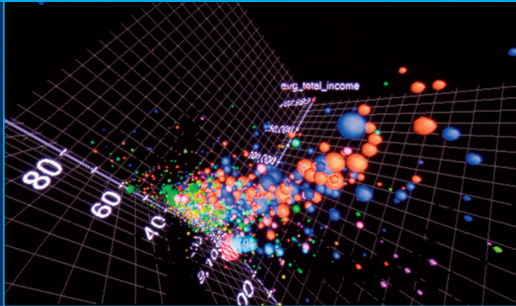
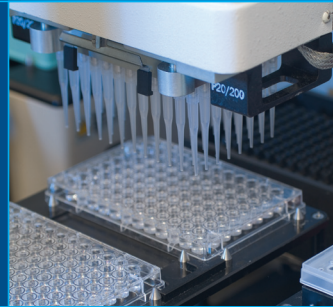
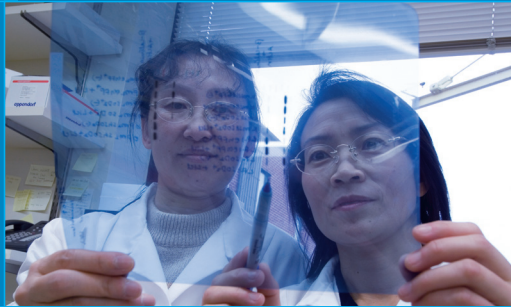


# Advanced Technology Program



**Accelerating discoveries for the treatment of cancer and AIDS**

# Advanced Technology Program

Accelerating discoveries for the treatment of cancer and AIDS

The Advanced Technology Program (ATP) laboratories at the National Cancer Institute at Frederick, operated by SAIC-Frederick, Inc., were established to provide NCI and other NIH investigators with access to leading-edge technologies and specialized expertise through a tightly integrated, highly effective approach to the study of complex biological problems.

Under the direction of Tim Harris, PhD, our scientists—at the forefront of their respective fields—continuously meet challenges with new technologies and make significant contributions to collaborative research projects with NIH scientists and extramural collaborators.

Our wide range of cutting-edge technologies accelerate the translation of basic research discoveries into new treatments for patients with cancer and AIDS. These technologies are

integrated under the unified management structure of a Federally Funded Research and Development Center (FFRDC). The FFRDC enables the rapid and flexible deployment of these technologies to achieve targeted R&D priorities of the federal government and of our corporate and academic partners.



## Powerful Tools

Each ATP lab devotes a substantial portion of its effort to technology development, resulting in advanced methods and approaches designed for maximum impact on discovery and translational research.

The ATP can be accessed through a variety of funding, contractual, and partnership mechanisms. Please contact for further information:

### Program Director

#### Timothy Harris, PhD

Corporate Vice President of Technology  
SAIC-Frederick, Inc.  
301-846-1144 or harristjr@mail.nih.gov

### Public-Private Partnerships

#### David Hoekzema, MBA

Director, Strategic Business Development  
SAIC-Frederick, Inc.  
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### Intramural/NIH Institutional Programs

#### Bruce Crise, PhD

Director, Business Development  
SAIC-Frederick, Inc.  
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### Advanced Technology Program

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National Cancer Institute at Frederick  
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Frederick, MD 21702

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## Research Collaborations

The resources available to you include the opportunity to partner with the biomedical research scientists on our staff. They are engaged daily in everything from routine laboratory processes to complex experimental design and interpretation of results. Projects frequently flow across the range of expertise within the ATP groups. Our scientists have already enabled many investigators to extend their inquiries to depths and in directions perhaps otherwise inaccessible.

## ATP Technologies and Capabilities

### Genetics and Genomics

- 4 Molecular Technology
- 6 Core Genotyping

### Proteins and Proteomics

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- 14 Proteomics and Analytical Technologies

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# Laboratory of Molecular Technology

Cutting-edge genomic expertise, tools, and analysis

## *A Powerful Partner*

The Laboratory of Molecular Technology (LMT) is an integrated molecular biology laboratory focusing on high-throughput gene discovery and analysis, including advanced sequencing, genetics, and genomics technologies, with associated bioinformatics and information management. With a focus on quality and service, the LMT is committed to helping the National Cancer Institute and scientific community understand, treat, and eradicate both cancer and disease. LMT offers access to its technologies and expertise through routine technical support, as well as more complex collaborations that focus on technology development.

## *Helping You with Powerful Science*

- Highly automated robotic systems that increase throughput, accuracy, and cost efficiency
- High-throughput automation for nucleic acid extractions, sequencing, molecular diagnostics, microarray, and quantitative PCR analyses
- Strategies designed to identify pathways/genes/ gene products involved in the development of cancer
- Integration of genomic DNA and expression profiles to identify prognostic and diagnostic markers

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For information about these services, contact:

**Daniel Soppet, PhD**

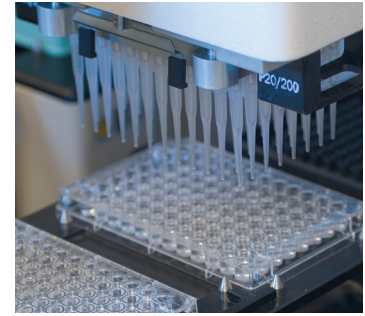
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## **Areas of Expertise and Available Technologies**

The LMT is now offering Roche/454 GS FLX next-gen sequencing technology, producing 250 bp reads using standard GS FLX chemistry and 500 bp reads using Titanium chemistry. Other services offered include the Affymetrix High-Throughput Array (HTA) system, with capacity for simultaneous processing of 24, 48, 72, or 96 samples for genotyping, gene expression, and molecular profiling; array-based comparative genomic hybridization (aCGH); and an LMT-developed microRNA array for molecular profiling and microRNA discovery provided on the Agilent platforms.

