



# Translational Research: Advancing Human Health

**Department of Surgery**  
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SCHOOL OF MEDICINE

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On the cover: High-tech glasses under development at Washington University help breast surgeon Julie Margenthaler, MD, visualize cancer cells. The glasses are now being adapted for use in laparoscopic procedures. See page 43.

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UNLESS OTHERWISE NOTED

**F**OR DECADES, our physicians and scientists have conducted multidisciplinary basic science research to better understand the root cause of our most daunting medical challenges. Today, that work continues, with our efforts strategically focused on efficiently translating scientific findings into new diagnostics and therapies and on improving outcomes at the population level.

The breadth of the Department of Surgery's translational research can be seen in this report. The result: exciting progress in every division. In breast cancer, that progress is a promising vaccine that appears to prime patients' immune systems to attack tumor cells and help slow cancer's progression. In urology, it is developing a 12-marker panel to diagnose aggressive prostate cancer and spare men with slow-growing cancer unnecessary treatment. In public health sciences, our newest division, we are empowering more than 100 community members to advise researchers on how to more effectively conduct their research.

Our researchers think big, with hepatobiliary-pancreatic surgeons assembling a multidisciplinary team to look at two drugs and two immunologic approaches for treating pancreatic cancer, with the goal of using a Cancer Frontier Fund award as a stepping stone to a much larger national grant. The faculty's scope is also broad, with many surgeons and postgraduate trainees earning a master of population health sciences (MPHS) degree and joining our public health sciences faculty in conducting clinical effectiveness and outcomes research.

Another part of our mission is training and mentoring future generations of researchers. Our faculty extends general surgery residents a broad array of translational training opportunities, from basic science research that leads to clinical trials, to clinical effectiveness research to the MPHS program. The newest option — earning an MBA in the Washington University Olin Business School — allows residents to complete practicums in health-care quality studies.

More than ever, we are focused on translating scientific knowledge into solutions that provide our patients the best possible outcomes.



### **Timothy Eberlein, MD**

William K. Bixby Professor of Surgery  
Chair, Department of Surgery  
Washington University School of Medicine  
Director, Alvin J. Siteman Cancer Center

# Translational Research: Advancing Human Health

In its mission to advance human health, the Department of Surgery has for decades conducted the full spectrum of bench-to-bedside scientific investigations — an approach now known as translational research. Our large, multidisciplinary faculty work collaboratively on all four phases of translational research, designated T1-T4, to uncover the roots of disease, develop potential solutions, determine the best methods of application, and finally, examine and address factors that may affect implementation at a population level. With this approach, we aim to maximize our impact on building a healthier tomorrow.





## **T1: Translation to Humans**

Discover the roots of disease and propose potential clinical solutions

- Discover new disease mechanisms
- Develop potential new approaches for diagnosis, therapy and prevention
- Test effect and feasibility in animals and humans

## **T2: Translation to Patients**

Test effectiveness in clinical trials

- Assess safety and effectiveness (phase II and III)

## **T3: Translation to Practice**

Determine optimal implementation in clinical practice


- Refine the details: Who should receive it? How much? When?
- Study cost effectiveness
- Compare effectiveness with existing options

## **T4: Translation to Population**

Examine the factors that affect the health of a population

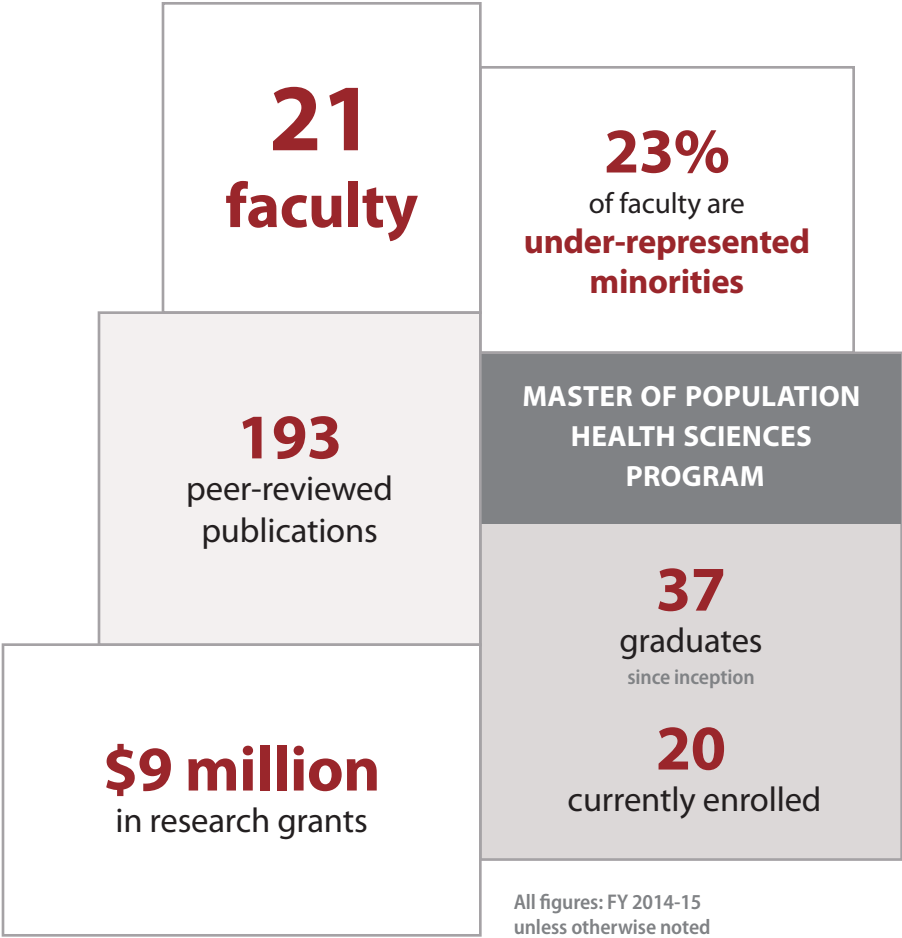
- Identify social determinants of health
- Evaluate best ways to disseminate and adopt best practices
- Identify and resolve barriers to implementation

# Division of Public Health Sciences



Among the division's many areas of multidisciplinary research is defining and addressing issues that affect health on a population level — such as access to mammography.

The Division of Public Health Sciences is nationally known for cancer-disparities research and is actively engaged with the community to identify and solve public health issues. Our division was established in 2010, and our faculty contribute an invaluable knowledge base to the department’s multidisciplinary research. Our Master of Population Health Sciences Program attracts physicians, clinical doctorates and medical students interested in careers combining medicine and clinical outcomes or other areas of population health.





# Community ambassadors bridge the gap

**A**S PUBLIC HEALTH RESEARCHERS work toward their goals of addressing disease prevention and health disparities, among other issues, their work is distinctly tied to the community setting. Yet there is often a communications gap between these researchers and the communities they serve. Melody Goodman, PhD, has made strides in closing that gap through a training program that educates community members about public health sciences — empowering them to advise researchers and even become researchers themselves.

“It’s harder for academics to think about how projects play out in the community because we are all about the science,” says Goodman, a researcher in the Division of Public Health Sciences whose work represents the T4 stage of translational research. “Community members are really good about saying ‘this would be useful to us’ and ‘this is how you get it out to people.’”

Goodman started the Community Research Fellows Training (CRFT) program in 2013. The program — similar to one she piloted in Long Island, New York, before joining Washington University’s faculty — has trained more than 100 fellows in the first three cohorts.

The 45-hour course teaches fellows about institutional review boards and ethical issues and helps them understand the research process. When fellows complete the course, they are better qualified to serve on institutional review boards and research advisory boards. They also act as citizen ambassadors to improve understanding of and participation in research. Fellows in the first cohort could apply for grants to do research of their own.

Goodman is especially proud of fellows who do research themselves. For example, one fellow led a project to better understand the needs of older homeless women. (See sidebar.) Another fellow, 72 at the time, became a presenter for a university fall-prevention program.

Through the CRFT program’s Patient Research Advisory Board, fellows review proposals and give feedback to investigators on community-engaged or community-based research projects.

“They want to make sure that we develop research proposals in a way that’s meaningful and beneficial to the community,” says Goodman.

## Program graduate addresses needs of older homeless women

Paulette Sankofa, EdD, a member of the first cohort of graduates in the Community Research Fellows Training (CRFT) program, is changing the perspective of social service providers who work with older homeless women.

Sankofa, 64, who completed the CRFT program in 2013, was homeless herself when she began the training, although she had housing by the end of that year. “I thought maybe I could make a difference by gaining these new skills,” she says.

In the homeless shelter, Sankofa, who has several graduate degrees, found other older women, but observed that shelter programs typically addressed the mobility and health needs of younger inhabitants. CRFT got funding for a pilot project, “The New Face of Homelessness,” for which Sankofa and another fellow, LaDoris Payne, studied barriers to receiving health care among older homeless women. Findings are forthcoming. Ultimately, Sankofa hopes to engage service providers in a discussion of key issues.



Paulette Sankofa, EdD, pictured here in front of the homeless shelter where she once lived, now studies the needs of older homeless women.



Through the Community Research Fellows Training program, founded by Melody Goodman, PhD, members of the community learn to serve as citizen ambassadors for research — advising investigators, educating others in the community and even performing research themselves.



TIM PARKER

## HIGHLIGHTS

■ Bettina Drake, MPH, PhD, is leading a study of how different consent models affect women's intentions to donate to a biobank. The 330 women were given three consent types: 1) Notice: participants are notified that samples may be used in future studies; 2) Broad: participants are asked for permission once for biospecimen use in multiple future studies; or 3) Study-specific: participants are asked for consent before each biospecimen use. More than half preferred the study-specific method. Additional analyses are under way.


■ Mary Politi, PhD, led one of the earliest studies to examine effective ways to explain health insurance terms to people enrolling in insurance under the Affordable Care Act. The research showed that using plain language, providing comparisons to familiar contexts and using stories about how people might make health insurance decisions can help support complex decisions about insurance choices. The study had 343 participants from urban, suburban and rural areas who did not have health insurance or only recently had enrolled.

■ Division Chief Graham Colditz, MD, DrPH, the Niess-Gain Professor of Surgery, was the senior author of a study reporting that short-term weight gain, particularly during premenopausal years and among normal-weight women, adds to the risk of breast cancer. The findings were published in the journal *Breast Cancer Research and Treatment*.

# Division of General Surgery

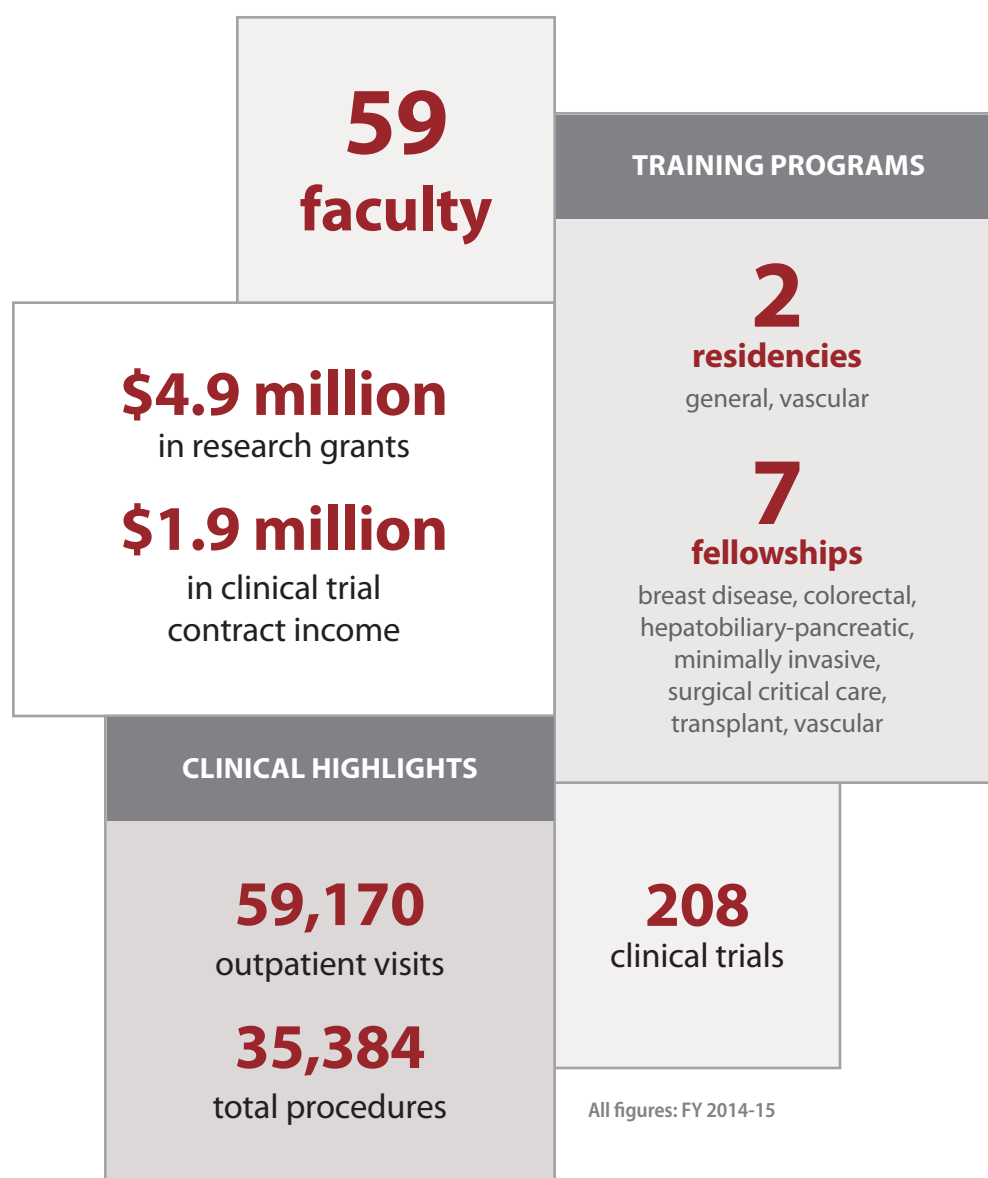
Acute and Critical Care Surgery | Colon and Rectal Surgery | Endocrine and Oncologic Surgery

Hepatobiliary-Pancreatic and Gastrointestinal Surgery | Minimally Invasive Surgery | Transplant Surgery | Vascular Surgery



High-tech glasses, tested here by Julie Margenthaler, MD, left, and developed by radiologist Samuel Achilefu, PhD, may help surgeons visualize cancer cells, which, labeled with a tumor-seeking contrast agent, glow blue when viewed through the eyewear.

General surgeons historically have performed a wide range of surgical procedures. As a trend toward specialization gained steam in the mid 1990s, our Division of General Surgery was divided into subsections: Acute and Critical Care, Colon and Rectal, Endocrine and Oncologic, Hepatobiliary-Pancreatic and Gastrointestinal, Vascular, and Transplant — and in 2007, Minimally Invasive Surgery. Today, our surgeons contribute leading advances in all division subspecialties, and our residency is recognized as premier in its field.





# Foam addresses severe bleeding

**U**SE OF A SPECIALIZED FOAM to stop severe internal bleeding due to trauma is a step closer to reality in the operating rooms of Barnes-Jewish Hospital and other Level 1 trauma centers, largely through the efforts of a Washington University trauma surgeon.

Grant Bochicchio, MD, MPH, the Harry Edison Professor of Surgery and chief of the Section of Acute and Critical Care Surgery, is principal investigator of a phase I clinical trial evaluating the safety of ClotFoam® in patients who experience mild-to-moderate bleeding during liver surgery. The foam — noncompressible and designed to stop bleeding — is administered via an applicator device during surgery.

Bochicchio and colleagues already have established the foam's effectiveness in animals; their clinical trial evaluates safety and effectiveness in humans — the later stages of T1 translational research.

The National Institutes of Health (NIH) and U.S. Army have funded the research to investigate methods to stop hemorrhage in soldiers wounded on the battlefield. The need to address this problem is underscored in a Wall Street Journal article, which reported the findings of a team of military medical specialists: Almost a quarter of Americans killed over 10 years in recent wars died on the battlefield of wounds they potentially could have survived with proper medical care; 90 percent bled to death when the bleeding could have been stopped.

“The only other product available to treat this type of bleeding is a pellet that expands in patients who are bleeding from tract wounds, such as from a gunshot,” says Bochicchio.

Bochicchio sees a broader application. For example, the foam could be used to control bleeding in victims of motor vehicle crashes and other trauma, for whom bleeding is the most preventable cause of death.

In other work, Bochicchio and the University of Maryland's Marc Simard, MD, PhD, have investigated the use of the drug glyburide to prevent secondary brain injury in lab animals. Bochicchio recently completed a Department of Defense-funded trial demonstrating that glyburide was safe in healthy human subjects. He and colleagues plan future trials assessing its effectiveness as a prophylactic agent for individuals at risk for brain injury.

Bochicchio has received personal financial compensation from Biomedica for his work on the development of ClotFoam®.

## Blood-clotting drug evaluated for trauma

Washington University researchers are preparing to study the use of tranexamic acid (TXA) to stop severe bleeding in trauma patients. Early trials of TXA — already used to control bleeding conditions such as hemophilia — have demonstrated benefits for trauma patients. The Washington University study, scheduled to start in fall or winter 2015, will dive deeper to examine TXA's effects on immune function and coagulation, as well as dosing, efficacy and safety.

Section Chief Grant Bochicchio, MD, MPH, and pediatrician Philip Spinella, MD, director of the Critical Care Translational Research Program, will lead the Department of Defense-funded trial in trauma patients at Barnes-Jewish Hospital.

Many trauma patients experience coagulopathy — a condition in which the blood's ability to clot is impaired — and die from sudden rapid blood loss. Standard care involves administering intravenous sterile saline en route to the hospital and evaluating possible use of blood products once there. The trial will include this standard treatment but will randomly assign patients to low-dose TXA, moderate-dose TXA or placebo.



