2018 Annual Report

HSC Cores
Research Facilities
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## Annual Report 2018

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## Service Recharge Centers

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<td>Materials Characterization Lab</td>
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<td>National Center for Veterans Studies</td>
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<td>USTAR CTR Genetic Discovery</td>
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HSC CORES Facilities
## Overall Financial Summary

### Revenue & Expenses
- HSC Core Facilities budgeted $6.53 million for FY18, with expenses totaling to $6.14 million. Approximately $3.47 million in expenses went to salaries and benefits while $2.68 million was spent on equipment and operating supplies.
- In FY18, $4.91 million in services were billed, and collected from all units combined. An overhead fee of 5% ($266,796) was used for administrative support.

### Core Research Facilities

<table>
<thead>
<tr>
<th>Core Research Facilties</th>
<th>FY18 Expenses</th>
<th>Total Revenue</th>
<th>SVPHS</th>
<th>VPR</th>
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### Service Recharge Centers

<table>
<thead>
<tr>
<th>Service Recharge Center</th>
<th>FY18 Expenses</th>
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<th>SVPHS</th>
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Cores Administration

Overview
The Health Sciences Center (HSC) Core Facilities Administration reports to Dr. John Phillips, who reports to Dr. Monica Vetter. The administrative office is managed by Ms. Brenda Smith, with assistance from Ms. Audrey Gallagher, Ms. Terra Curley, and Mr. Jonathan Conger. Responsibilities of the Core Administration office include - personnel management, budget preparation, financial affairs, ordering of supplies, and tracking expenses for all 26 Core Facilities and Service Recharge Centers. In addition, the Administrative Core supports general research infrastructure for the community, e.g. maintaining the X-ray film developer in the SOM and the research irradiator logging and access requests. All cores and recharge centers operate on a charge-back basis, with the Administration Core recovering 5% of the revenue collected for these billing and collection services. The management of the administrative office is performed by the HSC Core Advisory Board.

Personnel
John Phillips, Ph.D., Director HSC Core Facilities
Brenda Smith, Director of Finance
Audrey Gallagher, Administrative Manager
Terra Curley, Accountant
Jonathan Conger, Administrative Assistant

2018 Annual Update
- In FY18, the Cores Administration office was successfully able to process billing in 1 business day even though the amount of billed revenue has increased to 26 labs. The new HSC scheduling/billing system validates chartfields with the University’s CIS system. This has eliminated the majority of billing errors.
- In FY18 the core billed 4.91 million; however, what is most impressive of this past year was the collection rate for billed services was 100%. We have developed an account management system to allow each Director to view revenue and expenses in real time. The tracking system stores fiscal data so that historical comparisons between revenue and expenses can be performed as well as proof of expenses, and operational analysis.
- The two new Service/Recharge Centers (National Center for Veterans Studies and USTAR Center Genetic Discovery) are now managed through the administrative office to increase accountability and reduce expenses associated with billing and collections.
- The fifth annual retreat was held on September 22nd. Approximately 100 people attended. Directors had an opportunity to discuss methods for maintaining market share, engaging researchers to provide higher quality data analysis and methods to track usage. Nanofab, BIDAC, Nuclear Engineering and Emergency Preparedness all made presentations showing their services.
- The electronic inventory system created for capital equipment tracking is still being heavily used by additional departments and groups in Health Sciences and Main Campus. Upgrades for FY18 allow more reporting and tracking of equipment and better access from hand held devices. As of August 2018, there are 61 Departments, and 3,735 items entered into the system. These items are located in 653 rooms across campus. The total asset value of these items is $45.2 million. This system continues to expand and is free to use by any group on campus.
In FY18, a new purchasing system was created which tracks expenses and revenue in real time. The system is reconciled to the management reports in CIS.

FY2019 Goals
- Upgrade the electronic inventory system
- Upgrade the resource/billing system

Cores Administration Revenue & Expenses
FY18 Expenses: Total $559,676
The Cores Administration Budget covers the following expenses:
- Salaries/Benefits: $407,195
- Fixed Expenses (IT Support for 76 staff, developer, x-ray, software): $152,481
- Unanticipated equipment repairs and replacement: $79,290
FY18 Revenues: Total $679,796
- VP of Health Sciences Support: $413,000
- FY18 Revenue Generated from Services: $266,796

Advisory Board Committee
Last meeting date: January 30, 2018
- Andy Weyrich¹, Associate Dean for Basic and Translational Sciences
- Joseph Yost¹, Professor, Neurobiology and Anatomy
- Mark Yandell, Professor, Human Genetics
- John Phillips¹, Director, Core Facilities
- Dennis Winge, Professor, Hematology
- David Stillman¹, Professor, Pathology
- Wes Sundquist, Professor, Biochemistry
- Brad Cairns¹, Professor, Huntsman Cancer Institute
- Carl Wittwer, Professor, Pathology
- Eric Schmidt, Professor, Medicinal Chemistry
  ¹ in attendance

Addendum
The administrative core ensures that all cores maintain a regular faculty advisory committee meeting that conforms to the following guidelines: cores.utah.edu/wp-content/uploads/2015/09/Faculty-Advisory-Committee-Responsibilities-2.pdf
Overview
The mission of the Biomedical Image and Data Analysis Core (BIDAC) facility is to provide advanced medical computing, scientific visualization and data analytics services to research groups at the University of Utah. We offer services and consulting that range from standard image processing tasks (image registration, image segmentation) to more advanced group-wise studies, including morphometric analysis and deep learning (artificial intelligence). BIDAC leverages the computational resources and software development infrastructure of the Scientific Computing and Imaging (SCI) Institute. In partnership with CHPC and the HSC Core imaging facilities, we are actively developing new services that are based on the needs of HSC researchers and Core users. As a resource for advanced medical computing and data analytics, our goal is to further the scientific mission of the University of Utah by significantly enhancing the capabilities and competitiveness of HSC research laboratories.

Services
BIDAC offers a range of services including consulting, training, image processing, image analysis, image visualization, workflow development, software prototyping, and algorithm development. Main services that have been developed and/or used during FY2018 include:

- Deep learning analysis (artificial intelligence) for biomedical image classification and regression. We have been developing expertise in applying, comparing and fine-tuning state-of-the-art Convolutional Neural Networks (CNN) to enable robust biomedical image classification and/or image regression.
- Big data engineering workflow for inpatient and outpatient medical imaging, enabling subsequent machine learning analysis. In partnership with researchers from Radiology, the Enterprise Data Warehouse (EDW) and the Center for High Performance Computing (CHPC), we have developed software and hardware infrastructure to support secured data transfer (from the hospital PACS), HIPAA-compliant data storage and data management of large radiological datasets to enable deep learning and natural language processing analyses. A clinical study of interest focuses on retrospective 2D chest X-ray images.

Personnel
Clement Vachet, Director

2018 Annual Update
Grant Support - BIDAC performed preliminary work and/or provided letters of support for the following grant submissions:
- NIH R21 – Tracy Frech, PhD, Dept. Internal Medicine
- NIH Common Fund Initiative – Alexander Lex, SCI Institute
- NIH R21 – Joyce Schroeder, Dept. Radiology

Inter-disciplinary collaborations - projects to enhance imaging capabilities have been performed with the Center for High Performance Computing (CHPC) and with several Health Sciences Cores (directly or involving end-users).
**Revenue/Expenses**
FY18 Expenses: Total $77,729  
FY18 Revenue: Total $95,564  
- VP of Health Sciences Support: $35,000  
- FY18 revenue generated from services: $60,564  

*Legend displays total annual revenue by year earned.*

**Advisory Board Committee**
Edward DiBella, PhD, Prof. Radiology and Imaging Sciences, Director UCAIR  
Florian Solzbacher, PhD, Professor Electrical & Computer Engineering, Director CEI  
Tolga Tasdizen, PhD, Associate Professor Electrical & Computer Engineering

**FY18 Scientific Impact**  
**Research Support**  
Revenue Generated (see charts following):

**Revenue by Affiliation**
- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 1  
# of investigators: 7
Top Users

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<thead>
<tr>
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Overview

The Cell Imaging Facility provides training and consultation on the use of confocal microscopy, widefield automated microscopy, two-photon, and software analysis tools for quantitative analysis of image data. The facility has Zeiss 880 Airyscan confocal, a Leica SP8 White light laser confocal, Two Olympus FV1000 Spectral confocals, two Nikon A1 confocals, and a Multi-photon confocal from Prairie. In addition, two Nikon Ti automated microscopes and two spinning disk confocals (CSU10, W1) are available for live cell imaging. A Zeiss Axioscan Z1 slide scanner is available for automated archiving of histology and fluorescence data. Automated microscopes with one of four different stage incubators are available (CO2, temperature, humidity, one with Hypoxia) and also available for live cell imaging. Nikon Elements, Metamorph, Imaris and Volocity software are available for 2D and 3D analysis of image data.

