The Singapore Bioimaging Consortium (SBIC) is a Research Institute of the Biomedical Research Council under the Agency for Science, Technology and Research (A*STAR) in Singapore. SBIC is located in the heart of Biopolis, Singapore's premier international Research and Development hub for Biomedical Sciences.

OUR MISSION
As a Research institute, with a multidisciplinary team of biologists, physiologists, chemists, physicists, electrical/electronic engineers, computer scientists and clinicians, SBIC investigates human diseases which are major public health issues using molecular physiology and advanced bioimaging tools, in a translational and pivotal mode with the medical community and industrial partners (MNCs and SMEs). SBIC also works on strategic bioimaging projects, including the development of novel imaging probes.

As a National Consortium, SBIC aims to harness and coordinate existing imaging expertise and capabilities in Singapore, bringing together substantial strengths in the physical sciences and engineering with those in the biomedical and clinical sciences.

SBIC: AN INTEGRATED R&D ORGANIZATION
SBIC has built a competitive state-of-the-art multimodal bioimaging platform comprising 4 laboratories all located in the Helios Building at Biopolis:

- Laboratory of Molecular Imaging (LMI) with all modalities of in vitro and in vivo cellular imaging (optical imaging, MR spectroscopy and imaging, C-13 hyperpolarization, micro CT, nanoSPECT, microPET, MR-PET, NIRS-MRI, signal and image processing and analysis).
- Laboratory of Metabolic Medicine (LMM) for molecular physiology and metabolic phenotyping.
- Laboratory of Molecular Chemistry (LMC) for the development of chemical / biological probes, with advanced fluorescence chemistry and radiochemistry capabilities.
- Translational Imaging Industrial Laboratory (TIIL) for providing fee-for-service activities to external partners.

SBIC: A UNIQUE CAPACITY TO PROMOTE RAPID TRANSFERS OF RESULTS
The vertical integration of multidisciplinary competences from genes to humans within SBIC, and the extensive horizontal network of transverse collaborations across institutions and disciplines in Singapore and overseas, confers SBIC a unique capacity to promote rapid transfer of results in animal and human imaging research onto the clinical environment, to the immediate benefit of patients. It also ensures the development of financially sound and sustainable contractual research with industrial partners (pharmaceutical industry, food & nutrition, personal care). SBIC currently operates 5 joint laboratories with industrial partners under the form of public-private partnerships.

A leading multimodal bioimaging platform in Asia and in the world
A close interface with the industrial sector
A demonstrated ability to attract, develop and retain talents
A multidisciplinary R&D activity focusing on human diseases which are major public health issues
A high societal impact with rapid bench-to-bedside transfers in collaboration with the clinical community
A proven success in capturing economic opportunities in order to create value
ENABLING TECHNOLOGIES

MRI & MRS  Optical Imaging  Isotopic Imaging  Molecular & Cell Biology  Probe Synthetic Chemistry  Image Analysis & Processing

Selected Major Public Health Issues:
- Nutrition & Dysmetabolism
- Cardiovascular Diseases
- Focused Neurobiology

Personal Care & Wellness
- Skin
- Muscle

Innovation in Life Imaging
- Smart Molecular Probes
- Novel Imaging Methods
- Novel Imaging Devices

Aging

RESEARCH THRUSTS

Industrial engagement
Pharma, Nutrition, Personal Care Medical Devices

Clinical partnership

Joint Industrial Labs

Industrial Collaboration

SBIC Pre-clinical R&D
Principal Investigators

**Kishore BHAKOO, PhD**  
Director of Translational Imaging Industrial Laboratory  
Head of Translational Molecular Imaging Group

Prof. Bhakoo received a PhD in Neurochemistry of Stroke at Institute of Neurology, University of London in 1983. His interests lie in translational medicine using multimodal imaging in drug discovery pipelines. He worked at Ludwig Institute for Cancer Research, as Wellcome Research Associate at Royal College of Surgeons Unit at Institute for Child Health, as Staff Scientist and University Research Lecturer at University of Oxford, and as Group Head and Senior Lecturer at MRC Clinical Science Centre at Imperial College London. In 2009, he was appointed as Head of Translational Molecular Imaging Group at SBIC. He also holds external academic posts including Adjunct Associate Professor of Biochemistry and Orthopedic Surgery, NUS.

