Cancer Center
Shared Resources
# Shared Resources

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Cancer Center
Shared Resources
Campus Map
The Sanford Burnham Prebys Medical Discovery Institute Cancer Center, directed by Dr. Garth Powis, has an extensive Core system with 10 Shared Resources housing a total of 19 facilities. Our primary mission is to provide advanced technology, expertise, and instrumentation to cancer investigators that may not be easily acquired by individual laboratories.

Our cores, staffed by technical experts, offer high-quality interactive services that provide cost-effective sample analysis, assistance in experimental design, data analysis, and grant or manuscript preparation. Many of the cores offer a choice of full service, or investigator training on advanced instrumentation for independent use. Most cores also offer services for outside non-profit and for-profit investigators.
The Animal Facility’s mission is to provide a comprehensive animal care and use program for investigators utilizing animals in their cancer research projects. The facility strives to maximize the scientific benefits of animal experimentation while maintaining an emphasis on animal welfare.

The 24,000 sq. ft. AAALAC-accredited vivarium houses mice in ventilated cages and provides husbandry services and complete breeding colony maintenance services with tissue samples for genotyping.

The Animal Facility also provides care for a small number of rats, frogs, and Zebrafish and has a separate dedicated BSL2 mouse facility. Many procedures can be performed by trained animal care staff, including injections (SC, IM, IP, IV), tumor measurements, blood collection, drug administration, tissue harvest, and surgical pre-and post-op care.

The Mouse Reproductive Services lab performs embryo rederivation, line rescue and recovery and embryo and sperm cryopreservation.

SERVICES
- Husbandry, breeding colony maintenance
- Procedures
  - Blood and tissue collection
  - Injections & drug administration
  - Tumor measurements
  - Surgical pre- and post-op care
  - Animal transfers and quarantine
  - Animal health screening
- Administrative & IACUC support
- Mouse reproductive services
  - Cryopreservation of embryos and sperm
  - Re-derivation
  - Line rescue and recovery
  - Transgenic mouse services (including CRISPR) at nearby Core facilities (UCSD, Salk, Scripps)

EQUIPMENT & SUPPORT
- Ventilated mouse cages
- Centralized cage washing facility
- Autoclave
- Anesthesia machines
- Procedure rooms
- Biosafety cabinets
- Irradiator (cell and animal)
- Motor and sensory equipment
  - Treadmill
  - 5-Station Rota-Rod
  - Water maze with video camera
  - Hot plate analgesia meter
  - Stereotactic CNS microinjection station
Animal Imaging & Analysis

The Animal Imaging and Analysis lab provides state-of-the-art imaging and analytical services for Sanford-Burnham investigators. The facility can perform *in vivo* near-infrared imaging without reporter genes, as well as *in vivo* non-invasive luminescence and fluorescence imaging for xenograft tumor growth and metastasis studies.

Analytical equipment supports complete blood cell counts (CBCs) and analysis of serum components revealing metabolic or organ stress from small samples of mouse blood.

**Services**

- Imaging and analytical services can be done by trained animal facility specialists.
  - Live near-infrared imaging on animal, native cells and cell lines without reporter genes.
  - Live animal imaging - luminescence and fluorescence (Xenogen)
  - Live animal imaging – ultrasound
  - Blood and serum analysis
- Training on the various instruments can also be provided for regular users.
- We also provide Luciferin and luciferase-labeled cell lines and transgenic mouse line.

**Equipment**

- Li-Cor Pearl Imager: near infra-red imaging
- IVIS Spectrum (Xenogen): bioluminescence & fluorescence imaging
- Vevo 770 (VisualSonics): high-resolution ultrasound & guided-injection system
- VetScan HMII Hematology System: 18-parameter blood count & clinical chemistry analyzer
- VetScan VS2 (Abaxis) for blood chemistry, electrolytes, blood gas & immunoassay
- VetTest Chemistry Analyzer (IDEXX) blood & urine
- CODA-6 (Kent Scientific), tail-cuff blood pressure system
- Faxitron MX-20 Digital Specimen Radiography
- Oxycycler (BioSpherix, Ltd.): for oxygen consumption, carbon dioxide production & hypoxia studies
- Metabolism cages: to monitor and measure food & water intake & waste production.
- Stereotaxic instrument: microinjection equipment

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**Bill Stallcup, Ph.D.**
Scientific Director
The Tumor Analysis service provides expertise in analysis animal models of human cancer and other diseases.

