

Interdisciplinary Center for Biotechnology Research

ICBR

Genomics

Bioinformatics

Cellomics

Proteomics



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Education & Training





The mission of the Interdisciplinary Center for Biotechnology Research is clear and straightforward—

to provide scientifically knowledgeable, technically superb research services to the faculty. Our goal is simply to become a world-class research support center.

This goal has been significantly strengthened by our move to our own consolidated space in the Cancer & Genetics Research Complex (CGRC) in the summer of 2006. For the first time in ICBR's twenty year history, nearly all of our research support laboratories are conveniently housed in one location, the CGRC's South Wing.

Since assuming the directorship in mid-June 2006, I've taken the opportunity to evaluate ICBR's mission, structure and services. As an interdisciplinary Center established in 1987 by the Florida legislature, and reporting directly to the Vice President for Research, our mandate is to bring to the campus the best of the front line technology within the ever-changing and wide-ranging scope of the molecular life sciences. This is a difficult task - but this fundamental faculty research enhancement remains the basic first principle that I am using to govern all of ICBR's growth and management decisions.

Therefore, to better represent today's biotechnology landscape, we have reorganized ICBR's research laboratories into four scientific divisions:

Proteomics • Genomics • Bioinformatics • Cellomics

The use of the "-ics" signifies ICBR's dedication to an integrative approach to the science and technology of modern biological research. Together with the co-location of services within our own space, this organization allows, supports and encourages a synergy across all of the technologies that we provide. Our Education and Training Program draws upon all of these divisions to develop and teach hands-on laboratory courses and workshops to promote the use of molecular techniques in biological research and education. Each of these divisions and the high-end services they offer are profiled in this brochure.

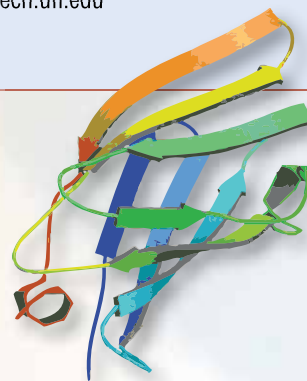
In addition to giving principal investigators across all disciplines access to these specialized and high end technologies, the ICBR staff, many at the PhD level, also offer and encourage consultation to improve approaches to faculty-designed research problems and proposals, thus leveraging faculty expertise and grant resources to the maximum. ICBR staff is also strongly committed to developing new advances in their technology areas and to passing this knowledge on to users. UF faculty reimburse ICBR primarily for consumable costs, making the use of our facilities and access to ICBR staff cost effective. This extensive interaction and cooperation between UF faculty and ICBR results in significant enhancement of faculty competitiveness and productivity.

ICBR's comprehensive research services are dedicated entirely to advancing your discoveries. I invite you to visit anytime to "talk science" and to tour our splendid new facility.

Robert Ferl, PhD
ICBR Director and Professor

"ICBR is flexible, forward-thinking, and responsive to change. We welcome your research ideas, challenges, and proposals. We'll work with you to move your research from concept to reality."

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The use of the “-ICS” signifies ICBR’S dedication to an integrative approach to the science and technology of modern biological research.

Proteomics

Our mission is to provide high-quality analytical services to investigators engaged in protein or proteomics-based research.

We feature state-of-the-art instrumentation and experienced personnel in the areas of mass spectrometry, protein and peptide separations, and peptide synthesis.



Our services have evolved from classical protein characterization approaches such as N-terminal sequencing

and amino acid analysis to more comprehensive methods that involve protein expression profiling and characterization of posttranslational modifications on a proteome-wide scale. Protein identification of gel-purified proteins in addition to the analysis of complex protein mixtures such as whole cell lysates are routine services. Various enrichment and separation strategies as well as stable isotope labeling technologies can also be utilized for relative quantitation of protein expression and posttranslational modification. We currently house five mass spectrometers dedicated to peptide and protein analyses:

- Hybrid quadrupole-TOF (ABI QSTAR XL)
- Hybrid quadrupole-linear ion trap (ABI 4000 QTRAP)
- 3-D ion trap (Thermo LCQ Deca)
- MALDI-TOF/TOF (ABI 4700 Proteomics Analyzer)
- MALDI-TOF (ABI Voyager DE-Pro)

We utilize the 2D DIGE system from GE Healthcare to label protein mixtures with fluorescent tags, prior to mixing and co-migrating them on the same 2D gel for comparison (for example, normal vs. diseased cells). Our Typhoon 9400 variable mode imager allows for more accurate quantitation of 2D DIGE gels via the incorporation of a fluorescently labeled internal standard within the gel. Fluorescent gel stains specific for posttranslational modifications such as phosphorylation and glycosylation can also be incorporated into the 2D gel-based workflow. Sophisticated image analysis software is used to determine significant changes in protein expression or posttranslational modification. Gel spots of interest can be excised, digested in-gel, and prepared for mass spectrometric analysis using a robotic gel manipulation platform.

