



# UCSF Department of Medicine ZUCKERBERG SAN FRANCISCO GENERAL

## INTERVENTIONALISTS: ENGINEERING HEART AND GUT HEALTH

ZSFG cares for residents of San Francisco, many of whom have health and social issues which increase the complexity of their care. Fortunately, ZSFG has a number of interventional specialists who provide potentially life-saving procedures which are less invasive alternatives to surgery. These state-of-the-art approaches require a high level of training, skill and teamwork. In this issue we feature some of the latest innovations in interventional cardiology and endoscopy.

For a patient experiencing a heart attack, time is critical to preserving heart muscle – the sooner they can receive treatment, the better their chances of survival and long-term health. The ZSFG Interventional Cardiology team provides expert, life-saving, real-time care with skill and compassion.

“The bulk of patients we treat come to the General with acute coronary syndromes,” said John MacGregor, MD, PhD, Professor in the ZSFG Division of Cardiology and Director of the ZSFG Cardiac Catheterization Laboratory and Interventional Cardiology, who joined the ZSFG faculty in 1991. “They’re already sick and having heart attacks, or they’ve already had a cardiac arrest or two and have been resuscitated. We do exceptionally well in treating these patients.”



John MacGregor MD PhD

Interventional cardiology is a subfield of cardiology in which cardiologists perform therapeutic procedures. They make a small cut in the skin to access a blood vessel in the groin, arm or neck, thread a thin, flexible tube into the heart, then

insert tiny instruments and devices through this catheter. This subspecialty began in the late 1970s with balloon angioplasty, which uses a small inflatable balloon to push plaque up against the artery wall and open a blocked vessel. Soon after, cardiac stents were developed; these collapsible tube-shaped devices are inserted into a newly opened artery, helping prevent re-narrowing of the blood vessel. In the early 2000s, new and improved stents emerged which were more flexible, easier to insert, and coated with drugs that further reduced the chances of artery restenosis.

About 15 years ago, Mitch Katz, MD, then director of the San Francisco Department of Public Health, created a program to treat patients experiencing a ST elevation myocardial infarction (STEMI), a life-threatening heart attack in which one of the main arteries feeding the heart is completely blocked. In these urgent cases, it is essential to quickly mobilize a team to open the artery as quickly as possible. The national goal of “door-to-balloon” time is 90 minutes. ZSFG is one of five receiving hospitals, taking care of STEMI patients from the Mission, Noe Valley, Bayview, downtown San Francisco, and San Francisco International Airport, among other areas.

Thanks to this program, there is a five-person ZSFG STEMI team on call at all times, including



Interventional Cardiology Team (clockwise from left): Aaron Cramer, RN; Fanny Pelayo, RN; Matt Durstenfeld, MD; Emily Cedarbaum, MD; Annabelle Flores, RN; Thelma Sandoval; John MacGregor, MD, PhD; Michelle Estanislao

an interventional cardiologist, two nurses, a radiology technician, and a cardiology fellow. Their goal is to be in the Emergency Department within 20 minutes of receiving a page, and they treat an average of two STEMIs each week. “Because we have a dedicated on-call nursing staff, we don’t have to transfer patients to another hospital after hours,” said Dr. MacGregor. “That’s allowed us to greatly improve the treatment of STEMI patients and other kinds of heart attacks and cardiac arrest.”

### Strong Teamwork

Soon after the STEMI program began, Dr. MacGregor began meeting monthly with doctors and nurses in the Emergency Department and Cardiac Catheterization Lab to reduce the number of false alarms and increase efficiencies. By analyzing each step of the STEMI activation process, they found that if the Emergency Department promptly received the patient’s electrocardiogram and activat-



ed the STEMI team's pager right away, the patient could usually be treated within 90 minutes. "The systems we've developed here over the years help ensure that our outcomes are as good as possible, and comparable to or better than what's achieved elsewhere," he said.

This requires strong teamwork with the Emergency Department as well as within the Cardiac Catheterization Lab. "Our cath lab nurses are phenomenal," said Dr. MacGregor. "They anticipate what we need, have medications ready to go, are very knowledgeable about treatment of acute coronary syndromes, and are really kind, compassionate people."