Services

The training and equipment provided by the facility is aimed at reducing the startup time and degree of expertise necessary for an individual user to design and execute experiments requiring microscopy and image processing. Services are offered at multiple locations in an effort to provide the service within proximity to the user base.

Equipment

**HSC Location**
- Olympus FV1000 Confocal Microscope
- Nikon A1 Confocal Microscope
- Nikon A1R Confocal Microscope
- Prairie Multi-Photon Confocal Microscope
- Zeiss Axioscan Z1 automated slide scanner with 100 slide loader
- EVOS FL Widefield Microscope
- Nikon Ti Automated Microscope

**HCI Location**
- Leica SP8 confocal with white light laser
- Nikon Ti Automated Microscope
- Nikon Ti Automated Microscope with CSU10 Spinning disk confocal
- Ibidi stage incubator with CO2, temperature and hypoxia control

**SMBB Location**
- Olympus FV1000 Confocal Microscope

**Biology ASB Location**
- Olympus IX81 Automated Microscope
- Zeiss 880 Airyscan Confocal
- Vutara super resolution and Optera Swept Field Confocal

**Personnel**

Christopher Rodesch, Ph.D., Director
Michael J. Bridge, Ph.D., Research Associate
2018 Annual Update

New Services
- Consultation is available at four locations, 230ASB in Biology, SMBB Nanofab center, 5221 HCI and Building 585 HSC

New Equipment
- Spinning disk confocal in Biochemistry, W1 from Visitek

Goals 2019
Grants have been submitted for two new confocal instruments. Replacement of aging devices will need to be a priority in FY2019. Optimizing acknowledgement of the core for manuscripts published with data generated from the core is very important in developing a strategy to acquire additional equipment.

Revenue/Expenses
FY18 Expenses: Total $346,434
FY18 Revenue: Total $361,223
- VP of Health Sciences Support for normal operating expenses: $165,000
- FY18 revenue generated from services: $196,223

Advisory Board Committee
Last meeting date: June 6th, 2018.
Marcus Babst, Associate Professor, Biology
Josh Bonkowsky, Associate Professor, Neurobiology and Anatomy
Bruce Edgar, Professor, Oncological Sciences
Kristen Kwan, Assistant Professor, Human Genetics
Michelle Mendoza, Associate Professor, Oncological Sciences
Minna Roh, Associate Professor, Biochemistry
Yan-Ting Shi, Associate Professor, Nephrology
Lukas Timmins, Associate Professor, Biomedical Engineering

Billed Revenue by Fiscal Year

* Legend displays total annual revenue by year earned.
FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 135
# of investigators: 154

Revenue by Department

- Oncological Sciences
- Biology
- Pathology
- Nutrition & Integrative Physiology
- Pharmaceutics & Pharmaceutical Chemistry
- Bioengineering
- Neurology
- Orthopaedics
- College of Engineering
- Physical Therapy & Athletic Training
- Mechanical Engineering
- Molecular Medicine
- Dermatology
- CCTS
- Anesthesiology
- College of Pharmacy
- Obstetrics & Gynecology
- Neurobiology & Anatomy
- Human Genetics
- Internal Medicine
- Surgery
- Biochemistry
- Neurosurgery
- Pediatrics
- Pharmacology & Toxicology
- Medicinal Chemistry
- Chemistry
- CVRTI
- Core Research Facilities
- Dentistry
- Chemical Engineering
- Elec & Computer Engineering
- Exercise & Sport Science
- Ophthalmology & Visual Sciences
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Centralized Zebrafish Animal Resource (CZAR)

Overview
The CZAR Facility provides state-of-the-art systems for housing, breeding, and doing experiments with zebrafish, an emerging vertebrate model system. The CZAR currently houses approximately 5000 fish tanks with a capacity of 7750 tanks maintained on 5 independent recirculating water systems. The communal laboratory space also increased, providing additional areas for Zebrafish mating, embryo microinjection, and afternoon embryo production in an Alternate Light Cycle room. The design encourages intellectual and experimental synergism among research groups, facilitating 1) large genetic screens carried out as collaborations between multiple laboratories; 2) collaborative research projects that require shared use of specific genetically marked or mutagenized animals; 3) development and distribution of resources and new technologies that advance the research efforts of all laboratories on campus; 4) a teaching environment in which the newest technologies and resources are disseminated quickly; and 5) training and experimental support for laboratories wishing to try pilot zebrafish experiments. This centralized communal space has been instrumental in the University’s ability to attract and recruit two new Zebrafish faculty members in the last year, 10 laboratories that have large-scale commitments to zebrafish research and 14 additional smaller-scale groups currently use the CZAR.

The expanded facility houses approximately 125,000-150,000 fish, including a large number of wild type and mutant fish strains. The CZAR staff strives to improve and optimize zebrafish husbandry practices within the facility by monitoring and troubleshooting observed health issues, testing new diets, and addressing concerns raised by users.

Services
The CZAR Core Facility is responsible for the daily care and maintenance of the fish and aquatic systems. The facility provides the following services:

- Housing and maintaining zebrafish, monitoring their health, and providing specialized nursery care and diets resulting in high survival rates of young fry.
- Establishing practices and providing oversight to ensure the safety and health of the animals in compliance with IACUC standards and regulations.
- Propagating wild type lines and providing animals from these lines to investigators.
- Providing laboratory bench space and supplies to perform experiments.
- Providing and maintaining shared-use equipment including 7-8 microinjection stations with bright field stereomicroscopes, and 3 fluorescence stereomicroscopes.
- Providing education and training to investigators and students individually.
- Providing specialized centralized services performed by the permanent staff, such as in vitro fertilization, sperm cryopreservation and storage.
- Providing Quarantine facilities to house fish from outside sources to generate clean lines to import into the facility.
- Monitor husbandry success through mating success and nursery survival data.
- Propagating individual lab WT or transgenic lines for a nominal fee. This service can be requested through the Cores web site.
- Offering a “Fish School” course for new users to learn best practices in handling and caring for their fish, as well as how to tell male and female fish apart.

**Equipment**
- M205 FA Leica Fluorescence Microscope
- Zeiss Fluorescence Microscope with LED light source
- Olympus Fluorescence Microscope
- 7 microinjection stations with bright field stereomicroscopes
- Analog camera and monitor to facilitate teaching microinjection in real time
- Temperature sensors throughout facility to help monitor the quality of temperature control, and record deviations that could affect fish health.

**Personnel**
Maurine Hobbs, PhD, Director  
Sharon Johnson, Senior Laboratory Specialist - Zebrafish Husbandry and WT line maint.  
Talmage Long, Technician - Nursery Manager  
Nathan Baker, Lab Aide

**2018 Annual Update**

**New Services**
- In May 2018, a new 1000 tank capacity fish system was installed in the Crocker Science Center building. The CZAR has provided expertise and support services to help the Crocker Science Research Zebrafish (CBRZ, aka ‘sea breeze’) facility ready to accept and support research zebrafish.

**Revenue/Expenses**
**FY18 Expenses:** Total $468,567  
**FY18 Revenue:** Total $471,413  
- VP of Health Sciences Support: $137,000  
- Total FY18 Revenue Generated from Services: $334,413

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* Legend displays total annual revenue. NOTE: Revenue for FY15 & FY16 is maximal due to facility limitations.
**Beginning in October 2016, the increased revenue shows the new tanks coming online
Advisory Board Committee
Last meeting date: 11/08/2017
Richard Dorsky, Associate Professor, Neurobiology and Anatomy- Chair
David Jonah Grunwald, Professor, Human Genetics
Joshua Bonkowsky, Associate Professor, Neurobiology and Anatomy and Pediatrics
Kristen Kwan, Assistant Professor, Human Genetics
Amnon Schlegel, Assistant Professor, Internal Medicine
Rodney Stewart, Assistant Professor, Oncological Sciences
Roger Van Andel, Director, Office of Comparative Medicine
Randall Peterson, Dean, College of Pharmacy
H. Joseph Yost, Professor, Neurobiology and Anatomy and Pediatrics

FY18 Scientific Impact
Research Support
- Grunwald, Title: Expansion of a Zebrafish Research Core Facility, Grunwald, 1G20OD018369-01, NIH, $500,000, 06/01/2014 – 05/31/2015.
- Grants supported by this core, as of July 2018, are listed as an appendix following this report.

