Radiology Annual Report 2015

Radiology Annual Report 2014-15

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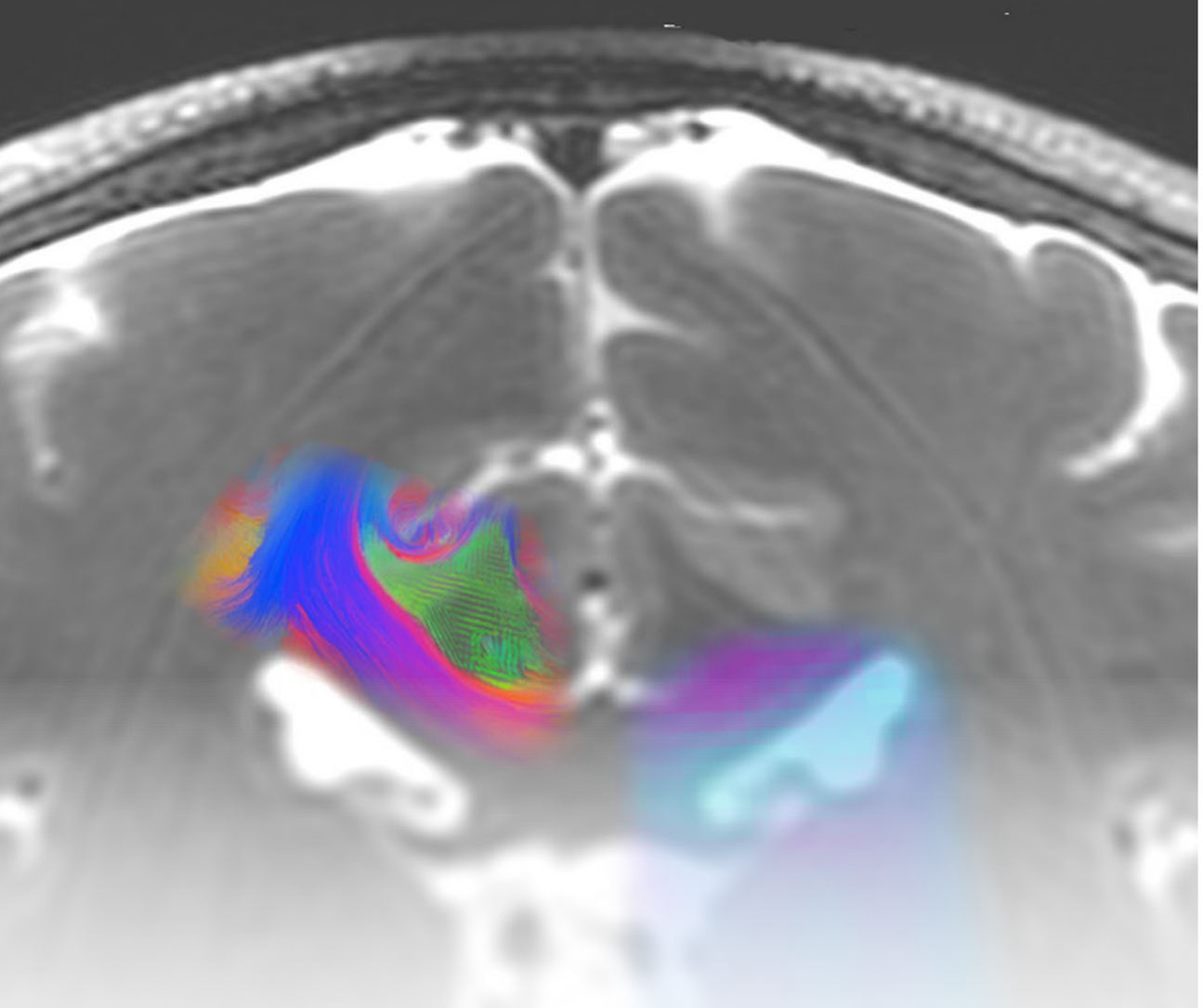

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This Page

Ultra-High Field (7T) MRI captures new microstructural details including cortical fiber patterns and the geometry of tissue compartments.
Acknowledgements: Christoph W. Leuze, Qiyuan Tian, Grant K. Yang, Jennifer A. McNab

Cover

"This three year old child with repaired congenital heart disease travelled from the east coast to Stanford specifically to have a cardiac MRI. We have developed and validated an unparalleled MRI method to comprehensively assess anatomy, blood flow, and heart function in under 10 minutes. This Stanford Radiology method permitted determination of blood flows to various regions of the lungs, which is not otherwise possible by MRI. The exam confirmed a good surgical result, with open blood vessels and flow to all portions of the lungs. To enable this technology, the Stanford team redesigned the entire imaging pipeline, from data acquisition to image reconstruction and image post-processing."
-Shreyas Vasanawala, MD, PhD

Contents

http://radiology.stanford.edu/about/annualreport/

From the Chairman

> “We continue to expand both clinically and academically with enormous potential for making a great impact in precision health”
>
> SANJIV SAM GAMBHIR, MD, PHD

IT IS NOW 4 YEARS since I began my role as Chair of the Department of Radiology and I continue to remain blessed with the support of so many faculty, staff, and trainees both in our Department and at Stanford University as a whole. In my last message to you through the previous Annual Report, we shared examples of the Department of Radiology’s successes and growth in multiple new areas of clinical and research expansion. Since that time, the continued growth and expansion of our work has fully exceeded our most optimistic expectations.

With a truly outstanding group of faculty, staff, and trainees, we continue to push the boundaries of what the field of Radiology will become in the years ahead. “Science without Borders” will continue to be a key theme during my chairmanship. Over the past four years, we have made tremendous strides in this direction by creating significant bridges to scientific and clinical activities throughout the medical school, affiliated hospitals, and across the Stanford campus.

We continue to pursue some key research areas that we believe will be important to health care in the long-term. These include: 1) Early disease detection as one of our strategies for moving from precision medicine towards precision health e.g., lung cancer early screening, wearable sensors for continuous monitoring. 2) Theranostics through the use of technologies such as MR-high intensity focused ultrasound (MR-HIFU) as well as through radiochemistry with imaging agents that serve as both diagnostics and therapeutics. 3) Multimodality imaging through strategies that combine the best of what each modality has to offer e.g., MR + PET; ultrasound + photoacoustics. 4) Bringing together in vitro diagnostics with in vivo diagnostics for improved patient care (e.g., lung cancer detection and management through the use of CT, PET-CT, and circulating tumor cells). 5) Expansion of clinical trials to bring new instrumentation and new imaging agents to the clinic. 6) Digital breast tomosynthesis or 3D mammography for more accurate breast imaging. 7) Improved strategies for pediatric oncologic imaging including PET-MR that may reduce radiation relative to PET-CT while still providing similar accuracy. 8) Novel strategies for improving cardiovascular imaging including 4D visualization and 3D presentation for better patient care. 9) Imaging informatics for extracting more useful information from medical images as well as combining information from different disciplines e.g., genomics, pathology, and radiology. 10) Planning for upgrading our RIS and PACS in 2016 so that we can keep our clinical imaging informatics state-of-the-art. 11) Efforts to improve delivery of care through process re-engineering to improve quality of care in our imaging centers. 12) Nurturing of start-up companies to help push academic discoveries and research to the private sector creating jobs and eventually allowing strategies pioneered at Stanford to be made available worldwide.

With the opening of many new clinical and research facilities, we have increased our footprint significantly. For clinical space, faculty and staff are working hard on readying both the children’s and adult hospitals to open in 2017 and 2018 respectively. A significant amount of planning for staffing and new equipment has already taken place. 1) In July 2015, we opened a patient-centric radiology facility in the new Stanford Cancer Center South Bay, part of the Cancer Center expansion; 2) In November 2015, we will open a new Neuroradiology Imaging Center in the Stanford Neuroscience Health Center, Hoover 2, to complement the expansion in clinical neurology/neurosurgery; 3) The Breast Imaging Clinic in the Cancer Center will also undergo a much needed expansion; and 4) We are actively planning for staffing centers and placing imaging equipment in the East Bay including a multi-specialty office building in Emeryville and Valley Care Hospital. In research space, we recently completed renovations in the Lucas Center to make way for the first time-of-flight PET-MR system anywhere in the world. In addition to the PET-MR system, we recently installed a new clinical hyperpolarizer system to allow for high-sensitivity imaging with MR using hyperpolarized molecular imaging agents. Renovation of the SHC Film Library is complete and now provides the much needed workspace for clinical faculty and administrative staff. We recently completed renovation of the Grant Building basement that has long been home to many faculty and administrative staff. A ribbon cutting ceremony will celebrate the new Grant and Library spaces in late 2015.

Regarding research space, in July 2013 we completed construction of new facilities on Porter Avenue as part of the Technology & Innovation (TNI) Park where we have ~40,000 net square feet of dry and wet research space. This facility includes state-of-the-art chemistry space and a small animal imaging facility. We received an 11.7T small animal MR as a gift from Agilent that will soon be installed at the TNI. This growth is the largest research space expansion in the history of our Department. The Department of Genetics is also housed there and this co-habitation is resulting in many new exciting opportunities combining the best of genomics and imaging.

Dr. Sanjiv Sam Gambhir, Chair, Department of Radiology

2014-15

The growth in our faculty has brought in spectacular recent recruits. We are pleased to welcome twenty-four new faculty, twelve adjunct or affiliated faculty, two courtesy appointments, and one consulting faculty. Each one of our new faculty additions not only fills a critical gap in a specific area in the department, but also brings fresh energy and excitement to the team. Please see pages 12-23 for information about the new hires – keep an eye out for them and welcome them to our Radiology family.

Several new leadership transitions have occurred: (i) Drs. Greg Zaharchuk and Andrei Iagaru have done a terrific job helping to launch the new PET-MR research program. Dr. Garry Gold, in addition to continuing his critical role as the Associate Chair for Research, will join Dr. Andrei Iagaru to co-lead the PET-MR program as Dr. Zaharchuk transitions out of this role. (ii) Dr. Max Wintermark was appointed Section Chief of Neuroradiology and has done a terrific job expanding the Neuroradiology footprint. (iii) Dr. Payam Massaband, who has been acting Chief of the Palo Alto VA Radiology Department, was recently named as the new Radiology Residency Program Director following the successful leadership of Dr. Terry Desser since 2004. Several new Associate Directors will join him soon to help our Radiology Residency training program continue to evolve. (iv) We also have begun to combine the Nuclear Medicine and Radiology residencies through a unique track to train the next generation of academic leaders.

Several faculty searches are currently in progress and include two positions in Neuroradiology and one for Pediatric Radiology. Medical Director of Clinical Operations. In the next few months, we should conclude two important leadership searches for the Section Chief of Breast Imaging and the Chief of Radiology Service at VA Palo Alto Health Care System. In addition, we are launching a new search for a basic scientist to join the Radiological Sciences Laboratory who will lead efforts in medical physics and advanced x-ray research.

We have also had changes in scientific staff leadership with the hiring of a new Deputy Director at the Canary Center, Dr. Stephanie van de Ven replaces Dr. Bree Mitchell who has moved her research and family up north to OHSU in Portland, Oregon. Dr. Rajan Munshi, who is working with the Industrial Contracts team on large industry supported projects, was hired in 2014, primarily to lead the Google Life Sciences collaboration, which should kick off in early 2016. Additionally, Dr. Praveen Gulaka was hired as Deputy Director of the PET-MR program and is working with Drs. Iagaru and Gold to continue advancing our expertise in this exciting new area of hybrid imaging. On the administrative side, in 2014 we hired Ms. Jessie Leong as the new Lucas Center Manager following the retirement of Ms. Donna Cronister who served in this role for twenty years. We are very fortunate to have each of these talented individuals with their significant prior experience in conducting research, leading and managing large groups, and mentoring scientific and administrative staff.

Regarding our research successes, and according to the most recent data published by the Academy of Radiology Research in 2014, we continue to be among the top NIH-funded Radiology Departments in the country, and the highest NIH-funded per capita of all Radiology Departments in the USA. Overall research funding is strong with an increase in total funding from 2013-15 of 16%. New NIH projects for 2015 include: eight R01s, four R21s, one T32, one U54 and one P41 as of August 15, 2015. Industrial collaborations also continue to grow and have resulted in more than 20 new awards during 2015, many of which have brought in funding for our clinical trials research program that is significantly bolstered by the introduction of focused ultrasound and PET-MR capabilities. In addition, our success with non-profit and foundation sponsors remains strong with more than 10 new projects funded during 2015.

The Stanford Department of Radiology reflects new and broader interests that are underscored by our successes and collaborations in multiple areas, including physics, chemistry, molecular biology, mathematics, materials science, engineering, genetics, bioinformatics, epidemiology, structural biology, and neuroscience. The original notion of a Radiology department as an "x-ray department" still exists but no longer represents a complete picture of today's ever-changing imaging department. The broad reach of imaging sciences in health care has given new meaning, new career paths, and new excitement to the field of Radiology.

Through our efforts with the Canary Foundation, we continue to build bridges with the local community, including the annual Canary Challenge bike ride, a prime example of our success in community engagement. This annual event, now in its 5th year, was again tremendously successful with about 1000 riders who raised more than $1M in support of cancer research and early detection.

All of the great progress in our Department is due to the commitment of our highly dedicated faculty and staff. I especially want to thank all of our Section Chiefs and Vice/Associate Chairs for their tremendous efforts and their continued support. It is my pleasure to learn from them each day and to benefit from their great collective wisdom, enthusiasm, and support.

Sanjiv Sam Gambhir M.D., Ph.D.
Virginia and D. K. Ludwig Professor of Cancer Research
Chair, Department of Radiology

Associate Chairs and Section Chiefs

Sanjiv Sam Gambhir, MD, PhD

Chair, Department of Radiology
Director, Molecular Imaging Program at Stanford
Director, Canary Center at Stanford for Cancer Early Detection

R. Brooke Jeffrey, MD

Vice Chairman
Associate Chair, Academic Affairs

Richard Barth, MD

Associate Chair, Radiology
Radiologist-in-Chief, LPCH
Section Chief, Pediatric Imaging

Michael Federle, MD

Associate Chair, Education

Garry Gold, MD

Associate Chair, Research

Robert Herfkens, MD

Associate Chair, Clinical Technology

Curtis Langlotz, MD, PhD

Associate Chair, Information Systems

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Associate Chair, Performance Improvement

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Christopher Beaulieu, MD, PhD

Section Chief, Musculoskeletal Imaging

Dominik Fleischmann, MD

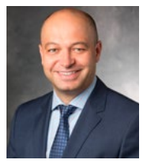
Section Chief, Cardiovascular Imaging

Gary Glover, PhD

Co-Director, Radiological Sciences Laboratory

Lawrence "Rusty" Hofmann, MD

Section Chief, Interventional Radiology



Andrei Iagaru, MD

Co-Section Chief, Nuclear Medicine and Molecular Imaging
Nuclear Medicine Residency Program Director

Debra Ikeda, MD

Section Chief, Breast Imaging

Payam Massaband, MD

Acting Section Chief, VA Palo Alto
Radiology Residency Program Director

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Co-Director, Integrative Biomedical Imaging Informatics at Stanford

Kim Butts Pauly, PhD

Co-Director, Radiological Sciences Laboratory

Sylvia Plevritis, PhD

Co-Director, Integrative Biomedical Imaging Informatics at Stanford

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Co-Section Chief, Nuclear Medicine and Molecular Imaging

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Section Chief, Nuclear Medicine
VA Palo Alto

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Section Chief, Body MRI

Juergen Willmann, MD

Section Chief, Body Imaging

Max Wintermark, MD, MAS, MBA

Section Chief, Neuroimaging & Neurointervention

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Lawrence Cheung, MD
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Terry Desser, MD
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Michael Federle, MD
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Howard Harvin, MD
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Assistant Professor

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Juergen Willmann, MD
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Clinical Instructor

Long Ngoc Trinh, MD
Clinical Instructor

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Utkan Demirci, PhD
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Sanjiv Sam Gambhir, MD, PhD
Professor

Parag Mallick, PhD
Assistant Professor

Sharon Pitteri, PhD
Assistant Professor

Tom Soh, PhD
Professor

Juergen Willmann, MD
Professor

Cardiovascular Imaging

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Frandics Chan, MD, PhD
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Adjunct Clinical Assistant Professor

Dominik Fleischmann, MD
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Daniel Spielman, PhD
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Ann Leung, MD
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Margaret Lin, MD
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Payam Massaband, MD
Clinical Assistant Professor

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Clinical Assistant Professor

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Lewis Shin, MD
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Clinical Associate Professor

George Segall, MD
Professor

Minal Vasanawala, MBBS
Clinical Assistant Professor

New Faculty Appointments

Hans-Christoph Becker, MD | Cardiovascular Imaging 2014

Professor

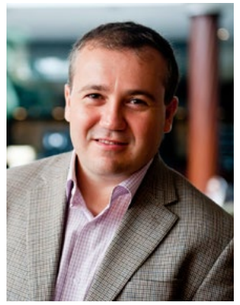
Dr. Hans-Christoph Becker ("Christoph") joined our department as Professor of Radiology (2014). Dr. Becker was previously Professor of Radiology and Section Chief of Body CT and PET in the Department of Clinical Radiology at University Hospital of Grosshadern, Ludwig-Maximilians-University Munich, Germany. He is a world-renowned expert and pioneer of cardiac CT with a specific focus on noninvasive cardiac imaging. He managed the CT radiology research facility with more than 90 active clinical trials. His primary research is focused on cardiac CT (including perfusion), rotating C-arm CT for intervention, phase IV clinical contrast media studies and radiation protection. Dr. Becker is a great fit for our needs in the CV Imaging Section. His additional expertise in clinical trials and oncologic imaging is an added benefit to our department.

Jeremy Dahl, PhD | Pediatric Imaging and RSL 2014

Assistant Professor

Dr. Jeremy Dahl joined our department as Assistant Professor of Radiology August 1, 2014. Dr. Dahl was most recently an Assistant Research Professor in the Department of Biomedical Engineering at Duke University. He received his undergraduate degree in Electrical Engineering from University of Cincinnati in 1999 and his PhD in Biomedical Engineering at Duke in 2004. Dr. Dahl's research interest is in diagnostic ultrasound imaging. He is PI on two active NIH R01 grants and was Co-PI on a Coulter Foundation grant and PI on an NIH R21. He will be applying his unique knowledge to build bridges between the basic sciences and clinical pediatric imaging, as well as other areas of biomedical imaging (e.g., body imaging, molecular imaging, interventional radiology).

Utkan Demirci, PhD | Canary Center 2014



Associate Professor

Dr. Utkan Demirci joined our department as an Associate Professor at Radiology with tenure at the Canary Center in 2014. Prior to his Stanford appointment, he was an Associate Professor of Medicine at Brigham and Women's Hospital, Harvard Medical School, Harvard-MIT Division of Health Sciences and Technology. He leads a group of 20+ researchers focusing on micro- and nano-scale technologies. He received his BS degree in Electrical Engineering in 1999 as a James B. Angell Scholar (summa cum laude) from University of Michigan, Ann Arbor. He received his masters in Electrical Engineering (2001), his masters in Management Science and Engineering (2005), and his PhD in Electrical Engineering (2005), all from Stanford University.

Curtis Langlotz, MD, PhD | IBIIS and BMIR 2014

Professor
Associate Chair,
Information Systems

Dr. Curtis Langlotz joined our department in 2014 as Professor of Radiology and Associate Chair for Information Systems. In addition to his Radiology appointment, Dr. Langlotz has a secondary appointment with the Stanford Center for Biomedical Informatics Research in the Department of Medicine. Dr. Langlotz has led many national and international efforts to improve the quality of radiology reports, including the RadLex terminology standard, the RadLex Playbook of radiology exam codes, and the report template library of the Radiological Society of North America. He was previously Professor and Vice Chair of Informatics in the Department of Radiology at the University of Pennsylvania. He received his undergraduate degree (1981) in Human Biology, masters in Computer Science (1983), MD (1989), and PhD in Medical Information Science (1989), all from Stanford University.

New Faculty Appointments

David Larson, MD, MBA | Pediatric Imaging 2013

Dr. David Larson joined our department as Associate Professor of Radiology and Associate Chair of Performance Improvement (2013). Dr. Larson previously was Assistant Professor and the Janet L. Strife Chair for Quality Improvement and Safety in Radiology at Cincinnati Children's Hospital, Cincinnati, Ohio. Dr. Larson completed his undergraduate degree in Mechanical Engineering at Brigham Young University (1997) and joint MD/MBA degrees at Yale (2002). He completed his residency in diagnostic radiology (2007) and pediatric radiology fellowship (2008) at the University of Colorado. At Cincinnati Children's, he developed an automated system for CT radiation dose monitoring and optimization. Dr. Larson works closely with faculty, staff, and administration to improve performance at SHC and LPCH and co-directs the Clinical Effectiveness Leadership Training course at Stanford School of Medicine.

Associate Professor
Associate Chair,
Performance Improvement

Matthew Lungren, MD, MPH | Pediatric IR Imaging 2014

Dr. Matthew Lungren received his BA degree, magna cum laude, in English Literature and BS degree in Biology from Arizona State University in 2002. He went on to University of Michigan Medical School where he graduated cum laude and AOA in 2007, also receiving the University's radiology outstanding scholar award. He completed a transitional Internship at Oakwood Hospital, Dearborn MI, 2007-2008, and completed his radiology residency at Duke University 2008-12 where he was chief resident. He completed a one year adult IR fellowship at Duke University in 2012-2013 and received his MPH from the University of North Carolina Gillings School of Global Public Health in 2014. Dr. Lungren joined our faculty following a one year fellowship in pediatric radiology and pediatric interventional radiology at Cincinnati Children's Hospital.

Assistant Professor

Andreas Loening, MD, PhD | Body Imaging/Body MRI 2015

Dr. Andreas Loening joined our department in 2015 as an Assistant Professor. He was previously a Clinical Instructor in our Body MRI and Body Imaging sections, a position he held for almost a year. Dr. Loening received his BS degree (1998) and M. Eng. degree (1999) from MIT in Electrical Engineering. He enrolled in the UCLA Medical Scientist Training Program in 1999, and transferred to Stanford in 2003 where he completed his PhD in Bioengineering (2006) and his MD (2008). He completed a transitional internship at the University of Hawaii from 2008 to 2009, followed by radiology residency and then Body MRI fellowship, both at Stanford, from 2009 to 2014.

Assistant Professor

H. Tom Soh, PhD | Canary Center 2015

Dr. H. Tom Soh joined our department as Professor of Radiology and Electrical Engineering (dual appointments). Previously, he was the Ruth Garland Endowed Chair of Materials and Mechanical Engineering at UCSB. Dr. Soh received his BS with a double major in Mechanical Engineering and Materials Science with distinction from Cornell University (1992), and his MS & PhD (1999) degrees in Electrical Engineering from Stanford. Among many honors, he is a John Simon Guggenheim Fellow (2010), Alexander von Humboldt Fellow (2012) and a Fellow of the American Institute for Medical and Biological Engineering (2015).

Professor

New Faculty Appointments

Avnesh Thakor, MD, PhD | Pediatric/Adult Interventional 2015

Dr. Avnesh Thakor joined our department in 2015 as Assistant Professor of Radiology. Prior to joining, he completed both a Pediatric Interventional Radiology fellowship at SickKids Hospital, Canada (2014-2015) and an Adult Interventional Radiology Fellowship at Vancouver General Hospital, Canada (2013-2014). Dr. Thakor received his BA (2001) and a combined MBBChir, PhD degree (2006), all from Cambridge University, UK. Following training, Dr. Thakor completed an internship in general medicine/surgery, a radiology residency, and an Interventional Radiology Fellowship at Cambridge University (2006-2013). He also earned a MA, an MSc degree in Cancer Therapeutics from the University of London (2010) and a research MD degree (2013) from Cambridge University which was combined with post-doctoral research at MIPS, Stanford University.

Assistant Professor

Max Wintermark MD, MAS, MBA | Neuroimaging & Neurointervention 2014

Dr. Max Wintermark joined our department as Professor of Radiology and section chief of Neuroimaging & Neurointervention, effective August 1, 2014. He was previously Associate Professor of Radiology at the University of Virginia where he also served as the section chief of Neuroradiology. Dr. Wintermark is the chair of the research committees of the American Society of Neuroradiology (ASNR) and of the American Society of Functional Neuroradiology (ASFNR). Dr. Wintermark also serves as the chair of the ACRIN neuro committee, the chair of the imaging core of the NINDS-funded StrokeNet clinical trial network and the co-chair of the Stroke Imaging Research (STIR) group. Dr. Wintermark has a specific interest and expertise in stroke, traumatic brain injury, epilepsy, movement disorders and psychiatric disorders.

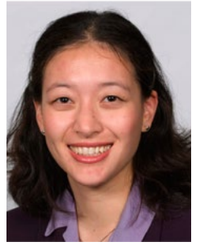
Professor

New CE and Instructor Appointments

Audra Brunelle, MD | Breast Imaging 2015

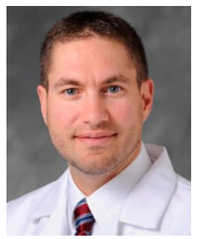
Dr. Audra Brunelle joined the department as a Clinical Instructor of Breast Imaging effective July 1, 2015. She received her MD from Indiana University School of Medicine in 2009 where she also completed her residency in 2014. She completed her fellowship from the University of California San Francisco.

Joan Cheng, MD | Body Imaging 2015



Dr. Joan Cheng joined the department in 2015 as a Clinical Instructor within the Body Imaging Section. In 2006, she received her MD from the University of Michigan Medical School and went to New York Medical College for her Internship (2007). In 2012 Dr. Cheng completed her residency at Columbia University Medical Center followed by fellowships at the Dana Farber Cancer Institute in 2013 and the Boston Medical Center in 2014.

Safwan Halabi, MD | Pediatric Imaging 2015



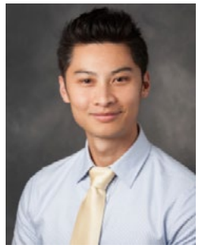
Dr. Safwan Halabi joined the department as a Clinical Assistant Professor of Pediatric Imaging in 2015. He was also named the Pediatric Radiology Informatics Director at Lucile Packard Children's Hospital. Dr. Halabi received his MD from the University of Toledo, College of Medicine in 2001; completed an internship and residency at the Henry Ford Health System in Michigan; and completed a pediatric imaging fellowship in 2007 at the Cincinnati Children's Hospital and Medical Center. With a clinical focus in fetal and perinatal imaging, Dr. Halabi also joins the fetal imaging group at the Perinatal Diagnostic Center. His research interests in data mining, outcomes, patient-centric care, and clinical decision support will fill a significant need in the department and at LPCH.

New CE and Instructor Appointments

Jeremy Heit, MD, PhD | Neuroimaging & Neurointervention 2015

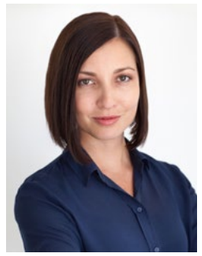
Dr. Jeremy Heit joined the department in 2015 as a Clinical Instructor of Neuroimaging & Neurointervention. He specializes in treating stroke, brain aneurysms, brain arteriovenous malformations, brain and spinal dural arteriovenous fistulae, carotid artery stenosis, vertebral body compression fractures, and congenital vascular malformations. Dr. Heit received his PhD in Developmental Biology from Stanford in 2007 and his MD in 2008. He completed residency training at Massachusetts General Hospital before returning to Stanford where he completed his fellowship in neurointerventional radiology.

Michael Iv, MD | Neuroimaging & Neurointervention 2013



Dr. Michael Iv joined the department in 2013 as a Clinical Instructor and was promoted in 2015 to Clinical Assistant Professor of Neuroimaging & Neurointervention. He specializes in advanced diagnostic imaging of the brain, spine, and head and neck with clinical and research interests in vascular and brain tumor imaging. Dr. Iv received his MD from UCLA in 2006. He then completed residency training at Santa Clara Valley Medical Center in 2011 and subsequent neuroimaging fellowship at Stanford in 2013.

Michelle James, PhD | Molecular Imaging Program 2013



In 2013, Dr. Michelle James joined the department as an Instructor within the Molecular Imaging Program at Stanford. Prior to coming to Stanford she attended the University of Sydney receiving her BS in Pharmacology/Medicinal Chemistry (2004) and her PhD in Pharmacology/ Radiochemistry.

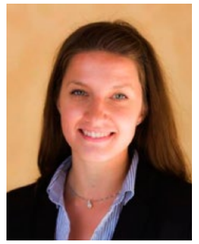
Christine Kim, MD | Neuroimaging & Neurointervention 2015

Dr. Christine Kim joined the department in 2015 as a Clinical Instructor of Neuro-imaging & Neurointervention. She received her MD in 2007 and completed residency training at the University of Connecticut in 2009. Following residency training, Dr. Kim completed a fellowship in interventional radiology at the University of Washington Medical Center (2013), followed by a neuroradiology fellowship at Stanford (2015).