Investigators have access to a wide variety of human cancer cell lines for xenograft studies and primary human xenograft models as well as transgenic mouse solid tumors and leukemia models. Solid tumors are typically initiated by subcutaneous or orthotopic transplantation of cultured cells, frozen viable tumors or fresh transplanted tumor tissue. Experimental compounds or other host manipulations are administered and tumor size, metastases, histopathology and blood chemistry are evaluated.

SERVICES

- Formulation advice
- Maximum tolerated dose
- Patient-derived xenograft (PDX) model support
- Tumor transplantations
- Analysis of human tumors in immunodeficient mice
- Analysis of mouse tumors in immune competent hosts
- Derivation of 2D and 3D cell cultures from xenograft tumors
- Tumor and cell line resources
- Technical training in animal tumor methods
The Cell Imaging Facility broadly supports our three Cancer Center research programs by providing access to sophisticated microscopes for digital imaging.

The facility offers expertise, training, and assistance in advanced biological microscopic imaging techniques and use of complex image processing software. The facility provides well-maintained, aligned, and calibrated microscopic equipment, as well as troubleshooting for equipment and experimental problems.

TEM and SEM are available at the nearby Salk Biophotonics facility.

### SERVICES
- Wide-field microscopy, phase and differential interference (Nomarski) contrasts, multi-spectral epi-fluorescence microscopy
- Single and multi-photon laser point scanning confocal microscopy
- High-speed spinning disk confocal microscopy.
- Time-lapse imaging in CO₂ and temperature-controlled environment.
- Recording dynamics of single molecule interactions within single cells. Foster Resonance Energy Transfer (FRET), Fluorescence Recovery After Photobleaching (FRAP), calcium flux imaging and Total Internal Reflection (TIRF).
- 3D and 4D Image rendering and morphometric analysis.
- Training and consultation

### EQUIPMENT
- Six wide-field fluorescence microscopes with cooled CCD cameras, some with automated XYZ stage, microinjection attachment, CO₂/Temp. controlled chambers
- EVOS FL Auto Imaging system
- Three confocal systems:
  1. Zeiss LSM 710 NLO multiphoton laser point scanning confocal microscope
  2. Olympus FluoView-1000; laser point scanning confocal microscope
  3. Yokogawa Spinning Disk Laser confocal microscope
- Multiple image processing software packages
- Super-resolution and Electron Microscopy services available through the Salk Biophotonics Core.
The Histopathology facility provides standard and customized histology services to facilitate cancer research, with expertise in pathology, tissue microarray analysis, and routine and special histological stains. The core also offers immunohistochemistry and immunofluorescence capabilities, and powerful analysis tools to our Cancer Center members. The facility maintains and provides training for several pieces of common use equipment: paraffin microtome, cryostat, and cytospin. Training is also provided for basic histological techniques.

Before starting a project, please contact us so that we can help you plan the best course of action. Drop into the lab, call, or email for more information.

SERVICES
- Traditional Histology: Conventional and research-specific custom sectioning and staining.
- Immunohistochemistry: Development of custom protocols (overlay assays, competition assays).
- Laser Capture Micro Dissection (MMI CellCut): Sample Preparation for DNA and RNA extraction, training and assistance.
- Digital Pathology: Electronic data acquisition, data analysis, web based data sharing and archiving of histology results.
- Custom Image Analysis and development of novel algorithm-based scoring methods to quantify immunohistochemical and histological parameters.
- Assistance with all aspects of tissue acquisition.

