pharmacology program.

**Multidisciplinary Critical Care**

In the mid-1970s, then Chair Dr. Philip Larson recognized that a multidisciplinary ICU with significant anesthesia leadership was the best way to care for critically ill patients—whether critical illness was due to medical, surgical,
or traumatic etiologies. Dr. Mike Rosenthal was recruited jointly by Anesthesia, Medicine, and Surgery and for 25 years provided leadership in the ICU, training residents and over 100 fellows in diagnosing and treating ICU patients based on their physiology.

At the VA Palo Alto Health Care System, beginning in 1993, Dr. Eran Geller created and led the multidisciplinary, medical-surgical ICU, composed of intensivists from anesthesia, medicine and surgery, ICU-trained nurses, respiratory therapists, pharmacists, dieticians, and social workers. Supported by an analytic database, the MSICU became a national model for improved clinical care and patient outcomes. It also provided a venue for studying the fundamental pharmacokinetics and pharmacodynamics of intravenous sedatives in the ICU. Today, anesthesiologist-intensivists provide 24-hour coverage in multiple ICU locations: the medical-surgical, trauma-general surgical, and cardiothoracic ICUs at Stanford Hospital; PICU at LPCH, and the trauma-anesthesiology ICU at Santa Clara Valley Medical Center. At monthly multidisciplinary ICU conferences, members of all teams share their challenges. Daily critical care lectures cover such topics as shock and sepsis. Stanford now has 14 fellowship positions in critical care medicine. In this fastest growing, most expensive area of medicine, opportunities in critical care abound.

**Leadership**

As chair during the past 12 years, Dr. Ronald Pearl has overseen tremendous growth in all the departmental missions, including clinical care, education, research, and leadership. Reflecting on the first half-century of the department, he noted, “On my fifth birthday, I was told it was a milestone…. a road marker used during the Roman Empire to indicate distance traveled and to confirm one is traveling the right path. On our 50th milestone, what we celebrate is
growth, accomplishments, and potential.”

Looking both back and ahead, the department honors the leaders who traveled our road, leaders who recognized that “leadership and learning are indispensable to each other,” and that “opportunities multiply as they are seized.”

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1 **Statistics:** The 200 Anesthesia faculty members (including 57 women) practice in three hospitals (over 100 operating rooms and procedural suites), five Intensive Care Units, four pre-operative assessment clinics, and three pain management centers. We train 72 residents and 30 fellows per year.


4 **Statistics:** Pediatric anesthesiologists at LPCH care for greater than 7,500 infants, children, teens, and young adults per year for organ transplantation, complex cardiac surgery, radiation therapy, and invasive radiological procedures.

5 Much of this section is based upon Becky Oskin’s “It’s Not Child’s Play,” from *Stanford Anesthesia* © 2010.


7 From “From the Chairman,” *Stanford Anesthesia* © 2010

8 John Fitzgerald Kennedy

9 Sun Tzu