Current instrumentation includes:

- Typhoon 9400 variable mode imager (GE Healthcare)
- Decyder 6.5 and Progenesis PG220 gel image analysis software
- Investigator™ Proteomic System featuring ProPic, ProGest, and ProMS

We offer a variety of solid and solution phase (for larger quantities of small peptides) peptide synthesis services utilizing tBoc or Fmoc chemistry. Our specialty is custom synthesis to suit the individual needs of customers. Select services include the synthesis of combinatorial peptide libraries, cyclic peptides, peptides containing peptide-bond surrogates, and labeling of peptides with various affinity and fluorescent tags. We also develop compounds for specialized applications involving protein quantitation or posttranslational modification analysis.

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Genomics

Gene-based analysis remains at the forefront of life-sciences discovery. ICBR’s Genomics Division has one singular mission: Provide the means for specialized genetic data acquisition, and at reasonable cost.



Our philosophy is that scientists should not be burdened with creating and maintaining the technical infrastructure to generate, store, and analyze genomic data, but instead focus on using this information for scholarly publication and for developing external funding opportunities. The Genomics Division provides life scientists with services that include large- and small-scale DNA sequencing, fragment analysis and gene expression using microarrays and quantitative or real-time PCR. A high-throughput technology platform (by Illumina) that supports a range of life science applications including SNP genotyping

and RNA profiling done in a massively parallel fashion will be available in 2007.

ICBR’s **Custom DNA Sequencing** services use state-of-the-art capillary array sequencers, ABI 3130 and 3730xl, to sequence DNA from purified templates or bacterial cultures. The Production DNA Sequencing group has a design capacity of over 700 million bases of high quality sequence per month due partly to the 384-capillary MegaBACE 4500 sequencer, but largely to our newly acquired 454 Life Sciences DNA sequencing unit, GS20, which is capable of sequencing a whole genome in three days. A broad spectrum of projects utilizing the pyrosequencing technology of the 454 have included, among others:

- Sequences of four bacterial genomes
- Multiple individual chloroplast genomes
- Metagenomics surveys of environmental samples

- Transcriptome profiling using normalized and non-normalized cDNA libraries
- Transposon-insertion site profiling technology

ICBR **Fragment Analysis** services apply molecular technology to studies in ecology, evolution, and conservation biology. The staff develops projects from sampling strategy through final publication, and provides extensive support in the analysis and interpretation of DNA sequence data. Mitochondrial DNA sequences are the primary methodology used for population and evolutionary studies. Second generation fingerprinting assays (using microsatellite libraries) are used for fine scale analysis of populations and for pedigree determinations.

ICBR's **Gene Expression** services can assist a client to develop a statistically valid experimental design. Services most often include complete Affymetrix and Agilent sample preparation and labeling from total RNA samples. In many cases where clients prefer to do their own chemistry, we provide array hybridization and array scanning services. Although microarrays have the ability to simultaneously evaluate the expression level of thousands of gene transcripts, they are not extremely quantitative.

ICBR's **Real-time PCR** (RT-PCR) service assists users to obtain precise, quantitative information (hence, the name qPCR) on gene expression of smaller number of gene species. The ABI Prism 7900HT is designed for performing RT-PCR in either 384-well microplate format or in credit-card size micro card format. The latter can be customized to assay from 1 to 384 genes using only a two-microliter sample volume.

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Bioinformatics

In recent decades, the rapid progress in genome-scale research has led to a near exponential accumulation of biological information. The quantity and complexity of biological information emphasizes information management and data mining at a scale previously unheard of in the life sciences. Bioinformatics emerged in response to this need. Early in the development of the Genomics Research Lab, ICBR realized the importance and necessity of bioinformatics support to genomic and proteomic projects, and gradually built a biologically oriented computation infrastructure.

In our role as a computation support group, we adhere to two goals:

- **Provide a computation infrastructure to facilitate the operation of ICBR high throughput core facilities**
- **Provide data management and analysis services to ICBR clients at reasonable cost**

The services we provide range from basic system administration to large volume data storage, from third party program operation to custom database development, from local BLAST search to whole genome annotation, from standard statistical analysis to advanced machine learning algorithm design, from transcriptome analysis to proteome analysis, etc.



Most of our data analysis tools are based on widely accepted public domain software or third party programs. At the same time we develop, build, and maintain our own databases and develop new systems to automate batch execution, improve performance, and integrate results. The lab also provides on-site and project-specific support for researchers on experiment design and data analysis. This service helps both our clients and us gain more insights

into their data, to understand the questions they ask, and the answers they seek.

