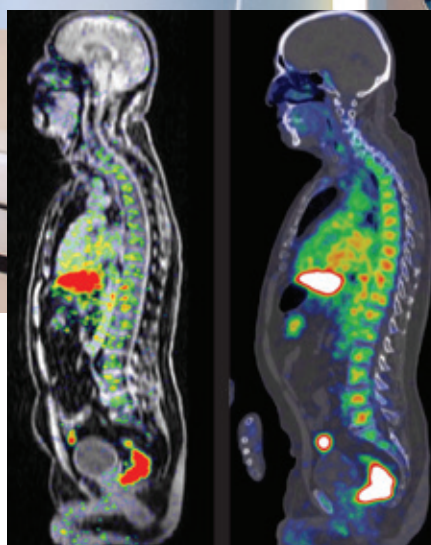
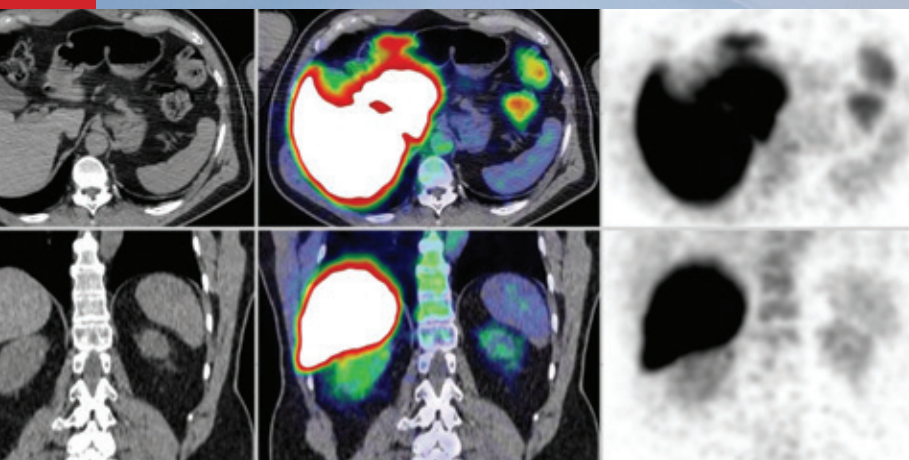


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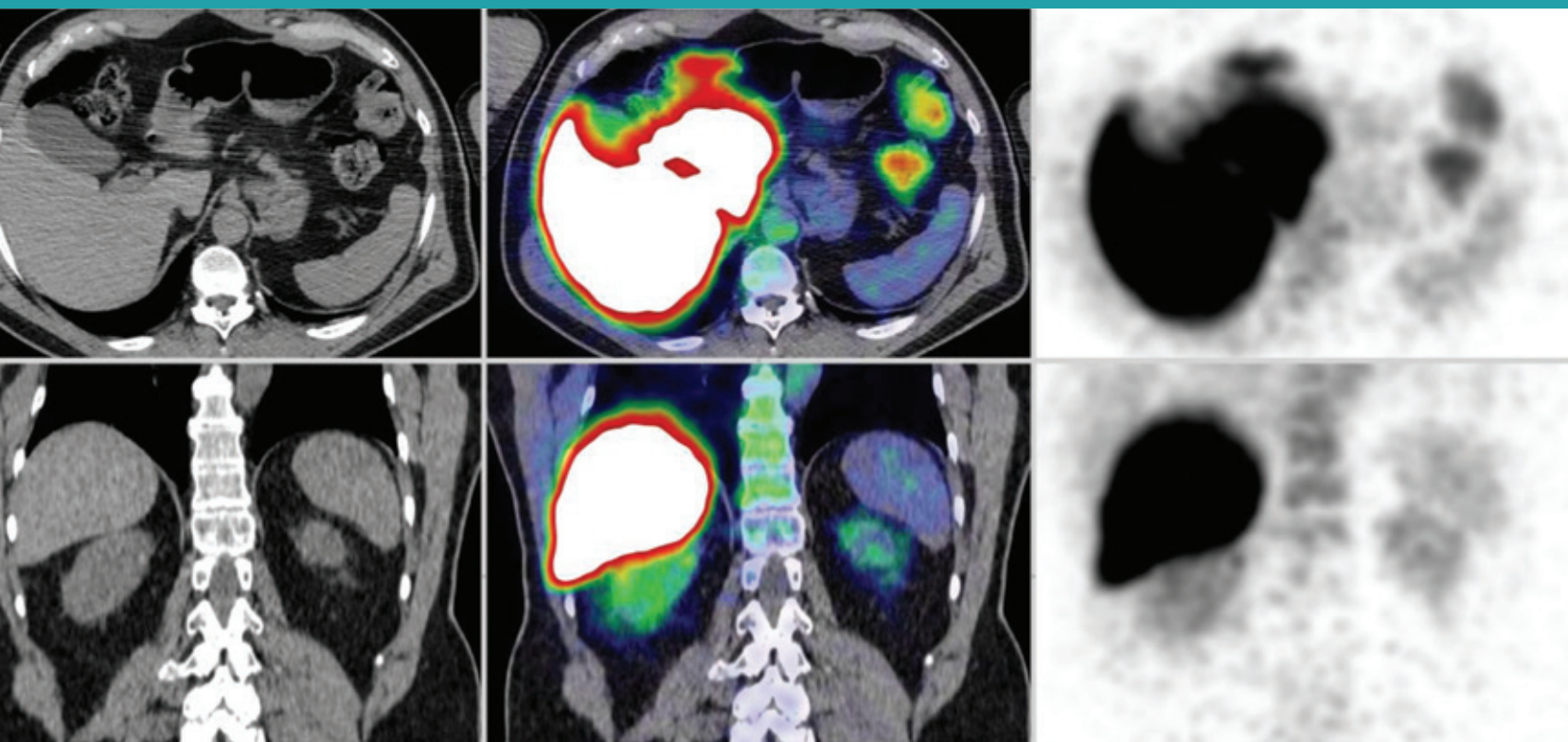
DEPARTMENT OF RADIOLOGY AND BIOMEDICAL IMAGING

# IMAGES



**UCSF**

University of California  
San Francisco



**Above:** Transverse (top row) and coronal (bottom row) PET/CT images obtained after administration of  $^{89}\text{Zr}$ -DFO-VRC01, a radiolabeled broadly neutralizing antibody against the HIV envelope protein gp120, in a HIV patient on antiretroviral therapy (ART). The left panels are CT images, the right panels are PET images and the center panels are colorized PET images overlaid on the CT image. Uptake of the labeled antibody in the spine may be related to the persistent HIV reservoir.

**On the cover:** Erika Padilla-Morales, CNMT, Nuclear Medicine Technologist, Molecular Imaging and Therapeutics, UCSF China Basin Imaging Center (photo by Marco Sanchez, UCSF Campus Life Services)

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# In This Issue

## MESSAGE FROM THE CHAIR

- 2 Dr. Chris Hess reflects on the department's recent accomplishments

## CLINICAL AND RESEARCH NEWS

- 4 Molecular Imaging of the HIV Reservoir: A First-in-Human Study
- 6 UCSF Launches Artificial Intelligence Center to Advance Medical Imaging
- 10 Peripheral Nerve Ultrasound in Clinical Practice
- 11 Augmenting Radiology: Using Augmented Reality Tools for Education and Clinical Care
- 12 The Promise and Perils of Molecular Diagnosis and Therapy
- 13 UCSF Radiology Faculty Support Global Health Efforts

## DEPARTMENT UPDATE

- 18 New Faculty
- 21 Departmental Strategic Planning
- 22 A New Clinical Section: Molecular Imaging and Therapeutics
- 24 New Appointments
- 25 2019 Retirements
- 25 In Memoriam

## EDUCATION

- 29 Radiology Training Programs 2019-2020
- 31 PGY-2 Residents: Class of 2023
- 34 Goldberg Center for Medical Student Education
- 35 Masters of Science in Biomedical Imaging – Learning the Fundamentals of Medical Imaging
- 36 A Focus on Diversity and Inclusion
- 37 Margulis Society
- 38 Alumni News
- 40 Honor Roll of Donors
- 41 Radiology Continuing Medical Education

## PHOTO GALLERY

- 42 Department Highlights

## RESEARCH

- 44 Improving Care Through Research
- 45 Neuro Research Group
- 46 Body Research Group
- 48 Vascular and Cardiac Research Group
- 49 Advanced Imaging Technologies Specialized Research Group
- 50 The Center for Intelligent Imaging (Ci<sup>2</sup>)
- 51 Chemistry, Probes and Molecular Therapy Specialized Resource Group

## CLINICAL SECTIONS

- 52 Abdominal Imaging
- 52 Breast Imaging
- 52 Cardiac and Pulmonary Imaging
- 53 Interventional Radiology
- 53 Molecular Imaging and Therapeutics
- 54 Musculoskeletal
- 54 Neuroradiology
- 55 Neuro Interventional
- 55 Pediatric Radiology
- 56 SFVAMC
- 56 Zuckerberg San Francisco General

# MESSAGE FROM THE CHAIR

Dear Friends:

When I wrote this letter in late February 2020, COVID-19 cases were relatively few in San Francisco. Much has changed in recent weeks across the U.S., and the story of COVID-19 is still unfolding in our city and in California. While the pandemic has consumed much of our present attention and is reshaping UCSF as I write now, this issue of Images reflects on our accomplishments in the past year, which was outstanding for the UCSF Department of Radiology and Biomedical Imaging.

Several recent accolades illustrate the achievements of our faculty and trainees. *Doximity* once again recognized our residency as a leading training program in the country. According to the latest data from the Academy for Radiology & Biomedical Imaging Research, for the first time our National Institutes of Health funding exceeded \$56M, placing us second in total funding to radiology departments nationwide. Overall, *US News & World Report* rated our hospitals among the nation's top 10 and first in Northern California, bolstered by top-ranking clinical programs in radiology. We have a lot to be proud of!

But statistics and rankings fail to recognize the true excellence of our department's people and programs. As you will read in these pages, our faculty, trainees and staff represent radiology's elite. Our department's clinical, research and educational programs define the standard of practice. Decades of energy and enthusiasm for innovation, the broad international dissemination of our brand, and a thriving and inquisitive work environment make UCSF the best place in the world to learn and practice the art and science of Radiology.

This year, the department launched the Center for Intelligent Imaging, or CI<sup>2</sup>, to accelerate the application of artificial intelligence (AI) in radiology, leveraging advanced computational techniques and industry collaborations to improve patient diagnoses and care. (See feature article on page 6.) Through years of evolution, Radiology has become a central hub for information in medicine, always on the forefront of digital innovation. As some of us recall, the first

conversion of radiograph images to an electronic format (PACS) occurred over 30 years ago. Our field has become exceptionally skilled at delivering predictions and guidance for individuals. For what medical questions do you seek answers: The appropriate treatment for a patient presenting with a stroke? Predicted response of a cancer to surgery or chemotherapy? The extent of injury or prognosis after traumatic injury? The minimally invasive treatment with the best outcome? The Center for Intelligent Imaging will develop and apply AI to devise powerful new ways to look inside the body and to evaluate health and disease.

No successful endeavor comes without challenges. Chief among these: how to manage the growth of our clinical enterprise while maintaining focus on our academic mission. To this point, exam volume is growing at a rate that is rapidly exceeding radiologist capacity. Higher spatial resolution, multiple contrasts, volumetric acquisition with standard multiplanar reformatting and multi-modality techniques such as CT/PET and MR/PET also continue to increase the information content in each exam. The number of images in a single cross-sectional examination has grown by a factor of at least 10 for most of our studies, which greatly adds to "eye time" for our radiologists. Some of our PET/MR examinations have over 10,000 individual images!

Further, the clinical expansion of UCSF Health fuels the growth in imaging volumes. At our Mission Bay campus, the Precision Cancer Medicine Building opened in the spring of 2019. Construction is almost complete for the Weill Institute for Neurosciences, which opens in late 2020, followed soon thereafter by a new psychiatry building and the UCSF Center for Vision Neuroscience. A new outpatient building is planned at Mission Bay, and UCSF Health is extending its practice around the Bay Area. After upgrading our CT/PET capabilities this year at our China Basin Landing facility, we will begin construction for additional MR and CT/PET scanners to our clinical space there. At Parnassus Heights, we completed an initial renovation to create a

more modern, patient-friendly face for the Department; our next Parnassus project will add PET/CT and MR equipment to meet patient needs.

Even as our physical footprint in San Francisco grows, the institution is also expanding its reach outside of the city. UCSF Health opened its doors for primary and specialty care across the Bay at the Berkeley Outpatient Center, a joint venture with John Muir Health. The integration with the UCSF Benioff Children's Hospital Oakland continues, and the health system has finalized formal strategic affiliation agreements with Marin General Hospital. We look forward to working with our colleagues, many of whom are also alumni, through these new affiliations and partnerships.

While growth may be perceived as a challenge, it offers major opportunities. We are at a unique point in the history of our field, a time that requires us to re-imagine the practice of radiology. We will develop innovative ways to gather and assimilate data, to interact with and interpret images and other data, to deliver treatments precisely, as well as to communicate, deliver information, and improve our work climate. Critical to achieving these goals: training the next generation of radiologists and imaging scientists, recruiting and retaining the best minds in the field, providing the best possible clinical service to patients and investing in our research programs.

As you read through the pages of *Images*, I hope that you enjoy these glimpses into the future of our field. To see this bright future for yourself, please feel free to visit us at any of the UCSF sites across the city, at Zuckerberg San Francisco General Hospital, or at the San Francisco Veterans Administration Medical Center.



Christopher Hess, MD, PhD  
*Alexander R. Margulis Distinguished Professor,  
 and Chair of the Department of Radiology and  
 Biomedical Imaging*



# CLINICAL AND RESEARCH NEWS

## Molecular Imaging of the HIV Reservoir: A First-in-Human Study

Denis Beckford Vera, PhD; Henry VanBrocklin, PhD; Robert Flavell, MD, PhD; Timothy Henrich, MD

**A**cquired immunodeficiency syndrome (AIDS), caused by human immunodeficiency virus-1 (HIV-1), remains a serious global health threat. According to UNAIDS global statistics at the end of 2018 (<https://www.unaids.org/en/resources/fact-sheet>), 75 million people have been infected with HIV since the disease inception, 32 million people have succumbed from AIDS-related diseases and 38 million people are currently living with HIV. The FDA has approved 37 anti-HIV drugs that target various components of the viral replication process. Among the most successful treatments are antiretroviral therapy agents (ART) that achieve complete or near-complete HIV suppression. None of these drugs are curative agents so AIDS remains a lifelong incurable disease even when controlled.

HIV that integrates into the host cell genome prior to ART suppression persists within the host and will reemerge when the patient ceases ART. The persistent HIV is harbored in tissues outside the circulatory system that are inaccessible to repeated biopsy sampling and continue to evolve and replicate. Identifying these tissue reservoirs is crucial to understand the disease-sustaining mechanisms and to develop curative therapies. A major hurdle to achieving HIV eradication, either through targeted-drug or immune-based therapy strategies, is the limited ability to fully identify and characterize the whole-body viral load in the ART setting. This has spurred an interest in developing molecular imaging approaches, including positron emission tomography (PET), to assess the HIV reservoir and eventually integrate imaging into the design and implementation of curative therapies to reduce the HIV reservoir burden and associated HIV-related morbidity.

Philip J. Santangelo, PhD, and colleagues (*Nature Meth.* 12:427-32, 2015) developed a copper-64 (positron emitting, 12.7 h half-life) labeled monoclonal antibody, 7D3, targeting the CCR5 binding site of the simian immunodeficiency virus (SIV) envelope specific Gp120 protein. They demonstrated specific uptake in known viral reservoirs in the GI tract, axillary and inguinal lymph nodes, and nasal-associated lymphoid tissue (NALT) in SIV-infected rhesus monkeys. They also demonstrated that reservoirs could be detected in ART-suppressed monkeys in the same tissues albeit the intensity of the <sup>64</sup>Cu-7D3 uptake was reduced. Inspired by the exciting preclinical imaging results in viremic and ART-treated SIV, we translated a similar PET imaging approach to humans.

Broadly neutralizing antibodies (bnAbs), developed by the Vaccine Research Center at the National Institutes of Health, interact with the HIV envelope protein gp120 at the CD4 binding site (Zhou, et al., *Science* 329: 811-17, 2010; Wu, et al., *Science* 329: 856-61, 2010) and neutralize multiple HIV-1 strains. One bnAb, VRC01, has advanced to clinical trials in humans and was available for labeling with the 78-hour half-life positron-emitting isotope zirconium-89. This enabled serial imaging over a week and provided ample time for mAb uptake and distribution in tissues with clearance from non-target tissues – all critical factors for effective imaging of tissue HIV burden *in vivo*.

The bifunctional chelate desferoxamine (DFO) was coupled to VRC01 and zirconium-89 was added to produce <sup>89</sup>Zr-DFO-VRC01. Following conjugation, the ability of the radiolabeled VRC01 to bind to HIV env RSC3 protein was evaluated and found to be similar to that of the unconjugated antibody (Wu et al., 2010) indicating that radioisotope conjugation does not significantly alter VRC01 binding. The pharmacokinetics of <sup>89</sup>Zr-DFO-VRC01 was followed in male and female Balb/C mice over five days using microPET/CT imaging and in normal non-human primates using the mini-EXPLORER PET scanner at the UC Davis Primate facility. These studies were used to estimate the whole body and organ radiation absorbed dose (dosimetry).

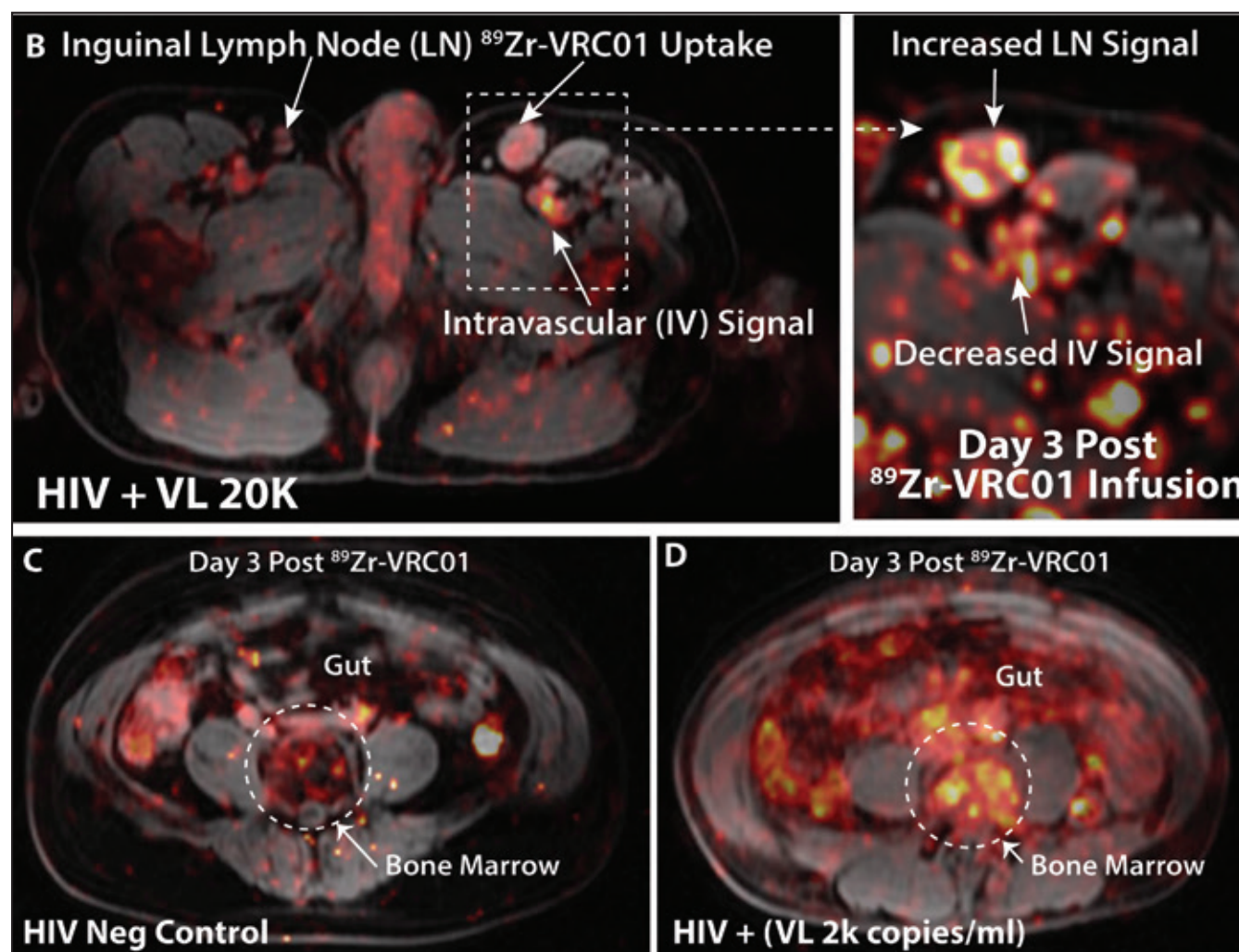
Following pre-clinical development, an investigational new drug (IND) for <sup>89</sup>Zr-DFO-VRC01 was filed and approved by the FDA (IND 139652). With approvals in place serial PET-MR imaging, out to six days post injection, was performed on 14 participants including viremic individuals, ART-suppressed individuals and uninfected controls. We observed intra-participant variation in background tracer uptake as would be expected with such a labeled monoclonal antibody in a population with diverse body size and metabolism. Uptake values of <sup>89</sup>Zr-DFO-VRC01 within inguinal lymph nodes, axillary lymph node regions, NALT, bone marrow and testes were significantly higher in HIV-infected participants than in the uninfected controls in blood pool adjusted analyses. Furthermore, significant differences were demonstrated between ART-suppressed individuals and controls in select tissue compartments (inguinal LN and NALT). Importantly, we identified an increase in uptake values in various tissues in several ART-suppressed individuals compared to uninfected controls, albeit generally lower than in

viremic participants. Tissue sampling from a subgroup of HIV-infected participants (viremic and ART-suppressed) was evaluated to determine if  $^{89}\text{Zr}$ -VRC01 uptake was due to HIV gp120-specific binding or less specific processes such as non-specific Fc receptor binding to macrophages or other antigen presenting cells in the setting of generalized tissue inflammation and increased blood flow. A strong correlation was found between lymph node uptake and tissue HIV protein expression, supporting HIV-mediated uptake.

Overall, a new PET imaging agent has been developed and translated for the first-in-human imaging evaluation of the HIV reservoir. This represents the first *in vivo* molecular imaging of HIV infection in humans. This new agent may

be useful in the development of new drugs and therapeutic interventions, in monitoring response to therapy, and providing a valuable resource to develop curative strategies for HIV. ■

*Denis Beckford Vera, PhD, is an assistant research scientist, Henry VanBrocklin, PhD, is a professor and director of the PET/SPECT Radiochemistry Laboratory, and Robert Flavell, MD, PhD, is the chief of Molecular Imaging and Therapeutics Clinical Section in the Department of Radiology and Biomedical Imaging at UCSF. Timothy Henrich, MD, is an associate professor in the Division of Experimental Medicine, Department of Medicine, UCSF.*

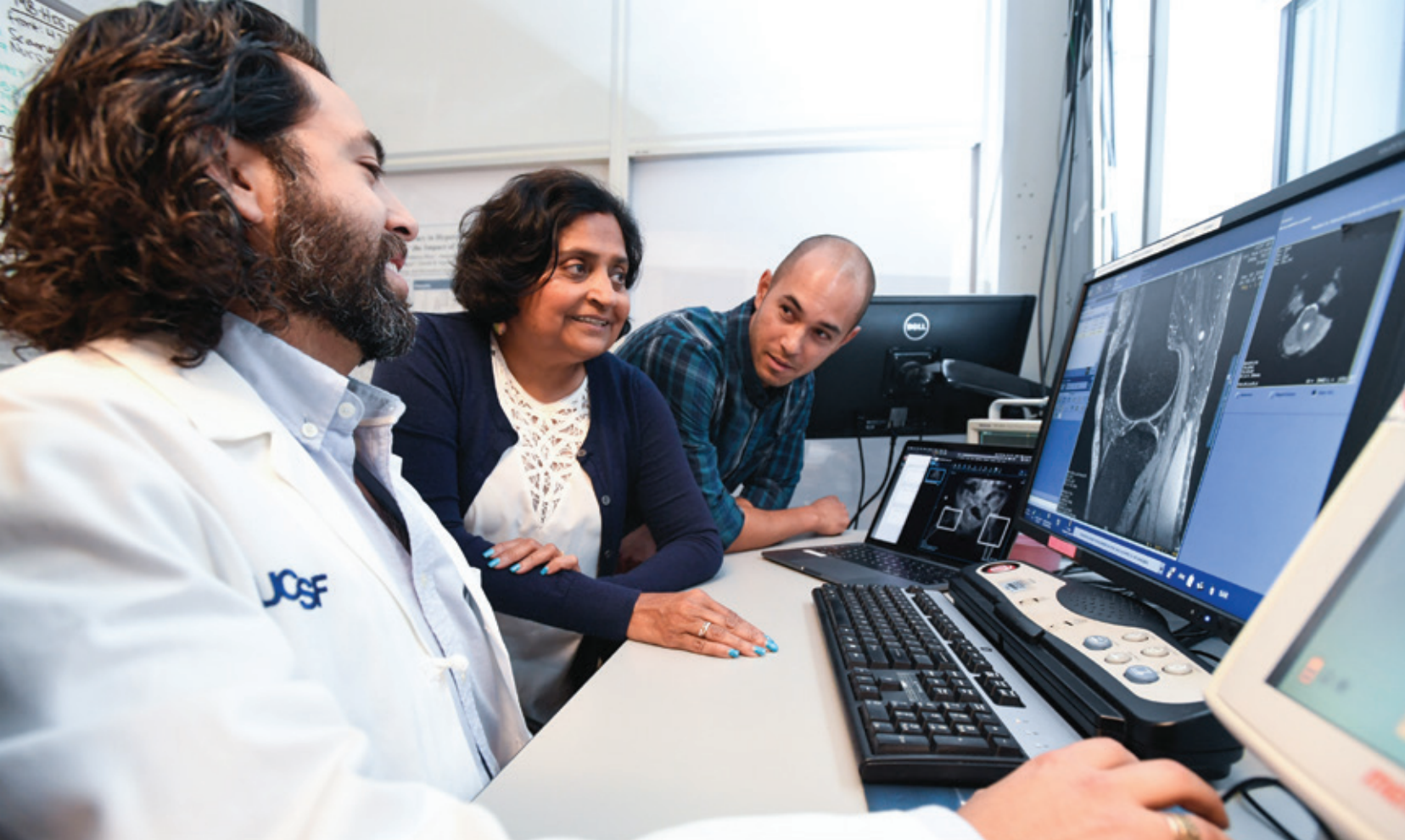


**Figure 1:** (Panel B left): Axial PET/MR image of  $^{89}\text{Zr}$ -VRC01 taken 24 h after injection in an HIV infected patient with a viral load of 20 thousand copies per mL of blood showing Inguinal Lymph Node (ILN) and intravascular (IV) signal.

