

RESEARCH CORE SUMMARY



Beth Israel Deaconess Medical Center (BIDMC) maintains 18 core research facilities, available to BIDMC investigators as well as to scientists from the Longwood Medical Area and beyond. The shared scientific services provided through the BIDMC Cores enable researchers to advance their work in an efficient and cost-effective manner, while at the same time encouraging and promoting cross-departmental collaborations among investigators.

For general information about the BIDMC Research Program, visit our site, bidmc.org/research.

INSTITUTIONAL CORES

Berenson-Allen Center for Noninvasive Brain Stimulation

Director: **Alvaro Pascual-Leone, MD, PhD**

Co-Director: **Peter Fried, PhD**;
pfried@bidmc.harvard.edu

Coordinator: **Andrea Vatulias, (617) 667-0203**;
avatulias@bidmc.harvard.edu

The Berenson-Allen Center for Noninvasive Brain Stimulation provides investigators with access to leading-edge noninvasive brain stimulation technology, including transcranial magnetic stimulation (TMS) and transcranial electrical current stimulation (tCS). Our center specializes in brain-image-guided TMS, combined TMS with electroencephalography (EEG) and electromyography (EMG), and neuronavigated TMS brain mapping for a variety of research studies. Capabilities include the assessment of brain-behavioral relations, noninvasive cortical mapping, studies of brain cortical excitability, functional connectivity analysis, and cortical plasticity characterization and modulation in healthy participants and patients with a variety of neuropsychiatric disorders. Services also include basic and advanced training in TMS, customized group training in TMS for single- and multi-site clinical trials, consultation for noninvasive brain stimulation study design, development of novel brain stimulation paradigms, and advice on the design of clinical trials and the establishment of TMS clinics.

Biomedical Research Informatics

Director: **Griffin Weber, MD, PhD**;
gweber@bidmc.harvard.edu

The Biomedical Research Informatics Core (BRIC) builds and manages web-based tools that enable query, analysis, and visualization of clinical data. These include Clinical Query 2 (CQ2), which provides access to BIDMC's clinical data warehouse, and the Shared Research Information Network (SHRINE), which queries databases at other institutions. Many investigators use CQ2 or SHRINE for preliminary or exploratory research before working with the InSIGHT Core for more complex data analyses.

Bioinformatics & Systems Biology Core

Director: **Manoj K. Bhasin, PhD, (617) 667-0009**;
mbhasin@bidmc.harvard.edu

The mission of Bioinformatics and Systems Biology core

is to provide expertise and infrastructure in designing and analyses of high-throughput OMICS data to answer underlying biological questions. The core supports state-of-the-art next-generation sequencing assays and analysis of data including, Whole Genome or Exome sequencing data, RNA-Seq, protein-nucleic acid interactions (ChIP-Seq) and global methylation. The core also supports analysis of proteomics, metabolomics and lipidomics data generated using Mass Spec, SomaScan, Luminex and Protein arrays. A special emphasis is made on implementing/developing systems biology frameworks and models for integrative analysis of genomic, epigenomics proteomic, metabolomic, imaging and clinical data to identifying key molecules driving pathophysiology. The core also provides analysis of single cell genomics data as well as proteomics data. Core specializes in providing analysis of cancer mutational panels to identify clinically important and druggable mutations.

CRC – Clinical Research Center

Director: **Janet Mullington, PhD, (617) 667-4269**;
jmullington@bidmc.harvard.edu

Manager: **Michelle Beck, (617) 667-4269**;
mbeck1@bidmc.harvard.edu

The Harvard Catalyst Clinical Research Center (CRC) at BIDMC provides a wide array of services and facilities to investigators to support the conduct of clinical research projects. Services provided include bed and board; routine and specialized nursing care; routine and specialized nutrition services; research coordination and project management services; assistance with specimen collection, measurement and short term sample storage; and outpatient interview rooms, examination rooms, and specialty testing labs. CRC nursing staff experienced in research work with investigators to implement the study protocols to ensure consistent and accurate data collection. Nurses also work in tandem with staff from other units where research is occurring, to provide a high quality experience for participants and investigators. In addition, the CRC has an active Metabolism & Nutrition Research unit whose services include DXA, anthropometric measurement, indirect calorimetry, weighed meals, diet design, nutrient analysis, nutrition counseling, and education. Research support may be provided within our research unit or by our staff in other locations in the hospital.

