

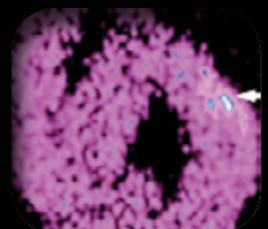
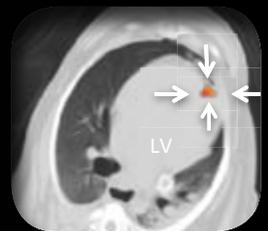
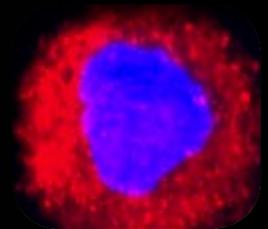
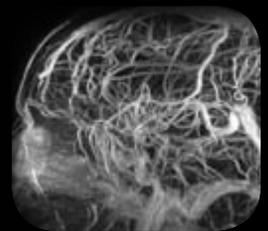
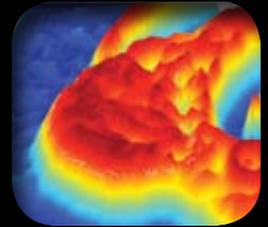


Stanford Molecular Imaging Scholars Program

An NIH Training Program

Sanjiv Sam Gambhir, MD, PhD, Program Director

Craig Levin, PhD, Co-Program Director





Stanford Molecular Imaging Scholars (SMIS) Program

An NIH Training Program

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Program Overview

The Stanford Molecular Imaging Scholars (SMIS) program is a diverse training program bringing together more than thirteen Departments, predominantly from the Stanford Schools of Medicine and Engineering, in order to train the next generation of interdisciplinary leaders in molecular imaging. Oncologic molecular imaging is a rapidly growing area within molecular imaging which combines the disciplines of chemistry, cell/molecular biology, molecular pharmacology, physics, bioengineering, imaging sciences, and clinical medicine to advance cancer research, diagnosis and management.

The goals of SMIS are to train postdoctoral fellows through a diverse group of over 40 basic science and clinical faculty mentors representing 8 program areas, incorporating formal courses in molecular imaging, molecular pharmacology, cancer biology, cancer immunology, virology, and gene therapy, with a clinical component including hematology/oncology rounds.

Program Design and Requirements

SMIS fellows will be recruited into a three-year program to complete coursework and research with at least two complementary mentors. Clinical exposure will take place in the second year. The program requires fellows to (1) complete a minor focus in specialized coursework including one mandatory molecular imaging course and two elective courses selected from the following: molecular basis of cancer, animal virus/host interactions, gene therapy, cellular and molecular pharmacology, and tumor immunology, (2) complete a major focus through a mentored research project, and (3) complete a significant grant preparation to help gain experience and confidence in the grant application process.

Involvement of fellows in all aspects of research conferences is required and essential. This includes attending various research conferences such as Molecular Imaging Program at

Stanford (MIPS) Monthly Seminar Series, MIPS/Nuclear Medicine Grand Rounds, and Chemical and Systems Biology lectures. Fellows are also required to attend or present at the weekly MIPS Journal Club. Additional conferences are available and fellows are encouraged to attend based on their interests and schedules. All fellows and mentors will be expected to attend quarterly dinner meetings where fellows will be given an opportunity to present on their research, both orally and by poster.

Faculty

The Training Committee will assign to incoming fellows at least two mentors selected to guide their intended research experience based on their research focus stated in their application and their interview. In matching the fellow to their two mentors, the Training Committee will also provide recommendation for courses to be taken for a particular fellow.

The program provides opportunities for vertical integration of multiple technologies/approaches. To place guided tracks for trainees, faculty research interests are organized into eight program areas.

Qualifications

Potential SMIS trainees will have already obtained their PhD and/or MD from a Nationally Accredited University. Applicants must be either a U.S. citizen or permanent resident to apply. Exceptional applicants from non-U.S. Universities will also be considered but must still meet all other requirements. Up to three years of support is available. Funding is available for postdoctoral stipend, supplies, and travel.