(Panel B right): A magnified portion of the axial PET/MR image taken 3 days after injection in the same patient showing the increase in signal in the ILN and the decrease in IV signal.

(Panel C): Axial PET/MR image of  $^{89}\text{Zr}$ -VRC01 taken 3 days after injection in a healthy volunteer showing no uptake in the vertebral bone marrow (VBM).

(Panel D): Axial PET/MR image of  $^{89}\text{Zr}$ -VRC01 taken 3 days after injection in an HIV infected patient with a viral load showing the enhanced uptake of agent in the VBM.



Radiology Vice Chair for Research Sharmila Majumdar, PhD, (center) who runs the Center for Intelligent Imaging's operations, discusses artificial intelligence-aided images with colleagues. Assistant Professor of Clinical Radiology Javier Villanueva-Meyer, MD, (left) and computational research data scientist James Hawkins (right).

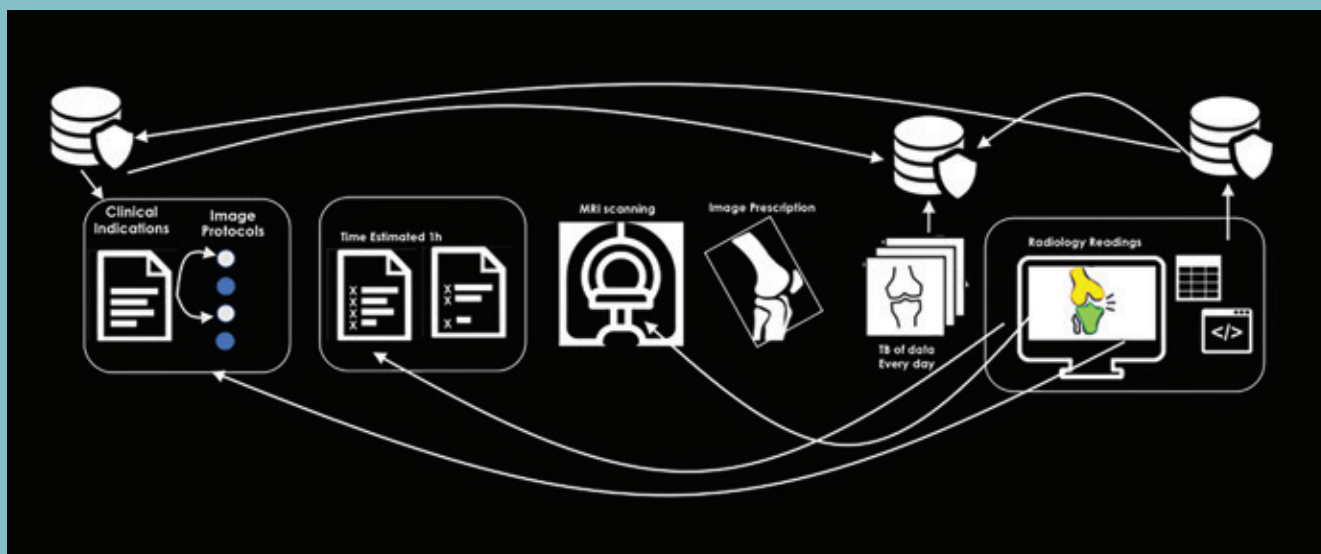
## UCSF Launches Artificial Intelligence Center to Advance Medical Imaging

### Intelligent Imaging Hub will Harness Computational Tools to Improve Patient Care

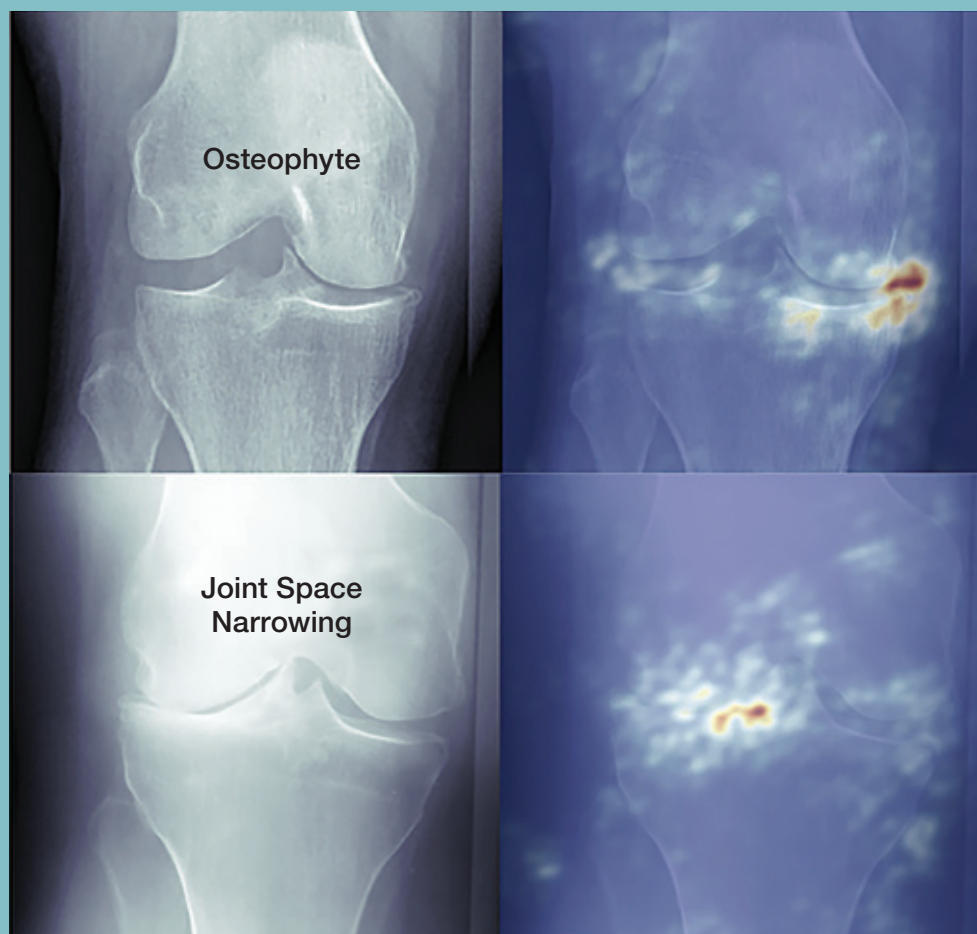
Since the development of magnetic resonance imaging and the university's 1975 collaboration with industry to install the first MRI systems in the US and worldwide, UCSF has been a leader in medical imaging. Now, the Department of Radiology and Biomedical Imaging and UCSF have launched a new center to accelerate the application of artificial intelligence (AI) technology to imaging, leveraging advanced computational techniques and industry collaborations to improve patient diagnoses and care. The Center for Intelligent Imaging, or Ci<sup>2</sup>, aims to enable the same type of transformation via intelligent radiology, with the goal of once again collaborating with industry to be among the first institutions to bring medical imaging AI to the bedside. The objective is to ensure faster, safer, quantitative, and value-added imaging utilizing machine/deep learning.

"Artificial intelligence represents the next frontier for diagnostic medicine," said Christopher Hess, MD, PhD, chair of the UCSF Department of Radiology and Biomedical Imaging and founding clinical director of Ci<sup>2</sup>. "It is poised to revolutionize the way in which we perform, interpret, and use imaging to direct patient care. The Center for Intelligent Imaging will serve as a hub for the multidisciplinary development of AI in imaging to meet unmet clinical needs and provide a platform to measure impact and outcomes of this technology."

Investigators in Ci<sup>2</sup> have teamed with Santa Clara, CA-based NVIDIA Corporation, an industry leader in AI computing, to build infrastructure and tools that will enable the translation of AI into clinical practice. NVIDIA engineers and data scientists are working alongside UCSF investigators to develop clinical AI tools, applying powerful computational resources that are available in



**Figure 1:**  $C^2$  aims to impact the entire value chain of imaging, from the time the patient comes for a scan to the final delivery of individualized, quantitative, prognostic and care-defining information.



**Figure 2:** Deep learning to diagnose OA – Saliency Maps computed as gradient of output category with respect to input image. Saliency Maps show how output category value changes with respect to a small change in input image pixels, since they show the importance of each pixel in the model decision-making process. In the first row image the hot spot is in correspondence to the location of an osteophyte. In the second row image it is in correspondence to joint space narrowing. (Faculty: Padoia, Majumdar, Link.)

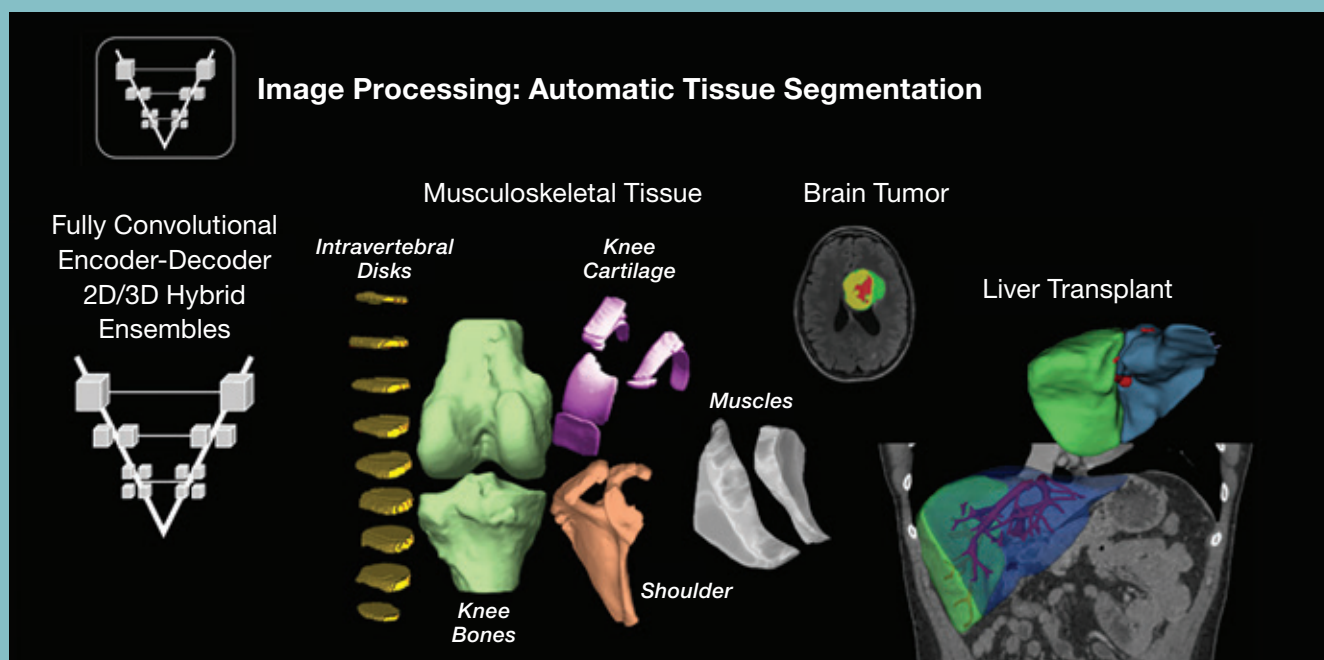


Figure 3: Organ and tissue segmentation undertaken by CP<sup>2</sup>.

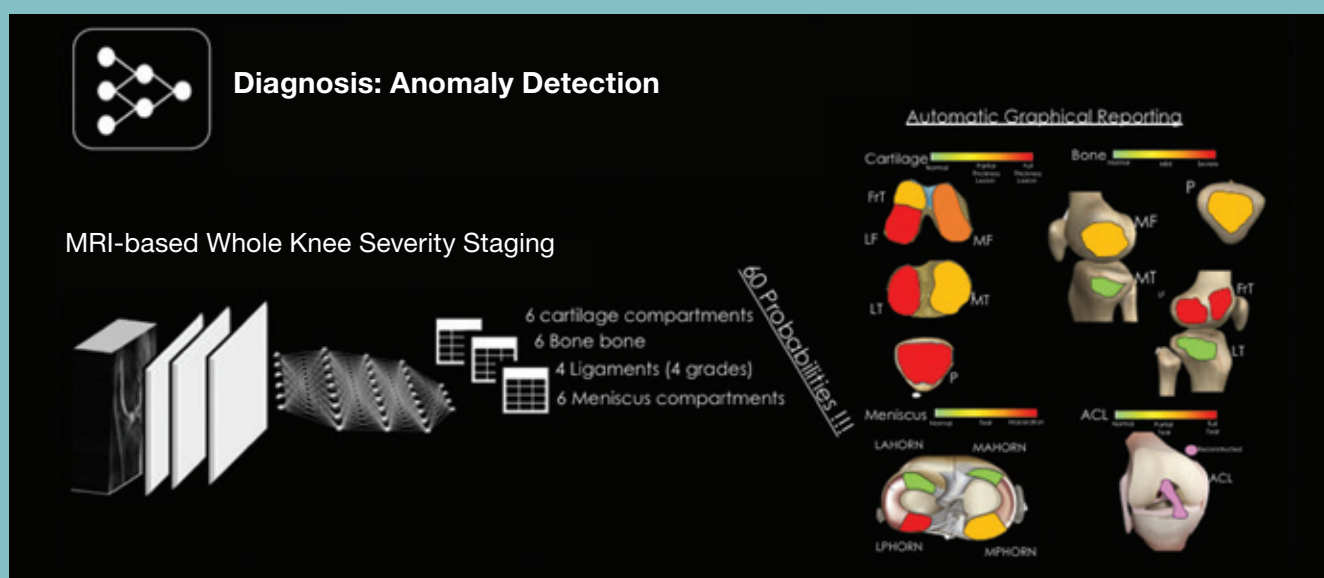


Figure 4: Segmenting and identifying knee joint tissues to determine the extent of degeneration.

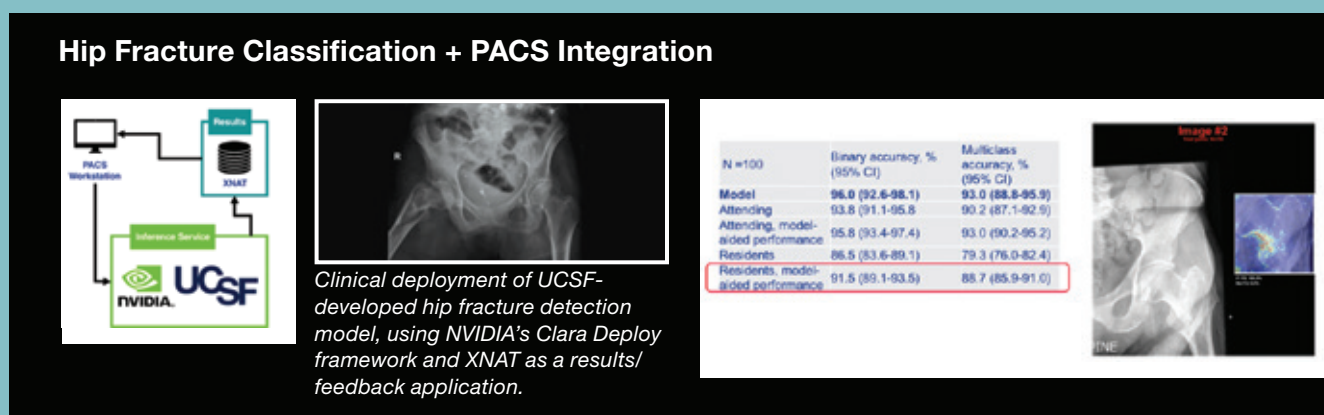


Figure 5: NVIDIA's Clara platform deploys models for hip fracture detection.

few medical institutions, with the goal of accelerating the AI development cycle and integrating it seamlessly in the clinic. Researchers in the center will use patient images and clinical data from UCSF Health and other institutions to develop, test and validate deep learning algorithms. The center's computational infrastructure includes NVIDIA's DGX-2 supercomputer, one of the first to be installed in the medical community.

"AI is one of the greatest tools of this century," said Abdul Hamid Halabi, director of health care at NVIDIA. "Ci<sup>2</sup> is bringing together an innovative ecosystem of startups, vendors, UCSF's thought leadership in radiology, and NVIDIA's Clara platform on the world's fastest GPUs, to create imaging AI solutions for improving patient care."

"The volume of medical imaging has been rapidly increasing and radiologists are struggling to keep up with the sheer number of images," said Sharmila Majumdar, PhD, a professor and vice chair in the UCSF Department of Radiology and Biomedical Imaging. "Ci<sup>2</sup> aims to impact the entire value chain of imaging (Figure 1, page 7), from the time the patient comes for a scan to the final delivery of individualized, quantitative, prognostic and care-defining information."

The center has research, education, clinical deployment, industry and institutional collaborations as its four pillars. Research efforts span organ systems, diseases, link imaging with electronic medical records, and translate to the clinic. Partnerships with the Bakar Computational Health Sciences Institute and Center for Digital Health Innovation are at the crux of the center's collaborative efforts.

The diversity of projects and the impact are demonstrated in the following examples. Figure 2 (page 7) demonstrates applications in osteoarthritis (OA), which affects 27 million US adults, with symptoms including stiffness, limited joint function and pain, often leading to severe disability and undermining overall quality of life. The center has demonstrated the ability of deep learning to diagnose OA in the knee joint and quantitatively stage the disease severity using X-rays, an imaging modality routinely used in the clinic.

In MRI, the tedious manual post processing required to extract quantitative metrics from MR images, identifying and segmenting specific tissues, and the lack of standardized reporting of features have restricted the use of quantitative imaging in the clinic. Figure 3 shows the efforts at organ and tissue segmentation undertaken by the center.

Valentina Padoia, PhD, and Majumdar have partnered with the Center for Digital Health Innovation and GE Healthcare to develop methods for segmenting and identifying the tissues of the knee joint. In addition, they have analyzed the extent of joint degeneration (Figure 4), where the algorithm performed as well as radiologists.

Majumdar will be leading a study in the center funded by the National Institutes of Health to evaluate chronic back pain using AI-fueled algorithms, data analysis, quantitative sensory assessments, brain imaging, and biomechanical evaluation of the spine.

The center also will link academic innovation to startups to promote collaborative AI imaging research and development. The inaugural start-up company to leverage Ci<sup>2</sup> in this capacity is London-based Kheiron Medical Technologies, Ltd. Kheiron Medical will work with the UCSF breast imaging group to ensure that its Mia™ breast cancer screening software can be safely and feasibly deployed in ethnically diverse populations.

"Breast cancer affects every woman's life, either directly or indirectly," said Bonnie Joe, MD, PhD, professor of radiology and chief of breast imaging in the department. "The impact of AI is magnified through its application to breast imaging. Augmenting the radiologist's ability to detect breast cancer early will help us make a dent in this deadly disease."

"Ci<sup>2</sup> is unique in its focus on accelerating the translation of AI from the laboratory to the bedside, putting AI software through its paces to make sure it is safe and effective for patients," said Peter Kecskemethy, chief executive officer of Kheiron Medical. "Together, we believe we can help usher in a new age of cancer care when AI-supported cancer diagnostics and workflows enable doctors to provide earlier and more accurate detection and tracking, and better outcomes for patients across the globe."

For deployment to the clinic, the computation core of the center led by Jason Crane, PhD, his team of Marram Olson and James Hawkins, have leveraged the collaboration with NVIDIA and used the Clara platform to deploy models for hip fracture which aid residents to perform as well as the radiologists in detecting hip fractures in X-rays (Figure 5). ■

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*Thanks to Elizabeth Fernandez for her October 11, 2019 UCSF News article about Ci<sup>2</sup>. You can read her story here: [tiny.ucsf.edu/Ci2](https://tiny.ucsf.edu/Ci2).*

**"Ci<sup>2</sup> aims to impact the entire value chain of imaging,  
from the time the patient comes for a scan to the final delivery of individualized,  
quantitative, prognostic and care-defining information."**

– Sharmila Majumdar, PhD

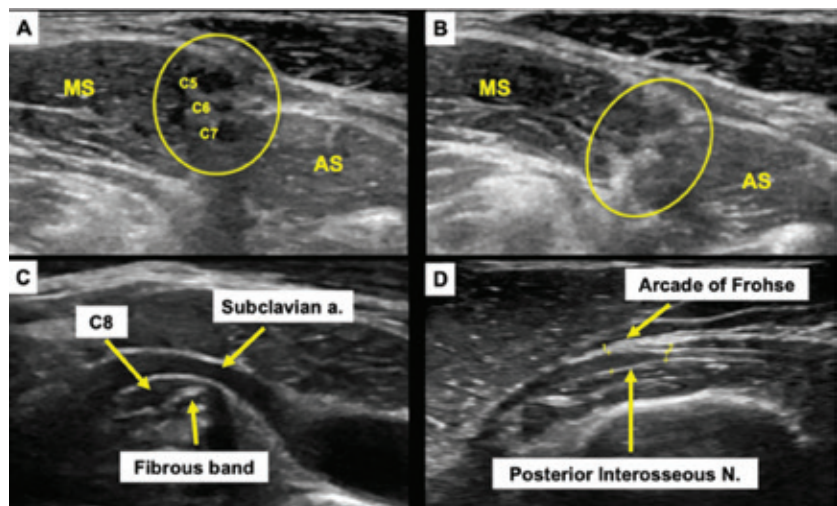
# Peripheral Nerve Ultrasound in Clinical Practice

By Vinil Shah, MD

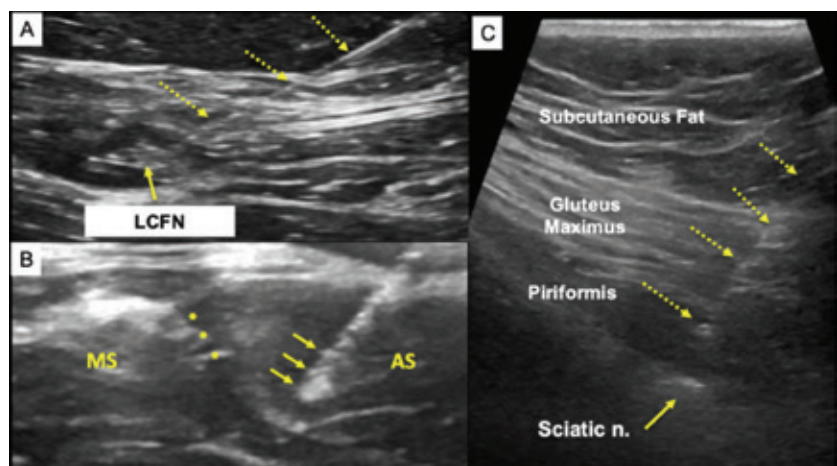
Neuromuscular ultrasound (US) plays an increasingly important role in the diagnosis of peripheral nerve disorders. Over the last decade, improvements in US technology with availability of high-resolution, high-frequency transducers have made it possible to routinely image small peripheral nerves. At UCSF, neuroradiologists frequently use US in combination with magnetic resonance neurography (MRN) to help clinicians localize and characterize nerve injury, confirm entrapment neuropathies (Figure 1), detect underlying neoplasm, aid in pre-operative planning, monitor treatment response, and perform therapeutic injections (Figure 2).

Neuromuscular US has several advantages over other clinical and imaging studies. Ultrasound is cost-effective, widely available, non-invasive and portable. While MRN provides an excellent depiction of three-dimensional nerve anatomy and pathology, US provides superior spatial resolution that enables detailed real-time visualization of even the smallest peripheral nerves (Figure 1). The dynamic information provided by US complements the morphologic and functional information provided by MRN and greatly aids the clinician in the diagnostic work-up and management of patients with peripheral nerve disorders. ■

*Vinil Shah, MD, is an assistant professor of Radiology in the Neuroradiology subspecialty in the Department of Radiology and Biomedical Imaging. He specializes in imaging and targeted treatment of spinal and peripheral nerve disorders. He is also the neuroradiology fellowship program director.*



**Figure 1:** Diagnosing peripheral nerve entrapments with high-resolution ultrasound (A) Normal appearing hypoechoic C5-C7 nerve roots between the anterior (AS) and middle (MS) scalene muscles in neutral position. (B) With abduction there is complete effacement of those nerve roots, suggesting dynamic compression of the brachial plexus in the interscalene triangle in a patient with neurogenic thoracic outlet syndrome. (C) Dynamic US of another patient with ulnar neuropathy, hand atrophy and weakness shows compression of the extraforaminal C8 nerve root by a fibrous band. The fibrous band was released surgically with symptom resolution. (D) Dynamic US in a patient with posterior interosseous neuropathy (PIN) shows compression of the PIN by the supinator arch (Arcade of Frohse). This patient also underwent surgical release of the entrapped nerve with improvement in symptoms.



