

**BIOGRAPHICAL SKETCH**

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NAME: Loening, Andreas Markus

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

POSITION TITLE: Assistant Professor of Radiology

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)	END DATE MM/YYYY	FIELD OF STUDY
Massachusetts Institute of Technology, Cambridge, MA	BS	06/1998	Electrical Science and Engineering
Massachusetts Institute of Technology, Cambridge, MA	MENG	02/1999	Electrical Engineering and Computer Science
Stanford University, Stanford, CA	PHD	06/2006	Bioengineering
Stanford University, Stanford, CA	MD	06/2008	Medicine
University of California, Los Angeles, Los Angeles, CA	Other training	08/2003	MSTP Training grant
University of Hawaii Residency Programs, Honolulu, HI	Other training	06/2009	Transitional Internship
Stanford University Medical Center, Stanford, CA	Resident	06/2013	Radiology
Stanford University Medical Center, Stanford, CA	Fellow	06/2014	Body MRI

**A. Personal Statement**

I am a practicing radiologist with sub-specialty training in body MRI and a clinical focus in prostate imaging. My research interests include applications of new contrast agents and contrast mechanisms to application in body MRI and PET/MR. My background in medical imaging research encompasses a large spectrum of work, including the development of software medical imaging analysis tools, development and evaluation of molecular imaging contrast agents in small animals and humans including agents specific to prostate cancer, and implementation and evaluation of pulse sequences for body MRI and PET/MR.

1. Minamimoto R, Hancock S, Schneider B, Chin FT, Jamali M, Loening A, Vasanawala S, Gambhir SS, Jagaru A. Pilot Comparison of <sup>68</sup>Ga-RM2 PET and <sup>68</sup>Ga-PSMA-11 PET in Patients with Biochemically Recurrent Prostate Cancer. J Nucl Med. 2016 Apr;57(4):557-62. PubMed PMID: [26659347](#).
2. Loening AM, Saranathan M, Ruangwattanapaisarn N, Litwiller DV, Shimakawa A, Vasanawala SS. Increased speed and image quality in single-shot fast spin echo imaging via variable refocusing flip angles. J Magn Reson Imaging. 2015 Dec;42(6):1747-58. PubMed PMID: [26094580](#); PubMed Central PMCID: [PMC4684814](#).
3. Deroose CM, De A, Loening AM, Chow PL, Ray P, Chatziioannou AF, Gambhir SS. Multimodality imaging of tumor xenografts and metastases in mice with combined small-animal PET, small-animal CT, and bioluminescence imaging. J Nucl Med. 2007 Feb;48(2):295-303. PubMed PMID: [17268028](#); PubMed Central PMCID: [PMC3263830](#).
4. Loening AM, Gambhir SS. AMIDE: a free software tool for multimodality medical image analysis. Mol Imaging. 2003 Jul;2(3):131-7. PubMed PMID: [14649056](#).

## B. Positions and Honors

### Positions and Employment

- 2013 - 2014 Contractor (Radiologist), VA Palo Alto Health Care System, Palo Alto, CA  
2014 - 2015 Clinical Instructor, Department of Radiology, Stanford University, Stanford, CA  
2015 - Assistant Professor of Radiology, Department of Radiology, Stanford University, Stanford, CA

### Other Experience and Professional Memberships

- 2009 - Member, Radiological Society of North America  
2014 - Member, International Society for Magnetic Resonance in Medicine  
2015 - Member, Society of Abdominal Radiology

### Honors

- 1999 - 2003 Medical Scientist Training (MSTP) Grant Award, University of California Los Angeles School of Medicine  
2001 - 2004 National Defense Science and Engineering Graduate (NDSEG) Fellowship, Department of Defense  
2004 - 2006 Stanford Bio-X Graduate Student Fellowship, Stanford University  
2004 - 2008 Medical Scientist Training (MSTP) Grant Award, Stanford University School of Medicine