EQUIPMENT
- Aperio Scanscope AT2 and FL systems
- Leica CM 3050 cryostat
- Leica RM 2125 paraffin microtome
- Leica BOND-RX automated system for IHC/ISH
- Leica Autostainer ST5010 for H&E
- Shandon Cytospin 3
- Sakura Tissue Tek vacuum infiltration tissue processor
- Leica EG 1160 paraffin embedding station
- MMI Cell Cut Laser Microdissection system
NMR & Crystallography

SERVICES

- **NMR:**
  - Spectrometers maintained for investigator usage
  - Collecting and processing NMR data according to users specifications
  - Training of users for basic NMR experiments
  - Troubleshooting if problems arise
  - Consultation: feasibility studies, optimization.

- **Crystallography:**
  - Crystal structure of small molecules, macromolecules, protein-chemical ligand complexes
  - High throughput capabilities

The NMR facility offers capability for NMR studies on proteins, peptides, small molecules and carbohydrates in solution or in solid state.

The facility provides the infrastructure for NMR data collection, as well as expertise in data collection and analysis. The core also provides consultation with investigators on the feasibility of NMR for structural studies of proteins involved in oncogenesis, as well as help in obtaining binding information by multi-dimensional NMR techniques.

The Crystallography facility is primarily an infrastructure core utilized by experts to produce and analyze crystals. High throughput liquid drop dispensing capabilities coupled with imaging incubators provide the ability to more rapidly identify crystallization conditions, and two independent detectors enhance X-ray analysis.

### EQUIPMENT

- 600 MHz Bruker Avance, 5 mm TCI cryoprobe: high resolution structural studies of macromolecules
- 500 MHz Bruker Avance, automatic sample changer, 3 probes: structural studies and NMR-based drug discovery
- 500 MHz Bruker Avance solid-state with a new MAS probe: high resolution structural studies of membranes proteins
- 400MHz JEOL JNM-ECS spectrometer, with a 5 mm proton/multi-frequency auto-tune probe, and an auto sample changer – highly automated for chemistry analysis
- Phoenix microdrop liquid handling system and Formulatrix (4° and 22°) imaging incubators (for automated crystal detection).
- Rigaku FR-E SuperBright X-ray generator and two independent detectors.

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Scientific Director
The Protein Analysis Core provides Cancer Center members with a variety of analytical services focused on biophysical characterization of structural and functional properties of proteins in solution, under native, non-denaturing conditions. The core performs quality control of protein samples (folding, stability, aggregation) and measure molecular weight of proteins, protein complexes, oligomers and assemblies. It also can characterize protein conformation and shape in solution; determine oligomeric state of protein (including stoichiometry and $K_d$ for self-association) as well as measure protein binding to proteins, peptides, small molecules, compounds, metal ions, lipids, carbohydrates, nucleotides and other ligands (including determination of equilibrium ($K_d$) and kinetic rate ($k_{on}$ and $k_{off}$) constants, stoichiometry, binding enthalpy and entropy).

SERVICES
- Absorbance spectroscopy
- Analytical ultracentrifugation (AUC)
- Atomic force microscopy
- Differential scanning calorimetry (DSC)
- Fast kinetics, stopped flow
- Fluorescence spectroscopy
- FPLC, analytical runs
- Isothermal titration calorimetry (ITC)

EQUIPMENT & RESOURCES
- NanoTemper Monolith 115 for measuring any interaction from ion to particles by thermophoresis
- Absorbance diode-array spectrophotometer Agilent 8453 UV/Vis
- Analytical ultracentrifuge, Beckman Coulter XL-I
- Atomic Force microscope, Agilent 5500 AFM/SPM
- Differential scanning calorimeter, CSC Nano II DSC
- Fluorescence spectrometer/fluorometer, BioLogic MOS-250
- Isothermal titration calorimeters, GE Healthcare/Microcal ITC200 & VP-ITC
- Stopped-flow system, BioLogic SFM-20
Flow Cytometry

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Robert Rickert, Ph.D.
Scientific Supervisor

The facility provides access to high-speed cell sorting and analytical flow cytometry in two locations on the Sanford-Burnham campus. Trained investigators have 24-hour access to a variety of analytical flow cytometers available for independent use. Core staff provide technical expertise, hardware and software training, operate the facility’s cell sorters and are available to assist with analysis experiments for those Cancer center members who prefer to have their samples run by an expert cytometrist.