### **DNA Sequencing**

- Standard and High-throughput Sanger DNA sequencing
- Next-Gen sequencing on Roche/454 utilizing GS FLX and Titanium chemistries
- Mutation screening
- Viral insertion site identification and mapping
- LMT-LIMS Sequencing Database

### **Laboratory Automation**

- Beckman FX/Agencourt DNA and RNA extractions
- Multiple Beckman and Hamilton platform capabilities
- Custom method development
- HTA for 24- and 96-sample PEG arrays

### **Quantitative PCR and SNP Genotyping**

- Absolute and relative gene expression analysis utilizing TaqMan® assays
- Multiplex gene expression analysis
- Microarray confirmation analysis: Copy number and fold expression
- miRNA confirmation analysis: Qiagen miRNA panel
- SNP genotyping, utilizing TaqMan® assays

### **Clinical Diagnostics**

- Mutation detection under Clinical Laboratory Improvement Amendment (CLIA)
- Array-CGH for identification and characterization of human DNA copy number variations

### **Microarrays**

- Low- and high-throughput Affymetrix gene expression microarrays
- Affymetrix genotyping microarrays
- Agilent expression microarrays
- Low- and high-throughput array-CGH
- miRNA microarrays

### **ATP Collaborative Technology Development**

- Whole transcriptome sequencing
- Ultra-high-throughput mutation detection
- Whole genome methylation status
- Wiki-LIMS

# Core Genotyping Facility

Illuminating cancer genetics

## *A Powerful Partner*

With remarkable advances in genomic technologies, the National Cancer Institute established the Core Genotyping Facility (CGF) to investigate the contribution of germline genetic variation to cancer susceptibility and outcomes. Working in concert with epidemiologists, biostatisticians, and basic research scientists in the intramural research program, the CGF has developed the capacity to conduct genome-wide association studies (GWAS), and candidate gene approaches to identify the heritable determinants of various forms of cancer.

## *Helping You with Powerful Science*

- Standardized and automated sample-handling techniques
- Assay design and validation
- Next-Gen sequencing capabilities via Roche 454 Platform
- Genotyping capabilities on multiple platforms from uniplex assays to GWAS
- Unparalleled data analysis and bioinformatics support

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For information about these services, contact:

**Amy A. Hutchinson**

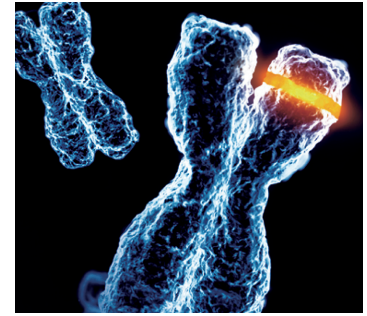
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For support:  
[www.ncifcrf.gov/research-technologies](http://www.ncifcrf.gov/research-technologies)



## **Areas of Expertise and Available Technologies**

Equipped with the latest genotyping technology, the CGF has developed the capacity to conduct genome-wide association studies (GWAS) and candidate gene approaches to identify the heritable determinants of various forms of cancer. Additional functions include bioinformatics and analysis tools, integration of new technology, QA/QC, project management, and administration. All components function to provide cutting-edge technology and resources for the National Cancer Institute.

### **Sample Handling**

- Optimized procedures documented via SOPs
- Initial sample qualification using ND-1000 spectrophotometer
- Whole genome amplification available
- Automated Picogreen absorbance assay for DNA quantitation
- High-throughput ABI Identifiler assay

### **Genotyping Capabilities**

- Standard and custom AB TaqMan uniplex genotyping
- Fluidigm BioMark 48x48 and 96x96 Dynamic Arrays
- Illumina GoldenGate 384 to 1536 custom-selected SNPs
- Illumina iSelect 7,600 to 121,600 SNPs on a custom panel for disease-related or pathway-specific studies
- Fully automated pipeline for all Illumina Infinium arrays

### **Next-Gen Sequencing**

- Roche 454 Platform for targeted deep resequencing and de novo SNP discovery
- Ongoing collaboration with Roche-Nimblegen to evaluate and optimize sequence capture technology for adoption at the Core Genotyping Facility

- Recent addition of the Covaris Sonication equipment, which enables high-throughput and efficient sample fragmentation
- Ongoing collaboration with Fluidigm to evaluate the SlingShot and high-density digital arrays for absolute sample quantitation and replacement of the titration steps

### **Bioinformatics and Data Analysis**

- Extensive QC review (quantity, quality, known and unknown duplicates) of all samples before genotyping
- Assay validation using highly characterized HapMap populations
- LabVantage Sapphire R5 LIMS for support of all sample processing activities
- Publicly available analysis tools including SNP500Cancer (<http://snp500cancer.nci.nih.gov>); Genewindow (<http://genewindow.nci.nih.gov>); and TagZilla (<http://tagzilla.nci.nih.gov>).
- Genotype Library and Utilities (<http://code.google.com/p/glu-genetics>)
- Basic association analyses for all genotype reports
- Value-added, in-depth analysis support available

# Protein Chemistry Laboratory

Expertise in macromolecular interactions

## *A Powerful Partner*

The Protein Chemistry Laboratory (PCL) has expertise in macromolecular interactions and experience with surface plasmon resonance (SPR) spectroscopy. These techniques provide valuable resources for identifying appropriate targets for drug development, developing assays for drug screening, characterizing affinity reagents, and gaining insights into areas of anti-cancer and anti-HIV drug development. PCL also offers advanced protein chemistry techniques for protein identification and has developed powerful tools for molecular binding studies.