## C. Contribution to Science

1. Enhanced single shot fast spin echo (SSFSE) imaging for clinical imaging: Part of my work focuses on optimizing and validating new pulse sequences that allow us to decrease the time required for MR imaging protocols and/or improve our diagnostic accuracy. This work has been driven by the desire to make routine body MRI examinations more diagnostic and comfortable for patients, as well as the constrained imaging time available at each bed position during whole body MRI and PET/MR studies. As a component of this work, I have worked extensively on parameter optimization experiments and clinical validation of a single shot fast spin echo (SSFSE) sequence that incorporates variable refocusing flip angles.
  - a. Hicks RM, Loening AM, Ohliger MA, Vasanawala SS, Hope TA. Variable refocusing flip angle single-shot fast spin echo imaging of liver lesions: increased speed and lesion contrast. *Abdom Radiol (NY)*. 2017 Jul 8;PubMed PMID: [28689221](#).
  - b. Loening AM, Litwiller DV, Saranathan M, Vasanawala SS. Increased Speed and Image Quality for Pelvic Single-Shot Fast Spin-Echo Imaging with Variable Refocusing Flip Angles and Full-Fourier Acquisition. *Radiology*. 2017 Feb;282(2):561-568. PubMed PMID: [27564132](#); PubMed Central PMCID: [PMC5283873](#).
  - c. Loening AM, Saranathan M, Ruangwattanapaisarn N, Litwiller DV, Shimakawa A, Vasanawala SS. Increased speed and image quality in single-shot fast spin echo imaging via variable refocusing flip angles. *J Magn Reson Imaging*. 2015 Dec;42(6):1747-58. PubMed PMID: [26094580](#); PubMed Central PMCID: [PMC4684814](#).
  - d. Ruangwattanapaisarn N, Loening AM, Saranathan M, Litwiller DV, Vasanawala SS. Faster pediatric 3-T abdominal magnetic resonance imaging: comparison between conventional and variable refocusing flip-angle single-shot fast spin-echo sequences. *Pediatr Radiol*. 2015 Jun;45(6):847-54. PubMed PMID: [25433510](#); PubMed Central PMCID: [PMC4449830](#).
2. AMIDE - a medical imaging data examiner: I initially began development in 2000, and continue to maintain, a freely available open source medical imaging software package called AMIDE. This work arose out of a need for software that could handle, fuse, and analyze multi-modality medical imaging data sets including PET/CT/MRI. Since its initial release in 2001, this program and subsequent versions have been made freely available so that it could have the most impact on advancing the field of imaging. This software application is used world-wide by thousands of individuals, has been cited in over 700 research publications, and its use has been acknowledged in countless additional articles.

- a. Loening AM. AMIDE. [revised 2014]. [Internet]. San Francisco, CA, USA: Sourceforge; 2001. Available from: <http://amide.sf.net>.
  - b. Loening AM, Gambhir SS. AMIDE: a free software tool for multimodality medical image analysis. *Mol Imaging*. 2003 Jul;2(3):131-7. PubMed PMID: [14649056](#).
3. Application of PET/MR to prostate cancer: I am intimately involved in several research projects utilizing PET/MR to evaluate prostate cancer. This has included work with new PET agents to identify recurrent prostate cancer, and evaluating combined PET agent approaches to identifying metastatic prostate cancer. More generally, I have worked on optimizing and validating new pulse sequences for the constrained imaging time available per bed in PET/MR imaging, including aiding in the design and analysis of studies looking at the efficacy and orthogonality of various pulse sequences in PET/MR.
- a. Minamimoto R, Sonni I, Hancock S, Vasanaawala S, Loening A, Gambhir SS, Iagaru A. Prospective Evaluation of <sup>68</sup>Ga-RM2 PET/MRI in Patients with Biochemical Recurrence of Prostate Cancer and Negative Conventional Imaging. *J Nucl Med*. 2017 Oct 30;PubMed PMID: [29084827](#).
  - b. Obara P, Loening A, Taviani V, Iagaru A, Hargreaves BA, Vasanaawala S. Relative value of three whole-body MR approaches for PET-MR, including gadofosveset-enhanced MR, in comparison to PET-CT. *Clin Imaging*. 2017 Sep 29;48:62-68. PubMed PMID: [29031209](#).
  - c. Minamimoto R, Hancock S, Schneider B, Chin FT, Jamali M, Loening A, Vasanaawala S, Gambhir SS, Iagaru A. Pilot Comparison of <sup>68</sup>Ga-RM2 PET and <sup>68</sup>Ga-PSMA-11 PET in Patients with Biochemically Recurrent Prostate Cancer. *J Nucl Med*. 2016 Apr;57(4):557-62. PubMed PMID: [26659347](#).
  - d. Minamimoto R, Loening A, Jamali M, Barkhodari A, Mosci C, Jackson T, Obara P, Taviani V, Gambhir SS, Vasanaawala S, Iagaru A. Prospective Comparison of <sup>99m</sup>Tc-MDP Scintigraphy, Combined <sup>18</sup>F-NaF and <sup>18</sup>F-FDG PET/CT, and Whole-Body MRI in Patients with Breast and Prostate Cancer. *J Nucl Med*. 2015 Dec;56(12):1862-8. PubMed PMID: [26405167](#).
4. Work with tissue culture and small animal models: I have been extensively involved in experimentation utilizing tissue culture and small animal models. This has included models of cartilage injury, metastatic cancer including prostate cancer, and cardiac function. Imaging methods utilized in this research have included small animal CT, PET, and bioluminescence.
- a. Chen IY, Gheysens O, Ray S, Wang Q, Padmanabhan P, Paulmurugan R, Loening AM, Rodriguez-Porcel M, Willmann JK, Sheikh AY, Nielsen CH, Hoyt G, Contag CH, Robbins RC, Biswal S, Wu JC, Gambhir SS. Indirect imaging of cardiac-specific transgene expression using a bidirectional two-step transcriptional amplification strategy. *Gene Ther*. 2010 Jul;17(7):827-38. PubMed PMID: [20237511](#); PubMed Central PMCID: [PMC2900530](#).
  - b. Deroose CM, De A, Loening AM, Chow PL, Ray P, Chatziioannou AF, Gambhir SS. Multimodality imaging of tumor xenografts and metastases in mice with combined small-animal PET, small-animal CT, and bioluminescence imaging. *J Nucl Med*. 2007 Feb;48(2):295-303. PubMed PMID: [17268028](#); PubMed Central PMCID: [PMC3263830](#).
  - c. Berger F, Lee YP, Loening AM, Chatziioannou A, Freedland SJ, Leahy R, Lieberman JR, Beldegrun AS, Sawyers CL, Gambhir SS. Whole-body skeletal imaging in mice utilizing microPET: optimization of reproducibility and applications in animal models of bone disease. *Eur J Nucl Med Mol Imaging*. 2002 Sep;29(9):1225-36. PubMed PMID: [12418463](#).
  - d. Loening AM, James IE, Levenston ME, Badger AM, Frank EH, Kurz B, Nuttall ME, Hung HH, Blake SM, Grodzinsky AJ, Lark MW. Injurious mechanical compression of bovine articular cartilage induces chondrocyte apoptosis. *Arch Biochem Biophys*. 2000 Sep 15;381(2):205-12. PubMed PMID: [11032407](#).
5. Molecular imaging in small animal models: I have worked on several projects involving small animal research using molecular imaging techniques. As a component of my dissertation project in the laboratory of Dr. Sanjiv (Sam) Gambhir, I studied and modified the bioluminescent protein Renilla luciferase to modify its characteristics. This work culminated in highly-engineered Renilla luciferase variants with greatly improved stability characteristics and red-shifted emission spectra. Due to their modifications these

