## VCU Core Laboratory Summary

Currently 17 active core laboratories:

### Cancer Centre
- Structural Biology
- Flow Cytometry
- Nucleic Acids
- TG Mouse
- Molecular Biology/
- Biological Macromolecule
- Vector Virus
- Biostats
- TDAAC (Tissue)
- CRIS (cancer research informatics)
- Behavioral Measurement

### Other
- CHiPC (computing)
- MA Twin Registry
- Nanocharacterization
- Proteomic Mass Spectrometry
- Microscopy
- Bioanalytic Mass Spectrometry
- Supply Center
VCU Core Laboratory Summary

Historically:

• No central oversight
• Cores emerged organically
• Most were in Massey Cancer Center – not true “institutional” cores
• Limited strategic planning
• Unsustainable financials
• Heavy dependence on philanthropy

Transition to a centralized model long overdue!!
All institutional cores are now organized under the Office of the VP Research
Approximate $3.5 Million total “revenues”
Approximate $3.8 Million total “revenues”

Significant financial challenge in future as philanthropic support is phased out
Nanomaterials Characterization Core

www.nano.vcu.edu/NCC/NCC.html

- Hitachi SU-70 Scanning Electron Microscope (SEM)
- JOEL JSM-5610 SEM with EDS capability
- ESCAlab 250 X-ray photoelectron spectrometer
- VEECO IKON Atomic Force Microscope

Coming 2010: HEETF funded Small-angle X-ray scattering (SAXS) system

VCU’s newest core - opened in 2009!
Proteomic Mass Spectrometry Core
www.vcu.edu/csbc/msrsbc

• LCQ Deca XP+ MS
• Micromass Quadropole-time of flight (Q-tof) MS
• Micromass LCTT LC-MS workstation
• Several other LC systems

Kristina Nelson,
Ph.D.
Director

Coming 2010: High mass accuracy Orbitrap grade instrument with nanoLC front end acquired with HEETF funds!
Nucleic Acids Research Facilities
http://www.narf.vcu.edu/  Sanger Hall 5-050

• DNA Sequencing core
• Oligo synthesis core
• Real Time PCR core
• Microarray core
• ABI freezer programme
• Seqweb – web based GCG bioinformatics suite
Quantitative Real-Time PCR Using TAQMAN chemistry

- mRNA quantitation
- sequence detection of SNPs

ABI Prism® 7900 Sequence Detection System

- Convenience
- ~24 hr turn around
- biotinylated & fluorescent oligos
- HPLC purification

ABI DNA synthesizer
Nucleic Acids Research Facilities

Microarray core

Fully equipped for hybridization and image acquisition of Affymetrix gene chips, including Human Genome U133A 2.0 and Mouse Genome 430A 2.0 chips
Nucleic Acids Research Facilities

• “Traditional” Sanger sequencing by capillary electrophoresis: ABI 3730
  • choice for routine sequencing

• “Next Generation” sequencing:
  • 454 Genome Sequencer FLX
    • $4 \times 10^5$ 250 bp reads in one run
    • whole genome sequencing
  • Illumina/Solexa 1G
    • $6 \times 10^7$ 25 bp reads in one run
    • re-sequencing and variant detection
Multiple applications:

- **SNP Genotyping** – linkage and fine mapping
  - multiplex up to 1536 SNP loci/rxn

- **Methylation profiling**
  - epigenetic changes on a genome-wide scale!

- **Bead Arrays** - Genome-wide expression profiling
Microscopy Facility

www.vcu.edu/anatomy/microscopy/
Sanger Hall 9th Floor

- Access to advanced equipment
- Instruction
- Consultation
- Collaboration
- Service
- Grant applications

S.C. Henderson, Ph.D.
Director
Microscopy Facility

- multi-photon laser scanning microscope
- confocal laser scanning microscope
- multi-channel TIRF microscope
- widefield fluorescence microscope
- transmission electron microscope (TEM)
- scanning electron microscope (SEM)
- scanning probe atomic force microscope
- stereology system
- microdissection system
- multi-dimensional image analysis
- deconvolution
- live cell imaging
- FRET / FRAP
- molecular localization
- cyro-ultramicrotomy
Transgenic/ Knock Out Mouse Core

Jolene Windle, Ph.D.
Director

- Transgenic mouse production
- Knock-out/knock-in mouse production
  - ES cell electroporation
  - Colony selection and screening
  - Blastocyst injection
- Mouse line re-derivation
- Embryo cryopreservation
- DNA purification and genotyping
- Consultation on project and vector design,
- Training in mouse husbandry protocols, etc.

http://www.massey.vcu.edu/research/?pid=2003
Structural Biology Shared Resource

http://www.massey.vcu.edu/research/?pid=2002

• X-ray crystallography
  – H. T. Wright, Ph.D.
  – Martin Safo Ph.D.

• NMR spectroscopy
  – J. Neel Scarsdale, Ph.D.

• Molecular Modeling Facility
  – Glen Kellogg, Ph.D.
Structural Biology Shared Resource

Molecular Modeling Resources

- **Hardware**
  - 16 SGI graphics Workstations
  - Linux File Server
  - Laser Printers

- **Software**
  - Sybyl • HINT • Insight II
  - Biopolymer • Delphi
  - Felix • Homology
  - Other Modeling Software

Databases:
- NCI 3D
- Pomona MedChem

Developmental Software

Glen Kellog, Ph.D.
Structural Biology Shared Resource

X-ray crystallography resources

Blal repressor from *s. aureus*

Martin Safo, Ph.D.