In addition to treating heart attacks, the Cardiac Catheterization Lab also implants pacemakers to support stable heart rhythms and performs other procedures, such as draining excess fluid from the sac surrounding the heart to treat a condition called tamponade.

Dr. MacGregor encourages his trainees to pay attention to details. "Manual dexterity can be developed, but the most important thing is to have a very conscientious, meticulous approach to understanding all the patient's test results, symptoms, and circumstances to make a recommendation best suited to that patient," he said. "I'm very proud of everyone who has contributed to our program. Our patients range from the poorest of the poor to the richest of the rich, and they've all gotten very high-quality care. And we're always trying to improve the care we provide."

### Improving Access to Care

In 2017, the ZSFG Division of Cardiology recruited a second interventional cardiologist, Lukas Zier, MD, MS, Assistant Professor of Medicine. Dr. Zier completed medical school, internal medicine residency, and fellowships in general cardiology and interventional cardiology at UCSF. "When I was hired, interventional cardiology was at an inflection point," he said. "Many procedures had recently become available which were less invasive and had good data behind them. I was hired to help get our patient population access some of these new technologies."

As the founder of the ZSFG Complex Coronary Artery Disease and Structural Heart Disease

Programs, Dr. Zier works with multidisciplinary teams to help hundreds of patients each year.



Lukas Zier MD

Many of the latest elective cardiology procedures are complex and require an onsite cardiothoracic surgeon, which ZSFG does not have. So Dr. Zier and Dr. MacGregor work closely with UCSF Health colleagues in interventional cardiology and cardiothoracic surgery, offering these procedures on the Parnassus campus to ZSFG patients. "Since 2017, we've established a good pathway to get patients access to these technologies that can help them feel better and live longer," said Dr. Zier.

Dr. Zier and his colleagues are expert in treating complex coronary artery disease. With simple coronary disease, they can insert a wire into a blood vessel and steer it past the blockage, also known as a lesion. That wire serves as a train track to position the balloon and place the stent. "Where things start to get complex is if a patient has a lot of disease that prevents us from just putting a balloon in and opening up the vessel," he said. It's difficult to pass a wire through a stiff, calcified blockage. To break this logjam, they use lasers, a tiny drill called an atherectomy device, or a lithotripsy device which creates shock waves, similar to the way urologists break up kidney stones.

Dr. Zier has particular expertise in treating chronic total occlusions (CTOs) – complete blockages of the coronary arteries that supply the heart itself with oxygenated blood. "In that case, you can't just take a wire and steer it past a lesion," he said. It's like a freeway accident that brings traffic to a complete standstill: emergency vehicles have to find alternate routes to access the crash victims.

One option is to carefully insert the wire into the blood vessel wall to bypass the lesion, then punch back into lumen, or the channel through which blood flows, downstream of the blockage. (Picture an ambulance driving on the shoulder of the highway before reaching the site of an accident.) This is called dissection and re-entry. Another option involves threading the wire down a smaller nearby artery called a collateral vessel, then opening the

lesion from the downstream side – like an ambulance taking a residential street and driving up an offramp to reach the crash site.

Some of the highest risk patients may need temporary support from an Impella, a heart pump which helps supply blood to the rest of the body. ZSFG is acquiring an Impella, which will allow heart attack patients to receive some of these interventions onsite if they are too sick for transfer.

"What improves the likelihood of opening up a chronic total occlusion is being able to cycle through a bunch of techniques, rather than being limited to just knowing the most straightforward approach," said Dr. Zier. "It's like a chess match, which requires problem-solving on the fly. Depending on what my opponent does, I may have to change my approach and techniques."