**Figure 2:** US-guided injections in patients with peripheral nerve entrapments (A) Therapeutic lateral femoral cutaneous nerve (LFCN) steroid injection in a patient with meralgia paresthetica. Dashed arrows indicate needle position. (B) Diagnostic Botox injection into the anterior scalene (AS) muscle of a patient with suspected neurogenic thoracic outlet syndrome due to AS muscle hypertrophy. Marked symptom improvement after the injection helps confirm the diagnosis. MS = middle scalene muscle. Asterisks = Brachial plexus trunks. (C) Diagnostic and therapeutic Botox injection into the piriformis muscle in a patient with sciatica due to suspected piriformis syndrome. Dashed arrows indicate needle position.

# Augmenting Radiology: Using Augmented Reality Tools for Education and Clinical Care

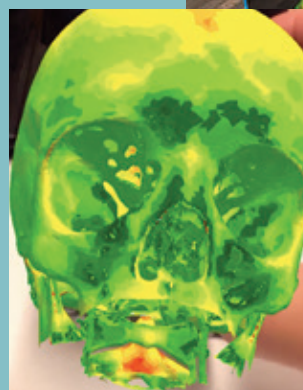
By Benjamin Laguna, MD, and Jesse Courtier, MD

Radiologists are trained to build and interpret complex three-dimensional models in their minds when reading stacks of two-dimensional CT or MRI images. However, the way they ultimately convey this information is limited by a written radiology report or an in-person review. Increasingly, imaging is being used for more than just a diagnostic interpretation. Interventionalists use imaging every day to understand complex anatomy and prepare a surgical approach. But often, our surgical colleagues must translate 2D imaging information for themselves into a mental picture, with only images and a written report as a guide. A recent study assessing surgeons' accuracy with 2D to 3D localization shows this can be challenging for the non-radiologist, who lacks training in making the 2D to 3D leap. (Figure 1) Augmented reality (AR) is a powerful new 3D visualization technology that offers exciting potential to bridge this 2D to 3D gap. AR projects digital 3D information onto a real-world background. This can be done via a head-mounted device, such as the Microsoft HoloLens or via mobile devices, such as the Apple ARKit. In the UCSF Department of Radiology and Biomedical Imaging, we are at the forefront of developing real-world applications of AR within our field. (Figure 2)

## Clinical Applications

With funding through the UCSF Innovation Ventures Catalyst Program and the UCSF Center for Advanced 3D+ Imaging, we are collaborating on the development of novel applications of AR technology across a number of areas. We see these tools as having tremendous potential in the fields of education, training, and most critically, in pre-surgical planning. Having the ability to, for instance, send a complex CT-based model to your surgical team the day before a procedure to understand the three-dimensional complexities, or to send an unusual case to a colleague on the other side of the world, would allow for better communication and understanding before entering the operating room. The fact that these can be viewed anywhere you can bring a mobile device – for example from the office, OR, or even at home – dramatically improves scalability. We believe this opens a tremendous potential for improved and more efficient communication of medical imaging information.

Phantom testing of AR technology in DICOM-derived models has demonstrated promising results, showing that high-fidelity AR models can be created from medical imaging data. We recently presented our promising preliminary results from a retrospective study of application in planning for pediatric elbow fracture repair. Current



**Figure 1:** Augmented reality 3D bone thickness "heat map" pelvic model derived from a CT scan. Image capture is displayed via the Microsoft HoloLens 2.

**Figure 2:** Augmented reality 3D bone thickness "heat map" skull model derived from a CT scan. Image capture is displayed via an Apple iOS device using a Merge Cube for manipulation.

collaborative initiatives underway include a study at the ZSFGH Orthopedic Trauma Institute assessing use of 3D AR models to improve pre-operative classification of complex acetabular fractures. We hypothesize these models will allow for a lower degree of inter-observer variability in fracture classification, which in turn guides appropriate clinical management in these cases. We aim to investigate the ability of 3D AR models created with the Mimics software's thickness analysis tool to determine optimal placement of fixation devices based on bone thickness. (Figure 1) This technology also has exciting applications in craniofacial surgery (Figure 2), with a planned collaborative project in plastic surgery. A current project assessing the impact of AR technology on medical student anatomy small group test scores is also underway.

## Future Directions

These technologies hold the potential to truly begin bridging the 2D-3D gap in medical imaging. We and our collaborators are very excited to be a part of innovation in this area. ■

*Jesse Courtier, MD, is an associate clinical professor in Pediatric Radiology and Benjamin Laguna, MD, is a clinical fellow in the Neuroradiology Section of the Department of Radiology and Biomedical Imaging.*

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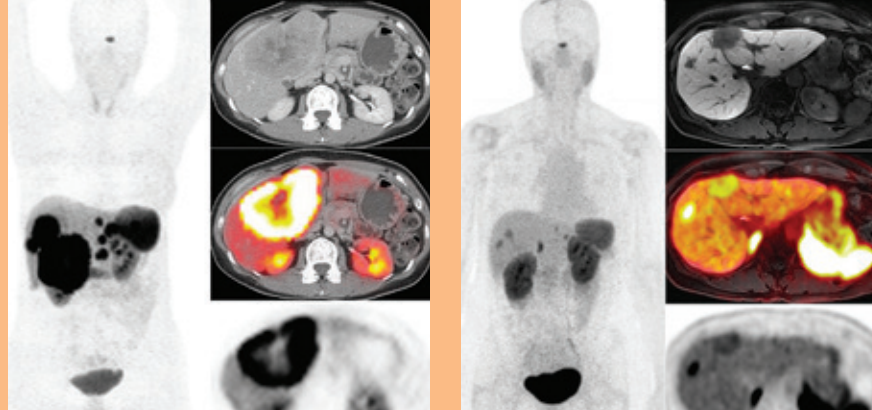
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# The Promise and Perils of Molecular Diagnosis and Therapy

By Thomas Hope, MD

Nuclear medicine has long held the promise of pairing imaging and therapeutic agents for the treatment of cancer. Since the initial use of <sup>131</sup>Iodine for the treatment of thyroid cancer, it was clear that targeting tumors using systemically administered radionuclides could provide a promising pathway to treat many cancers. Until recently this promise had not been fulfilled although many have tried. There are a number of reasons for this: targets on tumor cells had not yet been discovered, targeting molecules were large and therefore had poor biodistributions for therapeutic applications, and availability of radionuclides appropriate for treatment were limited.

The FDA approval of <sup>177</sup>Lu-DOTATATE changed this circumstance dramatically. DOTATATE is a small molecule, similar to octreotide, that targets the somatostatin receptor of neuroendocrine tumor cells. The paired imaging agent, <sup>68</sup>Ga-DOTATATE, uses PET to demonstrate that somatostatin receptors are expressed on the cell surface, and therefore aids in patient selection. This is the basis of theranostics: the same molecule is used both for imaging and therapy. <sup>177</sup>Lu-DOTATATE therapy has demonstrated impressive impact on treating patients in the NETTER-1 trial, with limited associated toxicity (Figure 1). It has quickly become a mainstay in treating patients with neuroendocrine tumors at UCSF and has formed the foundation of a vibrant partnership between medical oncology and nuclear medicine, with the development of the neuroendocrine tumor destination program.



**Figure 1:** Patient with midgut neuroendocrine tumor treated with four cycles of <sup>177</sup>Lu-DOTATATE demonstrate marked reduction in size of the patient's hepatic metastases. The pre-treatment <sup>68</sup>Ga-DOTATATE PET/CT (left) demonstrates necrotic liver dominant metastatic disease. Post-treatment <sup>68</sup>Ga-DOTATATE PET/MRI (right) demonstrates marked reduction in the size of the patient's hepatic metastases.

But treatment of neuroendocrine tumors is just the beginning of a growing revolution that started overseas with the development of small molecules that target prostate cancer. The prostate specific membrane antigen (PSMA) is a protein expressed on the majority of prostate cancer cell surfaces, and a class of small molecules that target PSMA have been developed. Initially, these agents were used to help localize metastatic disease in patients with biochemical recurrence. UCSF was the first institution in the United States to use <sup>68</sup>Ga-PSMA-11, and its use has shifted the way patients are treated with prostate cancer, impacting medical oncology, urology and radiation oncology. In collaboration with UCLA, we are leading the effort to obtain a new drug application from the FDA. Together, we have submitted our NDA, and hope that in 2020 we will obtain approval from the FDA for use of this agent in prostate cancer patients, allowing for broader use outside of a few academic institutions.

Although significant excitement surrounds <sup>68</sup>Ga-PSMA-11, the therapeutic pairing may be even more impactful. <sup>177</sup>Lu-PSMA-617, a small molecule therapeutic agent that targets PSMA similar to <sup>68</sup>Ga-PSMA-11, has been studied in Germany and Australia where it has demonstrated impressive efficacy in heavily pretreated castrate-resistant prostate cancer patients. These results have led to the development of a company-sponsored Phase III

trial. This trial will compare radioligand therapy using <sup>177</sup>Lu-PSMA-617 to the current standard of care. At UCSF, we are leading correlative science for this therapy, in the hope that we can help predict which patients are likely to respond to treatment, in order to improve patient selection in the future. We have also developed multiple investigator-sponsored trials evaluating these therapies in combination with immunotherapies and other routes of administration to improve the therapeutic efficacy while minimizing associated toxicity.

This is an exciting time for molecular imaging and targeted therapy, with increasing amounts of research funds and corporate investment in this field leading to the development of numerous novel therapeutic strategies. UCSF has positioned itself in the center of these developments and will directly impact how the field develops over the coming years. In particular we look forward to the potential approval of <sup>68</sup>Ga-PSMA-11 PET based on trials designed and performed at UCSF, which will lead to the wide availability of this critical imaging agent moving forward. ■

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*Thomas Hope, MD, is an associate professor and the director of Molecular Therapy for the Molecular Imaging and Therapeutics Clinical Section in the UCSF Department of Radiology and Biomedical Imaging. He also serves as chair of the UCSF Helen Diller Family Comprehensive Cancer Center's new Molecular Imaging & Radionuclide Therapy Site Committee.*

# UCSF Radiology Faculty Support Global Health Efforts

A woman shunned by her neighbors because she had a mastectomy. An elderly man living in a remote village struggles with aphasia following a stroke. These are not ordinary incidents faced by UCSF radiologists here in the Bay Area. Rather, they are among the motivators prompting our faculty to engage in promoting global health.

“Our faculty are passionate about excellence in clinical care, education and science, at home and in locations around the world. They understand that in an interconnected world, addressing health disparities is a shared goal,” said Department Chair Christopher Hess, MD, PhD. “We are proud that so many of our faculty have channeled this passion into a long-term commitment to several worthwhile global health efforts.”

Here are some of their stories.

## Amie Lee, MD

### UCSF Global Cancer Program, Tanzania

In Tanzania, more than 80% of women with breast cancer are diagnosed at stage III or IV, when treatments are much less effective and mortality is high. My primary interest is in improving appropriate utilization of diagnostic imaging for women with signs and symptoms of breast cancer to increase early stage diagnosis. Seeing the gross inequities in breast cancer outcomes in developing countries, specifically the advanced stages at diagnosis, has reinforced to me the importance of access to quality breast imaging care for early detection and diagnosis globally and within our own local community.

The Global Cancer Program (GCP) is a priority initiative of the UCSF Helen Diller Family Comprehensive Cancer Center. Its mission is to reduce the global cancer burden through innovation, education and collaboration. I have been a member of the GCP since 2017 and am currently involved in breast imaging research and capacity-building partnerships with the radiology department at Muhimbili University of Health and Allied Sciences (MUHAS), and the Muhimbili National Hospital (MNH) in Dar es Salaam, Tanzania. The GCP also has a strong interdisciplinary partnership with the Ocean Road Cancer Institute (ORCI), the national referral center of cancer care in Tanzania.

In 2017, under the leadership of GCP Director Dr. Katherine Van Loon, the GCP and MUHAS co-hosted a weeklong meeting of stakeholders in Dar es Salaam, Tanzania to formally launch the MUHAS-ORCI-UCSF Cancer Collaboration. I was invited by Dr. Van Loon to serve as the radiology delegate. The meeting highlighted a need for capacity-building, cancer research training and mentorship, and since then, partnerships and projects have been launched across specialties including pathology, radiology, oncology, nursing and surgery. The GCP also is collaborating with the Tanzanian Ministry of Health and ORCI to establish Tanzania’s National Cancer Treatment Guidelines. Also in 2017, teaming up with two UCSF pathology faculty colleagues, we led a three-day hands-on educational course on ultrasound-guided Fine Needle Aspiration for radiologists and pathologists sponsored by the GCP and MUHAS, the largest academic medical center in Tanzania which trains

“My primary interest is in improving appropriate utilization of diagnostic imaging for women with signs and symptoms of breast cancer to increase early stage diagnosis.” – Amie Lee, MD

Dr. Amie Lee (left) in Tanzania. Below, right: Tanzania faculty at UCSF.



the majority of the nation's physicians. The efficacy of this course was published in the *Journal of Global Oncology*. In 2019, we returned to teach another three-day course, with previously trained Tanzanian physicians also serving as course instructors.

I am the UCSF co-investigator and research mentor to Dr. Lulu Sakafu, a Tanzanian radiologist who is leading a study investigating the extent and factors involved in the delay between symptom onset and diagnostic imaging evaluation of breast cancer in Tanzania. When Dr. Sakafu was at UCSF for a five-week intensive clinical research training program in 2018, I helped her develop her research plan and provided clinical education in our breast imaging clinic. She recently presented her scientific abstract at AORTIC's 12th International Conference on Cancer in Africa. Dr. Sakafu now heads the Radiology Department at her hospital, overseeing the development of their first breast imaging program.



**Learn more** at [globalcancer.ucsf.edu](http://globalcancer.ucsf.edu).

## **Tatiana Kelil, MD**

### ***RAD-AID, Ethiopia***

I was born in Ethiopia, where I had first-hand experience with disparity in access to health care, limitations of resources and trained health care providers. My desire to return and help was ingrained very early on in my life. Once I was in the United States, I became involved in global health-related activities throughout my training and academic career.

My current work is through RAD-AID, a nonprofit organization whose goal is to improve access to radiology resources in low-resource countries. RAD-AID first travels

**“The most rewarding part of this work is the magnitude of impact you can have.”**

– Tatiana Kelil, MD

*Dr. Tatiana Kelil, far right, demonstrates ultrasound-guided fine needle aspiration and core biopsy skills*



to a country and performs a comprehensive radiology readiness assessment to understand the needs of that specific community and create a plan to meet them.

As part of that collaboration I will travel to Ethiopia in February 2020 to support two teaching hospitals, St. Paul's and Black Lion Hospital. Black Lion recently acquired a mammography unit and St. Paul's has had a mammography unit for about a year. Our main focus now is getting both units up and running and I will be among the first few radiologists to go there and help them get set up. Part of my role will be to provide didactic and hands-on courses on interpretation of breast imaging studies and image-guided breast biopsies.

RAD-AID started a breast imaging training program at St Paul's Hospital a year ago. The curriculum is still in the building process. During my visit, I will be teaching ultrasound-guided fine needle aspiration and core biopsy skills. In addition to teaching residents and practicing radiologists, I will also be training radiology technologists on proper patient positioning for mammography and optimizing ultrasound images.

The most rewarding part of this work is the magnitude of impact you can have. Worldwide, approximately 2 million women are diagnosed with breast cancer annually and about 600,000 die from it, roughly one woman every minute! About 66% of the mortality is in low-resource countries where there is lack of early detection and treatment. Tanzania, a country I visited in 2017 as part of the UCSF Global Cancer Program, has 58 radiologists for about 58 million people. I appreciate knowing that I can have exponential impact by training just a few more radiologists who will be responsible for treating millions of people.

I am establishing a RAD-AID chapter at UCSF and hope that more radiologists will be able to participate. Not everyone might be able to go to a low-resource country in person, but those interested can, for instance, give lectures remotely. If our residency and fellowship trainees or medical students can get early exposure to global health, they are more likely to be interested and involved for the rest of their careers.



**Learn more** at [rad-aid.org](http://rad-aid.org).

## **Marc Kohli, MD**

### ***AMPATH, Kenya***

Indiana University, where I was a resident in 2005, had a long-term partnership with Moi University in Kenya, to create a medical school and a teaching hospital. I was invited to visit the Radiology Department there and to think about how we might be able to build information systems. I found something that interested me and also fell in love with the people and the place, and since have returned over 10 times. I grew and learned a lot about global health, which has helped me become a better physician here in the States as well.



Dr. Marc Kohli in Kenya

**“When I’m on service in Kenya, physicians come to the reading room and ask questions in the same way they do at UCSF.” – Marc Kohli, MD**

Originally, I had a big misconception about how care was delivered in settings that are resource constrained. I assumed that the people would just sit around and lament that they didn’t have a fancy CT scanner or access to the best interventional procedure. That couldn’t have been further from the truth: the people who provide care are dedicated to helping their patients in the same way as providers in the US. My experiences in Kenya helped me think outside of my American mindset about what’s missing and instead focus on doing the best with the tools we have.

Fifteen years later, if you add it all up, I have spent almost a year of my life in Kenya. Many of the residents that I helped are now faculty members themselves. I have helped them expand the services they offer, primarily through developing a self-contained, self-sufficient mobile X-ray truck. It runs off a generator, and the newest version runs off solar power. The truck improves access to care by traveling to rural areas and providing X-ray and limited laboratory services to clinics whose patients would otherwise have to travel long distances to access care.

There is a perception that there isn’t any opportunity for radiology in global health because the hospitals lack the technology and resources. That’s a big myth. Frequently we are able to make ultrasound-based diagnoses in Kenya without relying on other modalities. Indeed, because patients often present with disease in a more advanced stage than here, some diagnoses are easier to make with ultrasound than they are with CT or MR. Additionally, even in the public hospital in Kenya there are several CT

scanners, contrast power injectors, and MR systems available as well.

When I’m on service in Kenya, physicians come to the reading room and ask questions in the same way they do at UCSF. I have attended tumor boards, orthopedic conferences, and surgical M&Ms – a lot of the same structures that exist here. The main difference is that specialization is harder for Kenyan radiologists due to extreme shortages that force more generalization.

Developing relationships over the past fifteen years has been incredibly satisfying. Dr. Joseph Abuya and I have written several papers together and had a great collaborative relationship that wouldn’t have happened if I hadn’t gone to Kenya in the first place.



**Learn more** at [ampathkenya.org](http://ampathkenya.org)

### **Lori Strachowski, MD**

*Imaging4Change, Haiti; Pan American Health Organization (PAHO/WHO), Grand Cayman*

I have always been drawn to helping the underserved. So in early 2015 when I was approached by Imaging4Change to help develop the first women’s health clinic at Hospital Bernard Mevs in Port au Prince, Haiti, I jumped at the opportunity. I thought my many years working at Zuckerberg San Francisco General (ZSFG) would be suitable preparation; yet the experience was a real eye-opener for me. I didn’t expect the streets to still be covered in rubble from the earthquake five years prior. I didn’t expect the peak age of breast cancer in Haitian women



Above, left: Dr. Lori Strachowski demonstrates breast ultrasound skills; above, right: Dr. Strachowski with the Grand Cayman Health Services Authority (HSA) Hospital staff.

**“It is not uncommon for a woman to be shunned by her community or divorced by her husband after losing her breast.” – Lori Strachowski, MD**

to be in the third decade nor the available resources to be so severely limited (no pathologists, no oncologists, no radiation therapy). And I certainly didn't expect to learn that in the Haitian culture, mastectomy is considered so disfiguring it is not uncommon for a woman to be shunned by her community or divorced by her husband after losing her breast.

As mastectomy is performed on all Haitian women with a breast lump, be it cancer or not, my mission of teaching providers to perform breast ultrasound and US-guided biopsies seemed dire. So, we worked into the night, occasionally performing biopsies by the lights of our cell phones during power outages, and sent specimens to Florida for interpretation two weeks later while waiting another two weeks for results. In total, we saw more than 600 women that week, diagnosed six cancers and equally important, diagnosed several dozen benign breast lesions sparing women needless surgeries.

Later that year, through my contact at Imaging4Change, I was connected to the Pan American division of the World Health Organization (PAHO). The Zika virus outbreak was underway and the Ministry of Health of Trinidad and Tobago was requesting the assistance of a radiologist from the United States to remotely interpret ultrasound exams on fetuses with suspected Zika infection. In Trinidad and Tobago, abortion is not permitted. However, given the grim prognosis of congenital Zika syndrome, the authorities would allow termination if a diagnosis could be confirmed. I was sent select images from a volunteer gynecologist in Trinidad and Tobago who performed the ultrasound examination, and rendered my opinion.

My involvement with PAHO led to several webinars

in 2016 and 2017 lecturing on various ultrasound topics including neonatal head sonography, Zika infection, first trimester pregnancy failure, and ectopic pregnancy. These were particularly rewarding as they allowed me to connect with several hundred practitioners all over South America and the Caribbean where educational resources are both extremely limited and highly appreciated.

My involvement with PAHO continued in 2018 with a four-day breast imaging workshop on the island of Grand Cayman for the Health Services Authority (HSA) Hospital. The hospital had recently acquired a tomosynthesis unit and their sole mammographer had retired. Didactic lectures, interpretation at the workstation and hands-on training in breast US, US-guided and tomosynthesis-guided breast biopsies were provided to the two new radiologists and cadre of technologists who were all highly motivated. Our relationship continued overseas with me providing operational guidance and helping to create a policy and procedure manual as well as sample structured reports.

I was invited to return in 2019 to give a three-day workshop in obstetrical US to both the radiologists and obstetrician-gynecologists. It has been such a wonderful and satisfying experience to teach a group of such eager, bright and appreciative clinicians, several of whom I now remain in contact with through WhatsApp. I hope to increase my global health involvement over time and cannot think of a more fruitful way to spend my retirement years.



**Learn more** at [image4change.com](http://image4change.com) and [paho.org](http://paho.org).

## Bhavya Rehani, MD, and William Dillon, MD *Health4theWorld, global*

Dr. Bhavya Rehani: My grandfather lived in a small village in India. When he had a stroke he did not have access to even a single doctor. He had aphasia, so he lost his voice. That led me to thinking that any human being anywhere in the world deserves the basic human right to health care access. That led to Health4TheWorld (H4TW), which I co-founded with the assistance of Dr. Ankur Bhartiya and Dr. Bill Dillon.

Dr. Bill Dillon played a significant role in the formation and growth of the organization. The growth and impact which we were able to achieve wouldn't have been possible without Bill's visionary leadership, intellectual solutions, optimism, and kind support of the team members at every step. We now have close to 200 doctors, nurses and healthcare professionals as well as other team members, including a lot of software engineers, volunteering to help us do this good work. After launching in 2017, H4TW spread to 22 countries in one year and the organization has touched the lives of thousands of people.

As Bill has said, "When I traveled as part of the American Society of Neuroradiology international professorship program, I spent a week or two in a particular country to lecture and educate health care trainees. However, I recognized when I left there was nothing left behind that sustained my visit. Then with the leadership of and drive from Bhavya, we came up with the idea and capability to lecture online in real time and also record our lectures. Bhavya and her husband Ankur have been the driving force behind H4TW's success."

With H4TW, we leverage technology to provide health care access through efforts such as the H4TW stroke app. Its components help people communicate after voice loss, provide exercises and health care reminders and machine learning-based chat bots, all which help to alleviate suffering and prevent another stroke. Prescribed for patients by their doctors, the free app has been downloaded in 22 countries, and is culturally sensitive and available in Swahili, Nepali,

Filipino, Chinese, and Spanish.

We also created the H4TW Academy, one of the largest online educational platforms. It contains a spectrum of close to 14 specialties, more than 100 talks and 500 videos on YouTube and the website. There is also a Spanish curriculum for Spanish-speaking radiologists. We have leading health experts from 20 academic institutions, including some from UCSF Radiology, who have volunteered to teach through H4TW Academy.

Our volunteer faculty teach in Africa almost every week: medicine in a rural hospital in Cameroon, radiology in the first radiology residency program at the University of Rwanda, as well as other training programs. There are a few virtual reality models on the website and machine learning chat bots to help community health care workers and villagers who are not trained, treat multiple conditions. For example, if a patient comes in with chest pain, the chat bot will tell them what questions to ask, how to go down a diagnostic algorithm.

H4TW has been featured in *Forbes*, NBC, the *San Francisco Business Times* and other media. In addition, the organization has won multiple awards including the 2018 Stevie Tech Start Up of The Year by the American Business Awards. This past year, I was honored to be named as one of the *Silicon Valley Business Journal's* 'Women of Influence', an award that serves as meaningful recognition for our efforts to create free technology and educational solutions to people in low resource communities worldwide.

Our goals are simple. We want each health care provider to have access to the kind of reliable medical knowledge needed to treat their patients, free of cost, anywhere in the world. We believe that every patient should have access to basic knowledge on how to prevent diseases and how to improve their life if they have a life-threatening disease. It is a long journey, but we are confident that with the many volunteers willing to help, we will all make that happen. ■

 **Learn more** at [health4theworld.org/academy](https://health4theworld.org/academy).

**"With H4TW, we leverage technology to provide health care access through efforts such as the H4TW stroke app."** – Bhavya Rehani, MD

Dr. Bill Dillon (center) with residents and attendings, Mumbai, India



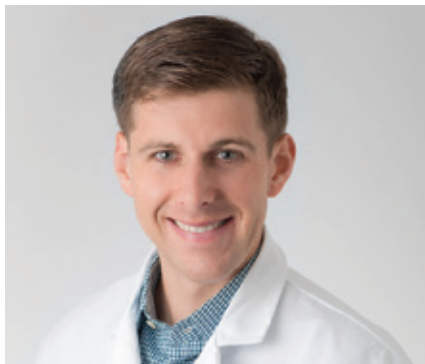
Dr. Bhavya Rehani (left) provides training to a caregiver (center) and patient in Bhutan.



# DEPARTMENT UPDATE

## New Faculty

The UC San Francisco Department of Radiology and Biomedical Imaging would like to extend a warm welcome to our talented incoming faculty members. We are proud of their accomplishments and look forward to their future contributions as faculty members to our clinical, educational and research endeavors.