- Raxis-IV++ imaging plate detection system
- X-Stream cryogenic system
- MicroMax-007 high frequency rotating anode
- Blue Max-Flux Confocal optical system
- Raxis-IV++ 2θ stage
- CrystalClear software (data acquisition and processing)
Brand New
600 and 700 MHz
Bruker NMR
instruments
installed summer 2009 are
available NOW!!
Biological Macromolecule Core

www.pubinfo.vcu.edu/mlbiocore  Sanger Hall 6-047

- **Routine molecular biology procedures**
  - Mini, midi, maxi scale plasmid preps
  - Bacterial transformation
  - Insert purification
  - Genomic DNA, RNA, and miRNA isolation
  - siRNAs from Invitrogen and Qiagen

- **Custom Services**
  - Custom subcloning
  - Library screening

- **Site directed mutagenesis**

- **Recombinant protein production**

Biological Macromolecule core now provides protein purification services as a major new activity!!
Center for High Performance Computing (CHiPC)

http://www.vcu.edu/csbc/bccl/

- Supports computationally intensive projects of all descriptions including bioinformatics and structural modeling
- Currently maintains a very heavily utilized 496 node “Beowulf class” cluster.
- >40% of use comes from medical campus

Gregory Buck, Ph.D.
Director
Demand for processor cycles at VCU doubles every eighteen months and is accelerating.

Harris Hall server room renovation:

Phase I: Grand opening November 2009
Supports up to 2500 processor nodes

4x Infiniband initiative: will provide networking infrastructure for a sub-cluster that is highly optimized for multiprocessing jobs. A single Gromacs job should scale properly to at least 64 processors, NAMD to 128 processors.
Flow Cytometry Shared Resource

www.massey.vcu.edu/research/?pid=1995

Flow Cytometry

**Analysis:** Full range of analyses including DNA/cell cycle, 4-color immunofluorescence, apoptosis, viability/cytotoxicity, membrane potential

**Sorting:** Sterile or clean sorting of viable or fixed cells with >95% purity

**Autocloning:** Sorting >1 cell into media-filled plates, 6-96 wells, or into PCR plates

**High Speed Sorting:** Sterile, 1- to 4-way sorting with >95% purity

Confocal Imaging

Also offered in this core!!
Flow Cytometry Shared Resource

Moflo High Speed Cell Sorter

Elite Flow Cytometer and Sorter

XL-MCL Flow Cytometer

Now operational!
BD FACSemia Cell-Sorting System
TDAAC is a portal of entry for VCU investigators to access human tissue samples to support IRB approved research projects.

- **Sample processing**
  - Catherine Demur, Ph.D.
    - obtain biomolecules for analysis
    - gene expression analysis
  - Amy Ladd, Ph.D.
    - Laser Capture Microdissection

- **Clinical annotation**
  - Lynne T Penberthy, M.D. Ph.D.

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Tissue & Data Acquisition & Analysis Core

Specimen Procurement & Related Services
- Informed Consent
- Tissue Acquisition
- Primary & Secondary Clinical Data
- Histology Services
  - Investigator Specific Protocols
  - Tissue Bank (Solid Tissue & Hematopoietic Samples)

Clinical Specimen Processing
- RNA, DNA, Protein Extraction
- Quality Control
- Viable Mononuclear Cell Cryopreservation & Plasma Collection
- Molecular Morphology-Genomics

Histological Parameters
- Molecular Parameters
Clinical Trials and Research Specimen Processing Service

www.pathology.vcu.edu/clinical/outreach/research.html

• Routine Clinical Laboratory Testing
  ▪ Chemistry, Hematology, Immunology, Microbiology, Molecular Testing
  ▪ Anatomic Pathology

• Specimen Collection (Phlebotomy, Urine Collection)

• Specimen Processing Services
  ▪ Processing for Central & PK/PD laboratories
  ▪ Centrifugation (custom rcf & temp)
  ▪ Custom aliquotting
  ▪ Storage at flexible temperatures (-70°C, -20°C, 4 C, RT)
  ▪ Shipping (Certified for diagnostic, infect, IATA, Hazmat)
Cancer Research Informatics and Services

www.massey.vcu.edu/research/?pid=2176
In addition to data and informatics support, services provided by CRIS include:

- Population sample estimates.
- Study sample creation.
- Consulting for grant applications.
- Analysis of data.
- Creation of customized data sets.
- Query development and report development.
Biostatistics Shared Resource Facility

http://www.massey.vcu.edu/research/?pid=1994

BSR consultations are FREE for MCC members!
Mid-Atlantic Twin Registry
www.matr.vcu.edu

- Population-based registry of twin pairs from Virginia, North Carolina, and South Carolina
- ~300,000 identical and fraternal twin pairs born between 1915 and 1998
- Assist with identifying twin pairs, research compliance, assurance of privacy, etc.

One of the world’s largest twin registries!
Developmental Cores & Future directions

• Behavioral Measurement
  • Dr. L. Dumenci
  • BMs relevant for cancer research
  • Psychometric evaluation of existing measures

• Lipidomics
  • Dr. Sarah Spiegel
  • 4000 QTRAP and a 3200 QTRAP instruments now available
  • Seeking to expand user base

• Small Molecule Bioanalytic MS
  • Dr. Thomas Karnes
  • ABI QTrap 4000