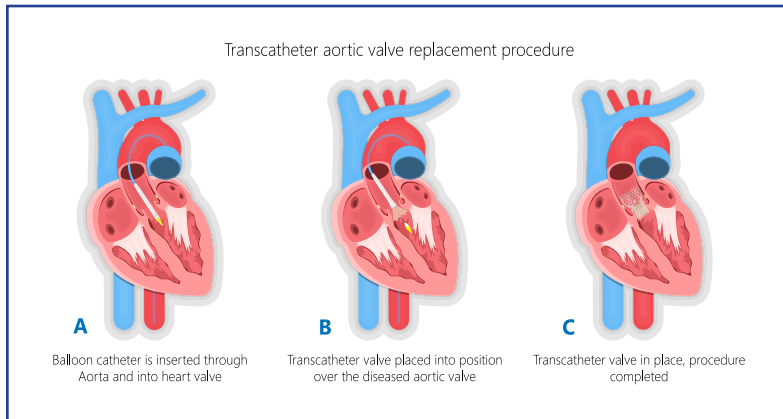
His goal is to match the level of revascularization – the restoration of blood flow through the coronary arteries – that a patient would have received from cardiac bypass surgery. This often requires treating multiple lesions, sometimes more than one in a single vessel. "Not every interventional cardiologist gets trained to do all these things, but we offer a range of high-quality services to treat a very high level of complexity," said Dr. Zier. "I'm very proud to offer this level of service to anyone in San Francisco who needs it."

### Advances in Structural Heart Disease

In addition to treating coronary artery blockages, Dr. Zier and his colleagues also help patients with structural heart disease – anatomical problems of the heart itself. In the past, patients who did not respond to medication often required open-heart surgery, which involves a chest incision, stopping their heart, and placing them on a heart-lung machine. Many older, frailer patients are not suitable candidates for such an invasive operation. But newer percutaneous or transcatheter procedures, which require only a small cut to access a major blood vessel and insert a catheter, are often better tolerated by such patients. They also experience shorter hospital stays and faster recovery times.

Patients with structural heart disease may have holes in the heart which can be patched using tiny devices delivered via catheter. These include plugs to treat atrial septal defect, a birth defect in which





there is a hole between the top two chambers of the heart, as well as patent foramen ovale, an opening between the two top chambers of the heart which is normal during fetal development but usually closes up shortly after birth.

Patients with mitral valve regurgitation have abnormal backflow of blood from the left ventricle to the left atrium, and interventional cardiologists can use something called the MitraClip to repair the leaky valve. This device, which acts like a binder clip, is also delivered through a catheter. It grasps the center of the two leaky valve leaflets, pinning them together to create two smaller openings which reduce backflow while allowing blood to move forward through the heart.

Some patients with aortic stenosis, in which their aortic valve thickens and has trouble opening properly, can now receive a new valve without surgery. By using a procedure called transcatheter aortic valve replacement (TAVR), an interventional cardiologist delivers a collapsible replacement valve to the heart, then expands and places it within the existing valve. “There’s no question that there are no good medical options for a symptomatic patient with severe aortic stenosis,” said Dr. Zier. “If you don’t intervene, about 50 percent pass away within two years. But if we can intervene through TAVR or surgery, their life expectancy goes back to that of age-matched controls.”

Sometimes surgery is the best option for a particular patient, and Dr. Zier works with a multidisciplinary team of interventional cardiologists and cardiothoracic surgeons to develop a treatment plan for each patient. “Our surgical colleagues, under the direction of (Chief of the UCSF Health

Division of Adult Cardiothoracic Surgery) Dr. Tom Nguyen, have been really forward-thinking about doing minimally invasive mitral valve replacements and repairs through a small incision in the side, as opposed to opening

up the whole chest,” said Dr. Zier. “We’ve also done these hybrid percutaneous techniques to repair the mitral valve. The space is really exciting.”

### Caring for the Whole Patient

In addition to increasing patient access to a full range of interventional and surgical options, Dr. Zier and his colleagues take a holistic approach to patient care. “Often, their social determinants of health and social needs are intimately tied with their disease,” he said. For example, a patient might have difficulty consistently taking anti-clotting medications after receiving a stent. “We think about ways to support them in taking their medications after doing this complex procedure – or we might recommend doing bypass surgery instead, because it’s not as critical to take aspirin and Plavix afterwards,” he said. “That’s why we always do this in conjunction with a multidisciplinary team, in which our patients are also evaluated by our surgical colleagues, and we come to a consensus decision about the best way to help a patient.”

Dr. Zier is passionate about promoting both equality and equity in patient care. “I’m a big believer in Lean implementation, and applying standard work to our patients so we’re not influenced by implicit or explicit bias,” he said. “That helps avoid thoughts creeping in, such as ‘This person is unhoused and won’t show up for appointments, so I won’t make the appointment in the first place.’ Make the appointment. See if they get there.