Sri-Rajasekhar Kothapalli, PhD | Molecular Imaging Program 2014

Dr. Sri-Rajasekhar (Raj) Kothapalli joined the department in March 2014 as an Instructor in the Molecular Imaging Program at Stanford. Dr. Kothapalli completed his masters in Applied Physics at the University of Massachusetts followed by graduate work at Washington University in St. Louis where he received his PhD in 2009. As a postdoc at Stanford, mentored by Dr. Sanjiv Gambhir, he developed and translated a novel transrectal ultrasound and photoacoustic imaging system for prostate cancer screening, collaborating with Dr. Khuri-Yakub (Electrical Engngineering) and Drs. James Brooks and Joe Liao (Urology). His current research work focuses on dual modality ultrasound and photoacoustic imaging systems for other clinical and pre-clinical applications.

Kerstin Müeller, PhD | Radiological Sciences Laboratory 2015



Dr. Kerstin Müeller joined the department in 2015 as an Instructor in the Radiological Sciences Lab. She received her diploma degree in Electrical-Electronic Communication Engineering in 2010 and her doctoral degree in medical imaging in 2014 from the Friedrich-Alexander-Universität Erlangen-Nürnberg. Dr. Müeller's PhD project focused on motion estimation and compensation of cardiac chambers in interventional radiology, which provided strong collaboration opportunities with the Siemens Healthcare GmbH, Forchheim.

New CE and Instructor Appointments

Viswam Nair, MD, MS | Molecular Imaging Program 2014

Dr. Viswam Nair joined the department in 2014 as an Instructor within the Molecular Imaging Program at Stanford. He is Co-Director of the Lung Stanford Nodule Assessment Program (2013) and Assistant Director for the Lung Cancer ScreeningProgram (2014). Dr. Nair received his BA in Chemistry from the University of Pennsylvania and his MD from The Ohio State University (2004). He completed his fellowship in Pulmonary & Critical Care Medicine (2010) at Stanford Hospital and a Master's degree in Epidemiology at Stanford University (2011).

Seung-min Park, PhD | Molecular Imaging Program 2014

Dr. Seung-min Park joined the department in 2014 as an Instructor within the Molecular Imaging Program at Stanford. He received his PhD in Applied Physics at Cornell University (2008), completed his postdoctoral training in Bioengineering at UC Berkeley (2014), and served as a Visiting Scholar in MIPS (2013-14). Dr. Park's research focuses on cancer diagnostics via liquid biopsy and single circulating tumor cell analysis, as a part of the Center for Cancer Nanotechnology Excellence and Translational Diagnostics (CCNE-TD).

Bryan Smith, PhD | Molecular Imaging Program 2015

Dr. Bryan Smith joined the department in 2015 as an Instructor in the Molecular Imaging Program at Stanford. He received his PhD in Biomedical Engineering as an NSF Fellow from The Ohio State University, Columbus, Ohio in 2006. He then joined the MIPS group as a postdoctoral scholar in the Stanford Molecular Imaging Scholars (SMIS) program. Dr. Smith was awarded a Stanford Dean's Fellowship, and then an NIH K99 Pathway to Independence Award for his work in nanomedicine.

Russell Stewart, MD, MBA | Body Imaging 2015

In 2015, Dr. Russell Stewart joined the department as a Clinical Instructor in Body Imaging. He attended Stanford University as an undergraduate and University of Chicago for his MD and his MBA (2009). Dr. Stewart returned to Stanford in 2010 where he completed his residency and followed up with a fellowship in musculoskeletal radiology.

Eric Tranvinh, MD | Neuroimaging & Neurointervention 2015

Dr. Eric Tranvinh joined the department in 2015 as a Clinical Instructor in Neuroimaging & Neurointervention. He received his MD from the University of Texas Southwestern Medical Center in 2008, completed his residency at University of Texas Health Science Center (2013) and his fellowship at Stanford (2015).

New Courtesy and Consulting Faculty Appointments

Carolyn Bertozzi, PhD | 2015

Dr. Bertozzi recently (April, 2015) joined the Stanford Faculty as the Anne T. and Robert M. Bass Professor in the School of Humanities and Sciences and the new Stanford ChEM-H (Chemistry, Engineering & Medicine for Human Health), the new interdisciplinary institute that brings together chemists, engineers, biologists and clinicians to understand life at a chemical level and apply that knowledge to improving human health. In addition to her role as Professor in the ChEM-H Institute, Dr. Bertozzi also holds a courtesy appointment in the Department of Radiology. Dr. Bertozzi was elected to the National Academy of Sciences in 2005 and named a Fellow of the American Academy of Arts and Sciences in 2010.

Geoffrey Sonn, MD | Molecular Imaging Program 2015

Dr. Geoff Sonn is a urologic oncologist whose clinical practice focuses on patients with prostate and kidney cancer. Dr. Sonn completed his medical training at the David Geffen School of Medicine at UCLA. After medical school, Dr. Sonn completed a six-year urology residency at Stanford followed by two years at UCLA as a urologic oncology fellow. In 2013, Dr. Sonn returned to Stanford as Assistant Professor of Urology. Dr. Sonn's primary research interest is in developing and applying novel imaging techniques to improve the care of patients with urologic cancers. In 2015, Dr. Sonn was appointed Assistant Professor of Radiology (courtesy appointment) and is working primarily with our MIPS and Canary faculty to translate our advanced early detection, treatment, and monitoring approaches into clinical practice.

Vikram S. Bajaj, PhD | Molecular Imaging Program 2014

Dr. Bajaj earned his PhD in physical chemistry at MIT and was a principal investigator at UC Berkeley and the Lawrence Berkeley National Laboratory (LBNL), where he remains an affiliated scientist and advisory board member. He recently joined the Department of Radiology as a Consulting Associate Professor of Radiology (2015). As its lead scientist, Dr. Bajaj directs translational science research teams and programs at Google Life Sciences and works closely with team members here at Stanford and at Duke University. Dr. Bajaj's research interests in academia, startups, and industry bridge multiple disciplines and include, for example, bioinformatics, molecular imaging, nanotechnology, nanoscale NMR and MRI, microfluidic NMR, dynamic nuclear polarization and structural biology.

New Adjunct/Affiliated Appointments

Breast Imaging

Long Ngoc Trinh, MD
Clinical Instructor (Affiliated), 2014

Interventional Radiology

Christopher Takehana, MD
Clinical Instructor (Affiliated), 2015

Musculoskeletal Imaging

Patrick Lee, MD
Veterans Affairs
Adjunct Clinical Assistant Professor, 2015

Michelle M. Nguyen, MD
Veterans Affairs
Clinical Assistant Professor (Affiliated), 2014

David Sandman, MD
Veterans Affairs
Adjunct Clinical Assistant Professor, 2015

Sabrina Ward, MD
Adjunct Clinical Instructor, 2015

Neuroimaging and Neurointervention

Mircea C. Dobre, MD
Adjunct Clinical Instructor, 2015

Cam Tran, MD
Adjunct Clinical Instructor, 2015

Pediatric Imaging

Aaron Potnick, MD
Adjunct Clinical Instructor, 2015

Matthew Schmitz, MD
Adjunct Clinical Instructor, 2014

Evan Zucker, MD
Adjunct Clinical Instructor, 2015

Thoracic Imaging

Charles T. Lau, MD, MBA
Veterans Affairs
Clinical Assistant Professor (Affiliated), 2015

Faculty Retirements

Philip Kivitz, MD | Years of Service 1986 - 2014

Dr. Philip Kivitz (October 24, 2014) received his MD from Hahnemann University in Philadelphia and served in the US Navy for 3 years before completing his radiology residency at Mount Zion Hospital & Medical Center in San Francisco. He joined Stanford Radiology in 1986. During his career, Dr Kivitz founded and served as Medical Director at the Breast Evaluation Center in San Francisco from 1980-1992. He also served on the boards of the Northern California Cancer Center and the Susan G. Komen for the Cure - San Francisco Chapter and has been a senior reviewer and site inspector for the American College of Radiology (ACR), which administers the Mammography Quality Standards Act (MQSA) for the FDA.

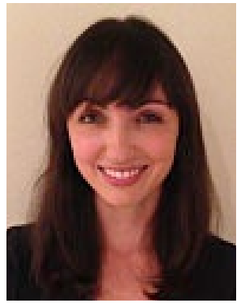
Robert Mindelzun, MD | Years of Service 1990 - 2014

Dr. Robert E. Mindelzun (April 30, 2014) completed his radiology residency at Albert Einstein College. He was appointed Chief of the Department of Radiology of the Naval Hospital in Yokosuka, Japan (1969-72). He arrived in California in 1972 to work as a radiologist at Menlo Clinic and eventually became chief of radiology at Santa Clara Valley Medical Center (1974-1990). He joined Stanford in 1990 and was promoted to Full Professor in 2000. Dr. Mindelzun has been recalled for clinical service on many occasions since 2006 and confirmed retirement in 2014. During his career, Dr Mindelzun has been honored as the Teacher of the Year 4 times (1977, 1984, 1991, and 1998).

William Northway, MD | Years of Service 1964 - 2014

Dr. William W. Northway (January 31, 2014) joined Stanford in 1964 as an Instructor, and was promoted to full Professor in 1977. He served as chief of Pediatric Radiology from 1994-1998 and "retired" in 1998. He has been recalled every year since 1999 and finally completely retired in January, 2014. We are truly grateful to Dr. Northway, whose research has changed the way premature babies with lung disease are treated worldwide. In recognition of his service and ability to weave research, patient care, and teaching together, the Stanford Medical Center Alumni Association honored Dr. Northway with the prestigious J.E. Wallace Sterling "Muleshoe" Lifetime Achievement Award in May, 2005.

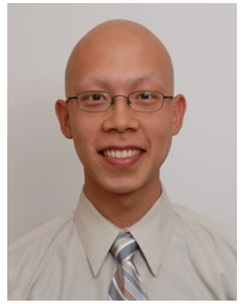
Faculty Departures



Keren Baron, MD
Adjunct Clinical Instructor
Breast/Body 2014
Now at Madison Ave Women's Hopital, New York

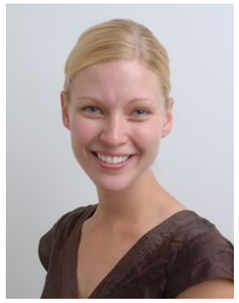
Rebecca Fahrig, PhD
Professor, RSL 2015
Now Head of Innovations, Angiography X-ray Division, Siemens Healthcare

Klaus Hambuechen, Dipl. Ing.
Consulting Professor, 2014, Now Retired



Albert Hsiao, MD, PhD
Clinical Instructor
CV Imaging 2014
Now an Asst Professor of Radiology at UCSD

Jesse Jokerst, PhD
Instructor, MIPS 2015
Now an Asst Professor of NanoEngineering at UCSD



Kendra Klang, MD
Clinical Instructor (Affiliated)
VAPAHCS 2014

David Paik, PhD
Assistant Professor 2014
Now Director, Imaging Science at Elucid Bioimaging, Inc.

Dorcas Yao, MD
Clinical Associate Professor (Affiliated)
VAPAHCS 2014
Now Chief, Purchased Care; Deputy Associate Chief of Staff, Administrative Medicine Service, Phoenix VA Health Care System, AZ

Faculty Leadership Announcements

Kim Butts Pauly, PhD
Professor of Radiology
Appointed Co-Director of the Radiological Sciences lab joining Dr. Gary Glover in this leadership role (2014)

Garry Gold, MD
Professor of Radiology
Andrei Iagaru, MD
Associate Professor of Radiology
Drs. Gold and Iagaru have been named to co-lead the new PET-MR Program with PET-MR imaging program

Safwan Halabi, MD
Clinical Assistant Professor of Radiology
Named Pediatric Radiology Informatics Director at Lucile Packard Children's Hospital

Curtis Langlotz, MD, PhD
Professor of Radiology
Associate Chair for Information Systems and Medical Informatics Director, Department of Radiology and Stanford Health Care (2014)

David Larson, MD, MBA
Associate Professor of Radiology
Associate Chair of Performance Improvement, Department of Radiology (2013)

Max Wintermark, MD, MAS, MBA
Professor of Radiology
Appointed Chief of the Neuroradiology Section, Department of Radiology (2015)

Faculty Honors and Awards

Kim Butts Pauly, PhD	2014 Appointed Co-Director of RSL 2015 Elected to the AIMBE College of Fellows
Frandics Chan, MD, PhD	2015 Department Senior Faculty Teaching Award
Heike Daldrup-Link, MD	2015 Elected to the American Society for Clinical Investigation (ASCI)
Utkan Demirci, PhD	2014 Named Editor-in-Chief of Advanced Health Care Technologies
Rebecca Fahrig, PhD	2015 Named "Alumni of Distinction" University of Western Ontario
Michael Federle, MD	2014 Recipient of 2014 Gold Medal for Distinguished Service by the American Roentgen Ray Society (ARRS)
Anthony Filly, MD	2015 Department Adjunct Faculty Teaching Award
Nancy Fischbein, MD	2014 Department Senior Teaching Award

Faculty Honors and Awards (continued)

Sanjiv Gambhir, MD, PhD	2014 Named Fellow of American Association for the Advancement of Science (AAAS) 2015 J. Allyn Taylor International Prize in Medicine 2015 Stanford Biodesign Leadership Award of the Innovation Fellowship Program 2015 SNMMI Peter E. Valk, MD, Memorial Lectureship Award (PET Center of Excellence Award) 2015 Named President-Elect of WMIS for 2017
Gary Glover, PhD	2014 Academy of Radiology Research Distinguished Investigator
Garry Gold, MD	2015 Stanford Biodesign Leadership Award of the Innovation Fellowship Program 2015 Elected Vice President of ISMRM
H. Henry Guo, MD, PhD	2014 Department Junior Teaching Award
Brian Hargreaves, PhD	2014 Academy of Radiology Research Distinguished Investigator 2015 Named a Fellow of the ISMRM for his scientific and educational contributions 2015 Stanford Biodesign Mentorship Award of the Innovation Fellowship Program
Andrei Iagaru, MD	2015 Elected to Membership on Board of American Board of Nuclear Medicine
Michelle James, PhD	2014 First Prize at INMiND TSPO Symposium 2015 SNM Alavi Mandell Award for "Evaluation of Sigma-1 Receptor Radioligand [18F]FTC-146 in Rats and Squirrel Monkeys using Positron Emission Tomography"
R. Brooke Jeffrey, MD	2015 Received Society of Abdominal Radiology Lifetime Achievement Award
David Larson, MD, MBA	2014 Received RSNA Honored Educator Award
Charles Lau, MD, MBA	2015 Department Junior Faculty Teaching Award
Iain Ross McDougall, MD, PhD	2014 Received the Light of Life Award
Michael Moseley, PhD	2015 Distinguished Investigator Award (Academy of Radiology Research)
Norbert Pelc, ScD	2014 Elected as AIMBE Director At-Large 2014 Academy of Radiology Research Distinguished Investigator 2014 Named Ram and Vijay Shirram Chair of Bioengineering 2015 Named Outstanding Inventor by Stanford University
Sylvia Plevritis, PhD	2014 Elected to the AIMBE College of Fellows
Rajesh Shah, MD	2015 Stanford Biodesign Mentorship Award of the Innovation Fellowship Program
Shreyas Vasanawala, MD, PhD	2015 Stanford Biodesign Mentorship Award of the Innovation Fellowship Program
Joseph Wu, MD, PhD	2014 Academy of Radiology Research Distinguished Investigator 2014 Elected as Council Member for American Society Clinical Investigation (ASCI) 2015 Elected to American Association of Physicians (AAP) 2015 Associate Editor of Circulation Research
Kristen Yeom, MD	2015 "MRI Surrogates for Molecular Subgroups of Medulloblastoma" nominated for Lucien Levy Best Research Article Award of the American Journal of Neuroradiology

Radiology Family Photo Album


2015 Annual Welcome Party


2014 WMIC


2014 RSNA

2014 CMC

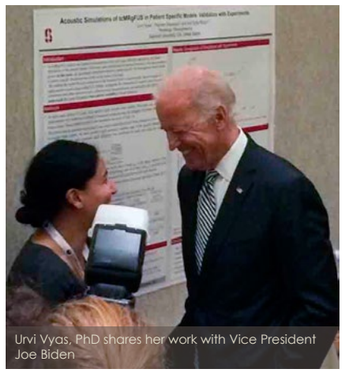

2014 New Year Party


2013 RSNA

2015 SNMMI


2015 Radiology Graduation


2015 Welcome Party


Urvi Vyas, PhD shares her work with Vice President Joe Biden


2015 Radiology Graduation

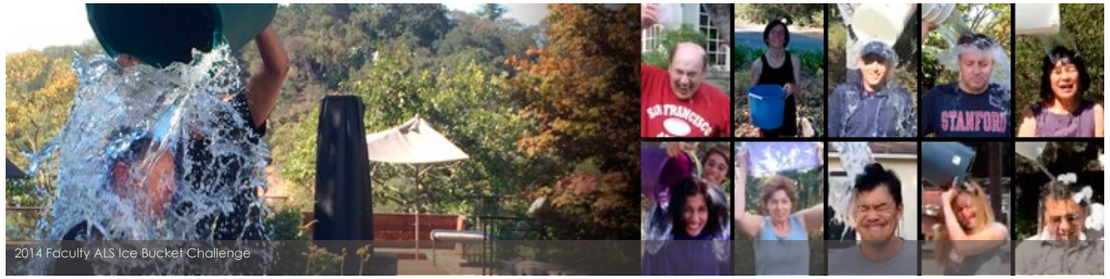
2014 RSNA

2014 RSNA

2015 Blake Wilbur CT Open House


2015 Peter Poullos's promotion


2015 Radiology Graduation



2014 Faculty ALS Ice Bucket Challenge


2015 Annual Welcome Party


2015 Annual Welcome Party


2014 CAMRT


Shannon Walters and H. Henry Guo, MD, PhD with 3D printed lung tissue, used to plan stent placement


2014 GMC


2015 South Bay Cancer Center Opening


2015 Annual Welcome Party


2015 South Bay Cancer Center Opening

2015 South Bay Cancer Center Opening

2014-15 Radiology Babies

Andrew Quon, MD
Associate Professor
Casey
7-27-2015

Meng Gu, PhD
Research Associate, Spielman Group
Albert Gu
7-11-2015

Andrea Tichy, PhD
Industry Collaborations Manager
Lauren
2-14-2015

Kim Duong
MRI Technologist
Sophie Duong Tran
12-26-2014

Bradford Harrold
MRI Technologist
Makenzie Mae Harrold
4-30-2015

David Russel's Granddaughter
Facilities Manager
Halley Kipnis
2-13-2015

Michele & Jason Smith
Both MRI Technologists
Madison Avery
12-23-2014

H. Henry Guo, MD, PhD
Clinical Assistant Professor
Mark Yen Guo
4-18-2014

Justin Beck
MRI Technologist
Macie Christie
1-29-2014

New Major Equipment

Clinical Equipment

2014	CT scanner (CT1) replaced in Stanford Hospital
2014-15	Mammography converted to Tomosynthesis Mammography in Blake Wilbur and Advanced Medicine Center
2015	CT scanner replaced in Blake Wilbur
2015	CT scanner replaced in Stanford Medicine Imaging Center, Palo Alto
2015	CT Scanner upgrade in Redwood City Outpatient Imaging
2015	South Bay Cancer Center: New CT, 3T MRI, PET-CT, Mammography, Ultrasound, Diagnostic Radiology, Portable Nuclear Medicine Camera
2015	New Portable X-ray Units in Stanford Hospital and Lucile Packard Children's Hospital bringing advanced digital imaging to patients (digital detectors)
2016	Hoover 2 Stanford Neurosciences Health Center: CT, 3T MR, PET-MR, Ultrasound, Diagnostic Radiology/ Fluoroscopy
2016	Stanford Hospital: 3T MR replacement, Hybrid Angio Operating Room Suite Advanced Medical Center: New 3T Wide Bore MR to be shared by Radiation Oncology and Radiology Blake Wilbur: 3T MR Replacement and 1.5T MR Upgrade Stanford Medicine Outpatient Clinic Redwood City: New 3T Wide Bore MR SPECT Camera Replacement in Nuclear Medicine

Research Equipment

2015	PET-MR upgrade to FDA approval configuration
2015	New Hyperpolarizer installed
2015	7T Small Animal MR system upgrade (Clark Center)
2016	New 3T Small Animal MR system (Porter site)
2016	New 11.7T Small Animal MR Imaging system (A Generous Gift from Agilent for the Porter site)
2016	Small Animal PET System for Molecular Imaging (Porter site)

Opening of the Siemens Force CT at Sherman in August 2015

Medical School Expansion

July 13, 2015

Stanford Cancer Center South Bay opens with a Radiology presence that includes Diagnostic Radiology, Mammography, Ultrasound, CT, 3T MRI and PET-CT.

November, 2015

Stanford Neuroscience Center - Hoover Campus to open and includes Diagnostic Radiology/Fluoroscopy, Ultrasound, CT, 3T MR and PET-MR.

New Stanford Hospital construction underway – a major undertaking to include significant resources for an advanced imaging department.

Opening in 2017

Emeryville location is ideally suited to support an SHC regional health center incorporating Stanford faculty practices and University Healthcare Alliance physicians. Development of this health center will serve the growing needs of physicians in this East Bay region. Radiology will provide imaging services that include CT, PET-CT, MR, Bone Density, Ultrasound, and Mammography.

Lucile Packard Children's Hospital Stanford Expansion: The expansion, which will include a new main building, adds 521,000 square-feet to the approximately 300,000 square-foot existing hospital. The new facility will optimize the hospital's services and infrastructure, adding more beds, private rooms, state-of-the-art operating suites, family-friendly amenities and the flexible floor space the hospital needs to adapt to new technologies and streamline services.

Opening in 2018

The New Stanford Hospital: An 824,000 square-foot facility will feature amenities and services focused on the health and well-being of patients, as well as the most advanced diagnostic, therapeutic and surgical technologies. It will house an additional 368 beds, bringing the total to 600 on site, and the new Emergency Department will have twice the floor space of the current facility.

Performance Improvement

The RITE Program:
Use of a Team-Based, Project-Based Multidisciplinary Performance Improvement Course to Facilitate Improvement

A 10-session, 20-week course (Radiology Improvement Team Education, or RITE) was developed and implemented in the radiology department, with strong support from both the hospital and medical school leadership. Eight projects were commissioned for the course based on projected costs and benefits of each project. Teams were assembled for each project; each team included a team leader, 3-7 project participants, a sponsor, and a quality improvement (QI) coach.

This multidisciplinary program was effective in simultaneously facilitating the execution of multiple departmental improvement projects and improving participants' self-assessed skills in QI methodology. Total time spent in class was 20 hours, with half of that time occurring during the lunch hour. The program now occurs twice annually facilitating the completion of 12-15 major projects and educating 60-80 individuals including technologists, nurses, doctors, fellows, residents, hospital administrative staff, and even patients every year.

First Radiology Quality Improvement Team graduation. Team members celebrate how they have personally contributed to improvement in clinical processes that improve patient care in areas such as patient wait time, stroke code response time, and patient history details.

David Larson, MD
Associate Chair, Performance Improvement

Kandice Garcia, MS, BSN, RN
Performance Improvement Manager

Jake Mickelsen
Performance Improvement Education Manager

Lauren Sederberg
Performance Project Coordinator

Sergio Sousa
Administrative Associate

Translational Research and Today's Radiology Department

What comes to mind when you think of "Radiology"? Do you envision chest x-rays, bone x-rays, mammograms, and maybe even an ultrasound for your soon-to-arrive new child? While the Stanford Department of Radiology provides all of these imaging services with the most advanced and sophisticated equipment, advanced radiology departments such as ours offer so much more.

Here at Stanford, we purposely focus on translational research to create and improve diagnostic imaging tools that span from molecular to whole body imaging. Our scientists and clinicians are committed to working together and creating a truly Translational Research environment to improve health care for their patients here at Stanford as well as patients all over the world.

In the following few pages, we highlight four Translational Research programs, three of which are already having significant impact on patients who visit our clinics, and a fourth area that is currently in pilot phase with great promise to improve care for patients in low resource areas.

I. Chronic Fatigue Syndrome

II. MR Guided Focused Ultrasound (MRgFUS)

III. Transforming Cardiac MRI

IV. Point-of-Care Diagnostics

These contributions to patient well-being represent only a small number of radiologic advances in health care that you can expect from Today's Radiology Department.

Chronic Fatigue Syndrome

A MIASMA OF MYSTERY, MALADY, AND MISERY

PROJECT NAME

Chronic Fatigue Syndrome

PROJECT LEADER

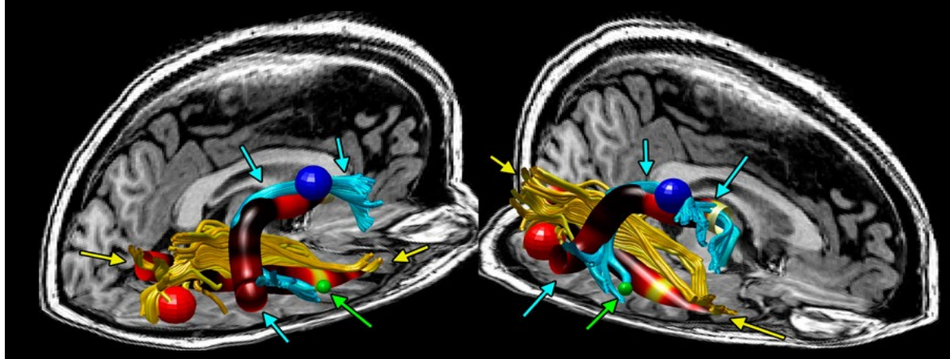
Michael Zeineh, MD, PhD

SELECTED PUBLICATIONS

Zeineh MM, Kang J, Atlas SW, Raman MM, Reiss AL, Norris JL, Valencia I, Montoya JG. Right arcuate fasciculus abnormality in chronic fatigue syndrome. Radiology. 2015 Feb;274(2):517-26. doi: 10.1148/radiol.14141079. Epub 2014 Oct 29. PubMed PMID: 25353054.

Bruce Goldman. Stanford University Medical Center. Brain abnormalities found in chronic fatigue patients. ScienceDaily. ScienceDaily, 29 October 2014.

The record of Chronic Fatigue Syndrome (CFS) is a sorry one from the patients' perspective for they have suffered not only its debilitating symptoms and their ramifications, but also the indignity that their disease "did not exist." That they were "malingerers and hypochondriacs" came not only from peers and lay persons, but some physicians as well have harbored the conviction that this entity was, fundamentally, a psychological aberration with no physical cause. This additional burden was then added to the suffering from the symptoms of the disease itself. In broad terms, these are exhaustion and overwhelming fatigue for more than six months, and may also include muscle and joint pain, incapacitating headaches, sleep disorders, food intolerance, gastrointestinal problems, hypersensitivity to light, and short-term memory loss. The extent of disability can range from mild to extremely severe, from six months to thirty plus years.



3D rendered image shows the right arcuate fasciculus (blue tracks and arrows). This track was consistently different between patients and controls, suggesting an alteration in the microstructure of the brain underlying CFS. The blue and green spheres show the adjacent regions of thickening in the patients' gray matter. Putting two and two together suggests that a few regions of the right hemisphere (the regions that are thicker) are abnormally connected by the right arcuate fasciculus, and this explains the symptoms of fatigue in CFS.

CFS is known for devastating the quality of life of patients, not only exacting severe limitations on their own activities, but also disrupting or destroying the fabric of their lives, for example, relationships with friends, family, employers, loss of jobs, income, and many other aspects of life. While not directly life threatening, the condition is so hopeless that suicide sometimes ensues.

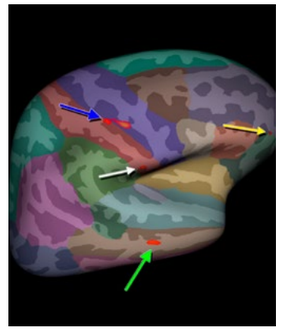
But there is good news and on two fronts: the disease—and it IS a disease—has now been shown to have a physical basis, and this new understanding of the mechanism is a firm, first step toward a remedy for CFS patients.

These exciting new results, published in the journal, Radiology, February 2015 by Michael Zeineh, MD, PhD, Assistant Professor of Radiology, and his colleagues would not have been possible on an earlier generation of MRI machines. Employing new techniques enabled by new MR imaging technology and sequences allows neuroradiology specialists such as Dr. Zeineh to document details such as that shown in Figure 1. Changes observed in detailed MRI acquisitions show deviations from normal brain images that correlate with the extent of clinical symptoms presented by the patient.