Revenue by Affiliation

Revenue by Department

# of grants: 20
# of investigators: 25
### Top Users

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### Publications

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<th>Zebrafish Investigator</th>
<th>Grant Title</th>
<th>Funding Source</th>
<th>Annual Amount of Direct Cost Funding</th>
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<td>Trans-Cellular Activation Of Transcription To Analyze Dopaminergic Axon Reorganization</td>
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<td>A toolkit for gene-targeting in zebrafish</td>
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<td>Hedgehog Signaling and Cilia in Choroid Fissure Morphogenesis and Coloboma</td>
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**Total Current Grants, Annual Direct Costs:** $7,130,167
Overview
The DNA Peptide Facility provides researchers with chemical synthesis of custom oligonucleotides and oligopeptides. The facility synthesizes standard DNA/RNA oligos and peptides with multiple purity options, ranging from crude to HPLC. This Core has the ability to incorporate a wide array of specialty modifications, including fluorophore-labeling and functional group derivatization via amino-, thiol-, and modifications compatible with click chemistry. The goal of the facility is to provide quality service with speedy turnaround times.

Services
- Routine and custom DNA synthesis
- Routine and custom RNA synthesis
- Routine and custom Peptide synthesis
- Peptide Purification
- Amino Acid Analysis

Equipment
- Dr. Oligo 192 DNA Synthesizer
- ABI 3900 DNA Synthesizer
- ABI 394 DNA Synthesizer (2)
- ABI 433 Peptide Synthesizer
- ABI 433 Peptide Synthesizer
- Beckman Coulter System Gold 125P HPLC System
- Beckman Coulter System Gold 126 HPLC System
- Hewlett Packard Series 1100 HPLC system (2)
- Beckman Coulter DU800 Spectrophotometer
- BioTek Epoch Plate Reader Spectrophotometer

Personnel
Mike Hanson, Ph.D., Director
Jan Mees, Lab Aide
Meredith Ford, Lab Technician
Evan Shaw, Lab Technician

2018 Annual Update
New Equipment
- The DNA Peptide Facility now offers a 25 nmole DNA Synthesis service. These prices make the facility much more competitive with commercial vendors.
Revenue/Expenses
FY18 Expenses: Total $388,795
FY18 Revenue: Total $400,228
- VP of Health Sciences Support: $0
- FY18 Revenue Generated from Services: $400,228

* Total billed annual revenue displayed in legend.

Advisory Board Committee
Last meeting date: August 2014.
Raphael Franzini, Professor, College of Pharmacy
Jen Heemstra, Assistant Professor, Chemistry
John Weis, Professor, Pathology

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 192
# of investigators: 194
Top Users

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<td>Hill, Christopher</td>
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Publications


3. 8-Oxo-7,8-dihydro-2'-deoxyguanosine and abasic site tandem lesions are oxidation prone yielding hydantoin products that strongly destabilize duplex DNA. Fleming AM, Burrows CJ. Org Biomol Chem. 2017 Oct 11;15(39):8341-8353.


Overview

The DNA Sequencing Facility provides DNA sequencing services and employs the latest technologies to generate high quality data with the goal of rapid sample turnaround at competitive prices. DNA sequencing is accomplished with the use of state-of-the-art DNA sequencers and lab robotics such as the Ion Torrent PGM and Proton, the Qiagen Q24 Pyrosequencer, and the Biomek FX for liquid handling needs. Data from standard DNA sequencing services are typically reported to customers the same day as they are run. Sample information can be submitted online and sequencing data files are available online for download using a simple and secure interface. The next generation sequencing platform used has many advantages over other services, including price and sample turnover.

Services

**DNA Sequencing**
- Standard Sanger DNA sequencing
- Primer walking on clones
- Mutation detection and resequencing custom projects
- Ion Torrent NGS sequencing
- Pyrosequencing

**Cell Line Authentication**
- Human Cell Line Authentication by STR

**Robotics**
- Biomek FX with Span-8 and 96 head

**Fragment Analysis**
- RNA quality determination (RIN equivalents)
- Fragment sizing and concentrations

**Other Services**
- Lab consumables for sample submission
- Life Technologies freezer program

**Equipment**

**Sequencers**
- Ion Torrent Proton
- Qiagen Q24 Pyrosequencer
- Applied Biosystems 3730xl

**Liquid Handlers**
- 1 Biomek FX programmable liquid sample dispensers
- Fragment Analysis
- AATI Fragment Analyzer

**Personnel**
Derek Warner, Director
Michael Powers, Senior Laboratory Specialist
2018 Annual Update

New Services
- We added the ability to send out Illumina sequencing through two contracted providers. Labs simply need to provide the DNA or RNA and data will be returned in approximately 3 weeks.

Revenue/Expenses
FY18 Expenses: Total $379,872
FY18 Revenue: Total $343,169
- VP of Health Sciences Support: $0
- FY18 revenue generated from services: $343,169

Advisory Board Committee
Last meeting date: October 27, 2017
Lynn Jorde, Professor, Human Genetics
Colin Dale, Associate Professor, Biology
Robert Weiss, Professor, Human Genetics
Emily Coonrod, Associate Director, Personalized Health

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation
- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 182
# of investigators: 186
Top Users

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Publications


Drug Discovery

Overview
The Drug Discovery Facility provides compound collections for screening. The facility delivers low-cost and efficient access to chemical libraries for screening, to equipment for automation, and to synthetic chemistry support for the characterization and validation of compounds for potential use as therapeutics, diagnostics and biological tools.

Uniqueness
The University of Utah possesses the scientific and medical talent, innovation research culture, and state-of-the-art research facilities to contribute substantially to the discovery of small molecule drugs. However, significant challenges still remain in translation of basic scientific discoveries into potential human therapeutics. The uniqueness of the Drug Discovery Facility is it coordinates the cooperative efforts of individual research groups in a wide variety of different drug discovery studies, ultimately leading to discover novel chemical probes and new pharmaceutical lead compounds.

The most valuable assets at the facility are the private/proprietary chemical collections that could result in new intellectual property. These unique molecules of therapeutic potential offer the facility to assist in the translation of fundamental discoveries in biology into novel therapeutics and commercial opportunities. It is anticipated that the discovery of candidate lead compounds from the facility will stimulate interest in commercial development of technology at the University of Utah through licensing agreements with pharmaceutical industry partners and the production of new biotechnology companies.

Services
- High-throughput screening
- Small molecule chemical libraries
- Pooled CRISPR-Cas9 libraries/Screening
- Assay development
- Consultation on target identification/validation, hit to lead optimization, PK/PD/Efficacy
- Chemical support for drug discovery

Viral Packaging Service
- Small/large scale viral (lentivirus, adenovirus, adeno-associated virus) packaging, titrations, concentrations and transductions of cells of interest.
- Lentivirus delivery of Cas9 and sgRNA

Equipment/Compound Collection
Automated Liquid Handling Stations:
- Tecan EVO100/MCA96 Liquid Handler with sterile bio-hoods
- Tecan EVO100/MCA384 Liquid Handler with sterile bio-hoods
- HP D300 Digital Dispenser
- Axygen Platemax semi-automatic plate sealer
- KingFisher Duo Prime – Automated DNA/RNA extraction, protein/cell purification

Automated Detection Systems:
- Molecular Devices ImageXpress XLS Automated High-Content System
- Bio-tek Plate Neo 2 Plate Reader with stacker
CRISPR Libraries:
- The genome-scale CRISPR-Cas9 knockout (GeCKO) v2 library
- The human CRISPR Brunello lentiviral pooled libraries
- Subset CRISPR libraries: a) human Lentiviral sgRNA library-kinases, and b) human Lentiviral sgRNA library-nuclear proteins

Commercial Compound Libraries:
- Chembridge Diverset EXP(50K) and CL (50K)
- Microsource Spectrum Collection
- NIH Clinical Collection
- Epigenetics Screening Library
- Kinase Inhibitor Library
- NCI Diversity Set IV
- Natural Products Set III
- Enamine 3D Diversity Set (50K)
- NIH Approved Oncology Drugs Set II
- NIH Natural Products Set IV
- Mechanistic Set III
- University of Utah metabolite library v1.0

Private/Proprietary Chemical Collections:
- UUPCC – University of Utah Private Chemical Collection
- Dept. of Chemistry Library
- Ireland Natural Product Collection

Personnel
Bai Luo, Ph.D., Director

2018 Annual Update

New Equipment:
- **KingFisher Duo Prime System – Automated DNA/RNA Extraction and Protein/Cell Purification:** The KingFisher Duo Prime can control the collection and release of magnetic particles and transfer them from vial to vial in a 96-well plate format. It can be used with diverse types of magnetic beads, and there are multiple kits available for specific assays. Routine uses include DNA/RNA extraction, cell isolation, immunoprecipitation, small-scale protein purification, affinity selection and isolation of circulating nucleic acids.

New Service:
- **Viral Packaging Service production** - Small/large scale viral (lentivirus, adenovirus, adeno-associated virus) packaging, titrations, concentrations and transductions of cells of interest.

