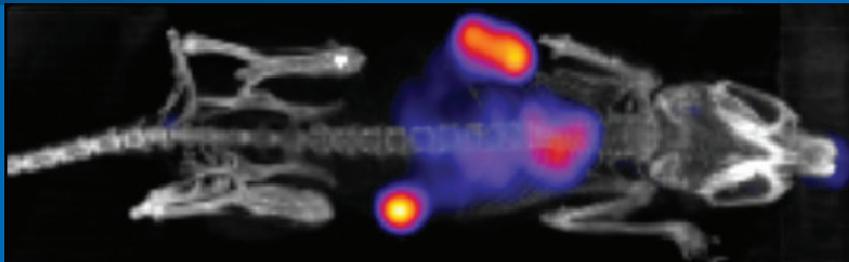


# Visiting Scholar Opportunity



## Small Animal Imaging Program/Laboratory Animal Science Program

### Cancer Challenge

Basic discovery research has revealed that cancer is a complex disease resulting from alterations in molecular pathways and cellular processes. Because therapeutic or prevention intervention can utilize these alterations for improved patient-specific diagnosis and treatment, it is imperative to employ technologies that can detect molecular changes.

Imaging studies have provided pre- and post-treatment response to therapy by analyzing anatomical tumor growth. With an ever-increasing number of molecules to investigate the tumor microenvironment, there is an important opportunity to integrate and exploit imaging techniques in the assessment of molecular processes in the preclinical setting.

Furthermore, imaging provides a unique methodology that enables researchers to extract spatially and temporally defined data in context. This capability is essential for understanding complex systems, and few are more complex than those found in cancer biology. Imaging and preclinical animal models, including xenografts, patient-derived xenografts, and genetically engineered mouse models, are integral to a research portfolio that furthers the understanding of tumor biology and the development of therapeutic interventions.

These functions and systems are one aspect in assisting the core mission of the Frederick National Laboratory for Cancer Research (FNLCR) in translation of “molecularly targeted therapies and diagnosis” from the preclinical setting into the clinic.

### Visiting Scholar Opportunities

The small-animal in vivo imaging community has achieved considerable progress in designing, developing, and implementing state-of-the-art, in vivo imaging and analysis techniques for preclinical research. However, challenges remain to (i) improve multimodality image fusion, such as ultrasound-nuclear-MRI; (ii) improve rapid quantitative visualization of large, preclinical datasets; (iii) improve and standardize quantitative assessment of therapeutic response; (iv) advance and standardize techniques for rapid in vivo cancer screening; (v) standardize in vivo and ex vivo correlation which can be

utilized in the preclinical and clinical setting; and (vi) develop and standardize animal handling and in vivo imaging techniques for assessment of therapeutic response.

The Visiting Scholars Program invites early and mid-career investigators to submit an Expression of Interest (<http://frederick.cancer.gov/VisitingScholarProgram.aspx>) describing how the candidate will contribute to one of the priority areas identified below.

### Small Animal Imaging Program Areas of Focus

The following areas are of interest and currently being addressed by the FNLCR Small Animal Imaging Program (SAIP):

1. Improve image visualization of large, preclinical datasets for rapid quantitative assessment of therapy.
2. Advance and standardize techniques for rapid in vivo imaging for pretreatment screening.
3. Develop and standardize ex vivo and in vivo correlation that can be utilized in the preclinical and clinical setting.
4. Develop, validate, and standardize animal-handling techniques for in vivo imaging, for the assessment of therapeutic response.

A major challenge in the clinical and preclinical community is the quantitative assessment of a response to therapy. Image analysis quantitates alterations in the tumor volume and the percent change in the uptake of a molecular imaging probe. However, the type of anesthetic, carrier gas, and temperature of the vivarium can alter the animals’ microenvironment, which in turn can modify the uptake of the molecular probe.

Improvement in the quantitative assessment to therapy in preclinical studies must also include the development, validation, and standardization of animal-handling and -monitoring techniques (internal temperature, along with pulmonary and/or cardiac function). Such improvements should also include the correlation of anatomical to molecular imaging and correlation of in vivo datasets to standard pathology and histochemistry ex vivo datasets.