Clinical Research Coordinator Core

Director: **Janet Mullington, PhD, (617) 667-4269**;
jmullington@bidmc.harvard.edu

Manager: **Michelle Beck, (617) 667-4269**;
mbeck1@bidmc.harvard.edu

BIDMC's Clinical Research Coordinator Core provides investigators with access to administrative support for clinical trials, and can be of particular value for smaller trials that do not require a full-time coordinator. Specific services include assistance with IRB application materials and other IRB documentation; research participant recruitment and retention; assistance at study visits; case report form completion; research sample processing; and maintenance of source documentation.

REDCap eData Collection Core

Director: **Stephen Berry, (617) 754-8820**;
sberry@bidmc.harvard.edu

REDCap Specialist: **Chris Botte, (617) 667-3758**;
edc@bidmc.harvard.edu

REDCap is a web based electronic data collection system that enables basic and clinical researchers, quality control staff, and administrators to create electronic data capture forms for simple to complex multi-arm studies or to utilize the web survey functionality to create quick simple surveys or multi-variable, repeated surveys that are compliant with relevant HIPAA and IS security guidelines. This service is provided at no cost to the user and is supported by the Harvard Catalyst grant. Please contact Chris Botte or visit the REDCap web site at: <https://redcap.bidmc.harvard.edu/redcap/> to learn more.

Flow Cytometry Core

Director: **Peter Weller, MD, (617) 735-4110**

Managers: **John Tigges, (617) 735-4193**;
jtigges@bidmc.harvard.edu

Vasilis Toxavidis, (617) 735-4191;
vtoxavid@bidmc.harvard.edu

Providing scientists with the ability to rapidly analyze, enumerate and physically separate cells suspended in fluid, the Flow Cytometry Core offers investigators the newest available software and machinery with both



cell sort and analysis capabilities. A combination of highly specialized electronics, micro fluidics, and optics and fluorescence detectors, BIDMC's flow cytometry instrumentation can simultaneously analyze multiple parameters of individual cells at rates of up to 70,000 cells per second.

Genomics and Proteomics Core

Center Director: **Towia Libermann, PhD**, (617) 667-0760; tliberma@bidmc.harvard.edu

Genomics: **Towia Libermann, PhD**

Proteomics: **Simon Dillon, PhD**, (617) 667-0884; sdillon1@bidmc.harvard.edu

The Genomics and Proteomics Core provides investigators with the instrumentation, expertise and services required to study all kinds of genomics and proteomics applications. The core is equipped with state-of-the-art technologies for transcriptional profiling, genotyping, real-time PCR, proteomics and bioinformatics. Affymetrix GeneChip high-throughput and whole genome arrays are available for human and most animal models. Next generation sequencing service is provided for RNA and DNA sequencing, methylation analysis, ChIP sequencing, metagenomics and targeted sequencing. Protein biomarkers in biological samples can be comparatively and quantitatively measured using SOMAscan aptamer arrays, the iTRAQ isobaric tagging system followed by MALDI-TOF/TOF mass spectrometry, as well as by ELISA and other protein-based technologies. To directly guide investigators in the interpretation of more complex data, full bioinformatics services provide access to phenotypically annotated proteomics and genomics data as well as an array of analytic procedures with which to explore the data sets for further hypothesis generation. For more information, please contact Towia Libermann at tliberma@bidmc.harvard.edu.

Glycomics Core Summary

Scientific Advisor: **Richard Cummings, PhD**, rcummin1@bidmc.harvard.edu

Manager: **Sylvain Lehoux, PhD**, slehoux@bidmc.harvard.edu

The Glycomics Core is the most recent addition to the BIDMC Core facilities. The Glycomics Core provides services, instrumentation, and expertise in glycomics to BIDMC research groups, affiliated and non-affiliated institutions, and corporate companies. Currently, the Glycomics Core offers glycan microarray analysis on 9 different Defined and Shotgun glycan arrays; N- and O-glycan Mass Spectrometry profiling and analysis for individual glycoproteins, sera, cells, or tissues; training; distribution of specific reagents. More services including glycoproteomics approaches, detailed glycan sequencing, and customized production of glycan microarrays will also be available in the near future.