"Using a trio of sophisticated imaging methodologies, we found that CFS patients' brains diverge from those of healthy subjects in three distinct ways," Dr. Zeineh said. "Quantitative imaging, especially diffusion tensor imaging that is suited to assessing the integrity of white matter," shows that:

- The white matter content (which contains the brain's communication cables) of CFS patients' brains was less than that of a normal brain.
- A part of the nerve that connects the frontal and temporal lobes, the right arcuate fasciculus, consistently has an abnormal appearance in CFS patients.
- Additionally, in CFS patients there is an abnormal thickening of the brain's gray matter at each end of this right arcuate fasciculus. "Its correspondence with the observed abnormality in the white matter joining them makes it unlikely that the two were chance findings…" according to Dr. Zeineh.

Following up on these promising new results, the Stanford scientists are planning a substantially larger study. Dr. Zeineh's Laboratory focuses on "translational neuroimaging with the goal to advance neuroradiology to gain insight into diseases that are just beyond our reach...This study was a start, it shows us where to look," Professor Zeineh said.



Regions of the gray matter in the right hemisphere of CFS patients that are abnormally thicker.

> "Using a trio of sophisticated imaging methodologies, we found that CFS patients' brains diverge from those of healthy subjects in three distinct ways"
>
> MICHAEL ZEINEH, MD, PHD

MR Guided Focused Ultrasound (MRgFUS)

STANFORD LEADING MR GUIDED FOCUSED ULTRASOUND INNOVATION IN RESEARCH AND CLINICAL TREATMENT

While Stanford Radiology has a long history of success in translating benchtop work into the clinic, it is rare to witness such a tremendous impact as has been experienced with MR guided high intensity focused ultrasound (MRgFUS). MRgFUS allows the physician to localize harmful tissue, precisely apply therapy to obliterate the targeted tissue, and monitor results in real-time, yielding rapid improvement for the patient. MRgFUS accomplishes this without surgical incision, radiation exposure, or significant long-term morbidity for the patient.

PROJECT NAME

Focused Ultrasound

PROJECT LEADERS

Pejman Ghanouni, MD, PhD
Kim Butts Pauly, PhD

SELECTED FUNDING

NIH P01 CA15999204: MRI-Guided Cancer Interventions: ExAblate Treatment of Soft Tissue Tumors of the Extremities

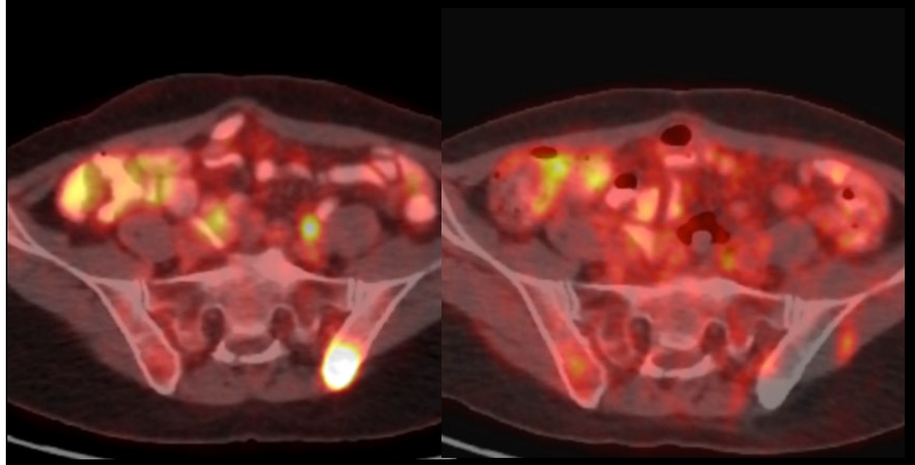
InSightec Clinical Trial: ExAblate Treatment of Metastatic Bone Tumors for the Palliation of Pain

SELECTED PUBLICATIONS

Avedian R, Gold G, Butts Pauly K, Ghanouni P. Is MR Guided High Intensity Focused Ultrasound a Feasible Treatment Modality for Extremity Soft Tissue Tumors? Clinical Orthopaedics and Related Research. 2015 Jun 4. PMID: 26040967.

Ghanouni P, Butts Pauly K, Elias WJ, Henderson J, Sheehan J, Monteith S, Wintermark M. Transcranial MR-Guided Focused Ultrasound: A Review of the Technique and Application. AJR Am J Roentgenol. 2015 Jul; 205(1): 150-9. PMID: 26102394.

Bitton R, Butts Pauly K, Ghanouni P. Improving thermal dose accuracy in MRgFUS: Long-term thermometry using a prior baseline as a reference. J Magn Reson Imaging. 2015 Jun 26. [Epub ahead of print] PMID: 26119129.

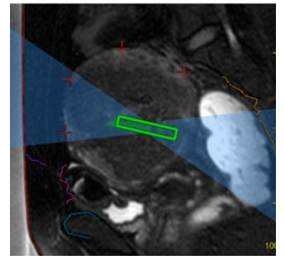


43 year old with metastatic colon cancer. PET-CT on the left from 1 month before MRgFUS treatment of a painful metastasis in the left posterior iliac bone, and PET-CT on the right from 3 weeks after treatment. The lesion has been completely ablated.

In the early 2000's, Kim Butts Pauly, PhD, well known for her work in MRI for monitoring minimally invasive procedures, began to explore the promise of using MR to monitor thermal therapy. Her work at this time was centered on making MRgFUS more accurate in the presence of motion. Around the same time that Dr. Butts Pauly and colleagues began to present and publish their MR guided focused ultrasound research, InSightec gained FDA approval in the United States to place their systems for clinical use. Stanford soon received such a system, with opportunities for use in a myriad of clinical applications.

With a solid research foundation, MRgFUS was perfectly poised to move into clinical use. Pejman Ghanouni, MD, PhD, a diagnostic radiologist with MR experience in clinical body imaging, began using MRgFUS for the treatment of patients with painful osseous metastases in 2010, while serving as an National Cancer Institute Fellow with Drs. Butts Pauly and Gary Glazer. Dr. Ghanouni joined the faculty in 2011 and embraced the role of the clinical champion of MRgFUS, further propelling MRgFUS into clinical use, where the benefit to patients has been remarkable. With the continued efforts and enthusiasm of Dr. Butts Pauly and Dr. Ghanouni, MRgFUS has emerged as a valuable approach to treat a growing number of diseases, including bone metastases, uterine fibroids, soft tissue tumors, and neurologic disorders.

Dr. Ghanouni, who has been described as a "pioneering Body MRI radiologist" leads ten MRgFUS clinical trials at Stanford. A dedicated clinician and enthusiastic patient advocate, Dr. Ghanouni admits that while the greatest benefit is to the patient, the greatest reward is to the clinician who witnesses a patient undergoing rapid relief from pain and discomfort. Both Dr. Ghanouni and Dr. Butts Pauly are committed to improving and driving this technology forward, making it available to any patient who may benefit.



45 year old with a large uterine fibroid causing heavy menstrual bleeding and urinary frequency. This is a sagittal MR image acquired of a woman lying prone on the MRgFUS device during treatment. An individual sonication (green rectangle with blue focused ultrasound beam path) is depicted within the fibroid. Using MR imaging, obstacles to the beam can be demarcated, including the C-section scar (purple line), bowel (violet line), and pubic bone (blue line). Note that the system has tilted the beam to avoid these structures while effectively heating the fibroid (green thermal dose). The edge of the uterus is marked to monitor for motion (red +), and the skin (red line) and sacrum (yellow line) are contoured to prevent excess energy being deposited on the skin and sacral nerves.

> "I'm excited to see it work, to see patients [with bone metastases] with no other options [for managing their pain] to be able to pursue normal activities again."

PEJMAN GHANOUNI, MD, PHD

Transforming MRI for Children and Beyond

PROJECT NAME

Transforming Cardiac MRI

PROJECT LEADER

Shreyas Vasanawala, MD, PhD

SELECTED FUNDING

Tashia and John Morgridge Faculty Scholar Fund

National Institutes of Health

GE Healthcare

SELECTED PUBLICATIONS

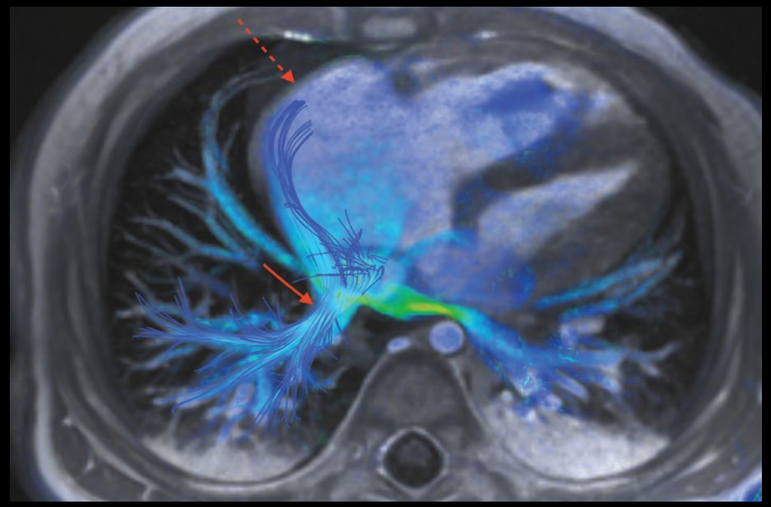
Robust self-navigated body MRI using dense coil arrays. Zhang T, Cheng JY, Chen Y, Nishimura DG, Pauly JM, Vasanawala SS. Magn Reson Med. 2015 Jul 29. doi: 10.1002/mrm.25858.

Free-breathing pediatric MRI with nonrigid motion correction and acceleration. Cheng JY, Zhang T, Ruangwattanapaisarn N, Alley MT, Uecker M, Pauly JM, Lustig M, Vasanawala SS. J Magn Reson Imaging. 2015 Aug;42(2):407-20. doi: 10.1002/jmri.24785.

Evaluation of valvular insufficiency and shunts with parallel-imaging compressed-sensing 4D phase-contrast MR imaging with stereoscopic 3D velocity-fusion volume-rendered visualization. Hsiao A, Lustig M, Alley MT, Murphy MJ, Vasanawala SS. Radiology. 2012 Oct;265(1):87-95.

Imaging can play a major role in the care of children, as younger children cannot easily express their symptoms. Ultrasound and MRI, which are radiation-free, are uniquely suited to imaging children whose young bodies are particularly sensitive to ionizing radiation, and are always the first choice for children, young adults, and expectant mothers. MRI in particular is a powerful diagnostic tool, but exam times often exceed an hour. Getting a small child to remain still for beyond a few minutes often requires anesthesia, introducing cost and risks that many families and physicians try to avoid. Thus, we have become creative, pushing the traditional boundaries of MRI.

Congenital heart disease, with its complex anatomical and physiological abnormalities, is an area that needs a new approach. MRI for these conditions is not only lengthy, but also require intense direct oversight from highly subspecialized radiologists, who are often only located in large children's hospitals. Thus, Dr. Shreyas Vasanawala, MD, PhD, Associate Professor of Radiology at Stanford, and Dr. Michael Lustig, Associate Professor of Electrical Engineering at Berkeley, sought a better way. These two experts reasoned a cardiac MRI study should not be performed in the conventional way, with sequential acquisition of two-dimensional images, and sequential assessment of anatomy, blood flow, and heart chamber function. They redesigned the whole imaging process to encode anatomic and physiologic information over the whole chest and across the entirety of the heart beating cycle all at once, and had the fortune of working with Marcus Alley, PhD, an expert at the Lucas Center.



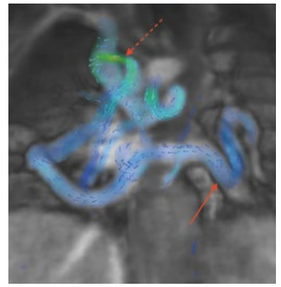
MRI done in under 10 minutes on a child showing abnormal streaming of blood flow from the vein draining a lung (solid red arrow) into the right atrium (dashed red arrow). Normally, oxygenated blood should flow to the left atrium to be distributed to the rest of the body. In this case, the oxygenated blood unfortunately goes out the right atrium and recirculates back to the lung.

Working with post-doctoral scholars Tao Zhang and Joseph Cheng, they found that MRI data could indeed be encoded in an abstract way all at once, and by doing so, the exam could not only be shortened from over an hour to under 10 minutes, but that also the image resolution could be improved. However, there were two challenges to this approach. First, decoding high-fidelity images from such abstract data using a computer that comes with MRI scanners took weeks, which is clinically impractical. However, they found that graphics cards designed for teenagers' video games could be used, with new algorithms, to generate very high quality images in minutes.

But a second problem remained. The reconstructed data was still an abstract combination of anatomy and physiology in the form of a time-varying vector field of blood flow. This is not traditionally what radiologists are used to interpreting to make diagnoses, and the team, working with a Radiology resident and fellow Albert Hsiao MD, PhD, developed new methods of rendering the data to intuitively present the anatomy and physiology. These included color overlays of blood speed and arrows to show blood flow direction.

Currently at Lucile Packard Children's Hospital at Stanford, as a result of rethinking the whole imaging chain from image data acquisition and image reconstruction to image display, an MRI has been condensed from over an hour to minutes, reducing the frequency, depth, and duration of anesthesia that children need in order to get an MRI. Furthermore, data from any MRI scanner can now be fed to a cloud-based computational infrastructure for even greater speed, effectively connecting imaging hardware anywhere in the world to supercomputing power. The techniques developed here are now deployed at major hospitals in the US and in Europe.

With this highly sophisticated approach, we efficiently code all cardiovascular anatomy and physiology simultaneously. A radiologist can very quickly analyze anatomical variations and quantify problems with blood flow, heart valves, and the pumping function of the heart. This yields an improved comprehensive diagnosis quickly and economically, with less anesthesia.

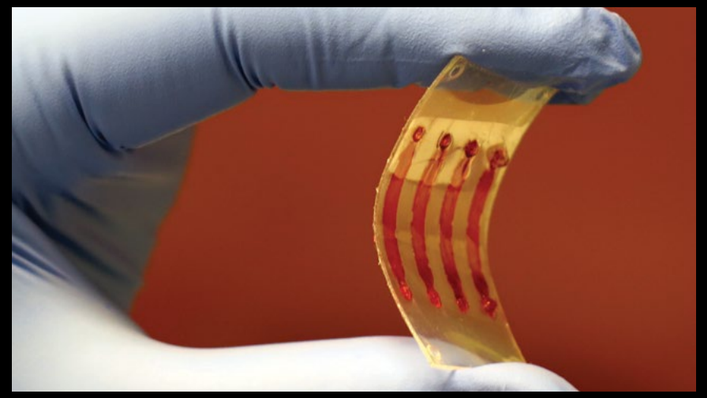


MRI on a one day old done with no sedation or anesthesia. Again, in under 10 minutes, complete analysis of this baby's heart disease was achieved. Here blood from one lung (solid red arrow) abnormally crossed to the other side of the body and eventually drains into a vein (dashed red arrow) back to the right side of the heart. Again, oxygenated blood recirculates to the lung instead of bringing oxygen to the rest of the body.

Point-of-Care Diagnostics

New technologies are changing the way scientists and clinicians manage their patients, especially in remote corners across the globe. Our world, with ever more advanced communication, allows for an increase in the exchange of ideas at a very rapid pace. Coupling communication advances with a bioengineering focus on nano/micro-technologies and molecular targeting allows countries with sophisticated scientific knowledge and resources to provide resources to areas, where resources did not exist a few short years ago.

Examples of such engineering advances can be found in our own Department of Radiology and the Bio-acoustic MEMS in Medicine Lab (BAMM), led by Dr. Utkan Demirci, Associate Professor of Radiology in the Canary Center at Stanford for Cancer Early Detection. Dr. Demirci and his team have developed and combined new paper and flexible polymer substrates with special sensing devices for rapid and accurate detection of pathogens such as HIV, as well as other biotargets. These novel technologies offer the type of robust, simple, and inexpensive biosensing systems required to provide point-of-care in remote areas, where there is minimal diagnostic infrastructure or equipment and a lack of trained medical technicians.



Flexible microchip with electrodes sends an electrical signal when patient samples contain HIV.

PROJECT NAME

Point-of-Care Diagnostics

PROJECT LEADER

Utkan Demirci, PhD

SELECTED FUNDING

NIH/NIAID 5 R01 AI09328205: Novel disposable microchips for HIV-1 viral load

NIH/NIBIB 5 R01 EB01577605: Minimizing the role of cryoprotectant toxicity for cryopreservation

NIH/FIC 5 R21 T200991502: Malaria screening in resource-poor settings using a simple, power-free, cell phone-friendly device

NIH U54EB15408 Point of Care Technology Research Center in Primary Care

SELECTED PUBLICATIONS

Shafiee H, Asghar W, Inci F, Yuksekkaya M, Jahangir M, Zhang MH, Durmus NG, Gurkan UA, Kuritzkes DR, Demirci U. Paper and Flexible Substrates as Materials for Biosensing Platforms to Detect Multiple Biotargets. Scientific Reports, 2015; 5: 8719 DOI: 10.1038/srep08719

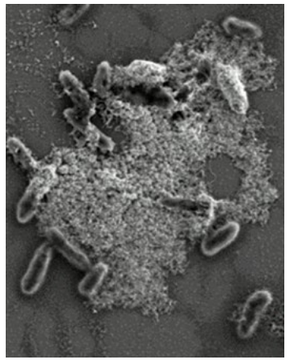
NIBIB: Smarter, Cheaper Technologies Offer Improved Point-of-care Medicine. Science Highlight: May 5, 2015. http://www.nibib.nih.gov/news-events/newsroom/smarter-cheaper-technologies-offer-improved-point-care-medicine

The BAMM lab develops assays for the simple and rapid detection of HIV-1, various bacteria, and CD4+ T lymphocytes. The assays for pathogens and cells were used as proof of concept to demonstrate the utility of several new detection and sensing technologies. For instance, a flexible microchip with electrodes sends an electrical signal when patient samples contain a virus, such as HIV. Similarly, flexible chips are designed to capture and image CD4+ cells to monitor an individuals' health status. Overall, Dr. Demirci and his team continue to develop platforms and sensing devices that are easy to make, easy to use and that can be safely disposed of after use - characteristics necessary for developing affordable tools with broad applications in both developed and developing countries.

This platform is being used in detection of HIV in acute stage and bringing much-needed treatment to individuals, who are HIV-positive. This particular test consists of a disposable flexible polyester chip with implanted electrodes. HIV-1 antibody-coated magnetic particles are added to whole blood or plasma, where they capture viruses creating, and followed by lysing viruses to obtain an electrolyte solution. When added to the flexible chip, the lysate changes the electrical conductivity of the chip, which gives a simple electrical readout that when read using a cell phone app, is capable of indicating whether or not the sample contains HIV-1. In addition to detecting early stage infection, the electrical readout is much simpler and less expensive than current assays.

The disposable microchip platform yields results from "on the spot" testing that is unlike standard laboratory techniques, which need time to grow antibodies and in so doing, delay treatment that provides opportunity for the disease to become more firmly established. This bioengineering approach to disease early detection is one example of an emerging point-of-care technology with tremendous potential impact on healthcare, especially in remote areas with limited resources.

"The goal of our work," says Utkan Demirci, PhD, of the Demirci Bio-Acoustic-MEMS in Medicine Laboratory at Stanford School of Medicine, "is to simplify the techniques that both capture the biotarget and detect that captured target. Both aspects of a simplified test must be addressed to move this type of work forward to practical use in low resource settings. These platform technologies can be potentially broadly applied to other diseases such as detecting oncogenic viruses such as KSHV, HPV, HBV and HCV, which also need to be monitored in the developed world setting at a primary care physicians office, or during a dental appointment, or at the bedside. "



Scanning electron micrograph showing bacteria adhered to the gold nanoparticles on the substrate.

> "The goal of our work, is to simplify the techniques that both capture the biotarget and detect that captured target."
>
> UTKAN DEMIRCI, PHD

ASSOCIATE CHAIR, EDUCATION

Michael Federle, MD

RADIOLOGY RESIDENCY

Payam Massaband, MD
Terry Desser, MD (2004-2015)
Gloria Hwang, MD
Peter Poullos,MD
Erika Rubesova, MD

NUCLEAR MEDICINE RESIDENCY

Andrei Iagaru, MD

ARTS PROGRAM

Advanced Residency Training at Stanford
Sanjiv Sam Gambhir, MD, PhD

TBI² PROGRAM

Training in Biomedical Imaging & Instrumentation
Norbert Pelc, ScD, Kim Butts Pauly, PhD

SCIT PROGRAM

Stanford Cancer Imaging Training
Sandy Napel, PhD, Graham Sommer, MD

SMIS PROGRAM

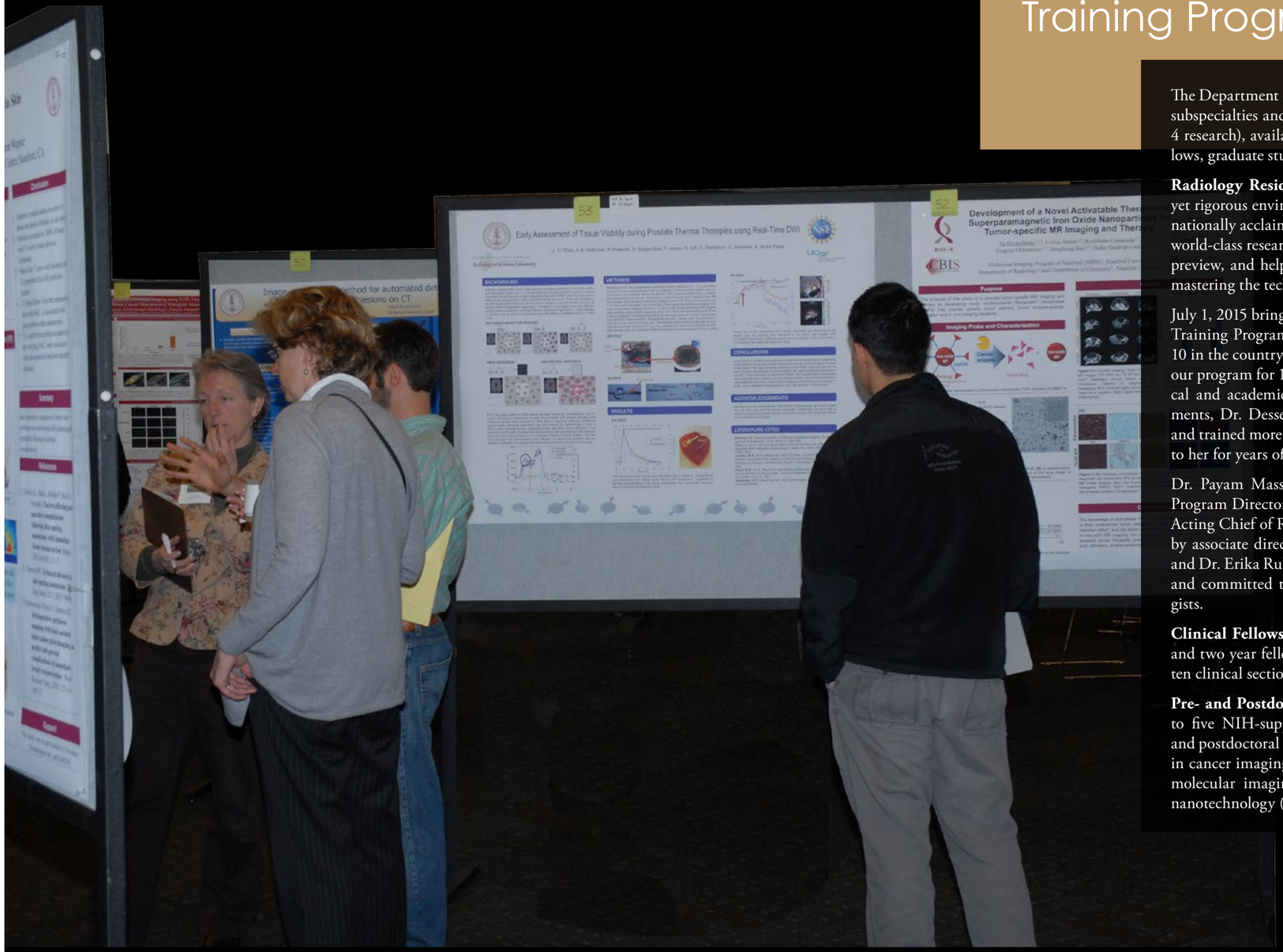
Stanford Molecular Imaging Scholars
Craig Levin, PhD

CCSB PROGRAM

Cancer Systems Biology Scholars Program
Sylvia Plevritis, PhD

CANCER-TNT PROGRAM

Cancer-Translational Nanotechnology Training, Jianghong Rao, PhD



Center for Biomedical Imaging at Stanford (CBIS) Symposium

Training Programs

The Department of Radiology offers training in all radiology subspecialties and is made up of 14 sections (10 clinical and 4 research), available to all trainees, including residents, fellows, graduate students, and visiting scholars.

Radiology Residency Program. We provide a supportive yet rigorous environment for trainees to learn from an internationally acclaimed faculty, known for superb teaching and world-class research. Trainees work with these individuals to preview, and help develop, the imaging of tomorrow while mastering the techniques of today.

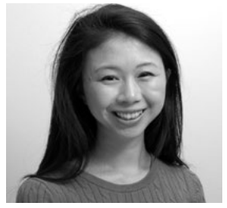
July 1, 2015 brings a change in Leadership for our Residency Training Program, which continues to rank among the top 10 in the country. Dr. Terry Desser, who has successfully led our program for 11 years, is stepping down to return to clinical and academic interests. Among her many accomplishments, Dr. Desser has developed lasting relationships with and trained more than 100 residents. We are deeply indebted to her for years of service.

Dr. Payam Massaband was appointed the new Residency Program Director on July 1, 2015, having recently served as Acting Chief of Radiology at the Palo Alto VA. He is joined by associate directors Dr. Gloria Hwang, Dr. Peter Poulos, and Dr. Erika Rubesova. The new leadership team is honored and committed to training the next generation of radiologists.

Clinical Fellowship Training. Radiology offers many one and two year fellowships. In 2015 we have 43 fellows across ten clinical sections.

Pre- and Postdoctoral Training Programs. We are home to five NIH-supported training programs for predoctoral and postdoctoral candidates. Our programs include training in cancer imaging (SCIT), physics/instrumentation (TBI2), molecular imaging (SMIS), systems biology (CCSB) and nanotechnology (Cancer-TNT).