Washington University researchers will study the effects of the blood-clotting drug tranexamic acid in trauma patients.





COURTESY GRANT BOCHICCHIO, MD

Grant Bochicchio, MD, MPH, and a colleague assemble the device used to apply a specialized foam the surgeon is testing for controlling severe bleeding in trauma patients. The device must be assembled immediately before each use.

## HIGHLIGHTS

■ The American College of Surgeons (ACS) gave the Barnes-Jewish Hospital Trauma Program high marks during a site visit in which it re-verified the hospital as a Level 1 Trauma Center. ACS Level 1 verification is considered a gold standard for trauma centers. Reviewers found no deficiencies and praised the program for its involvement with the ACS and leadership on state and regional committees overseeing trauma care. The ACS first verified Barnes-Jewish as a Level 1 Trauma Center in 1996.

■ Washington University physicians at Barnes-Jewish Hospital have played a key role in developing guidelines for Missouri's Time-Critical Diagnosis statute, which designates certain hospitals as trauma, stroke and STEMI (ST-segment elevation myocardial infarction) centers. Douglas Schuerer, MD, director of trauma, and Julie Nash, MSN, RN, manager of trauma and acute care surgery, have led development of regulations that bring smaller hospitals into the trauma system as Level 4 centers so they can receive guidance in treating and transferring patients.

■ Grant Bochicchio, MD, MPH, joined a coalition of top U.S. trauma surgeons who appeared before Congress to highlight the need for more trauma research funding. The coalition was assembled by major trauma organizations including the American Association for the Surgery of Trauma, the Eastern Association for the Surgery of Trauma and the Western Trauma Association.

# New steps reduce infection rates

**W**ASHINGTON UNIVERSITY colorectal surgeons have significantly lowered surgical site infection (SSI) rates for patients at Barnes-Jewish Hospital by implementing an expanded, standardized set of infection-control procedures.

The effort is one of many patient safety and quality-improvement initiatives at Barnes-Jewish, undertaken primarily for patient benefit, but also to address the closer scrutiny of patient outcomes by government and private insurance companies. In refining the implementation of clinical care, the work represents T3 translational research.

The effort includes a group of procedures, or interventions, generally thought to be effective, with the goal of identifying which are best.

“We started the bundle of interventions in January 2013 when our SSI rate was higher than the national average,” says colorectal surgeon Matthew Silveira, MD. “Then we looked at outcomes data from the American College of Surgeons National Surgical Quality Improvement Program® (NSQIP) to determine which interventions actually affected surgical site infection rates in our patients.”

Since implementation, the overall rate of SSIs for colorectal procedures at Barnes-Jewish has dropped from 26 percent in 2010 to 8 percent in 2014. That level is better than the NSQIP benchmark for Barnes-Jewish based on the hospital’s patient population and other factors.

To gauge the effectiveness of each intervention, the surgeons examined the NSQIP data and compared outcomes in Barnes-Jewish patients who received a given intervention vs. those who did not.

Examples of specific interventions and the resulting 2014 SSI rates:

- Washing abdomen preoperatively with antimicrobial soap chlorhexidine — If performed: 4.8 percent. If not performed: 15.6 percent
- “Clean closure:” using all new instruments, changing gloves and gowns, and redraping patient prior to beginning the closing procedure — If performed: 5 percent. If not performed: 12.1 percent
- Patient takes oral antibiotics as part of bowel prep — If performed: 4.5 percent. If not performed: 12.9 percent

The surgeons plan to refine their intervention bundle and improve compliance. They also are implementing protocols to address other surgical complications and reduce hospital length of stays. (See Highlights.)

## Mutch named section chief

Matthew Mutch, MD, who is nationally known as a clinician and educator in the laparoscopic treatment of colorectal cancer, has been named chief of the Section of Colon and Rectal Surgery.

Mutch succeeds James Fleshman Jr., MD, who left to become chair of the Department of Surgery at Baylor University Medical Center.

Mutch treats a broad spectrum of benign and malignant colorectal disease. His research focuses on identification of molecular markers to predict cancer-related outcomes in patients with rectal cancer, clinical outcomes in laparoscopic colorectal surgery and enhanced recovery after surgery.

Mutch completed his medical doctoral and residency training at Washington University and a colon and rectal fellowship at Lahey Clinic in Burlington, Massachusetts.

Mutch is program director of the Colon and Rectal Surgery Fellowship and serves on the Siteman Cancer Center Quality Assessment and Safety Monitoring Committee.

On a national level, he is vice chair of the Colon and Rectal Surgery Residency Review Committee and secretary of the Association of Program Directors for Colon and Rectal Surgery.



Matthew Mutch, MD, is the new section chief.





Colorectal surgeon Matthew Silveira, MD, left, and colleagues are refining already successful efforts to reduce surgical site infection. One measure involves using all-new surgical instruments, gowns and gloves for the closing procedure.

## HIGHLIGHTS

■ After implementing a successful initiative to reduce surgical site infections at Barnes-Jewish Hospital and Barnes-Jewish West County Hospital, colorectal surgeons are taking the next step with an Enhanced Recovery Program designed to reduce other complications, hospital length of stay and readmissions. It includes: patient education, special nutrition, exercise and bowel preparation before the operation; infection-control procedures and fluid administration during the operation; and walking, breathing exercises, nutrition and multimodal pain medication after the operation.

■ The Section of Colon and Rectal Surgery is the leading accruer in a nationwide clinical trial looking at wound irrigation to minimize surgical site infections. Colorectal surgeons also are participating in the national multicenter Perfusion Assessment in Laparoscopic Left Anterior Resection study evaluating use of perfusion imaging to evaluate blood flow in patients undergoing laparoscopic removal of the rectum. The goal is to see how the use of perfusion imaging affects surgical decision-making and outcomes.

■ The section is planning a study to see which follow-up method works best to prevent readmission of patients who receive an ileostomy at Barnes-Jewish Hospital as part of their colorectal operation. The study is being conducted by principal investigator Steven Hunt, MD, and clinical nurse coordinator Bonnie Johnston, RN, CWOCA.

# Trials target breast cancer metastasis

**B**REAST SURGEON REBECCA AFT, MD, PHD, and colleagues have spent years examining the molecular characteristics of cells responsible for metastatic breast cancer. Bringing that work into the clinical realm, she also leads clinical trials of drugs aimed at killing those cells.

Aft studies disseminated tumor cells (DTCs) — those that leave the original tumor and spread to distant sites in the body, sometimes developing into secondary tumors known as metastases. Breast tumors shed thousands of DTCs every day, and they often lodge in bone marrow.

“Bone marrow may be a DTC sanctuary, allowing DTCs to adapt and spread to different organs, where they’re a leading cause of death,” says Aft.

Her research has helped to uncover the molecular characteristics of DTCs — information that has contributed to identifying drugs aimed at killing the dangerous cells. Since 2004, she has led clinical trials testing these and other drugs in breast cancer patients at the Alvin J. Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine. The scope of Aft’s work puts her squarely in the T2 stage of translational work.

In a clinical trial, Aft has studied the bone-strengthening drug zoledronic acid (Zometa®), finding that it improves survival in patients with estrogen-receptor-negative stage II and III breast cancer, prevents cancer therapy-induced bone loss and improves bone-mineral density in premenopausal women undergoing breast cancer treatment. But although zoledronic acid makes the cellular environment less hospitable for DTCs, it doesn’t kill them.

Currently, Aft is leading a study evaluating the drug trastuzumab (Herceptin®) in a specific subset of breast cancer patients: those who test positive for human epidermal growth factor receptor 2 (HER2) in bone marrow DTCs but whose tumors are HER2 negative. The 15-20 percent of breast cancer patients who fall into this category are at high risk of metastases.

Herceptin® has been shown to prevent metastasis in patients whose tumors test positive for HER2. Aft hopes her study patients also will benefit.

“Our long-term goal is to prevent metastases in women who are at high risk,” says Aft.

## Early trial finds breast cancer vaccine safe

A breast cancer vaccine developed at Washington University is safe in patients with metastatic breast cancer, results of an early clinical trial indicate. Preliminary evidence also suggests that the vaccine primed the patients’ immune systems to attack tumor cells and helped slow cancer progression.

William Gillanders, MD, vice chair for research, was principal investigator of the trial. Results were reported in *Clinical Cancer Research* in December 2014.

The new vaccine causes the body’s immune system to home in on a protein called mammaglobin-A, found almost exclusively in breast tissue. The protein’s role in healthy tissue is unclear, but breast tumors express it at abnormally high levels. Gillanders and Washington University colleagues were the first to study the protein in breast cancer and elicit an immune response to it, then developed the vaccine based on that work. They have received funding for a larger clinical trial to test the vaccine in newly diagnosed breast cancer patients.



Based on their own basic research, William Gillanders, MD, senior scientist Xiuli Zhang, MD, and colleagues have developed a breast cancer vaccine now in clinical trials.



Rebecca Aft, MD, PhD, shown here visiting patient Iola West, conducts basic science and clinical research focused on finding ways to prevent breast cancer metastasis.



TIM PARKER

## HIGHLIGHTS

■ Siteman Cancer Center received an exceptional rating, the highest score possible, from the National Cancer Institute (NCI) during its five-year review in January 2015. The center's tumor immunology program — led by William Gillanders, MD, and Robert Schreiber, PhD — also received an exceptional rating. The NCI renewed Siteman's status as a Comprehensive Cancer Center, one of only 45 U.S. cancer centers to earn the designation for its added depth and breadth of research.

■ Breast surgeon Virginia Herrmann, MD, returned to the faculty after 10 years at the Medical University of South Carolina and the Hollings Cancer Center in Charleston. She is extending Siteman's outreach to breast cancer patients in north St. Louis County through a practice at Christian Hospital. Herrmann has met with leaders in local municipalities such as Ferguson and Black Jack to learn more about the cancer care needs of underserved patients and will work to enroll more of these patients in clinical trials.

■ Amy Cyr, MD, Julie Margenthaler, MD, and co-authors reported in the *Journal of Surgical Research* that radiologic staging studies are overused in newly diagnosed stage I–II breast cancer patients. In these patients, routine radiologic staging in the absence of symptoms suggesting distant spread of cancer is not recommended. The study reported that 882 of 3,291 stage I–II patients underwent additional imaging and/or biopsies. Identification of distant metastasis was rare; even among these patients judged appropriate for staging, only 1.2 percent were diagnosed with metastatic disease.

# Collaboration seeks new therapies

**P**ANCREATIC DUCTAL ADENOCARCINOMA (PDAC) is the most common form of pancreas cancer, accounting for more than 80 percent of cases. The cancer — with a five-year survival rate of only six percent — has proven highly resistant to treatment, making development of new therapeutic approaches a major priority.

The Section of Hepatobiliary-Pancreatic and Gastrointestinal Surgery has a long history of translational science in pancreas cancer. Building on work that began at the laboratory bench, the research is now moving into the clinical arena with a group of four collaborative projects attacking the cancer through immunologic therapy and drug development.

“Several of these projects are based on basic scientific discoveries at Washington University, and all will ultimately result in therapeutic trials,” says William Hawkins, MD, section chief and Neidorff Family and Robert C. Packman Professor. “This research is successfully and strategically moving laboratory discoveries from bench to bedside to address a very difficult disease.”

The projects draw on the expertise of surgeons, oncologists and basic scientists at Washington University and two other institutions. Goals include:

- Develop and test personalized vaccines for PDAC patients based on their genetic factors
- Evaluate a strategy to overcome the immune suppression caused by tumors
- Screen combinations of drugs for inhibiting molecular pathways that foster tumor survival
- Develop a delivery platform for small-molecule drugs that sends drugs directly to tumors and avoids adverse side effects

The researchers will use the preliminary data to support an application for a Specialized Programs of Research Excellence (SPORE) grant, a major collaborative translational research award sponsored by the National Cancer Institute.

The projects are supported by The Foundation for Barnes-Jewish Hospital's Cancer Frontier Fund, established to accelerate the traditional pace of innovation in cancer treatment.

## Hawkins named section chief

William Hawkins, MD, was named chief of the Section of Hepatobiliary-Pancreatic and Gastrointestinal Surgery, and the Neidorff Family and Robert C. Packman Professor in November 2014. He also was appointed director of the Hepatobiliary-Pancreatic Fellowship Program.

Hawkins joined the faculty in 2004 after completing a surgical oncology fellowship at Memorial Sloan Kettering Cancer Center in New York. His clinical practice includes cancers of the pancreas, liver and stomach, and benign and malignant bile duct diseases. His research focuses on novel therapies for pancreatic cancer, including drug development and immunology.

Hawkins received a Washington University Bear Cub grant to develop and potentially commercialize a drug that will serve as a platform for delivering chemotherapy to patients with pancreatic cancer. His lab is funded by the NIH.

Hawkins earned a medical degree at the State University of New York at Stony Brook School of Medicine and completed a surgical residency at Harvard Medical School.



William Hawkins, MD, is the new section chief.



Basic research by medical oncologist Andrea Wang-Gillam, MD, PhD, surgeon William Hawkins, MD, and others is fostering development of new pancreas cancer therapies.



## HIGHLIGHTS

■ Steven Strasberg, MD, was the senior author of a report by the Second International Consensus Conference on Laparoscopic Liver Resections that evaluated the current status of laparoscopic liver surgery. Published in the *Annals of Surgery*, it concluded that minor laparoscopic liver resection had become standard, but major liver resections were still in the exploration phase. Authors made recommendations on preoperative evaluation, bleeding controls, transection methods, anatomic approaches and equipment, and recognized the need for a formal education structure.

■ Lymph node status is one of the most important predictors of recurrence after gastrectomy for gastric cancer. Ryan Fields, MD, was senior author of a seven-institution study that found patients with lymph-node-negative gastric cancer, T stage 3 or higher, have a significantly shorter time to recurrence compared with those whose tumors were at a lower stage. The study recommended more aggressive postoperative therapy and surveillance regimens. The study was sponsored by the U.S. Gastric Cancer Collaborative and published in the *Annals of Surgery*.

■ Strasberg was senior author, and Bruce Hall, MD, PhD, MBA, a co-author of a study establishing a quantitative benchmark for complications after the Whipple procedure, the most common operation to remove pancreatic cancers. The study used data from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP®). The benchmark should prove useful in identifying areas needing quality improvement. The study was published in the *Annals of Surgery*.

# 3-D printing reshapes surgical care

**A**T THE WASHINGTON UNIVERSITY INSTITUTE for Minimally Invasive Surgery (WUIMIS), 3-D printing and other technologies play a central role in advancing patient care. Already known for pioneering laparoscopic surgery and for producing and evaluating meshes used in hernia surgery, WUIMIS today is partnering with the Division of Plastic and Reconstructive Surgery and orthopedic surgeons to develop 3-D printing technologies that make various treatments less costly, more efficient and more effective.

Three-D printers are at the forefront of the research center's latest technological wave, as staff scientists team up with plastic surgeons Albert Woo, MD, and Kamlesh Patel, MD, to create craniofacial models that guide them in the operating room. Use of the models is not new; Woo and Patel previously worked with outside companies to produce them in the shape of their patients' skulls so they could plan surgeries and reference the models during surgery. But securing a commercial-grade printer for plastic surgery through a grant from The Foundation for Barnes-Jewish Hospital allows them to produce models significantly cheaper and faster.

"These models decrease operative time and help us to be more exact with our reconstructions, thereby decreasing the need for reoperation," says Woo. "By having the technology at Washington University, we can produce models within 24 to 48 hours rather than several weeks. That allows us to create models not only for patients who can wait weeks for surgery, but for acute patients as well."

Other 3-D printers at WUIMIS are being used to produce prosthetic arms, which Washington University biomedical engineering students couple with electronic circuitry to provide basic arm and hand function.

"By contracting your arm muscles, you can move the arm and hand. It will twist the wrist or will tell the fingers or thumb to open or close," says student Savannah Est.

The arm is especially suitable for children, who grow out of devices quickly and are apt to break them. WUIMIS personnel are working with Washington University orthopedic surgeons to offer the technology.

WUIMIS plans to provide the modeling technology to other surgical specialists, such as urologists and heart surgeons and eventually may be able to produce other types of prostheses.

## Collaboration keeps 14-year-old moving

Sydney Kendall, a 14-year-old Chesterfield, Missouri, girl, is excited about blazing a trail in the use of 3-D printing to manufacture prosthetics.

Sydney lost her right forearm in a boating accident at age six. In the past two years, Washington University biomedical engineering students working with WUIMIS have combined circuitry with 3-D printing to give her a pink prosthetic arm — allowing her to throw a ball, move a computer mouse and perform other tasks — and more recently, a blue arm that further expands her range of motion. The blue model costs only a fraction of what a standard prosthetic costs to produce.