Application

Applicants to the SMIS program will be evaluated based on five criteria including the following:

Chemistry of Molecular Probes

Zhen Cheng, PhD
Hongjie Dai, PhD
Michael Lin, MD, PhD
Jianghong Rao, PhD
Paul Wender, PhD

In Vivo Molecular Imaging

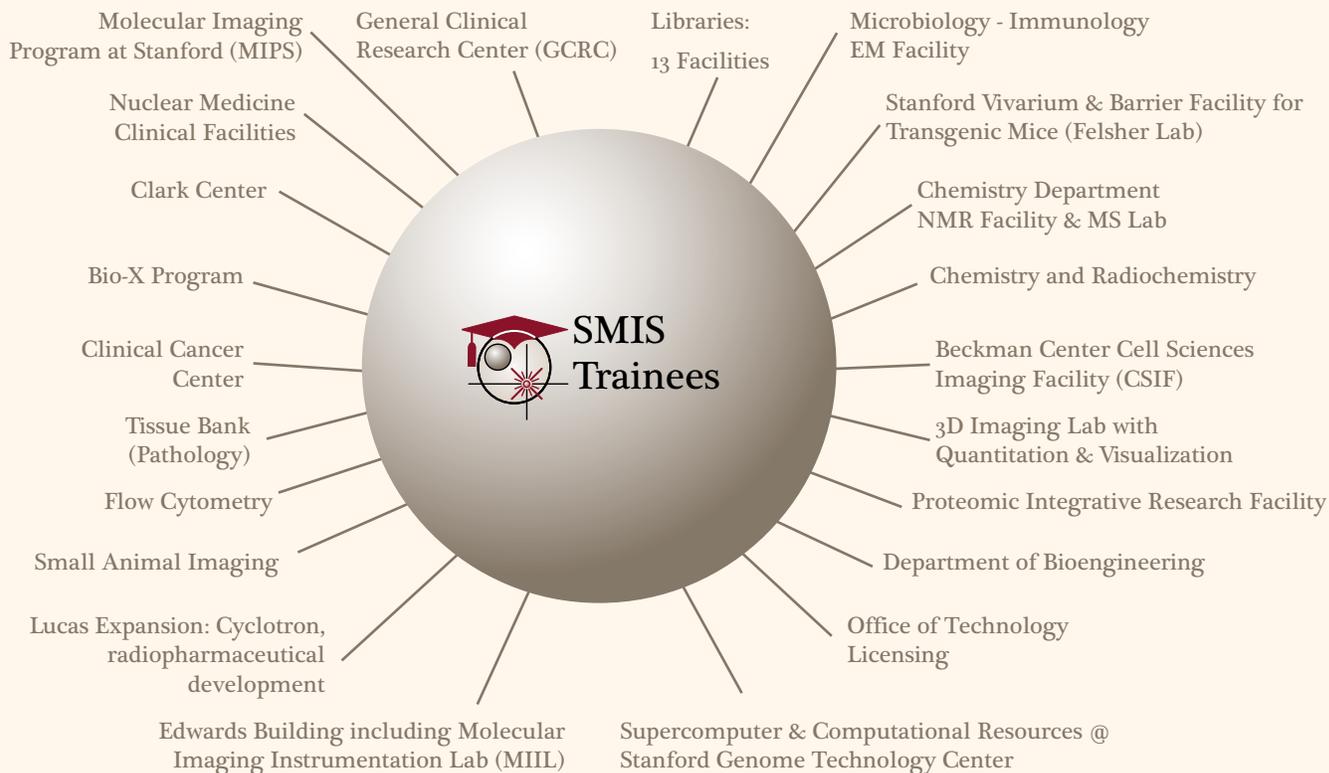
Sandip Biswal, MD
Francis Blankenberg, MD
Jennifer Cochran, PhD
Christopher Contag, PhD
Sanjiv Sam Gambhir, MD, PhD
Edward Graves, PhD
Lawrence "Rusty" Hofmann, MD
David Paik, PhD
Ramasamy Paulmurugan, PhD
Brian Rutt, PhD
Juergen Willmann, MD
Joseph Wu, MD, PhD

Molecular/Cell Pharmacology

Helen Blau, PhD
Christopher Contag, PhD
Sanjiv Sam Gambhir, MD, PhD
Michael Lin, MD, PhD
Garry Nolan, PhD
Ramasamy Paulmurugan, PhD
Jianghong Rao, PhD

Resources and Facilities

Shown below are the many facilities that are available to the SMIS trainees.