*Matthew J. Barkovich, MD*

### **Matthew J. Barkovich, MD**

In September 2019, Matt Barkovich joined the department as an assistant professor in residence in the Neuroradiology section.

In 2013, Barkovich received his medical degree from UC San Diego School of Medicine. In 2014, he completed a one-year internship at Highland Hospital in Oakland, CA. His four years of training as a Diagnostic Radiology resident were completed at UCSF in 2018. During his final year of residency, Barkovich was a research fellow in the 2017-2018 NIH T32 Biomedical Imaging program at UCSF where he focused his research on Neurofibromatosis type 1 (NF1) and how imaging abnormalities in NF1 patients correlate with clinical phenotype. In 2019, Barkovich completed a fellowship in Neuroradiology at UCSF.

Barkovich was named the 2014 Intern of the Year at Highland Hospital, received the Resident Research grant from the Margulis Society in 2016,

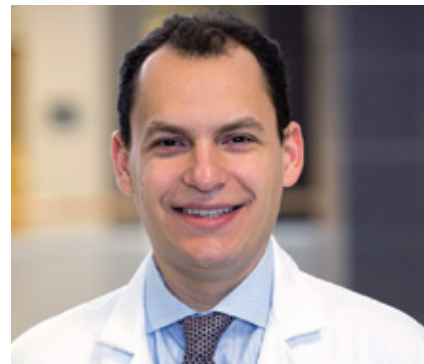


*Shital Gandhi, MD*

and was a recipient of the American Society of Pediatric Neuroradiology Derek Harwood Nash Award in 2018 for his work developing a pediatric hindbrain atlas. His research is focused on using advanced imaging to better understand the molecular pathways that drive neurodevelopmental disorders and normal brain development.

### **Shital Gandhi, MD**

Shital Gandhi joined the department in July 2019 as an assistant professor of clinical radiology focused on Ultrasound in the Abdominal Imaging section. She received her medical degree from Grant Medical College in Mumbai, India in 2001. In 2007 she completed her four-year Diagnostic Radiology residency from the Long Island College Hospital, Brooklyn, NY. After working as a neuroradiologist in New York, she moved to San Francisco and completed an Ultrasound and Abdominal Imaging fellowship at UCSF in 2015.



*Michael B. Heller, MD*

Gandhi currently practices diagnostic ultrasound and obstetrical care including ultrasound-guided intraoperative localization. She also practices with the UCSF Fetal Treatment Center assisting in image-guided procedures.

### **Michael B. Heller, MD**

In July 2019, Michael Heller joined the department as an assistant professor in the Interventional Radiology section.

Heller obtained his medical degree from Northwestern University Feinberg School of Medicine in Chicago, IL in 2013, followed by an internship at Massachusetts General Hospital in Boston, MA in 2014. Heller served as chief resident from 2017-2018, completing his four-year Diagnostic Radiology residency at UCSF in 2018. In 2019, Heller completed a fellowship in Interventional Radiology at Northwestern University in Chicago, IL.



*Joseph R. Leach, MD, PhD*

### **Joseph R. Leach, MD, PhD**

Joseph Leach obtained his PhD from the UCSF-UC Berkeley Joint PhD Program in Bioengineering in 2009. In 2013 Leach earned his medical degree at UCSF, followed by a one-year internship at California Pacific Medical Center of San Francisco. Leach completed a four-year Diagnostic Radiology residency at UCSF in 2018. During 2017-2018 Leach was a NIH T32 Training Grant research fellow at UCSF Radiology, where he focused his research on the development of methodologies by which to study the biomechanics of abdominal aortic aneurysms on a patient-specific basis, incorporating data from both routine clinical and more advanced imaging modalities. Leach completed a clinical fellowship in Abdominal Imaging/Ultrasound at UCSF in 2019.

Leach joined the department as an assistant professor in residence in the section of Abdominal Imaging in July 2019.

### **Yan Li, PhD**

Yan Li joined UCSF Radiology and Biomedical Imaging as an assistant professor in March 2019. Li received her medical degree from Shanghai Jiao Tong University in China, Master of Science in Biochemistry from McGill University in Canada, and PhD from the UCSF/UC Berkeley Joint PhD Program in Bioengineering. Before accepting her current position,



*Yan Li, PhD*

she worked in the laboratory of Sarah Nelson, PhD, as a post-doctoral fellow and later as an assistant research scientist.

Li's research focuses on developing methods for obtaining reliable metabolic information from the brain in order to characterize spatial and temporal heterogeneity and the biologic behavior during disease time for brain tumors, psychiatric and neurologic diseases. This includes the development of new methods for obtaining whole brain metabolites and tools for generating metrics of brain neurotransmitters using 3T and 7T MR scanners, implementation of statistical methods to relate metabolic metrics to clinical outcomes or measures, and integrating steady state 1H metabolic imaging with PET, hyperpolarized 13C and advanced MR imaging parameters in order to elucidate the underlying normal and abnormal biological process.

### **Alexander H. Lam, MD**

Alexander Lam earned his medical degree at UC Davis School of Medicine in 2013, followed by a one-year internship in the Department of Internal Medicine at California Pacific Medical Center in San Francisco. His four-year Diagnostic Radiology residency was completed in 2018 at UC Irvine School of Medicine in Orange, CA, where he served as chief resident from 2017-2018. Lam completed a one-year fellowship in Vascular and Interventional Radiology



*Alexander H. Lam, MD*

at the Department of Radiology, University of Virginia School of Medicine in Charlottesville, VA in 2019.

Lam is the recipient of several awards, including the Roentgen Resident/Fellow Research Award, Society of Interventional Radiology Foundation Radiology Resident Research Grant, and the American College of Radiology – Association of University Radiologists Research Scholar Award.

Lam joined the Interventional Radiology section at UCSF Radiology in 2019 as an assistant clinical professor.

### **Dimitrios Mitsouras, PhD**

Dimitrios Mitsouras received his Bachelor of Science in Computer Science from Brown University in 1998, and his Master of Science (2000) and PhD (2004) in Computer Science and Electrical Engineering from the Massachusetts Institute of Technology.

Mitsouras' academic appointments were as an instructor at Harvard Medical School (2004-2008); assistant professor in the Department of Radiology at Harvard Medical School (2008-2017) and associate professor, Faculty of Medicine, at the University of Ottawa, Canada (2017-2019).

Mitsouras has held a number of major research administrative leadership positions, most recently as director of Medical Physics & MRI Research (2013-2015) at the Applied



*Dimitrios Mitsouras, PhD*

Imaging Science Lab in the Department of Radiology at Brigham and Women's Hospital, Boston, MA, and director of the Applied Imaging Science Lab at the same institution (2015-2017). He also serves as associate editor of the journal *3D Printing In Medicine*.

He is a recipient of a 2013 Career Development Award from the National Institutes of Health, and a 2016 *Magna Cum Laude Award* from RSNA.

Mitsouras has had a strong focus on education and teaching throughout his career. His interdisciplinary background has allowed him to teach difficult scientific techniques to clinicians and concurrently to develop basic scientists into effective clinical scientists. has published more than 80 peer-reviewed articles, two patents, and seven book chapters that have been collectively cited more than 2800 times. He has also developed and taught seven CME courses on clinical 3D Printing (2014-2018), Computational Fluid Dynamics (2016-2017), and Artificial Intelligence (2018) that have been attended by over 1000 clinicians and clinical and science trainees at the Radiological Society of North America.

Mitsouras joined UCSF Radiology as an associate professor in residence in Cardiovascular Imaging Research in July 2019.



*Preeti Sukerkar, MD, PhD*

### **Preeti Sukerkar, MD, PhD**

In August, 2019, Preeti Sukerkar joined UCSF Radiology and Biomedical Imaging as an assistant clinical professor in Musculoskeletal Imaging.

Sukerkar received her PhD in Chemistry in 2011 and her medical degree in 2013 from the Northwestern University's Feinberg School of Medicine in Chicago, IL. In 2014, Sukerkar completed a one-year internship in internal medicine at the Advocate Illinois Masonic Medical Center, Chicago. Her four-year diagnostic radiology residency was accomplished in 2018 at Stanford Healthcare, Palo Alto, CA, where she served as chief resident. She then completed a fellowship in both Musculoskeletal Imaging and in Body MRI at Stanford in 2019.

In 2013, Sukerkar was the recipient of the first prize in the MIT Enterprise Forum of Chicago. In 2016, Sukerkar was a recipient of Stanford's Etta Kalin Moskowitz Fund research Award and a Top 10 Poster Award at the QI/Patient Safety Symposium.

### **Joseph (An Thanh) Vu, PhD**

Joseph Vu obtained his PhD from the UCSF-UC Berkeley Joint PhD Program in Bioengineering in 2011. He served as a research associate in Radiology at the University of Minnesota's Center for Magnetic



*Joseph (An Thanh) Vu, PhD*

Resonance Research from 2012-2015, where he developed advanced fMRI and dMRI methods for the 7T Human Connectome Project. Subsequently, as a senior research scientist at Advanced MRI Technologies, Vu continued to advance the field of high spatiotemporal resolution fMRI through multiple BRAIN Initiative projects.

In 2016, Vu took on the roles of physicist in Radiology at the San Francisco Veterans Affairs Health Care System (SFVAHCS) and technical director for the Center for Imaging of Neurodegenerative Diseases (CIND) at the SFVAHCS, where he developed internationally patent pending fMRI technology, spear-headed shared equipment grants to fund major upgrades and expansions of the 7T MRI system at the SFVAHCS, and serves on both the UCSF and VA MRI Safety Committees.

In March 2019, Vu accepted the position of assistant adjunct professor at UCSF Radiology and at the SFVAHCS, where he serves as director of Advanced Imaging Technologies for the Veteran Affairs Advanced Imaging Research Center (VAARC). ■

# Departmental Strategic Planning

During the past year, the UCSF Department of Radiology and Biomedical Imaging has been actively engaged in a collaborative strategic planning process to define the department's goals for the next five years. Over 100 faculty, campus leaders, trainees and staff worked with a focus on the following objectives:

- Establishing a clear and strong mission and vision for the future
- Clearly articulating value propositions for Radiology in a shifting landscape
- Underlining and establishing the central role of Radiology in the institution
- Achieving strong alignment of our clinical, educational and research programs
- Construction of effective teams for clinical practice and research
- Supporting a positive and inclusive culture that fosters innovation and excellence
- Increasing engagement and improving morale of faculty, staff, and trainees

Following the process, the department vision was established through 2025 as *Leading Innovation in Imaging to Integrate Care and Improve Health*.

We are embarking on the implementation phase of this project, with a focus on the following areas identified during the strategic planning process:

- Diversify our financial portfolio
- Extend our reach beyond the department
- Channel investments into team science that takes aim at clinical needs and at clinical “moonshots”
- Develop and implement initiatives that enhance community, support personal and professional development, and reduce bureaucracy
- Develop and strengthen dated organizational and operational paradigms

These goals align with the University's mission and PRIDE values: Professionalism, Respect, Integrity, Diversity and Excellence. ■



Members of the department at the second strategic planning session at the Presidio Officers' Club, San Francisco on October 26, 2019.

# A New Clinical Section: Molecular Imaging and Therapeutics

The past decade has seen a number of new molecular diagnostic and therapeutic imaging agents enter clinical practice, especially in oncology, cardiology and the neurosciences. The UC San Francisco Department of Radiology and Biomedical Imaging has served, decade after decade, as a hub for basic and translational research in this area driving the innovation of new agents, undertaking preclinical studies to demonstrate their potential and safety, and advancing their use for state-of-the-art clinical care.

To meet the challenges introduced at the cutting edge of a rapidly growing clinical field, the department inaugurated a new clinical section, Molecular Imaging and Therapeutics (MI&T), in September 2019. This section oversees the clinical practice of traditional nuclear medicine as well as the adoption of multimodality PET/CT and PET/MR and implementation of new diagnostic and therapeutic molecular agents for patients. The section works closely with the department's Chemistry, Probes and Molecular Therapy Specialized Resource Group and with clinicians and researchers in other departments to usher in a new generation of imaging and treatment modalities.

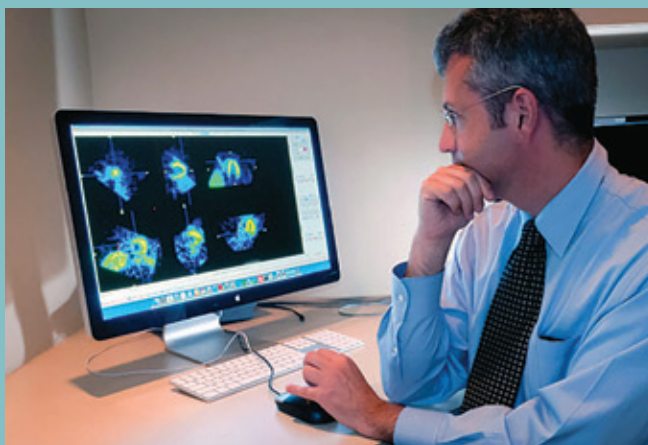
## Molecular Imaging and Therapeutics (MI&T) Leadership

**Robert Flavell, MD, PhD**, section chief, oversees MI&T operations, with an eye toward growth of its research, clinical, and educational missions. He received his BA from Wesleyan University, his PhD from the Rockefeller University and his MD from Weill Cornell Medical College. He completed his radiology residency at UCSF, including an NIH T32-funded research fellowship, continuing at UCSF with a fellowship in nuclear medicine.

Flavell's area of research interest is the development of new molecular imaging and therapeutic probes, with

*Robert Flavell, MD, PhD*





*Miguel Hernandez Pampaloni, MD, PhD*

a particular focus on prostate cancer and how alterations in the tumor microenvironment drive disease progression. He has been recognized by early career awards from several societies and federal agencies, including the RSNA, Society of Nuclear Medicine and Molecular Imaging, Society of Abdominal Radiology, Prostate Cancer Foundation, Department of Defense, American Cancer Society, and the National Institutes of Health. Moreover, Flavell has distinguished himself through quality improvement, clinical service and educational projects within the section of nuclear medicine.

**Thomas Hope, MD**, director of molecular therapy for MI&T, is leading the introduction and use of molecular imaging-guided therapies. As part of this role, he chairs the Cancer Center's new Molecular Imaging and Radionuclide Therapy Site Committee.

After receiving his undergraduate and medical degrees from Duke University and Stanford University, respectively, Hope completed his residency at UCSF and clinical fellowship in Body MRI and Nuclear Medicine at Stanford.

An international leader in PET/MR research and the translation of new molecular imaging agents, Hope launched the highly successful PSMA prostate program at UCSF and championed the use of multiple new targeted therapies to treat patients with neuroendocrine and other tumors. He currently serves as principal investigator on grants from the NIH and the Prostate Cancer Foundation. He has received numerous accolades in molecular imaging, including the Henkin Fellow and Marc Tetalman Memorial Award from the Society of Nuclear Medicine and Molecular Imaging, the Young Investigator Award from the Prostate Cancer Foundation and the Wylie J. Dodds Research Award from the Society of Abdominal Radiology.

Hope has achieved distinction through his international academic footprint championing molecular imaging and his vast experience in new agent program development.

**Miguel Hernandez Pampaloni, MD, PhD**, director of nuclear cardiology for MI&T, oversees nuclear cardiology and develops new techniques to evaluate cardiac metabolism and function. Along with Hope, he also serves as vice-chair of the Cancer Center's new Molecular Imaging and Radionuclide Therapy Site Committee. He received his MD and PhD from the Universidad Complutense School of Medicine in Madrid and completed residencies in nuclear medicine at both San Carlos Hospital in Madrid and at the University of Pennsylvania. He was a postdoctoral fellow in Cardiovascular Nuclear Medicine in the UCLA Department of Medical and Molecular Pharmacology and at Hammersmith Hospital, Imperial College London, UK.

Pampaloni is published broadly and has spoken to national and international audiences on multiple topics in nuclear medicine and molecular imaging, especially quantitative myocardial blood flow and ischemic cardiomyopathy. He led the Nuclear Medicine section for a decade, during which time he directed the opening of operations at Mission Bay Hospital, helped to bring multiple new imaging and treatment agents to clinical practice, and guided the professional development of numerous highly successful residents, fellows and faculty. He has served as principal investigator and co-investigator on multiple clinical trials and received numerous accolades for his scientific presentations.

**Spencer Behr, MD**, and **Courtney Lawhn Heath, MD**, have joined the MI&T section as core faculty. ■



*Thomas Hope, MD*

# New Appointments

## Matthew Bucknor, MD, Appointed Associate Chair for Wellbeing and Professional Climate



In July, Matthew Bucknor, MD, was appointed as the inaugural associate chair for Wellbeing and Professional Climate for the Department of Radiology and Biomedical Imaging. In this role, Bucknor serves as the departmental lead for programs and initiatives addressing diversity and inclusion, interconnectedness, burnout

and work-life balance. He will also continue to oversee the department's Diversity and Inclusion Committee.

In October 2019, Bucknor received the Chancellor's Martin Luther King, Jr. Leadership Award for Faculty. "Our underrepresented in medicine (UIM) students in this year's class can be directly attributed to the pipeline initiatives implemented under Dr. Bucknor's aegis," noted department Chair Christopher Hess, MD, PhD. "It is incredibly gratifying and inspiring to see Dr. Bucknor's efforts helping us to better identify appropriate candidates for our program and contribute to real changes in representation."

In 2015, Bucknor was selected as an inaugural UCSF John A. Watson Faculty Scholar for his commitment to diversity and became the founding chair of the department's Diversity and Inclusion Committee. In this capacity, he has coordinated outreach programs for underrepresented minorities; promoted educational initiatives focused on unconscious bias; and developed departmental pipeline programs to encourage students from diverse backgrounds to pursue radiology and radiology-related research. He has also been a member of the UCSF Differences Matter initiative and formed powerful collaborations across the university to further efforts to make UCSF the most diverse, equitable and inclusive academic medical system in the country.

Bucknor received his Bachelor of Arts in Biochemical Sciences from Harvard College and his medical degree from the Stanford University School of Medicine. He completed his radiology residency at UCSF, including an NIH T32 research fellowship and joined the faculty in 2014 after completing a clinical fellowship in Musculoskeletal Radiology at Stanford University. Throughout his time at UCSF, Bucknor has distinguished himself as a collaborative clinician and outstanding translational scientist. He is an internationally recognized expert in noninvasive thermal ablation with high intensity focused ultrasound and has helped pioneer several new indications for this exciting new treatment modality.

"Our ability to recruit and broadly support the diverse talents and needs of our clinicians, researchers, staff and trainees is critical to our future in this time of unprecedented innovation and challenge," said Hess. "I am determined that we set the national standard as an outstanding place to work, using diversity, equity and positive culture as tools for achieving excellence. I am looking forward to the opportunity for all of us to think together critically with Dr. Bucknor about these issues."

## Christopher Laubenthal, MBA, Joins Department as Chief Administrative Officer



Christopher Laubenthal, MBA, became the chief administrative officer (CAO) for the UCSF Department of Radiology and Biomedical Imaging in July, 2019. Laubenthal came to UCSF from the University of Iowa Carver College of Medicine, where he served as clinical department administrator for the Department of Internal Medicine.

"Chris' deeply rooted commitment to the tripartite missions of academic medicine was evident from the very beginning of the search process and reflective of his prior experience and achievements through 25 years of administrative leadership in academic medicine," said Chair Christopher Hess, MD, PhD.

During his most recent six years at the University of Iowa, Laubenthal served as the key strategic partner to the incoming chair of Internal Medicine. He designed and implemented a new departmental faculty compensation plan that reinforced clinical incentives and aligned department and division financial targets and faculty mission-based activities. While at Iowa, Chris also developed a new divisional budgeting system and dashboard reporting for divisional decision-making.

Laubenthal grew up in Iowa City, Iowa, where he completed his BA and MBA at the University of Iowa and started his early career in academic medical practice management. Previously president-elect for the Association of Administrators in Academic Radiology (AAARAD), he was most recently nominated to serve as president-elect of the Administrators of Internal Medicine (AIM). "His leadership in these national organizations of academic administrative managers illustrates the high level of respect that his peers carry for him in both Radiology and in Internal Medicine," says Hess.

UCSF Radiology would like to thank Mary Bobel, MBA, for her support and leadership over the past three and a half years that she served as CAO for the department. She will remain at UCSF as the administrative lead for the UCSF Department of Otolaryngology – Head and Neck Surgery. ■

## 2019 Retirements

### Helen Galvin, MD



After more than 38 years in the Department of Radiology and Biomedical Imaging, Helen Galvin, MD, retired in July 2019. "Helen is an exceptional radiologist and she has a strong devotion to providing extraordinary patient care," noted Dr. Ronald Zagoria, vice chair for Clinical Operations. "She is a

compassionate physician and a highly valued colleague."

Galvin began her diagnostic radiology training at Mater Hospital, Dublin, Ireland. She then came to UCSF, where she completed her residency. Galvin served as a clinical instructor prior to joining the faculty as an assistant professor of radiology. In 2003, she became a clinical professor of radiology. Her clinical duties were performed at a variety of sites including the Ambulatory Care Center at UCSF, Mt. Zion Hospital and ZSFG. Her clinical focus was on emergency and outpatient radiology, including radiography, mammography, breast MRI and ultrasound.

Galvin has returned to the department part-time on a recall appointment in the department's urgent care radiology section.

### Virginia Griswold, MD



Virginia J. Griswold, MD, associate clinical professor of radiology, retired in July after 30 years of service to UCSF and the San Francisco Veterans Affairs Medical Center. During her many years of loyal service as a clinical attending physician, she worked primarily in the areas of nuclear medicine, abdominal imaging and

ultrasound, with an emphasis on vascular ultrasound. Griswold had extensive experience in intraoperative ultrasound and performed intraoperative localizations and biopsies of gastrointestinal tumors including hepatocellular carcinoma, pancreatic adenocarcinoma, and gastrointestinal stromal tumors. She was also experienced in providing ultrasound for vascular surgery, including carotid endarterectomies and coronary bypass grafts.

Griswold completed her medical degree at La Sapienza, Faculta' di Medicina e Chirurgia, in Rome, Italy. Her residency was completed at the Boston University School of Medicine, followed by a fellowship at the same institution in Nuclear Medicine and Ultrasound. She subsequently completed a fellowship in MRI at UCLA-Harbor Medical Center, serving as faculty for one year at that institution before joining UCSF in 1989 as an assistant professor.

Griswold was a frequent lecturer, giving numerous invited presentations, particularly on vascular ultrasound. She was also a dedicated teacher, contributing to medical student education at UCSF over a number of years in the fourth-year medical student elective. She received the Haile Debas Excellence in Teaching Award from UCSF Medical School in 2005.

She was active in numerous professional organizations, among them the Women's Veteran's Committee at the SFVAMC, and the Bay Area chapter of the American Association for Women Radiologists, where she held a variety of positions, serving as president in 1992.

"Virginia was a complete radiologist, with training in a wide variety of modalities and techniques," noted Michael Hope, MD, chief of radiology, SFVAMC. "We thank her for the dedicated service she provided for so many years to veterans needing imaging services at the SFVAMC." ■

## In Memoriam

### Rahul Desikan, MD, PhD

1978-2019

By Christopher P. Hess, MD, PhD

Rahul Desikan, MD, PhD, passed away on July 29, 2019 after a 2½ year, hard-fought battle with a rapidly progressive form of ALS. Rahul was a deeply committed and caring husband and father, a brilliant neuroscientist and radiologist, and an inspiring friend and colleague beloved by many within and outside of UCSF.

Born in New Delhi, India, Rahul immigrated to Queens, NY as a young boy. He attended the Bronx High School of Science and won a scholarship to attend Boston University in Massachusetts. As an undergraduate, he triple-majored in Neurosciences, Biology and Classics. He went on to obtain a PhD in Neuroanatomy and Neurobiology and to attend medical school at the same institution. After moving west to attend UC San Diego for his radiology residency, UCSF was fortunate to attract him in 2015 as a clinical fellow in neuroradiology. He joined the faculty as assistant professor of neurology and pediatrics in 2017.

Fascinated by the intricacy of the structure and function of the brain at an early age, Rahul dedicated his scientific career to understanding the pathobiology of neurodegenerative illness and neurodevelopment.



Dr. Rahul Desikan (seated) with his lab.

He received numerous accolades for his trailblazing research: the Alzheimer's Imaging award and the Cornelius Dyke Memorial award from the American Society of Neuroradiology, the Early Career Investigator award and George Bartzokis Award from the Charleston Conferences in Alzheimer's Disease, and the Junior Investigator award from the National Alzheimer's Coordinating Center.

Rahul is perhaps best-known for the computational brain atlas that he developed while completing his PhD. The 2006 publication in *Neuroimage* detailing the "Desikan atlas," an anatomic description of the brain's surface, quickly became one of the most widely used tools in the neuroscience community. It has been cited more than 4,500 times and color figures of the atlas in various forms fill the pages of leading scientific journals.

During his fellowship and as a faculty member in the UCSF neuroradiology section, Rahul turned his focus to elucidating the genetic architecture of neurodegenerative disorders and how they define individual disease vulnerability. He introduced a highly accurate polygenic hazard score for predicting the age of onset of Alzheimer's disease. He also helped delineate a shared genetic milieu between Alzheimer's and cardiovascular disease, adding fuel to the idea that controlling blood lipid levels might delay or prevent the onset of dementia. His work shed new light on genetic pleiotropy in Alzheimer's disease, as well as in ALS, Parkinson's, frontotemporal dementia, bipolar disorder and schizophrenia. This work was the subject of the more than 25 papers that he published in high-impact journals such as *JAMA*, *Brain*, *Nature Scientific Reports*, *Nature Genetics* and *Acta Neuropathologica* after his diagnosis with ALS.