Graduating Diagnostic Radiology Residents 2014-15



Stephanie Chang, MD

Current Position:
Fellowship, Body MRI
Stanford University, CA

Michael Chiou, MD

Current Position:
Fellowship, Musculoskeletal
Stanford University, CA

Steven Deso, MD

Current Position:
Fellowship, Interventional
Stanford University, CA

Jacob Harter, MD

Current Position:
Fellowship, Musculoskeletal
University of California,
San Francisco, CA

Gabriel Howles-Banerji, MD, PhD

Current Position:
Fellowship, Interventional
Stanford University, CA

Osamu Kaneko, MD

Current Position:
Fellowship, Neuroimaging &
Neurointervention
Stanford University, CA

Mia Gorovoy, MD

Current Position:
Fellowship, Breast Imaging
Stanford University, CA

Lina Nayak, MD

Current Position:
Fellowship, Breast Imaging
University of California,
San Francisco, CA

Jason Oppenheimer, MD

Current Position:
Fellowship, Musculoskeletal
Massachusetts General Hospital, MA

Holly Thompson, MD, MPH

Nuclear Medicine Resident
Current Position:
Kaiser Permanente
Santa Clara, CA

Tatianie Jackson, MD

Nuclear Medicine Resident
Current Position:
Radiology Resident
Boston Medical Center, MA

Graduating Fellows 2014-15

Asmaa Aamir, MBBS

Body Imaging

Current Position:
Associated Radiologists
Phoenix, AZ

Jeffrey Goletz, MD

Body Imaging

Current Position:
Bay Imaging Consultants

Graduating Fellows 2014-15 (continued)

Simon Abramson, MD

Body Imaging

Current Position:
Vision Radiology, Fremont, CA

Michael Griffin, Jr, MD, PhD

Body Imaging

Current Position:
Medical College of Wisconsin, Milwaukee, WI

Quazi Al-Tariq, MD

Body Imaging

Current Position:
Radiologist, Pomona Valley Medical Center, Pomona, CA

Michael Adam Heisler, MD

Body Imaging

Current Position:
Kaiser Permanente Medical Group, Modesto, CA

Graham Bay, MD

Body Imaging

Current Position:
Assistant Professor, Radiology, University of Manitoba, Canada

Aalok B. Turakhia, MD

Body Imaging

Current Position:
Bay Imaging Consultants, Walnut Creek, CA

Robert Jesinger, MD, MSE

Body/Breast Imaging

Current Position:
Department of Radiology, David Grant USAF Medical Center, Travis Air Force Base, CA

Katherin Hanneman, MD

Cardiovascular Imaging

Current Position:
Department of Radiology, Toronto General Hospital, Ontario, Canada

John R. Downey, MD

Breast Imaging

Current Position:
Kaiser Permanente Medical Group, Walnut Creek, CA

Michael A. Kadoch, MD

Chest Imaging

Current Position:
Fellowship, Cardiovascular Imaging, Stanford University, Stanford, CA

Yueyi Irene Liu, MD, PhD

Breast Imaging

Current Position:
Kaiser Permanente Medical Group, San Jose, CA

Osmanuddin Ahmed, MD

Interventional Radiology

Current Position:
Rush University, Chicago, IL

Sanjay N. Gupta, MD, MPH

Cardiovascular Imaging

Current Position:
Interventional Radiology, Rush University, Chicago, IL

Michael Ginsburg, MD

Interventional Radiology

Current Position:
Radiology & Nuclear Consultants, Palos Heights, IL

Gregory T. Havlena, MD

Interventional Radiology

Current Position:
Interventional/Diagnostic Radiologist, Kaiser Permanente, Fontana, CA

Russell Stewart, MD, MBA

Musculoskeletal Imaging

Current Position:
Body Imaging, Radiology, Stanford University, Stanford, CA

Paul F. Laeseke, MD, PhD

Interventional Radiology

Current Position:
University of Wisconsin, Madison, WI

Joshua M. Ng, MD

Interventional Radiology

Current Position:
Hackensack University Medical Center, Hackensack, NJ

Thomas J. Ward, MD

Interventional Radiology

Current Position:
Florida Hospital, Orlando, FL

Dustin K. Johnson, MD

Musculoskeletal Imaging

Current Position:
MSK Radiologist, Kaiser Permanente Medical Center, Santa Clara, CA

Christine Kim, MD

Neuroimaging & Neurointervention

Current Position:
Clinical Instructor, Neuroradiology, Stanford University, Stanford, CA

Ka-Wah Tung, MD

Musculoskeletal Imaging

Current Position:
Salinas Valley Radiologists Salinas, CA

David Douglas, MD

Neuroimaging & Neurointervention

Current Position:
United States Air Force, Travis Air Force Base, CA

Wosen Bekele, MD

Neuroimaging & Neurointervention

Current Position:
Kaiser Permanente Medical Group, Vallejo, CA

Jeremy J. Heit, MD, PhD

Neuroimaging & Neurointervention

Current Position:
Clinical Instructor, Radiology, Stanford University, Stanford, CA

Shanshan Bao, MD

Pediatric Radiology

Current Position:
2nd Year Fellowship, Pediatric Radiology, Stanford University, Stanford, CA

Eric Tranvinh, MD

Neuroimaging & Neurointervention

Current Position:
Clinical Instructor, Neuroradiology, Stanford University, Stanford, CA

Eugene Wilson, IV, DO

Neuroimaging & Neurointervention

Current Position:
Chief of Diagnostic Imaging, Martin Army Hospital, Fort Benning, GA

Farshad Moradi, MD, PhD

Nuclear Medicine & Molecular Imaging

Current Position:
Assistant Professor, Radiology
University of California San Diego, San Diego, CA

Guofan Xu, MD, PhD

Nuclear Medicine & Molecular Imaging

Current Position:
Kaiser Permanente, San Jose, CA

Alex Lewis, MD, MBA

Body MRI

Current Position:
Boca Radiology Group, Boca Raton, FL

Matthew Bernbeck, MD

Pediatric Imaging

Current Position:
Advocate Children's Hospital, Chicago, IL

Niloy Dasgupta, MD

Pediatric Imaging

Current Position:
Fellowship, Vascular and Interventional Radiology, Mallinckrodt Institute of Radiology, St. Louis, MO

Christine Kassis, MD

Pediatric Imaging

Current Position:
Pediatric Radiologist, Diversified Radiology, Denver, CO

Vanessa Starr, MD

Pediatric Imaging

Current Position:
Attending, Santa Clara Valley Medical Center, San Jose, CA

Piotr Obara, MD

Body MRI

Current Position:
Loyola University Medical Center, Maywood, IL

Graduating PhDs 2014-15

Alexander Grant, PhD

Molecular Imaging Program at Stanford

Current Position:
Research Assistant, Stanford University, Stanford, CA

Dissertation:
Applications of Optics in PET: Fast Timing, Multiplexing, and PET-MR

Paul Reynolds, PhD

Molecular Imaging Program at Stanford

Current Position:
Intuity Medical, Inc., Sunnyvale, CA

Dissertation:
Design and Development of Data Acquisition Electronics for a 1mm Resolution Clincial Postitron Emission Tomography (PET) System

Sarah Sasportas, PhD

Molecular Imaging Program at Stanford

Current Position:
Google Life Sciences, Mountain View, CA

Dissertation:
Molecular Imaging and Mathematical Modeling Approaches to Interrogate the Liquid Phase of Cancer

Jocelyn Barker, PhD

Radiological Sciences Lab

Current Position:
Post-doctoral Fellow, Rubin Lab, Stanford, CA

Dissertation:
Image Processing in Pathology for the Discovery of Clinically Relevant Disease Subtypes

Jang-hwan Choi, PhD

Radiological Sciences Lab

Current Position:
Post-doctoral Fellow, Fahrig Lab, Gold/Levinston Lab, Stanford, CA

Dissertation:
Acquisition of 3D knee morphology under weight-bearing conditions using a C-arm CT scanner for the assessment of knee disorders

Francisco Gimenez, PhD

Radiological Sciences Lab

Current Position:
Consultant, Bay Area, CA

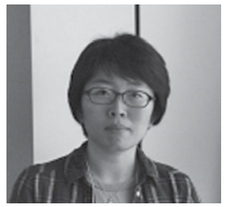
Dissertation:
Fast Adaptive Structured Reporting for Decision Support in Radiology

Tiffany Ting Liu, PhD

Radiological Sciences Lab

Current Position:
Post-doctoral Fellow

Dissertation:
Precision Medicine in Glioblastoma: Integrated analysis using molecular-scale and imaging-scale data to identify clinically-relevant glioblastoma subgroups

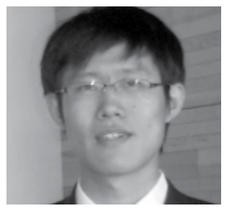


Mihye Shin, PhD

Radiological Sciences Lab

Current Position:
Mechanical Engineer, Apple Inc., Cupertino, CA

Dissertation:
Development and evaluation of two novel instruments for X-ray imaging



Yuan Yao, PhD

Radiological Sciences Lab

Current Position:
Research Assistant, Pelc Lab, Stanford, CA

Dissertation:
Optimizations in spectral CT measurements

Incoming Diagnostic Radiology Residents 2015-16

Eric Bultman, MD, PhD
MD/PhD Univ of Wisconsin
BA Univ of Arizona
BS Univ of Arizona

Karen Kuhn, MD, DPT
MD George Washington Univ
DPT Duke Univ
BS Duke Univ

Adam Luce, MD
MD Boston Univ
MS Univ of California Berkeley
BS Univ of California Berkeley

Aleema Patel, MD
MD Brown Univ
BA Brown Univ

Vivek Patel, MD, PhD
MD Univ of Pittsburgh
PhD Univ of Pittsburgh
BA Univ of Delaware, Newark

Emir Sandhu, MD, MBA
MD Harvard University
MBA Harvard Univ
BA Univ of NC Chapel Hill

Alexander Sheu, MD
MD Northwestern Univ
BS Northwestern Univ

Stephen Vossler, MD
MD Stanford Univ
BSE Arizona State

Krista Weiss, MD
MD Tufts Univ
BS Harvard College

Incoming Nuclear Medicine Residents 2015-16

Jason Lee, MD, MBA
MD American Univ of Antigua
MBA Plymouth State Univ
BS Univ of California Berkeley

Powen Tu, MD, PhD
MD/PhD Boston Univ
BS Cornell Univ

Diagnostic Radiology Residents 2015-16

2nd Year
Michael Ang
Angela Fast
Roger Goldman
Lewis Dirk Hahn
Wilson Lin
Nathaniel Moradzadeh
Aleema Patel
Preeti Sukerkar
Yingding (Bryan) Xu
Byung (Jason) Yoon

3rd Year
Henry Andoh
Christina Chen
Christopher Denucci
Zlatko Devcic
Aaron Eifler
Stephanie Go
Chrystal Obi
Joshua Reicher
Mark Sun

4th Year
Lauren Chan
Alexis Crawley
Ibrahim Idakoji
Benjamin Johnson
Michael Llewellyn
Michael Muelly
Jessica Sin
Tust Techasith
Neil Thakur

Diagnostic Radiology Fellows 2015-16

Body Imaging
Asmaa Aamir, MD
Quazi Al-Tariq, MD
Roi Bittane, MD
Benjamin Ge, MD
Joy Liau, MD
Edward Lo, MD
Thomas Loehfelm, MD, PhD
Nita Nayak, MD
Sheena Prakash, MD
Chara Rydzak, MD
Angela Trinh, MD

Body MRI
Stephanie Chang, MD
Steven Co, MD

Breast Imaging
Mia Gorovoy, MD

Cardiovascular Imaging
Recai Aktay, MD, MPH
Michael Kadoch, MD

Chest Imaging
Khalil Jivraj, MD

Musculoskeletal Imaging
Praveen Anchala, MD
Michael Chiou, MD
Qiqing Ge, MD

Interventional Radiology
Steven Deso, MD
Adam Fang, MD
Luke Higgins, MD, PhD
Gabriel Howles-Banerji, MD
Maria Jepperson, MD
Sirish Kishore, MD

Neuroimaging & Neurointervention
Hans Bakken, MD
Louis Golden, MD
Osamu Kaneko, MD
Hannes Kroll, MD
Bryan Lanzman, MD
Amar Patel, MD
Brian Bolt, MD (Yr 2)
Wilson Chwang, MD (Yr 2)
Aleksandrs Kalnins, MD (Yr 2)
Mrudula Penta, MD (Yr 2)
L. "Ram" Srinivasan, MD, PhD (Yr 2)
Nicholas Telichak, MD, MS (Yr 2)

Nuclear Medicine
Lesley Flynt, MD
Kaveh Vejdani, MD

Pediatric Imaging
Raphael Alford, MD
Shanshan Bao, MD
Tom Cullen, MD
Lillian Lai, MD

Radiology Training Programs

Standing (left to right): Saeid Zanganeh, Jessica Maxey, Ryan Spitler, Tzu-Yin Wang, Shiva Abbaszadeh, Katheryne Wilson, Erica Cherry, Steffi Perkins; Kneeling (left to right): Aaron Mayer, Srivathsan Koundinyan, Joshua Cates, Michael Mastanduno, Annalisa Pawlosky; Missing SMIS fellow: Moiz Ahmad; Missing SCIT fellow: Mehmet Gunhan Ertosun.

TBI^2 Program

Training in Biomedical Imaging Instrumentation

NIH 5 T32 EB009653 05

PI: Norbert Pelc, ScD
PI: Kim Butts Pauly, PhD
Program Manager: Marlys LeSene

The TBI^2 program offers unique multidisciplinary research in biomedical imaging technology spanning magnetic resonance, computed tomography and radiography, ultrasound, PET, and hybrid imaging such as X-ray/MR and PET-MR, as well as image processing and analysis for diagnosis, radiation therapy, and basic science. TBI^2 is a two-year program.

CURRENT STUDENTS

Srivathsan Koundinyan, PhD
Jessica Maxey
Aaron Mayer
Steffi Perkins

SCIT Program

Stanford Cancer Imaging Training

NIH 5 T32 CA009695 23

PI: Sandy Napel, PhD
PI: F. Graham Sommer, MD
Program Manager: Sofia Gonzales

The SCIT Program offers a unique research opportunity through our Advanced Techniques for Cancer Imaging and Detection Program, which began its 20th year of training in 2012. Initially designed and directed by Dr. Gary M. Glazer, the goal of this two year program is to provide MD and PhD research fellows training in cancer-related imaging research.

CURRENT STUDENTS

Erica Cherry, PhD
Mehmet Gunhan Ertosun, PhD
Ryan Spitler, PhD
Tzu-Yin Wang, PhD
Saeid Zanganeh, PhD

SMIS Program

Stanford Molecular Imaging Scholars

NIH 5 R25 CA118681 09

PI: Craig Levin, PhD
Program Manager: Sofia Gonzales

The SMIS Program is a two-year cross-disciplinary post-doctoral training program at Stanford University. The centerpiece of the SMIS program is the opportunity for trainees (PhD or MD with an emphasis on PhD) to conduct innovative molecular imaging research that is co-mentored by faculty in complementary disciplines.

CURRENT STUDENTS

Shiva Abbaszadeh, PhD
Moiz Ahmad, PhD
Joshua Cates, PhD
Michael Mastanduno, PhD
Annalisa Pawlowsky, PhD
Katheryne Wilson, PhD

CSBS Program

Cancer Systems Biology Scholars

NIH 1 R25 CA 18099301

PI: Sylvia Plevritis, PhD
Program Manager: Holly Chung

The CSBS program is a 2-year postdoctoral training program at Stanford University focused on innovative, multidisciplinary cancer research education that seamlessly integrates experimental and computational biology to systematically unravel the complexity of cancer. We bring together 36 Stanford faculty mentors from 19 departments or divisions bridging the Schools of Medicine, Engineering and Humanities and Sciences. After one year of curriculum planning, candidate recruitment for our first cohort of trainees is underway.

Cancer-TNT Program

Cancer-Translational Nanotechnology Training

NIH 1 T32CA 196585-01

PI: Jianghong Rao, PhD
Program Manager: Billie Robles

The Cancer-TNT postdoctoral training program is a diverse, synergistic three-year training program that brings together 25 faculty and nine departments from the Schools of Medicine, Engineering, and Humanities and Sciences. Trainees' skill sets will bridge multiple disciplines such as chemistry, molecular biology, bioengineering, molecular imaging, nanoengineering, and clinical cancer medicine. The Cancer-TNT program will provide a unique training opportunity that expands the overarching goal of the NCI to eradicate cancer. Stanford University, with support from the NCI, is a major training center with significant expertise and resources in the rapidly growing field of cancer nanotechnology. Trainee recruitment will begin in late 2015 and early 2016 with an on-going recruitment cycle.

Canary Center at Stanford Summer Internship Program

PI: Sanjiv Sam Gambhir, MD, PhD
Deputy Director:
Stephanie van de Ven, MD, PhD

The Canary Center at Stanford is a research center dedicated to early cancer detection research. As part of our efforts to train the next generation of scientists, we offer a paid and unpaid summer internship program. Canary Center interns will work in faculty labs for a 10-week internship in our state-of-the-art research facility. Each participant will be matched with a faculty, postdoctoral scholar, or senior scientist mentor who will help them craft a research project. The successful applicant can expect to work in a dynamic lab environment on challenging projects that involve a broad range of research techniques. The program also includes a series of weekly seminars on early cancer detection research, conducting scientific research, careers in science and the chance to interact with other interns. The program culminates with a research symposium, where students present individual talks or posters on their summer projects in front of their peers, faculty and lab mentors.

Trainees and Visiting Scholars

Canary Center

Maria Arampatzidou, PhD
Murat Baday, PhD
Aarohi Bhargava-Shah
Semih Calamak
Gizem Calibasi
Pu Chen, PhD
Thirupathiraja Chinnasamy, PhD
Jung Kyu Choi, PhD
Tolga Demitras
Rammohan Devulapally, PhD
Zhihong Dong
Rami El-Assal, DDS
Menekse Ermis
Kira Foygel
Sinan Guven, PhD
Fatih Inci, PhD
Jedd Lewis
Mark Lifson, PhD
Fei Liu, PhD
Mehmet Ozen
Yeseren Saylan
Rohit Siroya
Alessandro Tocchio, PhD
Sarah Totten, PhD
Thillai Veerapazham, PhD
Albert Wang, PhD
Jaeyoung Yang, PhD
Ahu Yildiz, PhD
Hakan Yildiz, PhD
Xinli Zhou

IBIIS

Aaron Abajian
Benedict Anchang, PhD
Jocelyn Barker, PhD
Alborz Bejnood
Marina Bendersky, PhD
Selen Bozkurt
Hakan Bulu, PhD
Byoung Wook Choi, MD, PhD
William Du
Sebastian Echegaray
Mehmet Ertosun, PhD
Luis de Sisternes Garcia, PhD
Francisco Gimenez
Saeed Hassanpour, PhD
Assaf Hoogi, PhD
Abra Jeffers
Melissa Ko, PhD
David Knowles, PhD
Franco Lamping
Tiffany Liu
Diego Munoz
Rebecca Sawyer
Majid Shafiq, MD
Pierre Starkov
Avinash Thangali
Yu Yan
Darvin Yi

MIPS

Shiva Abbaszadeh
Moiz Ahmad
Michael Angelo
Jung Hwa Bae
Samuel Banister, PhD
Lucia Baratto
Amir Barkhodari
Celine Beinat, PhD
Matthew Bieneiosek
Jos Campbell
Joshua Cates
Chen-Ming Chang
Niladri Chattopadhyay
Hao Chen, PhD
Zixin Chen
Yunfeng Cheng
Erica Cherry
Myunghyeon Chin
Jared Churko, PhD
Mehmet Ertosun
David Freese
Alexander Grant
Kenneth Hettie, PhD
Su Hyun Hong
David Hsu
Daijuan Huang, MD, PhD
Ohad Ilovich
Mehran Jamali
Jessica Lee Klockow, PhD
Nigel Kooreman, PhD
Uma Kota
Toshiyuki Kowada
Inyong Kwon, PhD
Timothy Larson
Jonathan Leaf
Brian Lee
Jaecheol Lee, PhD
Keumsil Lee, PhD
Changhao Liu, MD
Michael Mastanduno
Alexander Mihlin
Saeed Mohammadi
Mikael Palner
Annalisa Pawlosky
Chris Pohling
Kanyi Pu
Praveen Shukla, PhD
Prachi Singh
Aiguo Song
Ida Sonni
Li Tao
Ophir Vermesh
Tzu-Yin Wang, PhD
Judson Wilson
Katheryne Wilson, PhD
Timothy Witney
Jinghang Xie
Saeid Zanganeh
Tao Zhang
Zhe Zhang, PhD
Hua Zhu, PhD

Clinical Radiology

Lofti Abou-Elkacem, PhD
Kamal Aggarwal
Kathrin Baeumler, PhD
Sayan Chowdhury, PhD
Joseph Cheng, PhD
Ahmed El Kaffass, PhD
Signe H. Forsdahl, MD, PhD
Kwangeun Jang
Bin Jiang
Anna-Margaretha Karrmann, MD
Suchismita Mohanty
Mario Moreno
Anne Muehe
Jeyarama Narayanan, PhD
Hossein Nejadnik
Pira Neungton, MD
Anjali Sheahan, PhD
Rosa Sigrist, MD
Seyedmeghdad Taghavig-armestani
Valentina Taviani, PhD
Sarah Totten
Keerthi Valluru, MS
Huaijun Wang, PhD
Christian Wuerslin, PhD
Umit Yoruk
Huiping Zhang, MD
Tao Zhang, PhD
Jianhua Zhou, MD, PhD
Xiaoliang Zhou
Guangming Zhu, MD, PhD

RSL

Kathrin Baeumler, PhD
Wei Bian, PhD
Bastian Bier
Marianne Black
Akshay Chaudhari
Jingyuan Chen
Erica Cherry
Janghwan Choi, PhD
Jang Hwan Choi
Ben Cohn
Keshav Datta
Audrey Fan, PhD
Maged Goubran, PhD
Haisam Islam
Hesam Jahanian, PhD
Ethan Johnson
Feliks Kogan, PhD
Seul Lee
Steve Leung
Christoph Leuze, PhD
Evan Levine
Michael Marx, PhD
Matthew Marzelli
Jessica Maxey
Uche Monu
Kerstin Mueller, PhD
Wendy Ni
Jae Mo Park, PhD
Mihir Pendse
Steffi Perkins
Juan Plata
Brady Quist
Mahdi Salmani Rahimi, PhD
Paurakh Rajbhandary
Christian Riess, PhD
Xinwei Shi
Mi Hye Shin
Picha Shunhavanich
Ryan Spitler, PhD
Subashini Srinivasan, PhD
Jason Su
Bragi Sveinsson
Lickkong "Leo" Tam, PhD
Qiyuan Tian
Jinghui Wang, PhD
Taylor Webb
Hans Weber, PhD
Simone Winkler, PhD
Meng Wu
Christian Wuerslin, PhD
Grant Yang
He Yang, PhD
Yuan Yao
Patrick Ye
DaeHyun Yoon, PhD
Hyo-Seon Yoon
Umit Yoruk

Trainees Honors and Awards

Lotfi Abou-Elkacem, PhD	2015 Mildred Scheel Cancer Fellowship Award of the German Cancer Aid Foundation
Stephanie T. Chang, MD	2015 Roentgen Resident/Fellow Research Award
Aadel Chaudhuri, MD, PhD	2015 RSNA Research Resident Award
Joseph Cheng, PhD	2015 W.S. Moore ISMRM Young Investigator Award
Thomas Christen, PhD	2014 ISMRM W.S. Moore Young Investigator 2014 ISMRM Junior Fellow
Guido Davidzon, MD	2015 SNMMI Future Leaders Academy
David Douglas, MD	2015 Received Henkin Government Relations Fellowship 2015 Roentgen Resident/Fellow Research Award 2015 Radiology Fellow Teaching Award
Audrey Fan, PhD	2015 Stanford Neurosciences Institute Interdisciplinary Scholar
Susan Hiniker, MD	2015 Roentgen Resident/Fellow Research Award
Tatianie Jackson, MD	2014 Elected to the board of the Nuclear Medicine Resident Organization (NMRO)
Osamu Kaneko, MD	2015 RSNA/AUR/APDR/SCARD Radiology Education Research Development
Feliks Kogan, PhD	Named a 2015 ISMRM Junior Fellow. Received summa cum laude merit award for work presented at the 2015 ISMRM
Paul Laeseke, MD	2015 Roentgen Resident/Fellow Research Award
Aaron Mayer	2015 National Science Foundation full scholarship 2015 Bio-X Honorary Fellow
Emily McWalter	2014 Awarded a “New Researcher Advocacy Award” from CIBR (Coalition for Imaging & Bioengineering Research)
Kanae Miyake, PhD	2015-2017 SNMMI Wagner-Torizuka Fellowship
Uche Monu	2014 Recipient of “Diversifying Academia, Recruiting Excellence (DARE)” Fellowship
Surya Murty	2015 National Science Foundation full scholarship
Hossein Nejadnik, MD, PhD	Received 2014 RSNA Trainee Research Prize
Jae Mo Park, PhD	2014 ISMRM Junior Fellow
Laura Sarah Sasportas, PhD	2014 Received France "Best Engineer of the Year" Award Received the Young Investigator Award at 2014 SNMMI
Adam Shuhendler, PhD	2014 Young Investigator Award, World Molecular Imaging Congress (WMIC) 2015 Young Investigator Award, Society of Nuclear Medicine and Molecular Imaging (SNMMI)
Salil Soman, MD, MS	Accepted faculty position at Harvard Medical School (Instructor in Neuroradiology) 2014 ISMRM Junior Fellow
Bragi Sveinsson, PhD	Received magna cum laude merit award for work presented at 2015 ISMRM
Valentina Taviani, PhD	Named a 2015 ISMRM Junior Fellow
Holly Thompson, MD	2015 Received Alpern Foundation Grant to Support Cancer Research 2015 SNMMI Future Leaders Academy
Ophir Vermesh, PhD	Awarded 2014 Dean's Fellowship
Urvi Vyas, PhD	2014 Shared her work in MRgFUS with Vice President Joe Biden
Andrew Wentland, MD, PhD	2014 ISMRM Summa Cum Laude Merit Award
Tim Witney, PhD	2015 Received SNM Alavi Mandell Award for: "Preclinical Evaluation of 18F-Fluoro-Pivalic Acid as a Novel Imaging Agent for Tumor Detection"
Yuan Yao, PhD	2015 Siebel Scholar
Ahu Arslan Yildiz, PhD	2014 Named among the top innovators under 35 in Turkey

RADIOLOGY LEADERSHIP

Sanjiv Sam Gambhir, MD, PhD
Chair of Radiology

Brooke Jeffrey, MD
Associate Chair, Academic Affairs

Richard Barth, MD
Associate Chair and
LPCH Radiologist-in-chief

Michael Federle, MD
Associate Chair, Education

Garry Gold, MD
Associate Chair, Research

Robert Herfkens, MD
Associate Chair, Clinical Technology

Curtis Langlotz, MD, PhD
Associate Chair, Information Systems

David Larson, MD, MBA
Associate Chair, Performance Improvement

Ann Leung, MD
Associate Chair, Clinical Affairs

PET-CT fusion image shows an early stage lung cancer initially detected in an asymptomatic individual by low dose screening CT.

Clinical Sections

Under the leadership of Dr. Sam Gambhir, the Department of Radiology continues with its strong history of clinical success in all imaging modalities, including Computed Tomography (CT), Nuclear Medicine, Magnetic Resonance Imaging (MRI), Magnetic Resonance Spectroscopy (MRS), Positron Emission Tomography (PET), Focused Ultrasound (FUS), Molecular Imaging and emerging hybrid imaging approaches such as PET-CT, PET-MR and MR-FUS. The influence of MRI and Molecular Imaging on clinical imaging departments has introduced lightning speed changes to the way we now do business in Radiology. Internationally, departments of radiology are no longer limited to describing the anatomy as depicted in an image or a set of images. With sophisticated instrumentation, unique biomarkers (both radioactive and non-radioactive), new technologies and interventional techniques, radiologists have moved onto the front lines of patient care, where we are often able to detect disease at earlier time points and frequently treating patients with minimally invasive radiologic approaches.

The reward for our clinical radiology teams is recognized through the expanding camaraderie with our colleagues in other disciplines, such as oncology, medicine, immunology, orthopedics, etc., and the growing opportunities for patient-doctor relationships.

In the next pages, please read about our outstanding clinical faculty, our advanced imaging offerings, including disease detection, treatment and monitoring offered by the Stanford University Department of Radiology and all affiliated Hospitals, Clinics and Out Patient Centers.

Back Row (left to right): Andreas Loening, Michael Griffin, Michael Heisler, Vol Van Dalsem, Jeff Goletz, Lewis Shin, Robert Jesinger. Center Row: Amelie Lutz, Aya Kamaya, Aalok Turakhia, Graham Bay, Nayeli Morimoto, Pete Poulos, Mia Gorovoy, Gabi Gayer. Front Row: David Gross, Brooke Jeffrey, Juergen Willmann, Mike Federle, Terry Desser.

Body Imaging

Juergen Willmann, MD

The Body Imaging section consists of 12 nationally and internationally renowned faculty and 9 body fellows who are specialized in the interpretation of diseases of the abdomen and pelvis, as well as additional body parts such as the thyroid, carotid, and peripheral venous system. With experts in computed tomography, magnetic resonance imaging, ultrasound, molecular imaging, x-ray, and fluoroscopy, our section is committed to training the next generation of body radiologists while delivering cutting edge clinical care. The breadth of experience among the faculty is reflected in the wide range of academic pursuits enjoyed by the section, ranging from clinical assessment of low dose CT protocols, novel pulse sequences in MRI, and new contrast agents for ultrasound to photoacoustic imaging of the bladder and imaging-guided delivery of novel therapeutics such as microRNAs into liver cancer in preclinical animal models.

ACHIEVEMENTS

• Dr. Desser awarded 2014 Faculty of the Year; Dr. Jeffrey nominated for the Lifetime Achievement Award, Society of Abdominal Radiology; Dr. Kamaya nominated fellow of the Society of Radiologists in Ultrasound; and Dr. Willmann elected fellow of the Society of Abdominal Radiology.

• Among the first nationwide and the only place in the Bay Area to introduce contrast-enhanced ultrasound imaging and ultrasound elastography for routine clinical care.

• We introduced novel low dose CT imaging protocols that are now used routinely for our patients.

• First in the USA to perform clinical trials using ultrasound molecular imaging for prostate cancer and first in the world to conduct clinical trials with ultrasound molecular imaging for breast and ovarian cancer.

Left to right: Scott McIntosh, Brian Hargreaves, Robert Herfkens, Valentina Taviani, Pejman Ghanouni, Bruce Daniel, Alex Lewis, Shreyas Vasanawala, Molly Murphy, Piotr Obara, Maggie Bos, Marcus Alley, Lewis Shin, Andreas Loening.

Body MR Imaging

Shreyas Vasanawala, MD, PhD

The Body MR section aims to provide outstanding patient care, lead innovations in the practice of Body MR, and train the next generation of clinician scientists, while developing a tight link between diagnosis and therapy for highly personalized care.