Xenograft animal models have been the standard for preclinical assessment of response to therapy, and evaluation for enrollment into a treatment cohort is a simple tumor caliper measurement. With the advent of genetically engineered mouse models, the evaluation for enrollment is dependent on the ability to palpate and is likely to also require multiple rapid, prescreen imaging sessions. To reduce prescreening imaging costs, techniques such as elastography can be developed and standardized for high-throughput image acquisition with simple analysis.

Quantitative evaluation of a response to therapy requires several cohorts, each containing 15–20 mice, to obtain statistical significance. Evaluating this large dataset is time-consuming and costly. Methods should be developed and standardized for rapid, automated, quantitative analysis and visualization of large, preclinical datasets.



The Small Animal Imaging Program (SAIP), a program within the Laboratory Animal Sciences Program Directorate (LASP), FNLCR, SAIC-Frederick, provides in vivo imaging techniques to assist researchers in investigating intact complex biological systems; characterizing mouse models and molecular imaging probes for early detection and therapy; imaging disease-related biomarkers and pathways; monitoring tumors in vivo; and serial imaging for preclinical drug efficacy studies. The SAIP imaging facility incorporates several preclinical, noninvasive in vivo modalities and capabilities (3T MRI utilizing specially designed rodent coils,  $\mu$ PET/CT, nanoSPECT/CT, 40 MHz ultrasound and photoacoustics, bioluminescence, and 2D and 3D fluorescence scanners); high-end image processing work stations; several animal holding rooms; laboratories for surgery and cell work; access to expert veterinary care (Laboratory Animal Medicine, LASP); correlation to ex vivo pathological results (Pathology/Histotechnology Laboratory, LASP); image visualization development (Imaging and Visualization Group, Advanced Biomedical Computing Center); and animal models (LASP and the Center for Advanced Preclinical Research). Also located within SAIP is a research radiochemistry laboratory (operated by the Applied and Developmental Research Directorate) capable of producing novel nuclear and optical probes to complement targeted ultrasound and optical probes that are available for advanced molecular imaging.

## For more information, please contact:

**Dr. Joseph D. Kalen**

Phone: 301-846-5283

E-mail: [kalenj@mail.nih.gov](mailto:kalenj@mail.nih.gov)

To learn more about these programs, visit:

### The Small Animal Imaging Program:

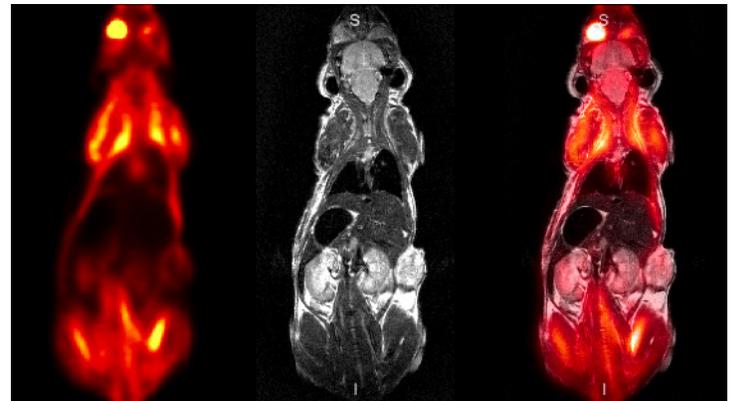
<http://frederick.cancer.gov/Science/LASP/Saip.aspx>

### The Visiting Scholars Program:

<http://frederick.cancer.gov/Careers/VisitingScholar/Default.aspx>

## Recent Articles

1. <http://www.ncbi.nlm.nih.gov/pubmed/23454247>
2. <http://www.ncbi.nlm.nih.gov/pubmed/21998674>



Coronal slice of  $[^{18}\text{F}]$ FDG/PET (left panel)-MRI (middle panel) and fused image (right panel).

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National Institutes of Health  
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