Scientists planning a flow cytometry experiment are encouraged to consult facility staff for assistance with protocols, fluorochrome selection or other aspects of experiment design.

SERVICES
- High speed cell sorting performed by facility personnel in two locations
  - Single-cell (clone) sorting into 96 or 384-well plates
  - Simultaneous sorting of up to 4 populations
- Analytical flow cytometry: do-it-yourself 24hr/day, or assisted by appointment
- Hardware and software training
- Consultation
  - Experiment design
  - Data analysis and interpretation
  - Pre-publication manuscript review

EQUIPMENT
- Analyzers & Sorters
  - Amnis ImageStreamX MarkII imaging flow cytometer, 12 channels, 3 lasers, 3 magnifications & plate loader
  - ACEA Novocyte 3000, 3 ss lasers, 13 color analyzer with 96-well plate loader
  - BD LSR Fortessa X20, 5 lasers, 18-color analyzer
  - BD LSR Fortessa 14-color FACS analyzer with HTS plate loader for 96 or 384-well plates
  - BD FACSCanto 6-color & BD Calibur 4-color Analyzers
  - BD FACSCalibur 4-color analyzer
  - EMD Millipore Muse Cell 2-color Analyzer
  - BD FACSaria IIu 14-color and BD FACSaria 11-color high-speed cell sorters in biosafety enclosures
- Countess Automated Cell Counter
- Computer Workstations (Mac) and data analysis software (FlowJo, ModFit LT)
The facility provides high-throughput 3rd generation DNA sequencing on the Illumina NextSeq 500, the Ion Torrent Ion Proton sequencer and the Ion Torrent Personal Genome Machine (PGM). The NextSeq 500 can sequence 20 RNA-seq, or ChIP-seq libraries per day. All three platforms offer rapid turnaround, with sequencing run times ranging from 2-7 hours, and support projects from 100 Mb to more than 10 Gb of sequence. Several sequencing applications are supported, including whole transcriptome and whole human exome sequencing. The facility is a Life Technologies AmpliSeq Exome Certified Service Provider.

The core provides complete genomic service, from user submitted DNA or RNA to final analyzed data, and all quality checks, library preparation, sequencing, and data analysis are performed by core staff. Additional advanced bioinformatic support is also available.

The core also supports analysis using the Nanostring nCounter, providing sample processing and training. The nCounter is a simple, cost-effective way to profile hundreds of mRNAs, microRNAs, non-coding RNAs, or DNA targets simultaneously with high sensitivity and precision.

**SERVICES**
- NextSeq sequencing
- Ion Torrent PGM and Ion Proton sequencing
- Quality analysis of starting RNA or DNA
- Library Preparation
- Sequencing of samples
- Basic next-generation sequencing bioinformatic analysis
- Advanced bioinformatic analysis

**EQUIPMENT**
- Illumina NextSeq 500 sequencer & NeoPrep automation
- Ion Proton Next-Generation sequencer
- Ion Torrent Personal Genome Machine (PGM)
- 2 Torrent Servers and one high memory cluster for bioinformatic analysis
- Ion One Touch 2 (soon to be replaced by the Ion Chef)

*Additional analytical equipment:*
- Nanostring nCounter
- 2100 Bioanalyzer (Agilent)
- Qubit Fluorometer (Life Technologies)
- Nanodrop Spectrophotometer
The facility provides cancer researchers with microarray-based global analysis of gene expression in humans and mice using an Illumina platform. Starting with investigator RNA samples, the facility confirms RNA quality, then performs microarray analysis and initial data analysis. Array data are returned to the investigator, and if desired, passed on to the Bioinformatics core facility for more detailed analysis.