**BHUAN Prakash KN, PhD**  
Group Leader of Signal and Image Processing Group

Dr. Bhanu obtained his Ph.D. from Indian Institute of Science, Bangalore in 2002 and did his postdoctoral work at I2R, A*STAR. He later joined the Biomedical Imaging Laboratory, Singapore Bioimaging Consortium as Research Scientist in 2005. His Signal and Image Processing Group (SIP) focuses on the development of novel post-processing algorithms and tools by combining machine learning techniques, biological vision models and signal statistics for MRI/MRS, fat metabolism, neuroimaging and multi-modal imaging studies.

**CHANG Young-Tae, PhD**  
Head of Laboratory of Bioimaging Probe Development

Dr. Chang studied chemistry in POSTECH, Korea and received his Ph.D. in 1997. After postdoctoral work with Peter Schultz at UC Berkeley and the Scripps Research Institute, in 2000, he started his academic career as an assistant professor at New York University. In September, 2007, he moved to National University of Singapore and Singapore Bioimaging Consortium, and now he is a full professor and Head of Laboratory for BioimagingProbe Development (LBPD) at SBIC. LBPD is interested in bioimaging probe development using Diversity Oriented Fluorescence Probe Approach (DOFLA), and the current main focus is stem cells, neuron, Aβ oligomer, pancreatic beta cells, and activated macrophage.

**FU Yu, PhD**  
Group Leader of Brain Plasticity Group

Dr. Fu received his PhD from Stony Brook University in 2011 and postdoctoral training at UC San Francisco. His group focuses on understanding the mechanisms of brain plasticity and exploring strategies for improving brain plasticity in aging people and patients. His current research interests include the roles of different classes of neurons in visual cortical plasticity and the circuit mechanisms of modulating cortical functions by neuromodulators. His group is also developing molecular, genetic and viral tools for specifically tracing and manipulating different types of neurons, aiming to elucidate functions of neural circuits in certain animal behaviors.

**HAN Weiping, PhD**  
Deputy Director of SBIC  
Head of Laboratory of Metabolic Medicine

Dr. Han received his Ph.D. from Cornell University in 1996, and then worked at University of Pittsburgh and UT Southwestern Medical Center before joining SBIC. His research aims to understand the molecular basis of diabetes and diabetic complications, to discover and validate targets for drug development, and to develop mouse models for understanding and evaluation of therapeutic interventions. His laboratory uses molecular genetics and physiology techniques to analyze genetically modified animals and cells.

**Philip LEE, PhD**  
Group Leader of Functional Metabolism Group

Dr. Lee received his PhD from NUS in 2010 and completed his postdoctoral training at SBIC. Dr. Philip Lee has keen interests in discovering and understanding the role of metabolism in disease pathology. He takes advantage of the arsenal of imaging modalities and transgenic animal technology to study metabolic alterations in diabetes, liver cancer and heart failure. Trained as a MRI physicist, he is also interested in developing new MRI pulse sequences and hyperpolarization techniques for rapid metabolic imaging and in vivo modeling of enzyme kinetics. He is also actively involved in the clinical study of skeletal muscle metabolism in human thyroid diseases.
Principal Investigators

Shigeki SUGII, PhD
Group Leader of Fat Metabolism and Stem Cell Group
Dr. Sugi graduated from Kyoto University and obtained his PhD from Dartmouth College in 2003. The long-term goal of his group is to develop applications of adipose-derived cells for treating metabolic diseases. His goal is to investigate therapeutic use of adipose-derived stem cells (ASCs) and understand biological mechanisms at the stem cell level that lead to depot specific differences of adipose tissue. His group currently works with other investigators to develop novel imaging methods of different adipose tissues (white, beige, and brown), explore potential therapeutic use of ASCs through reprogramming into induced pluripotent stem (iPS) cells, and study depot-specific molecular differences between subcutaneous and visceral fat-derived ASCs.