Histology and Microscopy (Morphology) Core

Director **Susan J. Hagen, PhD**, (617) 667-5308; shagen@bidmc.harvard.edu

Histology Core

Histology Core Supervisor: **Susan White**, (617) 667-4117; swhite1@bidmc.harvard.edu

Histotechnologist: **Lena Liu**, (617) 667-1828; zliu1@bidmc.harvard.edu

BIDMC's Histology Core provides investigators with services in frozen tissue preparation and sectioning, paraffin histology for cells and tissues, including embedding, sectioning and routine and special staining.

Microscopy Core

Confocal Microscopy and Immunostaining

Confocal Core Supervisor: **Lay-Hong Ang, PhD**, (617) 667-5373; lang@bidmc.harvard.edu

Confocal Specialist: TBD (617) 667-1880

Electron Microscopy

EM Core Supervisor: TBD (617) 667-4188

Confocal Specialist: **Kyle Smith**, (617) 667-4188; khsmith@bidmc.harvard.edu

The Microscopy Core at BIDMC has two active services. The Confocal Microscopy and Immunostaining Service provides technical assistance and instrumentation for immunostaining, conventional and live-cell confocal microscopy, super-resolution microscopy, light and fluorescence microscopy, and digital image acquisition and processing. Independent or assisted use of instrumentation and/or software, and consultation for experimental design and analysis is also available.

The Electron Microscopy Service provides investigators with technical assistance and instrumentation for electron microscopy techniques including tissue processing, thick and thin sectioning, immunoEM, and high pressure freezing/freeze substitution. The instrumentation is also set-up to do EM tomography and support is available for image processing. Consultation for experimental design and analysis is also available.

Mass Spectrometry Core (phosphoproteomics, metabolomics and lipidomics)

Director: **John Asara, PhD**, (617) 735-2651; jasara@bidmc.harvard.edu

Research Associate: **Min Yuan**, (617) 735-2652; myuan@bidmc.harvard.edu

Sr. Research Associate: **Susanne Breitkopf, PhD**, (617) 735-2653; sbreitko@bidmc.harvard.edu

The Mass Spectrometry Core specializes in a targeted and non-targeted mass spectrometry based proteomics approach and metabolomics profiling by liquid chromatography/tandem mass spectrometry (LC-MS/MS). The Core's specialty is analysis of immunopurified peptides, proteins, protein complexes, in particular mapping and quantifying phosphorylation and other post-translational modifications involved in cellular signaling. This information is then used to assemble functional protein networks. Using leading-edge mass spectrometry instrumentation including orbitraps, ion traps, and triple quadrupoles, the Core provides investigators with protein complex identification and quantification, identification and quantification of post-translational modifications, and quantitative profiling of endogenous cellular metabolites. The core is also capable of lipidomics profiling using new technology. The core also has capabilities metabolic flux analysis with ^{13}C and ^{15}N sources.

Molecular Medicine Core

Director: **Steven Balk, MD**, (617) 735-2062; sbalk@bidmc.harvard.edu

Scientific and Technical Supervisor: **Victoria Petkova, PhD**, (617) 667-0603; vpetkova@bidmc.harvard.edu

The core is equipped with the following instruments: Illumina MiSeq Next Generation Sequencer, Arcturus XT Laser Capture Microdissection System, Agilent 4200 TapeStation Bioanalyzer, Covaris E220 Ultra-Sonicator, ABI 7000 and 7500 Fast Real-Time qPCR systems, Li-Cor Odyssey System Infrared Imager.

On an hourly fee basis we provide: training on equipment usage, consultations, core setup, data analysis, troubleshooting, primer design, LCM usage. On per sample or per run fee basis we provide: MiSeq runs, qRT-PCR runs, quality and quantity DNA and RNA analysis, Covaris ultrasonicator sample shearing, LiCor scanning.