Quantitative real-time PCR (Q-PCR) service is predominantly SYBR green-based analysis, and can either use primers from Cancer Center investigators, or core-designed custom primers. The facility provides control primers and assists with experimental design, as well as providing relative quantitation analysis. Q-PCR analysis in the facility can also provide gene, RNA, or viral copy number data.

**SERVICES**

- RNA sample quality analysis
- Q-PCR service:
  - from total RNA to data analysis – from RNA (1-step), or from synthesizing cDNA (2-step)
  - SYBR Green or Hybridization Probes (predominantly SYBR Green)
  - Supports Hybridization probe (TaqMan) approaches
  - Special services: RNA purification and Q-PCR Primer design
- Microarray analysis:
  - from total RNA to data for mRNA or miRNA
  - Initial microarray data analysis, informatic analysis done through the Bioinformatics facility

**EQUIPMENT**

- Stratagene Mx3000p real-time PCR instrument (96 well)
- Roche LC480 real-time PCR instrument (interchangeable 384 well or 96 well)
- Roche LC96 real-time PCR
- Bio-Rad Experion Bioanalyzer (similar to Agilent Bioanalyzer)
- Nanodrop ND-1000 spectrophotometer
- MicroArray: Illumina BeadStation microarray system
The Proteomics Facility provides state-of-the-art mass spectrometry (MS)-based proteomic services for analysis of peptides, synthetic compounds, carbohydrates and proteins by facilitating MW determination, protein identification, qualitative and quantitative characterization of post-translational modifications, plus quantitative and differential proteomic profiling of low-complex biological samples. Facility staff regularly identifies, validates, develops, and implements new methodologies for identification, quantification and characterization of biologically important proteins, especially those involved in tumorigenesis. Such approaches can support a mechanistic understanding of cancer and other life threatening diseases, as well as identify new therapeutic targets and diagnostic biomarkers.

The Proteomics Facility also supports users with assistance in grant and manuscript writing, proteomics software applications, data analysis, and experimental design of proteomic studies. The facility is continuously expanding its capabilities in large-scale differential proteomics analysis and in phosphoproteomics (and other PTMs) for discovery of potential biomarkers and mapping protein profiles.

**SERVICES**

- Molecular Weight (MW) Determination MW of peptides, protein and protein/Peptide cleavage mapping
- Protein Identification from 1D or 2D gels, IP enriched material, simple –complex sample
- Characterization of post-translational modifications like phosphorylation, ubiquitination, methylation etc
- Differential and Quantitative proteomics analysis of simple to complex biological samples using Mass-Tagged or Label-Free approach
- Proteomics data analysis tools for CID and ETD data include Sage-N SORCERER Enterprise platform, Integrated Proteomics Pipeline (IP2 from Yates lab) utilizing cloud computing and MaxQuant on a local server
- Hands on Training on MALDI-TOF

**EQUIPMENT**

- Two Thermo Orbitrap Fusion Lumos Tribid systems
- Thermo Q-Exactive Plus: high resolution, full scan MS.
- Thermo LTQ Orbitrap Velos Elite mass spectrometer:
- Thermo Quantiva mass spectrometer
- Bruker Daltronics AutoflexII MALDI TOF/TOF Mass Spectrometer: for MW determination
- HCT Ultra Mass Spectrometer (Bruker Daltronics) and Proteineer liquid handler
- BravoAssaymap system for sample preparation
- Off-Line Michrom MDLC pump and fraction collector for 2D and 3D peptide fractionation prior to 1D LC-MS/MS
- Ettan DALT six large vertical system and Ettan IPGphor IEF system for 2D gel electrophoresis
- Automated spot handler (Shimadzu Biotech Xcise)
The Chemical Library Screening Core, by allowing Cancer Center researchers a special conduit into the powerful resources of the CPCCG, provides a comprehensive suite of capabilities for preclinical small molecule drug discovery, complete with experienced project management.