We provide services that are personally tailored for each patient and delivered with state-of-the-art MRI technology and highly trained staff. Most exams use techniques developed and uniquely available here at Stanford. Faculty members are internationally recognized experts in body MRI, and have deep experience developing new methods to improve diagnostic precision.

Body MRI research at Stanford is fostered by close collaborations and friendships between clinicians and research scientists in the Department of Radiology, the University, and throughout the Bay Area.

ACHIEVEMENTS

• Multicenter MRgFUS trial treating essential tremor.

• Clinical trial in MRgFUS treatment of uterine fibroids.

• NIH sponsored non-invasive MRgFUS treatment of bone metastases around metal implants.

• Initiated clinical MRgFUS treatment of vascular malformations.

• Introduced whole body MR exams.

• Clinical deployment of ultra-fast pelvic MRI exams.

• Multi-parametric prostate MRI.

Nayeli Morimoto, Jafi Lipson, Jennifer Kao, Bruce L. Daniel, Sunita Pal, Debra M. Ikeda.

Breast Imaging

Debra Ikeda, MD, FACR

Stanford Breast Imaging began tomosynthesis (3D Mammography) in 2013, we are now all 3D in 2015 and see a decrease in false positives and an increase in cancer detection. Stanford formed the California Breast Density Information Group and the website "breastdensity.info" to help women understand breast density. Our research includes a focus on tumor imaging correlated with blood biomarkers or with cancer and stromal genetics. Other work includes non-contrast MR imaging, a new method of marking positive lymph nodes for surgeons (published in the Annals of Surgical Oncology). Our work with Oncologists and Radiation Oncologists shows MRI helps in patient selection for chemotherapy or radiation therapy regimens. We will soon install new equipment to implement Contrast-enhanced mammography (CEM) a 10 minute "poor person's" MRI that shows great promise of finding cancer in the dense breast.

ACHIEVEMENTS

• Stanford Breast Imaging and Mammography Section provides the highest standards of clinical excellence in a compassionate, caring environment.

• Stanford Breast Imaging offers Tomosynthesis for 3D mammography – demonstrating our commitment to state-of-the-art imaging for our patients decreasing false positives, increasing cancer detection.

• Contrast-agent-free detection of breast tumors with MR imaging.

• We are devoted to providing personalized breast care in a holistic manner, to minimize patient discomfort and anxiety.

Row 1 (left to right): Dominik Fleischmann, Shannon Walters. Row 2: Frandics Chan, Kate Hanneman, Sanjay Gupta. Row 3: Hans-Christoph Becker, Robert Herfkens, Anna Karmann. Row 4: Mario Moreno, Signe Helene Forsdahl, Aya Kino, Malwana Adalat.

Cardiovascular Imaging

Dominik Fleischmann, MD

The Cardiovascular Imaging (CVI) Section uses dedicated image post-processing techniques to provide unprecedented 3- and 4-D visualization and quantitation of cardiovascular anatomy and pathology to establish an accurate diagnosis and facilitate treatment planning for surgical or endovascular procedures, some of which are pioneered at and unique to Stanford. Our internationally renowned imaging experts in cardiovascular imaging have extensive clinical and research expertise in CT, MR, and Nuclear Medicine imaging technology applied to the clinical management of acquired and congenital cardiovascular diseases.

Also, with a deep understanding of radiation exposure, we are highly trained leaders in promoting the latest dose reduction techniques, thereby allowing us to provide the best quality images under the most advanced conditions for our patients, one at a time.

ACHIEVEMENTS

• Coronary calcium score screening to modify risk factors and stabilize current disease state.

• Coronary CTA (CCTA) allows coronary artery imaging without coronary catheterization.

• Working together as a team of radiologists, basic scientists, and technologists to reduce radiation exposure according to international safety principles of ALARA (As Low As Reasonably Achievable).

Front row (left to right): Dan Sze, Gloria Hwang, Nishita Kothary, Rajesh Shah, David Hovsepian, David Wang, William Kuo. Back row: David Wang, Rusty Hofmann, Matthew Lungren.

Interventional Radiology

Lawrence "Rusty" Hofmann, MD

Interventional Radiology (IR) offers the entire range of vascular and nonvascular image-guided procedures. We are experts in treating endovascular arterial disease, stenting (expanding) occluded blood vessels, endograft repair of aneurysms, deep vein thrombosis (DVT), and chronic venous occlusions. We also specialize in image-guided tumor treatments including chemoembolization, radiofrequency ablation, cryoablation, NanoKnife ablation, and radioembolization. Our group also provides services to alleviate pelvic pain due to symptomatic fibroids and gonadal vein embolization for pelvic congestion syndrome.

As pioneers of minimally invasive surgery, we employ advanced imaging techniques to eliminate the need for open surgery and allow shorter recovery times.

ACHIEVEMENTS

- IR is the first section in all of Stanford Hospital, to adopt a structured data reporting process for "Big Data" analytics.
- In 2014, the VA Palo Alto Hospital became the first and only VA health care facility nationwide to offer radioembolization to VA patients diagnosed with liver cancer.
- Section Chief, Dr. Rusty Hofmann, is the global-PI on the first ever FDA approved trial for venous stents, initiated in 2014.
- Our interventional team conducts clinical trials in the fields of cancer as well as non-cancer.
- IR will launch an Interventional Radiology residency training program in 2018.

Left to right: Kate Stevens, Vol VanDalsem, Bao Do, Garry Gold, Sandip Biswal, Chris Beaulieu, Amelie Lutz, Geoff Riley, and Payam Massaband. Not shown: Michelle Nguyen, MD.

Musculoskeletal Imaging

Christopher Beaulieu, MD, PhD

The musculoskeletal section provides state of the art imaging services and special interventions for patients with bone, joint, and soft tissue disorders. Over 65,000 examinations are performed annually including radiography, MRI, CT, US and injection/aspiration procedures. Six full time faculty at Stanford and two faculty at the Palo Alto VA oversee resident and fellow trainees. Research efforts include the development of efficient imaging methods for assessment of arthritis, imaging around metallic implants, imaging of peripheral pain, MR neurography, and bioinformatics applications to bone tumor diagnosis.

ACHIEVEMENTS

- Established peripheral nerve imaging "MR neurography" service.
- Pre-clinical implementation of PET-MR for imaging of peripheral pain.
- Digitization of over 2000 cases of historical studies from the late Dr. Henry Jones bone tumor collection.
- Design and operation of wireless, digital x-ray system at the San Francisco 49ers new Levi's stadium.
- Multiple NIH grant awards.

Front row: Michael Marks, Nancy Fischbein, Max Wintermark, Pat Barnes. Row 2: Greg Zaharchuk, Christine Kim, Eric Tranvinh, Jeremy Heit, Mrudula Penta, Zina Payman, Mary Marcellus, Tarik Massoud. Row 3: Michael Zeineh, Kari Galatolo, Aleks Kalnins, Wilson Chwang, David Douglas, Gene Wilson, Nick Telischak, Wosen Bekele, Patty Smith, Michael Iv, Osamu Kaneko, Ram Srinivasan.

Neuroimaging & Neurointervention

Max Wintermark, MD, MAS, MBA

Neuroimaging & Neurointervention consists of 12 world-renowned faculty and 12 fellows who specialize in interpreting imaging studies of the brain, spine, and head and neck. We offer minimally invasive treatment of cerebral aneurysms and other cerebral vascular malformations, stenting of carotid arteries, vertebroplasty, and image-guided biopsy. We have unique expertise in advanced neuroimaging techniques including dual-energy CT, functional MRI, DTI and tractography, spectroscopy, and perfusion imaging. We are the only Bay Area center to offer the brain "stress test", advanced blood flow imaging to evaluate cerebrovascular reserve. We offer rapid, dedicated stroke MR and CT imaging to differentiate between completed stroke and "at-risk" tissue, with automated decision support software that has been validated in multicenter trial.

ACHIEVEMENTS

- Development of a new facility for integrated neurological imaging (CT, MRI, and PET-MR) and care, in collaboration with colleagues in Neurology and Neurosurgery.
- Implementation of Visualase combined neurosurgical/neuroradiological MRI procedure for minimally invasive brain surgery.
- Submission of an IND to the FDA to enable combined PET-MR imaging of cerebral blood flow using oxygen-15 water.
- Multiple NIH and industry-sponsored clinical trials, in diverse areas such as acute stroke, chronic fatigue syndrome, and traumatic brain injury.
- Section work on chronic fatigue syndrome is featured in the New York Times as a landmark study pushing the envelope of detecting microstructural alterations with imaging.

Front Row: Libby Farmer, Nora Gurevich, Phuong Pham, Monica Ranger, Tracy Burk, Chris Fujii. Middle Row: Shawna Kinsella, Luan Nguyen, Krithika Rupnarayan, Tatianie Jackson, Andrew Quon, Paula Castendeda, Henry Guo, Julie Kulm. Back Row 3: Judit Lantos, Mehran Jamali, Matt Gabrielle, David Douglas, Holly Thompson, Andrei Iagaru, Zach Leonard, Guofan Xu.

Nuclear Medicine & Molecular Imaging

Andrei Iagaru, MD & Andrew Quon, MD

The Division of Nuclear Medicine and Molecular Imaging at Stanford University Medical Center is a robust imaging center offering a broad range of capabilities including SPECT-CT, PET-CT, PET-MR and radiotherapy. With the ultimate goal of advancing patient care, our section actively participates in translational research as well as state-of-the-art clinical imaging. We make every effort to support collaborations across academia as well as with the industry. We are committed to improving health through excellence in image-based patient care, research and education.

ACHIEVEMENTS

- Opened a theranostic program for neuroendocrine tumors with ^{68}Ga DOTA TATE (diagnostic) and ^{177}Lu Octreotate (therapy).
- Fully implementing ^{223}Ra (Xofigo®) as a therapy option for patients with metastatic castrate resistant prostate cancer.
- Leading PET-MR research program in collaboration with GE Healthcare and other sections in the Department of Radiology.
- Initiated a collaboration with Palo Alto VA to perform amyloid PET to assess the effects of Traumatic Brain Injury (TBI) in Veterans.
- Actively supporting more than 20 novel clinical translational research programs such as ^{18}F FPPRGD$_2$, ^{18}F FLT, ^{18}F FSPG.
- Advocating for dual training in Nuclear Medicine and Diagnostic Radiology. Launched the first such combined residency track in the US.

Front Row: Francis Blankenberg, Hans Ringertz, Richard Barth, Erika Rubesova, Peter Moskowitz, Row 2: Evan Zucker, Christine Cassis,David Larson, MD, Frandics Chan, Roland Bammer. Back Row: Beverly Newman, Matthew Bernbeck, Shanshan Bao, Glen Seidel, Jeremy Dahl.

Pediatric Imaging

Richard Barth, MD

The mission of the Pediatric Radiology Section is to improve the health of children via high resolution imaging for detection and treatment of disease. We are passionately committed to addressing imaging issues unique to children.

Pediatric Radiology at LPCH offers a comprehensive program that works every day to improve the health of children through the application of state-of-the-art technology. Fellowship trained pediatric radiologists and a professional staff knowledgeable in delivering high quality pediatric care provide imaging services in a child-friendly environment. In addition to advanced imaging for our patients, we proudly feature a robust research program with projects ranging from basic science to bedside applications. All of our research follows a highly translational trajectory with a singular goal of moving into routine clinical use to improve care for children.

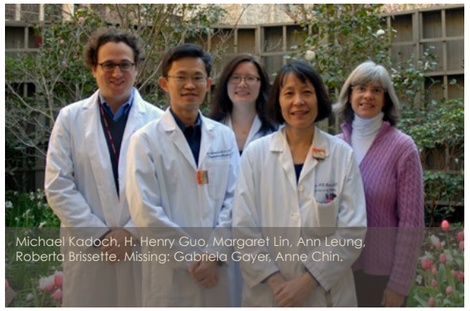
ACHIEVEMENTS

• Dr. Heike Daldrup-Link published results on applications of radiation-free MRI as an alternative to CT scanning.

• Dr. Shreyas Vasanawala introduced rapid acquisition radiation free MRI as an alternative to CT scans. His work on motion correction combined with rapid acquisition has resulted in decreased radiation exposure, decreased imaging time, and thereby, decreased anesthesia requirements.

• Dr. Kristen Yeom has described MRI features that promise to predict molecular subgroups and provide risk stratification for children with medulloblastoma brain tumors.

• Drs. Richard Barth and Erika Rubesova validate sonographic elastography for non-invasive assessment of liver disease as an alternative to biopsies.



Michael Kadoch, H. Henry Guo, Margaret Lin, Ann Leung, Roberta Brissette. Missing: Gabriela Gayer, Anne Chin.

Thoracic Imaging

Ann Leung, MD

The chest section continues to work toward implementation of clinical and research programs that focus on low-dose CT (LDCT) lung cancer screening. LDCT lung cancer screening, a test for early disease detection for individuals at high risk for lung cancer, is now covered for all privately insured and Medicare beneficiaries (as of February, 2015). In addition to a clinical trial, we are also collaborating with MD Anderson to develop and validate early lung cancer detection biomarker panels.

Additionally, Drs. Guo and Leung work with a multidisciplinary Radiology group that includes Lior Molvin, RT, MBA, Jia Wang, PhD-Physicist, Shannon Walters, RT, and Dominik Fleischmann, MD, Director of CT at Stanford Hospital. This group aims to develop new technology that will optimize imaging results while minimizing radiation dose for each individual who presents for low-dose CT screening at Stanford.

ACHIEVEMENTS

• Dr. Ann Leung is an invited Member of the Fleischner Society, the Society for Thoracic Imaging and Diagnosis.

• Dr. Leung is also President-elect and Program Committee Chair for the Society of Thoracic Radiology (STR).

• Dr. H. Henry Guo voted 2014 Teacher of the Year (Junior Faculty).

• Early and unique success with high fidelity 3D printing of airways from an iterative reconstruction (MBIR) CT dataset.

Front row (left to right): Michelle Nguyen, Tsuyumi Tanaka, Payam Massaband, Becky Phan, Leah Furman, Melissa Phillips, Belinda Quintanilla, Lorie Carr, Louise McManus, Mario Martinez-Ruiz, Valeriano Sia, Fe Cabanag, Anthony Academia, Ian Mariano; Second row: Frank Trinidad, Bill Bourgeois, Dayid Vansyckle, Jeslyn Rumbold, Ali Tahvildari, Michele Steuernagel, Angela Malenfant; Back row: Eric Olcott, Eric Tranvinh, MD, Katherine To'o, Lewis Shin, Jamie Cortes, Tom Leddy.

VA Radiology

Payam Massaband, MD

The Palo Alto Health Care System is a flagship of the VA for clinical care and maintains one of the top three research programs in the VA. It is a large multispecialty tertiary care center with a 900+ bed system, consisting of three inpatient facilities and seven outpatient clinics throughout northern California and the Bay Area.

There are multiple ongoing expansion projects with over $1 billion dollars of capital projects within the next decade. As a major part of the expansion program, we have broken ground on a new radiology department, expected to open in 2017.

The Palo Alto VA serves more than 85,000 veterans including polytrauma, multi-organ system, as well as traumatic brain and spinal cord injury patients. It is these very real clinical needs that drive significant collaborations among faculty and staff at the Palo Alto VA, Stanford Hospital, and Stanford University.

ACHIEVEMENTS

• Our team has achieved a 25% increase in productivity over the last 12 months, improving the timely imaging care of our veterans.

• Dr. Massaband appointed Radiology Residency Program Director for the Department of Radiology.

• Expansion of services offered in Modesto.

• Expansion of services planned in the new Monterey Clinic, scheduled to open in 2016.

• Dr. Charles Lau earned distinction as the Junior Faculty of the Year 2015.

• Dr. Dorcas Yao named as Director of Imaging Informatics of the VA, Pheonix, AZ.

Back row (left to right): Ronni Norte, Craig Williams, Kent Hofchings, Lucas Pollard, Joanne Delano, Ken Luong, Anthony Burger, Rodney Rodriguez; First row: Crystal Virata, Rick Huntington, Clarita Domingo, Lindsey Flores, George Segall, Christine Keeling, Jen-Shi Liu; Missing from photo: Milton Johnson, Minal Vasanawala.

VA Nuclear Medicine

George Segall, MD

VA Nuclear Medicine provides a full range of diagnostic and therapeutic procedures using radionuclides, including general nuclear medicine, PET-CT and SPECT-CT, and cardiac stress tests. Radionuclide therapy includes sodium I-131 for thyroid disorders, and radium-223 chloride for prostate cancer metastases to the skeleton. In cooperation with Interventional Radiology, Y-90 microsphere therapy for ablation of liver tumors was offered for the first time in January 2015. The Nuclear Medicine Service is a tertiary referral center in VISN 21 for PET-CT and other advanced imaging procedures. Equipment includes 1 PET-CT camera, 3 SPECT-CT cameras, and 2 bone densitometry scanners, one in Palo Alto and one in Livermore.

The Nuclear Medicine Service trains Radiology residents, Nuclear Medicine residents, and Cardiology fellows. It is the only VHA Nuclear Medicine Technologist Training Program, and is one of only 2 training programs in Northern California.

ACHIEVEMENTS

• Demonstrating myocardial perfusion of cardiac vessels, including normal wall motion.

• Experts in FDG PET-CT scanning, a critical approach for our patient populations at the Palo Alto Veterans Hospital.

• We continue to train Nuclear Medicine Technologists in the only VA-based training program in the United States.

RADIOLOGY RESEARCH LEADERSHIP

Sanjiv Sam Gambhir, MD, PhD
Chair of Radiology

Garry Gold, MD
Associate Chair, Research

Sandy Napel, PhD
Co-Director, IBIIS

Sylvia Plevritis, PhD
Co-Director, IBIIS

Kim Butts Pauly, PhD
Co-Director, RSL

Gary Glover, PhD
Co-Director, RSL

Research Sections

Under the leadership of Dr. Sam Gambhir, Chair of Radiology and Dr. Garry Gold, Associate Chair for Research, the Department of Radiology is pleased to provide an overview of the research that our faculty, trainees and staff are engaged in. Our faculty are internationally known for their expertise and lead multiple collaborative programs that embrace a wide range of disciplines within the School of Medicine, across the Stanford campus, and, indeed, throughout the world. Our scientists include experts in areas such as MRI, Ultrasound, CT, X-Ray, PET, SPECT, Spectroscopy, Chemistry, Molecular Imaging, Genomics/Proteomics, Bioinformatics and Computational sciences. Our Department is highly regarded and internationally well-known for its research in the imaging sciences. We have built on that long-established reputation and now present research led by faculty from disciplines that in the past seemed "far out" rather than key for radiology's expanded interests, especially to our cancer/disease early detection goals. Areas that add significantly to our department include disciplines such as genetics, proteomics, bioinformatics, metabolics, nanosciences, and non-invasive therapeutics.

In this Annual Report Research Section we present highlights of thirty (30) separate research laboratories housed within the four research sections in the Department of Radiology.

I. Canary Center at Stanford for Cancer Early Detection

II. Integrative Biomedical Imaging Informatics at Stanford (IBIIS)

III. The Molecular Imaging Program at Stanford (MIPS)

IV. The Radiological Sciences Laboratory (RSL)

SECTION LEADERSHIP

Sanjiv Sam Gambhir, MD, PhD
Stephanie Van de Ven, MD, PhD

SELECTED FUNDING

The Canary Foundation

Center for Cancer Nanotechnology Excellence and Translation (CCNE-T) – NIH U54

Center for Cancer Nanotechnology Excellence Focused on Therapy Response (CCNE-TR) – NIH U54

Early Cancer Detection Research Network (EDRN) – NIH U01

SELECTED PUBLICATIONS

Characterizing deformability and surface friction of cancer cells. PROC NATL ACAD SCI Byun S, Son S, Amodei D, Cermak N, Shaw J, Kang JH, Hecht VC, Winslow MM, Jacks T, Mallick P, Manalis SR. 2013 May 7;110(19):7580-5.

Intact MicroRNA Analysis Using High Resolution Mass Spectrometry JOURNAL OF THE AMERICAN SOCIETY FOR MASS SPECTROMETRY Kullolli, M, Knouf, E, Arampatzidou, M, Tewari, M, Pitteri, SJ 2014; 25 (1): 80-87.

A High-Affinity, High-Stability Photoacoustic Agent for Imaging Gastrin-Releasing Peptide Receptor in Prostate Cancer CLINICAL CANCER RESEARCH Levi, J, Sathirachinda, A, Gambhir, SS 2014; 20 (14): 3721-3729.

Guided and magnetic self-assembly of tunable magnetoceptive gels. NATURE COMMUNICATIONS Tasoglu S, Yu CH, Gungordu HI, Guven S, Vural T, Demirci U. 2014 Sep 1; 5:4702(11).

Detecting cancers through tumor-activatable minicircles that lead to a detectable blood biomarker. Ronald JA, Chuang HY, Dragulescu-Andrasi A, Hori SS, Gambhir SS. Proc Natl Acad Sci U S A. 2015 Mar 10;112(10):3068-73. doi: 10.1073/pnas.1414156112. Epub 2015 Feb 23.

Canary Center at Stanford

The Canary Center at Stanford is a newly opened world-class facility dedicated to cancer early detection research programs. The mission of the center is to foster research leading to the development of blood tests and molecular imaging approaches to detect and localize early cancers. The center is the first in the world to integrate research on both in vivo and in vitro diagnostics to deliver these tests, by housing state-of-the-art core facilities and collaborative research programs in molecular imaging, proteomics, chemistry, and bioinformatics. These initiatives have extensive links to the Cancer Center at Stanford, forming a direct pipeline for the translation of early cancer detection research into clinical trials and practice.

ACHIEVEMENTS

- The Pre-Clinical Imaging core at the Canary Center opened this year (2015) adding animal imaging to the Proteomics, Chemistry and Cell and Molecular Biology facilities.
- Dr. Utkan Demirci joined the Canary Center Faculty in April of 2014. Dr. Demirci's lab focuses on applying micro- and nanoscale technologies to problems in medicine.
- The Associate Faculty membership has expanded to over 20 faculty including clinicians, cancer biologists, and engineers.
- As part of our efforts to train the next generation of scientists, we offer a paid and unpaid summer internship program.
- Tom Soh recruited from UCSB. His research focuses on portable, rapid, and sensitive diagnostic platforms.

From left to right: Alessandro Tocchio, Fatih Inci, Fei Liu, H. Cumhur Tekin, Hakan Inan, Jaeyoung Yang, Jedd Lewis, JungKyu Choi, Mark Lifson, Mehmet Ozgun Ozen, Menekse Ermis, Murat Baday, Pu Chen, Rami El Assal, Rex Mei, Semih Calamak, Xinli Zhou, Shuqi Wang (Albert), Sinan Guven, Thiruppathiraja C, Thomas Nieland, Tolga Demitras, Xinli Zhou, Zhihong Dong.

Demirci BAMM Lab

Utkan Demirci, PhD

One of the greatest achievements in medicine is the remarkable progress that has been made in understanding, diagnosing, monitoring, and treating disease conditions. Our work focuses on creating innovative micro/nanoscale technologies to understand and target broad medical challenges. Our lab has a strong and scholarly track record of multiple creative innovations. We have developed tools for detecting cells, infections in patients on dialysis, and cancer biomarkers. We have also created microfluidic tools to mimic the cancer microenvironment investigating tumor metastatic behavior. Specifically, using these unique tools, we have created new approaches detecting oncogenic viral load using intact viruses as an alternative to nucleic acid amplification methods. Such point-of-care tools enable patients and doctors to monitor the progression of health conditions.

ACHIEVEMENTS

- Differentiating cancer cells by utilizing levitation-based sorting system.
- Engineering nanoplasmonic surfaces to detect and quantify biotargets down to fg/mL levels.
- Integrating a cell phone with paper & flexible detection systems for point-of-need diagnostics.
- Developing microfluidic chips to monitor viral and bacterial infections in blood and produce supply.
- Generating 3-dimensional tissue construct using acoustic wave techniques.
- Cryopreserving distinct cell types.
- Portable holographic imaging system for biological objects.

Front row (left to right): Ravali Adusumilli, Mark Flory, Parag Mallick, Michelle Hori, Justin Carden. Back row (left to right): Parag Mallick, Calum MacAulay.

Multi-scale Diagnostics Lab

Parag Mallick, PhD

The Mallick lab focuses on translating multi-omic discovery into precision diagnostics. In particular, we use tightly integrated computational and experimental, multi-omic approaches to discover the processes underlying how cells behave (or misbehave) and accordingly how cancers develop and grow. We hope that by exploring these processes, and by formalizing our knowledge in predictive mathematical models that we will be able to better identify biomarkers that can be used to detect cancers earlier and describe how they are likely to behave (e.g. aggressive vs indolent, drug sensitive vs responsive). We are specifically working in three focus areas: Cancer Systems Biology, Multi-scale Biomarker Biology and Technology Development. Notably, many of the studies in our group are investigating fundamental physiological processes and thus are generally applicable to a range of cell-types and diseases.

ACHIEVEMENTS

- Development of the ProteoWizard Software Toolkit, a set of open-source, cross-platform tools and software libraries that facilitate multi-omic data analysis.
- Statistical model that predicts the likelihood of detecting a putative protein biomarker in the blood.
- Micro-environment dependent mathematical model of tumor evolution predicting outgrowth of aggressive cells in nutrient starved tumor regions.
- Collection and analysis of the first multi-scale dataset spanning the molecular to organismic scales.


From left to right: Cheylene Tanimoto, Sarah Totten, PhD, Sharon Pitteri, PhD, Maria Arampatzidou, PhD.

Cancer Molecular Diagnostics Lab

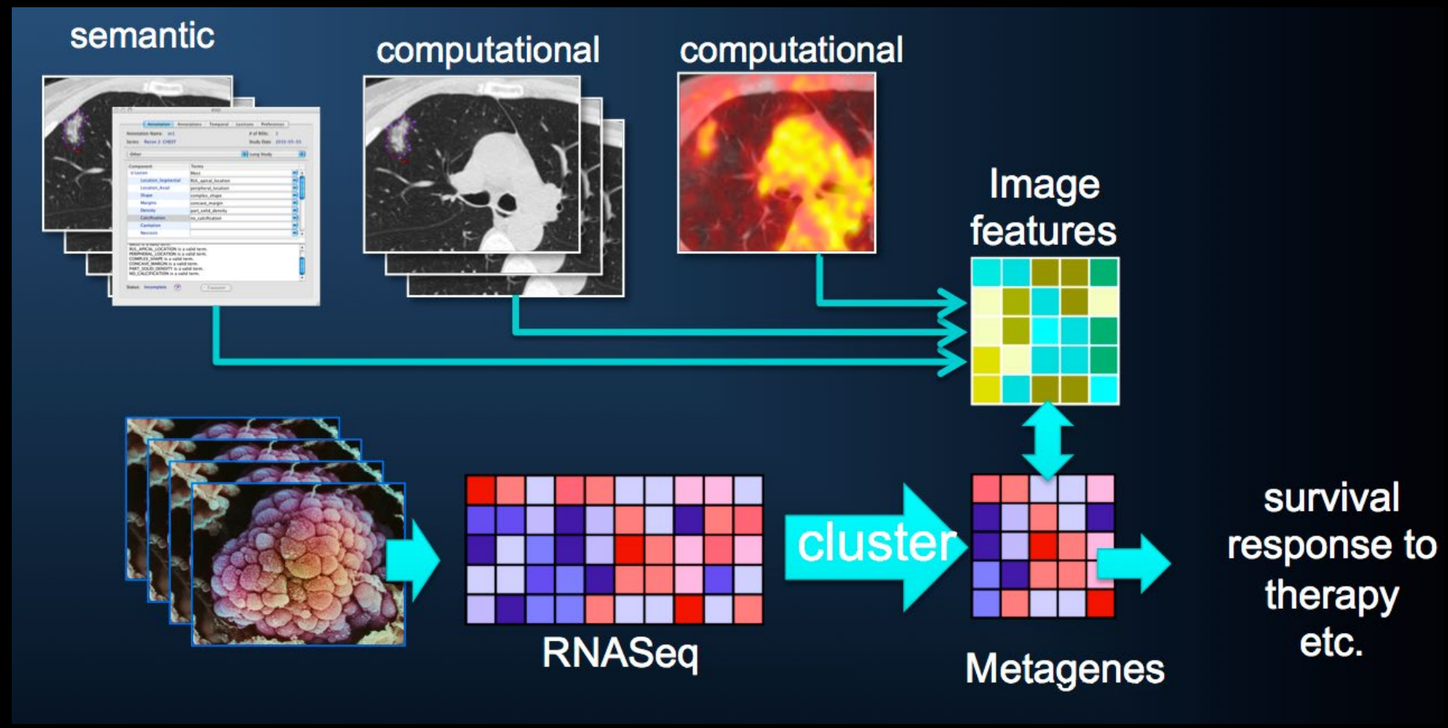
Sharon Pitteri, PhD

The Pitteri laboratory is focused on the discovery and validation of proteins and other molecules that can be used as indicators of cancer risk, diagnosis, progression, prognostication, and recurrence. Proteomic technologies, predominantly mass spectrometry, are used to identify proteins in the blood that are differentially regulated and/or post-translationally modified with disease state. A major goal of this research is to define novel molecular signatures for breast, prostate, and ovarian cancers, including particular sub-types of these diseases. We enjoy many collaborations with clinicians and other scientists to address challenges and opportunities in cancer early detection. Areas of particular interest and well established clinical interests include those with the breast imaging section, oncology groups and the Cancer Prevention Institute of California.