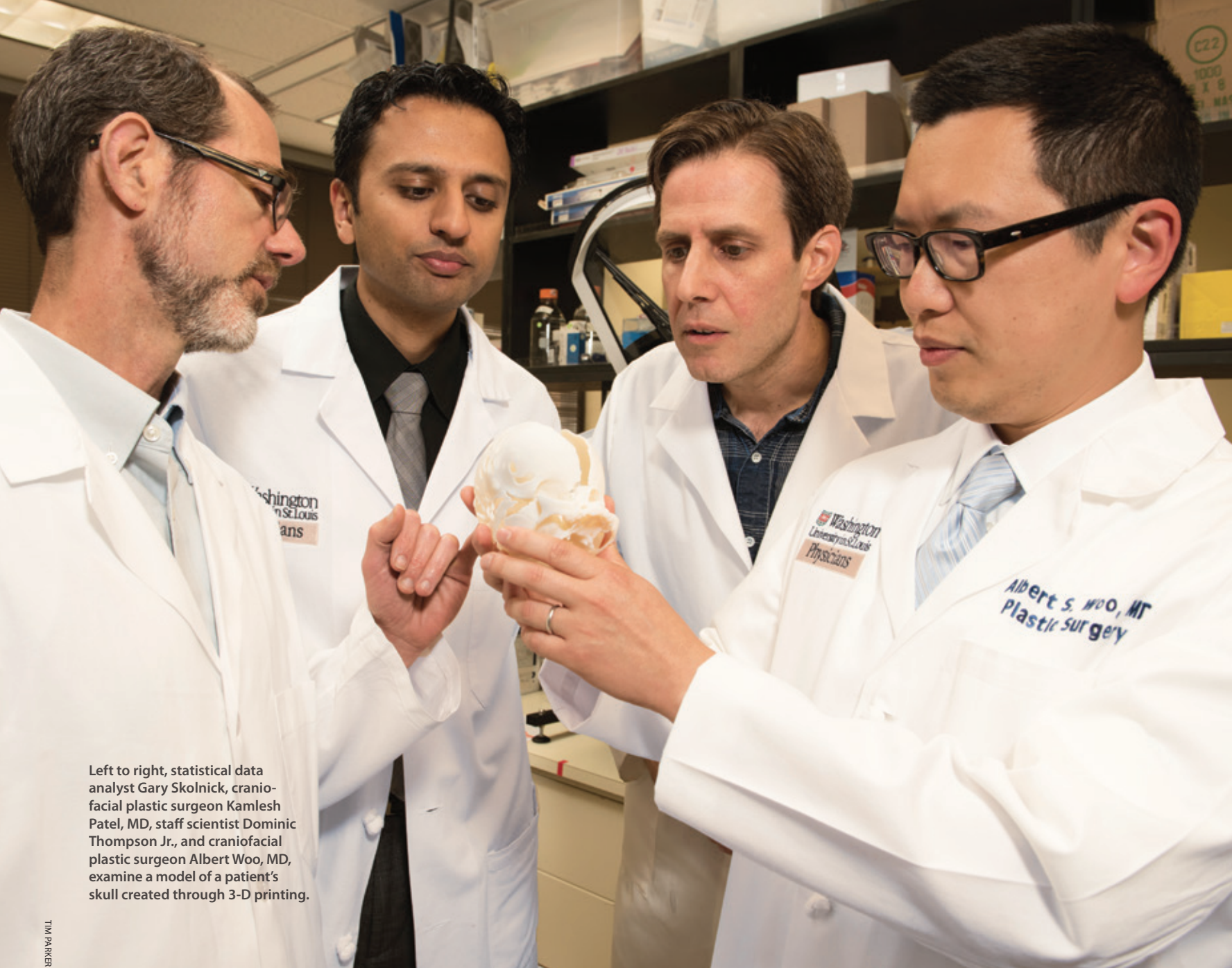
As Sydney moves her arm muscles, the prosthetic's electronics read the muscles' electrical impulses and allow her to open or close fingers and thumb, or twist the wrist.

"Sydney feels privileged to be chosen by her doctor (Washington University orthopedic surgeon Charles Goldfarb, MD, at Shriners Hospital) to be a part of this process," says her mother, Beth.



Biomedical engineering students Nabeel Chowdhury and Savannah Est combined electronics with 3-D printing to produce a functional prosthetic arm for 14-year-old Sydney Kendall.





Left to right, statistical data analyst Gary Skolnick, craniofacial plastic surgeon Kamlesh Patel, MD, staff scientist Dominic Thompson Jr., and craniofacial plastic surgeon Albert Woo, MD, examine a model of a patient's skull created through 3-D printing.

TIM PARKER

## HIGHLIGHTS

■ Surgeon Michael Awad, MD, PhD, who also serves as associate dean for medical student education, played a major role in the recent Liaison Committee on Medical Education (LCME) site visit of Washington University School of Medicine in St. Louis. He and Alison Whelan, MD, senior associate dean for education, led the school through the reaccreditation process, which required an extensive self-study and documentation. The survey was conducted March 8-11, 2015.

■ The Washington University Institute for Surgical Education (WISE) — a surgical simulation center — recently was reaccredited for three years by the American College of Surgeons as a Comprehensive Education Institute. The center serves not only the Department of Surgery, but other training programs at Washington University Medical Center and around the region.

■ WISE was one of the original 20 test centers for the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) Fundamentals of Endoscopic Surgery course, a test of knowledge and skills in flexible gastrointestinal endoscopy. The simulation center is also one of the original test centers for the SAGES Fundamental Use of Surgical Energy (FUSE) program and a beta test site for the FUSE certification examination, which certifies candidates in the safe use of surgical energy-based devices.

# Research addresses donor organ injury

**A** LONG-STANDING COLLABORATION among Washington University basic scientists and transplant surgeons to optimize donor organ health could improve transplant outcomes and potentially increase the pool of donors.

Their work addresses a major pitfall in transplantation called ischemia/reperfusion injury — inflammatory damage that occurs when blood flow is temporarily interrupted and then restored during the transplant process.

“Ischemia/reperfusion injury happens with live and cadaver donor organs and reduces the health of the organ, and ultimately, patient outcomes. Currently there is no way to stop it,” says William Chapman, MD, the Eugene M. Bricker Professor and chief of transplant surgery.

To address the issue, Chapman and his lab are partnering with Washington University biochemist William Frazier, PhD. Several years ago, Frazier discovered a molecular chain of events involving the protein CD-47 and nitric oxide that causes damage when blood returns to the organ. To counter this pathway, Frazier has developed a CD-47 antibody blockade system.

Chapman’s lab found that the blockade reduced ischemia/reperfusion injury and improved survival in an animal liver transplantation model — an example of the later stages of T1 translational research. He is now testing the blockade and other antibody variants in other animal models.

If effective in humans, the blockade could not only improve the health of organs suitable for transplant, but potentially reduce injury in marginal organs to make them usable for transplant. The approach has important implications for the organ transplant field because of the chronic shortage of donor livers, kidneys and other organs. There are currently more than 16,000 Americans waiting for liver transplants; more than 1,500 people die every year waiting for a donated liver to become available.\* More than 96,000 people are awaiting a kidney, but fewer than 17,000 people receive one each year.\*\*

“The ultimate goal is to test the antibody blockade in human trials, assuming it continues to show promise in animal studies,” says Chapman.

If the antibody blockade is tested in clinical trials, it would represent T2 research, translating initial findings to test a hypothesis in clinical trials.

\*American Liver Foundation

\*\*National Kidney Foundation

## New organ preservation method may improve donor pool

Livers from deceased donors are a gift of life, with almost 75 percent of liver transplant recipients surviving at five years.\* But many livers are not suitable for transplant — most often due to steatosis, or fatty liver — contributing to a severe shortage of these organs. So Washington University researchers are looking at whether an alternate preservation method could reduce fatty liver to make marginal donor organs healthy enough for transplant.

The Washington University and Barnes-Jewish Transplant Center is one of about 10 U.S. medical centers conducting a clinical trial of normothermic perfusion, in which the donor liver is stored at 37 C, rather than in cold storage, which goes down to 4 C. Although the trial will be in normal livers, the ultimate goal is to assess it in marginal organs.

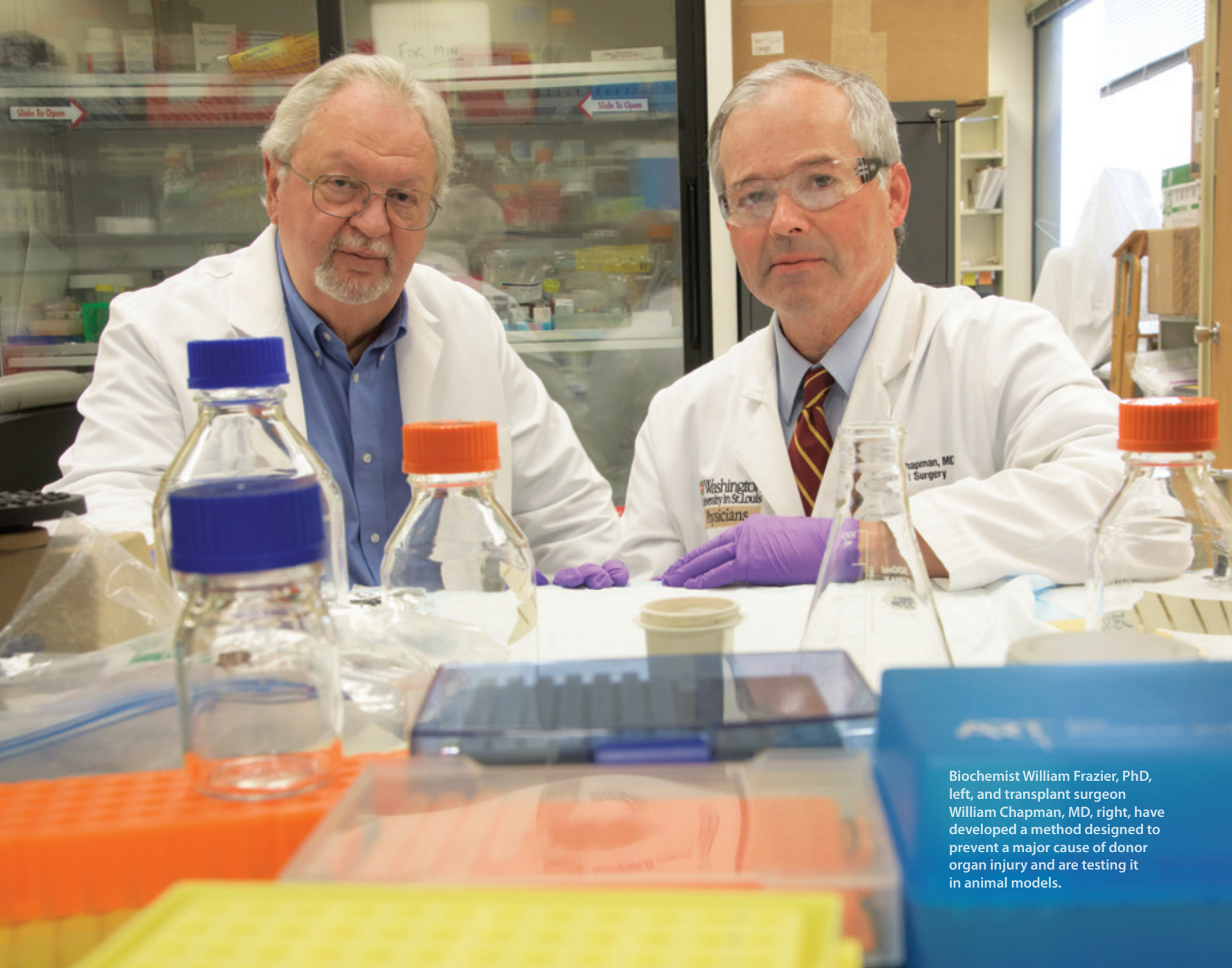
“If this method is effective, it could be an important way for us to address donor organ shortage,” says Transplant Surgery Chief William Chapman, MD.

\*U.S. Department of Health and Human Services



Surendra Shenoy, MD, PhD, president of the Vascular Access Society of the Americas, performs a transplant.





Biochemist William Frazier, PhD, left, and transplant surgeon William Chapman, MD, right, have developed a method designed to prevent a major cause of donor organ injury and are testing it in animal models.

## HIGHLIGHTS

■ An article by Washington University transplant surgeons about dedicated facilities for retrieving donor organs was the most accessed article in the American Journal of Transplantation in 2014. Surgeon M.B. Majella Doyle, MD, MBA, was first author. The article reported a study concluding that moving organ donors from hospitals to a regional stand-alone facility with a designated operating room for organ retrieval is more efficient and lowers costs considerably. Transplant Surgery Chief William Chapman, MD, was senior author.

■ Jeffrey Lowell, MD, and general surgery resident Shuddhadeb Ray, MD, were honored at the department's first annual Patient Safety and Clinical Effectiveness Meeting for their survey on improving the department's Surgical Morbidity and Mortality (M&M) Conference. M&M is an event all residency programs perform to review and learn from medical errors. A majority believed M&M could benefit from more faculty participation, quality-improvement focus, evidence-based literature and better-defined case selection. A follow-up survey is planned after organizers implement changes.

■ Yiing Lin, MD, PhD, is developing a technique to isolate DNA from the blood of patients to test for liver cancer or recurrence of liver cancer. If effective, the technique could be an alternative to much more expensive tests such as MRI and liver biopsy currently used for diagnosis. Lin has conducted the research using liver cancer tumors sequenced at The Elizabeth H. and James S. McDonnell III Genome Institute at Washington University.



# Studies probe diabetes vascular health

**V**ASCULAR SURGEON Mohamed Zayed, MD, PhD, is in the early stages of T1 translational research investigating the underlying mechanisms of atherosclerotic plaque progression in patients with diabetes and peripheral arterial disease (PAD). In this common and often difficult-to-treat patient group, blood flow in the lower legs and feet becomes severely restricted, leading to an inadequate blood supply to tissues. Zayed's goal is to identify new drug therapies that can reduce serious complications such as wounds and limb amputations.

"Over the past decade, there has been significant progress in decreasing the rates of heart attacks and strokes in patients with diabetes; however, amputation rates remain stubbornly high," says Zayed. "In fact, nearly 20 percent of diabetics who develop a peripheral limb wound will ultimately receive a major extremity amputation, which leads to further disability and represents a large socioeconomic burden."

Patients with diabetes are more vulnerable to developing PAD than those without diabetes. Recent investigations suggest that the vulnerability may be due to a combination of accelerated atherosclerotic plaque formation in peripheral arteries, as well as an impaired ability to develop new, alternate blood vessels to compensate for existing arterial blockages.

Zayed works in collaboration with Clay Semenkovich, MD, the Herbert S. Gasser Professor and chief of the Division of Endocrinology, Metabolism and Lipid Research, to evaluate the role of specific fat molecules that may contribute to PAD severity in diabetic patients. Studying vascular tissue harvested from patients with and without diabetes, they are using mass spectrometry to analyze patients' arterial plaques. In collaboration with Washington University's Diabetes Research Center, they aim to identify plaque molecules that could be targeted with drugs delivered directly to the plaques. The clinical trial patients are enrolled in an institutionally approved vascular tissue biobank.

"Ultimately, our goal is to determine what lipid molecules correlate with diabetic PAD, and attempt to normalize them with novel drugs using existing minimally invasive surgical techniques."

Zayed's research is funded by the Society for Vascular Surgery Foundation, the Vascular Cures Foundation Wylie Scholar Award, the St. Louis Veterans Affairs Health Care System and the Washington University Diabetes Research Center.

## Drug-coated balloons tested to treat PAD in the calf

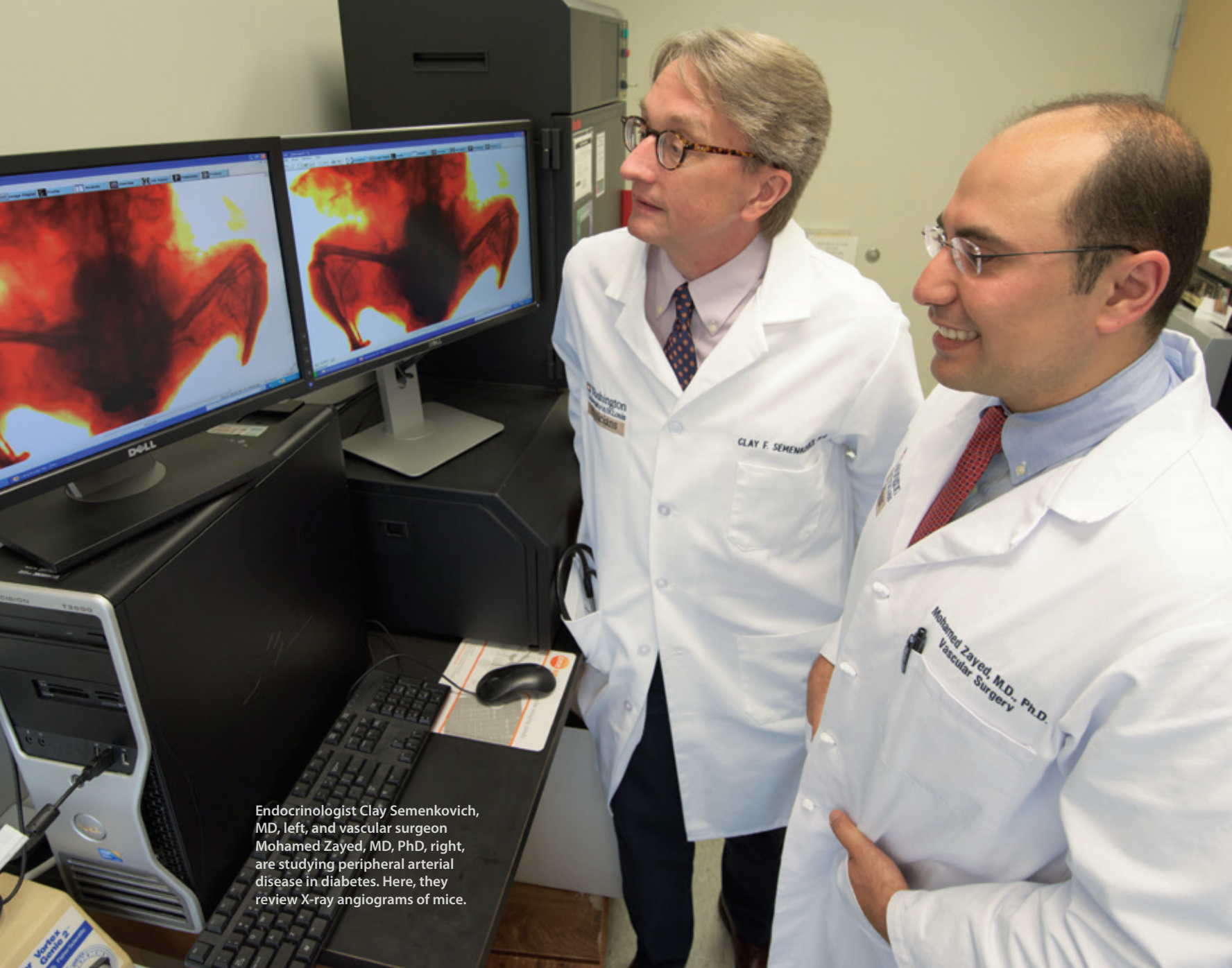
The Section of Vascular Surgery, which has been a leader in endovascular surgery to treat peripheral arterial disease (PAD), is participating in the first clinical trial of drug (paclitaxel)-coated balloons in patients with decreased blood flow below the knee.