Behind these services are our high performance hardware and staff with diverse skill sets. Our hazard-proof server room hosts a BLAST cluster with twenty-eight 2.4 GHz processors, a MASCOT server with 16G RAM and eight 2.4GHz processors, and a collection of dual-core LINUX servers. Most of our staff hold doctorate degrees. Their skill sets cover molecular biology, genomics, phylogenetics, machine learning, system administration, visualization, relational database and programming. All of these resources are dedicated to helping address biological data management and analysis requests.

Working closely with other ICBR facilities, we help our clients to decipher the mysteries embedded in the ocean of biological information and become more competitive in today's post-genome era.

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Cellomics

The Cellomics division of ICBR is devoted to assisting investigators in the study of cell structure, function and generation and application of cellular products.

The ICBR **Hybridoma Research Laboratory's** primary service is the development of new monoclonal antibodies. Monoclonal antibodies are used in many areas of basic scientific research, industry, human and animal medicine and agriculture. Monoclonal antibodies can be generated to almost any substance (toxins, drugs, blood proteins, cancer cells, viruses, hormones, environmental pollutants, food products, metals, plant materials). Monoclonal antibodies are routinely used to create sensitive tests for detecting or quantitating the presence or amount of various substances. These reagents are also routinely used in other applications such as flow cytometry and electron microscopy.

We can assist with antigen and immunoassay design and carry out all phases of hybridoma development: immunizing mice, fusions, screening

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(ELISA and western blotting) single cell cloning, mycoplasma testing and isotype determination. Other services include high density in vitro production, purification and biotin labeling of monoclonal antibodies. UF investigators may contract with this research laboratory for selection of human scFv reagents using phage libraries that have been licensed from the developers. Training opportunities in mammalian cell culture techniques and antibody applications are offered in collaboration with the ICBR Education and Training Lab.

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The ICBR **Flow Cytometry Research Laboratory** offers services that are



used for detecting cell surface or intracellular proteins, measuring apoptosis, cell cycle, cellular physiology, and have applications in both research and clinical medicine. The laboratory is equipped with 5 bench-top analyzers and one high-speed cell sorter. The staff is available for consultation in

experimental design and technical issues such as sample preparation. We can provide training for users that wish to learn the full operation of the instrumentation for self-service analysis, or we can analyze samples for you. The lab's most advanced instrumentation allows for up to 9 color experiments, and the cell sorter can be used to isolate specific populations of cells either in bulk or cloned as single cells into 96 well plates. This is done under sterile conditions so that the recovered cells can be put back into culture for further experimentation or for single cell PCR.

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The ICBR **Electron Microscopy Research Laboratory** provides



basic services in both transmission and scanning electron microscopy. We can provide complete or partial service on a sample. These services include thin-section EM, negative staining, replica formation, immunolabeling, and preparation for scanning EM.

Our laboratory offers an informal training program for those who want to learn all or part of the technology associated with EM studies. This includes operation of the microscopes. We also provide access to a fluorescent microscope for any basic optical microscopy studies.

All instruments are equipped with high resolution digital cameras. Data is provided via an FTP site or it can be provided to users on CD or DVD.

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The ICBR Education & Training Laboratory (ETL) develops and teaches hands-on laboratory workshops to promote the use of Molecular Techniques in biological research and education.

The workshop creation process starts with the full time ETL staff that will work with an expert in a particular field to define the theoretical material and supporting experimental work. The "expert" can be any person or company involved with biological life science research or technical applications.

The ETL will provide as much preparation and hands-on support as needed, or simply provide the physical location and advertising assistance if that is preferred. Additionally, ICBR showcases workshops developed within the ICBR Proteomics, Cellomics, Genomics and Bioinformatics divisions.

The courses and workshops are designed to reach faculty, graduate students and technical staff, as well as interested persons in the private and commercial sectors. We have students attend certain workshops from many parts of the world. Along with the regular schedule, the ETL offers several UF credit courses, most notably the Protein Chemistry and Molecular Cloning Laboratory for College of Medicine graduate students and a Molecular Diagnostics Laboratory for the College of Medicine medical doctoral students.

Our state of the art training facility is equipped for a diverse range of topics and techniques. Student work areas are designed to be mini-lab benches containing all the basic items students need experimentally such as pipettes, vortexers, and electrophoresis units. Each work area is also supplied with a laptop and wireless internet access so bioinformatics projects can be integrated into the course material. The instructional audio visual podium features a Smarttech Symposium™ interactive pen display, TELEX® wireless microphone system, digital projector and DVD/VCR player. Additionally, the ETL has access to all of the sophisticated equipment of our sister ICBR labs including Mass Spectrometers, Real-Time PCR machines, fluorescent microscopes and florescent plate readers. The preparatory lab area attached to the 2100 sq. ft. classroom is fully equipped for basic molecular biology or microbiology applications including mammalian tissue culture.