ACHIEVEMENTS

- Working with the breast imaging section, we have collected blood samples from 50 women with suspicious breast lesions to identify biomarkers of malignant versus benign lesions.
- Using state-of-the-art technologies we have measured levels of thousands of proteins in the blood to determine person-to-person and technical variation of protein levels in the blood.
- We are dedicated to discovering new blood-based diagnostic tests for breast and prostate cancers to improve early detection and prognostication.

Integrative Biomedical Imaging Informatics at Stanford (IBIIS)



The Integrative Biomedical Imaging Informatics at Stanford (IBIIS) section of the Department of Radiology focuses on pioneering, translating and disseminating methods utilizing the imaging information sciences to better understand health and disease, and to improve clinical care. Our research spans: automated image interpretation, knowledge extraction from natural language radiological reports, radiological decision support, correlation of imaging appearance with molecular components of tissue, novel imaging-based biomarkers of disease and response to therapy, data-driven models of cancer progression, and evaluation of cancer screening programs.

ACHIEVEMENTS

- Databases linking images to molecular properties of tumor tissue for lung cancer, gliobastoma (brain cancer), and liver cancer
- New tools to extract semantic and quantitative information from images and narrative clinical documentation, including radiology reports
- New grants awarded for developing tools and databases for quantitative imaging, and for training the next generation of researchers in cancer systems biology
- Recruitment of a new senior faculty specializing in knowledge extraction from natural language medical reports
- Expansion of IBIIS laboratory space in the James H. Clark Center, home of Stanford's flagship multidisciplinary Bio-X program

SECTION LEADERSHIP

Sandy Napel, PhD
Sylvia Plevritis, PhD

SELECTED FUNDING

NIH 5R01CA160251-06: Tools for Linking and Mining Image and Genomic Data in Non-Small Cell Lung Cancer

NIH U01CA142555-05: Computerized Quantitative Imaging Assessment of Tumor Burden

NCI R01CA160251-05: Tools for Linking and Mining Image and Genomic Data in Non-Small Cell Lung Cancer

SELECTED PUBLICATIONS

Faruque J, Rubin DL, Beaulieu CF, Napel S. Modeling perceptual similarity measures in CT images of focal liver lesions. J Digit Imaging 2013; 26:714-720.

de Sisternes L, Simon N, Tibshirani R, Leng T, Rubin DL. Quantitative sd-oct imaging biomarkers as indicators of age-related macular degeneration progression. Invest Ophthalmol Vis Sci 2014; 55:7093-7103.

Gevaert O, Xu J, Hoang CD, Leung AN, Xu Y, Quon A, Rubin DL, Napel S, Plevritis SK. Non-small cell lung cancer: Identifying prognostic imaging biomarkers by leveraging public gene expression microarray data--methods and preliminary results. Radiology 2012; 264:387-396.

Sloan CE, Chadalavada SC, Cook TS, Langlotz CP, Schnall MD, Zafar HM. Assessment of follow-up completeness and notification preferences for imaging findings of possible cancer: What happens after radiologists submit their reports? Acad Radiol 2014; 21:1579-1586.

Radiogenomics of Non-small Cell Lung Cancer. Linking Medical Image Phenotypes and Genomics. Funded by NCI R01 CA160251.

From left to right: Saeed Hassanpour Ghady, David Larson, Curt Langlotz, Kandice Garcia, Lauren Sederberg, Matt Lungren, Jake Mickelsen.

Langlotz Laboratory

Curtis Langlotz, MD, PhD

Dr. Langlotz's biomedical informatics laboratory is focused on improving the accuracy and utility of clinical imaging information by providing intelligent assistance to radiologists, clinicians, patients, and other consumers of the radiology report. His laboratory develops novel machine learning and natural language processing algorithms to extract discrete information from narrative radiology reports. When combined with automated reasoning techniques, these tools can provide real-time decision support for radiologists to improve accuracy and reduce errors. Information extraction techniques also enable rapid investigation of the relationships between imaging information, genomic data, and patient characteristics from electronic health records. His laboratory's translational approach accelerates the evaluation and dissemination of the resulting software systems and standards.

ACHIEVEMENTS

• Developed and evaluated a machine-learning classifier to extract anatomic and pathologic concepts from narrative radiology reports to enable imaging information to be correlated with clinical and genomic data.

• Created an algorithm to predict which patients will be high utilizers of imaging services based on radiology reports from their first day of imaging utilization. This algorithm identifies patients who could benefit from a comprehensive radiation dose reduction plan.

• Experimenting with deep learning methods to identify medical images with critical findings.

From left to right: Sandy Napel, Yu Yan, Sebastian Echegaray.

Radiological Image & Information Processing

Sandy Napel, PhD

Our lab focuses on developing new techniques to determine diagnosis and to predict prognosis, response to treatment, and outcomes. This involves the development algorithms to make image features (e.g. volumes, lengths, shapes, edge sharpness, curvatures, textures) computer-accessible, the building of integrated databases combining features of multidimensional radiological images and other clinical data, including molecular assays of biopsies and/or resected tissue, and machine learning algorithms to make inferences from the integrated data. Ultimately, we aim to translate these developments into clinical applications, including medical content-based image retrieval and decision support systems for radiologists. We primarily work with cross-sectional images, including CT, MR, and ultrasound, and specialize in cancer imaging, focusing mostly on lung, liver, and brain cancer.

ACHIEVEMENTS

• Developed pipelines to extract quantitative information from images.

• Participated in international networks for tool and algorithm sharing for cancer imaging.

• Nearing completion of several databases linking images to molecular properties of tumor tissue for lung, brain and liver cancer.

• Awarded several major grants for developing tools and databases for quantitative imaging.

Front Row (left to right): Holly Chung, Diego Munoz, Sylvia Plevritis, Andrew Gentles. Back Row (left to right): David Knowles, Majid Shafiq, Benedict Anchang, Melissa Ko, Ramzi Totah, Maggie Bos. Missing: Summer Han, Alborz Bejnood.

Cancer Systems Biology Lab

Sylvia Plevritis, PhD

Cancer Systems Biology Laboratory (CSBL) views cancer as a complex system whose components can be reverse-engineered for the purposes of understanding the molecular mechanisms of cancer progression and identifying approaches for more effective cancer control strategies. Our current research aims include: (1) reconstructing intra- and inter-cellular communication networks of cancer from genomic, proteomic and imaging data, (2) optimizing combination drug therapy strategies, and (3) quantifying the impact of risk-based screening and molecularly targeted therapeutics on population cancer incidence and mortality rates. Ultimately, our goal is to develop a multiscale view of cancer progression for improving early detection and treatment strategies for the individual patient. CSBL brings together computer scientists, statisticians, engineers, biological experimentalists and clinical researchers to tackle complex issues related to the biological basis and clinical relevance of our work.

ACHIEVEMENTS

• New algorithm for optimizing combination drug therapy based on single cell data.

• Novel prognostic signature of non-small-cell lung cancer.

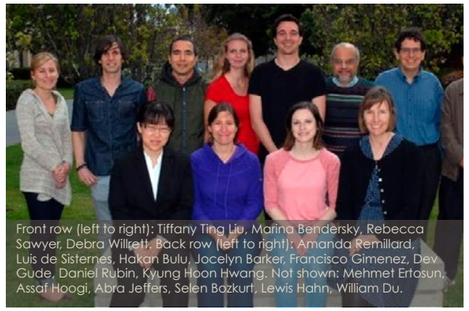
• New algorithm for quantifying spatial features on histology.

• Discovery of EMT drivers in breast cancer.

• Analysis of mammography and treatment on 2012 US breast cancer rates.

• Analysis of CT-based lung cancer screening strategies for the US population.

• Initiation of the Stanford Cancer Systems Biology Scholars Program.



Front row (left to right): Tiffany Ting Liu, Marina Bendersky, Rebecca Sawyer, Debra Willcett. Back row (left to right): Amanda Remillard, Luis de Sisternes, Hakan Bulu, Jocelyn Barker, Francisco Gimenez, Dev Gude, Daniel Rubin, Kyung Hoon Hwang. Not shown: Mehmet Ertosun, Assaf Hoogi, Abra Jeffers, Selen Bozkurt, Lewis Hahn, William Du.

Quantitative Imaging Laboratory

Daniel Rubin, MD, MS

Our laboratory develops computational methods and tools to discover imaging biomarkers of disease that enable precision medicine. We translate our discoveries into practice through decision support applications to reduce variation in clinical care and to improve patient outcomes. Our work spans the spectrum from basic science discovery (discover image phenotypes to define subtypes of diseases and to understand their molecular characteristics) to clinical practice through translational research (decision support, disease profiling, treatment response assessment, and personalized treatment selection). Our vision is that computational approaches to mining large collections of images will reveal knowledge that drives scientific discovery and guides clinical practice. Our ultimate goal is to bring cutting-edge radiological data and knowledge into practice for precision care of patients.

ACHIEVEMENTS

• Developed the ePAD semantic image annotation tool (http://epad.stanford.edu) to enable large scale science with images and machine learning methods to recognize disease subtypes and predict clinical outcomes.

• Developed natural language processing methods to provide decision support based on descriptions of imaging features in narrative radiology reports.

• Discovered novel quantitative imaging methods in pathology (distinguish gender-based subtypes of brain cancers), ophthalmology (predict progression of eye disease), and radiology (deep learning methods to automatically detect breast masses in mammograms).

SECTION LEADERSHIP

Sanjiv Sam Gambhir, MD, PhD
Christopher Contag, PhD

SELECTED FUNDING

NIH 5 P50 CA114747 10: In Vivo Cellular and Molecular Imaging Center@Stanford (ICMIC)

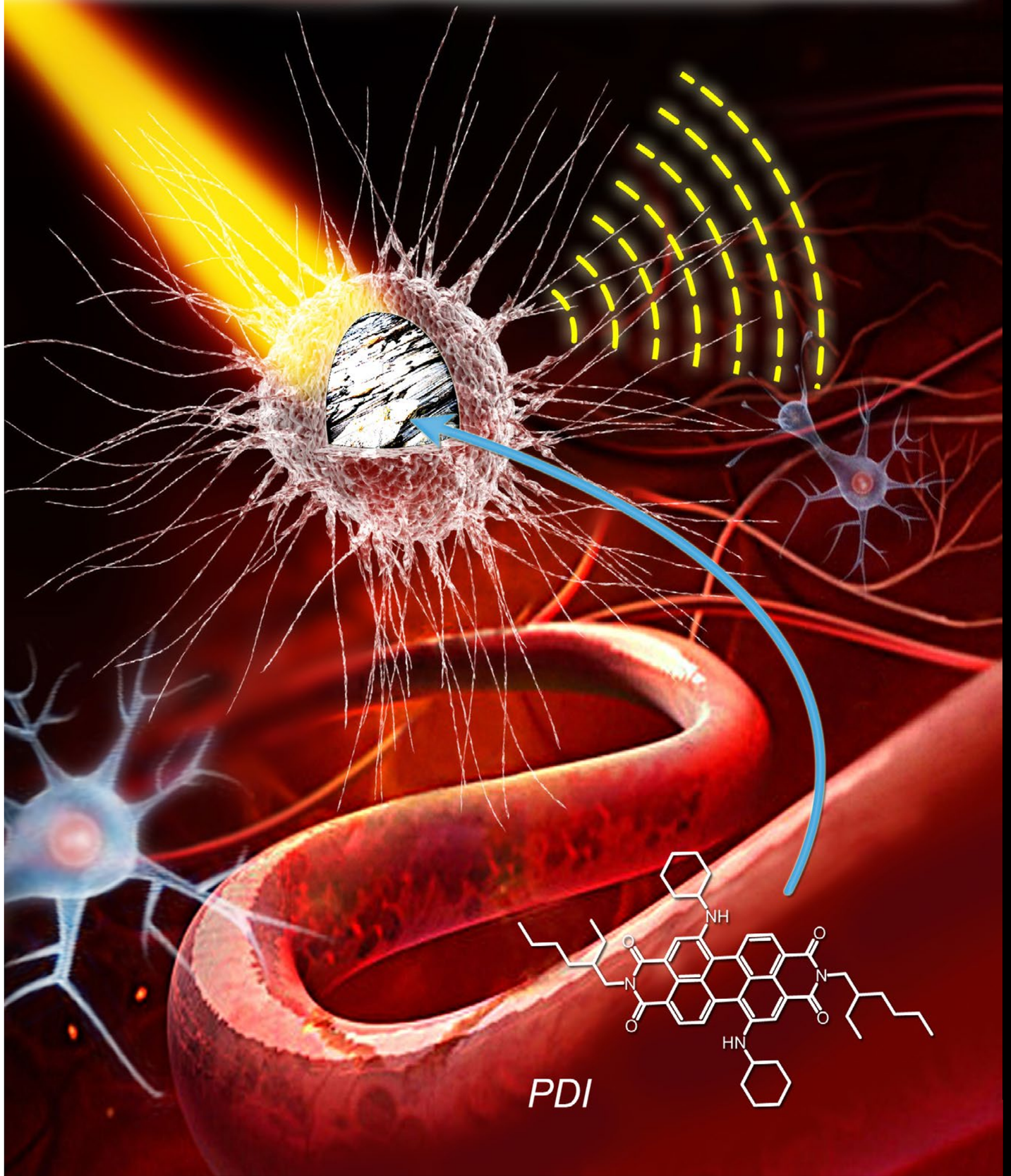
DOE DE-SC0008397: Stanford Molecular Imaging Training Program

SELECTED PUBLICATIONS

Detecting cancers through tumor-activatable minicircles that lead to a detectable blood biomarker. Ronald JA, Chuang HY, Dragulescu-Andrasi A, Hori SS, Gambhir SS. Proc Natl Acad Sci U S A. 2015 Mar 10;112(10):3068-73. doi: 10.1073/pnas.1414156112. Epub 2015 Feb 23.

Theranostic mesoporous silica nanoparticles biodegrade after pro-survival drug delivery and ultrasound/magnetic resonance imaging of stem cells. Kempen PJ, Greasley S, Parker KA, Campbell JL, Chang HY, Jones JR, Sinclair R, Gambhir SS, Jokerst JV. Theranostics. 2015 Mar 1;5(6):631-42. doi: 10.7150/thno.11389. eCollection 2015.

Perylene-diimide-based nanoparticles as highly efficient photoacoustic agents for deep brain tumor imaging in living mice. Fan Q, Cheng K, Yang Z, Zhang R, Yang M, Hu X, Ma X, Bu L, Lu X, Xiong X, Huang W, Zhao H, Cheng Z. Adv Mater. 2015 Feb 4;27(5):843-7. doi: 10.1002/adma.201402972. Epub 2014 Nov 6.

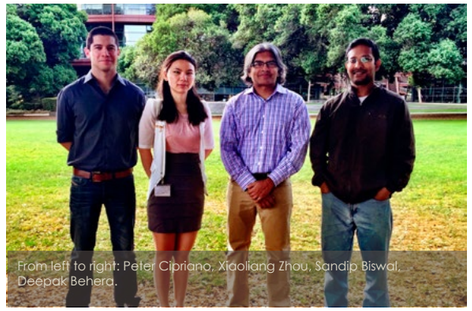


Perylene-3,4,9,10-tetracarboxylic diimide (PDI) and its derivatives are generally used as industrial pigments and materials for constructing various organic electronic devices. By encapsulating into amphiphilic polymers, water-soluble PDI nanoparticles can be easily prepared, and they exhibit excellent photoacoustic imaging (PAI) properties. The PDI-based nanomaterials can further be used for PAI of deep glioblastoma in orthotopic mice models. Photo credit: Zhen Cheng and Quli Fan from the Cancer Molecular Imaging Chemistry Laboratory.

Molecular Imaging Program at Stanford (MIPS)

Our continuing vision for the Molecular Imaging Program at Stanford (MIPS) has been to bring molecular imaging technologies to basic science cancer researchers – to create an environment in which non-invasive imaging technologies that permit longitudinal studies of tumor initiation, progression, metastasis and response to therapy would be adopted by basic scientists studying cancer. Within the MIPS program, we continue to develop animal models of cancer in which molecular imaging adds new dimensions to experimental design and allows investigators to acquire time-dependent data that could not be obtained in any other way. The MIPS program is supported by numerous funding sources, including the National Institutes of Health, multiple foundations, and strong industry partnerships. Since the inception of MIPS (2003), we have followed a clearly defined roadmap toward translating our work into clinical use to benefit patients.

In the following pages, our Radiology faculty describe their research, introduce their research teams, and share a few milestone achievements that they have made. A complete listing of sponsored research awards can be found beginning on page 100.



From left to right: Peter Cipriano, Xiaoliang Zhou, Sandip Biswal, Deepak Behera.

Molecular Imaging of Nociception and Inflammation Lab

Sandip Biswal, MD

Chronic pain sufferers are unfortunately limited by poor diagnostic tests and therapies. Our lab is interested in 'imaging pain' by using multimodality molecular imaging techniques to study nociception and neuronal inflammation as a means of improving objective, image-guided diagnosis and treatment of chronic pain disorders. We develop new molecular contrast agents for use in positron emission tomography (PET) and magnetic resonance imaging (MRI), working towards eventual clincal translation. The overarching goal of our efforts is to develop an imaging approach that will pinpoint the exact cause of one's pain, improve outcomes of pain sufferers and to help develop new chronic pain treatments.

ACHIEVEMENTS

• Running 2 clinical imaging trials to better identify chronic pain generators which study the use of [18F]-FDG PET-MR and SPIO MRI in the diagnosis of increased nociceptive activity and neural inflammation in patients with Complex Regional Pain Syndrome (CRPS) and chronic sciatica.

• With collaborators Fred Chin and Chris McCurdy, we have received FDA approval for a Phase 0 exploratory IND trial studying the biodistribution of a novel nerve injury imaging agent, FTC-146, in healthy volunteers and chronic pain patients using PET-MR.

From left to right: Kai Cheng, Changhao Liu, Zhe-Zhang, Hua Zhu, Zhen Cheng (PI), Su Hyun Hong, Hao Chen.

Cancer Molecular Imaging Chemistry Laboratory

Zhen Cheng, PhD

The main research of the Cancer Molecular Imaging Chemistry Laboratory (CMIML) is to develop novel multimodality techniques and theranostic agents for early detection and treatment of cancer, cardiovascular and neurological diseases. Currently, we are actively working on several research projects in the field of molecular imaging: 1) Molecular probe development based on novel protein scaffolds and small molecules; 2) Novel optical imaging techniques such as Cerenkov luminescence imaging, and NIR-II imaging for detection and image guided surgery; 3) Theranostic nanoparticles such as new QDs, next generation IO nanoparticles (IONPs), dumbbell Au-IONPs, etc.

ACHIEVEMENTS

• Developed several clinical translatable PET probes for cancer, cardiac and neurological diseases imaging.

• Developed a new class of small molecule based dyes for in vitro and in vivo near infrared window II imaging.

• Establishing Cerenkov luminescence imaging (CLI) as a new approach for bioimaging and further developing new molecular probes for CLI.

• Developed new nanoplatforms such as melanin nanoparticles, gold-tripod nanoparticles, Au-Iron oxide heterostructures, Perylene-diimide-based nanoparticles for cancer multimodality imaging and theranostics.

Front row (left to right): Zheng Miao, Bernadette Schneider, Bin Shen, Samuel Banister, Jun-Hyung Park, Corinne Beinat; Back row (left to right): Aileen Hoehne, Shawn Scatliffe, Jessica Klockow, Kenneth Hettie, Frederick Chin, George Montoya, Mikael Painer, Michelle James. Missing: Murugesan Subbarayan.

TRACER for Molecular Imaging Laboratory

Frederick Chin, PhD

The Translational Radiopharmaceutical Sciences and Chemical Engineering Research (TRACER) for Molecular Imaging Laboratory's specialized synthetic chemistry laboratory focuses on advancing radiopharmaceutical sciences for the expanding field of molecular imaging. We design and synthesize novel radioligands/radiotracers that bind to molecular targets related to specific nervous system (central and peripheral) disorders and cancer biology. In addition, new radiolabeling techniques and methodologies are created in our lab for emerging radiopharmaceutical development as well as for the general radiochemistry community. These radiochemistry approaches are coupled with innovative chemical engineering to further investigate new molecular imaging strategies. Successful imaging agents are also extended towards human clinical applications including disease detection and drug therapy.

ACHIEVEMENTS

• Two NIH awards: "Small Animal PET System (S10)" and "Cross-Species Multi-Modal Neuroimaging to Investigate GABA Physiology in Fragile X Syndrome".

• FDA-approved New Drug Applications to translate PET radiotracers for human studies.

• Exploratory Investigational Drug 126459 for [18F]FTC-146.

• Investigational New Drug 126903 for [18F] Flumazenil.

From left to right: Hossein Nejadnik, Carmel Chan*, Conghua Wang, Maryam Aghighi, Meghdad Taghavi, Heike Daldrup-Link, Olga Lenkov, Eileen Misquez, Saeid Zanganeh, Anne Muehe, Laura Pisani, Mary Schaffer Miller, Ziyan Sun (not shown: Shanshan Bao, Alexis Crawley, Preeti Sukerkar, Toktam Nezakati, Suchismita Mohanti, Kai Li).

Translational Tumor and Stem Cell Imaging Lab

Heike Daldrup-Link, MD

Our research program focuses on the intersection of cell biology, nanomedicine and medical imaging to develop novel platforms for understanding, diagnosing, and successfully treating diseases in pediatric patients. A number of these novel imaging technologies have been successfully translated from our basic science lab to clinical imaging applications, thereby creating direct value for our pediatric patients.

In addition to our achievements listed below, through collaborations with investigators from nine Departments at Stanford University, we recently launched a major initiative on the diagnosis and repair of cancer-therapy induced damage to the brain, heart and bones in pediatric cancer survivors.

ACHIEVEMENTS

• Nanoparticles for clinical oncology: MR imaging of tumor associated macrophages, image-guided cancer therapy without side effects.

• Radiation-free whole body staging of children with cancer.

• Immediately clinically applicable techniques for stem cell imaging (US14/161,315 and US14/210,752).

• Our team produced four books, over 100 publications, 5719 citations and 77 honors and awards.

Dr. Sam Gambhir and his team. Front row (left to right): Lauren, Michelle, Gayatri, Cristina, Stephanie, Caroline, Aileen, Jacob, Michael, Ryogo, Hongmei, Aloma, Lingyun, Jessie, Arutselvan and Elizabeth. Back row (left to right): Tricia, Laura, Mark, Bryan, Jos, Jesse, Raj, Mehran, Rick, Ethan, Sayed, Ophir and Seung-Min.

Multimodality Molecular Imaging Laboratory

Sanjiv Sam Gambhir, MD, PhD

The Multimodality Molecular Imaging Lab focuses on developing novel imaging modalities including, for example, PET imaging, bioluminescence optical imaging, fluorescence optical imaging, Raman spectroscopy and photoacoustic imaging to understand the molecular mechanisms of various diseases particularly cancer. More recently the lab has been developing blood based diagnostics that would complement existing imaging strategies and aid in early cancer detection.

Our goals are to marry fundamental advances in molecular/cell biology with those in biomedical imaging to advance the field of molecular imaging. We have a particular interest in cancer biology and gene/cell therapy. Research in early cancer detection and pharmacological therapy assessment is also being performed.

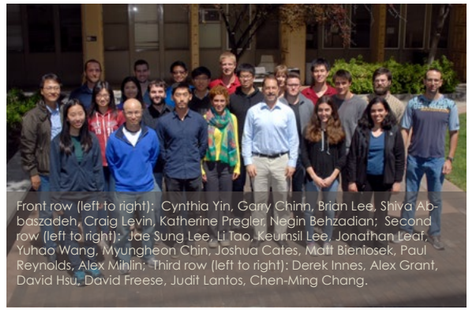
ACHIEVEMENTS

• First photoacoustic imaging trial in humans for prostate cancer using transrectal combined ultrasound/photoacoustic instrumentation.

• Developed a new PET tracer for imaging activated T-Cells for use in immunotherapy with proof of principle in Graft vs. Host disease.

• Developed several new photoacoustic imaging agents for prostate and thyroid cancers with testing in small animal models.

• Developed a new PET imaging agent for glioblastoma based on targeting PKM2.



Front row (left to right): Cynthia Yin, Garry Chinn, Brian Lee, Shiva Abbaszadeh, Craig Levin, Katherine Pregler, Negin Behzadian; Second row (left to right): Jae Sung Lee, Li Tao, Keumsil Lee, Jonathan Leaf, Yunao Wang, Myungheon Chin, Joshua Cates, Matt Bieniosek, Paul Reynolds, Alex Minlin; Third row (left to right): Derek Innes, Alex Grant, David Hsu, David Freese, Judit Lantos, Chen-Ming Chang.

Molecular Imaging Instrumentation Laboratory

Craig Levin, PhD

To create novel instrumentation and software algorithms for in vivo imaging of molecular signatures of disease in living subjects. These new cameras efficiently image emissions from molecular contrast agents to probe disease biology in tissues residing deep within the body using measurements made from outside the body. The technology goals are to advance the sensitivity and spatial, spectral, and/or temporal resolutions, to create new camera geometries for special biomedical applications, to understand the entire imaging process comprising the subject tissues, radiation transport, and imaging system, and to provide the best available image quality and quantitative accuracy. The ultimate goal is to introduce these new imaging tools into studies of molecular mechanism and treatments of disease in living subjects.

ACHIEVEMENTS

• Completed the world's first radio frequency-penetrable positron emission tomography (PET) insert for simultaneous PET-MR; awarded a new NIH R01 grant to build a brain imaging PET insert employing this concept.

• Built a new section of the world's first 1 mm resolution clinical PET system.

• Discovered a new method for detecting ionization created from 511 keV photons for PET.

• Developed a scalable technology to consistently achieve < 200 picoseconds coincidence time resolution for time-of-flight PET.

From left to right: Anjali Sheahan, Tarik Massoud, and Jey Ananta.

Lab of Experimental and Molecular Neuroimaging

Tarik Massoud, MD, PhD

In the LEMNI laboratory we focus on molecular and translational imaging of the brain especially in neuro-oncology. We are interested in developing novel experimental and molecular imaging techniques for theranostic applications in glioblastoma multiforme (GBM), to both interrogate fundamental cellular and molecular biological events, and to use in new anticancer therapeutic strategies. Generally, this includes the in vivo imaging of gene expression using reporter assays, protein-protein interactions, and signal transduction, as well as cellular and nano-imaging. Other emerging more specific research interests relate to animal modeling of gliomas, new glioma radiotracer development, studying the p53 transcriptional network in GBM, imaging protein folding and misfolding in cancer, and development of novel nanoparticle-based drug and microRNA formulations for ultra-targeted therapeutic strategies in endovascular neuro-oncology applications.

ACHIEVEMENTS

• Development of a novel molecular biosensor based on split reporter gene technology to image protein folding and misfolding in cancer and other diseases, for ultimate use in the discovery of new drugs.

• Development of novel strategies to package temozolomide in colloidal nanoparticles delivered to gliomas.

• Development of novel combined microRNA and chemotherapeutic approaches to treat and image gliomas.

From left to right: Aaroh Bhargava-Shah, Thillai Sekar, Ramasamy Paulmurugan, Rammohan Devulapally, and Kira Foygel.

Cellular Pathway Imaging Laboratory

Ramasamy Paulmurugan, PhD

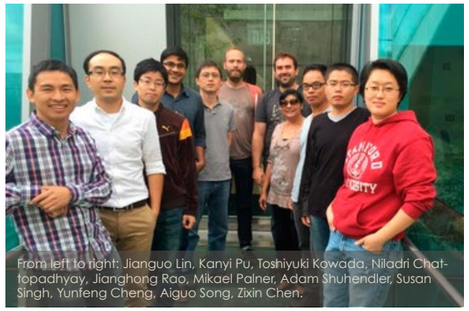
Our research interests are to develop in vivo imaging strategies for studying cellular signal transduction networks. A signal transduction network is a regulated biochemical process by which cells convert extracellular stimuli to execute functional changes within the cells. The intact signal transduction network is important for maintaining cells at their normal functional state. We developed Split-reporter complementation sensor and Degron-Blockade sensor to image histone lysine methylation and to screen novel small molecule compounds targeting specific histone H3 methylation marks in vitro and in vivo in small living animals. We are also working on using microRNAs as novel therapeutic drug for treating Triple Negative Breast Cancer by altering cellular homeostasis.