Drug-coated balloons have proven effective in preventing recurrent narrowing of the thigh arteries after angioplasty, and in this trial are now being tested in the smaller arteries of the calf. Successful treatment of blockages in these smaller arteries is critical in preventing amputation from PAD. Vascular surgeon Patrick Geraghty, MD, is one of three global principal investigators for the trial.

With the aging of the baby-boom generation, the increase in lower-extremity arterial disease has rivaled the occurrence of other vascular diseases such as carotid artery disease and abdominal aortic aneurysms. Endovascular treatment, with its decreased risk and faster recovery, is now widely used as an alternative to surgery in PAD.



Patrick Geraghty, MD, is one of three global principal investigators of a trial evaluating paclitaxel-coated balloons in patients with decreased blood flow below the knee.



Endocrinologist Clay Semenkovich, MD, left, and vascular surgeon Mohamed Zayed, MD, PhD, right, are studying peripheral arterial disease in diabetes. Here, they review X-ray angiograms of mice.

## HIGHLIGHTS

At Barnes-Jewish Hospital, vascular surgeon Mohamed Zayed, MD, PhD, and interventional radiology colleagues are using a new FDA-approved percutaneous thrombectomy cannula to remove large-volume blood clots from the veins of the abdomen and pelvis. The cannula suctions and filters clots from the venous circulation while pumping back the remaining filtered venous blood to the patient.

Professional and amateur athletes are among those seeking treatment from Robert Thompson, MD, for neurogenic, venous and arterial thoracic outlet syndrome (TOS). TOS involves nerve

and/or blood vessel compression in the lower part of the neck, shoulder and upper arm. Among his patients are former major league pitcher Aaron Cook, Kansas City Royals pitcher Chris Young, who won Major League Baseball's 2014 Comeback Player of the Year award, and roughly 18 other major league pitchers.

Nanette Reed, MD, has joined Patrick Geraghty, MD, to extend the outreach of the vascular surgery section at Barnes-Jewish St. Peters Hospital, about 30 miles west of St. Louis. Both see patients and perform open and endovascular procedures.

Vascular Surgery Residency and Fellowship Program Director Jeffrey Jim, MD, MPH, has encouraged trainees to take on challenging, but practical safety/quality-improvement projects. These include standardizing protocols for treating aortic dissections and emergent aneurysms, and developing new discharge instructions and preoperative protocols for common procedures.



# Division of Cardiothoracic Surgery

Cardiac Surgery | General Thoracic Surgery | Pediatric Cardiothoracic Surgery

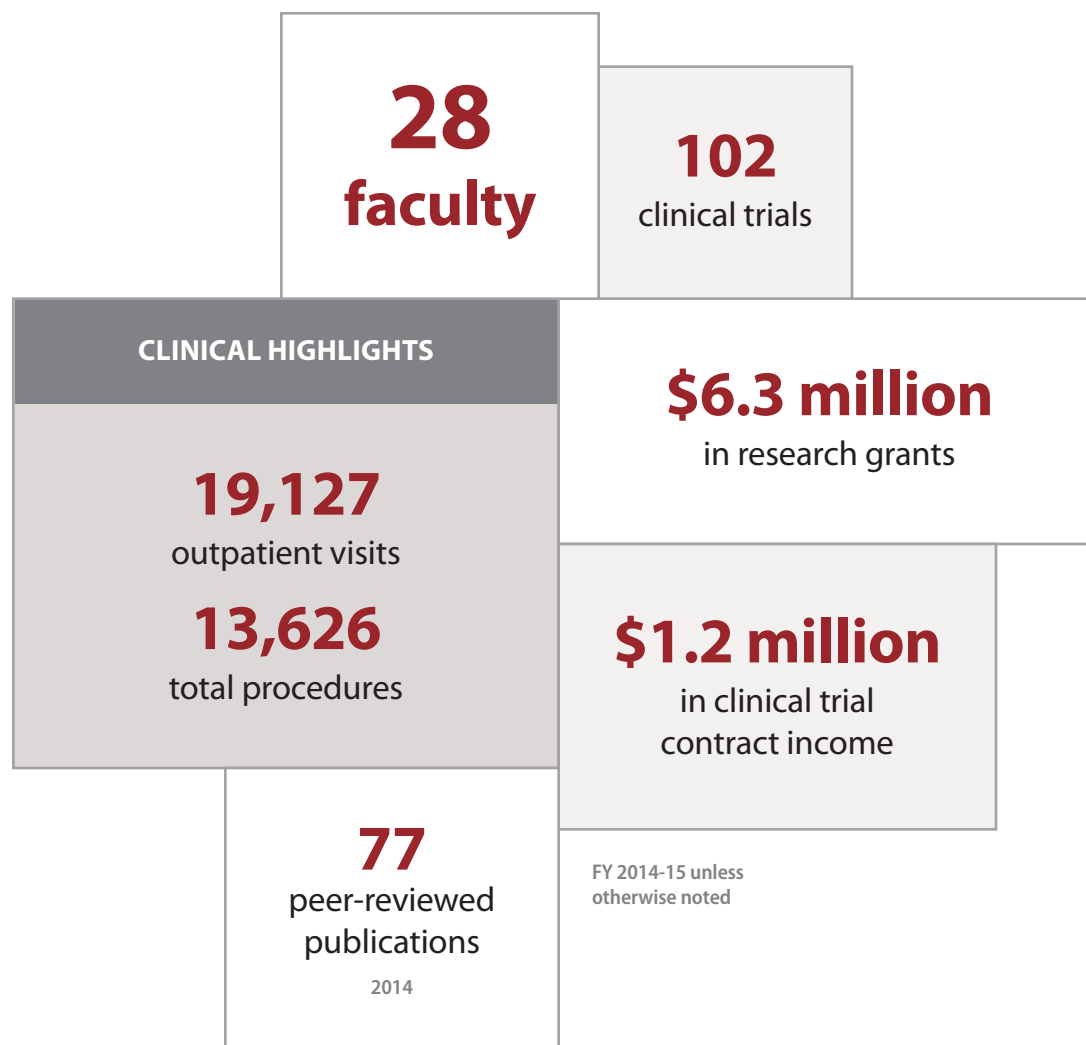
Critical Care Service in the Cardiothoracic Intensive Care Unit



Hersh Maniar, MD, and colleagues have performed clinical trials evaluating minimally invasive procedures that make heart valve replacement an option for previously inoperable patients.



The Division of Cardiothoracic Surgery has a long-standing dedication to excellence and innovation. Our chest service was initially established in 1920, and our residency program — the second-oldest in the country — was established in 1929. Today, our clinical expertise spans the entire breadth and depth of our specialty, and our surgical volumes have grown steadily over the last decade. In addition, we continue to contribute major advances to human health through groundbreaking clinical and basic science research.



# Surgeons take aim at postoperative AFib

**A** NEW APPROACH to the study of postoperative atrial fibrillation (AFib) could eventually lead to fewer complications and shorter hospital stays for many heart surgery patients.

Postoperative AFib, in which the heart's upper chamber beats erratically, is the most common complication after cardiovascular surgery.

"One-third to one-half of patients who have heart surgery get postoperative AFib," says Spencer Melby, MD, Washington University heart surgeon at Barnes-Jewish Hospital. "These patients stay in the hospital one to two days longer, their cost of care is much higher, and they have higher rates of stroke and mortality than patients without postoperative AFib."

Melby is performing T1 translational research to explain the underlying causes of postoperative AFib. He is the first to focus on inflammation within the pericardium — the fluid-filled sac surrounding the heart. His work involves patients undergoing cardiovascular surgeries; he has found that their pericardial fluid, routinely drained during surgery, contains higher levels of inflammatory substances than did their blood. The findings point to inflammation around the heart as a likely contributor to postoperative AFib and other surgery-related heart complications.

Reviewing patient histories, Melby and colleagues have since mapped the typical timing of postoperative AFib and associated risk factors: AFib occurs most frequently right after surgery or during a second phase about 48 hours later. The first period is likely related to trauma from surgery, but the second is almost certainly related to inflammation, Melby says.

The next step is to determine which inflammatory substances may induce atrial arrhythmias in an animal model and to study the effects of administering anti-inflammatory drugs within the pericardium, as opposed to systemically. The long-term goal is to identify potential drugs to prevent postoperative AFib and test them in human clinical trials.

Over the past 30 years, treatment of postoperative AFib has improved, but its rate of occurrence has not changed, Melby says.

"There is not going to be any one factor that cures postoperative atrial fibrillation," he says. "There are too many risks and contributing pathologies. At Barnes-Jewish, we perform 1,200 heart surgeries a year, so 400 to 500 people a year have postoperative atrial fibrillation. Any decrease in that rate would be meaningful."

## Basic science fosters surgical solutions

Translational research in atrial fibrillation (AFib) at Washington University bridges the gap from bench to bedside and has been funded by the NIH for 30 years.

AFib affects more than 2 million Americans and can lead to cardiomyopathy, heart failure and stroke. In 1987, Washington University physician-scientists' important findings on electrophysiology of the heart led to development of the Cox-Maze procedure by surgeon James Cox, MD. It became the gold standard for surgical treatment of AFib. In the operation, surgeons made small incisions in the heart, creating a "maze" of scar tissue to guide errant electrical signals in the heart back to more normal pathways.

Since then, Cardiothoracic Surgery Chief Ralph Damiano Jr., MD, the Evarts A. Graham Professor of Surgery, has developed new versions of the procedure that make it easier to perform — replacing incisions with radiofrequency ablation and adapting the procedure to minimally invasive techniques.



Division Chief Ralph Damiano Jr., MD, left, and surgical colleagues have pioneered minimally invasive approaches to treat atrial fibrillation.



Spencer Melby, MD, standing, confers with residents Puja Kachroo, MD, left, and Chirag Patel, MD, right. Melby is examining inflammation in the pericardium as a possible cause of postoperative atrial fibrillation.

## HIGHLIGHTS

■ In the past 10 years, cardiac surgical procedures in the Section of Cardiac Surgery have grown from almost 1,400 to 2,200 per year — an increase of about 60 percent. Part of the growth is attributed to outreach programs in Mount Vernon and Quincy, Illinois, which improve care in those regions and create a referral system for more complex surgeries at Barnes-Jewish Hospital. The number of valve cases and implantations of ventricular assist devices also have risen sharply.

■ The division established a cardiac surgery service at the John Cochran VA Medical Center. Steve Guyton, MD, MHA, who came from Oregon Health & Science University in Portland, is chief of cardiac surgery. He is joined by surgeons Spencer Melby, MD, and Michael Crittenden, MD. The service provides critical services for veterans from World War II through current-day conflicts and is the first new cardiac surgery program at a VA hospital in more than a decade.

■ In the past 10 years, 21 of 33 graduates of the Thoracic Surgery Residency Program have gone on to academic practice. Over that period, six residents have joined the Washington University faculty. Cardiac Surgery Chief Marc Moon, MD, the John M. Shoenberg Chair in Cardiovascular Disease, is the residency program director.



# New steps reduce pneumonia rates

**O**VER THE LAST SEVERAL YEARS, thoracic surgeon Varun Puri, MD, MSCI, has introduced several measures to reduce the incidence of pneumonia in patients undergoing surgical removal of the esophagus or lung. Pneumonia is a major complication that can lead to longer hospital stays, additional treatment and even death.

The work is an example of T3 translational research, in which comparative effectiveness/clinical studies are translated to clinical practice.

“The incidence of pneumonia after esophagus removal varies from about 10 to 25 percent, and it’s probably the single most significant variable predicting early postoperative death,” says Puri. “In patients undergoing lung removal, the incidence is lower, in the range of 5 to 10 percent, but it still is a major complication and often leads to intensive care unit readmission and ventilation.”

In 2011, Puri and Yinin Hu, MD, then a Washington University medical student, reported improved outcomes after esophagus removal by changing the type of tube used to deliver food and medicine directly to the stomach. Instead of the conventional nasogastric tube, inserted into the stomach through the nose, they used a retrograde gastrostomy (RG) tube, inserted through the abdominal wall into the small intestine and stomach. The switch decreased the incidence of postoperative pneumonia from a range of 20-25 percent to 10-15 percent.

Puri is now reviewing data from a prospective clinical trial investigating several other interventions. Participating patients, undergoing lung or esophagus removal, practiced an intensive oral hygiene regimen — brushing three times a day for a minimum of five days before surgery and applying a germ-killing chlorhexidine solution. Esophagectomy patients also could opt for use of an endotracheal tube that prevents nose and mouth secretions from pooling and entering the lungs. The results will be compared with a control group of patients who had the same surgical procedures sometime in the past three to five years.

“I think the intensive tooth brushing and oral hygiene is probably an important component of this group of interventions,” says Puri.

If results are positive, Puri hopes to further test the measures in a multicenter trial.

## Section earns STS’ highest rating


The Society of Thoracic Surgeons (STS) gave Washington University thoracic surgeons at Barnes-Jewish Hospital a three-star rating for lung cancer surgical outcomes between July 2011 and June 2014. The rating, the highest possible, is based on a composite score calculated from the STS National Database.

“This is the first time they provided a composite score from the STS Database for general thoracic surgery,” says Bryan Meyers, MD, MPH, chief of the Section of General Thoracic Surgery and the Patrick and Joy Williamson Chair in Cardiothoracic Surgery. “The actual observed results were compared to the expected outcomes to grade the program.”

The surgeons scored well on other benchmarks, including for their use of minimally invasive rather than open surgery for performing lobectomy in patients with Stage I lung cancer. They chose minimally invasive surgery — widely considered safer and equally effective in controlling cancer and sampling lymph nodes — in 78.6 percent of patients, compared with an STS average of 63.7 percent.



Surgical outcomes earned thoracic surgeons top scores in a recent national rating.



In quality improvement research, Varun Puri, MD, is evaluating several measures aimed at reducing the rates of postoperative pneumonia.

TIM PARKER

## HIGHLIGHTS

■ Daniel Kreisel, MD, PhD, was named surgical director of the Lung Transplant Program at Barnes-Jewish Hospital in January 2015. Since joining the faculty in 2006, Kreisel has dedicated his clinical and research efforts to lung transplantation. A member of the Thoracic Immunobiology Lab, he focuses on why failure rates after lung transplantation are higher than after transplantation of other grafts. He is a member of The American Society of Clinical Investigation, a section editor for The Journal of Immunology and a standing member on the NIH Transplantation, Tumor and Tolerance

Study Section. Kreisel succeeds Alec Patterson, MD, the Joseph C. Bancroft Professor of Surgery, who served as surgical director for 22 years.

■ Thoracic Surgery Chief Bryan Meyers, MD, MPH, is involved in key process-improvement projects as chair of the Maintenance of Certification Committee of the American Board of Thoracic Surgery. Among the improvements: During the recertification process enabling surgeons to maintain their board certification, thoracic surgeons are being asked to focus on an important aspect of their practice

and try to improve it compared with national benchmarks. The thoracic surgery board is also the first among the American Board of Medical Specialties to offer a self-paced, on-line “high stakes” recertifying exam that can be done from home or office; the exam lets surgeons learn in real-time why a chosen answer was correct or incorrect and allows them to go back and correct it. The idea is to make the exam less punitive and more of a learning process for assessing and improving knowledge. Modern software and computer cameras ensure the test-taker’s identity and spot-check exam behavior.

# Studies trace roots of congenital disease

**P**EDIATRIC CARDIOTHORACIC Surgery Chief Pirooz Eghtesady, MD, PhD, sees firsthand the challenges of babies born with hypoplastic left heart syndrome (HLHS), a condition in which the left side of the heart is critically underdeveloped and can't effectively pump blood to the body. HLHS requires the palliative Norwood operation in the first week of life, then two more surgeries later, the Glenn and Fontan procedures, to reshape the heart's physiology and achieve near-normal oxygen levels in the blood.

Although about 70 percent of babies born today with HLHS are expected to reach adulthood\* — the result of better diagnosis and management — Eghtesady's lab is looking for ways to better detect and possibly even prevent the condition.

"We still don't know what causes HLHS; many believe it is all genetic," says Eghtesady, who is the Emerson Chair in Pediatric Cardiothoracic Surgery and treats patients at St. Louis Children's Hospital. "We are looking at whether a common virus, the Cocksackie virus, potentially plays a part in the development of HLHS. If it turns out the virus does play a role, our goals would be to assess the disease sooner and to develop therapies to prevent the impact of the virus."

Eghtesady and his colleagues are taking two approaches, in tandem, working in the T1 phase of translational science. One involves using a mouse model to examine whether the Cocksackie virus is involved and to determine which features of the infection cause the disease. The second approach is a human clinical trial in which physicians collect serum from pregnant women and the lab looks for small RNA particles as potential markers for the virus. If the Cocksackie virus is found to contribute to HLHS, the markers would allow pregnant women with the virus to be identified earlier to better plan treatment for their children. A long-term goal would be to develop a vaccine and determine whether simple public health measures could prevent the disease.

Eghtesady has studied HLHS for 14 years.

"Prevention is the ultimate goal since long-term outcomes for children with the disease are still less than ideal; many still go on to need transplantation as adults," says Eghtesady. "There is a lot more we need to learn."