The Assay Development facility provides support in design and development of new and optimization of existing high-throughput screening assays, as well as for Structure-Activity Relationship (SAR) studies of hits obtained in primary screening, and can advise and help in preparation of data packages for screening-related grants.

The High-Throughput Screening core facility provides infrastructure for large chemical library screening of biological targets with diverse screening instrumentation, compound libraries (see below) and expertise on high throughput screens and automation.

The High-Content Screening core facility provides assay development, screening, and data analysis/mining expertise and services for high content screens using high-throughput microscopy systems. The core can also develop and conduct phenotypic assays, from functional assays, to transcriptional reporter modulation. Additionally, it can combine resources with the and Functional Genomics core for RNAi screening projects.

SERVICES and RESOURCES

- Design and development of cell-based and biochemical assays in diverse plate formats and detection platforms
- Full-scale capabilities and infrastructure providing rapid screening on a broad diversity of assays and detection platforms
- Several fully integrated industrial-scale high-throughput screening (HTS) workstations
- HTS microscopy/HCS and novel algorithm development for image analysis
- Full Hit-to-Lead chemistry and exploratory pharmacology
- Powerful NMR based Chemical Fragment Screening
- Highly integrated informatics infrastructure and efficient data mining capabilities
- Close ties with Protein production facility
- Cell production facility for scale-up tissue culture, including ES and iPSC capabilities
- Project management
- Support of projects performed by either PI laboratory or CPCCG personnel
- Full support of grant applications for available funding mechanisms
The Medicinal Chemistry core facility provides general synthetic and medicinal chemistry resources and expertise at the Institute and with external partners. Our team is staffed with industry-trained in all aspects of medicinal chemistry, preclinical development and synthetic chemistry problem solving.

The Cell-based Disease Models & Screening core provides resources and expertise to facilitate development of stem cell-based assay and patient-specific disease models for screening and testing small molecules and drugs, and specializes in culture, scaling, and directed differentiation of human embryonic and induced pluripotent stem cells.

The Cheminformatics core facility provides database and tools for compound registration and inventory, HTS plate formatting and tracking, HTS data processing as well as related data and information centralization.

All core facilities works closely helping in implementation and HTS execution of diverse plate-reader and imaging assays. They are complemented by Ultra High Throughput Screening and Exploratory Pharmacology in Lake Nona.

CHEMICAL LIBRARIES

A wide array of compound libraries are available for collaborative projects performed at CPCCG.

- Spectrum Collection: 2,000 compounds of known drugs, Microsource Discovery Systems.
- LOPAC Collection: 1,280 pharmacologically active compounds from Sigma-Aldrich.
- Kinase Inhibitor Collection: 244 known kinase inhibitors compiled from EMD Biosciences.
- US and International Drug Collections: 1,040 drugs in clinical trials in the USA and 240 non US drugs from Microsource Discovery Systems.
- Greenpharm Natural Product Collection: 240 known phytocompounds sold by Prestwick Chemicals.
- Prestwick Chemical Library: 1,200 small molecules, 100% being marketed drugs.
- StemSelect Collection: 303 pharmacologically active, structurally diverse modulators of cell fate from EMD
- Bioactive Lipid Library: 201 bioactive lipids from ENZO Life Sciences.
- Natural Product Library: 502 compounds from ENZO Life Sciences
- REDOX Library: 80 compounds with defined prooxidant or antioxidant activity from ENZO Life Sciences.
- InhibitorSelect Signal Pathway Collection: 64 compounds from EMD, target several signal pathways
- MLSMR Library: About 360,000 compounds, compiled for MLPCN, 95% with molecular weight ≤500Da.
- Sanford-Burnham HTS Library: About 320,000 compounds for general HTS screening selected from a pool of over three million compounds from five major chemical vendors (ChemBridge, Asinex, Enamine, Life Chemicals, and ChemDiv) using cheminformatics selection strategies.
Bioinformatics