Preclinical MRI, Hyperpolarizer & Seahorse Core

Director: **Aaron Grant**, (617) 667-3265; akgrant@bidmc.harvard.edu

Seahorse Scientific Advisor: **Pankaj Seth, PhD**, pseth@bidmc.harvard.edu

The Preclinical MRI Core facility at the Beth Israel Deaconess Medical Center offers instrumentation and expertise for a broad range of magnetic resonance imaging and spectroscopy applications for small animals, excised tissue and cell culture studies. We provide fee for service within BIDMC and to outside investigators. The hyperpolarized NMR core provides imaging of tissue function at the molecular level, principally directed toward studies of metabolism and perfusion. Through the use of carbon-13 labeled substrate molecules, hyperpolarized NMR can interrogate specific metabolic pathways non-invasively and in real time. Molecular substrate molecules including pyruvate, glutamine, succinate, fumarate and choline can be imaged with hyperpolarization. In addition, tracer molecules for studying tissue perfusion are available. The Seahorse facility within the Preclinical MRI core is available to assess mitochondrial respiration and glycolysis through in vitro measurement of oxygen consumption rates and extracellular acidification rates. Staff will perform runs, provide training, offer initial advice for XF24 analyzer run and supply plates and cartridges on a fee for service basis.

Preclinical Murine Pharmacogenetics Core

Scientific Advisor: **Pier Paolo Pandolfi, MD, PhD**, (617) 735-2121; ppandolfi@bidmc.harvard.edu

Director: **John (Seán) Clohessy, PhD**, (617) 735-2147; jclohess@bidmc.harvard.edu

One of BIDMC's newest Research Cores, the Preclinical Murine Pharmacogenetics Core (or Mouse Hospital as it is known) provides investigators with access to expertise in the design and implementation of preclinical trials to test new drugs, drug combinations and therapeutic modalities in a variety of models including standard xenograft, PDX and genetically engineered mouse models (GEMS) of human diseases. The Core offers the following services: Design and implementation of in vivo and in vitro assays to validate target specificity; collection of preclinical toxicity data for new agents or combinations of agents in GEMS;

acquisition of preclinical efficacy evidences for novel drugs or drug combinations allowing for evaluation and documentation of therapeutic potential in GEMS; and facilitation in reaching the appropriate in vivo imaging facility when the efficacy of a treatment can be monitored by imaging analysis (such as micro-MRI, micro-PET, etc.).

Research Glasswashing Core

Manager: **Tanya Santos**, (617)975-8532; msantos3@bidmc.harvard.edu

The Glasswashing core is primarily responsible for the cleaning and sterilization of reusable laboratory glassware, reagents, and equipment. This centralized service eliminates the need for individual investigators to maintain space, equipment and personnel in their own laboratories to handle the washing and sterilization.

SAIF – Small Animal Imaging Facility & Blood Lab Core

Director: **David Alsop, PhD**, dalsop@bidmc.harvard.edu

Manager: **Meaghan Fox**; (617) 667-2508, mfox2@bidmc.harvard.edu

Research Assistant: **Kathleen Schoolcraft**, (617) 667-0277, kschoolc@bidmc.harvard.edu

The Longwood Small Animal Imaging Facility (LSAIF) provides investigators with a streamlined system for the transport, testing and imaging of small animals used in research studies. High-quality technologies, including computed tomography (CT), positron emission

technology (PET), single-photon emission computed tomography (SPECT), bioluminescence imaging, fluorescence light imaging and magnetic resonance imaging (MRI) are available to scientists. The Core's services extend to experimental design, advanced data analysis, image fusion resources and a satellite animal facility for longitudinal studies. In 2011, the Longwood SAIF expanded with the addition of the Animal Blood Testing Facility. Blood testing is a valuable tool that can reveal a wealth of data to investigators. Testing results measured against reference standards can show abnormalities, presence of disease, health of organs, and trends in experimental groups. The Blood Lab gives investigators access to a wide range of experimental tools, including: Blood Gas, Complete Blood Count (CBC), and Lactate for virtually any small or large animal.

For more information visit www.LongwoodSAIF.org.