## Lifesaving surgeries reshape hearts and lives

One-year-old Anthony Hanson was born with the left side of his heart critically underdeveloped, a condition known as hypoplastic left heart syndrome (HLHS). Anthony has since undergone two successful, life-saving operations in a series of three to reshape his heart's physiology.

Anthony underwent the Norwood procedure at St. Louis Children's Hospital four days after birth and the Glenn procedure four months later; at the age of 2 or 3, he will undergo the Fontan procedure.

His mother, Amber Hanson, described Anthony as "doing wonderfully" at 10 months — walking with assistance, eating regular food and developing normally. Although the surgeries preserve life, they do not restore optimal circulation, says pediatric cardiothoracic surgery Chief Pirooz Eghtesady, MD, PhD, who performed Anthony's surgeries. "If we could find out how to prevent HLHS, that would be the ideal solution," he says.



A series of heart surgeries will improve circulation for Anthony Hanson, shown here with parents James and Amber Hanson.

\*Journal of the American College of Cardiology White Paper. Hypoplastic Left Heart Syndrome: Current Considerations and Expectations. JACC January 2012; 59:1 (Supplement):S1–S42.





Postdoctoral research fellow Vipul Sharma, PhD, left, lab supervisor Lisa Goessling and Pirooz Eghtesady, MD, PhD, seek a possible viral cause of hypoplastic left heart syndrome, a serious congenital condition.

TM PARKER

## HIGHLIGHTS

■ Pirooz Eghtesady, MD, PhD, led a research team using the “aviation black box principle” to record and examine failures in the pediatric cardiac operating room. During a two-year period, all unanticipated operative events were noted, ranging from those with little potential to cause harm to serious safety events. Early in the study, one surgeon recorded events in freehand on index cards after surgery and placed them into a locked box. Later, the surgical team recorded events in real time. The

study, published in the *Journal of the American College of Surgeons*, found that identifying patterns of failure could lead to process-improvement initiatives and potentially improve outcomes.

■ Peter Manning, MD, was one of only four surgeons elected to serve on the Joint Committee on Children with Congenital Heart Defects, a nationwide initiative to improve care for this patient population. Major U.S. children’s hospitals are represented on the committee, composed primarily of cardiologists.

■ Eghtesady and coauthors published their experiences with a comprehensive communication system of briefs and reviews to optimize preoperative, intraoperative and postoperative care in the *World Journal for Pediatric and Congenital Heart Surgery*. The system’s goal is to ensure procedures are carried out in the safest way possible.

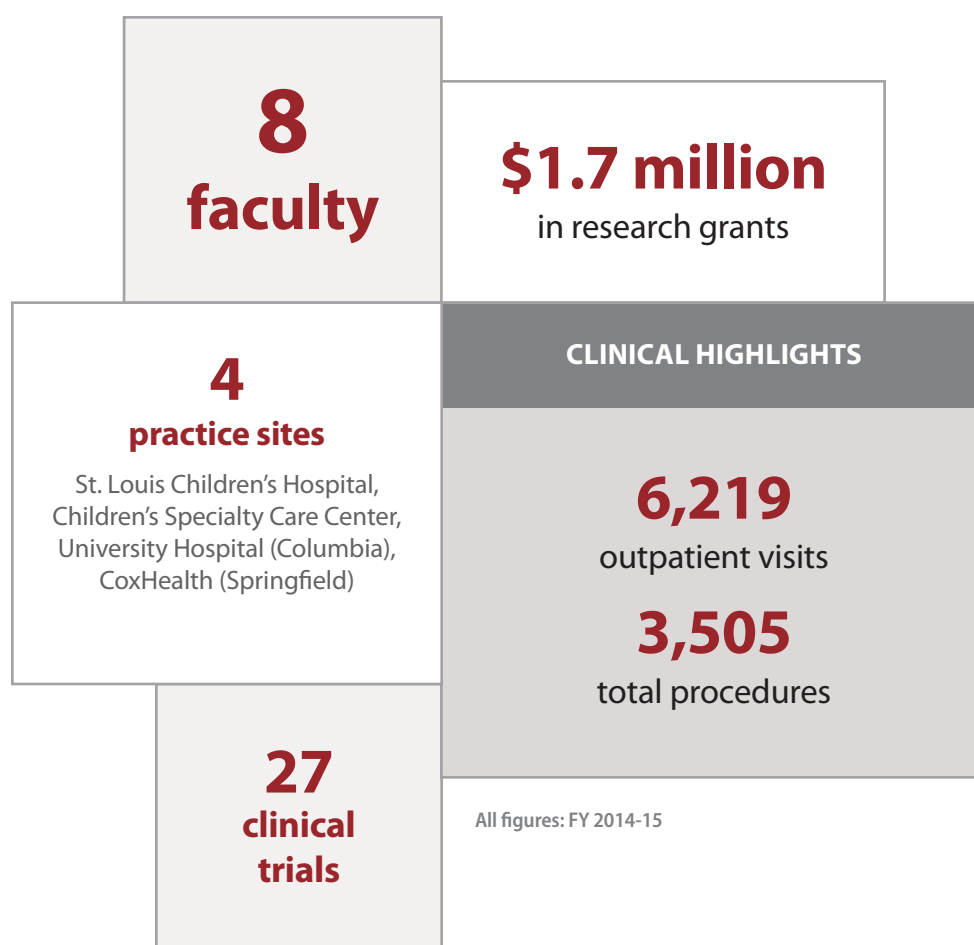


# Division of Pediatric Surgery



Jacqueline Saito, MD, MSCI, finishes a follow-up visit with patient Carrah McDaniel.

The Division of Pediatric Surgery has built a strong reputation in patient care, research and teaching as we continue to expand our services and community outreach. Our division was established in 1972 under pioneering surgeon Jessie Ternberg, MD, among the first to recognize that children have surgical problems distinct from those seen in adults. Today, we offer robust treatment in trauma and congenital conditions, tackle the complications of short-gut syndrome through research, and attract top fellowship candidates.





# Elucidating Short-Bowel Syndrome

**W**ASHINGTON UNIVERSITY PEDIATRIC surgeons, physicians and researchers at St. Louis Children's Hospital are conducting collaborative basic science research to solve a long-standing clinical problem: the complications and poor prognosis often associated with short-bowel syndrome.

In older children and adults, short-bowel syndrome most often results from surgery undergone to treat intestinal diseases, injuries or congenital defects; these procedures can require removal of half or more of the small intestine. In infants, the most common cause is necrotizing enterocolitis, which occurs with premature birth and leads to death of bowel tissue.

In the 1930s, one-year survival was low: about 20 percent. Subsequent improvements in nutrition and surgical approaches have led to improved survival, but patients still battle dehydration, malnutrition, infections and weight loss as their bodies work to digest food.

"Unfortunately, the long-term complication of this is liver failure with the possibility of a liver and/or small intestine transplant," says Brad Warner, MD, the Jessie L. Ternberg, MD, PhD Distinguished Professor of Pediatric Surgery and chief of pediatric surgery.

Warner and colleagues hope to find a solution through T1-stage research in the laboratory. They are investigating what happens to the gut microbiome — the collection of gut microorganisms and their genes — in response to removing the intestine; their long-term goal is to manipulate the microbiome to allow greater nutrient absorption and prevent bacterial infections. Collaborators Barbara Warner, MD, a pediatrician in newborn medicine, and Phillip Tarr, MD, director of the Pediatric Division of Gastroenterology, are analyzing stool samples from babies with necrotizing colitis, and Warner's lab is examining the microbiome in a mouse model. Jeffrey Gordon, MD, director of the Center for Genome Sciences & Systems Biology, is collaborating in the studies. In another project studying a mouse model, urologic researcher Jeffrey Arbeit, MD, and David Curiel, MD, PhD, director of the Department of Radiation Oncology's Division of Cancer Biology, aim to develop a method to deliver growth factor to endothelial cells lining the gut to enhance the cells' function.

"We hope to improve patients' ability to tolerate oral feeding and, ultimately, their outcomes," says Warner.

## Workgroup addresses clinical effectiveness

Pediatric surgeons formed the Program for Optimal Outcomes in Pediatric Surgery (POOPS) to improve clinical effectiveness. Jacqueline Saito, MD, MSCI, leads the group, which works with other centers in clinical trials and the study of severe birth defects.

The group participates in the Midwest Pediatric Surgery Research Consortium (MPSR), a research partnership of pediatric surgeons at 10 children's hospitals. With surgeons at the other MPSR centers, they are conducting trials on the use of needle aspiration alone instead of a chest tube to treat pneumothorax and treatment of uncomplicated appendicitis with antibiotics instead of appendectomy.

Surgeons have also joined the NIH-funded DHREAMS (Diaphragmatic Hernia Research & Exploration; Advancing Molecular Science) study to better understand the molecular genetic basis of congenital diaphragmatic hernia, an often fatal defect in which a hole in the diaphragm allows organs from the abdomen to move into the chest. Future projects include looking at outcomes for another abnormality, esophageal atresia.



Jacqueline Saito, MD, MSCI, leads a program focused on improving clinical effectiveness.

Brad Warner, MD, shown here with Khloe Fenderson, is studying the gut microbiome to find ways to improve nutrient absorption in children with short-bowel syndrome.



## HIGHLIGHTS

■ Martin Keller, MD, medical director of trauma, found there were fewer hospital-acquired conditions in trauma patients at St. Louis Children's Hospital after the hospital became an American College of Surgeons-verified Level 1 Pediatric Trauma Center in 2012. He reported the findings at the Department of Surgery's First Annual Patient Safety and Clinical Effectiveness Meeting in 2014. The improvements resulted from more standardized care.

■ Keller now provides pediatric surgical services on chest wall abnormalities at Shriners Hospitals for Children – St. Louis.

■ Washington University pediatric surgeons now provide an outpatient clinic and outpatient surgical services at CoxHealth in Springfield, Missouri, twice a month. Patients and their families travel to St. Louis Children's Hospital for inpatient operations. Pediatric surgeons continue to provide coverage for surgical services at University Hospital in Columbia.

■ Kathryn Bernabe, MD, was named medical student pediatric surgery rotation director for third- and fourth-year students, working with Clerkship Director John Kirby, MD, and Clerkship Coordinator Douglas Brown, PhD, in this new position.

■ Pediatric surgeons and other Washington University pediatric specialists now treat children at the new Children's Specialty Care Center in West St. Louis County, which features a full-service outpatient center and the Pediatric Acute Wound Service (PAWS).

■ Working with the World Pediatric Project, Brad Warner, MD, provides advanced esophageal surgery for children in other countries who suffer caustic injury from ingesting lye. Patients from as far away as Liberia and the Dominican Republic have traveled to St. Louis for surgery.



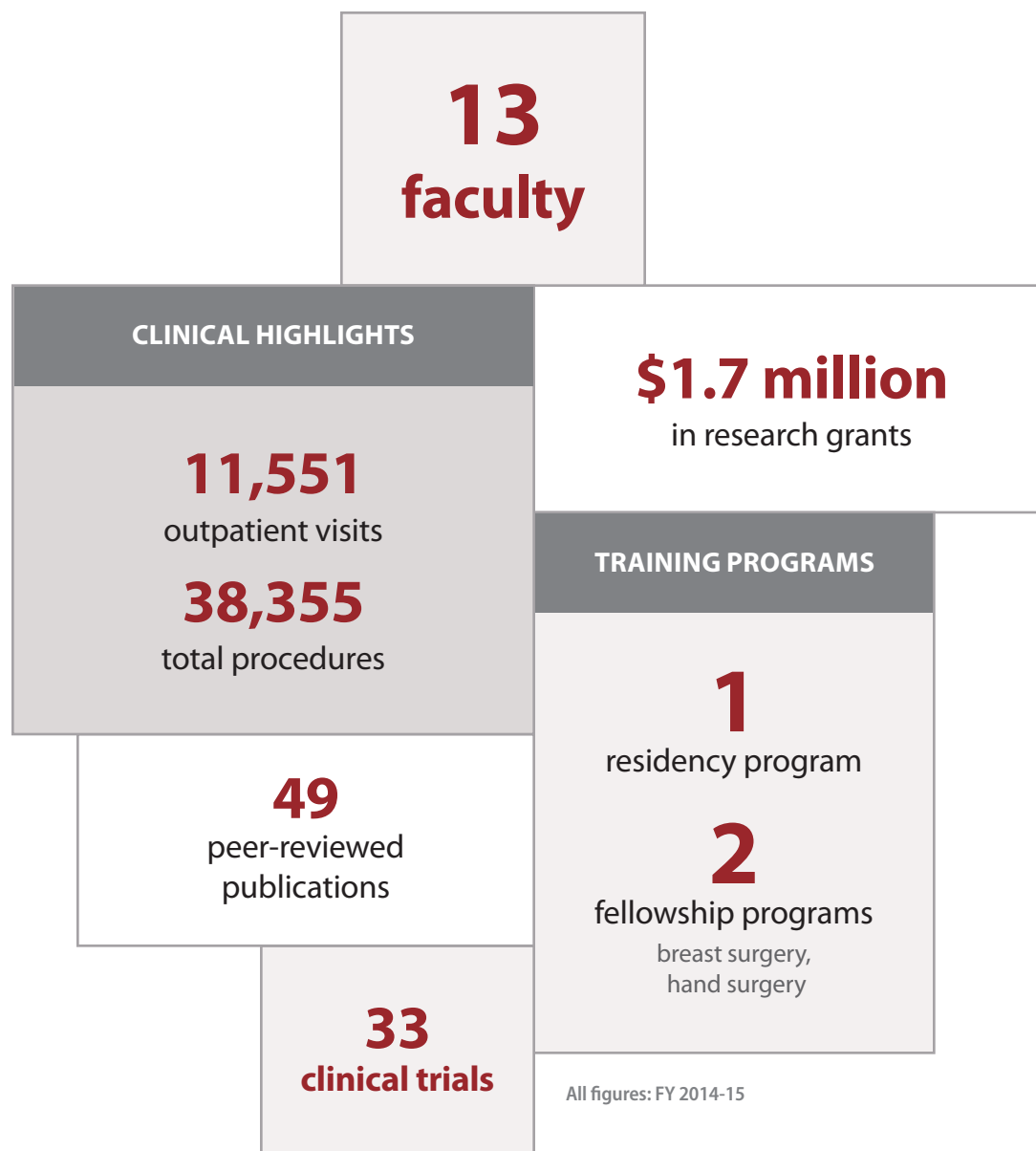
# Division of Plastic and Reconstructive Surgery



Thomas Tung, MD, visits with patient Zachary Eggemeyer about his upcoming hand surgery. The division is known internationally for peripheral nerve surgery and research.



The Division of Plastic and Reconstructive Surgery is focused on advancing patient care through basic and clinical research. Vilray Blair, MD, a founder of the plastic surgery specialty, served as our division's first chief in the early 20th century and trained many of the next generation's leaders. Today, we are known worldwide for peripheral nerve surgery and research; offer advanced treatment in facial paralysis, cleft palate and craniofacial deformities; and consistently send a high percentage of trainees on to academic practice.



# Basic science fuels nerve graft success

**N**EW METHODS TO RESTORE FUNCTION to nerve-damaged arms, legs, hands and feet have revolutionized the treatment of peripheral nerve injuries over the past 30 years. Much of the science contributing to these advancements has emerged — and continues to originate — from the Washington University Peripheral Nerve Research Lab.

“Every question that comes up in the clinic, we have looked at in the laboratory,” says Susan Mackinnon, MD, the Shoenberg Professor and chief of the Division of Plastic and Reconstructive Surgery. “We bring the answers we discover in the lab back to the clinic and the operating rooms at Barnes-Jewish Hospital.”

The lab recently tested the use of an anti-adhesive barrier to treat pain from neuroma, which occurs when scarring forms on the branch of an injured sensory nerve. But the lab’s major current focus takes aim at an old problem: the barrier to successful outcomes in nerve graft surgery.

Nerve grafts involve replacing or bridging the injured portion of a nerve with a segment of unrelated nerve — reinnervating muscles or providing sensation where it has been lost. The grafts should be done in a timely fashion; but even when they are, axon growth through longer grafts to restore functional connections is often inadequate. As a possible cause, the lab is looking at Schwann cells — nerve-sheathing cells that help axons cross the graft but undergo premature senescence, or irreversible decay.

The lab is collaborating with cell biologist Sheila Stewart, PhD, an expert in cell senescence, and is in the T1 stage of translational research to understand the senescence process in nerve grafting.

“Ultimately, we’d like to design methods to prevent the Schwann cells from becoming senescent in the first place,” says Matthew Wood, PhD, a biomedical engineer in Mackinnon’s lab. In tissue culture, the Mackinnon lab is investigating drugs to potentially block inhibitory proteins from the Schwann cells to allow better axon growth.

Wood says he and Mackinnon each bring different perspectives to the research. “It’s wonderful to work with a physician on this type of research to more quickly understand the medical problems that otherwise could take a number of years to fully appreciate.”

## Smile is surgeon’s best reward

After being born with incomplete facial paralysis on the right side of her face, six-year-old Courtney Shepard is learning what a full smile can do.

Tom and Tracy Shepard, Courtney’s parents, brought their daughter to pediatric plastic surgeon Alison Snyder-Warwick, MD, when Courtney was 4. One year later, the surgeon performed surgery to improve the symmetry of her smile — a procedure offered at a limited number of centers nationally. In the procedure, Snyder-Warwick moved muscle from the thigh to the face, connecting the masseteric nerve and facial arteries and veins to the muscle.

It takes about three months for the nerve to grow into the muscle. “Courtney noticed movement about 10 weeks after surgery, and by May 2015, she could smile broadly,” says Snyder-Warwick.