It was a cruel twist of fate in February 2017 when Rahul was diagnosed with one of the very diseases that he studied. His physical function declined rapidly, to the point where he became "locked in," able to communicate only by blinking and moving his eyes. His courageous battle with the disease was featured by the *Washington Post* and *Good Morning America*, and through a series of meticulously crafted, thought-provoking op-ed pieces in the *San Francisco Chronicle* and *Scientific American*. In his own powerful words, published in the *Washington Post* on April 28, 2019: "I don't want you to feel sorry for me. At all. It is just ironic, this new, condensed life of mine. I went into medicine to take care of patients with brain diseases. Now, I have one of the diseases that I study. Even with this lethal disease, I continue to find neurology fascinating and beautiful."

Despite losing the ability to speak, walk and use his hands, he maintained an active research group, writing grants and manuscripts, and cultivating the careers of the young scientists who worked with him. He regularly mentored fellows and other junior faculty in neuroradiology, and was always willing to serve as a sounding board for ideas, even opening up his home for group meetings and faculty holiday gatherings. Through the end of his life, Rahul was vocal about the need for increased awareness and research funding for ALS.

Rahul will be remembered as quintessentially human. As beautifully profiled last year in Boston University's *Bostonia* magazine, he was funny, humble, loving and wildly creative. Though his heartwarming impressions and endearing sense of humor, he had an uncanny way of making people laugh. Rahul inspired us all to be better people, to laugh, to enjoy, to be curious, to further science, to explore questions and to challenge the way neuroscience is studied. His spirit of optimism, humanity and gratitude left us in awe.

Rahul leaves behind his much-loved wife Maya Vijayaraghavan, MD, MAS, faculty member in the UCSF Department of Medicine, their two sons, Rabi and Amar, and his loving parents Veda and Krish and sister Vasudha.

## **Randy Hawkins, MD, PhD** **1949-2018**

By Christopher P. Hess, MD, PhD



Randall Hawkins, MD, PhD, friend and long-time faculty member in the UCSF Department of Radiology and Biomedical Imaging passed away unexpectedly on November 24, 2018.

Randy grew up in Southern California, northeast of Los Angeles in Wrightwood. A champion swimmer and lifeguard in high school, he went

on to obtain his undergraduate training in Physics at Occidental College. He received his medical degree from the University of California, Irvine, followed by residency training first in radiology at the University of Southern California and then in nuclear medicine at the University of California, Los Angeles. An innate scholar interested in the science of medicine just as much as the practice of medicine, he stayed on at UCLA to complete his PhD in Biomedical Physics. He quickly rose to become residency director and section head at UCLA in the Division of Clinical Nuclear Medicine, where he also served as vice chairman in the Department of Radiological Sciences.

After a distinguished career at UCLA, Randy was recruited as professor to UCSF by then-chair Dr. Ronald Arenson as chief of Nuclear Medicine, a role in which he served until 2009. Initially drawn to UCSF by a medical cyclotron and growing program in positron emission tomography (PET), he became a celebrated scientist and lecturer around the world. He gained international renown for his pioneering work that helped pave the way for the clinical use of PET in stroke, malignancy, dementia and epilepsy. During his tenure, Randy developed new and innovative mathematical techniques for PET and SPECT image reconstruction using Bayesian estimation and led fundamental work for applying these modalities in oncology and neurology.

Randy was a truly exceptional physician who had a broad impact on clinical care across UCSF. He was loved by residents and fellows and served as dedicated and caring mentor to numerous trainees and faculty.

## Marcia J. McCowin, MD

1952-2020

By William P. Dillon, MD; Irene Balcar, MD; Christopher P. Hess, MD, PhD



Dr. McCowin received her undergraduate degree from the University of California Berkeley in 1972 and her medical degree from George Washington University in 1976. After completing two years as a resident in internal medicine at LDS Hospital in Salt Lake City, Marcia moved to San Francisco to begin her training

at UCSF. She completed two residencies, diagnostic radiology in 1981 and nuclear medicine in 1983. After serving as chief resident of nuclear medicine, she joined the faculty at Stanford University as Clinical Professor of Radiology in 1985. In 1994, she returned to UCSF as associate professor, dedicating the majority of her time to nuclear medicine and chest imaging at the San Francisco Veterans Administration Medical Center (SFVAMC). Dr. McCowin was recognized as an insightful clinical radiologist, a passionate advocate for veterans and a committed educator. She became professor of clinical radiology in 2001.

Following her retirement in August 2019, Marcia maintained an active presence teaching medical students and residents. "She had a lovely personality and consistently positive outlook," said Dr. Michael Hope, current chief of service for Radiology at the SFVAMC. "Clinical services, especially the pulmonary and critical care teams, always sought out her opinion on challenging cases."

Education was the centerpiece of Dr. McCowin's long and dedicated UCSF and SFVAMC career. She became assistant director of the Radiology Learning Center in 2000, working closely with Dr. Henry Goldberg to create well-regarded UCSF Radiology medical student clerkships. Dr. McCowin was elected to the Haile T. Debas Academy of Medical Educators in 2004, and in 2006 was named an associate director of the Goldberg Center for Advanced Imaging Education. Her teaching focused on designing interactive tools for the learner to build competence and an understanding of the importance of imaging in medical diagnosis and therapy. She trained countless medical students over the course of her career, both at UCSF and at the SFVAMC. "Dr. McCowin was an exceptionally passionate teacher," according to Dr. Judy Yee, former SFVAMC chief of service and now department chair at Montefiore Health System and Albert Einstein College of Medicine. "She spent countless hours lecturing, hands-on teaching and reviewing cases with medical students and residents. Her service was critical to the educational mission of the department."

Marcia was known to her many friends, co-residents and colleagues as a gentle and fun-loving person. She had many outside interests in addition to her professional career, including singing in the choir at Grace Cathedral and as a member of the SF based a capella group, *Sweet*

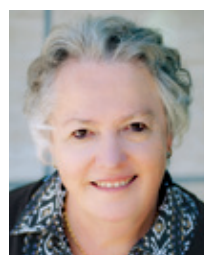
*Adelines*. Marcia was devoted to her large extended family, many of whom rallied to help in her last few months.

Throughout her career Dr. McCowin was especially grateful to her mentors, especially Gretchen Gooding, MD, Professor Emerita in the department. Marcia chose to honor Dr. Gooding through a generous legacy gift to the department designed to support an annual event that will focus on leadership and ethics topics for trainees. "Marcia McCowin was a loving, considerate person of great charm, who reached out to others to foster their learning and professional maturity," said Dr. Gooding. "She will be deeply missed as a person dedicated to the mission of expanding the horizons of Radiology."

## Sarah J. Nelson, PhD

1954-2019

By Christopher P. Hess, MD, PhD



Sarah J. Nelson, PhD, luminary imaging scientist, friend and long-time faculty member in the UCSF Department of Radiology and Biomedical Imaging, passed away on April 3, 2019 after a valiant struggle with cancer.

Sarah completed her undergraduate degree in Mathematics at the University of Manchester and her doctorate in Biomathematics at the University of Heidelberg. She then worked as a postdoctoral fellow at Fox Chase Cancer Center in Philadelphia for two years before being recruited to UCSF in 1990 by then-Chairman Alexander Margulis, MD, to work at the newly established Magnetic Resonance Science Center (MRSC). An innate leader and program builder, Sarah served during her tenure as the director of the MRSC, co-chair of the Department of Bioengineering and Therapeutic Sciences, director of the Surbeck Laboratory for Advanced Imaging, and scientific director for the California Institute for Quantitative Biosciences.

The programs that Sarah built during her career are too numerous to count. She was recognized internationally for her seminal contributions to metabolic imaging, particularly in magnetic resonance spectroscopy, hyperpolarized <sup>13</sup>C imaging and neuro-oncology. She published more than 270 papers in these areas. She was the inspirational force behind the installation of one of the world's first 7T MR scanners at UCSF and also helped bring hyperpolarized <sup>13</sup>C technology to the institution. Through the more than 25 years of continuous NIH funding that she obtained, and the close partnerships she cultivated with investigators in the UCSF Department of Neurosurgery and with corporate partners from General Electric and other companies, she established the brain tumor imaging program at UCSF, the Margaret Hart Surbeck Laboratory, and the Department of Bioengineering and Therapeutic Sciences. Among the many distinguished accolades that she received, Sarah was a Fellow of the International Society for Magnetic Resonance in Medicine, a Distinguished Researcher of the

Academy of Radiology Research, and a World Molecular Imaging Society Gold Medalist.

Sarah's profound impact came not only through her many personal contributions to imaging science, but also through the careers of the mentees and protégés that she helped to launch. She was recognized at UCSF and in the MR community for her ceaseless willingness to share insights and advice with students, post-doctoral researchers and junior faculty, to use her influence to promote the advancement and success of others, and to help nascent scientists to overcome personal and professional challenges. As mentor to scores of students and postdoctoral fellows, she received numerous distinctions for her teaching and mentoring, and many of her trainees have gone on to become leading imaging scientists around the world.

We have lost a pioneer in imaging science, an extraordinary leader, an innovator and a scholar who shared her wisdom and knowledge generously.

## Grant Hieshima, MD

1942-2019

By Randall T. Higashida, MD



Grant Hieshima, MD, died unexpectedly on August 9, 2019, at the age of 77, while enjoying one of his lifelong passions, deep-sea fishing, with his son Michael at his side. Grant was born in Southern California in 1942, and attended UCLA as an undergraduate. He received his medical education from Tulane

University Medical School, in New Orleans, where he graduated with honors in 1969. He pursued radiology with subspecialty training in neuroradiology and nuclear medicine. He was appointed to a faculty position in 1974 at Harbor-UCLA Medical Center in Torrance, California where he began to develop techniques to manage vascular trauma.

In 1983, Grant was recruited to UCLA Medical Center to start a new program in neurointerventional radiology (NIR). I was completing my final year of residency in radiology at UCLA, and after training with Grant, I asked to become his first NIR fellow.

At UCLA the day started at 7:30 am with morning read-outs of CT brain scans, followed by afternoons performing diagnostic angiography, myelography, pneumoencephalography of the brain ventricles, lumbar punctures for cerebrospinal fluid analysis. Only then would we start NIR procedures, usually working until the late evenings.

We were often called by hospital emergency rooms in Southern California to treat life-threatening gunshot and knife wounds to the head and neck, traumatic carotid cavernous sinus fistulas, and epistaxis due to head and neck trauma or tumor erosion. Grant had earned a reputation for being available for advice and treatment

for emergencies in which conventional surgery had high morbidity. His ability to quickly devise procedures for treatment won him the respect of many trauma and neurosurgical physicians.

Grant developed the Hieshima detachable silicone balloon in collaboration with two engineers who became lifelong friends, Bill Dormandy and Julie Bell, from Interventional Therapeutics Corporation. It was used to treat traumatic carotid cavernous sinus fistulas by floating the balloon from the internal carotid artery across the tear and then detaching the balloon by gentle traction. The balloon would self-seal after being inflated with contrast.

In 1986, Grant, Dr. Van Halbach, and I were recruited to start the Neurointerventional Radiology program at UCSF Medical Center by then-Chair of the Department of Radiology Dr. Alexander Margulis. Grant continued to innovate devices for NIR procedures and worked with engineers to develop better micro-guidewires, microcatheters and other embolic materials (HEMA, n-butyl cyanoacrylate, polyvinyl alcohol, microcoils) to treat a wider variety of head, neck, brain and spinal cord vascular abnormalities.

Grant trained more than 100 fellows in diagnostic angiography and NIR procedures. He was a well-respected academician with more than 150 scientific publications and 60 book chapters and was an invited speaker at more than 400 medical conferences across the world. He was an investigator on more than 20 grants and research trials involving new techniques in the management of brain aneurysms, subarachnoid hemorrhage with vasospasm, brain arteriovenous malformations, intra-arterial thrombolysis, and cerebral angioplasty.

Grant retired in 1996 from UCSF, after serving as chief of the NIR division for 10 years, and was named director of the Neuroscience Institute at St. Joseph's Medical Center in Orange County, California. He also consulted on the establishment of NIR services at Hoag Memorial Hospital, California.

In 1997, Grant was honored by the Joint Section of Cerebrovascular Surgery with the Luessenhop Award and in 1999 received the American Society of Neuroradiology's gold medal. In 2003, Tulane University Medical School named him "outstanding alumnus." He was the inaugural recipient of the Society of NeuroInterventional Surgery's Luminary lecture in 2007 and the next year, was honored by the Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center for his contributions to the field of medicine.

Grant was a visionary, pioneer of interventional neuroradiology procedures and techniques, a compassionate physician, a patient and learned teacher and mentor to his fellows, residents, and students, and a very kind and generous friend with a gentle spirit and soul.

Grant is survived by his loving wife Donna and his two sons, Glenn and Michael.

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# EDUCATION

## UCSF Training Programs 2019–2020

By Soonmee Cha, MD

The diagnostic residency was once again ranked top program by *Doximity*. The department launched the Integrated Interventional Radiology Residency Program, and our staff, educators, and residency and fellowship trainees received many distinguished awards.

In my role as vice-chair for Education, I am responsible for the strategic planning, integration, oversight, and direction of all the diverse education programs and activities within the Department of Radiology and Biomedical Imaging. This work is performed within the context of the UCSF's mission of "caring, healing, teaching, and discovering" and the department's vision of being "a world-class patient centered, academic community improving health through innovation in imaging and image-guided therapy." The goal of our education programs, "to train leaders in teaching, clinical care, research and public service" is strongly aligned with the UCSF and departmental missions.

### Residency Program

Our newest residents, a diverse group of talented and promising medical trainees, joined us in July. Thirteen of them will follow a four-year diagnostic radiology track, and one will complete three years of diagnostic radiology training before transitioning to a focused, two-year Interventional Radiology training program. They all hit the ground running and are already performing with a high level of skill and expertise. We are eager to train these future leaders in research, education, and clinical care.

Our outgoing chief residents, Kirema Garcia-Reyes, MD, Bryce Merritt, MD, and Molly Chapman, MD, did a fantastic job last year. Our incoming chiefs, Jonathan Jo, MD, Ryan Navarro, MD, MS, Alex Wright, MD, have willingly shouldered new duties and responsibilities this year.

Thank you to Jason Talbott, MD, PhD, associate program director, and head of the residency selection committee for providing invaluable dedication and insight to our program.

### Fellowship Training Program

Our goal is to thoroughly prepare fellowship trainees for the career of their choosing. We are dedicated to helping our clinical fellows and instructors become skilled clinicians in their chosen subspecialty, as well as becoming leaders and teachers in their field. The Department of Radiology and Biomedical Imaging offers fellowship and training opportunities to those physicians who wish to expand their

expertise in any of the following radiology subspecialties:

- Abdominal Imaging/Ultrasound (non-ACGME): Program Director, Spencer Behr, MD, and Associate Program Director Derek Sun, MD
- Breast Imaging (non-ACGME): Program Director Elissa Price, MD
- Cardiac & Pulmonary Imaging (non-ACGME): Program Director Travis Henry, MD
- Interventional Radiology (ACGME): Program Director, Evan Lehrman, MD
- Musculoskeletal Radiology (non-ACGME): Rina Patel, MD
- Neuroradiology (ACGME): Program Director Vinil Shah, MD, and Associate Program Director Yi Li, MD
- Neurointerventional Radiology (non-ACGME): Program Director Van Halbach, MD, and Associate Program Director Matthew Amans, MD
- Molecular Imaging & Therapeutics (ACGME): Program Director Miguel Pampaloni, MD, PhD
- Pediatric Radiology (ACGME): Program Director Jesse Courtier, MD

Under the leadership of Spencer Behr, MD, the program directors meet quarterly to discuss ways to improve the fellowship training programs. The fellowship educational fund, fellows social, chief fellow, and fellow council are some ideas implemented since the formation of this group. They strive to bring uniformity and equity, as well as to streamline policies and educational standards across all of the subspecialties.

### Teamwork

It takes a village to support our educational programs each and every day. Department Chair Christopher Hess, MD, PhD, is continuing our tradition of ensuring education remains integral to the department's mission.

If it takes a village, it also takes big hearts to shape growing minds. In 2019, I revamped and recruited new members to the Education Team, five bright and knowledgeable staff with huge hearts who share the same desire and vision to give our trainees an exceptional experience. Melinda Parangan-Chu is the director of education programs; Sandria Wong is the diagnostic radiology residency program coordinator; and Cindy Flores Gaytan serves as the coordinator for both the integrated and the independent Interventional Radiology programs, as well as resident education coordinator. New to the team are Sora Kang, fellowship programs coordinator

and Samira Zebarjadian, our medical student education coordinator and Molecular Imaging and Therapeutics program coordinator. Thank you to the members of our education team who strive to push each trainee to their best potential. Not only do they help our trainees with their administrative needs, they serve as mentors, advisors, and guide trainees during their time with us. You will often see them checking in on trainees' well-being and fostering work-life balance. They go above and beyond because they care.

Finally, our teachers also must be acknowledged for their role in educating our trainees. The success of our education programs is credited to the dedicated faculty and instructors whose commitment to fostering the skills and knowledge of our trainees is second to none.

## 2019 Notable Education Awards and Accomplishments

- Cindy Flores Gaytan – UCSF Jaclyne Witte Boyden Staff Service Award
- Benjamin Laguna, MD – UCSF Radiology and Biomedical Imaging 2019 Margulis Society Resident Research Award
- Courtney Lawhn-Heath, MD – SNMI Robert E. Henkin Government Relations Fellowship
- Eric Mastria, MD – CTSI Spring 2019 Resident Research Funding Award
- Adam Meeks, MD – UCSF Radiology and Biomedical Imaging, 2019 Outstanding Clinical Instructor/Fellow Teaching Award
- Bryce Merritt, MD – UCSF Radiology and Biomedical Imaging 2019 Elmer Ng Outstanding Resident Award

- Priya Rajagopalan, MBB, RSNA Research Award
- Andreas Rauschecker, MD, ASFNR – Trainee Research Award; ASNR/ASFNR MIT-E Award; Appointed to Radiology, Artificial Intelligence Board
- Jeffrey Rudie, MD – Appointed to Radiology, Artificial Intelligence Board; RSNA Trainee Award
- Karl Soderlund, MD – ASNR Summa Cum Laude Award for Scientific Presentation
- Jae Ho Sohn, MD – RSNA 2019 Margulis Award for Scientific Excellence ■

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*Soonmee Cha, MD, is a professor in residence of Radiology and Neurological Surgery, vice chair of Education, program director for the Diagnostic Radiology Residency Program, and associate program director for the Integrated Interventional Radiology Residency.*



*Chief residents (from left) Alex Wright, MD; Jonathan Jo, MD; and Ryan Navarro, MD, MS.*

*Radiology Residency Graduates, Class of 2019: (l-r back row) Adam Schwertner, MD, Andrew Callen, MD, Colin Burke, MD, Bryce Merritt, MD, Adam Coy, MD, John Colby, MD, PhD, Chair Christopher Hess, MD, PhD. (l-r front row) Associate Residency Director Jason Talbott, MD, Residency Program Director Soonmee Cha, MD, Courtney Lawhn Heath, MD, Ahley Oladipo, MD, Yilun Koethe, MD, Yujie Qiao, MD, Benjamin Laguna, MD, Maureen Chapman, MD, MA, Kirema Garcia Reyes, MD, Aaron Losey, MD, MS.*



## PGY-2 Residents: Class of 2023

### Emmanuel Carrodeguas, MD



Emmanuel Carrodeguas earned his medical degree in 2018 from Harvard Medical School in Boston, MA, where he was selected as the Martin Prince Scholar for Research Innovation for his research developing a machine-learning natural language processing tool for radiology reports. His recent research focused on

machine learning models at the Center for Evidence Based Imaging at Brigham and Women's Hospital in Boston, MA. Carrodeguas completed a transitional year residency at Signature Healthcare Brockton Hospital in Massachusetts in June 2019, before joining the department as a first-year diagnostic radiology resident in July 2019.

### Andrew Fenster, MD



In 2018, Andrew Fenster obtained his medical degree from the Albert Einstein College of Medicine in the Bronx, NY, followed by an internal medicine internship completed in June 2019. He received the 2018 Ralph Ger Award for outstanding academic performance and peer teaching. His research experience in

the Neurointerventional Radiology Research Department at Montefiore Hospital, New York, included a retrospective study on the safety of CT-guided epidural steroid injections for treatment of low back pain in an older patient population. In July 2019, Fenster joined the department as a first-year diagnostic radiology resident.

### Will Fletcher, MD, MS



Will Fletcher received his medical degree in 2018, from the Stanford University School of Medicine in Stanford, CA. While attending Stanford, he was awarded a National Science Foundation Graduate Research Fellowship and was a Department of Energy Computational Science Graduate fellow. Fletcher has

conducted research in the retrospective analysis of patients with liver tumors and parasitized extrahepatic arteries (presented at the 2018 Society of Interventional

Radiology meeting). Fletcher was co-director of the Radiology Interest Group at Stanford from 2015-2017. In June 2019, he completed a one-year internship in internal medicine at St. Mary's Medical Center in San Francisco, before beginning his diagnostic radiology residency in July 2019.

### Isaac K. Ghansah, MD, MSc



In 2018, Ghansah earned his medical degree at Case Western Reserve University School of Medicine in Cleveland, OH. There, he received the Satcher-Pamies Merit Scholarship (2014-2018). While at Case Western, he performed research assessing how aberrant GSK3B nuclear localization drives AML growth and

drug resistance. Ghansah served as the official Student National Medical Association contact for the Daniel Hale Williams minority pre-medical society at Case Western. Ghansah became a Diagnostic Radiology resident in July 2019, after completing a one-year internal medicine internship at Kaiser Permanente Oakland Medical Center in June.

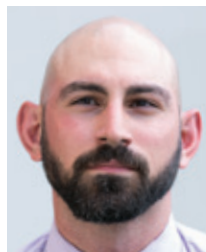
### Ashley Hastings-Robinson, MD



Ashley Hastings-Robinson earned her medical degree in 2018 from Northwestern University, Feinberg School of Medicine in Chicago, IL. While at Northwestern, Hastings-Robinson was a Department of Radiology Oncology Endowed Student Scholar. Hastings-Robinson was a medical student researcher in

the Department of Radiology and focused her investigation on the epidemiology and radiologic characteristics of primary bladder malignancies. At Northwestern, she served as a co-coordinator for the Correctional Medicine Coalition's Health Empowerment and Awareness Program, providing health education for incarcerated women at the Illinois Cook County Jail, as well as serving as board secretary for the Feinberg Student National Medical Association. She completed an internal medicine internship at Virginia Commonwealth University Hospital in June 2019 and became an incoming Diagnostic Radiology resident in July 2019.

### **Masis Isikbay, MD**



Masis Isikbay obtained his medical degree from Harvard Medical School in Boston, MA in 2018 and completed a general surgery internship at UCSF in June 2019. Isikbay's recent research experience was at the Harvard School of Public Health, Department of Epidemiology, where his investigations focused on defining

relationships between prostate cancer biomarkers, family history and unique tumor biology (2015-2016). He served as a graduate research assistant for Harvard's Transdisciplinary Prostate Cancer Partnership (2015-2017). Isikbay is the creator of stepwards.com, a medical education website dedicated to sharing medical information with other trainees. He entered the UCSF diagnostic radiology residency in July 2019.

### **Michael V. Khanjyan, MD**



Michael Khanjyan received his medical degree from UCSF in 2018, where he was a Pathways to Discovery Dean's Research Fellow (summer 2014). He was an NIH Translational Science TL1 Research Fellow (July 2016-June 2017), performing research focused on enhancing the survival and

differentiation of transplanted human cardiac progenitor cells following myocardial infarction. From July 2016-June 2017, Khanjyan was also a UCSF School of Medicine Pre-Health Undergraduate Program mentor for undergraduate students considering careers in health care. In June 2019, he completed an Internal Medicine internship at the Kaiser Permanente San Francisco Medical Center, before joining UCSF as a diagnostic radiology resident in July 2019.

### **Sarasa T. Kim, MD**



In 2018, Sarasa Kim received her medical degree from the Mayo Clinic School of Medicine in Rochester, MN. At Mayo, Kim served as a student representative for the Medical School Clerkship Committee (July 2014-May 2018), and as co-director of the Radiology Interest Group (March 2015-May 2016). She was president

of the Mayo Chapter of the American Medical Woman's Association (March 2015-June 2016) and was a training coordinator for the RIGHTS Clinic, a free clinic serving

victims of sex trafficking, from March 2015-June 2016. Kim received both the American Heart Association – Moller Medical Scholarship and the Jerry Chen Scholarship in 2015. In June 2019, Kim completed a one-year Medicine internship at Santa Clara Valley Medical Center. She joined the department as a diagnostic radiology resident in July 2019.

### **Amanda R. Liu, MD**



Amanda Liu earned her medical degree at the Warren Alpert Medical School of Brown University of Providence, RI. She received the Whalen Award for Excellence in Neuroscience and Behavioral Biology in 2014 and the John Evrard Prize in 2016. During her final year in medical school, Liu was the Medical Student

Senate student body president and served as a chief teaching assistant in both the Clinical Skills Clerkship and Brown Gateways to Medicine, Health and Research Program. She performed research in several departments while at Brown, including the departments of emergency medicine, diagnostic imaging, and the department of cognitive, linguistic, and psychological sciences. Following an internship at Tucson Hospitals Medical Education Program in June 2019, Liu became a diagnostic radiology resident in July 2019.

### **Rana Rabei, MD, MS**



In July 2018, Rana Rabei completed her medical degree at the Rosalind Franklin University (RFU) of Medicine and Science in North Chicago, IL. She earned Master of Science degrees in both Health Administration (2015) and Biomedical Sciences (2014) at the same institution.

In 2018, Rabei received the RFU Dean's Service Award and the Highest Basic Science Average Award. She received the Dr. John J. Sheinin Merit Scholarship, and the RFUMS/CMS Endowment Merit Scholarship in 2018, and a 2017 travel grant from the Society for Interventional Radiology. Rabei served as president of the RFU's Chicago Medical School (CMS) Student Council, and was a co-founder of the CMS Alumni Ambassador. Rabei completed an internship in general surgery at UCSF in June 2019. She became a resident in diagnostic and interventional radiology in July 2019.

