BIOGRAPHICAL SKETCH

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NAME: Gambhir, Sanjiv Sam

eRA COMMONS USER NAME (credential, e.g., agency login): gambhir2

POSITION TITLE: Chair, Dept. of Radiology, Professor of Radiology, Bioengineering and Materials Science & Engineering

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Arizona State University, Tempe, Arizona	BS	05/1983	Physics
University of California, Los Angeles	PhD	08/1990	Biomathematics (MSTP)
University of California, Los Angeles	MD	05/1993	Medicine (MSTP)

A. Personal Statement

My laboratory is focused on the molecular imaging of living subjects with a particular emphasis on cancer imaging. We have developed numerous molecular imaging assays to interrogate fundamental cell/molecular events including cell viability, cell trafficking, gene expression, protein levels, enzyme activity, and protein-protein interactions. Several of my lab's assays have been clinically translated. We continue to develop and translate novel tracers for positron emission tomography (PET) including [18F]-FHBG, [18F]AraG, and [18F]-Knottin among others. We are also developing multimodality imaging strategies that involve photoacoustics, Raman, and other related strategies and applying them to the early detection of cancer. I have significant experience as the PI in multidisciplinary grants that involve multiple investigators including P50's, U54's, U01's, and R01's. As a result of these previous experiences, I am aware of the importance of frequent communication among project members and of constructing a realistic research plan, timeline, and budget. I am also happy to train the next generation of scientists to tackle the major problems in cancer research.

B. Positions and Honors

Positions and Employment

1994-95	Nuclear Medicine Fellow, UCLA Center for Health Sciences.
1994-00	Assistant Professor, Department of Molecular & Medical Pharmacology, Crump Institute for Biological Imaging & Department of Biomathematics, UCLA.
1994-00	Director, Computational & Communication Sciences Division, Crump Institute for Biological Imaging, UCLA School of Medicine.
1996-03	Clinical Attending, Nuclear Medicine, Center for Health Sciences, UCLA School of Medicine.
1998-03	Principal Investigator, DOE Laboratory of Structural Biology and Molecular Medicine, UCLA.
2000-03	Associate Professor, Department of Molecular & Medical Pharmacology, Crump Institute for Molecular Imaging & Department of Biomathematics, UCLA.
2000-03	Chief, Division of Molecular Medicine, Laboratory of Structural Biology and Molecular Medicine (LSBMM), Department of Energy (DoE) Labs, UCLA.
2001-03	Director, Crump Institute for Molecular Imaging, UCLA.
2001-03	Vice Chair, Department of Molecular and Medical Pharmacology, UCLA.
2003-11	Head, Nuclear Medicine, Stanford University School of Medicine.
2003-present	Professor, Department of Radiology and Bio-X Program, Stanford University.
2003-2017	Director, Molecular Imaging Program at Stanford (MIPS).
2018-present	Division Chief, Molecular Imaging Program at Stanford (MIPS).
2005-present	Professor, Department of Bioengineering (Affiliated).
2008-2017	Director, Canary Center at Stanford for Cancer Early Detection.

2011-present Chairman, Department of Radiology, Stanford University School of Medicine.
2016-present Director, Precision Health and Integrated Diagnostics (PHIND).

Honors
2004   Distinguished Basic Scientist of the Year Award, Academy of Molecular Imaging
2004   Doris Duke Distinguished Clinical Scientist Award
2005   Scientific Achievement Award, Society of Molecular Imaging
2005   Fellow of the American Institute for Medical and Biological Engineering
2006   Hounsfield Medal, Imperial College London
2006   Paul C. Aebersold Award, Society of Nuclear Medicine
2007   Nobel Conference – Organized and co-chaired Nobel symposium, "Watching Life Through Molecular Imaging," Stockholm, Sweden
2008   Tesla Medal, United Kingdom Royal College of Radiologists
2008   Elected to American Society of Clinical Investigation
2008   Elected to the Institute of Medicine (IOM) of the US National Academies
2009   Virginia and D.K. Ludwig Endowed Professorship
2011   George Charles de Hevesy Nuclear Pioneer Award, Society of Nuclear Medicine
2014   American Association for the Advancement of Science (AAAS), Fellow
2015   J. Allyn Taylor International Prize in Medicine
2016   National Academy of Inventors (NAI)
2018   Benedict Cassen Prize, Society of Nuclear Medicine and Molecular Imaging (SNMMI)
2019   Marie Sklodowska-Curie Award – Institute of Electrical and Electronics Engineers (IEEE)