ACHIEVEMENTS

• Developing in vivo imaging methods to study cellular histone methylations by reporter protein complementation and degron protease blockade sensors.

• Developing FDA approved polymer nanoparticles to co-deliver tumor suppressor microRNAs and chemotherapeutic drugs to improve cancer chemotherapy and to prevent metastasis.

• Ultrasound-microbubble (US-MB) mediated localized delivery of FDA approved PLGA-Nanoparticles for the co-delivery of therapeutic micorRNAs and chemotherapeutic drugs to improve chemotherapy and prevent metastasis.



From left to right: Jianguo Lin, Kanyi Pu, Toshiyuki Kowada, Niladri Chattopadhyay, Jianghong Rao, Mikael Palner, Adam Shuhendler, Susan Singh, Yunfeng Cheng, Aiguo Song, Zixin Chen.

Cellular and Molecular Imaging Laboratory

Jianghong Rao, PhD

Research in the Rao lab focuses on developing novel molecular imaging techniques with chemical, physical and biological tools, to better understand fundamental biological events in living objects. We are interested in applying new chemistry to develop novel molecular probes for imaging the activity and functions of molecular targets, with a special interest in early disease diagnostic and therapeutic intervention. Some of the recent highlights from our lab include: new "smart" probes for detection of cellular apoptosis based on bioorthogonal condensation reaction, fluorogenic probes for point-of-care detection of tuberculosis and nanoparticle sensors for detection of intracellular reactive oxygen species.

ACHIEVEMENTS

• Dr. Toshiyuki Kowada receives postdoctoral fellowship from the Naito Foundation.

• Dr. Adam Shuhendler received Young Investigator Award to the 2014 World Molecular Imaging conference in Seoul, and Young Investigator Award at 2015 SNMMI Annual meeting in Baltimore.

• Dr. Yunfeng Cheng developed new probes for Tuberculosis detection and has been highlighted in Nature news.

• Dr. Kanyi Pu developed new nano sensors for real-time imaging of drug-induced hepatotoxicity, and the work has been highlighted in SciEx and also a patent has been filed by Stanford.

Back Row (left to right): Lotfi Abou-Elkacem, Tzu-Yin Wang, Jocelyn Steffen; Juergen Willmann, Sunitha Bachawal, Steven Machtaler, Rosa Sigrist, Katie Wilson, Huaijun (Morgan) Wang, Jianhua (Jerry) Zhou. Front Row (left to right): Sayan Mullick Chowdhury, Ahmed El Kaffas. Not Pictured: Keerthi Valluru.

Translational Molecular Imaging Laboratory

Juergen Willmann, MD

The Willmann lab develops and tests ultrasound molecular imaging for identifying and monitoring diseases with the goal of translating this approach to clinical use. This novel imaging modality employs intravascular contrast microbubbles which are modified to bind to regions of the diseased vasculature expressing unique proteins. Using these microbubbles, we can detect small foci (<1mm) of pancreatic and breast cancer and can monitor regions of diseased bowel undergoing active inflammation. We have also successfully explored their use as a drug delivery vehicle for cancer therapy. Finally, our lab has started the first-in-man clinical trial using these novel contrast agents in men with prostate cancer.

ACHIEVEMENTS

• Performed the first ever clinical KDR-targeted 3-D ultrasound molecular imaging trial in 14 patients with biopsy proven prostate cancer.

• Translated a selectin-targeted ultrasound molecular imaging in rodents to a large animal (pig) model of acute distal ileitis to asses disease activity in inflammatory bowel disease.

• Generated a dual-modality acoustic/photoacoustic B7-H3-targeted imaging approach for earlier breast cancer detection.

• Developed an imaging-guided drug delivery approach for therapy of hepatocellular carcinoma (HCC).

• Initiation of the first in the world clinical trial on 3D perfusion imaging of liver metastases in patients with colorectal cancer.

Back row left to right: Evangeline Tzatzalos, Praveen Shukla, Jared Churko, Kazuki Kodo, Ioannis Karakikes, Arun Sharma, Won Hee Lee, Jaecheol Lee, Raman Nelakanti, Tor Termglinchan, Timon Seeger, Yingxin Li. Middle row: Kolsoum InanlooRahatloo, Haodong Chen, Hyo-ju Yi, Youngkyun Kim, Mintao Zhao, Ning-Yi Shao, Ian Chen, Johannes Riegler, Sang-Ging Ong, Haodi Wu, Mohamed Ameen.
Front row: Adriana Bozzi, Elena Matsa, Rinkal Chaudhary, Chunli Zhao, Yan Zhuge, Nigel Kooreman, Joseph Wu, Priyanka Garg, Justin Vincent, Paul Burridge, Loan Nguyen, Alexandra Holmstroem, Lu Cui, Yu Ma, Ying Zhang, Dan Xiao.

Cardiovascular Gene and Cell Therapy Laboratory

Joseph Wu, MD, PhD

The Wu lab studies the biological mechanisms of adult stem cells, embryonic stem cells, and induced pluripotent stem cells. We use a combination of next generation sequencing, tissue engineering, physiological testing, and molecular imaging technologies to better understand stem cell biology in vitro and in vivo. For adult stem cells, we are interested in monitoring stem cell survival, proliferation, and differentiation. For embryonic stem cells, we are currently studying their tumorigenicity, immunogenicity, and differentiation. For induced pluripotent stem cells, we are interested in cardiovascular disease modeling, drug screening, and cell therapy. We also develop novel vectors and therapeutic genes for cardiovascular gene therapy applications.

ACHIEVEMENTS

• Performed "clinical trial in a dish" using patient-specific iPSCs to understand drug cardiotoxicity

• Designed cheaper, faster, and more accurate test to identify gene defects in heart patients

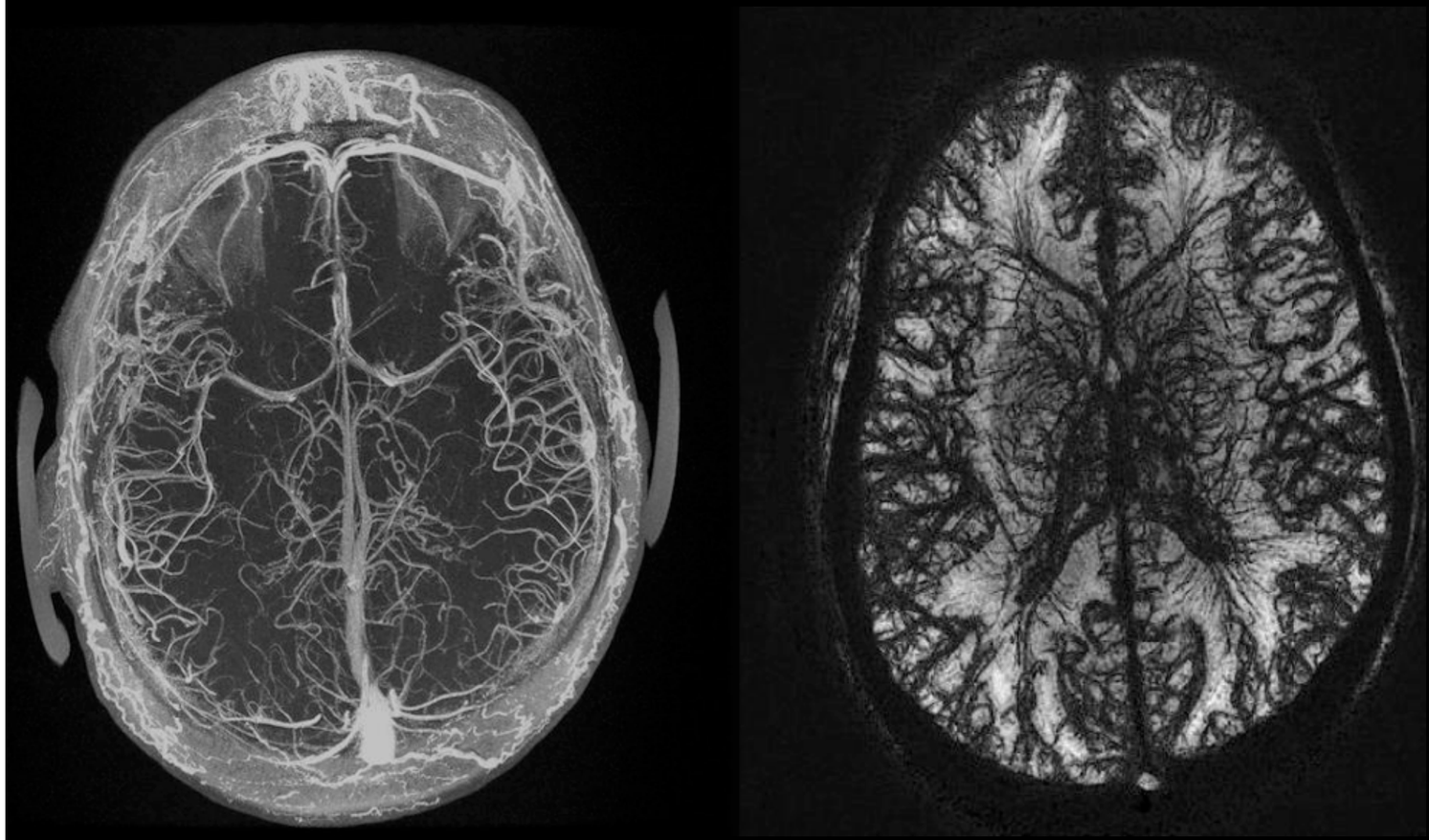
• Evaluated DNA damage seen in patients undergoing CT scanning

• Used ethnic specific iPSC-heart cells for studying ALDH2 genetic polymorphisms

• Demonstrated modeling of familial hypertrophic cardiomyopathy with disease-specific iPSCs

Radiological Sciences Laboratory (RSL)

The RSL comprises 11 faculty and approximately 90 graduate and postdoctoral trainees research staff and others devoted to advancing imaging technology for diagnostic, basic science and therapeutic applications within the department and in collaborations across campus and beyond. Our research topics include MRI, CT, Digital X-ray, ultrasound and imaging-guided therapy. In addition to its basic research, the RSL administers the Lucas MRI Service Center, which is in its 22nd year offering scan capabilities to the local and extended community.



Same sequence from a later echo showing pronounced T2* detail in the blood pool. Note the unique view of deep white matter vascular distributions. Acquired post-contrast using an FDA-approved iron-oxide particle (Ferumoxytol at 2mg/kg, off-label use). Thomas Christen, Samantha Holdsworth, G. Zaharchuk, Stanford Radiology

ACHIEVEMENTS

- Established a new Metabolic Imaging Center with MRI/PET scanner and 13C Spinlab hyperpolarizer, capable of concurrent acquisition of all three modalities. Initial study investigating Major Depression Disorder using radio-labeled 11C and fMRI to examine neural hyperactivity.

- Recruited new faculty member Jeremy Dahl, PhD and established ultrasound imaging lab at Porter Drive.

- Selected awards include: Kimberly Brewer, Jae Mo Park, Valentina Taviani: 2014 & 2015 ISMRM Junior Fellows. Kimberley Brewer: 2014 ISMRM Magna Cum Laude & Summa Cum Laude Merit Awards. Evan Levine: 2014 Best Poster Award at CBIS Symposium. Emily McWalter: NIH New Researcher Advocacy Award. Brian Hargreaves, Gary Glover, Norbert Pelc: Academy of Radiology Research Distinguished Investigators. Kim Butts Pauly: Fellow, AIMBE.

- The NIBIB-funded Center for Advanced MR Technology (PI Glover) was renewed for its 5th five year period by site visit in March 2015.

SECTION LEADERSHIP

Gary Glover, PhD
Kim Butts Pauly, PhD

SELECTED FUNDING

NIH 2 P41EB15891: Center for Advanced Magnetic Resonance Technology at Stanford (CAMRT)

NIH 5 T32CA00969523: Stanford Cancer Imaging Training (SCIT) Program

Multiple funding sources from Industry and Other Departments

SELECTED PUBLICATIONS

Variable spatiotemporal resolution three-dimensional Dixon sequence for rapid dynamic contrast-enhanced breast MRI. Saranathan, M; Rettmann DW, Hargreaves, BA; Jafi A. Lipson, IA; Daniel, BL J Magn Reson Imaging. 2014 Dec;40(6):1392-9. Featured cover paper.

Diffusion-weighted imaging with dual-echo echo-planar imaging for better sensitivity to acute stroke. Holdsworth SJ, Yeom KW, Antonucci MU, Andre JB, Rosenberg J, Aksoy M, Straka M, Fischbein NJ, Bammer R, Moseley ME, Zaharchuk G, Skare S. AJNR Am J Neuroradiol. 2014 Jul;35(7):1293-302.

The feasibility of assessing branched-chain amino acid metabolism in cellular models of prostate cancer with hyperpolarized [1-(13)C]-ketoisocaproate.Billingsley KL, Park JM, Josan S, Hurd R, Mayer D, Spielman-Sun E, Nishimura DG, Brooks JD, Spielman D. Magn Reson Imaging. 2014 Sep;32(7):791-5.

Ultrahigh-resolution imaging of the human brain with phase-cycled balanced steady-state free precession at 7 T. Zeineh MM, Parekh MB, Zaharchuk G, Su JH, Rosenberg J, Fischbein NJ, Rutt BK. Invest Radiol. 2014 May;49(5):278-8940 (6): 139.

Toward volumetric MR thermometry with the MASTER sequence. Marx M, Plata J, Butts Pauly K. IEEE Trans Med Imaging. 2015 Jan;34(1):148-55.

Bammer Neuroimaging Lab

Roland Bammer, PhD

Our research focuses on developing novel MRI acquisition and reconstruction methods for clinical neuroimaging. Currently, our research program concentrates on improving pediatric neuroimaging as well as similar studies on the adult side. We also provide support for Lucas Center users who are interested in advanced diffusion imaging, perfusion imaging or angiographic MRI applications. A major goal in our laboratory is to reduce motion- and distortion-sensitivity of MRI by development of sophisticated methods, such as stereo-vision and RF tracking in concert with real-time MRI. Motion correction can improve the diagnostic quality of MR images, reduce the number of repeat studies, and decrease or eliminate the need for sedation/anesthesia in small children.

ACHIEVEMENTS

• Maclaren J, Aksoy M, Bammer R. Contact-free physiological monitoring using a markerless optical system. Magn Reson Med. 2015 May 18.

• O'Halloran R, Aksoy M, Aboussouan E, Peterson E, Van A., Bammer R. Real-time correction of rigid body motion-induced phase errors for diffusion-weighted steady-state free precession imaging. Magn Reson Med. 2015 Feb; 73(2):565-76.

• Van AT, Aksoy M, Holdsworth SJ, Kopeinigg D, Vos SB, Bammer R. Slab profile encoding (PEN) for minimizing slab boundary artifact in three-dimensional diffusion-weighted multislab acquisition. Magn Reson Med. 2015 Feb;73(2):605-13.

Top row: Steve Leung, Patrick Ye, Taylor Webb, Ben Cohn, Ron Watkins; front row: Peji Ghanouni, Linsey Moyer, Rachelle Bitton, Aurea Pascal-Tenorio, Urvi Vyas, Make Marx, Hyo-Seon Yoon, Juan Plata, Kim Butts Pauly.

Focused Ultrasound (FUS) Lab

Kim Butts Pauly, PhD

The FUS Lab works on MR-guided Focused Ultrasound for treatments of a variety of disorders in the brain and body. We study how to deliver focused ultrasound safely and effectively through 1) MR techniques for guidance such as MR thermometry, MR-ARFI and MR-bone imaging, 2) ultrasound beam simulations for pretreatment planning, and 3) MR-assessment imaging. We also study ultrasound-based neuromodulation and BBB-opening with ultrasound.

ACHIEVEMENTS

• Dr. Urvi Vyas shared her work in MR-guided Focused Ultrasound with Vice President Joe Biden at the Focused Ultrasound Syposium, 2014.

• The BBC produced story on MR-guided Focused Ultrasound for Essential Tremor.

• Clinical translation of MR-guided FUS to treat pain produced remarkable patient benefits.

• Michael Marx received his PhD.

Jeremy Dahl, Carl Herickhoff, Dongwoon Hyun, You "Leo" Li.

Ultrasonic Imaging Research Laboratory

Jeremy Dahl, PhD

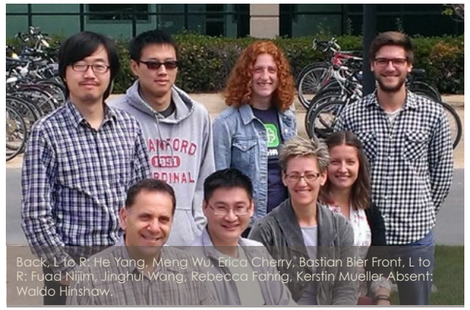
Our lab develops and implements ultrasonic beamforming methods, ultrasonic imaging modalities, and ultrasonic devices. Our current focus is on beamforming methods that are capable of generating high-quality images in difficult-to-image patients. These methods include B-mode and Doppler imaging techniques that utilize additional coherence information from the ultrasonic wavefields. We build these imaging methods into real-time imaging systems in order to apply them to clinical applications. We are also developing novel ultrasonic imaging devices, such as small, intravascular ultrasound transducers that are capable of generating high acoustic output.

ACHIEVEMENTS

• Developed a novel flow detection method with 50% greater sensitivity to flow than conventional methods.

• Achieved 20 micron displacement utilizing acoustic radiation force from a 1.4 mm cylinder, demonstrating the feasibility of ARFI imaging on IVUS-sized devices.

• Constructed a real-time (> 30 fps) ultrasound imaging system that implements a novel imaging modality to reduce image noise and improve ultrasound image quality.



Back, L to R: He Yang, Meng Wu, Erica Cherry, Bastian Bier Front, L to R: Fuad Nijim, Jinghui Wang, Rebecca Fahrig, Kerstin Mueller Absent: Waldo Hinshaw.

Advanced X-ray Imaging Systems Lab

Rebecca Fahrig, PhD

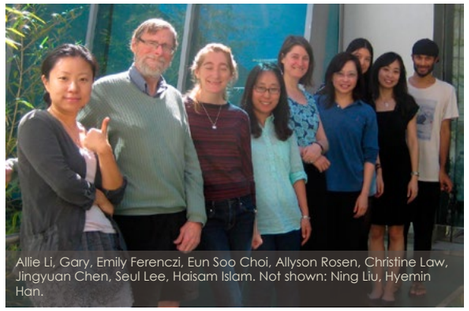
Our group conducts research with the broad goal of improving x-ray image quality, via both software and hardware approaches, to improve guidance of minimally invasive therapies. X-ray detector developments include a novel high-efficiency detector designed for MeV imaging, and an ultra-high-resolution, high-efficiency photon-counting detector for mammography and phase contrast x-ray imaging. Clinical translational investigations include 3D weight-bearing imaging of the knee, and 3D perfusion imaging of liver lesions.

This year has been a successful one regarding grant funding. NIH funding has been awarded for 2 projects: "Weight-Bearing Imaging of the Knee Using C-Arm CT" (R01) and "Charge Cloud Tracker: A High-Resolution Photon-Counting X-ray Detector" (R21).

ACHIEVEMENTS

• Dr. Jang- hwan Choi completed PhD on "Acquisition of 3D Knee Morphology under Weight-bearing Conditions using C-arm CT Scanner for the Assessment of Knee Disorders."

• Dr. Mihye Shin completed PhD on "Development and Evaluation of two Novel Instruments for X-ray Imaging."



Allie Li, Gary, Emily Ferenczi, Eun Soo Choi, Allyson Rosen, Christine Law, Jingyuan Chen, Seul Lee, Haisam Islam. Not shown: Ning Liu, Hyemin Han.

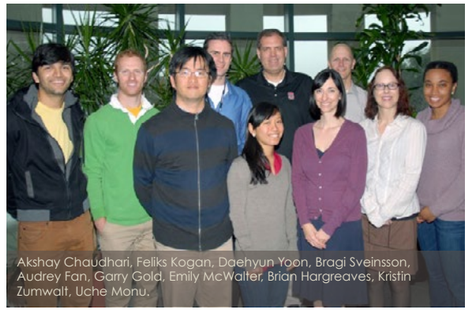
Functional Neuroimaging Laboratory

Gary Glover, PhD

The Functional Neuroimaging lab's research is directed, in part, towards exploration of rapid magnetic resonance imaging methods using spiral and other non-Cartesian k-space trajectories for mapping cortical brain function (fMRI). One fMRI contrast utilizes the hemodynamic response to altered brain metabolism invoked by various stimuli or in the resting state, with applications in the basic neurosciences as well as for clinical biomarkers. Challenges in developing these techniques include optimizing tradeoffs between sparse sampling, contrast to noise ratio, and temporal/spatial resolution, and in combining fMRI with other modalities, including positron emission tomography and electroencephalogrphy. We are very interested in mitigating confounds such as cardiac and respiration effects, and are also exploring neuromodulation with transcranial magnetic stimulation, transcranial DC stimulation and optogenetics.

ACHIEVEMENTS

- The NIBIB-funded Center for Advanced MR Technology (PI Glover) was renewed for its 5th five year period by site visit in March 2015.



Akshay Chaudhari, Feliks Kogan, Daehyun Yoon, Bragi Sveinsson, Audrey Fan, Garry Gold, Emily McWalter, Brian Hargreaves, Kristin Zumwalt, Uche Monu.

Joint and Osteoarthritis Imaging with Novel Techniques

Garry Gold, MD

The JOINT Lab's research is focused on improving imaging of musculoskeletal conditions including osteoarthritis. We would like to detect disorders at an early stage when intervention is more likely to be successful. Our work improves the accuracy of detection of musculoskeletal disease as well as functional imaging of bones, muscles, and joints under loaded conditions. Current projects include MR imaging of osteoarthritis, improved imaging around metal, and new methods of imaging the joint using weight-bearing CT. We are also exploring the use of gait retraining to treat osteoarthritis as well as two-photon microscopy of cartilage.

ACHIEVEMENTS

- Received a major NIH R01 award to study the development of Osteoarthritis
- Developed new software tools for assessment of tissue breakdown in the knee related to cartilage
- First direct measurement inertial forces in joints using phase contrast MRI
- Frist PET-MR trial of imaging of knee Osteoarthritis
- Studied cartilage material properties using T1p dispersion MRI
- Published consensus guidelines for use of imaging tools in the study of hip, knee, and hand Osteoarthritis

Bragi Sveinsson Evan Levine Uche Monu Feliks Kogan Umit Yoruk Hans Weber Manoj Saranathan Akshay Chaudhari Catherine Moran Brian Hargreaves Xinwei Shi.

Body MRI Research Group

Brian Hargreaves, PhD

Our research links basic science with clinical MRI and industry product development in an effort to provide improved techniques for patient care. One focus area is breast MRI, where high spatial-resolution imaging at high frame rates is needed to distinguish tumors based on perfusion differences. We also are developing high-resolution 3D methods to detect tumors based on limited water diffusion, in both breast and body imaging. Separately, we work on novel rapid and quantitative knee imaging approaches to characterize and study early osteoarthritis.

Our research lab has also been a leader in the development of robust MRI in the presence of metal, resulting in techniques to help assess complications with joint replacements, spinal fixation hardware or other metal devices.

ACHIEVEMENTS

- Developed non-invasive MRI guidance and temperature measurements for MR-guided Focused Ultrasound Surgery in patients who have implanted metal devices.
- Awarded 2 major grants for MRI assessment of complications near total joint replacements and developed interactive MRI methods that work in the presence of metal devices.
- Implemented robust, high-resolution whole-body MRI methods for PET-MR.
- Ongoing development and clinical utilization of high-resolution breast MRI techniques for earlier/more accurate detection of breast cancer.
- Continued development of new MRI methods to assess early osteoarthritis in knee tissues.

Jian Fu, Yuan Yao, Picha Shunhavanich, Sarah Divel, Scott Hsieh, Marlys LeSene, Norbert Pelc, and Paurakh Rajbhandary.

Inverse Geometry CT and Conventional CT

Norbert Pelc, ScD

The Pelc lab focuses on computed tomography. One major project currently underway is a multi-site project to demonstrate technology capable of achieving significant dose reduction. Our own focus is on the use of dynamic x-ray sources to personalize the x-ray illumination used for each study and on the design and performance requirements of photon counting x-ray detectors. We are also working on spectral CT and are studying the limits of iterative reconstruction. On the applications front, we are examining the accuracy and reproducibility of brain perfusion studies. At a high level, our goal is to improve the quality of CT images, reduce the radiation dose, and develop clinical applications.

ACHIEVEMENTS

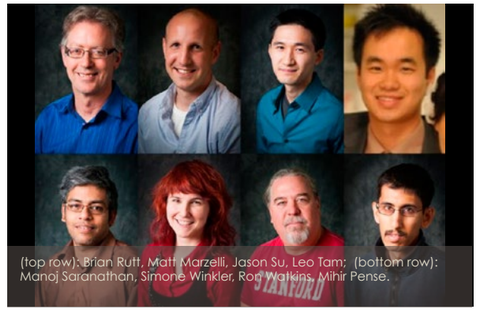
- We received a major U01 award from NIH for research in High Dose-Efficiency Computed Tomography.
- Dynamic pre-patient attenuators can reduce CT dose and improve material characterization with photon counting detectors.
- We explored the performance requirements for photon counting detectors and evaluated utility of depth segmentation.

Qiyuan Tian, Christoph Leuze, Grant Yang, Seul Lee, Jennifer McNab.

Laboratory for Ultra-High-Field MRI of Human Brain Microstructure

Jennifer McNab, PhD

The central mission of the McNab Lab is to develop magnetic resonance imaging (MRI) techniques that probe the structural and functional architecture of the human brain. This requires new MRI contrast mechanisms, strategic encoding/reconstructions schemes, brain tissue modeling and validation. Our current research is focused on the development of MRI pulse sequences and analysis strategies that capitalize on the benefits of ultra high field (7T) MRI and stronger and faster magnetic gradient technology. Specific neurological targets include cerebral cortical fiber patterns, axon diameters and density and high-resolution maps of resting state connectivity.


(top row): Brian Rutt, Matt Marzelli, Jason Su, Leo Tam; (bottom row): Manoj Saranathan, Simone Winkler, Ron Watkins, Mihir Pense.

Ultra-High-Field Magnetic Resonance Imaging Research Laboratory

Brian Rutt, PhD

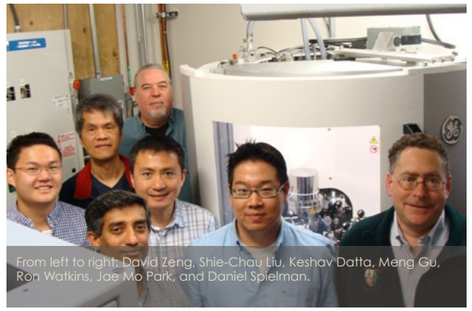
The overall goals of the Rutt Lab are to develop, optimize and exploit ultra high field (7T) whole body MRI in a variety of research applications, starting with the broad area of neuroimaging but progressing to other anatomical regions and applications. MR imaging at such high magnetic fields faces a number of significant technical challenges that have slowed its widespread application. The objectives of the group are to conceive, implement and apply novel strategies that solve these technical challenges, and then to develop methods that will enable routine high quality MR imaging at 7T. Our longer term aim is to employ these technical developments to study fundamental structural, physiological, metabolic and functional changes associated with important human diseases of the brain and eventually other anatomical regions.

ACHIEVEMENTS

- Established the impact of gradient strength on MRI estimates of axon diameter.
- Determined optimal q-space sampling for diffusion spectrum imaging.
- Demonstrated the contribution of lipids to MRI contrast through MRI evaluation of cleared tissue.
- Developed a pipeline for comparing MRI and CLARITY 3D histology.
- Developed MRI method for mapping cortical fiber patterns.
- Developed MRI method for mapping eccentricity of brain tissue compartments.

ACHIEVEMENTS

- Developed new parallel transmit MRI methods for 7T MRI.
- Developed new "focused RF" methodology for targeted hyperthermia.
- Developed new thermoacoustic methods for mapping absorbed power in MRI.
- Designed, analyzed and built high performance head gradient technology.
- Developed new sequences and post-processing methods that delineate thalamic nuclei and characterize T1 relaxation.
- Demonstrated benefits of 7T MRI in studying Alzheimer disease.


From left to right: David Zeng, Shie-Chau Liu, Keshav Datta, Meng Gu, Ron Watkins, Jae Mo Park, and Daniel Spielman.