Transgenic Core

Scientific Advisor: **Brad Lowell, MD, PhD**, (617) 735-3366; blowell@bidmc.harvard.edu

Director: **Joel Lawitts, PhD**, (617) 632-0264, jlawitts@bidmc.harvard.edu

The BIDMC Transgenic Core is a state-of-the-art facility that produces genetically altered transgenic mice and related services to the BIDMC research community. The Core's basic services include DNA injections; CRISPR injections; embryonic stem cell injections; embryo freezing; and line rescue.

X-ray Crystallography Core

Scientific Advisor: **Jerome Groopman, MD**, (617) 667-0070; jgroopma@bidmc.harvard.edu

Manager: **Gabriel Birrane, PhD**, (617) 667-0025; crystallography@bidmc.harvard.edu

As a method of determining the arrangement of atoms within a crystal, X-ray crystallography is a central component of many scientific investigations. Through BIDMC's recently opened X-ray Crystallography Core, researchers have access to state-of-the-art instrumentation, as well as computing facilities that can be used for data acquisition, analysis and processing. Specific services include: Guidance on expression in bacterial, insect and mammalian cells, purification and crystallization of macromolecules for X-ray crystal structure analysis; characterization of crystals; and collection of X-ray data at ambient and cryogenic temperatures.

Zebrafish Core

Director: **Trista North, PhD**, (617) 735-2083, tnorth@bidmc.harvard.edu

Facility Coordinator: **Nadine Budrow**, (617) 667-8943, nbudrow@bidmc.harvard.edu

The BIDMC Zebrafish Core Facility, built by Pentair Aquatic Habitats, offers wild-type lines that are maintained in house for shared use, wet lab space for breeding and line maintenance, dedicated procedure room for embryo manipulation, and a full time manager available for assistance with training and questions. Assistance with Zebrafish protocol planning and preparation is also available.

DEPARTMENTAL CORES

Blood Chemistry Core

Department: Surgery

Director: **Leo Otterbein, PhD**, lotterbe@bidmc.harvard.edu

Manager: **David Gallo**, dgallo@bidmc.harvard.edu

Hematologic analyses specifically designed to help laboratory animal and human researchers generate accurate, reliable, quality results using a small sample volume. Wide spectrum of organ specific panels. Capable of measuring blood, plasma, serum, culture media, cerebrospinal fluid, and urine. Contact David Gallo for more information and pricing.

Center for Advanced Orthopaedic Studies (CAOS) μ CT Core

Department: Orthopaedic Surgery

Manager: **Daniel Brooks**, djbrooks@bidmc.harvard.edu

The CAOS μ CT core provides high resolution 3D imaging of ex vivo specimens. Our main service is imaging of rodent bones for measuring bone microarchitecture and morphology. Additionally, we can image other types of specimens up to 36 mm in diameter and 80mm in length with voxel sizes as small as 6 μ m. We are available for consultation both before and after the completion of your project.

Center for Virology and Vaccine Research Flow Cytometry Core

Department: Medicine, CVVR

Manager: **Michelle Lifton**, (617) 735-4512, mlifton@bidmc.harvard.edu

Cell Sort Contact: **Mary Laughridge**, (617)735-4515; mlaughter@bidmc.harvard.edu

Flow Cytometry Tech: **George Tweet**, (617) 735-4612; gtweet@bidmc.harvard.edu

The Center for Virology and Vaccine Research Flow Cytometry Core offers sterile cell sorting and acquisition specifically for sorting live, unfixed and infectious human cells as well as dedicated staff for assistance with instrument operation, data analysis, and panel development.

InSIGHT (Integration of Standard Information Gathered using Healthcare Technology) Core

Department: Healthcare Quality

Manager: **Karla Pollick**, (617) 667-7157; kpollck@bidmc.harvard.edu

Technical Director: **Larry Markson, MD**, (617) 754-8031; lmarkson@bidmc.harvard.edu

The InSIGHT Core helps researchers and quality improvement teams use the vast array of data available in

BIDMC's clinical data repositories. We help you leverage these data to answer important questions, using tools of traditional clinical epidemiology and health services research. Services range from supplementing data in traditional clinical research (e.g. pulling admission laboratory test results for every patient in a cohort you have already collected) to building complete, high-complexity, large electronic cohorts for complex analyses.