New Compound Collection:
- **University of Utah metabolite library v1.0:** The University of Utah metabolite library v1.0 is composed of 453 endogenous and exogenous, primary and secondary metabolites observed, measured, or predicted in human tissues. Metabolites in the library include, but are not limited to, sugars, amino acids, nucleotides, cofactors, signaling molecules, and various precursors, intermediates, and byproducts thereof. All compounds are at 10 mM and solvated in DNase, RNase, Protease, free deionized water (acidic, basic, or neutral pH) or DMSO.
Revenue/Expenses
FY18 Expenses: Total $136,770
FY18 Revenue: Total $130,439
- VP of Health Sciences Support: $80,000
- VP of Research RIF Funds: $17,350
- FY18 Revenue Generated from Services: $33,089

Advisory Board Committee
Last meeting date: June 18, 2018.
Darrell Davis, Professor, College of Pharmacy
Ryan Looper, Associate Professor, Chemistry Department
John Phillips, Professor, Internal Medicine
Jared Rutter, Professor, Department of Biochemistry
Bryan Welm, Associate Professor, HCI

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):
Top Users

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Publications

Overview
The Electron Microscopy (EM) Facility utilizes transmission electron microscopy (TEM) and scanning electron microscopy (SEM) imaging to determine cellular structures, the morphology of biological macromolecules, the three-dimensional structures of biological macromolecules, and the size and structure of nanoparticles and other small particles. The EM Facility also prepares specimens for the microscope. The EM facility has five spatially distinct locations to serve the needs of the clinical and research groups. The main facility is in SMBB, and two TEMs are located there. Each of the following buildings house one TEM: RB LAB, BIOL, ASB, and CSC. Experiments requiring SEM are done in collaboration with microscopes owned by the Surface Analysis Laboratory.

Services
Clinical Services:
- Thin-section electron microscopy of tissue biopsies (technical part of clinical EM)

Research Services:
- Training on the TEMs, microtomes, sample preparation, and 3D image reconstruction
- Sections (“thick” and “thin”) cut on microtome and ultramicrotome
- Record images on transmission or scanning electron microscopes
- Prepare and image tissues and cellular specimens via embedding, drying, osmification, and thin-sectioning
- Prepare and image particulate and macromolecular samples by staining, metal coating, drying, and cryogenic TEM
- Image specimens via three-dimensional electron microscopy
- Remote access to TEMs

Equipment
- ThermoFisher Tecnai 12, transmission electron microscope
- JEOL JEM-1400 Plus, transmission electron microscope
- Two Hitachi 7100, transmission electron microscopes
- ThermoFisher Tecnai F20, transmission electron microscope
- ThermoFisher Titan Krios, transmission electron microscope, available Fall 2018
- Leica (UC7, UC6, and UCT) and Reichert (Ultracut E), ultramicrotomes
- Leica JUNG RM2055, microtome
- ThermoFisher Vitrobot, vitrification robot
- Gatan K2 Summit, direct electron detector (Tecnai F20)
- Gatan K2/K3, direct electron detector (Titan Krios)
- Gatan BioQuantum energy filter (Titan Krios)
- Two automatic tissue processors
- Two laboratory microwave ovens
- Sputter coater
- Glow discharger
- High-pressure freezer
- Freeze substitution machine
- Critical-point dryer
- Access to high-performance computing nodes (CHPC)
Personnel
David Belnap, Ph.D., Director
Nancy Chandler, Senior Laboratory Specialist
Linda Nikolova, Senior Laboratory Specialist
Willisa Liou, Senior Laboratory Specialist
Bryan Gustafson, Laboratory Technician

Goals for FY19
- Obtain high-quality TEM data from new Titan Krios microscope
- Maintain high-quality clinical services
- Increase research usage
- Increase usage of microscopes
- With opening of CSC, improve efficiency of labs by consolidation or other means

Revenue/Expenses
FY18 Expenses: Total $742,361
FY18 Revenue: Total $758,884
- VP of Health Sciences Support: $20,000
- VP of Research Support: $50,000
- FY18 revenue generated from services: $688,884

Advisory Board Committee
Last meeting date: March 2, 2017.
Erik Jorgensen, Distinguished Professor, Department of Biology
Patricia Revelo, Professor, Department of Pathology
Erhu Cao, Assistant Professor, Department of Biochemistry
Richard Rabbitt, Professor, Department of Bioengineering
FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 58
# of investigators: 85

Revenue by Department

- Biochemistry
- Human Genetics
- Pharmaceutics & Pharmaceutical Chemistry
- Neurobiology & Anatomy
- Molecular Medicine
- Oncological Sciences
- Physics & Astronomy
- Surgery
- Mechanical Engineering
- Pharmaceutics
- Ophthalmology & Visual Sciences
- Medicinal Chemistry
- College of Engineering
- Biology
- Pathology
- Internal Medicine
- College of Pharmacy
- Chemistry
- Pediatrics
- Bioengineering
- Pharmaceutical Chemistry
- Neurosurgery
- Pharmacology & Toxicology
- HCI
- Dentistry
- CVRTI
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Flow Cytometry

Overview
The Flow Cytometry Facility offers quantitative, multi-parameter fluorescence analysis, and cell sorting services that assists over 90 investigators including a subset of industry clients. The expertise and instrumentation to perform most flow cytometric assays that have been described in the literature are available within the expertise of the collective personnel and the physical resources of the Flow Cytometry Facility. The facility offers investigators the entire spectrum of cytometric experiment management, if desired, all the way from initial design consultation to the creation of graphics for publication.

Uniqueness
The Flow Cytometry facility is recognized mostly as an instrumentation based service lab. However, we believe that education is a crucial component for the growth and sustainability of the facility. First, facility staffs are encouraged to maintain state of the art knowledge in order to pass this information along to the users. Secondly, we believe that education in the field of flow cytometry for users will lead to more successful experimental outcomes that will in turn increase overall usage. To this end, we provide multiple levels of education from one on one consultation to routine seminars covering a variety of topics. Although this may not be unique when compared to other Core facilities, it is a noticeable quality of our services when compared to other non-centralized instrumentation on campus.

Services
The assays offered by the facility range from routine cell cycle analysis and immunophenotyping to complex multi-laser applications and high speed cell sorting. Examples of the assays available include, but are not limited to the following:

- DNA content/cell cycle measurement
- Immunofluorescence analyses
- Characterization of cell populations based on scattered light intensity measurements and autofluorescence
- Cell sorting including viable, sterile cell sorting
- Intracellular calcium flux
- A range of apoptosis assays
- Fluorescence Resonance Energy Transfer (FRET)
- Nanoparticle characterization
- Bivariate and univariate chromosome analysis
- Receptor-ligand interactions
- Cell proliferation studies including BrdU incorporation and CFSE tracking
- Viability assays (membrane exclusion and metabolic viability)
- Various function assays including oxidative metabolism, neutrophil function (oxidative burst, phagocytosis) cytoplasmic pH, membrane potential
- Kinetic analyses
- Signal transduction pathway analyses (simultaneous assessment of multiple intracellular phosphorylated epitopes combined in complex multi-color assays)
- Sample preparation and staining
Consultation and training is provided in order to define projects in the early stages of development to make optimal and efficient use of flow cytometry. The staff will prepare samples including staining, data collection, quality control, data analysis/interpretation, and creation of graphics. Alternatively, if the investigator chooses, the facility can provide consultation only on any of the above services so that the research is entirely in the hands of the investigator.

### Equipment

**Sorters**
- BD FACSAria-5 laser
- Propel Labs Avalon-2 laser
- BD FACSAria-4 laser

**Analyzers**
- BD FACSCanto
- BD LSRFortessa
- Beckman Coulter Cytoflex
- BD Celesta
- Cytek DxP

### Personnel

- James Marvin, Director
- Tessa Galland Lab Technician
- Nidhi Choksi Lab Technician
- Gabriel DeNiro Lab Technician

### FY18 Annual Update

**New Equipment**
- In order to keep pace with growing demand both instrument purchases and upgrades were accomplished in FY18. Both of the BD FacsAria cell sorters were upgraded with additional detectors. Now, with the exception of one laser both instruments are identical and users are free to rotate between them based on availability. The Cytoflex had an additional laser, and detectors added, along with a 96 well plate loader. Finally, in order to accommodate the growing demands of the main campus, another Cytoflex instrument was purchased and installed in the Crocker Science Center.

**Staffing**
- Both Tessa Galland and Nidhi Choksi are continuing their education and training in the flow cytometry facility. The lab has also added a part time undergraduate assistant (Gabriel DeNiro) to help with one large project that requires significant sample prep and sorting. This project is primarily done on nights and weekends.