The Core provides assistance in data analysis and data management for large cancer research projects, and in implementing or developing specific bioinformatics tools and pipelines. This includes analysis of large datasets generated in the Shared Resources (e.g., Next-Gen sequencing, Microarray or Proteomic data) or in investigator laboratories, as well as data comparison with other available databases. A biostatistician in the group provides expert statistical support (e.g., Kaplan-Meier survival curve with Logrank test, univariate and multivariate Poisson regression).

The facility assists with Systems Biology and Pathway Analysis, utilizing tools such as Ingenuity Pathway Analysis, NextBio, and MetaCore. A growing area of focus is systems biology integrating analysis across multiple data types (data generated in-house or mined in multiple public databases, such as TCGA), including genomics, proteomics, and metabolomics.


SERVICES

- Next-Gen Sequencing, Microarray and Proteomics Data Analysis
- Systems Biology Support and Pathway Analysis (via GeneGO, IPA, NextBio, Oncomine and TRANSFAC)
- Biostatistics (power analysis, sample size determination etc.)
- Gene Family Analysis and Annotation
- Human Genome Analysis
- Data Integration
- Grant and Paper Preparation
- Laboratory Information Management Systems (e.g., Animal Informatics, caArray, caTissue and LabKey)
- Website and Database Development
- Bioinformatics and Biostatistics Classes

EQUIPMENT & RESOURCES

- Gene expression (GeneSpring, BeadStudio, R/BioConductor, GenePattern, NMF)
- Next-Gen sequencing data analysis: from reads to biology. GeneSpring NGS, GATK Open Source from Broad Institute, BWA, samtools, bedtools all connected via GALAXY community workbench
- Proteomics (LabKey, Mascot, Sorcerer, TPP)
- caBIG tools: caArray, caTissue and LabKey
- Systems Biology (Ingenuity Pathway Analysis, NextBio, MetaCore and Partek GS)
- Linux cluster for Next-Gen works data analysis, running ABI Bioscope and other sequence analysis tools
- Linux cluster of 120 CPUs to support data protein annotation and inhibitor and lead discovery
- Linux servers for web and database development

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Scientific Director
The Functional Genomics Shared Resource consists of two facilities: Functional Genomics, and Viral Vectors. The Functional Genomics facility provides the capabilities for RNAi screening, from initial feasibility assessment, all the way through to verification of identified targets. It also serves as repository for reagents and assays, expertise and other technical information, and works towards technical improvements when necessary.

The facility develops image-based cellular assays and adapts them to HTS-siRNA screening in conjunction with the High Content Screening Core. It also collaborates with the Bioinformatics core facility to aid the screening follow-up process.

The Core’s primary focus has been loss-of-function screening via RNAi (siRNA and shRNA), to improve understanding of cancerous gene and protein functions and interactions, but gain-of-function screening capabilities (cDNA and miR over-expression) are also supported.

SERVICES

- Consultation: provide expert advice on all steps in a functional genomics experiment, from initial design to execution of high throughput projects
- Transfection testing: evaluate cell line transfectability through a battery of transfection reagents in parallel, both for transfection efficiency and impact on viability
- Assay development: cellular assays are taken from the researcher, tested under siRNA transfection or lentiviral transduction conditions, and brought to a 384-well format
- Screen execution: siRNA, lentiviral shRNA, miRNA and ORF collections are available for screening
- Data interpretation (statistics, network analysis)
- Hit reconfirmation and further validation