variants are highly advantageous in both cell culture and in vivo imaging work, have been disseminated worldwide, and have led to 6 patents.

- a. Loening AM, Fenn TD, Wu AM, Gambhir SS. Consensus guided mutagenesis of Renilla luciferase yields enhanced stability and light output. *Protein Eng Des Sel.* 2006 Sep;19(9):391-400. PubMed PMID: [16857694](https://pubmed.ncbi.nlm.nih.gov/16857694/).
- b. Loening AM, Wu AM, Gambhir SS. Red-shifted Renilla reniformis luciferase variants for imaging in living subjects. *Nat Methods.* 2007 Aug;4(8):641-3. PubMed PMID: [17618292](https://pubmed.ncbi.nlm.nih.gov/17618292/).
- c. Loening AM, Fenn TD, Gambhir SS. Crystal structures of the luciferase and green fluorescent protein from Renilla reniformis. *J Mol Biol.* 2007 Dec 7;374(4):1017-28. PubMed PMID: [17980388](https://pubmed.ncbi.nlm.nih.gov/17980388/); PubMed Central PMCID: [PMC2700051](https://pubmed.ncbi.nlm.nih.gov/PMC2700051/).
- d. Loening AM, Dragulescu-Andrasi A, Gambhir SS. A red-shifted Renilla luciferase for transient reporter-gene expression. *Nat Methods.* 2010 Jan;7(1):5-6. PubMed PMID: [20038949](https://pubmed.ncbi.nlm.nih.gov/20038949/); PubMed Central PMCID: [PMC4431758](https://pubmed.ncbi.nlm.nih.gov/PMC4431758/).

Complete List of Published Work in My Bibliography:

<https://www.ncbi.nlm.nih.gov/myncbi/andreas.loening.1/bibliography/47926964/public/>

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

### **Ongoing Research Support**

n/a lagaru (PI) 09/30/16-09/29/19  
Department of Defense  
*68Ga Bombesin PET/MRI in Patients with Biochemically Recurrent Prostate Cancer and Noncontributory Conventional Imaging*  
Major Goal: Evaluate a new PET radiopharmaceutical for detection of recurrent prostate cancer.  
Role: Co-Investigator

n/a Gold (PI) 09/01/16-08/31/18  
General Electric Healthcare  
*PET-MRI Advanced Research and Development Project*  
Major Goal: This project seeks to make PET-MR a routine application in neurological, body, and musculoskeletal imaging.  
Role: Co-Investigator

n/a Hargreaves (PI) 04/01/16-03/31/18  
General Electric Medical Systems  
*Advanced MR Applications Development - Tiger Team Years 9 & 10*  
Major Goal: A program of five major projects aimed at advancing body/vascular/cancer MRI, musculoskeletal MRI (osteoarthritis and post-operative orthopedic imaging), pediatric MRI, neurovascular and functional MRI, and high-field (7T) MRI. This is a collaboration between GE researchers, MRI scientists and clinical radiologists.  
Role: Co-Investigator

### **Completed Research Support**

n/a Willmann (PI) 01/25/17-01/24/18  
Philips Healthcare  
*Correlating Liver Stiffness Measurements from Ultrasound Shear Wave Imaging To Magnetic Resonance Elastography*  
Major Goal: To assess reproducibility of liver stiffness measurements with shear wave imaging and correlate values with MR Elastography.  
Role: Co-Investigator