### Goals for FY19

In FY16, the facility managed 5 instruments. In FY19, the facility will be managing 15 instruments. This incredible growth has been primarily in satellite facilities. Currently instruments are located in EEJ Medical Research Building, Human Genetics, HCI, Wintrobe, and the Crocker Science Center. The facility is planning to hire an additional staff member to keep up with growing cell sorting demands and the significant increase in quality control and quality assurance measures within the lab. Once the facility has caught up with instrument demands, the focus will be on providing the educational and training opportunities that have not taken place at the appropriate intervals.
Revenue/Expenses

FY18 Expenses: Total $468,258
FY18 Revenue: Total $527,586
- VP of Research Support (RIF): $0
- FY18 revenue generated from services: $527,586

Billed Revenue by Fiscal Year

*Total annual revenue displayed in legend.

Advisory Board Committee

Last meeting date: Oct 2017
Ryan O’Connell, Assistant Professor, Pathology
Thomas O’Hare, Associate Professor, Hematology
Daniel Leung, Assistant Professor, Internal Medicine
Matthew Williams, Assistant Professor, Pathology

FY18 Scientific Impact

Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

# of grants: 125
# of investigators: 143
Top Users

1. ARUP
   Off Campus

2. Camp, Nicola
   Department

3. Deininger, Michael
   NIH, Department, Foundation for Cancer Research

4. Williams, Matthew
   NIH, Department

5. Schiffman, Joshua
   Department

6. Atanackovic, Djordje
   HCI, Nora Eccles Treadwell Foundation, IMF, Department

7. Welm, Alana
   Army Medical Research Acquisition

8. Weyrich, Andy
   NIH, NHLBI

9. Cairns, Bradley
   HHMI

10. Rutter, Jared
    HHMI, Nora Eccles Treadwell Foundation
Publications

29. S. K. Whiteside et al., IL-10 Deficiency Reveals a Role for TLR2-Dependent Bystander Activation of T Cells in Lyme Arthritis. *Journal of immunology* 200, 1457 (Feb 15, 2018).
31. O. Zurita Rendon et al., Vms1p is a release factor for the ribosome-associated quality control complex. *Nature communications* 9, 2197 (Jun 6, 2018).
Overview
The Genomics Facility offers a variety of genetic analysis services including full service genotyping, from PCR setup through analysis, and assistance to researchers performing genotyping projects. The facility has commercial and custom sets of fluorescently labeled microsatellite markers that can be used for whole genome linkage studies and fine mapping projects. Researchers can select genes or regions of interest and the facility designs and optimizes the PCR primers, performs the initial PCR, runs the sequencing reactions, and analyzes the data using SoftGenetics Mutation Surveyor software.

Services
Fragment Analysis
- Full service genotyping from PCR setup through analysis
- Capillary Runs
- Microsatellite Instability
- Loss of Heterozygosity
- Multiplex Ligation Dependent Amplification

SNP Genotyping
- Taqman SNP Genotyping
- Illumina GoldenGate SNP Genotyping
- Whole-Genome Genotyping and Copy Number Variation Analysis
- Methylation Analysis
- Open Array Genotyping

Real Time PCR
- Gene Expression

Equipment
- One AB 7900HT system
- Illumina iScan
- Quantstudio 12k Flex Real-Time PCR System

Personnel
Derek Warner, Director
Michael Klein, Manager
Revenue/Expenses
FY18 Expenses: Total $220,473
FY18 Revenue: Total $289,027
- VP of Health Sciences Support: $0
- FY18 revenue generated from services: $289,027

Billed Revenue by Fiscal Year

* Legend displays total annual billed revenue by year.

Advisory Board Committee
Last meeting date: February 21, 2017
Gerald Krueger, Professor, Dermatology
Deborah Neklason, Research Associate Professor, Huntsman Cancer Institute
Nicola Camp, Professor, Department of Medicine/Human Genetics

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 63
# of investigators: 99
### Top Users

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<tr>
<td>1</td>
<td>Hotaling, James</td>
<td>FDTN for Embryonic Competence</td>
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<td>Pulst, Stefan</td>
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<td>Camp, Nicola</td>
<td>NIH</td>
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<td>Coon, Hilary</td>
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<td>Weiss, Robert</td>
<td>NIH, NIDDK, Department</td>
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<td>DeAngelis, Margaret</td>
<td>Macular Degeneration Foundation</td>
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<td>Peterson, Randall</td>
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<td>8</td>
<td>University of Arizona</td>
<td>Off Campus Academic</td>
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<td>Carrell, Douglas</td>
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<td>Recursion Pharmaceuticals</td>
<td>Commercial</td>
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### Publications

Overview
The Machine Shop Facility is equipped with a full complement of lathes, drills, mills, welders, grinders, and CNC systems, staffed by experienced machinists and engineers capable of turning an idea into reality. The Shop Staff provide consultation to assist with the design process for products ranging from precise surgical instruments to large-scale testing equipment. They also fabricate as well as repair devices and parts made from carbon-steel, stainless steel, brass, copper, plastics, and other materials depending upon the requirements of design specifications.

Services
- Device Design/Engineering from basic concept to finished product
- Milling
- Turning
- Drilling
- Grinding
- Soldering
- Welding of steel, aluminum, and other types of fabrication
- Sawing
- Repair and Maintenance
- The Machine Shop Facility continues to supply fast plastic fabrication using technology developed in our shop.

Equipment
- CNC Mills
- Traditional Mills
- Manual Lathes and CNC Lathe
- Grinders
- MIG, TIG, Gas, Arc, and Spot welders
- Wood Working Equipment
- Band & Table Saws
- Sharpening Equipment
- Polishing Equipment

Personnel
Barry Evans, Engineer, Director
Kim Slusser, Machinist, Surgical Tool Expert
Mike Sanches, Machine Operator, Research Specialist, Graphic Artist
Shawn Colby, Machinist, Director in Training
Revenue/Expenses
FY18 Expenses: Total $259,279
FY18 Revenue: Total $226,633
- VP of Health Sciences Support: $15,000
- FY18 revenue generated from services: $211,633

Billed Revenue by Fiscal Year

*Legend displays total annual revenue by year generated.*

Advisory Board Committee
Perry Renshaw, Professor, Psychiatry
Michelle Ford, Materials Management Facilitator, Facilities Engineering
Kyle Thomson, Researcher, Add Program

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

# of grants: 17
# of investigators: 69
### Top Users

<table>
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<th>Rank</th>
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<tr>
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<td>Ford, Michelle</td>
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<td>Renshaw, Perry</td>
<td>VA</td>
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<td>3</td>
<td>Myriad Genetics</td>
<td>Commercial</td>
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<td>Meisner, Steve</td>
<td>Department</td>
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<td>Primary Children’s Medical Center</td>
<td>Commercial</td>
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<td>Wachowiak, Matt</td>
<td>NSF</td>
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<td>7</td>
<td>Weiss, Jeffrey</td>
<td>NIH, Department</td>
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<td>Rodesch, Chris</td>
<td>HSC Cores</td>
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<td>Vanderwerff, Ryan</td>
<td>Department</td>
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<td>10</td>
<td>Floyd, Candace</td>
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</table>
Mass Spectrometry & Proteomics

Overview
The Mass Spectrometry & Proteomics Facility supports proteomics research and provides basic mass spectrometry (MS) services for a broad range of research and sample types, such as polymers, natural products, small synthetic molecules, peptides, large intact proteins, and nucleic acids. The facility is equipped with several high-performance mass spectrometers, including a state-of-the-art FTMS instrument (LTQ-FT; ThermoElectron) with nano-LC and nano-ESI ionization, and a state-of-the-art Maldi/ToF/ToF instrument (UltrafleXtreme; Bruker Daltonics) with tissue-imaging capabilities. LC/MS/MS instruments in the lab are equipped with nano-LC for ultimate sensitivity and chromatographic performance. The facility seeks to provide the highest quality mass spectrometry analyses for protein and other biomolecule investigations.

Services
A range of proteomics, FTMS, and general and tissue-imaging MS services are available. In addition, the facility periodically participates in an international proteomics proficiency evaluation conducted by the Association of Bimolecular Resource Facilities (ABRF) to ensure the competency of the facility compared with other leading proteomics laboratories for the structural analysis of proteins and peptides.