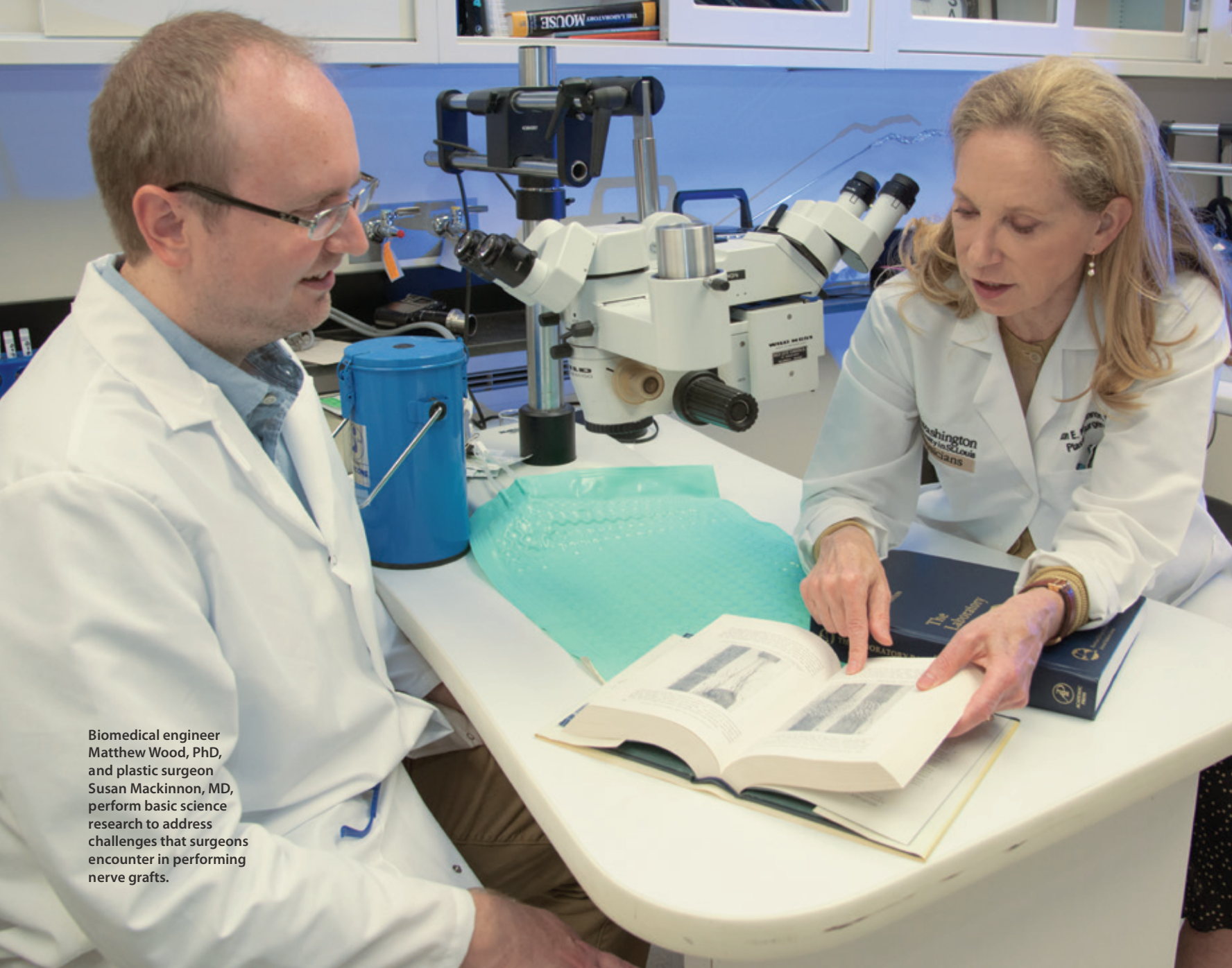
Courtney was initially uncertain about surgery, but now she appreciates her smile and frequently tells her parents, “Check my symmetry.”

“She is doing wonderful,” Tracy says.



Surgery has restored a beautiful smile for Courtney Shepard, born with incomplete facial paralysis on the right side of her face.





Biomedical engineer Matthew Wood, PhD, and plastic surgeon Susan Mackinnon, MD, perform basic science research to address challenges that surgeons encounter in performing nerve grafts.

## HIGHLIGHTS

■ At the Department of Surgery's first annual Patient Safety and Clinical Effectiveness Meeting, Donald Buck II, MD, and plastic surgery resident Minh-Bao Le, MD, presented a study on preparedness of plastic surgery residents for operations. The study found that 100 percent of residents prepare for cases the night before, but only 70 percent adequately review the patient's medical history. The study concludes that training residents in case preparation

will become more important as hospitals place greater emphasis on patient safety and quality improvement.

■ Plastic surgeons have added a white board with surgical and patient information in the plastic surgery operating rooms in the North Campus of Barnes-Jewish Hospital. The right-hand side displays the steps of the operation for the benefit of plastic surgery residents. The left side lists the patient's initials, age, medical history,

physical examination results and other information. By making that information easily accessible, the goal is to fully engage the entire surgical team in care of the patient.

■ Albert Woo, MD, received a grant from The Foundation for Barnes-Jewish Hospital to fund a 3-D printer that will be used to create craniofacial models that guide him in the operating room. See article on page 18.



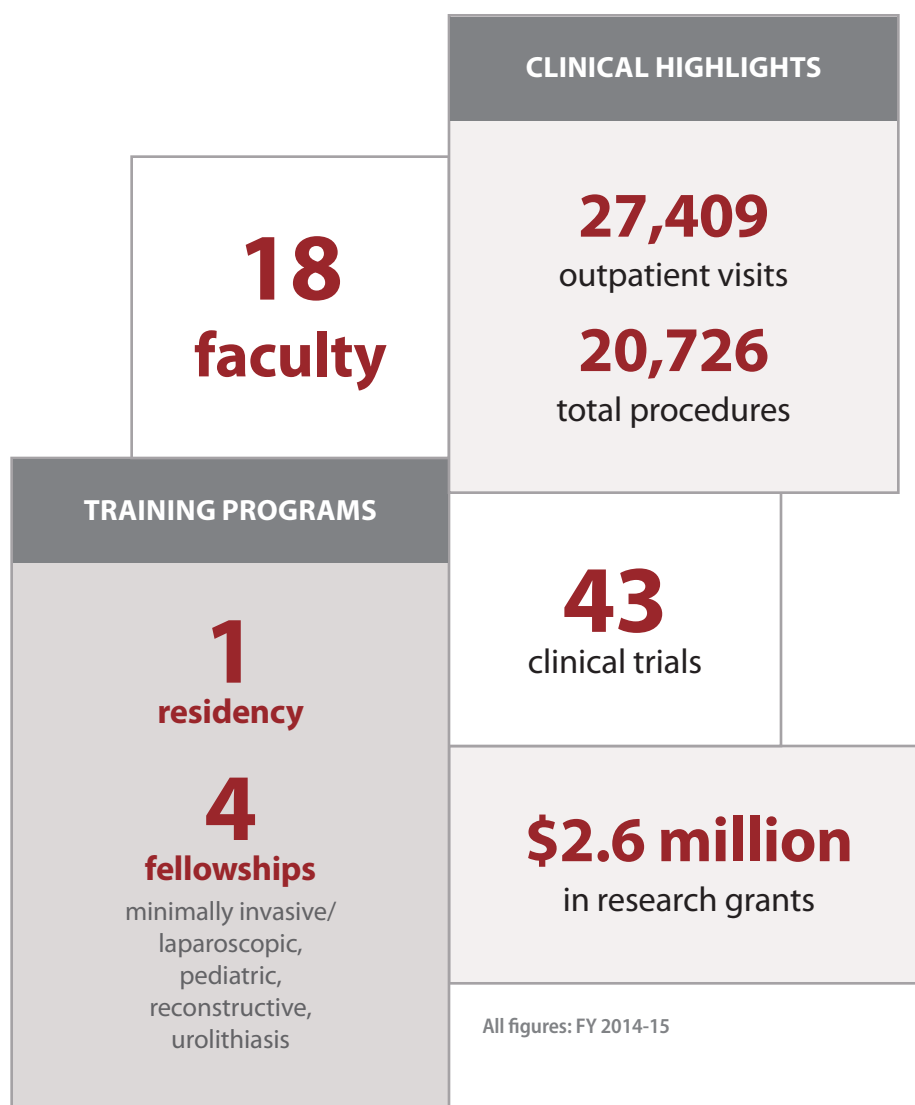
# Division of Urologic Surgery

Arnold Bullock, MD, visits with patient Joseph Griffin. Bullock was named the Alan A. and Edith L. Wolff Distinguished Professor of Urology in 2014.





The Division of Urology draws on a history spanning close to a century and faculty representing the full spectrum of urologic subspecialties. Our surgeons treat all urologic cancers and conditions, and our researchers have contributed major advances in the early detection and treatment of prostate cancer. From 1965-2012, our division was credited with the second-highest number of scientific articles rated in the top 100 in our field. And in our education mission, we offer highly regarded residency and fellowship programs.



# Refining prostate cancer diagnosis

**P**ROSTATE CANCER is the second-leading cause of cancer death in American men, but many prostate cancers grow so slowly they never become a health problem. So for urologists, the diagnosis often poses a dilemma: Which patients need aggressive therapy and which are better served by active surveillance to avoid unwanted side effects of treatment?

“The problem with the PSA test is that it’s often falsely positive in men who do not have cancer and leads to the discovery of nonaggressive cancer more often than aggressive cancer,” says Barnes-Jewish Hospital surgeon Gerald Andriole Jr., MD, the Robert K. Royce Distinguished Professor of Urologic Surgery and chief of the Division of Urology.

Andriole says better markers are needed to distinguish between nonaggressive cancer, which can be treated with a watch-and-see approach, and aggressive cancer that requires immediate treatment. He and colleagues are collaborating with Traxxson, a developer of molecular tests based in St. Louis’ biomedical corridor, to generate a 12-marker panel to diagnose aggressive prostate cancer. So far, using a few hundred serum samples from a Washington University biorepository, they have established a computer algorithm that can detect prostate cancer and distinguish markers that indicate more aggressive vs. low-risk cancer.

“Now that we’ve developed the training algorithm, we will perform a validation study with blinded samples of another couple hundred patients from Washington University and Johns Hopkins University and see how well the algorithm performs,” says Andriole.

Their work — applying basic knowledge of the disease’s mechanisms to develop a new diagnostic method and then performing early proof-of-concept testing — falls in the T1 stage of translational research.

Washington University has consistently been at the epicenter in prostate cancer screening translational research: The first systematic evaluation of the PSA test was conducted by Washington University urologists, and Andriole is chairman of the prostate committee of the NCI’s Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Trial. The study of approximately 80,000 men delineated the limitations of PSA screening for men in their 50s and 60s.

## Clinic addresses congenital abnormalities

Urologists Steven Brandes, MD, and Gino Vricella, MD, have opened a multidisciplinary clinic to treat adults with congenital abnormalities of the bladder, kidney and penis.

Conditions treated include urinary complications of spina bifida; congenital defects such as exstrophy, in which the bladder is outside the body; and posterior urethral valves, in which flaps of tissue grow in the urethra and can cause kidney damage. Physicians will address a variety of issues, including those related to sexual function, fertility, pregnancy, incontinence, urinary tract infections and other problems that affect quality of life. Patients with non-urinary problems will be seen by orthopedic surgeons, neurosurgeons, colorectal surgeons and other specialists.

“There are only a handful of multidisciplinary programs like this in the entire country to address transition urology,” says Brandes. “This is a unique program for a very underserved community.”



Gino Vricella, MD, left, and Steven Brandes, MD, right, are teaming up to improve treatment for congenital urologic abnormalities.

Working with a local company, Gerald Andriole, MD, right, and surgical colleagues are developing a 12-marker test panel to distinguish aggressive prostate cancer from low-risk forms of the disease.



## HIGHLIGHTS

Washington University urologists and researcher Samuel Achilefu, PhD, are developing a new application for goggles that help surgeons distinguish between cancer cells and healthy cells during surgery. Cancer cells — labeled with a tumor-seeking contrast agent — glow blue when viewed through the goggles. Washington University researchers already have shown the goggles, which Achilefu adapted from military night-vision glasses, to be useful in open surgical procedures. They

are now developing an optical system for laparoscopic partial kidney removal and transurethral removal of bladder tumors.

Robert Figenshau, MD, and Sam Bhayani, MD, co-authored a study reporting that a test measuring the presence of proteins in the urine was more than 95 percent accurate in identifying early-stage kidney cancers. Researchers Evan Kharasch, MD, PhD, and Jeremiah Morrissey, PhD, led the study.

Erica Traxel, MD, was named program director of the Urology Residency Program. Traxel is a pediatric urologist who completed her urology residency at Washington University and a pediatric urology fellowship at Cincinnati Children's Hospital.

The division expanded its outreach in the community by offering services at Christian Hospital in north St. Louis County, Cox Health in Springfield, Missouri, and the Children's Speciality Care Center in West St. Louis County.

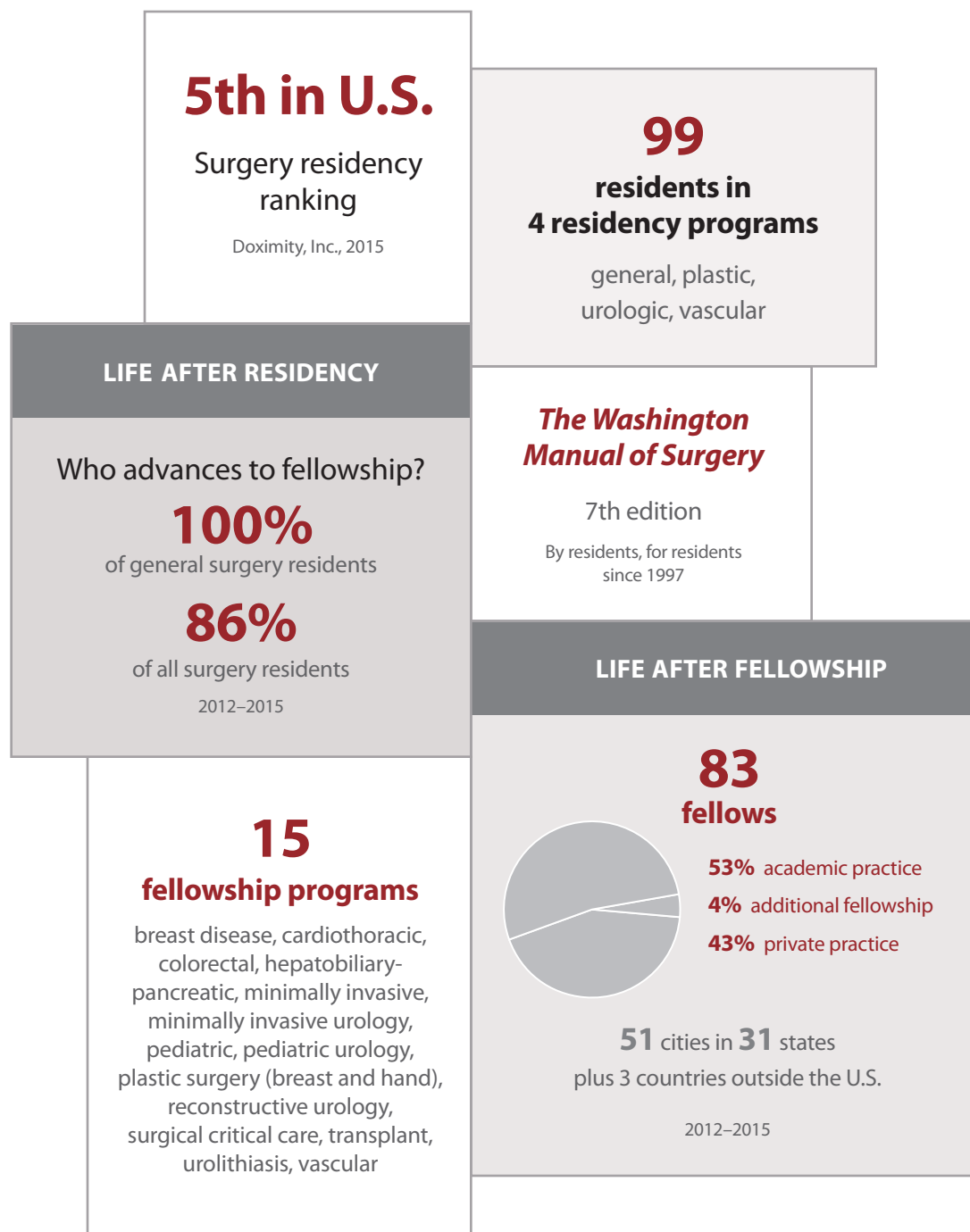


# Education



Douglas Schuerer, MD, left, director of trauma, discusses cases with surgical residents. Schuerer and colleagues are leaders in developing state-wide regulations and practices for emergency and trauma care.

Throughout our department's 100-year history, education has been a central part of our mission. Our training model initially was comparatively passive: "See one, do one, teach one." Today, our approach is more structured, and with the intensive growth of surgical specialization, options are numerous. Our programs lead national trends in simulation training, competency-based advancement and early specialization. Trainees treat large, diverse patient populations at Barnes-Jewish Hospital, St. Louis Children's Hospital and other centers.





# Broadening residents' research skills

**T**HE DEPARTMENT'S long-standing focus on translational research encompasses all of its missions, including education. During their required research years, general surgery residents gain the skills to closely connect basic science research with treatment methods, use data analysis to measure clinical effectiveness, or set up clinical trials. Research begins after the second or third residency year and continues at least two years.

"Decades ago, residents who performed research typically did basic science in a physiology lab," says Ryan Fields, MD, director of resident research. "Now, as a group, their work is very broad. Many perform basic science geared toward developing new treatment modalities, but a number also do epidemiologic and cost-effectiveness research. Collectively, their research goes from the single-cell level to the population level."

The work of three general surgery residents illustrates the point:

Matthew Strand, MD, works on T1-stage basic science in mice that holds the promise of improving cancer treatment. In Fields' lab, Strand is using gene-silencing materials carried by nanoparticles to disrupt genes that contribute to pancreas and colorectal cancers, with the goal of limiting or even reversing tumor progression.