## *Helping You with Powerful Science*

- SPR (Biacore®), fluorescence spectroscopy, and mass spectrometry
- SPR Array ProteOn XPR 36
- High-sensitivity protein identification (using both Edman sequencing and mass spectrometry)
- HPLC purification and quality control of proteins and oligonucleotides
- Extramural partnerships to develop new techniques and technologies

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For information about these services, contact:

**Robert Fisher, PhD**

Phone: 301-846-5154

Fax: 301-846-7269

[fisher@ncifcrf.gov](mailto:fisher@ncifcrf.gov)

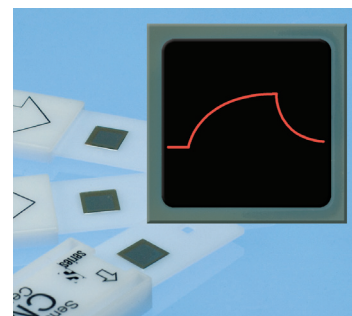
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## **Areas of Expertise and Available Technologies**

The depth of expertise in SPR spectroscopy at PCL provides an unparalleled resource to study macromolecular interactions, ranging from small molecules binding target proteins to protein–nucleic acid interactions. The technology and expertise at PCL are provided to the research community through routine technical support as well as through more complex collaborations.



### **SPR Spectroscopy**

- Acquisition of real-time signals that detail the molecular interactions between a tethered ligand and solution analytes
- Kinetic data, association/dissociation and equilibrium constants, obtained in a label-free environment
- Design of additional experiments to investigate the molecular mechanisms of interactions

### **Protein Chemistry/Characterization**

- Mass spectrometry and in-gel digestion used to identify proteins, cross-links, phosphorylation sites, and other post-translational modifications
- Classical Edman amino acid sequencing, which gives unambiguous and quantitative results about the N-terminal amino acid sequence of a protein
- Protein, peptide, and oligonucleotide analysis and purification by high-performance liquid chromatography

### **Mass Spectrometry**

- Expertise in MALDI-TOF (matrix-assisted laser desorption/ionization time-of-flight) mass spectrometry; emphasis on molecular-weight determination of oligonucleotides, proteins, and peptides
- Ongoing MALDI-TOF development of new matrices/modifiers and sample preparation

### **Fluorescence Spectroscopy**

- Steady-state fluorescence anisotropy and fluorescence intensity measurements for studying solution-based molecular interactions
- Time-resolved fluorescence approaches for quality control and interaction analysis

# Protein Expression Laboratory

Innovative solutions for access to proteins

## A Powerful Partner

The Protein Expression Laboratory (PEL) develops and adopts innovative gene cloning, cell culture, protein expression, and protein purification technologies to deliver cells, clones, and recombinant proteins for a broad range of applications. Under the leadership of an inventor of the Gateway® cloning system, PEL has proven particularly effective at providing researchers with solutions to intractable protein expression problems.

## Helping You with Powerful Science

- Construction of chimeric proteins that can be employed as in vivo reagents either to capture interacting proteins or to follow the dynamics of protein migration and interactions
- Expression of interacting proteins and virus-like particles from single DNA constructs
- Discovery of protein–protein interactions via tandem affinity purification
- Construction of lentiviruses to express genes and reporters from a variety of mammalian promoters
- The most highly efficient in vitro protein synthesizing systems available

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For information about these services, contact:

**James Hartley, PhD**

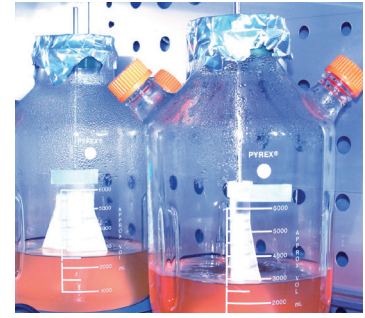
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[www.ncifcrf.gov/research-technologies](http://www.ncifcrf.gov/research-technologies)



## **Areas of Expertise and Available Technologies**

PEL has invented and demonstrated a proprietary approach to highly parallel protein expression for large numbers of proteins in human and other proteomes. These proteins will be critical for the development of reagents for biomarker discovery, validation, and detection. PEL provides access to its technologies and expertise through both routine technical support and more involved collaborations.