1. Record of research achievement including publications
2. Three letters of recommendation
3. Merit of proposed research, in particular, its relevance to the mission of the SMIS program
4. Evidence of interdisciplinary work in previous research
5. Academic records including undergraduate and graduate GPA and GRE scores

The following application materials must be sent via email to the program coordinator:

1. Curriculum Vitae
2. Application form
3. Undergraduate/Graduate GPA and GRE scores
4. Three letters of recommendation
5. 1-page career goal statement

6. 2-page written research proposal describing a project in cancer imaging

Application Deadline

Please see web site (<http://mips.stanford.edu/grants/smis/>)

Contact Information

Sofia Gonzales

SMIS Program Coordinator

Tel: (650) 724-9139

Fax: (650) 721-6619

Email: sofias@stanford.edu

Web Site: <http://mips.stanford.edu/grants/smis/>

Therapeutic Applications in Cancer

Dean Felsher, MD, PhD
Sanjiv Sam Gambhir, MD, PhD
Michael Goris, MD, PhD
Edward Graves, PhD
Lawrence "Rusty" Hofmann, MD
Calvin Kuo, MD
Ramasamy Paulmurugan, PhD
Juergen Willmann, MD

Tumor Immunology/Biology

Steven Artandi, MD
Helen Blau, PhD
Matthew Bogyo, PhD
James Brooks, MD
Jennifer Cochran, PhD
Gary Fathman, MD
Dean Felsher, MD, PhD
Matthew Scott, PhD

Imaging Instrumentation

Kim Butts Pauly, PhD
Gary Glover, PhD
Edward Graves, PhD
Craig Levin, PhD
Michael Moseley, PhD
Sandy Napel, PhD
Norbert Pelc, ScD
Sylvia Plevritis, PhD
Brian Rutt, PhD
Mark Schnitzer, PhD
Daniel Spielman, PhD
Lei Xing, PhD

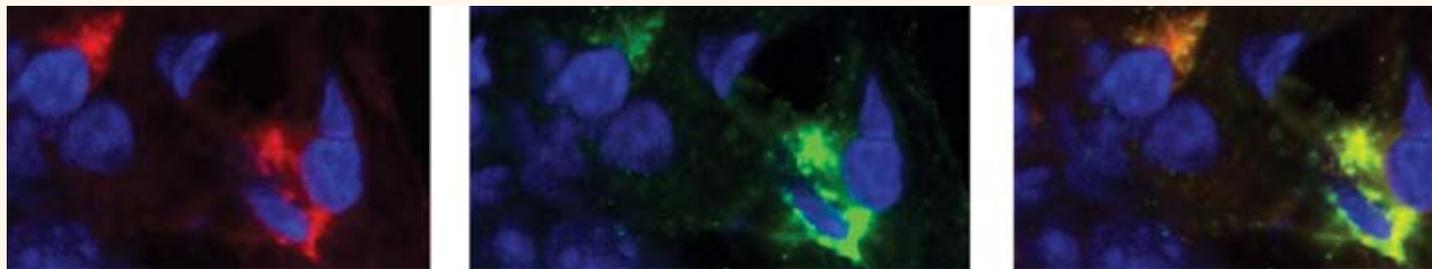
Related Program Project Grants

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

Sanjiv Sam Gambhir, MD, PhD, Principal Investigator

CCNE-T is a National Cancer Institute funded consortium composed of researchers from Stanford University, University of California, Berkeley, University of California at Los Angeles, University of Southern California, and Massachusetts Institute of Technology. The Center has two primary goals: to develop and validate nanotechnology-based tools and approaches so that we will be able to 1) detect cancers earlier and 2) predict which cancer patients will likely respond to a specific anti-cancer therapy and to monitor their response to therapy. Earlier detection of relevant cancers that are aggressive is a major challenge for the cancer community and hence earlier intervention will greatly improve patient outcomes. We are attacking this issue from two perspectives: 1) Develop clinically validated ultrasensitive and robust in vitro diagnostic nanosensors and imaging agents as well as imaging instrumentation, 2) Develop Circulating Tumor Cell and Cancer Stem Cell capture, sorting devices and use these devices to analyze captured cells at the single cell level with our comprehensive single cell analysis technologies under development. Our nanotechnology platforms are expected to become both early cancer detectors and reporters of therapeutic efficacy. By providing both sensitivity and specificity, we hope to be able to push the limits of earlier cancer detection and individualize patient monitoring so that a specific therapy for a given patient can be fully optimized.