Proteomics Services
- Protein ID from SDS Gel
- Protein ID from Solution
- Protein ID from Complex Isolates in Solution and IP Pull-down Experiments
- Identification of Protein Modifications/Post-translational Modifications
- Intact Protein MW Analysis
- Peptide Screening with MS/MS (FTMS) and accurate mass de novo sequencing
- Disulfide Linkage Characterization
- Identification of Sulfur-containing peptides
- “Top-Down” and “Bottom-Up” Proteomics
- Protein Expression/Quantification Analysis
- Custom Database Searching
- FTMS Services
- Accurate mass measurement-external calibration (Positive Ion)
- Accurate mass measurement-internal calibration (Positive Ion)
- Accurate mass measurement (Negative Ion)
- Peptide Sequencing with MS/MS and accurate mass de novo sequencing
- Identification of Sulfur-containing peptides
- High-resolution mass spectrometry (HR-MS) analysis

General MS Services
- ESI/MS
- ESI/MS/MS
- Nucleic Acids
- LC/MS
- LC/MS/MS
- Maldi/ToF/ToF
- Special Project/Method Development
Tissue-Imaging MS Services
- Cryostat Tissue Sectioning and Maldi Plate Setup
- Tissue Section Preparation and Setup
- Maldi/ToF Imaging of Tissue Sections
- Software Data Processing and Image Generation

Equipment
Mass Spectrometers
- New! Thermo QExactive HF
- Bruker UltraFleXtreme
- Waters Q-ToF-2
- Bruker Maxis II HD for high mass accuracy intact protein analysis.

HPLC Systems
- Two Eksigent 1D nanoLC systems
- One Eksigent 2D-Ultra system
- One Shimadzu 10AD system
- One Leica CM1950 cryostat system

Personnel
James Cox, Ph.D., Director
Krishna Parsawar, Ph.D., Assistant Director
Sandra Osburn, PhD., Research Associate

Revenue/Expenses
FY18 Expenses: Total $346,936
FY18 Revenue: Total $275,244
- VP of Health Sciences Support: $151,000
- FY18 revenue generated from services: $124,244

Billed Revenue by Fiscal Year

* Legend displays total annual revenue by year earned.

Advisory Board Committee
Darrell Davis, Professor, Medicinal Chemistry
Wes Sundquist, Professor, Biochemistry
Michael Kay, Professor, Biochemistry
FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation
- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 57
# of investigators: 72

Revenue by Department
- Biochemistry
- Medicinal Chemistry
- College of Pharmacy
- Chemistry
- Core Research Facilities
- Pharmaceuticals & Pharmaceutical Chemistry
- Oncological Sciences
- Radiology
- Obstetrics & Gynecology
- Mechanical Engineering
- Surgery
- Nano Institute
- Ophthalmology & Visual Sciences
- Biology
- Internal Medicine
- Molecular Medicine
- Bioengineering
- Human Genetics
- Pathology
- HCI
- Dentistry
- Pediatrics
- Neurobiology & Anatomy
- Pharmacotherapy
- Engineering
- College of Engineering
Top Users

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<td>Olivera, Baldomero</td>
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<td>Chou, Hung-Chieh</td>
<td>American Diabetes Assoc., JDRF</td>
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Publications

Metabolic Phenotyping

Overview
The Metabolic Phenotyping Core (MPC) offers several standardized and high quality metabolic and physiologic tests for phenotypic characterization of animal models of diabetes and other metabolic disorders. These metabolic and physiologic phenotyping tests include determination of whole body glucose metabolism and insulin sensitivity of animals by glucose and insulin tolerance tests and glucose clamps, assessment of whole animal energy expenditure using the Columbus Instrument’s Oxymax Lab Animal Monitoring System, determination of body composition by Bruker Minispec NMR and determination of circulating hormones, growth factors and cytokine concentrations using the Luminex xMAP multiplex technology (MAGPIX and Luminex 200). In addition, MPC performs tests to map the metabolic phenotype of different cell types and tissues using Agilent-Seahorse XF24 and XF®96 analyzers. The MPC also helps the scientists to optimize phenotyping tests. MPC’s goal is to expedite medical and biological research efforts by providing academic and non-academic researchers access to advanced metabolic phenotyping tests at a reasonable price.

Services
- Mitochondrial Bioenergetics Agilent-Seahorse XF®96 extracellular flux analyzers
- Cellular energy metabolism using Agilent-Seahorse XF24 and XF®96 extracellular flux analyzers
- Assessment of energy balance in mice using CLAMS Metabolic chambers
- Body Composition using Bruker Minispec NMR
- High throughput biomarker screening and quantification using Luminex technology
- Multiplexed protein analyte (hormone, growth factors, cytokines, adipokines, myokines and intracellular factors) quantification using MAGPIX and Luminex-200
- Whole body glucose metabolism and insulin sensitivity - Glucose, insulin tolerance tests
- Isolation of Pancreatic islets
- Beta cell mass, cell proliferation and cell death
- Chronic exposure of mice to cold/warm temperature
- Radiometric enzyme assays - glycogen synthase and phosphorylase activities in metabolic tissues

Equipment
- Seahorse Flux Analyzer XF24
- Seahorse Flux Analyzer XF®96
- Eight Columbus Instruments metabolic chambers equipped with temperature-controlled enclosure.
- Eight Columbus Instruments CLAMS metabolic chambers equipped with running wheels and with the capability to measure core body temperature and heart rate.
- Bruker Minispec NMR
- Luminex MAGPIX
- Luminex 200 System
- Powers Scientific rodent incubators

Personnel
Anil Laxman, Ph.D., Director
2018 Annual Update

Equipment
- Eight Columbus Instruments CLAMS metabolic chambers equipped with running wheels and with the capability to measure core body temperature and heart rate.

New Services
- MPC has recently purchased a CLAMS system with eight metabolic chambers using funds provided by VP of Health Sciences support and a generous contribution from Diabetes and Metabolism Center. This has increased the number of metabolic chambers in MPC from eight to sixteen thus allowing energy metabolism measurements by indirect calorimetry simultaneously in sixteen animals. The new CLAMS chambers have running wheel, which allows investigators to measure energy expenditure during exercise. This system is equipped with a telemetry system capable of measuring core body temperature and heart rate.

Revenue/Expenses

FY18 Expenses: Total $212,707
FY18 Revenue: Total $254,615
- VP of Health Sciences Support: $85,000
- VP of Health Sciences Support: $75,000 (for Metabolic Phenotyping CLAMS)
- FY18 revenue generated from services: $94,615

* Legend displays total annual revenue by year earned.

Advisory Board Committee
- Last meeting date: November 2017
  - Jared Rutter, Professor, Biochemistry
  - Carl Thummel, Professor, Human Genetics
  - Simon J. Fisher, Professor, Internal Medicine
FY18 Scientific Impact
Research Support

Revenue Generated (see charts following):

**Revenue by Affiliation**

- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 30
# of investigators: 41

**Revenue by Department**

- Nutrition & Integrative Physiology
- Internal Medicine
- Pathology
- Orthopaedics
- Pharmacology & Toxicology
- Molecular Medicine
- Biochemistry
- Oncological Sciences
- Physical Therapy & Athletic Training
- Exercise & Sport Science
Top Users

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Letter of Support for Grants

1. Katsu Funai’s application for Innovative Basic Science Award from American Diabetes Association to study the role of LPCAT3 in skeletal muscle insulin action.
2. Owen Chan’s application for Innovative Basic Science Award from American Diabetes Association titled “Contribution of Glutamate Oxidation to the Development of Counterregulatory Failure”.
3. Yufeng Huang’s NIH R01 application titled “Gene therapy with Tie2 agonism for protection of pancreatic beta cells and renal glomeruli in diabetes”.
4. Kuberan Balagurunathan’s NIH R01 application to study the role of Hs3st1/5 in the regulation of whole body glucose metabolism and insulin sensitivity (Role: Co-Investigator, Anil Laxman)

Publications

Overview

The Metabolomics facility provides analysis of metabolites found within a tissue, biological fluid, whole organism, culture, or other biological source. Currently metabolomics is a comparative science; the facility usually analyzes the differences found between biological samples that have been subjected to a treatment. This can be a genetic mutation, drug treatment, etc. Most analyses are relative; therefore, the facility can only make judgments on individual metabolites such as comparing the relative amounts of succinate between a mutant and a wild type but not compare the levels of succinate and fumarate within the same group or between groups. No one method is fully capable of completely profiling the metabolome. To maximize the number of metabolites observed, the facility is equipped with three chemical analysis platforms, GC-MS, LC-MS, and NMR.

Services

The primary mission of the facility is the metabolomics profiling of biological samples including serum, urine, tissues, *Drosophila*, *C. elegans*, yeast, and bacteria. The following metabolites can be analyzed from many biochemical pathways:

- Amino acids
- TCA cycle intermediates
- Organic acids including lactic acid and pyruvate
- Carbohydrates
- Nucleotides
- Lipids including sterols
- Di and tri peptides including glutathione
- Full lipid profiling by LC-MS
- Stable isotope label flux analysis by GC-MS

The facility processes every sample using two distinct but overlapping procedures, a targeted analysis and a non-targeted analysis. The targeted analysis is used to search every chromatogram for known metabolites. The non-targeted analysis uses data mining software to detect chromatographic peaks that are altered in two different conditions. This procedure is done with Principle Components Analysis (PCA) and Partial Least Squares-Discriminate Analysis (PLS-DA).