### **Gene Cloning**

- DNA clone construction, simple to complex
- Expression vectors with a wide variety of promoters, fusion tags, drug selections
- Vectors for *E. coli*, *Pichia pastoris*, *K. lactis*, baculovirus, lentivirus, adenovirus, transient and stable insect and mammalian expression
- Complete sequencing of all clones

### **Expression Optimization**

- Parallel optimization in *E. coli*, yeast, insect, and mammalian cells
- Comparison of promoters, fusion tags, expression conditions
- Analysis by stained gels and Westerns
- Comprehensive positive and negative controls

### **Discovery of Protein–Protein Interactions**

- Tandem affinity purification with in-house vectors and assays complementary to yeast two-hybrid
- Amino or carboxy fusions
- Two internal controls and a parallel negative control for each experiment
- Identification of interacting proteins by the ATP Laboratory of Proteomics and Analytical Technologies

### **Instrumented Expression**

- Fully instrumented expression for superior yield and reproducibility
- Vessels from 1 to 60 liters
- Automatic capture of growth parameters
- Automated sampling 24-7
- Outstanding for secreted mammalian proteins

### **Protein Purification**

- Microscale preliminary scouting with MEA Phynexus
- Affinity or native purification
- Fusion tag removal
- Low endotoxin available
- Microgram-to-gram scale with six computer-controlled work stations

### **On-Demand Protein Microarray**

Expression-ready plasmids onto slides (customized) to make protein array on-demand

### **Protein Delivery to Mammalian Cells**

- VLP (virus-like particle)-mediated protein delivery
- No genetic materials in the VLPs, only protein

# Viral Technology Laboratory

Specialty services in viral-based applications

## A Powerful Partner

The Viral Technology Laboratory (VTL) focuses on oncogenic viral pathogenesis and the role of viruses in cancer etiology using a combination of well-established techniques and cutting-edge technologies.

## Helping You with Powerful Science

- Generation, amplification, purification, concentration and titration of **lentiviruses** and **adenoviruses** expressing transgenes or shRNAs for gene delivery in vitro and in vivo
- Development of **PCR-based expression arrays** for viruses or pathways
- **Nucleic acid** extraction, purification, and quantitation from **blood, cells, or tissues** for various downstream uses, including PCR and SNP analysis
- Customized applications and assay development for viral analysis, including **antibody** and **antigen** screening assays, as well as sensitive and specific quantitative real-time PCR assays to **detect** viruses.

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For information about these services, contact:

### Betty Conde, PhD

Phone: 301-846-7533

Fax: 301-846-7119

[conde@ncifcrf.gov](mailto:conde@ncifcrf.gov)

### Rachel Bagni, PhD

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Fax: 301-846-7119

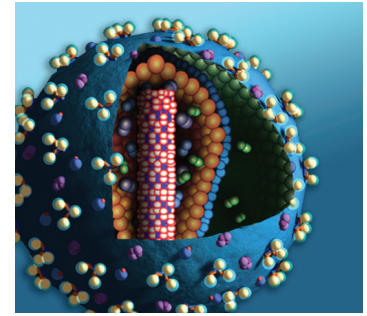
[bagnir@ncifcrf.gov](mailto:bagnir@ncifcrf.gov)

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## Areas of Expertise and Available Technologies

VTL offers custom recombinant lentiviral and adenoviral vectors for studying gene expression in vitro and in vivo. VTL also offers a variety of customized applications, assays, and analyses, including validated serological and molecular assays for measuring viral nucleic acids and other determinants of viral infection.

### Lentivirus and Adenovirus Production

- Recombinant **lentiviral** and **adenoviral** expression vector construction and virus production
- Viral vector expression of **shRNA** for gene knockdowns
- **Pre-made** adenoviruses (Ad-GFP, Ad-Cre-GFP, Ad-LacZ)
- **Large-scale**, CsCl-purified preparations of transfection-quality plasmid DNA and BAC preps
- Mammalian cell transduction and gene expression

### Custom Molecular Services

- Custom development of Q-PCR assays for **pathogen detection**
- Custom development of Q-PCR arrays for **viral** or **cellular pathway gene expression**
- Viral **genotyping** assays
- **Phylogenetic analysis** of viral nucleotide and protein sequence data

### Serological Testing

- **Luminex® multiplex** cytokine, chemokine, and cell-signaling analysis
- Commercial and in-house serological **ELISA** assays for antibodies to **viral infection**
- **Custom** serological assay development

### Molecular Testing

- Nucleic acid (**DNA** and **RNA**) extraction and purification from many specimen types, such as blood, cells, tissues, and saliva
- **Validated** real-time Q-PCR assays for **pathogen detection**. Validated assays include (but not limited to) HCV, HBV, HIV-1, EBV, HTLV-I/II, JCV, and BKV.
- **Mycoplasma detection**

# Laboratory of Proteomics and Analytical Technologies

Proteomics discoveries through enabling technologies

## A Powerful Partner

As one of the major mass spectrometry centers worldwide, and as its name suggests, the Laboratory of Proteomics and Analytical Technologies (LPAT) has a wide range of technologies and expertise for characterizing both single proteins and multiple proteins present within complex mixtures, as well as for cell profiling. These capabilities have helped to place NCI at the forefront of proteomics research.

## Helping You with Powerful Science

- State-of-the-art instrumentation capable of both high-throughput and complete protein characterization: includes three LTQ ion traps; an LTQ-FT-Mass Spectrometer (MS); a QqTOF MS; and a MALDI-TOF/TOF
- New methods for the analysis of lipids and steroid hormones
- New methods for quantifying carcinogens and their metabolites, PCR products, DNA fragments, proteins, peptides, and amino acids
- Nuclear Magnetic Resonance facility specializing in small-molecule structural determination and becoming increasingly involved in metabolomics

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For information about these services, contact:

**Timothy D. Veenstra, PhD**

Phone: 301-846-7286

Fax: 301-846-6037

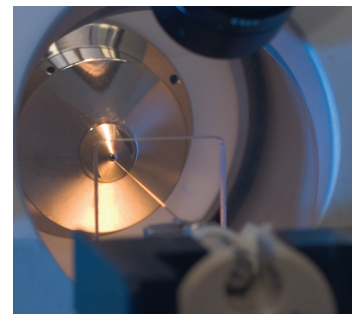
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## ***Areas of Expertise and Available Technologies***

The technologies developed at LPAT include a broad range of proteomic and protein analytical assays. Access to the LPAT technologies and expertise is available to the research community through both routine technical support and more involved collaborations.