Web Site: <http://mips.stanford.edu/grants/ccne-t/>



Heike Daldrup-Link, MD, PhD

In Vivo Cellular and Molecular Imaging Center (ICMIC)

Sanjiv Sam Gambhir, MD, PhD, Principal Investigator

The ICMIC, directed by Sam Gambhir, MD, PhD, established in 2005 recently began its second cycle (2010) with an overall vision that emphasizes the application and extension of molecular imaging to translational research and clinical applications. While the ICMIC continues with its original goals to 1) exploit molecular imaging by extracting basic information from animal models and pre-clinical studies, 2) provide new information on tumor diagnosis, initiation, progression, and responses to therapy, and 3) develop new imaging technologies, it now expands into clinical applications. The major goal for this new cycle is to provide the groundwork to integrate molecular imaging into translational studies that will move into clinical cancer applications. We will accomplish these goals by ensuring that basic scientists and clinician scientists are collaborating on ICMIC projects with well-defined end goals of clinical application. Additionally, ICMIC investigators form important scientific links to our NCI Funded CCNE U54 (Center for Cancer Nanotechnology Excellence) and NTR U54 (Network for Translational Research in Optical Imaging) programs through use of in vitro nanosensors and intraoperative microscopy, respectively. This will help to further accelerate our ability to bring important state-of-the-art solutions to cancer research and cancer patient care.

Web Site: <http://mips.stanford.edu/grants/icmic/2010-2015/>

Clinical Imaging

Scott Atlas, MD
Christopher Beaulieu, MD, PhD
Sanjiv Sam Gambhir, MD, PhD
Robert Herfkens, MD
Lawrence "Rusty" Hofmann, MD
Debra Ikeda, MD
R. Brooke Jeffrey Jr., MD
Michael McConnell, MD, MSEE
Andrew Quon, MD
Juergen Willmann, MD
Joseph Wu, MD, PhD

Nanotechnology

Zhen Cheng, PhD
Hongjie Dai, PhD
Sanjiv Sam Gambhir, MD, PhD
David Paik, PhD
Jianghong Rao, PhD
Robert Sinclair, PhD
Shan Wang, PhD

Related Program Project Grants

Early Cancer Detection Research Network (EDRN)

Sanjiv Sam Gambhir, MD, PhD, Principal Investigator

Prostate cancer is the most common non-cutaneous malignancy in U.S. males and is the second leading cause of cancer death. Since the mid-1980's, broad use of PSA testing of the U.S. male population has dramatically changed the number of men undergoing prostate biopsy, shifting diagnoses to predominantly early stage disease, and increasing the number of men undergoing treatment for localized prostate cancer. Along with this shift, death rates from prostate cancer have dropped significantly. However, two recent large-scale trials have called into question whether PSA screening is responsible for the drop in prostate cancer death rates and have suggested that PSA testing can lead to unnecessary and harmful biopsies, staging tests and treatments in a huge number of men. Without debating the relative merits of PSA screening, the post-PSA world has spawned significant and costly challenges (financial and human) that must be addressed in our quest for early detection and effective management. Our overall objective is to develop biomarkers that will reduce the impact of these costs. The work of this grant addresses a key unmet need in prostate cancer early detection and management: improving the screening process for this major epithelial cancer.

Overall Vision:

(A) We will combine state-of-the-art magneto-nanosensors for multiplexed protein detection using patient blood samples (in vitro) and (B) molecular ultrasound imaging with targeted microbubbles (in vivo) for the earlier detection and prognostication of prostate cancer. Long-term, a cost-effective strategy will be optimized with the merger of in vitro diagnostics followed by in vivo molecular imaging to optimize prostate cancer detection and management.