C. Contributions to Science

1. My labs early work developed reporter gene/reporter probe technology for positron emission tomography (PET) including translation of these approaches for gene therapy and more recently cell therapies in humans. This work allows use of different reporter genes that encode for a reporter protein that traps a PET tracer. This work has had significant impact as it has allowed many investigators to use these strategies in animal models and is being used clinically for imaging cell trafficking. This is critical as immunotherapies evolve and the need to know the numbers, locations, and viability of immune cell components.

  a. S.S. Gambhir, E. Bauer, M. Black, Q. Liang, M.S. Kokoris, J. Barrio, M. Iyer, M. Namavari, M.E. Phelps, H.R. Herschman. A Mutant Herpes Simplex Virus Type 1 Thymidine Kinase Reporter Gene Shows Improved Sensitivity for Imaging Reporter Gene Expression with Positron Emission Tomography. Proceedings of the National Academy of Sciences (USA), 97(6): 2785-2790, 2000. PMCID: PMC16007
  b. Y. Yu, A.J. Annala, J.R. Barrio, T. Toyokuni, N. Satyamurthy, M. Namavari, S.R. Cherry, M.E. Phelps, H.R. Herschman, S.S. Gambhir. Quantification of Target Gene Expression by Imaging Reporter Gene Expression in Living Animals. Nature Medicine, 6(8): 933-937, 2000. PMID: 10932234
  c. K.V. Keu, T.H. Witney, S. Yaghoubi, J. Rosenberg, A. Kurien, R. Magnusson, J. Willams, F. Habte, J.R. Wagner, S. Forman, C. Brown, M. Allen-Auerbach, J. Czernin, W. Tang, M.C. Jensen, B. Badie, S.S. Gambhir. Reporter Gene Imaging of Targeted T Cell Immunotherapy in Recurrent Glioma. Science Translational Medicine, 9(373): eaag2196, 2017. PMCID: PMC5260938

2. My labs research then began to expand beyond PET reporter gene/reporter probe technology to allow for multimodality reporter gene imaging including with fluorescence and bioluminescence. I have over 15 patents in this area and our vectors are have been freely made available to over 200 laboratories all over the world. They allow for numerous applications in studying cancer biology in small animal models that were previously not possible.

  a. S. Bhaumik and S.S. Gambhir. Optical Imaging of Renilla Luciferase Reporter Gene Expression in Living Mice. Proceedings of the National Academy of Sciences (USA), 99(1): 377-382, 2002. PMCID: PMC117568
  b. P. Ray, H. Pimenta, R. Paulmurugan, F. Berger, M.E. Phelps, M. Iyer, S.S. Gambhir. Non-invasive Quantitative Imaging of Protein-Protein Interactions in Living Subject. Proceedings of the National Academy of Sciences (USA), 99(5): 3105-3110, 2002. PMCID: PMC122480
  c. P. Ray, A. De, J. Min, R. Tsien, S.S. Gambhir. Imaging Tri-Fusion Multimodality Reporter Gene

Expression in Living Subjects. <u>Cancer Research</u>, 64: 1323-1330, 2004. PMCID: PMC4154814

3. Most recently over the last 10 years my lab has been developing novel nanotechnologies as well as strategies for early cancer detection that are based on numerous technologies including Raman optical and photoacoustic molecular imaging. We have also started to integrate mathematical modeling into studying cancer biology so as to inform the needed experiments and use the experiments to improve the models. These approaches are also being translated for clinical applications of early cancer detection and hold significant promise for future cost-effective management of cancer patients.