### ***The Mass Spectrometry Center***

- Protein identification via sequence-related information obtained by LC-MS/MS
- Peptide mapping acquired by MALDI-TOF
- Quantitative proteomics
- Identification of protein complexes
- Small molecule identification using tandem MS
- Quantitative lipid analysis
- Analysis of clinical samples, including tissue sections

### ***Separation Technology***

- Capillary electrophoresis
- Fast separation and sensitive laser-induced fluorescence detection
- Determination of protein isoelectric point
- High-pressure liquid chromatography
- DNA mutant detection
- Gas chromatography

### ***Nuclear Magnetic Resonance***

- NMR data acquisition
- Structural assignment
- Pulse sequence programming

# Optical Microscopy Analysis Laboratory

Cellular and molecular imaging expertise

## A Powerful Partner

The Optical Microscopy Analysis Laboratory (OMAL) provides the research community with valuable tools for understanding molecular interactions at the tissue, as well as cellular and intracellular, level and for imaging of living and fixed cells, tissues, and even whole organisms. This laboratory, coupled with others in NCI, allows the researcher to study the molecular biology of cancer in living tissue.

OMAL collaborates closely with NCI laboratories by providing quantitative microscopy-based technologies.

## Helping You with Powerful Science

- State-of-the-art, 3D optical (confocal) microscopy
- State-of-the-art algorithms for quantitative confocal image analysis of tissue and cells
- Applications for living cell imaging, FRAP, FRET, and two-photon

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For information about these services, contact:

**Stephen Lockett, PhD**

Phone: 301-846-5515

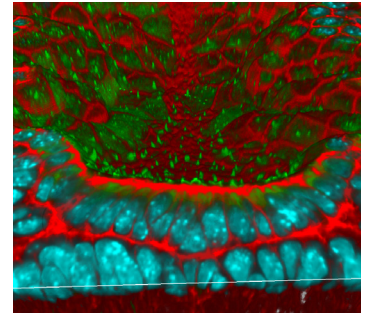
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For support:  
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## **Areas of Expertise and Available Technologies**

Confocal microscopy offers tremendous potential as a “bridge” for molecular imaging, from the microscopic level to whole animals. Access to OMAL technologies and expertise is available to the research community through both routine technical support and more involved collaborations.

### **Confocal Microscopy**

- High-resolution and time-lapse fluorescence imaging
- Microinjection
- Differential interference contrast microscopy
- Ratio imaging of calcium ions and other elements
- Experiments in uncaging and photoactivation of molecules in cells
- Fluorescence resonance energy transfer (FRET) experiments to detect direct binding of fluorescence-tagged molecules
- Fluorescence recovery after photobleaching (FRAP) experiments to measure the diffusion of molecules

### **Image Analysis**

- Cell and cell nucleus segmentation
- 2D and 3D cell segmentation, deconvolution, and FISH signal analysis
- Mathematical modeling of FRAP data
- Spatial-statistical analysis of gene organization in interphase nuclei
- Co-localization analysis of two fluorescence-tagged molecules in cells
- Automatic data archiving

### **Recent Collaborations**

OMAL collaborates with a number of NCI principal investigators, as well as with researchers in academia and public–private partnerships. In various collaborations during the past year, OMAL:

- Studied the cytoplasmic, molecular interactions of STAT3, activated in many major cancers
- Analyzed the mechanisms by which several natural products selectively kill tumor cell lines
- Developed the first steps for a public–private partnership intended to significantly improve diagnosis and treatment of cancer, speed up drug discovery, and advance understanding of human cancer by performing high-content molecular analysis at the cellular level in intact tissue sections
- Developed user-friendly interfaces with software to statistically analyze spatial aspects of the organization of fluorescence in situ hybridization (FISH) signals in interphase nuclei in cell culture samples and tissue sections
- Completed semi-automated, dynamic programming-based algorithms for segmenting whole cells from 3D images
- Analyzed the dynamics of GFP-STAT1 in living cells
- Built standard calibration samples of fluorescent dextrans in media of known viscosity
- Built a new model to quantify diffusion coefficients in fluorescence recovery that accounts for recovery during the bleaching phase

# ***Electron Microscopy Laboratory***

Ultrastructure analysis and imaging expertise

## ***A Powerful Partner***

The Electron Microscopy Laboratory (EML) provides the research community with high-quality, ultrastructural analysis, utilizing state-of-the-art electron microscopes. Instrumentation and sample processing techniques incorporate advanced technologies that will greatly aid research and collaborations.

## ***Helping You with Powerful Science***

- Transmission electron microscopes (TEMs) equipped with high-resolution CDD cameras
- 200kV cryo-TEM equipped with a cryo-sample holder
- Scanning electron microscope (SEM) equipped with X-ray energy-dispersed spectroscopy for atomic element analysis and variable pressure operation for hydrate samples
- Cryo-electron microscopy to significantly increase research possibilities

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For information about these services, contact:

**Kunio Nagashima**

Phone: 301-846-1594

Fax: 301-846-6716

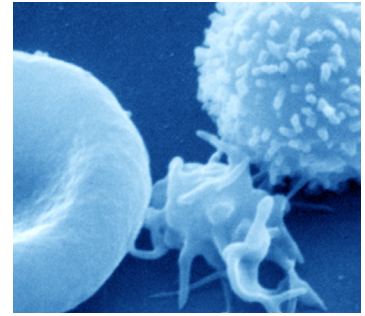
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## ***Areas of Expertise and Available Technologies***

Electron microscopy offers tremendous potential as a “bridge” for ultrastructural analysis from the subcellular level to nanomaterial analysis. Access to EML technology and expertise is available to the research community through both routine technical support and more involved collaborative research support.