EQUIPMENT and RESOURCES

- Benchcell work station with Bravo liquid handling platform (Agilent), Wellmate liquid dispenser (Matrix Technologies)
- STAR liquid handling station (Hamilton)
- Micro-plate reader Analyst HT, (Molecular Devices); Envision, (Perkin Elmer)
- High-throughput microscopes (IC100, Beckman-Coulter; IC200, Vala)
- Tissue culture facility
- Genome-wide siRNA libraries (Dharmacon OTP) focused libraries, miR agonists and antagonists, cDNA expression
- Developing CRISPR-CAS9 technologies for cell line editing and screening
The Viral Vectors facility (part of the Functional Genomics Shared Resource) assists researchers with the production of high-quality, high-titer lentiviral (HIV-1 and FIV), retroviral, and adenoviral (ad5) vectors. Our brand new exciting lentiviral-adenoviral vector swapping allows you to use both constitutive or inducible cDNA/shRNA lentivector (w/ selection marker) and adenovector in a cost-effective way. “The Works” service includes custom viral vector construction for constitutive or inducible cDNA/shRNA expression as well as promoter / enhancer reporter, viral packaging, and titration (control particles provided). In addition to package and titration of virus particles, the core also provides users with ready-to-transduce lentiviral stocks to mark cells or organelles with fluorescent or luminescent proteins, and with supplies for viral vector studies such as 100x viral concentration kit, large scale DNA plasmid preparation (ready for viral production), and high quality ready-to-use zbFGF (zebrafish basic FGF).

**SERVICES**

- **Lentiviral production services:**
  - 16 Ready-to-transduce lentiviral preps: nucleus, cytoplasm, or membrane localized eGFP, mCherry, tdTomato, luciferase, etc.
  - Custom lentiviral (HIV-1 and FIV) packaging and titration.
  - "The Works" custom lentiviral vector construction.

- **Retroviral production services:**
  - Custom retroviral packaging and titration.

- **Adenoviral production services:**
  - Custom production of adenoviral particles (Ad5) including virus recovery, amplification, purification, and titration.

- **Other services:**
  - Custom viral particles concentration and purification.
  - Large scale DNA plasmid preparations.
  - 100x viral concentration kit.
  - Ready-to-use zbFGF (substitute for human bFGF on hES cell and GBM culture).

- Consultation: free for core users.
The Cancer Metabolism Core is a developing Shared Resource within Sanford-Burnham’s NCI-designated Cancer Center. The scientific focus of the facility is to investigate the role of metabolism in cancer on both the cellular and organism level, combining in vitro and in vivo analysis.

A central focus of the facility is stable isotope-based metabolic tracer methods, which allow determination of metabolic fluxes in human cells. By supplying stable-isotope labeled metabolic substrates (such as glucose, glutamine, or lactate) to living cells, isotopomer patterns of key metabolites can be measured by mass spectrometry. These data yield information on both pathway activities and metabolite pool sizes. In addition, a number of other instruments and analyses are utilized with the overall goal of characterizing the metabolic program of tumors through the measurement of metabolites in cells, tissue samples, plasma and media.

**SERVICES**

- GC/MS-based analysis of metabolites such as amino acids, keto acids and lipids.
- Rapid and accurate measurement of major metabolites (glucose, glutamine, lactate, glutamate, ammonium and potassium) using the YSI 2950 analyzer.
- Measurement of ATP/ADP/AMP and NADPH/NADH metabolites and derivatives by HPLC.
- Both full service sample analysis and user training is available.

**EQUIPMENT**

- GCMS-QP2010 Plus for metabolomics and metabolic flux analysis. Expanded mass range (1.5 to 1090 Daltons), uniform temperature control, with an expanded temperature range of 100 to 300°C
- YSI 2950 metabolite analyzer, to measure glucose, glutamine, lactate, glutamate, ammonia and potassium in media, serum or other liquid samples in 96 wells or tubes
- Seahorse XFp to measure the two major energy producing pathways of the cell – mitochondrial respiration and glycolysis - in real-time. Fast, sensitive measurement of cellular bioenergetics and label free.
- Shimadzu Prominence HPLC for bioenergetics and other small molecules analyses.