The Canary Center for Cancer Early Detection at Stanford fosters research programs that support two distinct and complementary strategies for prostate cancer detection and management:

1. Development of blood-based screens of prostate cancer diagnostic and prognostic biomarkers, and
2. Targeted imaging tests to detect and localize prostate cancers within the prostate gland.

The Canary Center is uniquely positioned for development of highly translational interdisciplinary research projects. The work that will be undertaken as part of this EDRN award seeks to capitalize on recent cutting-edge technology platforms developed by the PI and Co-Investigators funded under the CCNE and MIPS initiatives by applying them to the early detection and management of prostate cancer.

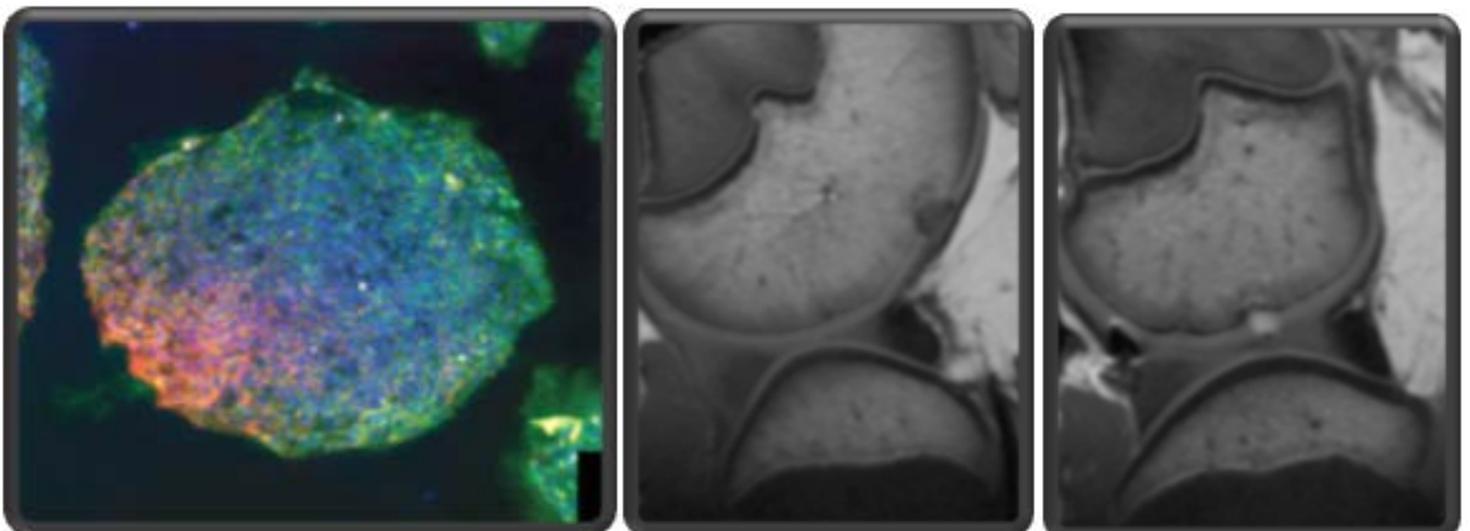
Our approach employs two complementary and synergistic projects:

Project 1 entails the adaptation of our newly-developed magneto-nanosensor for the multiplex analysis of blood markers for prostate cancer detection and prognostication.

Project 2 entails the adaptation of our latest ultrasound technology using tumor angiogenesis-targeted microbubbles to image prostate cancer.

Our goal is to combine these in vitro and in vivo platforms in an integrated approach that will lead to an accurate blood test for the early detection and prognostication of prostate cancer, along with an imaging strategy that will enable the accurate localization and biopsy of prostate lesions.

Web Site: <http://canarycenter.stanford.edu/grants/>



Imaging induced pluripotent stem cells: T1-weighted MR images of Gd-labeled iPS cells, implanted in cartilage defects

The Network for Translational Research in Optical Imaging (NTROI)

Christopher Contag, PhD, Principal Investigator

In this project, an interdisciplinary team of investigators at Stanford University, and partner institutions, is involved in a translational research program that combines imaging-technology development with biomarker discovery for the early detection of cancer in the esophagus. New imaging technologies have often been a key to the early detection and treatment of cancer. In this project, a unique endoscopic imaging tool that performs a noninvasive "optical biopsy" of esophagus tissues is being developed for detecting pre-cancerous conditions in the esophagus. The power of this tool, the miniature dual-axes confocal microscope, is that it images tissue structure with enough clarity and resolution to identify pre-cancerous tissues. This technology is also compatible with the use of optically-labeled biomarkers being developed in our group to specifically tag and identify pre-cancerous tissues. The combination of developing an advanced imaging technology, which greatly improves upon current in vivo imaging techniques, as well as the development of biomarkers specifically formulated for use with this imaging technology to locate pre-cancerous tissues, is an extremely powerful strategy.