### ***Technology***

- Negative-stained TEM analysis of virus, bacteria, nanoparticles, carbon nanotubes, liposomes, and macromolecule structures
- Thin-sectioned TEM analysis of tissue, cell pellet, virus pellet, bacteria, and cultured cells
- SEM analysis of tissue, cultured cells, blood cells, insect, bacteria, and virus
- Pre- and post-embedding immunoelectron microscopy (IEM) of tissue, cultured cells, yeast, and bacteria

### ***New Technology Development***

- TEM 3D tomography includes manual and automated stage tilt; high-resolution, bottom-mount camera to characterize nanomaterials and virus particles such as HIV
- Energy-dispersive spectroscopy (EDS) elemental analysis of thin-sectioned tissues and cells exposed to nanoparticles
- Microwave-aided immunogold labeling technique, an effective and efficient method for the rapid dehydration and infiltration of EM samples
- Cryo-TEM of macromolecule, virus, and liposome samples
- 3D tomography of macromolecule, virus, and liposome samples
- High-resolution and high-throughput EDS analysis of nanomaterials

### ***Electron Microscopy***

- Transmission electron microscopy (TEM) for ultrastructural and negative-stained semi-quantitative analysis
- Scanning electron microscopy (SEM), including cell-surface immunolabeling and cryofractured samples
- Immunoelectron microscopy (IEM): pre- and post-embedding, silver-enhanced, and IEM negative-stained analysis
- Ultra microtomes; Toluidine Blue-O-stained plastic sections from embedded samples
- Energy-dispersive spectroscopy (EDS)

# Nanotechnology Characterization Laboratory

New applications in cancer therapeutics and diagnostics

## *A Powerful Partner*

The Nanotechnology Characterization Laboratory (NCL) provides preclinical efficacy and toxicity testing of nanotech cancer therapeutics and diagnostics. The NCL is a formal collaboration among the National Cancer Institute's Alliance for Nanotechnology in Cancer, the National Institute of Standards and Technology (NIST), and the Food and Drug Administration (FDA) to accelerate the development and commercialization of nanoscale particles and devices for clinical applications.

## *Helping You with Powerful Science*

- Sterility testing
- Physicochemical characterization: size, topology, and molecular weight
- Aggregation and purity
- Surface characteristics, functionality
- Zeta potential, stability, solubility
- In vitro toxicity and immunological characterization
- In vivo efficacy and toxicity testing: pharmacokinetics and ADME
- Immunotoxicity
- Dose-range finding toxicity
- Efficacy

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For information about these services, contact:

**Scott E. McNeil, PhD**

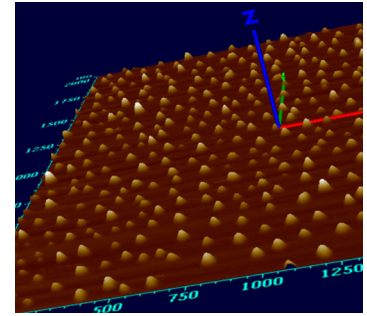
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For support:  
[www.ncifcrf.gov/research-technologies](http://www.ncifcrf.gov/research-technologies)



## **Areas of Expertise and Available Technologies**

NCL has an interdisciplinary staff with expertise in the evaluation of nanomaterials from the majority of types intended for medical applications—including liposomes, nanoshells, nanorods, metal colloids, functionalized gold, titanium dioxide, derivatized fullerenes, dendrimers, quantum dots, nanoemulsions, nanocrystals, iron oxides, and polymer-based nanomaterials. NIST and FDA also bring unique expertise to the NCL partnership.

### **The NCL Assay Cascade**

NCL now has more than 30 protocols in its assay cascade. These assays undergo in-house validation and regular revision to ensure applicability to a variety of nanomaterials. NCL has recently developed methods for:

- Gadolinium quantitation
- Two lysosomal dysfunction assays
- Stressor gene responses in cells
- Mycoplasma detection
- Cellular uptake via light microscopy
- Quantitation of gold in biological matrix
- Thin-layer chromatography assay for lipid-based systems
- Inductively coupled plasma mass spectrometry
- Atomic force microscopy
- Dynamic light scattering

### **Moving Nanotechnology Concepts to the Clinic**

For many nanotechnology drug developers, the prospect of preparing, characterizing, and submitting these products for regulatory approval can be daunting. Unlike protocols for small-molecule drugs or protein-based drugs, the protocols for characterizing new nanotech products are not well established.

NCL provides a smoother path to clinical trials by offering characterization based on protocols developed especially for nanoscale particles. NCL assays are now being promoted as “best practices” by standards-developing organizations such as ASTM International and the International Standards Organization (ISO). Three NCL methods for nanoparticle biocompatibility testing are now ASTM International standards.

The data generated from NCL characterization are intended for use in support of submission of Investigative New Drug (IND), or Investigational Device Exemption (IDE) applications with the FDA. NCL also conducts independent and collaborative research programs directed at understanding the relationships between nanoparticle structure and biological activity.