Malini OLIVO, PhD
Head of Bio-optical Imaging Group
Dr. Malini Olivo obtained a PhD in biomedical physics in 1990 and did postdoctoral training at University of Toronto and Princess Margaret Cancer Hospital, Canada, before coming to Singapore in 1996 to join Singhealth. She holds an adjunct Stokes Professorship at the National University of Ireland, Royal College of Surgeons, Dublin Ireland. She joined SBIC in 2012 to lead the optical imaging and biosensing research effort. In 2015, she was recognized for her pioneering contribution to biophotonics for clinical diagnostics and therapeutics by the Optical Society of America. Her current research interest is in vivo optical imaging, optical nano-biosensing and clinical translational nano-biophotonics.

Sendhil VELAN, PhD
Head of Metabolic Imaging Group
Dr. Velan received his PhD in Magnetic Resonance from University of Madras (1997). After his post-doctoral research at NIA/NIH (1997-98) he worked as a senior scientist at California Institute of Technology (1999-2003) and also served as a faculty in Radiology, West Virginia University (2004-2009). He joined SBIC with concurrent appointment at Singapore Institute for Clinical Sciences in mid 2009 as the head of Metabolic Imaging Group. Current focus of his group is on translational imaging studies of metabolic diseases including white and brown adipose tissue function, fat partitioning during obesity, fat mobilization and nutrition, energy balance in rodents and humans.

Edward ROBINS, PhD
Head of PET Chemistry Group
Dr. Robins received his PhD in chemistry from Bristol University, UK, 1997. After graduating, he spent 5 years as a postdoctoral scientist before joining Imaging Research Solutions Ltd. (IRSL) at Hammersmith Hospital (London, UK). In 2007, he became a Research Team Leader for Hammersmith Imanet Ltd. and in 2010 took on the role of Fundamental Radiochemistry Leader for Medical Diagnostics Discovery, GE Healthcare. In July 2011, Dr. Robins joined SBIC as Head of Radiochemistry and currently holds a joint-appointment as Head of Pre-Clinical Radiochemistry at the Clinical Imaging Research Centre (CIRC). His research focuses on the development of new labeling strategies for PET and SPECT radioisotopes and the synthesis and development of nuclear imaging probes for oncology, neurology and metabolic disease.

Thomas C Südhof, M.D.
Visiting Consultant, SBIC
Prof. Südhof is Avram Goldstein Professor in the School of Medicine at Stanford University, and has been an Investigator of the Howard Hughes Medical Institute since 1986. Among his numerous honors and awards, he was elected to the National Academy of Sciences (USA) in 2002, and Institute of Medicine (USA) in 2008, and received the Kavli Prize in Neuroscience in 2010, the Lasker Basic Medical Research Award (2013), and the Nobel Prize in Physiology or Medicine (2013). Prof. Südhof is Visiting Consultant for the focused neuroscience program at SBIC, which includes support from the A*STAR Visiting Investigator Program.
Our Resources

**Diversity Oriented Fluorescence Library**

Diversity Oriented Fluorescence Library Approach (DOFLA) is SBIC’s chemical probe platform for any molecular target or specific cell types. More than 10,000 fluorescent organic molecules are constructed as screening tool boxes. Through unbiased High-Contents Screening system, highly efficient novel probe development is the strength of DOFLA. While the fluorescent probes can be biochemical or intra-operative tools due to light penetration depth limit, SBIC has enabling technology to convert the fluorescent probes into radioactive PET or SPECT probes for preclinical in vivo evaluation and potentially application of these probes to first-in-man clinical imaging research.

**Metabolic phenotyping and mechanistic studies**

SBIC is equipped with a full range of molecular and cell biology, biochemistry and molecular physiology capabilities. Studies on metabolic phenotyping and mechanistic analysis are routinely performed by using these and molecular imaging techniques. Metabolic phenotyping covers glucose homeostasis, energy balance, and motor behavior. These studies provide a systemic understanding of whole body metabolic homeostasis, which is extended to include interactions between the brain and the peripheral metabolic organs.

**Magnetic Resonance Imaging & Spectroscopy**

SBIC’s MR imaging capabilities in high field MRI/MRS scanners include two 9.4 Tesla (Bruker Biospec) systems, a large animal 3T MR system (Siemens Skyra), a 7T Bruker Clinscan and an ultra-high field 11.7T Bruker BioSpec. SBIC’s MR suite also features two Dynamic Nuclear Polarization (DNP) systems (HyperSense and SpinLab) for dynamic visualization and quantification of metabolic fluxes *in vivo*. In addition to preclinical scanners, two vertical bore high field Nuclear Magnetic Resonance spectrometers (Bruker 400MHz, and 600MHz) machines support regular liquid state applications including biofluids and high resolution magic angle spinning spectroscopy (HR MAS) of intact tissues *ex vivo*.