“But just treating everybody equally doesn’t always mean it’s equitable,” Dr. Zier continued. “For patients who are unhoused, don’t have a cell phone and have other adverse social determinants of health, we need to do more. That means figuring

out a way to get them housed while they recover, and how to contact them.... We have wonderful primary care providers and dedicated programs at ZSFG focused on addressing social needs, so we try to leverage those resources. It’s a team effort, with tremendous dedication from clinic staff, schedulers, primary care physicians, cardiologists and cardiothoracic surgeons. I’m really proud of how far we’ve come in the last five years, and the partnerships we’ve built at San Francisco General and UCSF. I’m excited about the next five years and where we’ll go from here.”

### New Frontiers for Endoscopy

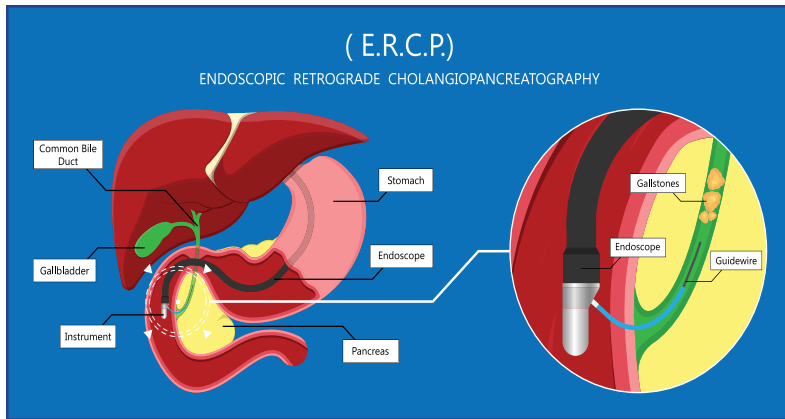
Just as interventional cardiology has made it possible to treat certain forms of heart disease less invasively and with fewer side effects, interventional endoscopy has transformed the field of gastroenterology. “Interventional endoscopy is a growing and really exciting field that builds upon principles and techniques that have been used for decades,” said Patrick Avila, MD, MPH, MPhil, Assistant Professor in the ZSFG Division of Gastroenterology. After completing his gastroenterology fellowship at UCSF, he spent an extra year as an advanced endoscopy fellow learning these specialized approaches before joining the ZSFG faculty in 2020.



Patrick Avila MD

Many people are familiar with how gastroenterologists use an endoscope – a thin, flexible tube with a camera at the end – to identify and remove polyps in the colon and help prevent colon cancer. The field has grown to include many other therapeutic procedures which can treat a wide range of conditions by opening blockages, draining fluid, and obtaining biopsies - all without surgery. With endoscopic retrograde cholangiopancreatography (ERCP), a gastroenterologist advances a long endoscope through the esophagus and stomach to the small intestine, then employs catheters, wires and devices to enter the bile duct and pancreatic duct to treat problems. “Before ERCP, we had to use open surgical techniques, which carried a lot of morbidity,” said Dr. Avila. “But now we can do many of these as outpatient procedures, without any incisions on the outside of the body.”





He and his colleagues use ERCP to remove bile duct stones, using electrohydraulic lithotripsy to create a high-voltage spark that breaks up large, calcified stones. “Basically, we can zap it to break it up into smaller fragments,” said Dr. Avila. “We can also insert a small little daughter scope within the scope to directly examine the bile duct and do targeted biopsies for bile duct cancer.”

Another advanced endoscopy technique is endoscopic ultrasound (EUS), which uses an ultrasound probe at the end of the scope to visualize other organs next to the esophagus, stomach, small intestine, colon or rectum. This gives gastroenterologists an excellent picture of organs that are otherwise difficult to see.

From inside the stomach, they can now get a front-row view of the liver, pancreas and gallbladder. “That has been transformative for diagnostic purposes,” said Dr. Avila. “It allows us to stage pancreatic cancer, and even use fine needle aspiration to directly biopsy the pancreas. Traditionally that’s very hard to do because of where the pancreas sits in the body – it’s a really hard organ to access. In the past, people had to undergo a very morbid surgery just to diagnose pancreatic cancer, but now we can see it and get biopsies.” He and his colleagues also use EUS to biopsy lymph nodes in the chest, accessing them through the esophagus.

