

TRANSLATIONAL IMAGING

Innovative Imaging Paradigms and Novel Model Development

Core and Affiliate Scientists in the Reproductive Sciences and Regenerative Medicine Unit have a long-standing commitment to provide *in vivo* imaging opportunities to the research community for the development and implementation of nonhuman primate models of human health and disease, and to explore translational imaging techniques for human applications. The program was initiated with ultrasound imaging with a major focus on the embryo/fetus and pregnancy, then expanded to bioluminescence/optical imaging and microPET specific to nonhuman primates. The acquisition of a state-of-the-art human clinical PET/CT scanner, the first hybrid unit with a 64-slice CT installed at a Primate Center, provides unique capabilities and resources for model development across all age groups. Innovative imaging applications includes the maternal/placental/fetal interface, fetal/pediatric congenital and acquired diseases, and cell trafficking across organ systems with the synthesis of new radioimmunoconjugates and radiolabeled antibodies using copper (^{64}Cu) and zirconium (^{89}Zr). Transformative total-body PET is available with the new EXPLORER PET imaging technology.

In vivo imaging capabilities are provided by faculty in the School of Medicine and College of Engineering, that are members of the Unit and the Multimodal Imaging Core. The Core has an established partnership with the Center for Molecular and Genomic Imaging, a campus facility that has a biomedical cyclotron and radiochemistry laboratory providing on-site synthesis of custom radiotracers for the Core. The Radiochemistry Research and Training Facility in Sacramento also provides logistics for bench-to-bed-side radiopharmaceutical conveyance and functions as a pipeline for commercialization of novel compounds. A range of studies focus on specialized molecular agents for use in a variety of disciplines such as oncology and regenerative medicine, to name a few. A spectrum of innovative tools, techniques, and assays are made available to investigators locally, regionally, and nationally, and through public-private partnerships.

Nonhuman Primate Models and *In vivo* Imaging includes:

- Models of neurodevelopmental disorders and obstructive renal disease
- Models of viral teratogens (e.g., CMV, Zika virus)
- Transplacental transport of cells and DNA (e.g., microchimerism)
- Stem/progenitor cell trafficking and biodistribution (autologous, allogeneic)
- Models of human cell transplant in the rhesus host (xenogeneic models)
- Innovative scaffolds and matrices for tissue engineering
- Gene transfer for IND-enabling studies for a range of childhood and inherited disorders
- Inflammation and imaging biomarkers and validation
- Maternal/placental/fetal, infant, and adult sample collection and pharmacokinetics / pharmacodynamics

Imaging Modalities and Related Assays and Tools

Imaging modalities include ultrasound imaging, optical / bioluminescence imaging (BLI), PET/CT, microPET, and transformative total-body PET. Also available are radiochemistry and pharmacokinetic analyses of radiopharmaceuticals. Faculty and staff work together in an integrated manner to implement the imaging goals of the program and to ensure investigators have the depth and breadth of imaging opportunities to conduct their research. The program has provided a means to incorporate non-invasive techniques and to use non-surgical ultrasound-guided methods to develop and study new monkey models of human disease. The Core also provides a range of assays including molecular techniques, ELISAs, and HPLC analyses to complement the imaging protocols provided.