The Spielman Laboratory for MRS and Multinuclear Imaging

Daniel Spielman, PhD

Magnetic resonance imaging (MRI) and spectroscopy (MRS) provide a wealth of information spanning spatial scales ranging from gross anatomy to biochemical processes. The Spielman laboratory focuses on the acquisition of spectroscopic data providing an in vivo window into metabolism. Our current research efforts are on using 1H and 13C spectroscopy to measure neuroenergetics and neurotransmitter function in the human brain and metabolic imaging of small animal models using hyperpolarized 13C MRS. Applications of his work include diagnosis and understanding of neurodegenerative and psychiatric disorders, cancer detection and treatment monitoring, and metabolic studies of the brain, heart, and liver.

ACHIEVEMENTS

- Acquired the first simultaneous in vivo PET and hyperpolarized 13C MRS study of a prostate cancer model using GE Healthcare's new 3T PET-MR system.
- Developed new approach for measuring neuroenergetics and neurotransmitter cycling throughout the human brain using 13C MRS.
- Identified in vivo liver metabolic changes in Nonalcoholic steatohepatitis (NASH) using hyperpolarized 13C MRS.
- Developed hyperpolarized 13C MR spectroscopic imaging method to detect early response to therapy for glioma treated with Avastin.
- Developed improved in vivo 1H MRS methods for measuring GABA, the primary inhibitory neurotransmitter in the human brain.


Greg Zaharchuk, MD, PhD, Audrey Fan, Samantha Holdsworth, Sun-Won Park, Wesley Zun, Salil Soman, Wendy Ni, Chris Hemond, Thomas Christen, Hesam Jahaniani, Christian Federau, Mike Moseley.

Clinical Center for Advanced Functional Neuroimaging (CAFN)

Michael Moseley, PhD
Greg Zaharchuk, MD, PhD

CAFN develops and implements powerful MRI tools to understand the basic foundations of the human brain, map neural anatomical and vascular microstructures via functional network connectivities, and thus diagnose and treat complex neurological diseases in individual patients. We do so by fostering many interdepartmental and international collaborations all focused on bringing cutting edge of MR imaging to our patients. Our tools include high-resolution diffusion mapping of abnormal brain development and loss of function, rapid and non-contrast blood flow and oxygenation mapping, time-resolved connectivity of the brain's many networks, and resolving the brain's inherent CSF and flow dynamics for intracranial pressure mapping. In an era of brain research, our mission is to improve investigation and treatment of disorders of the nervous system.

ACHIEVEMENTS

- Refined arrays of novel non-contrast agent CBF blood flow methods for clinical diseases of the CNS.
- Created and applied a clinical time-resolved method to map the brain's neural circuitry and metabolic oxygenation in patients with CNS disease.
- Collaborated with LPCH Children's Hospital to use plural image processing to map 8 different brain functions from a single scan.
- Clinical adoption of our high-resolution diffusion protocols all motion-corrected for advanced diffusion MRI.
- Implemented functional network mapping to perform a full personalized patient brain network analysis within 60 seconds.

Sponsored Research
New Awards 2014-15

NIH

2014	Bammer/Fleischmann	R21 (MPI)	Cardiac Diffusion Imaging for Heart Transplant Surveillance
2014	Chin, Frederick T	S10	Small animal PET system for molecular imaging of rodents and primates
2015	Chin, Frederick T	R01	Cross-Species Multi-Modal Neuroimaging to Investigate GABA Physiology in Fragile X Syndrome
2015	Dahl, Jeremy	R01	Clutter Suppression in Echocardiography Using Short-Lag Spatial Coherence Imaging
2015	Dahl, Jeremy	R01	Improved Image Quality of Focal Liver Lesions Using the Coherence of Ultrasound
2015	Daldrup-Link, Heike E	R01	Personalized Whole Body Staging for Children with Cancer: A Solution to the Conundrum of Long-Term Side Effects from CT and PET-CT Scans
2015	Daldrup-Link, Heike E	R21	Tracking Mesenchymal Stem Cells with MR Imaging: Clinical Translation
2015	Daldrup-Link/Rao	R21 (MPI)	Development of Novel Activatable Theranostic Nanoparticles for combined Cancer MR
2015	Datta, Gajanana Keshava	F31	Improved metabolic imaging using hyperpolarized 13C MR Substrates
2014	Demirci, Utkan	R01	Minimizing the role of cryoprotectant toxicity for cryopreservation
2015	Demirci, Utkan	R01	Novel disposable microchips for HIV-1 viral load
2015	Fahrig, Rebecca	R01	Weight-Bearing Imaging of the Knee Using C-Arm CT
2015	Fahrig, Rebecca	R21	Charge Cloud Tracker: A High-Res, High-DQE, Photon-Counting, Energy-Discriminating X-ray Dectector
2015	Gambhir, Sanjiv Sam	R01	Optimization of an activatable photoacoustic agent to image thyroid cancer
2015	Gambhir/Felsher	R01	Modeling and Predicting Therapeutic Resistance of Cancer
2015	Gold, Garry Evan	R01	Osteoarthritis: Quantitative Evaluation of Whole Joint Disease with MRI
2014	Hargreaves, Brian Andrew	R01	Comprehensive MRI near Total Joint Replacements
2014	Hargreaves, Brian Andrew	R01	Quantitative 3D Diffusion and Relaxometry MRI of the Knee
2015	Ghanouni/Hargreaves	R21 (MPI)	MR Guided Focused Ultrasound Surgery near Metal Implants
2015	James, Michelle	R21	New PET imaging agent for monitoring treatment response in Alzheimer's disease
2014	Jokerst, Jesse	K99	A Therapeutic Tool for Ultrasound-Guided Stem Cell Therapy
2014	Kothapalli, Sri Rajasekhar	K99	Transrectal Ultrasound and Photoacoustic Imaging of Prostate and Molecular Imaging Approaches
2014	Massoud, Tarik F	R21	Druggable p53 misfolding in cancer: A novel in vivo molecular imaging biosensor
2015	Pelc, Norbert J	U01	High Dose Efficiency CT System
2015	Rao/Felsher	T32 (MPI)	Cancer-Translational Nanotechnology Training Program (Cancer-TNT)
2015	Rubin, Daniel L	R01	Qualification and Deployment of Imaging Biomarkers of Cancer Treatment Response
2015	Spielman, Daniel Mark	R01	Imaging Brain Metabolism Using MRS of Hyperpolarized 13C-Pyruvate
2015	Spielman, Daniel Mark	R21	Novel MRS methods for measuring brain energetics and neurotransmitter cycling
2014	Spielman/Recht	R01 (MPI)	Metabolic Therapy of GBM Guided by MRS of Hyperpolarized 13C-Pyruvate
2014	Vasanawala/J Pauly	R01 (MPI)	Development and Translation of High Performance Receive Arrays for Pediatric MRI
2014	Vasanawala, Shreyas	R01	Rapid Robust Pediatric MRI
2014	Zaharchuk, Greg	R01	Imaging Collaterals in Acute Stroke (iCAS)
2014	Zaharchuk, Greg	R21	Oxygenation Fingerprinting with MRI for Ischemic Stroke
2014	Zavaleta, Cristina	K22	A New Strategy for Cancer Detection using Raman Spectroscopy with Nanoparticles
2015	Zavaleta, Cristina	R21	A New Raman-based Strategy to Identify Tumor Margins and Guide Surgical Resection

SUBCONTRACTS

2014	Churko, Jared	U of Maryland	Characterization of Cardiomyocytes derived from Human Induced Pluripotent Cells by Single-Cell RNA-sequencing
2015	Churko, Jared	U of Maryland	Real-time PCR to assess induced pluripotent stem cell pluripotency and differentiation potential
2015	Demirci, Utkan	Beth Israel	Malaria screening in resource-poor settings using a simple, power-free, cell phone-friendly device
2014	Demirci, Utkan	Brigham & Women's	A Novel Microfluidic HIV-1 Co-Culture Assay to Quantify Latent Reservoirs
2014	Demirci, Utkan	Brigham & Women's	Microfluidic PCR Method to Identify and Characterize HIV-Infected Single

*Listings include only new awards during 2014 and 2015 (YTD 8/1/15)

2015	Demirci, Utkan	U of Illinois	Rapid Disease Diagnostics using Photonic Crystal Enhanced Antigen Biomarker
2015	Demirci, Utkan	U of Louisville	Magnetic Cellular Assembly and Microfluidic Conditioning for Generation of Functional Cardiac Tissue
2014	Gambhir, Sanjiv Sam	Fred Hutch Cancer Rsch	Ovarian Cancer Early Detection Using Microbubble Contrast Enhanced Ultrasound (CEUS) Targeting Tumor Associated Angiogenesis
2014	Gambhir, Sanjiv Sam	Scripps Rsch Institute	Clinical validation of the HD-CTC fluid biopsy for the early detection of lung cancer
2015	Mallick, Parag	U of So. California	L2K2R2: Learn to Read to Know, Know to Learn to Read
2014	Matsa, Elena	U of Maryland	Single-cell droplet digital PCR to assess allele-specific knockdown of mutated mRNA in patient-specific hiPSC-cardiomyocytes carrying dilated and hypertrophic cardiomyopathy mutations
2015	Napel, Sandy	Mass Gen Hospital	Informatics Tools For Optimized Imaging Biomarkers For Cancer Research & Discovery
2014	Paulmurugan, Ramasamy	Mayo Clinic	Non-Invasive Imaging of Progenitor Cell Fate in the Ischemic Myocardium
2014	Plevritis, Sylvia Katina	Georgetown Univ.	Comparative Modeling: Informing Breast Cancer Control Practice & Policy
2014	Plevritis, Sylvia Katina	Mass Gen Hospital	Comparative Modeling of Lung Cancer Control Policies
2014	Rao, Jianghong	U of Tennessee	Fluorescent probes for Real-time Monitoring Mycobacterium tuberculosis Extrapulmonary Infection in vivo
2015	Rubin, Daniel L	Mass Gen Hospital	CTIIP - Pilot Challenge
2014	Spielman, Daniel Mark	U of Maryland	Dynamic Metabolic Imaging of Hyperpolarized Substrates
2014	Vasanawala, Shreyas	U of Wisconsin	Development and validation of quantitative MRI biomarkers of iron overload
2015	Wintermark, Max	Medical Univ of So. Carolina	POSITIVE trial
2015	Wintermark, Max	Medical Univ of So. Carolina	Stroke Trials Network National Data Management Center (NDMC)
2014	Wintermark, Max	U of Cincinnati	NSTN National Clinical Coordinating Center
2015	Wintermark, Max	UCSF	The vascular effects of infection in Pediatric Stroke (VIPS) Study

OTHER GOVERNMENT FUNDED PROJECTS

2015	Demirci, Utkan	NSF	Optimization of sperm sorting in microfluidic channels using coarse-grained modeling
2015	Demirci, Utkan	NSF	CAREER: Noninvasive fields for directed 3D microgel assembly for tissue engineering
2014	Fahrig, Rebecca	Dept of Army	A New Quantitative 3D Imaging Method for Characterizing Spray in the Near-field of Nozzle Exits
2015	Gambhir, Sanjiv Sam	Dept of Defense	Improved Ovarian Cancer Detection Using Combined Ultrasound and Photoacoustic Imaging
2015	Rao, Jianghong	Dept of Army	PET Imaging Heparanase Activity in Metastatic Prostate Cancer in Tumor Xenografts

INDUSTRY FUNDED PROJECTS

2015	Cheng, Zhen	GE Healthcare	A Novel PET Probe for PET-MR Early Detection of Parkinson's Disease
2015	Chin, Frederick T	Piramal Imaging SA	[68Ga]RM2 ([68Ga]-Bombesin) Manufacturing Agreement
2015	Chin, Frederick T	Piramal Imaging SA	Implementation of Revised Clinical-grade [18F]FSPG Radiochemistry for IND approval
2015	Daniel, Bruce Lewis	Intelligent Fiber Optic Sys.	MRI Compatible Fiber Optically Sensorized Biopsy Needles for Oncological Applications
2015	Fahrig, Rebecca	Siemens Medical Solutions	Phase Contrast
2014	Fahrig, Rebecca	Siemens Medical Solutions USA, Inc.	Combined Investigations : zeego flexibility and image quality improvement Phase II
2015	Fleischmann, Dominik	GE Healthcare	PET-MR for Myocardial Tissue Characterization: Technical Development for the Prediction of Arrhythmia in Patients with Dilated Cardiomyopathy
2014	Fleischmann, Dominik	Siemens Medical Solutions USA, Inc.	Siemens CT Project - Optimization of Injection Protocols
2014	Gambhir, Sanjiv Sam	Calithera	Evaluation of FSPG as a biomarker in the prediction of response to CB-839-aglutaminase inhibitor in tissue culture and in pre-clinical models
2014	Ghanouni, Pejman	InSightec	A Post Approval Registry: ExAblate Treatment of Metastatic Bone Tumors for the Palliation of Pain

*Listings include only new awards during 2014 and 2015 (YTD 8/1/15)

2015	Ghanouni, Pejman	InSightec	A Continued Access Study to Evaluate the Effectiveness and Safety of ExAblate Transcranial MRgFUS Thalamotomy Treatment of Medication Refractory Essential Tremor Subjects
2015	Ghanouni, Pejman	InSightec	A Phase IV Post Approval Clinical Study of ExAblate Treatment of Metastatic Bone Tumors for the Palliation of Pain
2014	Glover, Gary H	GE Healthcare	Development of Magnetic Resonance Imaging at 3T strength PET-MR magnets
2014	Gold, Garry Evan	GE Med Systems	Advanced MR Applications Development - Tiger Team Years 7 & 8
2014	Hargreaves, Brian Andrew	GE Med Systems	Magnetic Resonance Imaging near Metallic Implants
2015	Iagaru, Andrei	Bayer Healthcare Pharma.	Combined "One Stop Shop" NaF/FDG PET-MR Evaluation of Response to Xofigo in mCRPC Patients
2014	Iagaru, Andrei	GE Healthcare	Comparison of PET Image Reconstruction Protocols
2015	Iagaru, Andrei	Genentech, Inc.	Zr-89 PET Scans
2015	Iagaru, Andrei	Piramal Imaging SA	[68Ga]RM2 ([68Ga]-Bombesin) PET-MR Imaging of patients with biochemically relapsed prostate cancer and equivocal conventional imaging findings
2015	Kothary, Nishita N.	Siemens Corporate Research	Combined Investigations: zeego flexibility and image quality improvement
2014	Levin, Craig	Siemens Corporate Research	Integrated readout circuit for time-of-flight positron emission tomography
2014	Lipson, Jafi Alyssa	Hologic, Inc.	Contrast-Enhanced Digital Mammography (CEDM) vs Contrast-Enhanced Breast MRI (CE-MRI) in Patients with Known Breast Cancer (BI-RADS 6)
2015	Marks, Michael P	MicroVention, Inc.	HDE application for Low-Profile Visualized Intraluminal Support Device (LVIS and LVIS Jr.)
2014	Mittra, Erik S	Piramal Imaging SA	An Open-Label Study of the Efficacy of 18F-FSPG PET-CT in Subjects With Intracranial Cancers
2015	Paulmurugan, Ramasamy	Sci-Engi-Medco Solutions Inc	Dual Targeted Human Beta Defensin for Improving Chemotherapy
2015	Pauly, Kim Butts	GE Healthcare	Study of Neuromodulation using Focused Ultrasound with Concurrent fMRI
2014	Pelc, Norbert J	Philips Healthcare	Spectral CT
2014	Pelc, Norbert J	Samsung	Research on Stationary CT Imaging Architecture for Ultra-fast CT Scanning
2014	Rubin, Daniel L	GE Healthcare	RadLex Playbook-based Dose Optimization and Protocol Review
2015	Rutt, Brian	Bell Biosystems, Inc.	Single Cell Spatiotemporal and Functional Reporting using Magneto-Endosymbionts
2014	Rutt, Brian	GE Healthcare	Development of an insertable head gradient coil with order-of-magnitude performance increase
2014	Rutt, Brian	Sanofi US Services, Inc.	Novel 7T MRI methods to assess hippocampal and thalamic pathology with correlation to cognitive impairment in MS
2014	Spielman, Daniel Mark	GE Healthcare	The Imaging and Mitigation of Oxidative Stress
2014	Stolowitz, Mark L	Labcyte Inc.	High Throughput Biomarker Verification by MALDI-MS
2014	Vasanawala, Shreyas	Bayer Healthcare Pharma.	Open-label, multi-center study to evaluate safety, efficacy, and plasma gadolinium concentrations after an intravenous injection of 0.1 mL/kg body weight Eovist/Primovist for enhanced magnetic resonance imaging of the liver in children 0 to 2 months of age
2015	Vasanawala, Shreyas	GE Med Systems	Wireless Receiver Coil Transponders for MRI
2014	Willmann, Juergen Karl	Bracco Dx, Inc.	A Pilot Clinical Trial Using BR55 US Contraxt Agent to Assess Prostate Cancer by Molecular Imaging of VEGFR2
2015	Willmann, Juergen Karl	GE Healthcare	Real-time Fused Hyperpolarized MRS/PET/Molecular Ultrasound Imaging for Improved Diagnosis of Prostate Cancer
2015	Willmann, Juergen Karl	Philips Healthcare, N.A.	Clinical 3D Contrast-Enhanced Ultrasound for Treatment Monitoring in Oncology
2014	Willmann, Juergen Karl	Siemens Medical Solutions USA, Inc.	Introduction of Ultrasound Contrast Imaging and Quantitative Elastography into Clinic
2014	Wintermark, Max	Silk Road Medical	Comparing DW-MRI imaging studies before and after treatment for carotid atherosclerotic disease
2014	Zaharchuk, Greg	GE Healthcare	Comparison of 18F FDG PET-CT to PET-MR
2015	Zaharchuk, Greg	GE Healthcare	PET-MR Advanced Research and Development Project

FOUNDATION AND PROFESSIONAL SOCIETY AWARDS

2014	Daldrup-Link, Heike E	The MSK Transplant FD	Imaging Immune Responses to Stem Cell mediated Bone Repair
2015	Demirci, Utkan	Epilepsy FD	Disposable Chips to Measure Antiepileptic Drug Serum Concentrations at POC
2015	Ghanouni, Pejman	FUS Surgery FD	Lumbar Back Pain

*Listings include only new awards during 2014 and 2015 (YTD 8/1/15)

2014	Hanneman, Katherine Alison	RSNA	Combined positron emission tomography-magnetic resonance imaging for the diagnosis of cardiac sarcoidosis
2015	Iv, Michael	Musella FD	Using ferumoxytol-enhanced MRI to assess tumor associated macrophages in human glioblastoma multiforme
2014	Lan, Feng	AHA	Improve risk assessment and disease management of familial hypertrophic cardiomyopathy using patient-specific iPSC
2015	Moseley, Michael E.	ISMRM	A 5 minute motion-corrected pediatric brain protocol
2015	Ong, Sang Ging	AHA	Modulating the Interaction of Exosomes from Host Myocardium to Transplanted Stem Cells in Ischemic Heart Diseases
2015	Pauly, Kim Butts	FUS Surgery FD	FUSF Global Internship
2015	Rubin, Daniel L	ECOG R&E FD	ECOG-ACRIN Network Group Operations Center
2014	Rubin, Daniel L	RSNA	NIBIB/DOD IAA RadLex Playbook "Expedited Development of Radiology Lexicon
2014	Rubin, Daniel L	RSNA	Medical Image Sharing Through a Patient-Controlled Exchange System
2015	Soh, Hyongsok Tom	Morgridge Institute	Midwest Progenitor Cell Consortium
2015	Srinivasan, Ram	AHA	A Brain-Machine Interface for Recovery of Reaching Movements Following Stroke
2014	Wang, David S.	SIR FD	Ultrasound and microbubble-mediated therapeutic microRNA modulation of hepatocellular carcinoma
2015	Winkler, Simone Angela	Burroughs Wellcome	Combined RF-Shim coil Development for Ultra High-Field Magnetic Resonance Imaging
2015	Zeineh, Michael	Doris Duke Charitable Fd	The role of iron and inflammation in Alzheimer's disease: from ex vivo to in vivo

STANFORD INTERNAL AND OTHER FUNDING

2015	Chin, Frederick T	Stanford BIO-X	A Novel "Trigger and Release" Chemical Strategy for Imaging Tumor Hypoxia in Vivo
2015	Fahrig, Rebecca	Stanford - Coulter FD	Charge Cloud Tracker: A High-Res Photon-Counting X-ray Dectector
2015	Pauly, Kim Butts	Stanford - Coulter FD	Sensor-Enabled ultrasound Probes for Volumetric Image Acquisition and Interpretation: Proof For Concept in Pediatric Appendicities
2014	Pitteri, Sharon	UC Office of President	Imaging, Genomics, and Glycoproteomics for Cancer Detection
2014	Rao, Jianghong	Texas A&M	Application of Imaging to development of tuberculosis interventions
2015	Rubin, Daniel L	France-Stanford Center	iCBIR - Interactive Content-Based Image Retrieval for real-time decision support in radiology
2015	Spielman, Daniel Mark	Stanford Bio-X	In vivo Metabolic Imaging of Senescent Cells Using Hyperpolarized 13C MRS

Radiology Summary Statistics

187
Radiology Faculty
All Inclusive

Top 10
Residency Training
US News & World Report 2014-15

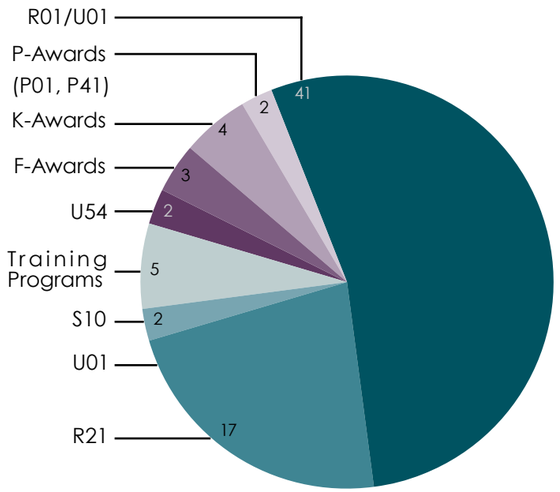
NIH Rank #3
NIH rank according to Academy of Radiology Research, acadrad.org, FY14

208
Radiology trainees, 2015 (Fellows, Residents, Postdocs, Students, Visitors)

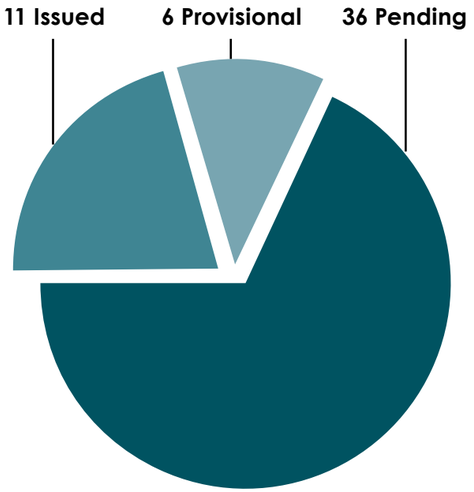
211
Total Number of Active Sponsored Projects FY14

5
Distinguished Investigators Academy of Radiology Research, 2014-15

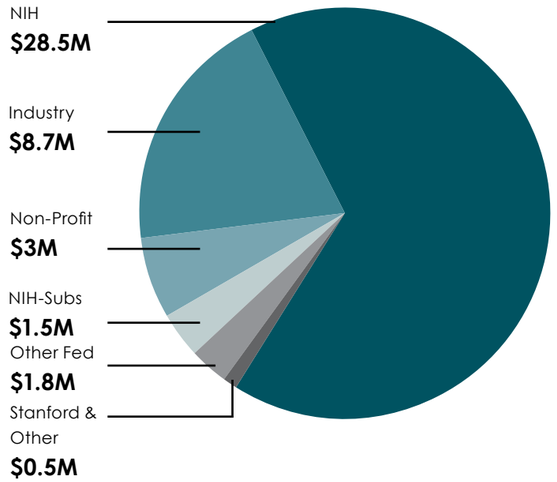
NIH Award Types



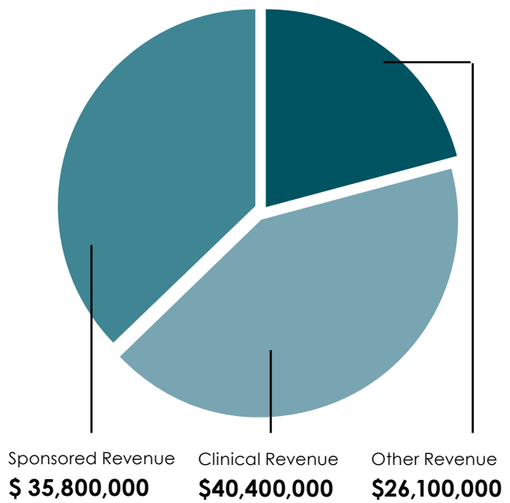
Patents (FY 10-15): 53



Research Funding FY15*
$43,908,344 (directs and indirects)

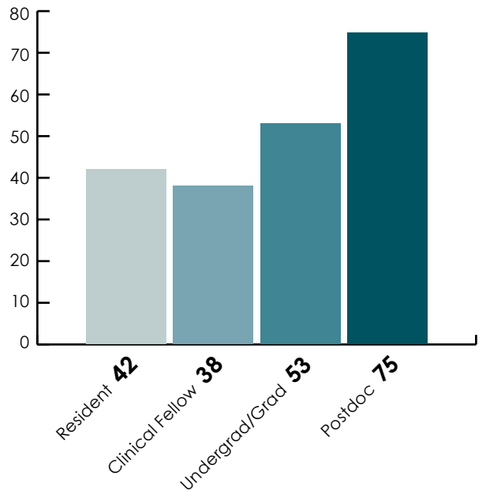


Budgeted Revenue FY16
$102,300,000

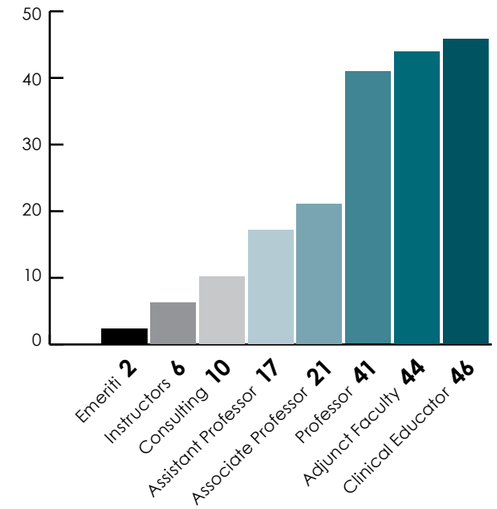


* Total Sponsored Research awarded 2015 (9//1/14 - 8/1/15)

Trainees: 208



Faculty: 187



Thank You For Your Generous Support

Stanford Department of Radiology thanks the following foundations for their generous support of our research in the imaging sciences including technology development and solutions for the early detection, monitoring, and treatment of disease.

The Canary Foundation

The Wallace Coulter Foundation

The Doris Duke Charitable Foundation

The Epilepsy Foundation

Focused Ultrasound Surgery Foundation

The Ben and Catherine Ivy Foundation

The Musculoskeletal Foundation

Sir Peter Michael Foundation

We also thank our generous Industry Partners for their ongoing support.

If You Would Like to Support Our Department...

If you would like to learn more about ways to support any area of research or training in the Stanford Department of Radiology, please feel free to contact any of the following members of the department.

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CANARY CHALLENGE

www.canarychallenge.com

The Annual Canary Challenge ride took place September 26, 2015. Thank you to everyone who joined family, friends and colleagues as a rider or volunteer for this event. This year, the Canary Challenge attracted about 1000 riders and volunteers who assembled bright and early Saturday morning to support the ride and raise funds for the early detection of cancer. The event, organized by the Canary Foundation, was by any measure a resounding success and raised $1,138,000 to support cancer research at the Stanford Cancer Institute and the Canary Center at Stanford.

Plan to meet your friends next September for the 2016 Canary Challenge, an amazing and extremely rewarding annual event.

See you in September for the 2016 Canary Challenge!

http://radiology.stanford.edu/about/annualreport/

Ultrasound is a complementary imaging modality for detection of mammographically occult breast cancers, especially in patients with dense breast tissue. Diagnostic accuracy of ultrasound in these patients can be significantly improved using contrast agents targeted at molecular signatures on the tumor neovasculature. In a large scale immunohistochemcical staining analysis of human tissues, it was found that B7-H3 is differentially expressed in breast cancer–associated vascular endothelial cells compared with normal, benign, and precursor lesions.

Breast Cancer Detection by B7-H3-Targeted Ultrasound Molecular Imaging.
Bachawal SV, Jensen KC, Wilson KE, Tian L, Lutz AM, Willmann JK.
Cancer Res. 2015 Jun 15;75(12):2501-9. doi: 10.1158/0008-5472. CAN-14-3361. Epub 2015 Apr 21.
PMID:25899053