   a. A. de La Zerda, C. Zavaleta, S. Keren, S. Vaithilingam, S. Bodapati, Z. Liu. J. Levi, B. Smith, T. Ma, O. Oralkan, Z. Cheng, X. Chen, H. Dai, B. Khuri-Yakub, S.S. Gambhir. Carbon Nanotubes as Photoacoustic Molecular Imaging Agents in Living Mice. <u>Nature Nanotechnology</u>, 3(9): 557-562, 2008. PMCID: PMC2562547

   b. M.F. Kircher, A. de la Zerda, J.V. Jokerst, C.L. Zavaleta, P.J. Kempen, E. Mittra, R. Huang, C. Campos, F. Habte, R. Sinclair, C.W. Brennan, I.K. Mellinghoff, E.C. Holland, S.S. Gambhir. A Brain Tumor Molecular Imaging Strategy Using a New Triple-Modality MRI-Photoacoustic-Raman Nanoparticle. <u>Nature Medicine</u>, 18(5): 829-34, 2012. PMCID: PMC3422133

   c. O. Vermesh, A. Aalipour, J. Ge, Y. Saenz, Y. Guo, S. Park, Y. Mitsutake, M. Bachmann, C.C. Ooi, J.K. Lyons, K. Mueller, H. Arami, A. Green, S.X. Wang, S.S. Gambhir. An Intravascular Magnetic Wire for High-Throughput Retrieval of Circulating Tumor Cells In Vivo. <u>Nature Biomedical Engineering</u>, 2: 696-705, 2018. PMCID: PMC6261517

Complete List of Published Work:
http://www.ncbi.nlm.nih.gov/sites/myncbi/sanjiv.gambhir.1/bibliography/44287268/public/?sort=date&direction=ascending

D. Additional Information: Research Support and/or Scholastic Performance
Ongoing Research Support

5P30 CA124435-12 (Artandi)   07/01/16 – 05/31/21
National Institutes of Health
Stanford Cancer Institute
Major Goal: To develop novel cancer imaging applications for cancer early detection and management.
Role: Investigator

n/a (PI-Gambhir)   06/01/16 – 05/31/21
Baseline Study LLC
The Baseline Study
Major Goal: To perform a longitudinal cohort study with detailed laboratory assessments in order to better understand the transition from health to disease

R01 CA199656 (PI-Gambhir)   09/01/16 – 08/31/21
National Institutes of Health
Nanoparticle-based Triple Modality Imaging and Photothermal Therapy of Brain Tumors
Major Goal: To use gold/silica nanoparticles as a way of optimizing imaging of tumor vs. normal tissues and for heating of tumor tissues as a treatment strategy.

U01 CA210020 (Iagaru)   05/01/17 – 04/30/22
National Institutes of Health
Molecular Imaging Methods for the Detection of Pancreatic Ductal Adenocarcinoma
Major Goal: We aim to drive biomarker development and validation efforts by establishing standardized bio-repositories of high risk individuals and evaluating two innovative molecular imaging approaches to detect pancreatic ductal adenocarcinoma (PDAC) much earlier than is currently possible.
Role: Co-Investigator

N/A (Dionne)   08/01/17 – 06/30/20
Stanford Catalyst of Collaborative Solution
A Microbial Culture Shift: Rapid Screening of Bacterial Bloodstream Infections and Antibiotic Susceptibility for Urban and Rural Clinical Care
Major Goal: Develop new ways to quickly detect bacterial infections in bodily fluids using Raman Optical Strategies.
Role: Co-PI

R01 CA208735 (Felsher)   09/07/17 – 07/31/22
National Institutes of Health
(PQ7) Multi-scale Analysis of Tumor Microenvironment Heterogeneity
Major Goal: The goal of this study is to understand tumor heterogeneity using multiple in situ analytic based measurements of tumor and host cells.
Role: Co-Investigator

SU2C-AACR-DT23-17 (Gambhir)   03/01/18 – 02/28/21
Boston University/Stand Up to Cancer
Intercept Lung Cancer Through Immune, Imaging & Molecular Evaluation-inTIME
Major Goal: Developing a combination of diagnostic tools, such as non-invasive nasal swabs, blood tests, and radiological imaging, to confirm whether lung abnormalities found on chest imaging are benign lung disease or lung cancer.