### Ethan J. Speir, MD



In 2018, Ethan Speir received his medical degree from Emory University School of Medicine in Atlanta, GA. While at Emory, Speir was a 2015 recipient of both the William C. Ware Scholarship and the David and Phyllis Fetters Scholarship, as well as a 2018 Society for Interventional Radiology travel grant.

He served as co-president of the Emory Interventional Radiology Interest Group from 2016-2018 and was a student interviewer and tour guide for the Emory School of Medicine Admissions in 2017-2018. To date, Speir has been an author on eight published peer-reviewed research articles. He completed a one-year internship at Emory University, Department of Medicine in June 2019 and joined the diagnostic radiology residency as an incoming resident in July 2019.

### Kevin H. Terashima, MD



Kevin H. Terashima received his medical degree in 2018 from UC Los Angeles David Geffen School of Medicine. He received the Medical Research Scholars Program Fellowship (2016-2017) and the David Geffen Medical Scholarship (2013-2016; 2017-2018). Terashima was coordinator for the UCLA

Pathology Interest Group (2014-2018), and was a volunteer laboratory assistant at the Saturday Science Academy Youth Training Program at the NIH campus in Washington, DC in spring 2017. Terashima has done research investigating gadolinium deposition in the brain for the NIH Medical Research Scholars Program in Bethesda, MD (July 2016-June 2017). He has been an author on five published peer-reviewed journal articles. In June 2019, Terashima completed a one-year medicine internship. In July 2019, he joined the diagnostic radiology residency as an incoming resident.

### Parmede Vakil, MD, PhD



Dr. Vakil obtained his PhD from the University of Illinois College of Medicine in Chicago in 2013, and his medical degree from the same institution in 2018. During medical school, he was University of Illinois James Scholar (2015-2018). He received the Lucien Levy Best

Research Article Award from the American Journal of Neuroradiology (AJNR) in 2014. He was the chair and founder of the Biomedical Research Mentors Program at Northwestern (2012-2019), a program supporting undergraduate students starting or seeking research positions. Vakil is an author on 12 peer-reviewed journal articles. He has served as a scientific reviewer for the AJNR and Magnetic Resonance in Medicine. Vakil completed an internship in medicine at Advocate Illinois Masonic Medical Center in Chicago in June 2019 and became a diagnostic radiology resident in July.

### Adam J. Yen, MD



Adam Yen earned his medical degree at the UCSF School of Medicine in July 2018. He completed a one-year internship at the Santa Clara Valley Medical Center before joining the department as an incoming diagnostic radiology resident in July 2019. Yen has conducted research in several UCSF departments. His

UCSF Radiology and Biomedical Imaging research was in the Neurointerventional and Interventional Radiology sections, as well as the Henry I. Goldberg Center for Advanced Imaging Education. Yen received a UCSF Pathways to Discovery Travel Grant (2016) and the UCSF Pathways Explore Raptor Research Grant (2015). He is the executive director and co-founder of the James S. Wong Private Foundation, which distributes monetary grants to disadvantaged communities to rectify health disparities. Yen was an interviewer for the UCSF School of Medicine Admissions Committee from 2015-2016 and 2017-2018, and served as president of the department's Radiology Interest Group in 2015-2016. He is an author on eight published peer-reviewed journal articles. ■

# Goldberg Center for Medical Student Education

By Emily M. Webb, MD

The UCSF School of Medicine is in the final year of transition to the new Bridges curriculum, with the fourth year students well into their Career Launch year. This is a capstone year consisting of career exploration as well as deep inquiry immersion in a topic relevant to health care or the domains of science. The Bridges curriculum provides a unique experience at UCSF. During the core clerkships, students spend a day week reviewing the underlying basic sciences relevant to their clinical rotations.

As part of these “foundational sciences” days, student now learn core radiology content. The radiology thread is taught alongside pathology in a course called “Appropriate Use of Diagnostic Tests.” This change to the curriculum is one of the most popular additions to the core clinical year, and it is a great opportunity for students to learn about radiology as they are first exposed to clinical medicine. We believe teaching this high-yield information from the outset of their clinical training will produce more informed, efficient physicians. Goldberg Center faculty are hard at work refining our teaching materials as this exciting endeavor is rolled out for the first time.

The Goldberg Center continues to thrive with the recent addition of Samira Zebarjadian, our terrific Medical Student Education coordinator. She is the backbone of all the Center’s activities and programs. We are lucky to have recruited her to our education team. If you haven’t met Samira yet, please stop by and say hello.

## Kudos to our Education Team

The faculty and resident members of the Medical Student Education Committee supervise the Goldberg Center’s medical student programs. Our resident representatives Maya Vella, MD, Tyler Gleason, MD, and Sage Kramer, MD, are our resident liaisons for Medical Student Education.



*Vishal Kumar, MD, 2019 Outstanding Medical Student Teaching Awardee.*

Emily Webb, MD, and Kimberly Kallianos, MD, serve as committee co-chairs.

Other committee members include: Brett Elicker, MD, Vickie Feldstein, MD, Stefanie Weinstein, MD, Lynne Steinbach, MD, Miles Conrad, MD, Elissa Price, MD, Evan Lehrman, MD, and Khai Vu, MD. They have all been asked to step up efforts recently due to all the innovations.

In addition, many UCSF faculty, volunteer faculty, fellows, and residents give generously of their time in our programs. We and the UCSF medical students who benefit directly from their contributions and time truly appreciate their efforts. Dr. Vishal Kumar received the 2019 Outstanding Medical Student Teaching Award from the Department of Radiology and Biomedical Imaging in recognition of his long-standing contributions, particularly in the realms of interventional radiology education and outreach activities to pre-medical students. ■



**For more information** about the Goldberg Learning Center’s activities, please contact Samira Zebarjadian (Samira.Zebarjadian2@ucsf.edu) or visit [radiology.ucsf.edu/education/medical-students](http://radiology.ucsf.edu/education/medical-students).

*Emily Webb, MD, is a professor of Clinical Radiology in the Abdominal Imaging Section, and she is the co-director of the Goldberg Center for Advanced Imaging Education in the Department of Radiology and Biomedical Imaging.*



The Henry I. Goldberg Center for Advanced Imaging Education is the headquarters for all medical student education in the UCSF Department of Radiology and Biomedical Imaging. The Center oversees radiology instruction in the pre-clinical curriculum, provides a course during clinical clerkships on the appropriate use of diagnostic tests, organizes lectures to senior students and a variety of radiology electives spanning both clinical applications of radiology and imaging research, and offers career advising and mentoring to UCSF medical students.

# Masters of Science in Biomedical Imaging – Learning the Fundamentals of Medical Imaging

The Masters of Science in Biomedical Imaging (MSBI) program annually enrolls 15-20 students, who come to UCSF to spend one year learning the fundamentals of medical imaging. MSBI students are commonly graduates from other UC institutions, but also come from across the US and around the world. This year we have international students coming from Cambridge (UK), Singapore and India, and domestic students from institutions spanning San Diego to Boston. The MSBI program is designed to bring students with diverse backgrounds rapidly up to speed on the scientific underpinnings of medical imaging technologies. Students entering the program typically have an undergraduate degree in engineering or the physical or biological sciences.

The MSBI program is led by Program Director Alastair Martin, PhD, and Director of Graduate Studies Susan Noworolski, PhD. Program Administrator Rukayah Abdolcader rounds out the MSBI administrative team. MSBI faculty includes 13 PhD

professors from the Department of Radiology and Biomedical Imaging. A wide range of clinical faculty contribute to the MSBI program by giving guest lectures and hosting MSBI students for shadowing or demonstration experiences. These real-world applications of medical imaging are particularly popular with the students.

## Classroom Learning Supports Hands-On Experiences

Mandatory core MSBI core courses deliver in-depth training in the principles of *in vivo* imaging modalities, including MRI, CT, PET, SPECT, and ultrasound. Students also choose from a wide set of electives related to imaging applications for major diseases and different organ systems.

Following their coursework, students bring the various elements of their learning together in applied research projects, working with faculty supervisors or as interns with industry partners. MSBI students benefit from the department's wide range of state-of-the-art imaging

facilities. The students consistently report that the hands-on activities, where they get to operate and perform experiments using these imaging systems, are the highlight of the MSBI program.

A high percentage of MSBI students remain through the summer academic quarter to apply their newly honed skills on a wide range of research projects under the supervision of UCSF faculty. These projects culminate in the MSBI Imaging Symposium, held in late August, where the students' research accomplishments are highlighted.

## MBSI – Graduates of 2018

The MSBI class of 2019 had 15 graduates. More than half the class had aspirations of continuing on to medical school, which has been a popular destination for MSBI graduates. Others intend to pursue a PhD or explore job opportunities in academic labs or industrial settings. All will leave having experienced an intense and fulfilling year within our department. ■



UCSF Masters of Science in Biomedical Imaging Class of 2019

# A Focus on Diversity and Inclusion

By Matthew Bucknor, MD

A commitment to diversity and inclusion remains a core focus of the department's mission, both as intrinsic values and as a means to improve our patient care, education and research missions. Our department has continued to make great strides toward building a broadly diverse faculty, trainee and staff community, while fostering a culture that is welcoming and supportive of anyone, regardless of background.

Outreach efforts organized by the Diversity and Inclusion Committee, including Q&A sessions with underrepresented minority, women, and LGBT medical student groups were a huge success, garnering highly positive feedback. Resident and faculty participation in the UCSF High School Outreach Conference and the Inside UCSF experience for undergraduates were also tremendous successes. We gave hundreds of students hands-on experience with real-time ultrasound and other imaging technologies.

New educational opportunities over the past year included a dedicated unconscious bias training session prior to the start of our interview season for residency and faculty interviewers and better coordination with the university's diversity champion training session.

Providing opportunities for students from diverse backgrounds to engage with our radiology department at various levels is central to our committee's work. One example is the Research Initiative to promote Diversity in Radiology (RIDR),

the department's summer student research internship. In its third year, the program expanded to 10 students who tackled a wide range of projects over eight weeks, ranging from machine learning for automated segmentation of MRI examinations of the hip to synthesis of new PET radiotracers. The students also had radiology shadowing experiences, weekly career development sessions, and opportunities to tour unique radiology facilities, including our cyclotron facility at China Basin. The students presented their work at the Summer Student Symposium at Genentech Hall in August. Learn more at <https://radiology.ucsf.edu/about/diversity/RIDR-program>.

At ZSFG, Vishal Kumar, MD, continued to expand shadowing experiences in partnership with a local nonprofit, Enterprise for Youth. It gives at-risk high school students opportunities to interact with radiologists, radiology technologists and nurses, and other health services staff, along with professional skills and career development workshops.

More information about the Diversity and Inclusion Committee can be found at <https://radiology.ucsf.edu/about/diversity>. ■

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*Matthew Bucknor, MD, is an associate professor in residence in the Musculoskeletal Imaging subspecialty section, chair of the Radiology and Biomedical Imaging Diversity and Inclusion Committee, and associate chair of Wellbeing and Professional Climate in the Department of Radiology and Biomedical Imaging at the University of California, San Francisco.*

*RIDR program students pictured with Dr. Matthew Bucknor, program director (front row, far left) and Samira Zebaradian, program coordinator (front row, far right)*



# The Margulis Society

The board of the Margulis Society looks forward to welcoming Richard Barth, MD, as the biennial Margulis Society Alumnus Lecturer in fall 2020. Look for an announcement soon.

Barth is a 1980 graduate of the UCSF Diagnostic Radiology Residency Program. He has served as radiologist-in-chief at the Lucile Packard Children's Hospital at Stanford University since 2003. In 2009, Barth was named the UCSF Department of Radiology and Biomedical Imaging Outstanding Alumnus. He was the 2014 President of the Society for Pediatric Radiology and in 2014-2015 chaired its Board of Directors. In Barth's role as a pediatric imager, he has focused on improving the accuracy of diagnosis balanced with minimizing radiation exposure for children undergoing imaging studies.



Richard Barth, MD

## Career Evening

Last year marked the 19th year that the Margulis Society has hosted a career evening for residents and fellows. Erik Gaensler, MD, diagnostic radiology residency alumnus, a physician with Bay Imaging Consultants, and a longtime Margulis Society board member, served as the moderator.

The Margulis Society conceived the career evening to provide trainees with an opportunity to learn from radiology alumni in both private practice and academic fields. The 2019 event featured discussion on topics ranging from career fulfillment in the field of radiology to academic vs. private practice career paths, from best practices for interviewing to assessing private practice options. A question-and-answer session followed the discussion, in which attendees could tap the panelists' expertise and experience.

The panelists included UCSF Radiology faculty members Spencer Behr, MD, fellowship director; Matthew Bucknor, MD, associate chair for Wellbeing and Professional Climate; Soonmee Cha, MD, vice chair for education and Diagnostic Radiology Residency director; and Christopher Hess, MD, PhD, department chair. In addition to Gaensler, alumni participants from private practice were Camilla Lindan, MD, Kaiser Permanente and UCSF clinical faculty; Christopher Mutch, MD, Bay Imaging Consultants; Gina Song, MD, Kaiser Permanente; and Jean Yeh, MD, California Pacific Medical Center.

In thanking the panelists following the program, Cha said, "the trainees who were there had a wonderful time and learned valuable tips and advice from each and every one of you."

## Margulis Society Residency Commons

Margulis Society member donations are supporting a planned renovation of the former Stone Library. The new space features a modern layout designed to facilitate educational and social gatherings – these are especially important now, due to the large number of worksites on the trainees' rotation schedule. "Residents are very excited about the community-building opportunities that a dedicated residency commons will provide," noted Alyssa McNamara, MD, a PGY3 resident representative on the Margulis Society board of directors. "Thank you to the Margulis Society for funding this important renovation." The Margulis Society plans to showcase the space once the renovation is complete. ■

## The Margulis Society Board of Directors

### President:

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### Resident Representatives:

Adam Yen, MD (PGY2)

Alyssa McNamara, MD (PGY3)

Evan Calabrese, MD, PhD (PGY4)

Alex Wright, MD (PGY5)

### Fellow Representative:

Benjamin Laguna, MD,  
Neuroradiology

# Alumni News

## 1967

**Charles Gooding, MD**, and **Gretchen A.W. Gooding, MD**, Mill Valley, CA, (1975) sent photos of their trip to **1** Mendocino, CA, and a hiking trip to Hetch Hetchy Reservoir.



## 1985

**Patricia Rhyner Hudgins, MD**, Jacksonville, FL. has joined the neuroradiology faculty at Mayo Clinic in that city.

## 1986

**Jeffrey Dieden, MD**, Oakland, CA, writes: "In December I spent two weeks in rural Western Kenya teaching radiology and consulting. **2** Here I am with a patient and Matibabu Foundation Radiological Technologist John Kennedy Otieno in Ugunja. The Matibabu Foundation works with Oakland-based Tiba Foundation. I taught a variety of health care professionals, including medical officers, the radiographer (technologist) and nursing students. I also advised on their future radiology plans and purchases. While briefly in Nairobi, as arranged by Professor **Bhavya Rehani, MD**, and Health4TheWorld, I lectured the radiology residents and medical students at Kenyatta National Hospital."



Dieden also sent a photo of **3** **RROK = Retired Radiologists of Oakland Kaiser**. Pictured (l-r) are Paul Radosovich, MD (1992), Dave Spring, MD (1976), Irene Balcar, MD (1981), Jeff Dieden, MD, and Peggy Lynch, MD (1988).

## 2006

**Max Wintermark, MD**, Palo Alto, CA, chief of neuroradiology at Stanford University, chaired the well-attended **4** ASFNR meeting in San Francisco, CA in November. Next year's ASFNR meeting will be in Santa Fe, NM and will be chaired by **Greg Zaharchuk, MD, PhD**.



## 2007

**Ashley Aiken, MD**, Atlanta, GA, has been named a full professor at Emory University, Department of Neuroradiology.

## 2011

**Judong Pan, MD**, Saratoga, CA, received the **5** UCSF Radiology and Biomedical Imaging's Outstanding Clinical Faculty Teaching award in June 2019.

## 2017

**Xin Cynthia Wu, MD**, Atlanta, GA, is a faculty member at Emory University and the recipient of the 2019 ASHNR Hanafee Research Award.



## 2018

**Sam Payabvash**, New Haven, CT, is now at Yale and received the Bayer HealthCare/RSNA Research Seed Grant.

**Elizabeth Tong, MD**, Palo Alto, CA is now a clinical instructor at Stanford University. She received the Hitachi Healthcare Americas/RSNA Research Seed Grant.

## 2019

**Adam Meeks, MD**, Berlin, MD, received UCSF Radiology and Biomedical Imaging's Outstanding Clinical Instructor/Clinical Faculty Teaching Award in June 2019. ■



## UCSF Radiology Recognizes James B. Spies, MD, MPH '84 as Outstanding Alumnus 2019

In 2019, the UCSF Department of Radiology and Biomedical Imaging presented its Outstanding Alumnus award to **James B. Spies, MD, MPH**, a 1984 graduate of the UCSF Diagnostic Radiology Residency Program. Spies, a professor and chair of the Department of Radiology at MedStar Georgetown University Hospital in Washington, D.C., received his award from **Maureen Kohi, MD**, chief of interventional radiology at UCSF, at commencement on June 7.

Spies' exemplary career began at Georgetown University School of Medicine. He was then matched with UCSF for a radiology residency. "When I arrived at UCSF, it was a little intimidating," he admitted. "But the department gave me the opportunities I needed." His time at UCSF was followed by a fellowship at New York University School of Medicine in vascular and interventional radiology. He received a Master of Public Health degree from Johns Hopkins University and served four years in the United States Air Force. After several years in private practice, Spies joined the faculty of Georgetown University in 1997 and became chair in 2005.

He has an active practice in uterine embolization for fibroids, has performed extensive research and is recognized as an international authority on this procedure. He continues to actively research uterine embolization, measuring outcomes for fibroid therapies, and is now studying the safety and efficacy of prostate artery embolization for benign prostatic hyperplasia.

Kohi described Spies as "a luminary in the interventional radiology world. Jim pioneered the field of uterine artery embolization for the treatment of symptomatic fibroids. He has published hundreds of scientific studies, given over 400 invited presentations and has edited a text on uterine embolization."

The global interventional community has acknowledged and benefited from Spies' lengthy career. His involvement with the Society for Interventional Radiology (SIR) includes serving as its president and chairing the SIR Foundation. In 2018, SIR honored Spies with its Gold medal. He also serves as a trustee of the American Board of Radiology (ABR). Spies is a Fellow of both SIR and ABR and has been named distinguished and honorary fellow of many international societies.

"Despite all of these accomplishments, when you meet Jim, you quickly realize that he is humble, honest, and down-to-earth," Kohi said in her remarks. "And he will let you know that what's most important to him is his family. Regardless of his busy schedule, he always manages to find time to mentor, sponsor and help out trainees, junior faculty and his colleagues."



Maureen Kohi, MD, and James B. Spies, MD, MPH

**"This is a great department and it is a privilege to train in a place like this. My hope for you is that your experience at UCSF will equal mine. I hope that you will succeed as I have, based on the outstanding training you received here."** — James B. Spies, MD, MPH

Early in his career, however, Spies did not consider himself a likely choice for a diagnostic radiology residency at UCSF. "While I was a good student, even the chair of radiology at my medical school thought that I would never get in; he advised me not to even bother applying," he said. "It was one of the chief residents at Georgetown who told me not to listen to him, that I should just apply anyway. And so, I did. I am still not sure why I matched, although my undergraduate degree in winemaking at UC Davis may have got the selection committee interested."

When he arrived in the Bay Area, Spies said, "I was the only first-year resident who had not done research, and half of the class had already completed another residency." However, he took full advantage of the opportunities presented and the resources available. On his first research project he was mentored by **Hedvig Hricak, MD, PhD**, then-faculty member and current chair of the Department of Radiology, Memorial Sloan-Kettering Cancer Center. And he credits the teaching he received from **Ernest Ring, MD, Robert Kerlan, MD** (1981), **Roy Filly, MD**, and **Hideyo Minagi, MD** (1962), professors emeritus at UCSF Radiology, along with **Michael Federle, MD, FACR** (1979), professor emeritus at Stanford Radiology, for putting him on a path to success.

With all this in mind, Spies offered the following advice to trainees at commencement: "Realize the gift you have been given. This is a great department and it is a privilege to train in a place like this. My hope for you is that your experience at UCSF will equal mine. I hope that you will succeed as I have, based on the outstanding training you received here." ■

# Honor Roll of Donors

**The Margulis Society and the Department of Radiology and Biomedical Imaging gratefully acknowledges the following donors for their generous contributions. This list reflects gifts made between January 1, 2019 and January 31, 2020.**

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 Jacob Harter, MD  
 N. Paul Herman, MD  
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 Daniel R. Hightower, MD  
 Christopher K. Hoffman, MD  
 Donna Hoghooghi, MD  
 Julian B. Holt, MD  
 Thomas Hope, MD  
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 Priya M. Krishnarao, MD  
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*\*Donation of \$1,000 or more*

# UCSF Radiology Continuing Medical Education

## What to Look Forward to in 2020

**UCSF Imaging Update** in Nevis will take place December 6-11, 2020 at the Four Seasons Resort in Charlestown, Nevis. This week-long course is designed for both the general and sub-specialty radiologist. It is intended to provide an update of the recent advances in relevant topics in abdominal, thoracic, musculoskeletal, breast, neuro and pediatric imaging. The course director is Tara Morgan, MD. Presentations will focus on practical methods to optimize basic and advanced cross-sectional techniques for CT, MRI and Ultrasound, as well as how to recognize and avoid potential pitfalls in interpretation. Each daily session will include an open question period and discussion between attendees and faculty.

The Four Seasons Resort Nevis is a modern embodiment of the spirit and soul of the Caribbean. Rooted in history and heritage, this beachfront oasis offers a captivating combination of adventure, discovery, serenity and recreation.



## Save When Attending UCSF Courses

We reward loyal customers for attending our courses. The UCSF Radiology CME Loyalty Program offers three reward levels: Silver, Gold and Platinum. Each of them will give you 10%, 20% or 30% off registration fees for EVERY course attended. Learn more about the program here: [https://radiology.ucsf.edu/cme/loyalty\\_program](https://radiology.ucsf.edu/cme/loyalty_program)

## Continuing Medical Education Course Calendar 2020

Please visit our website to see a complete listing of CME offerings: <https://radiology.ucsf.edu/cme/upcoming>

**Sept 28-Oct 2, 2020**

### **UCSF Radiology Interventional Review**

UCSF Parnassus Campus – Kalmanovitz Library, San Francisco, CA

**October 25-30, 2020**

### **UCSF Imaging Update on Kauai**

Grand Hyatt Kauai, Koloa, Kauai

**November 9-13, 2020**

### **UCSF Breast Imaging Update**

Hyatt Indian Wells Resort & Spa, Palm Springs, CA

**December 6-11, 2020**

### **UCSF Imaging Update in Nevis**

Four Seasons Resort, Charlestown, Nevis, Caribbean

The Covid-19 outbreak has caused significant travel disruptions to national and international conferences. The health and safety of our meeting attendees is of utmost importance to us, and we base all decisions as to whether to hold a CME conference on information from UCSF and national health officials.

## For further information, please contact:

UCSF Radiology Continuing Medical Education  
Telephone: 415-476-5731  
E-mail: [rad-cme@ucsf.edu](mailto:rad-cme@ucsf.edu)

# PHOTO GALLERY

## Department Highlights



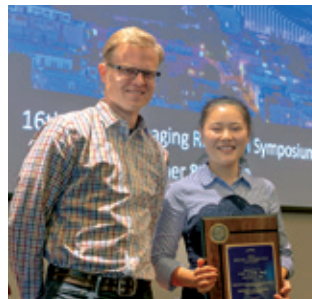
*Derek Sun, MD, accepts Minagi Award from Senior Residents*



*Society of Nuclear Medicine and Molecular Imaging (SNMMI)*



*NIH T32 Program graduates with Dr. Thomas Link (far right)*



*Honors and awards (clockwise from top right): Carlos Mayorga, recipient, Richard Sollitto Award; Yi Li, MD, recipient Rahul Desikan Award; Ben Laguna, MD, Recipient, Margulis Society Resident Research Award; Matthew Bucknor, MD, recipient, Chancellor's Award; Ghizlane Arsalane, RT, Recipient, Lanna Lee Award; Yan Wang, PhD, recipient, Hasegawa Award; Thomas Link, MD, PhD, recipient, Radiology Award for Outstanding Faculty Mentoring; Todd Bazzill, recipient, Cathy Garzio Award*



*The Education Team, 2019*



Summer student symposium



Holiday party



Movember mustaches



Drs. Kirti Magudia and Bonnie Joe at an ACR event



Technologist week



Radiology technologists and nurses

Radiology volunteers at the UCSF Beach Clean-up



# RESEARCH

## Improving Care Through Research

Welcome to the research section of *Images*! Our research program is a cornerstone of the UCSF Department of Radiology and Biomedical Imaging's overall mission. Our program encompasses traditional and emerging aspects of imaging and we strive for innovation, as well as scientific creativity in all aspects of imaging – from image acquisition to processing, interpretation, and outcomes – utilizing state-of-the-art techniques and equipment. The translation of our research investigations into patient treatments as well as tools to determine if treatments are effective are key program objectives. Our overarching goal is to improve care through our research – with the ultimate beneficiary of our research program being the patient.

### Structure

The research program in UCSF Radiology and Biomedical Imaging utilizes a matrix structure designed as a cross-functional environment. The structure promotes engagement and interaction amongst research team members and minimizes research silos.