Islet Isolation Core

Department: Medicine, Transplant Immunology

Director: **Maria Koulmanda, PhD**; mkoulman@bidmc.harvard.edu

Manager: **Vaja Chipashvili, MD**, (617) 735-2883; vchipash@bidmc.harvard.edu

The Islet Isolation Core provides Islets of Langerhans to investigators in the Boston area and beyond. This leaves the investigator to concentrate on experiments rather than the complexity of islet isolation.

- The islet isolation from mice, rats, porcine and non-human primates.
- Most commercially available animals can be used.
- Can also perform islet isolations on healthy external animals.
- Isolated islets can be picked up at our facility, sent via courier, or shipped overnight via FedEx.

Metabolism and Mitochondrial Research Core

Department: Emergency Medicine

Director: **Xiaowen Liu, PhD**, (617)667-0706
mkoulman@bidmc.harvard.edu

The Metabolism and Mitochondrial Research Core provides access to XFe 96 Extracellular Flux Analyzer, Seahorse technology, as well as additional services that include technical advice in experimental design, data analysis and basic training. The Core also provides affordable access to high performance, electrochemiluminescence immunoassays using MESO QuickPlex SQ 120. This instrument provides unparalleled sensitivity and dynamic range, using low sample volume, and fast, well-organized results. You can perform multiplex biomarker and cytokine assays, test for immunogenicity or toxicity, or we can help you develop your own unique assays. In addition, the Core provides measurement of pyruvate dehydrogenase activity and quantity, Citrate Synthase quantity assay, Cytochrome C assay for mitochondrial research. Website: <http://resuscitationscience.com/Display/CoreLab>

PERFUSE Core

Department: Cardiovascular Medicine

Chairman: **Michael Gibson, MD**, (617) 975-9950
sjamnet@bidmc.harvard.edu

Program Director: **Meghan Leitao, mleitao@bidmc.harvard.edu**

Imaging Core Laboratory: PERFUSE functions as an angiographic, ECG/EGM, coronary MRI core laboratory

for many clinical trials. We perform quantitative and qualitative analysis on defined physiologic variables derived from the specified patient population of each trial.

Global Principal Investigator/Study Chairman

of Trial: Dr. Gibson serves as the overall trial Principal Investigator for multi-center, international clinical trials. He leads the trail interacting with the sponsor, lead country investigators, local site investigators, DSMB and other trial personnel.

Clinical Event Adjudication Committee (CEC):

PERFUSE serves as the CEC adjudicating protocol specified, clinical site reported/clinical database generated, adverse clinical events or presenting diagnoses in a clinical trial.

Data Safety Monitoring Board (DSMB):

Dr. Gibson serves as both an organizer and or a member to assemble an independent DSMB for specific clinical trials. A DSMB reviews safety and tolerability data through the period of the primary endpoint for all patients receiving any amount of study drug.

Steering/Executive Committee Member:

Dr. Gibson provides academic and scientific leadership via expert opinion on study planning and conduct, including protocol design and development, research strategy, development of statistical analysis plan, reviewing trial process and clinical data, oversee the writing of the final trial results for publication.

Statistical Support: PERFUSE provides statistical support for clinical trials including programming and analysis

Translational MRI Research Core

Department: Radiology

Director: **David Alsop, PhD**, **dalsop@bidmc.harvard.edu**

Manager: **Meaghan Fox**, (617) 667-2508; **mfox2@bidmc.harvard.edu**

MRI Technologist: **Fotini Kourtelidis**, **fkourtel@bidmc.harvard.edu**

The Translational MRI Core of the BIDMC Department of Radiology provides state-of-the-art MRI capabilities for imaging human subjects and potentially large animals as part of research studies. The facility operates a research dedicated 3 Tesla system and can provide access to a 1.5 Tesla system. In addition to commercial tools for clinical imaging, customized software and protocols for applications including functional and structural brain imaging, abdominal perfusion and diffusion, muscle functional imaging and spectroscopy are available to users. Additional customization of applications either by the Core staff or in collaboration with the Division of MRI Research is encouraged.