Pamela Samson, MD, MPHS, has performed T3-stage research analyzing the treatment of lung and esophageal cancer patients through the National Cancer Data Base, run jointly by the American College of Surgeons and American Cancer Society. She finds that stage I lung cancer patients who undergo surgery more than eight weeks from diagnosis have a lower median survival. She and a mentor, thoracic surgeon Varun Puri, MD, MSCI, will analyze causes for these delays at Barnes-Jewish Hospital and may develop a clinical trial to evaluate potential solutions.

Dominic Sanford, MD, MPHS, performed T1-stage basic research showing that a drug that inhibits the CCR2 gene decreases pancreas cancer tumor growth. He designed and is now conducting a phase III clinical trial to test the drug in human patients.

Both Sanford and Samson completed master of population health sciences degrees at Washington University, gaining essential research skills.

"There is no shortage of research opportunities here; we have experts in every field," says Strand.

## National residency curriculum widely adopted

Mary Klingensmith, MD, vice chair for education and the Mary Culver Distinguished Professor of Surgery, was recruited by the Surgical Council on Resident Education (SCORE) in 2009 to lead the development of a national surgery residency training curriculum. The resulting SCORE curriculum, available since 2009, has been adopted by all but one of the 254 U.S. general surgery residency programs.

Klingensmith began as chair of the SCORE Planning Committee and is now vice president for SCORE, Inc.

"SCORE was established to provide a standard national curriculum for general surgery residencies and to address a disparity in the access to teaching materials that existed between smaller community residency programs and the larger, well-resourced programs," says Klingensmith. "The curriculum is now on a web portal and is accessible to everybody."

SCORE currently is developing content for pediatric surgery, vascular surgery, surgical critical care and surgical oncology fellowships.



Mary Klingensmith, MD, left, led development of a nationally standardized residency training curriculum that is nearly universally adopted.



Left to right: Research by general surgery residents Pamela Samson, MD, Dominic Sanford, MD, and Matthew Strand, MD, runs the gamut from basic lab investigations to clinical outcomes research.

TIM PARKER

## HIGHLIGHTS

■ Residents Paul Evans, MD, PhD, and Joshua Sommovilla, MD, won the Surgical Jeopardy contest held at the Annual Clinical Congress of the American College of Surgeons in October 2014. The game is modeled after the Jeopardy television show and tests the general and specialty surgery knowledge of residents from 24 programs. It was the second time in three years that Washington University general surgery residents won the contest.

■ General surgery resident Joshua Sommovilla, MD, won the Association for Surgical Education (ASE) "Outstanding Resident Teaching Award" at the association's 2015 annual meeting. The award is presented to four residents considered by their chair, faculty or residents/students to be outstanding teachers. Sommovilla, a research resident working in the Intestinal Adaptation Laboratory, a pediatric research lab led by Pediatric Surgery Chief Brad Warner, MD, also received a Surgical Education Research Fellowship through the ASE.

■ The Department of Surgery and Washington University's Olin Business School have entered into an agreement that allows faculty, residents and fellows to count 12 hours of previously earned graduate credit toward a master of business administration (MBA) degree. They may also substitute MCAT scores for a GMAT/GRE score in seeking admission. The degree requires completion of 42 credit hours and provides training to manage business operations and shape health-care policy.

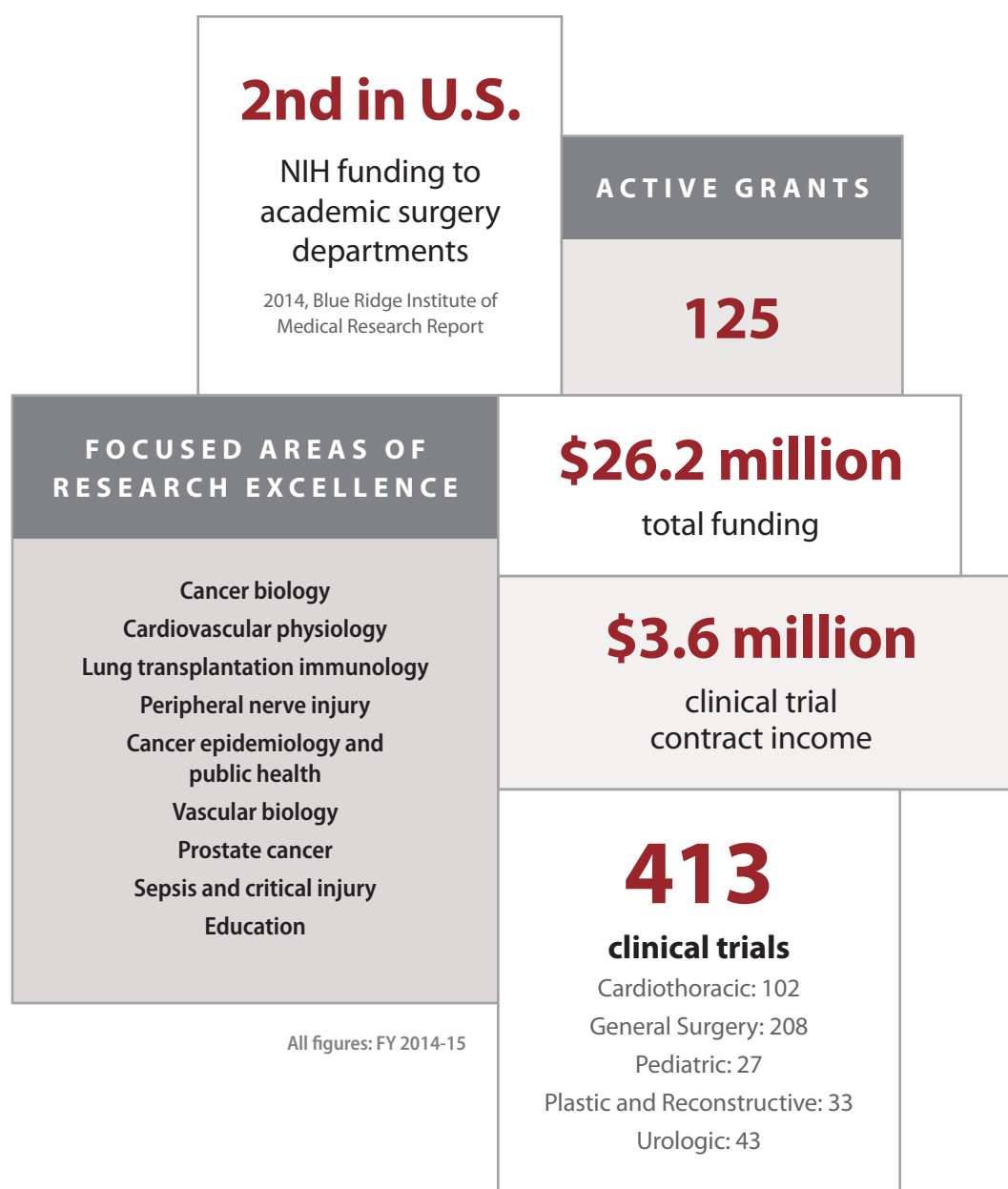


# Research



Fourth-year surgery resident Iheoma (Oma) Nwaogu, MD, right, reviews results of her research with endocrine and oncologic surgeon Julie Margenthaler, MD.

The Department's research enterprise is among the largest of its peers in the nation. Embracing Washington University's historical strength in collaborative biomedical research, our work encompasses the full spectrum of translational science, involving faculty from nearly every department of the School of Medicine. Research is ingrained in our culture, fostered by an institution-wide critical mass of outstanding faculty and facilities. And with a large full-time surgical faculty to support our busy clinical operations, surgeon-scientists have the flexibility they need to pursue critical questions aimed at advancing human health.





# Supporting translational science

**T**HE DEPARTMENT OF SURGERY strongly supports translational research from bench science through population-level investigations. Yet, today, its research landscape is changing as competition for funding grows and the department's faculty look for innovative ways to translate scientific knowledge into clinical advances.

## Basic And Translational Research

Despite a challenging funding environment, the department has more than \$26 million in basic and translational research support and 125 peer-reviewed, investigator-initiated grants. Although the department continues to receive notable basic research funding, the NIH is placing greater emphasis on applied research, so many surgeons are following suit.

"In the past, a surgeon might just do basic research," says Vice Chair for Research William Gillanders, MD. "But now that type of funding is harder to get, and surgeons are seeking translational research opportunities."

## Clinical Research

The department strengthened its approach to clinical trials by forming the Clinical Research and Data Management (CRDM) office, which serves as an interface between investigators, regulatory officials and sponsors. Services include education, mentorship and guidance for staff regarding study start-up, subject recruitment, billing policies, and quality assurance for data collection and entry. The CRDM also has developed internal educational and training programs and standards on improving Good Clinical Practice (GCP) training and quality assurance. Over the past five years, the number of clinical trials has risen exponentially to more than 400, and funding has grown to almost \$3.6 million.

## Public Health Research

The Division of Public Health Sciences began in 2010 under Graham Colditz, MD, DrPH. Colditz has since recruited more than 20 faculty, including epidemiologists, health educators and specialists in outcomes research methods. The division conducts studies at the population level and is a major resource for faculty throughout the medical school.

"If we are going to move to a population-based health-care system, having a public health sciences division will be critically important," says department Chair Timothy Eberlein, MD.

## Department hallmark: multidisciplinary collaboration

A key to success for many Department of Surgery researchers is collaboration with other departments and institutions. Prominent examples include:

- P30 Cancer Center Support Grant, led by department Chair Timothy Eberlein, MD. This award covers six schools within Washington University, 25 university departments and a formal consortium with Saint Louis University.
- Division of Plastic and Reconstructive Surgery Chief Susan Mackinnon, MD, Amy Moore, MD, and Matthew Wood, PhD, have established collaborations with the Department of Biomedical Engineering to use tissue engineering approaches to improve peripheral nerve regeneration.
- Vice Chair for Research William Gillanders, MD, and Robert Schreiber, PhD, Alumni Professor of Pathology and Immunology, have studied the role of mutant tumor antigens in the response to checkpoint blockade therapy.



Collaboration is a key component of all stages of translational research.

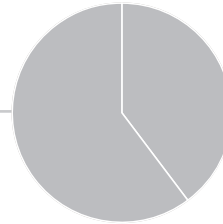
## RESEARCH GRANTS

Total: \$26,224,376

### By Source

**Government:**  
\$15,807,619

National Institutes  
of Health (NIH)  
\$14,531,575  
Department of  
Defense/Army  
\$1,079,483  
Agency for Healthcare  
Research and Quality  
(AHRQ)  
\$133,497  
NIH Subawards  
\$55,414  
Department of  
Education  
(work study funds)  
\$7,650

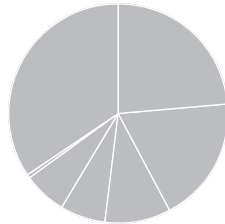


**Non-Government:**  
\$10,416,758

The Foundation for  
Barnes-Jewish Hospital  
\$2,955,712  
Burroughs Wellcome  
Fund  
\$2,500,000  
St. Louis Children's  
Hospital Foundation  
\$1,780,409  
NIH Subawards  
\$1,200,058  
Other Private  
Foundations  
\$1,149,332  
Industry  
\$395,099  
Professional Societies  
and Foundations  
\$360,038  
Other  
\$76,110



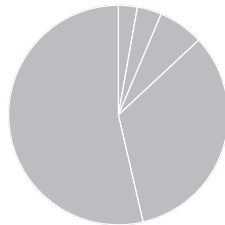
### By Division



Public Health Sciences	\$9,034,308
Cardiothoracic Surgery	\$6,260,941
General Surgery	\$4,879,592
Urologic Surgery	\$2,551,466
Pediatric Surgery	\$1,701,281
Plastic and Reconstructive Surgery	\$1,689,967
Chair	\$106,821

## CLINICAL TRIAL CONTRACT INCOME

Total: \$3,591,467



General Surgery	\$1,934,749
Cardiothoracic Surgery	\$1,193,767
Urologic Surgery	\$234,632
Plastic and Reconstructive Surgery	\$138,581
Public Health Sciences	\$89,738

All figures: FY 2014-15

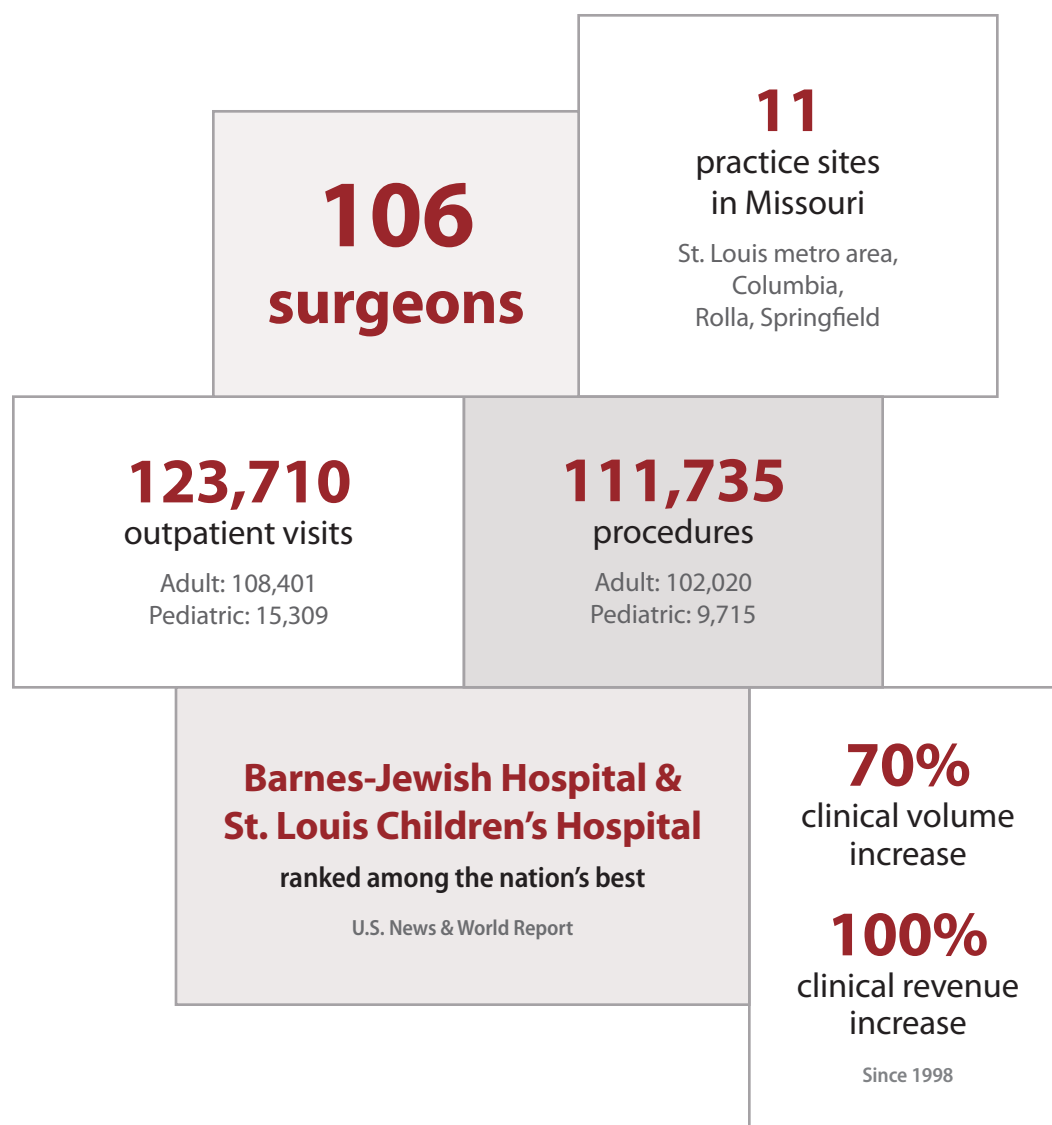


# Clinical Operations



Plastic and reconstructive surgeon Marissa Tenenbaum, MD, performs a breast procedure.

For more than 100 years, our department has been a national leader in surgical innovation, translating advancements from its extensive research activities into better methods of diagnosis, treatment and prevention. Today, we provide multidisciplinary care in nearly every surgical subspecialty, with a focus on excellence, quality and safety. Through strong partnerships with our nationally ranked hospital partners — Barnes-Jewish Hospital and St. Louis Children's Hospital — and expansion to 11 practice sites, our clinical practice continues to flourish.





# Improving safety and outcomes

**T**HE DEPARTMENT OF SURGERY continues to strengthen its patient safety and clinical effectiveness programs at Barnes-Jewish Hospital and Barnes-Jewish West County Hospital through workgroups that analyze outcomes data and take steps to improve care.

Two years ago, the department established surgeon-led teams to address surgical-site infections (SSIs), venous thromboembolism events and postoperative heart attacks. As an example of these efforts, for patients undergoing colorectal and urologic surgery, the SSI team developed and implemented a set of standardized protocols that have led to better outcomes. Currently, the team is studying which steps mattered most, with a goal of eliminating ones that made no difference.

“To minimize surgical site infections, our protocol starts at the patient’s home,” says Gerald Andriole Jr., MD, the Robert K. Royce Distinguished Professor of Urologic Surgery and division chief. “Additionally, there are special steps in pre-op, during surgery, and postoperatively. The goal is to minimize SSIs and to enhance early recovery after surgery.”

Andriole, who was recently named the department’s vice chair for patient safety and clinical effectiveness, leads a formal departmental organization charged with assessing and improving quality of care. In the past year, the department also held its First Annual Patient Safety and Clinical Effectiveness Meeting, highlighting projects in which faculty and trainee groups identified clinical problems, outlined steps to address them and reported on outcomes.