Web Site: <http://ntroi.stanford.edu/>

The Stanford Center for Cancer Systems Biology (CCSB)

Sylvia K. Plevritis, PhD, Principal Investigator

The Stanford Center for Cancer Systems Biology (CCSB) is one of twelve National Centers for Systems Biology funded by the National Institute of Health and National Cancer Institute. The Center is located at Stanford University School of Medicine and represents a multi-disciplinary collaboration. The Stanford CCSB aims to discover molecular mechanisms underlying cancer progression by studying cancer as a complex biological system that is driven, in part, by impaired differentiation.

The overarching goal of the Stanford CCSB is to provide a better understanding of the differentiation and self-renewal properties of cancer that will enable us to identify molecular therapeutic targets and strategies to eradicate this disease, or at least, maintain it in a nonlethal state.

Web Site: <http://ccsb.stanford.edu/>

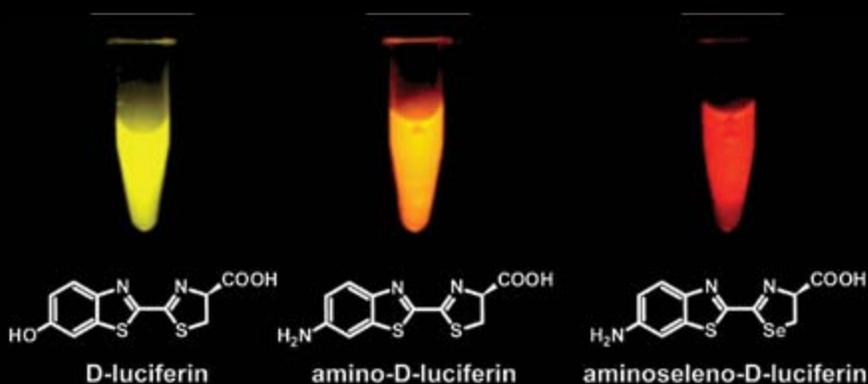
Center for Advanced Magnetic Resonance Technology at Stanford (CAMRT)

Gary Glover, PhD, Principal Investigator

The Center for Advanced Magnetic Resonance Technology at Stanford (CAMRT) was established as a National Research Resource in January 1995. The Center joins the Radiology Department's Richard M. Lucas Center for Imaging with those of the Electrical Engineering Department's Magnetic Resonance Systems Research Laboratory toward the common goals of developing innovative Magnetic Resonance Imaging and Spectroscopy (MRI/MRS) techniques for fundamental anatomic, physiologic and pathophysiologic studies, and serving the academic and scientific community through collaborations, education and access to Center facilities and resources.

Our mission is to develop innovative MR technology and make it widely available to users and students locally and nationwide. Core development is motivated by (1) core director's vision for technology advancement, (2) potential for future hypothesis-driven research, (3) medical need and potential health impact, (4) opportunity for collaboration and feedback from collaborators, (5) service application.

Web Site: <http://camrt.stanford.edu/>



Left: A selenium analogue of amino-d-luciferin, aminoseleno-d-luciferin, is synthesized and shown to be a competent substrate for the firefly luciferase enzyme. It has a red-shifted bioluminescence emission maximum at 600 nm (see scheme) and is suitable for bioluminescence imaging studies in living subjects.

Cover: background image is fluorescent images of NIH 3T3 fibroblasts that have been infected with a retrovirus encoding a fluorescent protein. Top to bottom images: 3D representation of a transverse microCT slice, feature-enhancing local phase map; Dynamic cerebral blood volume imaging (BVI) map; MR imaging of stem cell engraftments; Last two images provided by Joseph Wu, MD, PhD