Equipment

**Chemical Analysis Platforms**

- Agilent 5977B gas chromatograph-quadrupole mass spectrometer (GC-MS).
- Agilent 5973 gas chromatograph-quadrupole mass spectrometer (GC-MS)
- Agilent 6530 Ultrapressure liquid chromatograph-quadrupole time of flight mass spectrometer (UPLC-QTOF-MS)
- Agilent 6550 Ultrapressure liquid chromatograph-quadrupole time of flight mass spectrometer (UPLC-QTOF-MS)
- Agilent 6490 Triple quadrupole UPLC-MS for the targeted quantification of metabolites, lipids and peptides
- Agilent 7200 gas chromatograph-quadrupole time of flight mass spectrometer (GC-QTOF)
**New Equipment**
- New! Sciex 6500 QTRAP Triple quadrupole UPLC-MS for the targeted quantification of metabolites, lipids and peptides

**Personnel**
- James Cox, Ph.D., Director
- Alan Maschek, Ph.D., Research Associate
- Leon Catrow, Ph.D., Research Associate
- Tyler Van Ry, B.S. Technician
- Brad Naylor, Ph.D. Post-Doc

**Revenue/Expenses**
- **FY18 Expenses:** Total $836,830
- **FY18 Revenue:** Total $788,822
  - VP of Health Sciences Support: $533,225
  - Baylor Grant: $58,159
  - FY18 revenue generated from services: $197,438

*Legend displays total annual revenue by year earned.*

**Advisory Board Committee**
Last meeting date: May 21, 2018.
- Dennis Winge, Professor, Department of Hematology
- Carl Thummel, Professor, Department of Human Genetics
- William Holland, Assistant Professor, Department of Nutrition & Integrative Physiology
- Jared Rutter, Professor, Department of Biochemistry
FY18 Scientific Impact Research Support
Revenue Generated (see charts following):

Revenue by Affiliation
- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 32
# of investigators: 61

Revenue by Department
- HSC Cores
- Pathology
- Pediatrics
- Molecular Medicine
- Medicinal Chemistry
- Biology
- Internal Medicine
- HCI
- Oncological Sciences
- Pharmacology & Toxicology
- Surgery
- Neurosurgery
- Nutrition & Integrative Physiology
- Biochemistry
- Human Genetics
- Physical Therapy & Athletic Training
- Pharmacotherapy
- Ophthalmology & Visual Sciences
Top Users

1. Cox, James
   Baylor College of Medicine
2. Phillips, John
   NIH
3. Summers, Scott
   NIH, Department
4. Recursion Pharmaceuticals
   Commercial
5. Ulrich, Neli
   NCI
6. Deininger, Michael
   NIH
7. Harvard University
   Off Campus Academic
8. Joss-Moore, Lisa
   Department
9. Ward, Diane
   NIH
10. Massachusetts General Hospital
    Commercial

Publications

Mutation Generation & Detection

Overview
The Mutation Generation & Detection (MGD) Core Facility supports researchers by securing, developing, and optimizing the latest DNA nuclease technologies, reagents, and protocols for targeted genome modification. Currently, the MGD core specializes in providing customized Engineered DNA Nucleases in either the TALEN or CRISPR-Cas9 formats. These systems work in multiple model systems, including *D. rerio, D. melanogaster, C. elegans, P. falciparum, S. cerevisiae, T. castaneum*, mammalian cell lines, *A. aegypti*, and *M. Musculus*. The MGD Core also offers services to identify induced genomic modification using High Resolution Melt Analysis (HRMA). Our support includes hardware, reagents, and expert advice for optimizing and performing HRMA. Beyond these two main services, the MGD Core has established partnerships with the Mouse Transgenic Facility and the Centralized Zebrafish Resource Center to create engineered mouse and zebrafish models, respectfully, using CRISPR DNA Nucleases.

The MGD Cores also provides custom HRMA genotyping services, custom CRISPR validation services, and custom donor molecule services. To date the MGD Core has helped further the research of over 100 different laboratories around the world by providing more than 525 unique TALEN and CRISPR reagents. The MGD Core is also a member of the Utah Center for Iron and Heme Disorders. The mission of this facility is to support researchers by securing, developing, and optimizing the latest DNA nuclease technologies, reagents, and protocols for targeted genome modification.

Services

**TALEN Services**
- TALEN plasmid pair design and construction
- 2X TALEN plasmid pair design and construction (same gene)
- 0.5X TALEN effector plasmid design and construction
- Different Destination Vector

**Crispr Services**
- 1X CRISPR plasmid design and construction
- 2X CRISPR plasmid design and construction
- 1X CRISPR sgRNA RNA production
- Control non-targeting Crispr plasmid

**High Resolution Melt Analysis**
- BioFire LightScanner Access Fee
- HRMA PCR plates (10 pack)
- HRMA PCR sealing film (10 pack)
- BioFire LightScanner MasterMix 100 rxns
- BioFire LightScanner MasterMix 500 rxns
- Mineral Oil (500ml bottle)
- HRMA Training
- Help with optimization and analysis of HRMA assays
- Custom Mutation Detection upon request
Additional Services
- Mouse Transgenic Injection (partnership with Mouse Transgenic Facility)
- Blastocyst Validation of CRISPR reagents (partnership with Mouse Transgenic Facility)
- Short ssDNA donor design and production
- Long ssDNA design and production
- dsDNA donor design and production
- Custom RFLP genotyping of mutant and transgenic mice
- Custom HRMA genotyping in D. rerio, D. melanogaster, and mouse embryos
- Production of transgenic D. rerio using CRISPR reagents
- Production of CRISPR and donor constructs for generating transgenic D. melanogaster

Equipment
- BioFire LightScanner
- 3X Eppendorf Mastercycler ProS
- Eppendorf Centrifuge 5430
- 2X Eppendorf 5424 Microcentrifuges
- 27” Apple iMac Desktop with QWC Mercury Elite-Al Pro External Hard drive
- Illumina Eco
- Innova 43 bacterial Shaker
- Innova 42 bacterial Shaker
- Frigidaire -20°C Freezer
- Lonza 4D Nucleofector system:
  - 4D-Nucleofector Core Unit
  - 4D-Nucleofector X Unit
  - 4D-Nucleofector Y Unit
  - 4D-Nucleofector 96-well Shuttle
- CCI Biological Safety Cabinet
- NapCo Model 6300 CO2 Incubator
- ThermoFisher TSX600 -80C Freezer
- Sorvall RT 6300 Centrifuge
- ASUS ZenBook 3 Deluxe Laptop

Personnel
Crystal Davey, Ph.D., Director, current
Timothy Dahlem, Ph.D., Director, 2011-November 2017
Trang Satterlee, Lab Technician

2018 Annual Update

New Equipment
- ASUS ZenBook 3 Deluxe Laptop

New Services
The MGD Core has developed one new service continues to expand the functionality of its current services by constructing new unique CRISPR expression constructs.
- Production of CRISPR and donor constructs to generate transgenic D. melanogaster
- Crispr Transfection Reagents with mCherry marker gene
- Crispr Transfection Reagents with Blasticidin selection gene
Revenue/Expenses
FY18 Expenses: Total $164,533
FY18 Revenue: Total $133,844
- VP of Health Sciences Support: $15,000
- FY18 revenue generated from services: $118,844

Billed Revenue by Fiscal Year

* Legend displays total annual revenue by year earned.

Advisory Board Committee
Last meeting date: October 13, 2017.
David Grunwald, Department of Human Genetics (Senior Faculty Advisor)
Dana Carroll, Department of Biochemistry
Ryan O’Connell, Department of Pathology
Lewis Charles Murtaugh, Department of Human Genetics

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 40
# of investigators: 74
Top Users

1  Bonkowsky, Josh  NIH, Department, European Leukodystrophy Association
2  Kwan, Kristen  NIH
3  Evason, Kimberley  HCI, Department
4  Sundquist, Wesley  Department
5  University of Nebraska  Off Campus Academic
6  Shapiro, Michael  NIH, NSF
7  Grunwald, David Jonah  NIH
8  Jones, Kevin  NIH
9  Gregg, Christopher  NIH
10 Moon, Anne  Department
Collaboration and Support of Other HSC and University Facilities

Dr. Ryan O’Connell Lab
The MGD Core has partnered directly with Dr. Ryan O’Connell on the production of custom Crispr reagents for his lab. As part of this collaboration, Dr. O’Connell covered 10% of the MGD Core Director’s salary requirements for seven months of FY’18.

Center for Iron and Heme Disorders
The MGD is one of three Cores that make up the Utah Center for Iron and Heme Disorders (CIHD). The CIHD provides 10% of the MGD Core Director’s salary requirements and covers the full salary of the MGD Core’s part time Laboratory Technician.

DNA Sequencing Facility
The MGD Core spent $4316.00 with the DNA Sequencing Core in FY18.