2R44 CA203090-02 (MPI-Unger/Gambhir)   03/15/16 – 06/30/20
NIH/NuvOx Pharma LLC
Pancreatic Ductal Adenocarcinoma Targeted Ultrasound Contrast Agent
Major Goal: This project is directed towards development of a molecularly targeted ultrasound contrast agent with potential to detect early stage disease while it is still curable. In Phase I of this project, we showed feasibility and in this Phase II of the project we will complete studies that would ready the contrast agent for clinical testing.

1R01 CA231582-01 (Negrin)   09/01/18 – 08/31/23
NIH
Imaging and Regulation of Immune Function in HCT
Major Goal: To study the biology of iNKT cells in the setting of HCT with the goal of developing an effective strategy to reduce the risk of GVHD while maintaining or enhancing GVT reactions and to develop strategies for their clinical translation in the setting of HCT.

Role: Co-investigator

n/a (Gambhir)   01/01/19 – 012/31/21
The Ben & Catherine Ivy Foundation
A New Strategy to Image Tumor Metabolism in GBM Patients to Help Optimize Anti-Tumor Therapies
Major Goal: To study PKM2 levels in living subjects with Glioblastoma in order to better understand key metabolic regulatory pathways pre and pot-treatment of Glioblastoma.

R01 EB028646 (Ferrara)   08/01/19 – 06/30/24
NIH
In vivo PET imaging of novel engineered AAVs informs capsid design
Major Goal: Novel adeno-associated viruses show the potential to enhance gene delivery and transfection by ~50 fold in mice, potentially facilitating urgently needed treatments. This proposal seeks to understand the mechanistic basis for this enhancement and to determine whether the methods can be extended to other species. We develop novel imaging methods required to understand these mechanisms and translate the therapies to large animals and, in the future, to human medicine.
Role: Co-investigator

1R01 AR074492-01A1 (Gold)   08/16/19 – 06/30/24
NIH
Development of Sodium Fluoride PET-MRI for Quantittative Assessment of Knee Osteoarthritis
Major Goal: The goal is to develop a sodium fluoride-based PET-MRI approach that can quantitatively assess knee osteoarthritis.
Role: Co-investigator

N/A (Gambhir)   07/22/19 – 07/22/22
United Therapeutics Corporation
Predicting therapeutic response through PET imaging of natural killer cells during Dinutuximab treatment of melanoma
Major Goal: This study will evaluate the predictive value of NK cell PET imaging when treating melanoma with Unitixin.

Completed Research Support
n/a (PI-Gambhir)   12/01/16 – 11/30/19
The Ben & Catherine Ivy Foundation
Glioma Imaging
Major Goal: To develop and validate strategies for the improved detection and treatment of glioblastoma

U01 CA188383 (MPI-Gambhir/Felsher)   09/16/14 – 08/31/19
NIH
Modeling and Predicting Therapeutic Resistance of Cancer
Major Goal: Developing mathematical model strategies married to animal experimentation to understand cancer therapy resistance.

n/a (Mackall)   03/31/16 – 12/31/19
The Parker Institute for Cancer Immunotherapy
The Parker Institute for Cancer Immunotherapy at Stanford School of Medicine
Major Goal: To study T-cell imaging in Graft vs. Host disease in patients.
Role: Co-Principal Investigator

n/a (PI-Gambhir)   03/09/18 – 01/31/20
Novocure, Inc.
Investigating Impact of TTFields on Chemotherapies and on Hypoxic Phenotypes
Major Goal: Testing tumor treating fields and drugs in cell culture to study tumor growth kinetics.

R01 EB019006 (PI-Gambhir)   05/01/15 – 02/29/20
National Institutes of Health
Optimization of An Activatable Photoacoustic Agent to Image Thyroid Cancer
Major Goal: To develop new smart probes that activate only at tumor site to lead to changes in photo acoustic imaging signal.