Surgeon Bruce Hall, MD, PhD, MBA, serves as vice president for patient outcomes at BJC HealthCare — one of the nation’s largest academic hospital groups. Hall has worked with other department surgeons on the patient safety and quality initiatives and tracks results through the National Surgical Quality Improvement Program of the American College of Surgeons (ACS NSQIP®). He is associate director of the ACS NSQIP nationwide, and has led its implementation at BJC hospitals.

Hall says value-based purchasing and high-risk contracts are realities that encapsulate the future. “The government is now setting the example that it won’t pay for volume of procedures, but for quality. In a high-risk contract, you get paid to take care of a patient for a set period, no matter what happens,” he says.

## New appointments support improvement efforts

Urology Division Chief Gerald Andriole Jr., MD, the Robert K. Royce Distinguished Professor of Urologic Surgery, has been named vice chair for patient safety and clinical effectiveness. Andriole also leads the department’s Patient Safety and Clinical Effectiveness Committee.

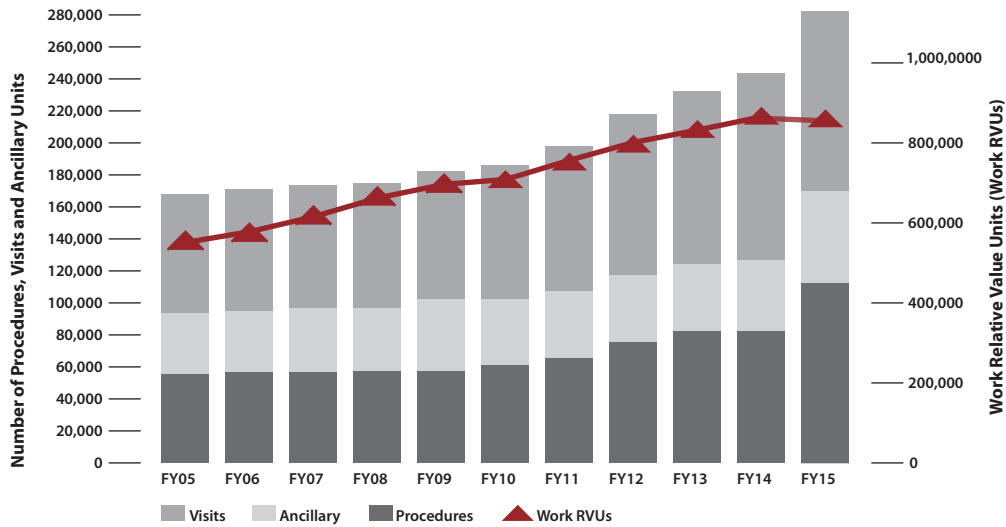
The department has developed an organized structure to promote patient safety and clinical effectiveness. Each division and section has two surgeons providing leadership, one with responsibility for patient safety and the other for clinical effectiveness. Tracey Guthrie, RN, director of clinical trials, is now also director of clinical effectiveness. Vicky Peck, RN, director of clinical operations for the urology division, coordinates patient safety activities.

The team works with surgeon Bruce Hall, MD, PhD, MBA, BJC HealthCare vice president for patient outcomes, who oversees data collection for the American College of Surgeons’ National Surgical Quality Improvement Program (ACS NSQIP®) and leads other quality improvement efforts at BJC hospitals.



Gerald Andriole, MD, will lead new patient safety and clinical effectiveness efforts.

## DEPARTMENT OF SURGERY CLINICAL ACTIVITY



Fiscal Year 2014–2015

Visits: 123,710  
Ancillary: 45,866  
Procedures: 111,735  
Work RVUs: 837,512

## Clinical Locations

### St. Louis Metro Area

#### Barnes-Jewish St. Peters Hospital

St. Peters  
Breast, Thoracic, Vascular

#### Barnes-Jewish West County Hospital

Creve Coeur  
Cardiac, Colorectal, Plastic, Urologic, Vascular

#### Christian Hospital

St. Louis  
Breast, Cardiac, General, Plastic, Urologic

#### Siteman Cancer Center-St. Peters

St. Peters  
Breast, Thoracic

### Siteman Cancer Center-South County

St. Louis  
Colorectal, Hepatobiliary-Pancreatic and Gastrointestinal, Thoracic, Urologic

### Siteman Cancer Center-West County

Creve Coeur  
Colorectal, Hepatobiliary-Pancreatic and Gastrointestinal, Thoracic

### St. Louis Children's Specialty Care Center

Town and Country  
Pediatric, Plastic & Reconstructive, Urologic

### Washington University Medical Center

St. Louis  
All specialties

### Columbia

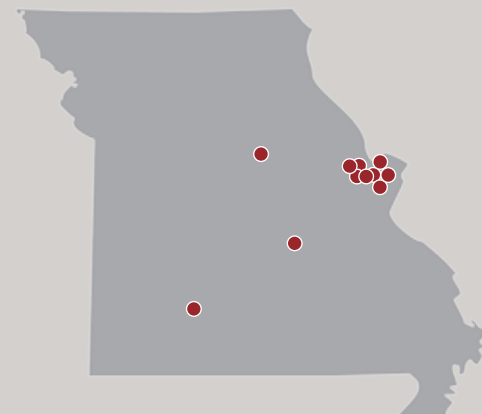
University Hospital  
Pediatric

### Rolla

Phelps County Regional Medical Center  
Vascular

### Springfield

CoxHealth in Springfield  
Pediatric, Urologic





# Washington University Medical Center



**W**ASHINGTON UNIVERSITY MEDICAL CENTER is among the largest academic medical centers in the nation. It is made up of Washington University School of Medicine, Barnes-Jewish Hospital, St. Louis Children's Hospital, and BJC HealthCare. The School of Medicine's 1,300 specialty and primary care clinicians who make up Washington University Physicians — the School of Medicine's clinical practice group — comprise the medical staffs at Barnes-Jewish and St. Louis Children's hospitals. Washington University Physicians is one of the largest academic clinical practices in the nation.

Barnes-Jewish Hospital is the largest hospital in Missouri, with 1,315 beds. It has been ranked on U.S. News & World Report's Honor Roll of America's best hospitals for 23 consecutive years, holds advanced certification from the Joint Commission on lung volume reduction surgery and ventricular assist devices and is an American College of Surgeons-verified Level I trauma center.

St. Louis Children's Hospital is the largest children's hospital in the region, with 264 beds and

an American College of Surgeons-verified Level I pediatric trauma center. It offers comprehensive services in every pediatric medical and surgical specialty and is recognized as one of America's top children's hospitals by U.S. News & World Report, which in 2015 ranked the hospital in all 10 specialties surveyed.

The Alvin J. Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine is the only National Cancer Institute-designated Comprehensive Cancer Center in Missouri and is ranked as one of the nation's top cancer facilities by U.S. News & World Report. It is among the top five nationally in patient volume.

Multidisciplinary, collaborative research is a hallmark of the school, which is renowned for its work in nearly every area of biomedicine. Interdisciplinary research centers address common pathways to disease; new facilities provide flexible lab space and foster team science. U.S. News & World Report perennially ranks the school's graduate programs among the nation's best. Faculty are authors of the Washington Manual of Medical Therapeutics, the most widely sold medical textbook in the world.





A major campus renewal project now underway consolidates and expands surgical services, cancer care, and other programs, expands private inpatient beds, and incorporates outpatient clinics and diagnostics.

**1,324**  
**physicians**

(university-employed)

**76**  
specialties and subspecialties

**1,579**  
hospital beds

**91,063**  
hospital discharges\*  
Barnes-Jewish Hospital and  
St. Louis Children's Hospital

\*2013

**83**  
accredited  
residency and  
fellowship  
programs

**\$464.7 million**  
research grants and contracts  
including \$325.2 million  
from the NIH

FY 2013–14

**986,714**  
outpatient visits

2013



# Leadership

## National and International Organizations

**Rebecca Aft, MD, PhD**  
**L. Michael Brunt, MD**  
**Jeffrey Lowell, MD**  
Professors of Surgery  
*Elected to American Surgical Association*

**Steven Brandes, MD**  
Professor of Surgery  
Division of Urologic Surgery  
*President-Elect, Society of Genitourinary Reconstructive Surgeons*

**Keith Brandt, MD**  
William G. Hamm Professor of Plastic Surgery  
Division of Plastic and Reconstructive Surgery  
*Executive Director of the American Board of Plastic Surgery*

**Michael Brunt, MD**  
Chief of the Section of Minimally Invasive Surgery  
*President of the Society of American Gastrointestinal and Endoscopic Surgeons*

**William Chapman, MD**  
Eugene M. Bricker Professor of Surgery  
Chief, Division of General Surgery and Section of Transplant Surgery  
*President, Western Surgical Association*

**Patrick Geraghty, MD**  
Professor of Surgery  
Section of Vascular Surgery  
*President, Midwestern Vascular Surgical Society*

**Mary Klingensmith, MD**  
Mary Culver Distinguished Professor of Surgery  
*Vice Chair for Education*  
*President, Association for Surgical Education*

**Daniel Kreisel, MD, PhD**  
Professor of Surgery  
Section of Thoracic Surgery  
Director of Lung Transplantation  
*Chair, General Thoracic Biology Club, American Association for Thoracic Surgery*

**Jennifer Lawton, MD**  
Professor of Surgery  
Section of Cardiac Surgery  
*Councilor, American Association for Thoracic Surgery*

**John Mazuski, MD, PhD**  
Professor of Surgery  
Section of Acute and Critical Care Surgery  
*President-Elect, Surgical Infection Society*

**Marc Moon, MD**  
John M. Shoenberg Chair in Cardiovascular Disease  
Chief, Section of Cardiac Surgery  
*Secretary, American Association for Thoracic Surgery*

**G. Alexander Patterson, MD**  
Joseph C. Bancroft Professor of Cardiothoracic Surgery  
*Editor, Annals of Thoracic Surgery*

## National and International Awards

**Patrick Geraghty, MD**  
Professor of Surgery  
Section of Vascular Surgery  
*Hero with a Heart Award, Marfan Foundation*

**William Gillanders, MD**  
Professor of Surgery  
Vice Chair for Research  
*2015 Cancer Researcher of the Year, Gateway for Cancer Research*

**Bruce Lee Hall\*, MD, PhD, MBA, and American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP®)**  
*John M. Eisenberg Patient Safety and Quality Award, The Joint Commission and National Quality Forum*  
\*Professor of Surgery, BJC HealthCare Vice President for Patient Outcomes

**H. Henry Lai, MD**  
Associate Professor of Surgery  
Division of Urologic Surgery  
*Zimskind Award; Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction*  
*Rising Star Award, American Urological Association*

**Matthew Mutch, MD**  
Chief, Section of Colon and Rectal Surgery  
*Victor Fazio Editorial Award for work as contributing editor of Diseases of the Colon & Rectum*

**Mohamed Zayed, MD, PhD**  
Assistant Professor of Surgery  
Section of Vascular Surgery  
*Vascular Cures' 2015 Wylie Scholar award, co-sponsored by the Society for Vascular Surgery*

## Washington University School of Medicine Awards

**Bryan Meyers, MD, MPH**  
Patrick and Joy Williamson Chair in Cardiothoracic Surgery  
Chief, Section of Thoracic Surgery  
*WUSM 2015 Distinguished Educator — House Staff Teaching Award*

## Community Awards

**Arnold Bullock, MD**  
Alan A. and Edith L. Wolff Distinguished Professor in Urology  
*Lifetime Achiever in Health Care Award, St. Louis American*

## Awards, national roles recognize faculty accomplishments



L. Michael Brunt, MD

### Brunt address highlights SAGES accomplishments

L. Michael Brunt, MD, chief of the Section of Minimally Invasive Surgery, combined his administrative responsibilities and a busy clinical year with many duties and initiatives as president of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) in 2014-15.

Brunt joined SAGES in 1992, when the organization was 11 years old and laparoscopic surgery was in its infancy. Since then, the organization has grown to more than 6,300 members with a mission of promoting patient care and safety in gastrointestinal and endoscopic surgery through education, research and innovation.

In his presidential address at the SAGES 2015 Annual Meeting on April 17 in Nashville, Tennessee, Brunt reflected on the organization's past and how SAGES came to lead the laparoscopic revolution in the early 1990s. He noted that this year, SAGES had awarded the 10,000th certificate in the Fundamentals of Laparoscopic Surgery Program and had recently implemented the Fundamental Use of Surgical Energy Program to promote operative safety. Brunt also has created a Safe Cholecystectomy Task Force to reduce biliary injuries.

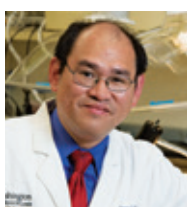
Brunt spoke of the opportunities SAGES had given him and encouraged members to take full advantage of the opportunities before them to make a difference in the surgical world and to their patients.



Keith Brandt, MD

### Brandt heads American Board of Plastic Surgery

Keith Brandt, MD, the William G. Hamm Professor of Plastic Surgery, became executive director of the American Board of Plastic Surgery (ABPS) on Aug. 1, 2015. As executive director, he will carry out the decisions of the ABPS board of directors, manage the ABPS board office in Philadelphia and run the written, oral and maintenance of certification examinations for the board. He will represent the board at society meetings and training programs. Brandt also serves as the liaison between the ABPS and the American Board of Medical Specialties — the umbrella organization of the 24 member boards — and as liaison to the Accreditation Council for Graduate Medical Education and the Plastic Surgery Residency Review Committee.



H. Henry Lai, MD

### Lai honored with Zimskind Award

Washington University urologic surgeon-scientist Henry Lai, MD, won the 2015 Paul Zimskind Award from the Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction for his research and leadership in the field of chronic pelvic pain. The award was first given in 1979 and honors Zimskind, a renowned urologic researcher and educator who served as chairman of the urology department at Jefferson Medical College. Lai has conducted his research as part of the Multidisciplinary Approach to the Study of Urologic Chronic Pelvic Pain (MAPP) Research Network, established by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). He has been principal investigator of a MAPP discovery site grant since 2014. Lai received the American Urological Association Rising Stars in Research Award in 2014.



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## New Faculty



**Jeffrey Blatnik, MD**  
*Minimally Invasive Surgery*

Jeffrey Blatnik, MD, joined the Section of Minimally Invasive Surgery as an assistant professor after completing a minimally invasive surgery fellowship at Case Western Reserve University in Cleveland, Ohio. He also completed a general surgery residency and earned a medical degree at Case Western Reserve University. Blatnik will focus on minimally invasive foregut surgery, inguinal hernia repair and laparoscopic diaphragm pacing for the treatment of spinal cord injury.



**Eleanor Drew, MD**  
*Acute and Critical Care Surgery*

Eleanor Drew, MD, was named an assistant professor in the Section of Acute and Critical Care Surgery. She joins the faculty after completing a surgical critical care fellowship at Washington University and a general surgery residency at University of Chicago Hospitals. She graduated from the University of Chicago Pritzker School of Medicine. Drew will specialize in surgical critical care, trauma and burn surgery.



**Feng Gao, MD, PhD, MPH, MS**  
*Public Health Sciences*

Biostatistician Feng Gao, MD, PhD, MPH, MS, has joined the Division of Public Health Sciences as an associate professor of surgery. He has a joint appointment in the Division of Biostatistics, where he has served on the faculty since 2003. Gao received medical and master of public health degrees at Beijing Medical University in China, and master's and doctoral degrees in biostatistics at Emory University in Atlanta. He provides statistical support for cancer-related studies at the Siteman Cancer Center. His responsibilities include study design, safety monitoring, data analysis and manuscript/abstract preparation.



**Grant Kleiber, MD**  
*Plastic and Reconstructive Surgery*

Grant Kleiber, MD, was named an assistant professor in the Division of Plastic and Reconstructive Surgery after completing a fellowship in hand, peripheral nerve and microsurgery at Washington University. He completed a plastic surgery residency at the University of Chicago Medical Center and received a medical degree at the University of Southern California-Keck School of Medicine in Los Angeles. Kleiber will specialize in hand surgery, burn care and reconstructive microsurgery.



**Esther Lu, PhD**  
*Public Health Sciences*

Esther Lu, PhD, a biostatistician, has joined the Division of Public Health Sciences as an assistant professor of surgery. She holds a joint appointment in the Division of Biostatistics, where she has served on the faculty since 2009. She has a master's degree in financial mathematics from the National University of Singapore and a doctoral degree in biostatistics from the Medical College of Wisconsin in Milwaukee. Lu is a member of the Institute of Clinical and Translational Sciences (ICTS) Research Design and Biostatistics Group (RDBG) and is currently providing statistical support for projects of the Siteman Cancer Center and the ICTS.



**Jingqin (Rosy) Luo, PhD**  
*Public Health Sciences*

Jingqin (Rosy) Luo, PhD, a biostatistician, recently became an assistant professor in the Division of Public Health Sciences. She has a joint appointment in the Division of Biostatistics, where she has served on the faculty since 2006. She received master's degrees at Renmin University in Beijing and Duke University. She also received a doctoral degree at Duke. Luo's current projects focus on genetic markers for breast cancer treatment resistance and late relapse, markers that can be targeted to improve immunotherapy, and genetic markers for gender-specific risk of glioblastoma with neurofibromatosis type 1.

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## Business Goals

General surgery resident Bola Aladegbami, MD, (left), confers with Bruce Hall, MD, PhD, MBA — BJC HealthCare vice president for patient outcomes and a faculty member of the Department of Surgery and Washington University Olin Business School. Aladegbami is spending his required residency lab years as a student in the Washington University MBA Program. He is the first resident to enroll in the program under a new agreement between the Department of Surgery and Olin, allowing surgery faculty and post-doctoral trainees to count 12 hours of previously earned graduate credit toward an MBA. The degree program provides training to manage business operations and shape health-care policy.



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An aerial view of Washington University Medical Center illustrates the final phase of a major campus renewal project now underway. It includes construction of two 12-story patient-care towers that will consolidate and expand space for surgical and other services. The facilities are designed to accommodate advanced, efficient approaches to patient care and to support comfort and healing for patients and their families.

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