In addition to our formal courses, vendor seminars are scheduled throughout the year on a variety of topics. Our facility is available to commercial life science companies to disseminate information on the latest techniques and equipment to our UF researchers. The ETL staff is available to support the vendors as needed, including facilitating wet lab demonstrations of the latest products.

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For current information on course schedules and availability, please join our ICBR Biotech Education email list at:
www.biotech.ufl.edu/WorkshopsCourses/mailList.html
Course registration is available online at:
www.biotech.ufl.edu



Sid Martin Biotechnology Incubator (SMBI)

www.biotech.ufl.edu



In the early 1990's, ICBR received grant funds from the US Department of Agriculture, the State of Florida, and UF to build a bio-business incubator whose purpose was to foster start-up biotech companies from university-based discoveries. Opened in 1995, the SMBI has now flourished into one of the most comprehensive bio-business incubation programs in the US. In a national survey of technology business incubators, the SMBI ranked 1st in intellectual property licensed to its companies, 4th in equity investment, and 7th in employment growth.

Located in Progress Corporate Park in Alachua, the SMBI's client companies benefit from access to ICBR's research services at UF faculty rates. Wet labs, office space, small and large animal facilities, a pilot fermentation facility, a greenhouse, plus scientific equipment and support services, combine to create an unparalleled setting for biotech startups. During its first decade, the SMBI has served 34 companies, 26 of which are active or have been acquired.

Center of Excellence for Regenerative Health Biotechnology (CERHB)

<http://cerhb.rgp.ufl.edu>

CERHB was founded in 2003 with a \$10 M award from the State of Florida as a result of a grant submitted by ICBR to the legislature's Centers of Excellence initiative and with matching funds from UF. CERHB's mission is to stimulate promising regenerative health research and facilitate commercialization of technologies that will provide treatments and cures for human diseases.

Located in Progress Corporate Park in Alachua, CERHB houses a biopharmaceutical manufacturing and testing services operation, Florida Biologix™, which provides investigational drug manufacturing capacity for university researchers and biotechnology companies in the Southeast. It also houses an educational facility complete with a cleanroom simulator and state-of-the-art equipment so that it can build a regional workforce by training students in regulatory compliance, quality systems, and biomanufacturing.

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UF Genetics Institute (UFGI)

www.ufgi.ufl.edu

During the past two decades the University of Florida has made substantial investments in human resources and infrastructure to support teaching and research in basic as well as applied genetics—biotechnology. To exploit the resources of this impressive research landscape, the Genetics Institute transcends traditional academic boundaries. Many researchers from the College of Medicine and throughout the Health Science Center, the Institute of Food and Agricultural Sciences, the College of Liberal Arts and Sciences, the College of Engineering and beyond, ranging even to the College of Law, are now housed in the stimulating interdisciplinary environment of the Cancer Genetics Research Complex (CGRC).

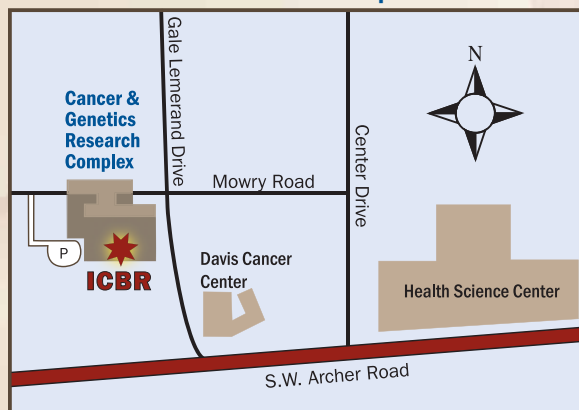
In this dynamic setting, the UFGI offers a cohesive and unified systems biology program for the entire campus, and aspires to the goals of harnessing this vast array of scientific talent to make exciting new discoveries, transfer technology to the marketplace and improve our quality of life.

UF Shands Cancer Center (UFSCC)

www.ufsc.ufl.edu

The University of Florida Shands Cancer Center is dedicated to providing state-of-the-art cancer treatment, prevention, control and education; conducting original scientific research aimed at discovering and comparing mechanisms of oncogenic and normal cell growth; and fostering multi, inter- and trans-disciplinary coordination and collaboration to facilitate clinical translation of novel research findings into developing new therapeutic, diagnostic and/or preventive trials. Many of UFSCC's research investigators and research physicians are housed in the CGRC which maximizes the opportunity to benefit from the discoveries of multi-disciplinary research teams working together on cancer-related projects.

ICBR's location on UF's campus:



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