One of the new initiatives this past year was establishing the Center for Intelligent Imaging (Ci<sup>2</sup>) in addition to other focused efforts in molecular imaging research. Intelligent imaging is one of the department's three specialized resource groups (SRGs) and has a concentration on artificial intelligence (AI) and imaging analytics. The other two SRGs, Advanced Imaging Technologies and Chemistry, Probes and Molecular Therapy (CPMT) focus on image acquisition and the development of new molecular imaging tools, respectively. Research groups (RGs) focus on imaging three organ-centric areas: Body, Neuro, and Vascular and Cardiac. Many of our research faculty are members of more than one SRG or RG, each of which is led by a PhD faculty researcher. The stimulating and dynamic research promoted through the matrix structure is further enhanced by the contributions of the department's substantial postdoctoral scholar and student researcher programs.

Our research collaborations range far and wide, including those within UCSF's diverse departments: the Helen Diller Family Cancer Center, Bakar Institute for Computational Health Sciences, the UCSF Computational Health Science Institute, for example, the national laboratories, and other national and international academic institutions.

### Grants

Our highly regarded research portfolio is funded by federal grants from the National Institutes of Health and

Department of Defense, as well as from foundations and industry. In addition, our equipment is supported by shared instrumentation grants. We are part of a UCSF-wide core and provide advanced imaging services across the university and to other institutions. In 2019, we had 54 grants for \$56,078,639 in total funding and were ranked fourth nationwide for funded grants by the NIH.

### Awards, Service and Honors

In 2019, Sarah J. Nelson, PhD was posthumously awarded the Gold Medal of the International Society for Magnetic Resonance in Medicine, a testament to the depth, strength and importance of her research. She was the third member of the department to receive this honor since the inception of the ISMRM in 1994.

Nola Hylton, PhD was recognized as a Society of Breast Imaging honorary fellow in 2019. Her impressive accomplishments include being an internationally known leader and recognized authority in the field of breast MRI for more than 20 years.

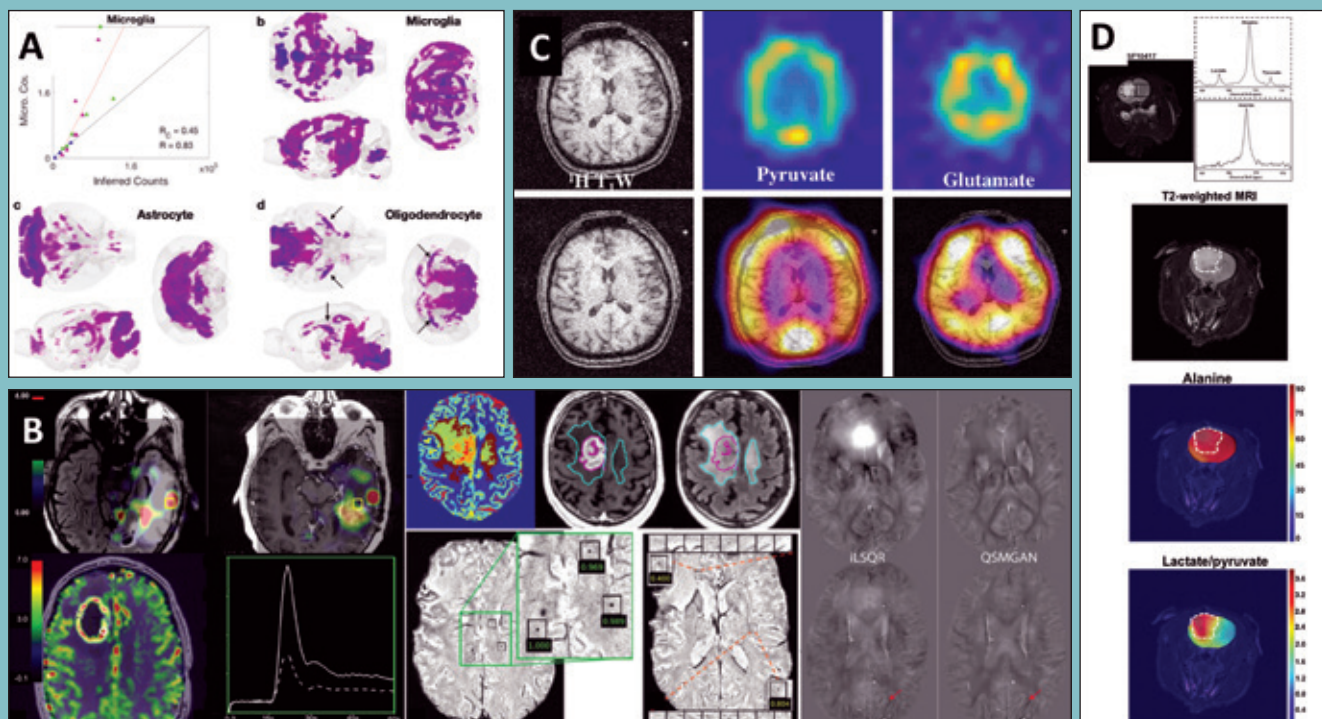
Our department's research faculty are members of national and international organizations, including the Institute of Electrical and Electronics Engineers and the American Institute for Medical and Biological Engineering. The latter represents the top medical and biomedical engineers and has selected six members of the department as distinguished fellows. Many of our researchers have been selected for membership in the Academy for Radiology & Biomedical Research, a prominent advocacy organization committed to advancing excellence in medical imaging research.

### Publications

The investigators in the department publish extensively in prominent imaging, application and technical journals. We were excited to learn that the journal *Radiology* included UCSF Radiology and Biomedical Imaging in its top 10 list for 2019, noting the number of downloads, altmetric ("hot topic") and "most cited" scores for publications that included our authors Drs. Jane Wang, Jae Ho Sohn, Spencer Behr, Rob Flavell, Youngho Seo, Miguel Pampaloni, Jeff Rudie, Berk Norman, Valentina Pedoia and myself, among others.

I hope you will enjoy learning more about our latest research endeavors in the pages that follow.

Sharmila Majumdar  
Margaret Hart Surbeck Professor  
Vice Chair, Research  
UCSF Radiology and Biomedical Imaging ■



## Neuro Research Group

By Sabrina Ronen, PhD

Investigations in the Neuro Research Group are aimed at developing and implementing novel multimodality imaging of the human brain in order to improve and enhance detection and treatment of neurologic and psychiatric diseases. Studies in the Neuro Research Group span preclinical, translational and clinical research and leverage a broad range of advanced imaging approaches including MRI, PET, MEG,  $^1\text{H}$  and hyperpolarized  $^{13}\text{C}$  MRS, among others. We aim to serve patients who suffer from neurodegenerative disorders, traumatic brain injury, epilepsy, multiple sclerosis, cerebrovascular disease, psychiatric disease, brain development issues, brain tumors and more.

Highlights from the past year include novel applications of advanced imaging methods, the use of previously unexplored hyperpolarized agents and the implementation of artificial intelligence (AI). Specifically, AI approaches are being leveraged for mapping cell types in the brain (see Figure A, courtesy of Dr. Ashish Raj), imaging both tau and microglia in Alzheimer's patients using PET ligands to determine how the two interact temporally (Dr. Ashish Raj), network modelling of multimodal dynamics in Alzheimer's disease and dementia to build software for predicting and tracking the disease, and developing a novel framework for fusion of MEG and dMRI datasets (Drs. Ashish Raj and Srikanth Nagarajan). AI is also being used for neuroimaging endophenotypes and predictors of post-traumatic brain injury dementia in veterans (Dr. Duygu Tosun). Innovative applications of deep learning are enhancing imaging susceptibility to generate accurate artifact-free quantitative maps of susceptibility and automatically quantify cerebral microbleeds that are related to cognitive deficits following

radiation therapy in glioma patients (see Figure B, courtesy of Dr. Janine Lupo).

New studies are underway aimed at breaking the barriers to microscale fMRI (Dr. Joseph Vu), assessing resting-state fMRI hyperconnectivity as a risk factor for Alzheimer's disease after traumatic brain injury (Dr. Susanne Muller), and imaging Latino elders to predict Alzheimer's disease (Dr. Michael Weiner). Several imaging studies focus on the adolescent brain to assess neural mechanisms of mindfulness, how open-label placebo works, and the connection between brain connectome, age, depression and suicidal ideation (Dr. Olga Tymofiyeva). Finally, multiple new investigations are underway developing and clinically translating new hyperpolarized  $^{13}\text{C}$  MRS approaches to detect disease and monitor response. Notable examples include using hyperpolarized  $^{13}\text{C}$  MRS of pyruvate to lactate conversion to monitor response to treatment in CNS lymphoma (Drs. Daniel Vigneron and Myriam Chaumeil), imaging for the first time the metabolism of pyruvate to glutamate in normal human brain and brain tumors (See Figure C, courtesy of Dr. Daniel Vigneron), and developing and validating the novel use of hyperpolarized alanine and glucose as probes for telomere maintenance mechanisms that are biomarkers of brain tumors (see Figure D, courtesy Drs. Sabrina Ronen and Pavithra Viswanath). ■

*Sabrina M. Ronen, PhD, is a professor and the director of the Neuroimaging Research Group in the UCSF Department of Radiology and Biomedical Imaging.*

# Body Research Group

By John Kurhanewicz, PhD

**T**he Body Research Group focuses on developing and translating innovative imaging methods and approaches to enable precision medicine in pathologies of the abdomen, breast and musculoskeletal system. By utilizing novel imaging technologies, imaging probes, and advanced deep learning and artificial intelligence tools, our work aims to advance the understanding of disease mechanism, accelerate disease diagnosis, provide individualized treatment and provide an early assessment of therapeutic response or resistance. The productivity of this large research group is demonstrated by the more than 50 peer-reviewed publications by its members and the research performed in 2019 highlighted below.

**Research in abdominal/pelvic imaging** focused on developing novel imaging tools for early diagnosis, risk stratification and treatment response monitoring in various abdominal and pelvic diseases, such as cancers, diabetes, and liver and kidney disease. Cutting-edge imaging methods, such as hyperpolarized carbon-13 metabolic MRI (HP <sup>13</sup>C MRI), positron PET/CT, and integrated PET/MRI, in conjunction with targeted probes, are being employed to interrogate metabolic and physiological processes central to disease progression, targeting disease for personalized treatment and to inform on therapy response at the earliest possible time point (Figure 1). In 2019 highlights of abdominal/pelvic imaging research at UCSF included funding of two new NIH grants in the areas of developing and translating HP <sup>13</sup>C MRI methods for localized and metastatic prostate cancer (PIs: Jeremy Gordon, MD, and Daniel Vigneron, PhD) and the application of HP <sup>13</sup>C MRI for the early detection of aggressive prostate cancer (PIs: Robert Bok, MD, and Daniel Vigneron, PhD). Additionally, two new NIH theragnostic grants involving the use of Lutetium (Lu)-PSMA to treat advanced prostate cancer patients (PI: Thomas Hope, MD) were funded. This new funding resulted in the start of two new clinical trials involving HP <sup>13</sup>C MRI for prostate cancer patients on active surveillance (NCT03933670) and Lu-PSMA treatment (NCT03805594) of advanced prostate cancer. Novel CT contrast materials in conjunction with dual energy CT are also being investigated to improve tissue characterization and diagnostic accuracy. Benjamin Yeh, MD, was awarded a new NIH grant investigating nanoparticle CT contrast agents for tumor detection, staging, and therapy planning and response. Z. Jane Wang, MD, and Peder Larson, MD, received the Distinguished Investigator Award from the Academy for Radiology and Biomedical Imaging Research at the 2019 RSNA.

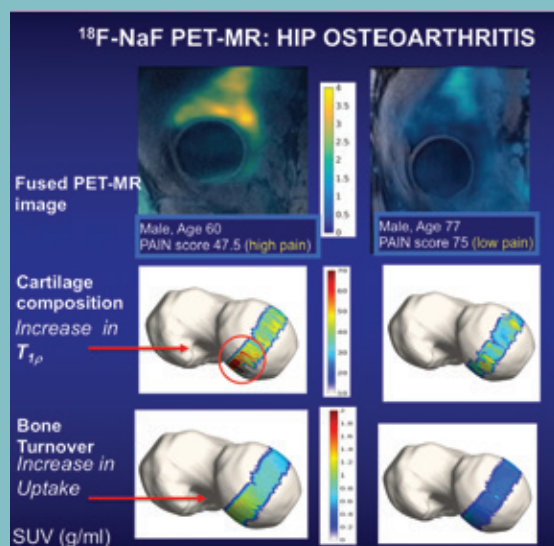
**Research in musculoskeletal imaging** has a strong focus on developing biomarkers for quantitative imaging in degenerative joint disease, lower back pain, osteoporosis, and bone metabolism. In collaborative, interdisciplinary efforts, the team focuses on diseases such

as osteoarthritis, osteoporosis, diabetes, HIV, and cancer (Figure 2). In 2019, highlights of musculoskeletal imaging included the grant award Roland Krug, PhD, received for developing new MRI methods for measuring endplate pathologies (endplates separate discs and vertebrae in the spine) to better select patients for non-addictive and minimally invasive treatments. Sharmila Majumdar, PhD, who became the Margaret Hart Surbeck Distinguished Professor of Advanced Imaging in 2019, received a grant award for improving imaging of low back pain, including developing deep-learning-based technologies for faster image reconstruction, tissue segmentation and spinal degeneration detection.

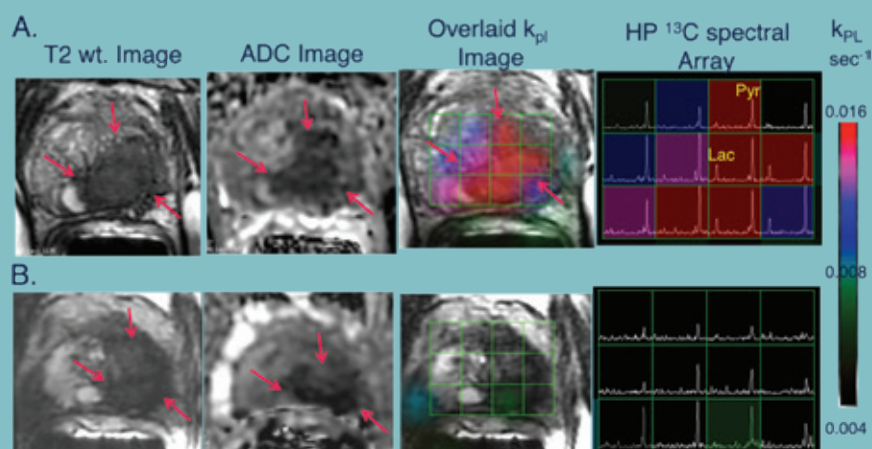
**Research in breast imaging** spans aspects of breast cancer care: improving screening for early detection of breast cancer; developing more accurate, less invasive means of diagnosis; improving pre-surgical planning; and developing imaging biomarkers for treatment monitoring and prognostication. Research on improving screening performance and risk stratification using mammography and MRI is currently augmented with artificial intelligence (AI) and machine learning approaches. Bonnie Joe, MD, in collaboration with Kheiron, Inc., received a grant to use AI performance evaluation in the screening mammography setting. A major research effort has been to develop quantitative MRI biomarkers for assessing treatment efficacy in neoadjuvant trials for breast cancer (Figure 3). Our methods for measuring tumor volumetric changes during neoadjuvant treatment are being used in the multi-center I-SPY 2 TRIAL of novel agents for breast cancer to randomize patients and assess drug efficacy. As part of the NCI Quantitative Imaging Network (QIN), we are working to improve the performance of diffusion-weighted imaging for breast cancer. Last year Lisa Wilmes, MD, became the UCSF PI for a NIH grant focused on developing a quality control program for quantitative MRI data acquisition and analysis in multi-site clinical trials. In partnership with scientists at the National Institutes of Standards and Technology, we are developing a breast MRI calibration phantom that can be used to improve accuracy and provide quality control in multi-center studies employing breast MRI quantitative markers. A recent programmatic effort in Breast Imaging at UCSF is the development of quantitative molecular imaging for breast cancer using dedicated breast PET (dbPET), and Nola Hylton, MD, and Ella Jones, MD, received an NIH grant to use dbPET for the characterization of breast cancer and its response to therapy. ■

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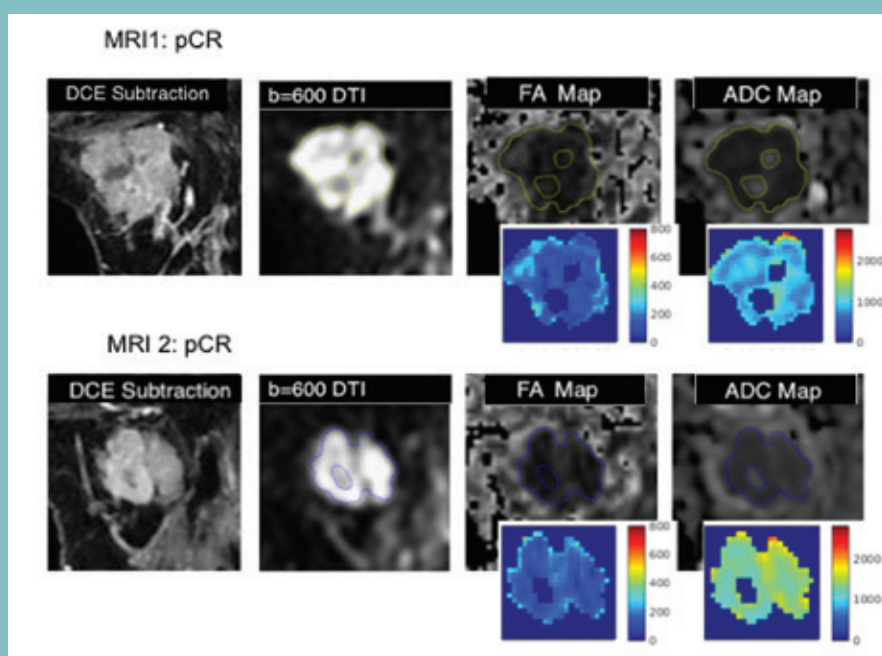
*John Kurhanewicz, PhD, is a professor in residence in the UCSF Departments of Radiology and Biomedical Imaging, Urology and Pharmaceutical Chemistry, a member of the California Institute for Quantitative Biology and UCSF Cancer Center, and faculty in the UCSF-UCB Bioengineering Graduate Group. He is the director of the UCSF Body Research Interest Group, the Biomedical NMR lab, and the Kurhanewicz Laboratory at UCSF.*



**Figure 1:** Patient with prostate cancer. A) Pre-treatment and B) post-treatment multi-parametric MRI demonstrates the utility of hyperpolarized  $^{13}\text{C}$  pyruvate MRI to detect early metabolic response prior to changes on conventional images.



**Figure 2:** Simultaneous  $^{18}\text{F}$ -Sodium fluoride and quantitative MR imaging in patients with hip osteoarthritis. The figure shows two subjects with osteoarthritis. On the left, one with pain shows higher uptake of  $^{18}\text{F}$ -NAF reflecting increased bone turnover and higher values of MR  $T_{1\rho}$  in focal areas. These focal areas of  $T_{1\rho}$  increase reflect the depletion of proteoglycan, an early biomarker for osteoarthritis.



**Figure 3:** DCE Subtraction, DTI, ADC and FA Maps are shown for the pretreatment (top) and three-week treatment (bottom) time points for a patient achieving a complete pathologic response after neoadjuvant chemotherapy.



*Monitoring of procedures in the Neurointerventional suite with High Resolution Imaging*

## Vascular and Cardiac Research Group

By David Saloner, PhD

The Vascular and Cardiac Research Group (VCRG) aims to develop rigorous, quantitative and high-quality imaging that will provide novel insights into the anatomic and physiological drivers of cardiovascular disease. The imaging advances developed by this team are informed by clinical needs and are aimed at making immediate improvements in patient management and care.

The VCRG team pursues research utilizing all modalities for assessing structural and functional parameters of the heart in health and disease. Advances in these domains have been achieved with the introduction of novel acquisition schemes that exploit advances in scanner hardware and improvements in software tools. They are augmented by the development of automated postprocessing tools that include the use of radiomics methodologies and the exploration of machine learning approaches. Examples include explorations of the use of hyperpolarized  $^{13}\text{C}$  in assessing cardiac perfusion, and accelerated tissue mapping methods to assess the myocardium.

Clinicians and scientists in the VCRG also have active NIH-funded projects in a broad range of vascular territories. Teaming with the Department of Vascular Surgery, we use imaging to assess the response of the vessel wall in lower extremity disease to transcatheter delivery of anti-inflammatory therapeutics injected directly into the vessel wall in lower extremity disease. We have devoted substantial efforts to assessing the compositional properties of the wall of abdominal aortic aneurysms, and to elucidating the role of mural thrombus on the likely progression of the disease condition as the thrombus ages over time. These efforts are coupled with biomechanical analyses of the stress distributions in the wall and

thrombus to investigate whether those measures are predictive of likely rupture.

The development of MR imaging methods with sub-millimeter resolution that suppress blood signal and provide the ability to delineate the wall of intracranial vessels is another active area of investigation. These methods are being utilized to explore identification of regions of inflammation and determine the role of those features in atherosclerotic and aneurysmal disease evolution. The combination of high-resolution lumenography with advanced capabilities for visualizing the velocity field throughout 3D volumes of interest provide an opportunity to determine pressure variations across hemodynamically significant lesions. This capability is used in areas as diverse as sound generation and idiopathic intracranial hypertension. We are optimistic that guidance from these studies will contribute to designing novel devices that can be used to ameliorate these conditions.

Device design is also of great interest in other interventional applications. One promising avenue is the use of devices that can be deployed in the distal vasculature to filter chemotherapy agents and to reduce their systemic toxicity. New imaging suites which provide combined catheter angiography and MRI in the same imaging session will be key in developing and refining these approaches. ■

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*David Saloner, PhD, is a professor in the Department of Radiology and Biomedical Imaging, and director of the Vascular and Cardiac Research Group at UCSF. He is also the director and founder of the Vascular Imaging Research Center at the San Francisco Veterans Affairs Medical Center.*

# Advanced Imaging Technologies Specialized Resource Group

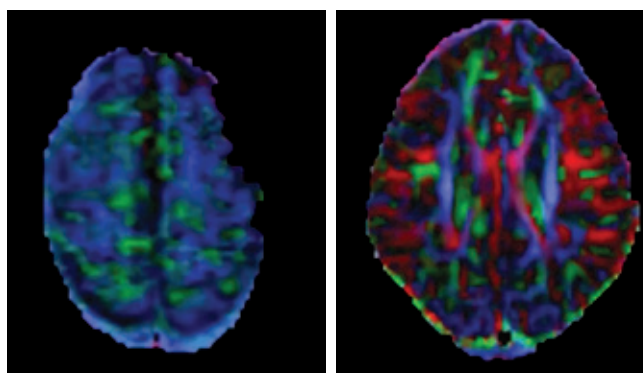
By Daniel B. Vigneron, PhD

The Advanced Imaging Technologies Specialized Resource Group has over the past year continued its mission “to advance imaging science to benefit human disease studies developing new technologies, hardware and advanced methodologies.” Leveraging outstanding expertise in imaging physics and world-leading facilities for both preclinical and clinical translation research, we accomplished significant advances in virtually all aspects of imaging research in 2019. New developments in radionuclide PET and SPECT imaging by Drs. Youngho Seo, Thomas Hope, Henry VanBrocklin, Robert Flavell, Michael Evans and David M. Wilson have led to new projects in cancer, HIV and brain research and extended into two new major NIH grants funding theranostic Lu-PSMA targeted therapy in advanced prostate cancer. Also, the 7 Tesla MRI projects led by Drs. Peder Larson, Joseph (An Thanh) Vu, Duan Xu, Yan Li and Janine Lupo are developing improved brain imaging techniques including silent-fMRI, high-resolution diffusion imaging, MR spectroscopy, and microbleed imaging, and received new hardware upgrade funding at the San Francisco VA Medical Center.

Hyperpolarized stable-isotope MRI molecular imaging technologies were developed by Drs. John Kurhanewicz, Sabrina Ronen, Robert Flavell, David M. Wilson, Renuka Sriram, Jeremy Gordon, Michael Ohliger, James Slater, Myriam Chaumeil, Robert Bok, Yan Li, Peder Larson and Daniel Vigneron to advance preclinical and clinical research enabling novel quantitative measurements of cellular metabolism. Major new funding was awarded for brain tumor, multiple sclerosis, lymphoma, prostate cancer, healthy volunteers and heart disease for pioneering studies using this exciting new MR molecular imaging approach.

Interventional MRI technology was also advanced in 2019 through the research of Drs. Alastair Martin and Steven Hetts on image-guided surgery and endovascular devices. Cardiac imaging is another focus of the AIT-SRG technology development, led by Drs. David Saloner, Peder Larson and Jing Liu, focusing on vascular imaging, metabolic imaging and machine-learning analyses.

The research conducted by the Advanced Imaging Technologies Research Group has been highly productive in the past year resulting in more than 130 publications and 20 grants totaling more than \$20 million. Prior research supported by this group has led to the creation of two new groups: the Center for Intelligent Imaging (Ci<sup>2</sup>) led by Drs. Sharmila Majumdar and Christopher Hess; and Chemistry, Probes and Molecular Therapy, led by Dr. David M. Wilson (see pages 50-51). ■



MRI images of premature brain (left) and at term.