**Nuclear Imaging**

Nuclear molecular imaging is an indispensable tool in routine clinical practice and in preclinical research and drug development. Dual-modality nuclear imaging platforms available at SBIC include a Siemens Inveon PET-CT, Mediso Nano SPECT-CT and the world’s first pre-clinical Mediso 7T MRI-PET system. These state-of-the-art imaging capabilities are supported by dedicated pre-clinical laboratory facilities for both imaging and radiochemistry for the production of PET and SPECT radiolabeled tracers for *in vivo* applications. These imaging modalities can be applied across a wide spectrum of drug development pipelines and characterization of disease pathologies, from assessment of target specificity, to *in vivo* therapeutic efficacy and evaluation of drug kinetics.

**Optical Imaging**

Optical imaging encompasses a variety of techniques that use light to visualise cellular and molecular functions with high resolution and sensitivity in living systems. Optical methods include Raman microscopy, surface plasmon resonance, diffuse speckle contrast analysis, multifunctional fiber optic spectroscopy and multi-modal near infrared spectroscopy (NIRS)-Fluorescence-MRI. SBIC collaboration includes the development of cell-specific markers (SBIC-Nikon), and optoacoustic imaging technologies for high resolution & deep penetration imaging such as multi-spectral optoacoustic tomography (SBIC-iThera Medical), Raster scanning optoacoustic mesoscopy (SBIC-TUM) and photoacoustic microscopy (SBIC-MPA).
Joint Laboratories with Industrial Partners

The SBIC-Nikon Imaging Centre (SBIC-NIC) was established as a joint venture in 2007. It is the only centre in Asia outside of Japan, providing state-of-the-art biological microscopy to researchers across Singapore and the region. The mission of the centre is to promote innovation in biological research and is committed to providing access to cutting edge microscopy and imaging technologies. The joint centre also organises training courses on microscopy techniques for the benefit of A*STAR and regional research community.

The SBIC-Bruker Preclinical Imaging (PCI) Centre was opened in 2014. The centre is the first facility of its kind in Asia, and only the second in the world. The PCI Centre is currently equipped with an In Vivo Xtreme system for optical imaging and a Skyscan 1176 microCT scanner. The PCI Centre provides demonstration, training and applications support for SBIC’s and Bruker’s preclinical multi-modal imaging platforms for researchers across Singapore and the region. The mission of the PCI centre is to foster closer collaborations between the academic and clinical communities, as well as the pharmaceutical companies.

The SBIC-iThera Medical Imaging Centre was established in 2016, as the first of its kind in the world. iThera Medical is a pioneer in multispectral optoacoustic tomography (MSOT), capable of real-time, tomographic imaging of optical contrast. Through this imaging center, we will investigate the use of proprietary MSOT technology in both preclinical and clinical applications, primarily in skin, fat and brain imaging. The MSOT technology promises to revolutionize imaging for point-of-care diagnostic purposes in the clinic.

The SBIC-Mediso Joint Laboratory was established in 2016. The centre is the only such facility in the world, and equipped with the first of its kind state-of-the-art combined high-field 7T-MRI-PET imaging system. The centre’s mission is to design and develop components dedicated for the integrated MRI-PET system, as well new applications for translational research. This reference site will allow demonstration of pre-clinical applications and feasibility of using integrated MRI-PET technologies in the context of cardiovascular, oncology and neuro-imaging research.

The SBIC-MicroPhotoAcoustics (MPA Inc) Imaging Centre was established in 2016, as the first of its kind in the world. MPA are pioneers of 3-D photoacoustic microscopy (PAM). The technology offers rapid-scanning optical-resolution (OR) and acoustic-resolution (AR) photoacoustic microscopy which enables imaging of endogenous and optical absorbers at high-axial (micron) and spatial (mm) resolution. This joint laboratory provides cutting edge photoacoustic microscopy technology to promote innovation in pre-clinical in-vivo imaging.
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