### Using Stents Creatively

Dr. Avila also places stents to open up blocked passageways. Pancreatic cancer can compress the bile duct, which prevents drainage of bile into the intestine, causes jaundice and itchiness, and can prevent the use of chemotherapy. “By placing a stent, we can support the delivery of chemother-

apy and palliate a patient’s condition,” he said. Some patients with esophageal cancer cannot swallow or tolerate liquids. “We can place a stent to stretch the esophagus open, allowing them to drink and eat a soft diet,” he said.

“It can have a tremendous benefit for patients. We use these stents all throughout the GI tract by accessing the area with the scope.”

Some liver transplant recipients develop inflammation in the area where their own bile duct and the donor liver’s bile duct are sewn together, creating a narrowing called an anastomotic stricture. “A transplanted liver is a very valuable resource, and it’s important to keep it healthy and draining,” said Dr. Avila. “Using multiple stents, we can slowly stretch that narrowing over time. Nearly all of the patients respond very well, and we can [eventually] remove the stents. It’s a minimally invasive way to protect their transplanted liver.”

Some patients with pancreatitis, or inflammation of the pancreas, develop a very large fluid collection in their abdominal cavity that compresses other organs, prevents them from eating or drinking, and is quite painful. From inside the stomach, Dr. Avila can visualize that collection, create a small hole in the stomach, and place a temporary stent. Over the next three to four weeks, the fluid drains from the pancreas into the stomach and is naturally disposed of through the small intestine and colon. After the stent is removed, the hole in the stomach usually closes up on its own. This procedure, called pseudocyst drainage, has almost completely replaced surgery.

Other patients may develop necrotizing pancreatitis, in which the pancreas and some of the surrounding tissue dies. Instead of having a collection of thin, clear liquid that drains easily through a stent, the patient develops tough, viscous material. Necrotizing pancreatitis has a high mortality rate, and surgical treatments also carry a high rate of

complications and mortality. But now there is an advanced endoscopic approach for necrosectomy, in which the gastroenterologist places a stent which connects the stomach and pancreas, then inserts a lasso-like snare through the stent to grab and remove dead tissue.

“There’s always a subset of patients who will need surgery, but some of these endoscopic techniques have evolved so much that they’re starting to replace surgical techniques, because they’re less invasive, less morbid, and have shorter recovery times,” said Dr. Avila. “When someone is critically ill and your maneuver can help them turn around quickly, it’s one of the most powerful things I’ve ever experienced.”

Dr. Avila is passionate about his work. “One of the things I enjoy about this field is that it forces you to be creative and repurpose off-the-shelf tools in novel ways,” he said. “There’s a real art to endoscopy, as well as developing grace and efficiency in your movements. What I love most is how closely we collaborate with our colleagues in surgery, interventional radiology and oncology, working together to develop the best strategies for patients. And with tough cancer surgeries, even in the best surgeon’s hands there can sometimes be complications and adverse events. We can help our surgical colleagues by providing patients with a minimally invasive solution, getting them through the recovery period and sparing them a big, morbid reoperation.

“I feel so privileged to work at the General with such a fantastic community of providers,” said Dr. Avila. “You can feel the mission. Being at a safety net hospital, providing the most advanced techniques and highest quality care to our patients, and helping them feel better is incredibly fulfilling.”  
*Elizabeth Chur*

Editors: Neil Powe, Laurae Pearson, Brooks Bigart

## SPOTLIGHT

Wishing our ZSFG Department of Medicine care and connection in this season of gratitude.

November is Native American Heritage Month at UCSF. Share in learning more: <https://mrc.ucsf.edu/events/native-american-heritage-month-ucsf>

Our ZSFG DOM Clothing Drive runs through Dec. 16 with [locations](#) in Central Admin, Cardiology/Pulmonary, CVP, DGIM, Experimental Medicine, HIV-ID-Global Medicine, Nephrology, Pediatrics/OBGYN.

The UCSF-ZSFG-OSR 13th Annual Toy Drive has launched! [bit.ly/UCSF\\_ZSFG\\_OSR\\_ToyDrive](http://bit.ly/UCSF_ZSFG_OSR_ToyDrive)