*Daniel B. Vigneron, PhD (top row, center), is a professor in the UCSF Department of Radiology and Biomedical Imaging and a professor in the UCSF Department of Bioengineering and Therapeutic Sciences. He is also director of the Advanced Imaging Technologies Resource Group, director of the Hyperpolarized MRI Technology Resource Center, and associate director of the Surbeck Laboratory for Advanced Imaging at UCSF.*

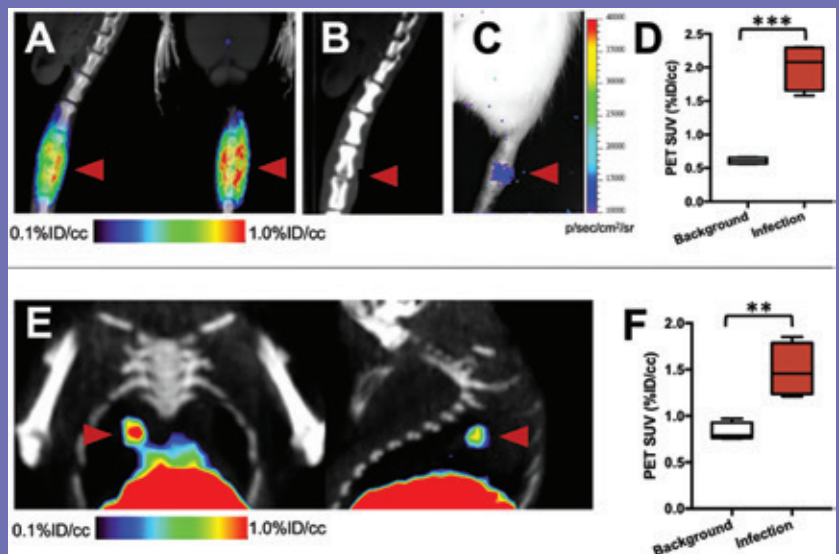
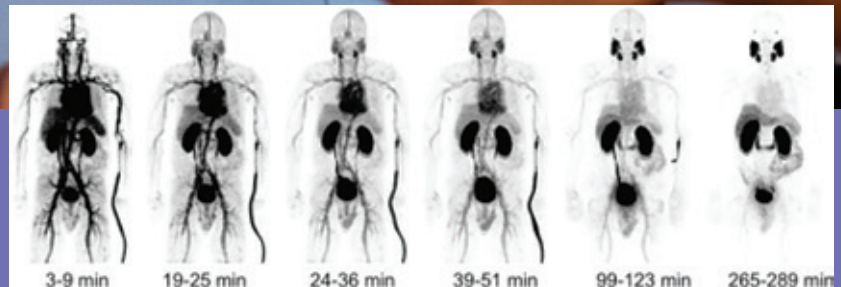


## The Center for Intelligent Imaging (Ci<sup>2</sup>)

By Christopher Hess, MD, PhD,  
and Sharmila Majumdar, PhD

The Center for Intelligent Imaging (Ci<sup>2</sup>) is unique in its dedicated focus on medical imaging by leveraging the power of data. The UCSF Department of Radiology and Biomedical Imaging, with its extensive annotated image archives, massive image databases developed out of research studies and clinical trials, and domain knowledge at all organ and disease levels, is positioned to lead in the discovery, innovation, and translation of intelligent imaging.

Ci<sup>2</sup> is an institutional resource focused on applications of artificial intelligence and image analysis tools in medical imaging. The Center provides the internal UCSF community and external academic and industry partners a unique resource in which to discover, innovate, and translate artificial intelligence tools to improve patient care. ■



For further information please see pages 6–9, or visit <https://intelligentimaging.ucsf.edu>.

# Chemistry, Probes and Molecular Therapy Specialized Resource Group

By David M. Wilson, MD, PhD

## Summary of Nuclear Imaging Research Structure

**David Wilson, MD, PhD**, was appointed director of the Chemistry, Probes and Molecular Therapy (CPMT) Specialized Resource Group, (See <https://radiology.ucsf.edu/research/research-interest-groups/CPMT>) and was elected a chartered member of the Imaging, Probes and Contrast Agents (IPCA) standing study section at the NIH. **Robert Flavell, MD, PhD**, was appointed chief of molecular imaging and therapeutics (MI&T). (See <https://radiology.ucsf.edu/patient-care/sections/molecular-imaging-therapeutics>) **Thomas Hope, MD**, was appointed the director of molecular therapy and **Miguel Pampaloni, MD**, was appointed director of nuclear cardiology. The highlights presented here represent the efforts of radiochemistry and nuclear imaging researchers.

## Radiochemistry/Nuclear Imaging Faculty

**Denis Beckford-Vera, PhD**: Published manuscripts, “PET/CT Imaging of Human TNF $\alpha$  Using [89Zr] Certolizumab Pegol in a Transgenic Preclinical Model of Rheumatoid Arthritis.” (Beckford-Vera et al., *Molecular Imaging and Biology*). “PET imaging of the EPR effect in tumor xenografts using small 15 nm diameter polyethylene glycols labeled with zirconium-89” (Beckford-Vera et al., *Molecular Cancer Therapeutics*).

**Michael Evans, PhD**: Awarded grants from the LAM Foundation, Precision Imaging of Cancer and Therapy, and Marcus Program in Precision Medicine Innovation. Selected to the Education Committee for WMIS, the editorial board for the journals *Contrast Media and Molecular Imaging* and *Biomolecules*. His article “Imaging PD-L1 expression with immunoPET” was recognized as one of the top five most viewed manuscripts in *Bioconjugate Chemistry* for 2018.

**Robert Flavell, MD, PhD**: Awarded Department of Defense PCRP Impact Award PC180733: “Clinical Translation of Hyperpolarized  $^{13}\text{C}$  Interstitial pH Imaging for Better Risk Stratification of Prostate Cancer.” Published manuscripts, “Hyperpolarized *in vivo* pH imaging reveals grade-dependent acidification in prostate cancer.” (Korenchan et al. *Oncotarget*). “Amino Acid-Derived Sensors for Specific Zn $^{2+}$  Detection Using Hyperpolarized  $^{13}\text{C}$  Magnetic Resonance Spectroscopy.” (Wang et al. *Chemistry*).

**Ella Jones PhD**: Awarded grant R01 CA227763: “Dedicated breast PET and MRI for characterization of breast cancer and its response to therapy”; Multi-PI: Nola Hylton, Ella Jones, Vivas Ignasi (OncoVision). Published manuscript, “Initial experience of dedicated breast PET

imaging of ER+ breast cancers using [F-18]fluoroestradiol.” (Jones et al. *NPJ Breast Cancer*).

**Youngho Seo, PhD**: Published papers, “Simplified and practical pretherapy tumor dosimetry – A feasibility study for  $^{131}\text{I}$ -MIBG therapy of neuroblastoma using  $^{124}\text{I}$ -MIBG PET/CT” (Seo et al. *Med Phys*) and “Joint correction of attenuation and scatter in image space using deep convolutional neural networks for dedicated brain  $^{18}\text{F}$ -FDG PET” (Yang et al. *Phys Med Biol*).

**Henry VanBrocklin, PhD**: Awarded major subcontracts: 1) Human imaging for the “Center without Walls for Imaging Proteinopathies with PET” NIH U19 led by Robert Mach, PhD at University of Pennsylvania. and 2) Alzheimer’s Disease Discovery Foundation through Rio Pharmaceuticals to evaluate excitatory amino acid transporter imaging in humans, a first-in-human study. Conducted the first zirconium-89 image in the EXPLORER total-body PET system at UC Davis.

**David Wilson, MD, PhD**: Awarded Bold and Basic grant, “Chitin-targeted PET tracers for specific imaging of fungal pathogens (co-PIs Drs. Fraser, Ohliger, Rosenberg). Published manuscript, “High enantiomeric excess in-loop synthesis of d-[methyl- $^{11}\text{C}$ ]methionine for use as a diagnostic positron emission tomography radiotracer in bacterial infection” (Stewart et al. *ACS Infectious Diseases*).

## Molecular Imaging and Therapeutics Clinical Faculty

**Spencer Behr, MD**: Published manuscript entitled, “Phase I study of CTT1057, an  $^{18}\text{F}$ -labeled imaging agent with phosphoramidate core targeting prostate specific membrane antigen in prostate cancer” (Behr et al., *Journal of Nuclear Medicine*).

**Thomas Hope, MD**: Awarded grants, R01CA235741 “MELT: Modulation of PSMA Expression for Lutetium Therapy” and R01CA229354 “Immunogenic priming with Lu-PSMA targeted therapy in advanced prostate cancer” Published manuscript, “Assessment of  $^{68}\text{Ga}$ -PSMA-11 PET accuracy in localizing recurrent prostate cancer” (Fendler et al. *JAMA Oncology*).

**Courtney Lawhn-Heath, MD**: Joined the Molecular Imaging and Therapeutics Section in January 2020.

**Miguel Pampaloni, MD**: Published manuscript, “Long-term corticosteroid-sparing immunosuppression for cardiac sarcoidosis” (Rosenthal et al. *Journal of the American Heart Association*). ■

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*David M. Wilson, MD, PhD, is an associate professor in the UCSF Department of Radiology and Biomedical Imaging and the director of the Chemistry, Probes and Molecular Therapy Specialized Resource Group.*

# CLINICAL SECTIONS

## Abdominal Imaging

*Ronald Zagoria, MD, Chief*

The Abdominal Imaging Section of the UC San Francisco Department of Radiology and Biomedical Imaging is made up of internationally recognized abdominal imaging experts who diagnose and treat disorders of all organs in the abdomen and pelvis, such as the liver, kidneys, GI tract, pancreas, colon, uterus, ovaries, prostate, and bladder. The Abdominal Imaging Section is focused on serving patients, conducting research, and training the next generation of radiologists.

Abdominal Imaging offers all imaging services and specialty services including, but not limited to, kidney tumor ablation, CT colonography (virtual colonoscopy), prostate MR imaging, liver fat and fibrosis assessment, prenatal and obstetrical ultrasound studies (also called US or sonograms), doppler ultrasound, abdominal ultrasound, gynecology/pelvic ultrasound, scrotal ultrasound,

ultrasound-guided biopsies, and ultrasound-guided transplantation monitoring.

Our specific areas of focus include the development of MRI and CT techniques to optimize assessment of multiparametric MRI scanning for detection and staging of prostate cancer;

advanced hepatic imaging, including multi-detector CT, CT cholangiography, new hepatobiliary MR contrast agents and MR cholangiopancreatography; and radiologic evaluation of diffuse liver disease, including cirrhosis, pseudocirrhosis, and nonalcoholic steatohepatitis. We use dynamic contrast-enhanced MRI, US and CT for assessment of all areas in the abdomen and pelvis.

Working with the UCSF Fetal Treatment Center, our radiologists offer ultrasound services that include prenatal diagnosis with ultrasound and MRI of even the most complex abnormalities.

## Breast Imaging

*Bonnie N. Joe, MD, Chief*

In 2019, the Breast Imaging Clinical Section moved into the UCSF Bakar Precision Cancer Medicine Building on UC San Francisco's Mission Bay campus. This places the clinic within steps of the UCSF Bakar Cancer Hospital



*Breast Imaging reading room at PCMB: (l-r) Karl Grunseich, MD, PGY4 resident, Heather Greenwood, MD, assistant professor, Bonnie N. Joe, MD, PhD, chief, Marc Erian, MD, fellow.*

and the Mission Bay research building for the UCSF Helen Diller Family Comprehensive Cancer Center.

Breast Imaging at UCSF offers mammography including tomosynthesis (also known as 3D mammography) and MRI for breast cancer screening. Mammography, ultrasound and MRI are available for diagnostic evaluations, cancer staging and treatment response assessment. Dedicated breast PET and functional MR imaging are offered in conjunction with research trials. We provide image-guided breast biopsy and localization under ultrasound, stereotactic and MRI guidance.

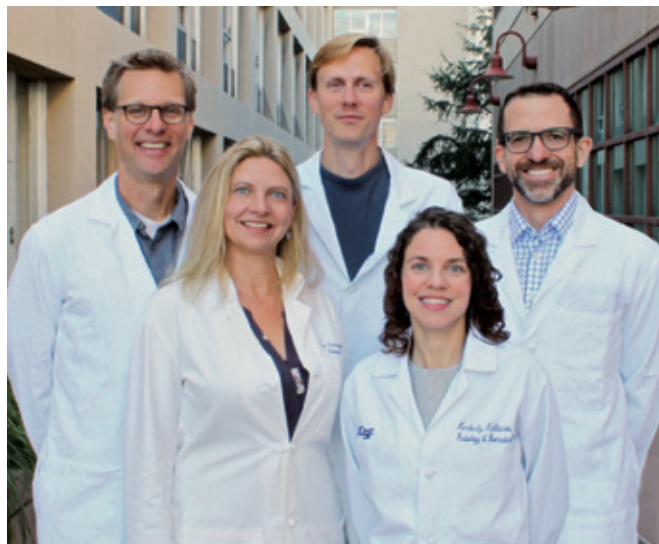
We work closely with the UCSF Center for BRCA Research and UCSF genetic counselors for patients requiring genetic and counseling services.

## Cardiac and Pulmonary Imaging

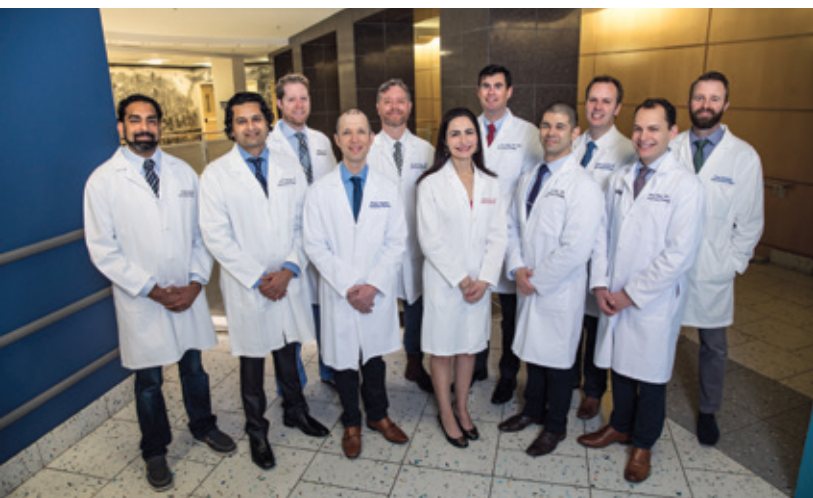
*Travis Henry, MD, Acting Chief*

The Cardiac and Pulmonary Imaging Section at UCSF Radiology is dedicated to safely performing the most current clinical imaging exams of both the respiratory and cardiovascular systems using advanced imaging modalities, such as HRCT, CTA, MRI, and percutaneous CT-guided lung biopsies. We develop and implement state-of-the-art methods for providing early diagnosis and improved outcomes for patients suffering from

*Back row (l-r) Drs. Michael Hope, Brett Elicker and Travis Henry. Front row (l-r) Drs. Karen Ordovas and Kimberly Kallianos.*



cardiac and pulmonary diseases. We are a world leader in HRCT for the diagnosis and management of interstitial lung disease. We use cardiac CTA for emergency room evaluation of atypical chest pain and for evaluation of coronary atherosclerosis and pulmonary venous anatomy in atrial fibrillation. Cutting edge MRI techniques such as T1 mapping are now being used for assessment of cardiac disease such as in patients with pulmonary hypertension. Cardiac MRI and CTA using computational modeling for quantitative assessment of ventricular performance and multidimensional flow techniques are routinely used in the assessment of congenital heart disease in both pediatric and adult patients.



*Interventional Radiology*

## Interventional Radiology

**Maureen P. Kohi, MD, Chief**

Over the past year, the Interventional Radiology (IR) Section has welcomed two new faculty members (Michael Heller, MD, and Alexander Lam, MD) and expanded our clinical sites and programs. The new junior attendings have worked hard to build the superficial venous program led by Vishal Kumar, MD and spearheaded the development of peripheral artery disease, genicular artery embolization, and painful bony metastasis ablation programs.

The opening of two new angiography suites at the Bakar Precision Cancer Medicine Building (PCMB) coincided well with our mission to provide accessible high-end outpatient care. At PCMB we are expanding our outpatient prostate and uterine artery embolization practices and offering more same-day liver tumor radioembolizations.

Multiple faculty members in our section received national honors this past year. We are excited at the selection of Maureen Kohi as the scientific chair for the 2021 Society of Interventional Radiology national meeting.

In addition, Peter Lokken, MD, was named an associate editor of the field's preeminent journal, *Journal of Vascular and Interventional Radiology*, and Miles Conrad, MD, PhD, has been nationally recognized for his work with hemorrhagic hereditary telangiectasia patients.

The implementation of a new IR residency guided by Evan Lehrman, MD, brings great excitement for the future of UCSF IR and the goal of training well-rounded and clinically focused interventional radiologists. We look forward to the interview season and the match of our third IR residency class.

## Molecular Imaging and Therapeutics

**Robert Flavell, MD, PhD, Chief**

This year saw major changes with the formation of the new Molecular Imaging and Therapeutics Section.

It oversees the clinical practice of traditional nuclear medicine, including multimodality PET/CT and PET/MR, and stewards the application of molecular therapeutic agents for our patients. The section works closely with the Chemistry, Probes and Molecular Therapy Specialized Resources Group to develop innovative imaging and therapeutic approaches.

Over the last year we have seen several new research and clinical tools in our department. Major highlights include the continued clinical implementation of theranostic agents including those directed against prostate-specific membrane antigens and the development of new agents for imaging HIV infection (*see article on page 4*). Over the next year, we look forward to the installation of two new PET/CT scanners, which promise to greatly extend our clinical and research capacities.



*Production of radiopharmaceuticals*

## Musculoskeletal

*Thomas M. Link, MD, PhD, Chief*

The team of the Musculoskeletal Section had another busy and successful year in 2019. Highlights include the Chancellor Award for Dr. Martin Luther, King Jr. leadership, awarded to Matt Bucknor, MD. I was honored to receive the Gwilym Lodwick Award from MGH-Harvard. Rina Patel, MD, excelled in her role as fellowship director and we were able to fill all fellowship spots for 2020 with top candidates. Kevin McGill, MD, PhD, worked hard on building a new ultrasound-guided biopsy program at the Precision Cancer Center at Mission Bay Hospital, which went live in September 2019. Also, our section is proud to announce the addition of Kai Cyrus to our team, the son of Daria Motamedi, who was born in October 2019.

Over the year, the Musculoskeletal Section saw an increase in volume, due to the continued growth of the Orthopedic Institute, new physicians in Orthopedic Surgery and the addition of new MRI scanners. Bucknor consolidated his MR-guided High Intensity Focused Ultrasound Program and the number of novel, minimally invasive procedures to treat bone tumors increased. In line with the increasing development of precision cancer treatment, the number of bone biopsies for bone metastases also increased. We were very pleased that Lynne Steinbach, MD, continued her support for our section and provided world-class training for our residents and fellows. Another 2019 highlight was the Howard Steinbach Memorial lecture, given by Christopher Beaulieu, MD, PhD, from Stanford University on the topic of machine learning and artificial intelligence.



*Thomas M. Link, MD, PhD*



*Dr. Achala Vagal with trainees and faculty during her visit to UCSF.*

## Neuroradiology

*Christine M. Glastonbury, MBBS, Interim Chief*

The Neuroradiology Section focuses on imaging and therapies to diagnose and treat the full range of neurologic disorders, including brain tumors, stroke and other vascular disorders, spine disease, neurodegenerative diseases, brain malformations, and disorders of the central and peripheral nervous system. We also have expertise in head and neck (H&N) imaging and radiation planning for H&N cancer. We are comprised of internationally recognized experts in every one of these disciplines. Our section offers the state-of-the-art imaging with CT, MRI, MEG and molecular modalities such as PET. With 19 full-time neuroradiologists across our clinical sites, UCSF Neuroradiology is one of the largest and diverse sections of neuroradiology in the United States.

This has been a very successful year with many national and international invited presentations and visiting professorships for our faculty, and many published papers and awards for our faculty and fellows. This past year we have especially enjoyed our UCSF Neuroradiology Alumni social events at the annual meetings for ASPNR, ASNR, ASHNR, ASFNR, and at the RSNA. One of the highlights of 2019 was the T. Hans Newton annual lecture with Professor Achala Vagal from the University of Cincinnati. She presented on "Acute Stroke Imaging: Current Evidence, What is Unknown, and What is Next" and the following morning presented a workshop for our fellows on the "Pitfalls of Automated CT Perfusion for Stroke." Neuro faculty members were also honored this year with the following awards: Yi Li, MD, received the inaugural Rahul Desikan, MD, PhD Award for Outstanding Research by a Junior Faculty (Oct. 2019), Leo Sugrue, MD, received the Haile Debas Excellence in Teaching Award (Aug. 2019) and Pratik Mukherjee, MD, PhD was named a fellow of the American Society of Functional Neuroradiology (Oct. 2019).

## Neuro Interventional Radiology

*Randall T. Higashida, MD, Chief*

The NIR Section at UCSF is one of the premier programs in the world specializing in the minimally invasive treatment of complex brain, head, neck, and spine vascular abnormalities. These include the interventional treatment of both ruptured and non-ruptured brain aneurysms, arteriovenous malformations, dural fistulas, vascular tumors of the head, neck, and spine, and other complex conditions.

We have three nationally recognized clinics that are co-chaired by the NIR faculty including: The Vascular Anomalies Clinic (Dr. Christopher Dowd); Hereditary Hemorrhagic Telangiectasia Clinic (Dr. Steven Hetts); and the Pulsatile Tinnitus Clinic (Dr. Matthew Amans). In addition, we have an NIR Clinic that sees outpatients on a daily basis for evaluation and treatment of complex neurovascular disorders.

The NIR service staffs four hospitals, including UCSF Parnassus, UCSF Mission Bay, Zuckerberg San Francisco General, and the SFVAMC Medical Center. In 2019, we began providing advanced acute stroke treatment in a unique XMR suite at ZSFG. Dr. Daniel Cooke completed the first multimodality stroke intervention, seamlessly moving a patient intra-procedurally between a state-of-the-art biplane X-ray angiography suite and 3-Tesla high-field MRI scanner in order to combine the best vascular imaging and best physiologic imaging of the brain to provide the patient with the best possible treatment outcome. The six full-time NIR physicians and three NIR fellows are available 24/7 to treat emergency large vessel acute ischemic stroke cases within 30 minutes of arrival in the emergency departments at multiple hospitals, as well as manage vascular trauma, and acute subarachnoid hemorrhage cases on an emergent basis.

The NIR service is integral and complementary to both the UCSF Stroke Neurology and Neurovascular Surgery services, in providing both diagnostic and interventional treatment as a tertiary referral center, for most of Northern California.

Our emergency stroke network has been enhanced by both teleradiology and video conferencing capabilities at key hospital sites which triage care to UCSF. For more information please refer to our UCSF NIR website at: <https://radiology.ucsf.edu/patient-care/sections/neuro-ir>.

*Neuro Interventional*



*Reviewing images at Benioff Children's Hospital Oakland (top photo) and UCSF Benioff Children's Hospital in San Francisco (lower photo).*

## Pediatric Radiology

*Ronald A. Cohen, MD, Interim Chief*

UCSF Pediatric Radiology provides specialized imaging for infants, children and pregnant women. Recognized as a top-ranked hospital, UCSF Benioff Children's Hospital in San Francisco and Oakland offers a unique pediatric-focused environment that is safe and pleasant for patients and their families. The Pediatric Radiology Section is dedicated to the health of children, conducting research and training the next generation of radiologists.

The mission of the Pediatric Radiology Ssection is to improve the health of children through advanced clinical imaging and research. The section studies pediatric disease through the lens of imaging and is focused on the development of new imaging technologies. Several basic science and clinical studies are ongoing with collaborations with multiple pediatric and surgical specialists.





(l-r) Drs. Ramya Srinivasan, Eugene Huo and Michael Hope

## SFVAMC Radiology

*Michael Hope, MD, Chief*

Last year was a year of great change for the Radiology Service at the San Francisco Veterans Affairs Medical Center. Two of our senior faculty, Marcia McCowin, MD, and Virginia Griswold, MD, retired after long and storied careers, and our chief of Musculoskeletal and Residency Site Director Ramya Srinivasan, MD, has moved on to pursue a simpler life in Kauai. They are succeeded by two exceptional new faculty, Joseph Leach, MD, PhD, for Body Imaging and Preeti Sukerkar, MD, PhD, for Musculoskeletal. We continue to provide comprehensive and high-quality imaging for our veterans as we search for additional faculty members. We plan to offer more accessible and state-of-the-art imaging in 2020, with a mobile CT unit in our Eureka clinic and a new PET/CT in San Francisco slated for the first half of the year.

We are excited to share new opportunities for imaging research at SFVAMC. We recently restructured our team to broaden the range of imaging research, and to help foster collaborations throughout the VA and UCSF research communities. To reflect this expanded scope, we have renamed our center the VA Advanced Imaging Research Center, or VAARC. Directing VAARC are Pratik Mukherjee, MD, PhD, for Neuroimaging; David Saloner, PhD, for Vascular and Cardiac Imaging; An (Joseph) Vu, MD, for Advanced Imaging Technologies, and Duygu Tosun-Turgut, PhD, for Imaging Informatics and Artificial Intelligence. Our focus has been bringing on new talented PhD researchers like Dimitrios Mitsouras, PhD, for Cardiovascular Imaging, and we have an ongoing search for additional PhD faculty. We are actively developing new projects in musculoskeletal MRI and big data through the VA system.

## Zuckerberg San Francisco General

*Mark W. Wilson, MD, Chief of Radiology*

At ZSFG we implemented a new PACS system, Agfa's Enterprise Imaging platform. As the name implies, this is an enterprise solution that will be used to host clinical imaging data from several departments at ZSFG, including but not limited to Radiology, Cardiology, Pathology, and Dermatology. We also rolled out our instance of the Epic Electronic Health Record. This will integrate all clinical activities at ZSFG and affiliated clinics, as well as interface with similar EHRs at other hospitals.

This year, our 3T intra-operative MRI scanner became operational. Given its close proximity to Anesthesia and OR services and support, this is a boon for the safe imaging of critically ill and trauma patients. In addition, it is linked to a bi-plane angiography suite, which allows it to augment our current cadre of IR and NIR procedures, as well as provide MRI guidance for newer innovative procedures.

We successfully established spine intervention, lung biopsy, and venous intervention outpatient clinics. These allow us to meet with patients and work them up in a relaxed setting, while explaining beforehand the nature of any procedure they may undergo, allowing them to have a complete understanding. These clinics are staffed by our team of very dedicated Radiology Nurse Practitioners as well as the respective Radiology faculty. ■

*ZSFG Radiology*







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