# Advanced Biomedical Computing Center

High-performance bioinformatics and modeling support

## A Powerful Partner

The Advanced Biomedical Computing Center (ABCC) provides high-performance computing support to biological researchers in all areas of bioinformatics, including the areas of proteomics, molecular modeling, imaging, data-intensive classification and knowledge discovery, structural biology and genomics, and nanotechnology modeling and simulation. ABCC maintains technological currency to provide a cyber infrastructure and scientific collaboration and consulting, which creates an environment for the solution of data-intensive problems.

## Helping You with Powerful Science

- Up-to-date, local copies of such databases as Genbank, PDB, PIR, SWISS-PROT, Genpept, NRDBNucl, and NRDBProt
- Comprehensive and diverse software resources, including high-performance computing resources, high-capacity storage, and 3D visualization for imaging
- Technical support, including collaborative research, parallel program development, visualization/graphics, algorithm optimization, and training seminars

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For information about these services, contact:

### Robert Stephens, PhD

Phone: 301-846-5787

Fax: 301-846-5762

[bobs@ncifcrf.gov](mailto:bobs@ncifcrf.gov)

### Jack R. Collins, PhD

Phone: 301-846-1990

Fax: 301-846-5762

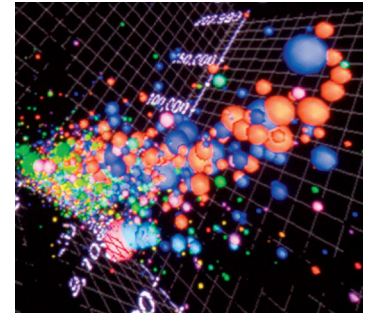
[collinsj@ncifcrf.gov](mailto:collinsj@ncifcrf.gov)

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## ***Areas of Expertise and Available Technologies***

Of particular interest, ABCC is developing analytical approaches for serum proteomic profiles and genomic analysis. Recently, ABCC has developed classification methods to identify biomarkers for interstitial bladder cystitis and colorectal cancer. For colorectal cancer, the biomarker is 86% accurate for pre-cancerous polyps and 96% accurate for Stage 1 tumors. ABCC has also developed rapid methods for finding tandem repeats and segmental duplications in whole genomes. In addition, ABCC has developed techniques for performing whole genome comparisons.

### ***Bioinformatics***

- Bioinformatics training and consultation with individual scientists or entire laboratories
- On-line access to all common bioinformatics applications and databases
- Sequence comparisons and analysis
- Database searching and peptide analysis, including pathway and microarray analysis; custom application and database development; Web-accessible applications; Web hosting; and Biomarker identification and classification
- Microarray analysis from all platforms
- Genome-wide association analysis
- Data integration and identifier conversion
- Data/laboratory management solutions
- Archive and long-term storage
- Next-generation sequence analysis

### ***Modeling***

- Homology modeling
- Docking
- Classes in modeling and molecular structure
- Structural genomics
- Characterization of physical properties
- Drug design
- Enzyme catalysis
- Interactions of metals with proteins
- Protein–protein interactions

### ***Image Analysis***

- 3D Image analysis (MRI, PET, CT/Spect, ultrasound, etc.)
- Cellular image analysis, data storage, and management
- Medical image analysis
- Visualization



## **Laboratory Animal Sciences Program**

Translational research support through integrated services

### ***A Powerful Partner***

The Laboratory Animal Sciences Program (LASP) works in parallel with the laboratories of the Advanced Technology Program to provide an integrated range of quality services, facilities, and technologies to support the diverse animal-based research requirements of the scientific community. LASP performs comprehensive oversight of facilities and operations to ensure the ethical use of laboratory animals under controlled and healthful environmental conditions.

### ***Helping You with Powerful Science***

The LASP veterinary staff manages the preventive medicine program, and provides clinical diagnosis, therapy, and preoperative and postoperative care for research colonies. Experienced scientific and technical personnel offer consultation and assistance in the design of animal research protocols, and in selection of appropriate animal models to meet the research objectives of investigators. Scientific support programs for mouse model development and phenotypic analysis and other technologies are offered in support of the research effort.

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For information about these services, contact:

**Lionel Feigenbaum, PhD**

Phone: 301-846-1696

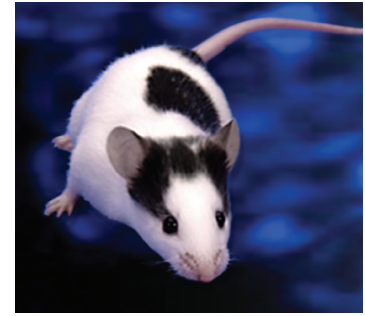
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For support:  
[www.ncifcrf.gov/research-technologies](http://www.ncifcrf.gov/research-technologies)





## **Areas of Expertise and Available Technologies**

Animal models of human diseases constitute a powerful tool in our understanding of disease etiology, progression, and treatment. Through the development of a longitudinal set of technologies, LASP is able to address some of the most salient questions in tumor biology. As a partner in the NCI Preclinical Models Research Initiative, LASP uses a wide range of services, facilities, and technologies to assist in developing targeted cancer therapies.

### **Transgenic Mouse Model Laboratory**

- Production and characterization of genetically engineered mice by pronuclear microinjection and gene targeting in ES cells
- Consultation in the design of targeting or transgenic constructs

### **Pathology/Histotechnology Laboratory (PHL)**

- Flexible and innovative histopathology and molecular pathology support, from rodent necropsies through to nucleic acid isolation from target cell populations
- Laser capture microdissection, immunohistochemistry, tissue microarray, in situ hybridization, blood chemistry analysis, and hematology
- Pathologist-assisted animal study design, histopathology and immunohistopathology evaluation, photomicrography, report and manuscript preparation

### **Cryopreservation and Assisted Reproduction Laboratory**

- Banking of mouse strains by preserving their frozen germplasm
- Alternative techniques (embryo, ovary, or sperm) enabling most inbred, spontaneous mutant, or genetically engineered strains to be cryopreserved

### **Animal Health Diagnostics Laboratory**

- Comprehensive diagnostic services to monitor and maintain the health status of animal research colonies

### **Animal Holding and Quarantine**

- High-quality facilities and resources that ensure that research animals are handled and cared for in a humane manner in a healthful, controlled environment
- Quarantine of imported animals and/or rederivation of pathogen-carrying strains

### **Small-Animal Imaging Program**

- Multimodality imaging facility (MRI, PET, SPECT, Ultrasound, X-ray CT, and Optical Imaging) for real-time in vivo monitoring of tumor cells, metastases, and tracking of gene expression

### **Speed Congenics Program**

- Accelerated production of congenic mouse strains by microsatellite marker-assisted backcrossing

# Visual Communications

Effective science deserves excellent presentation

## *A Powerful Partner*

Visual Communications provides the scientific community with expertise in the effective communication of information, both scientific and general. Visual Communications includes the NCI-Frederick Conference Center, which offers conference and events planning services; and Scientific Publications, Graphics & Media (SPGM), which provides a broad range of media production services. Professionals in Visual Communications provide support at the level of the customer's choosing, in whole or in part, to maximize the impact of print and presentation media.

## *Helping You with Powerful Science*

- Video and multimedia production
- Writing, proofreading, and editorial services
- Digital image capture and processing
- Design and illustration
- Large-format print output
- Free seminars and workshops on effective communication
- Conference facilities and video teleconferencing
- Conference and events planning

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For information about these services, contact:

### **Ken Michaels**

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For support:

[www.ncifcrf.gov/research-technologies](http://www.ncifcrf.gov/research-technologies)



## ***Areas of Expertise and Available Technologies***

Communicating ideas and concepts accurately and understandably is vital to scientific progress. To that end, the mission of Visual Communications is to assist all of its clients in presenting their science in the most effective manner possible.

### ***Digital Video and Multimedia***

- Animation and graphics for the screen
- Digital video shooting and production
- Video format conversions and duplication

### ***Manuscript Preparation***

- Editing
- Electronic file preparation and text formatting
- Preparation of graphics and figures
- Illustration and photography

### ***Oral Presentation***

- PowerPoint slideshows
- Graphics and photography

### ***Site Visit Preparation***

- Formatting reports and handout materials
- Illustration, photography, and visuals

### ***Scientific Posters and Titles***

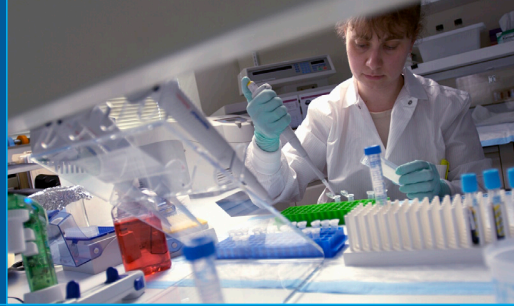
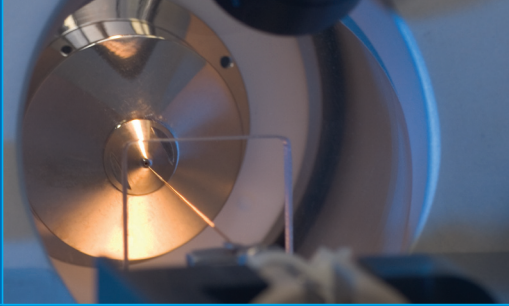
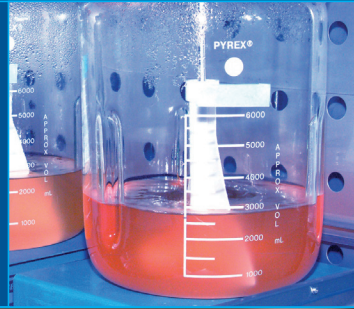
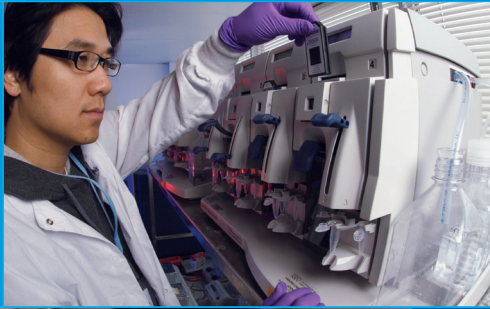
- Illustration and photography
- Large poster printing and laminating
- Design and layout

### ***Technical Services***

- Digital image capture, enhancement and file preparation
- Color matching and correction
- PDF file authoring

### ***Conferences and Events***

- Full service conference/events planning
- Facilities and audiovisual equipment
- Video teleconferencing equipment and setups



National Cancer Institute  
at Frederick

[www.ncifcrf.gov/atp](http://www.ncifcrf.gov/atp)



NATIONAL  
CANCER  
INSTITUTE