DNA Peptide Facility
The MGD Core spent $9583.92 with the DNA/Peptide Synthesis Core in FY18.

Mouse Transgenic Facility
During FY18 the MGD Core’s partnership with the Mouse Transgenic Facility to produce transgenic mouse models has directly brought in 24 different projects to the Mouse Transgenic Facility totaling at least $101,500 in chargebacks for that facility. All of these projects were initiated in the MGD Facility.

Total charge back impact of the MGD Core on other University Core Research facilities is $86,649.92

Non-billable Invoice Hours
One of the central purposes of the MGD Facility is to be a resource of education for researchers on the University of Utah campus. The MGD Core achieves this aim in official ways such as seminars given directly to different departments on campus. However, the central avenue of education by the MGD Core is informal one-on-one, in person communication with researchers. In the past, the MGD Core has tracked these interactions, but due to the number and randomness of these interactions in FY’16, the MGD Core stopped tracking them. Based on previous numbers the MGD Core estimates that it spends around 250-300 hours per year in direct interaction with researchers.

Letters of Support

Written and provided to faculty for support of grant applications:
1. LOS for Dr. Jayant Agarwal R21 proposal: “Targeted genomic recombination at mutation sites to aid in tumor detection and treatment.” February 2018
2. LOS for Dr. Josh Bonkowsky R01 proposal: “Identifying and Characterizing Modifiers of Adrenoleukodystrophy.” September 2017
3. LOS for Dr. Harry A. Dailey, February 2018
4. LOS for Drs. Allie Grossmann & John Hyngstrom: NCI SPORE Grant. May 2018
5. LOS for Dr. Kent Lai. July 2017
6. LOS for Dr. Kent Lai. October 2017
7. LOS for Dr. Dean Tantin RO1 proposal: “Role of Transcription Coactivator Oca-B in Gene Poising and Immunological Memory.” February 2018
8. LOS for Dr. Diane M. Ward Friedreich’s Ataxia Research Association (FARA) proposal: “Mitochondrial Oxidants and frataxin.” August 2017
Publications
Nuclear Magnetic Resonance

Overview
The Nuclear Magnetic Resonance core provides NMR services for the research community at the University of Utah, outside academic institutions and for profit companies. We provide access to five different high field NMR spectrometers (400, 500, 600, 800 and 900 MHz instruments; see Equipment below) located on the University of Utah Health Sciences campus and the University of Colorado Boulder and Denver campuses. The 600, 800 and 900 instruments are equipped with state of art consoles and high sensitivity cryogenic HCN probes ideal for protein and natural products research. The 400 and 500 are equipped with Mercury and Inova consoles respectively and conventional probes making them ideal for small molecule and natural products research. For data processing and analysis, we have a central server and five Linux workstations at the Structural Biology Computing Center (SBCC; Department of Biochemistry) with full access to SBGrid (www.sbgrid.org), a suite of structural biology software for NMR and XRAY data processing, analysis and structure determination.

Our staff has substantial experience characterizing small molecules, natural products, nucleic acids, carbohydrates and proteins using NMR spectroscopy. Our business model stresses user based data collection and analysis and thus we provide practical NMR training for individuals and groups on an as needed basis and teach formal NMR spectroscopy courses.

Services
- NMR data collection and analysis with/without staff
- NMR training for individuals and groups
- Formal courses in NMR spectroscopy

Equipment
- Varian Mercury 400 MHz NMR (University of Utah, Skaggs Hall)
- Varian Inova 500 MHz NMR (University of Utah, BPRB)
- Varian Inova 600 MHz NMR with HCN cryogenic probe (University of Utah, BPRB)
- DD2 800 MHz NMR with HCN cryogenic probe (University of Colorado-Boulder)
- DD2 900 MHz NMR with HCN cryogenic probe (University of Colorado-Denver)

Personnel
Jack Skalicky, Ph.D., NMR Core Director and Res. Associate Professor of Biochemistry
Dennis Edwards, RF Technician; 35+ years of NMR hardware repair

2018 Annual Update
New Equipment
- The Closed Cycle Chiller (CCC) cold head was replaced in FY 2018 (this service is required every 2-3 years for optimal operation of the 600 cryoprobe)
- Facilities added a new cooling loop in BPRB. This upgrade now provides reliable cooling water for more stable operation of the CCC helium compressor.

New Services
- The NMR Facility did not implement additional services in FY18
Revenues/Expenses
FY18 Expenses: Total $133,813
FY18 Revenue: Total $142,578
- VP of Health Sciences Support: $100,000
- FY18 revenue generated from services: $42,578

Advisory Board Committee
Last updates: June/July 2017.
Darrell Davis, Eric Schmidt and Jaclyn Winter, Department of Medicinal Chemistry
Wesley Sundquist, Department of Biochemistry
Jessica Kramer, Department of Bioengineering

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

* Legend displays total annual revenue by year earned.
## Top Users

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<td>6    Chou, Hung-Chieh</td>
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<td>8    Chandrasekharan, Mahesh</td>
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<td>9    Barrios, Amy</td>
<td>American Chemical Society</td>
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<tr>
<td>10   Prestwich, Glenn</td>
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Publications


Overview

The Preclinical (formerly Small Animal) Imaging Facility extends the benefits of modern diagnostic medical imaging technologies to the studies of anatomy and physiology in small animals. The facility operates one of each MRI, PET/SPECT/CT and fluorescence tomography scanners. The instruments are equipped with supporting and monitoring hardware that allows a wide variety of imaging experiments, including longitudinal studies, to be performed on live animals and specimens. Imaging scientists, full-time imaging personnel, and animal support technicians are available for technical consultation and experimental assistance.

Services

The Preclinical Imaging Facility has a variety of modalities to choose from such as MRI, PET/SPECT/CT, and near-infrared fluorescence imaging. Examples of scanning capabilities include the following:

7 Tesla small animal MRI systems
- Diffusion-weighted and diffusion tensor imaging
- Relaxometry (T1, T2, T2*) mapping
- Perfusion MRI
- Functional and awake-state functional MRI
- MR angiography
- Cardiac MRI
- NMR spectroscopy (localized and non-localized)
- Chemical shift imaging
- Parallel imaging techniques

CT/PET/SPECT Scanners
- Automatic transition between modes and seamless coordination of CT, SPECT, and PET data
- System can be configured as an ultra-high resolution preclinical CT scanner; a high-resolution, high-sensitivity preclinical SPECT scanner; or as a dual modality preclinical SPECT/CT scanner
- The Inveon 2-Head SPECT Module is designed to efficiently detect gamma rays ranging in energy from 30 keV to 250 keV, the SPECT system is ideal for use with most single photon-emitting radionuclides
- Includes two Inveon Research Workplace workstations for multimodality image review, fusion, and analysis which CT, PET, SPECT, and MR data in DICOM and Siemens Inveon CT, PET, and SPECT formats, as well as raw data import

FMT Mouse System
- 4 channel excitation with near-infrared laser diodes at 635, 670, 745, and 785 nm, maximizing tissue penetration depth and permitting multiplexed analysis of biological pathways
- System can be configured as an ultra-high resolution preclinical CT scanner; a high-resolution, high-sensitivity preclinical SPECT scanner; or as a dual modality preclinical SPECT/CT scanner
The Small Animal Imaging Facility also includes an Instrument Development Lab which primarily provides infrastructure for the construction of custom RF coils. These are often necessary to optimize the data quality for a given MRI application. The facility also houses basic machining tools (including a Milling machine) for making experimental apparatus’s such as scanning platforms and stereo taxes.

**Equipment**
- 7 Tesla Bruker BioSpec MRI Scanner
- Siemens Inveon CT/PET/SPECT System
- VISEN (now Perkin Elmer) FMT 2500™ Fluorescence Molecular Tomography

**Personnel**
- Edward Hsu, Ph.D., Director
- Samer Merchant, M.S., Imaging Specialist
- Adam Schmidt, Research Assistant
- Gavin Yeip, Research Assistant

**Revenue/Expenses**
- **FY18 Expenses**: Total $224,538
- **FY18 Revenue**: Total $277,856
- VP of Health Sciences Support: $50,000
- VP of Research Support: $100,000, (RIF) $27,377 (Spectral Camera ASM)
- FY18 revenue generated from services: $100,479

**Billed Revenue by Fiscal Year**

*Legend displays total annual revenue by year earned.*

**Advisory Board Committee**
- Last meeting date: April 1, 2018.
- Rob MacLeod, Professor, Bioengineering/SCI/CVRTI
- John Phillips, Research Associate Professor, Hematology
- Roger Van Andel, Director, Office of Comparative Medicine
- Edward DiBella, Professor, Radiology
- Donna Cross, Associate Professor, Radiology
FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 10
# of investigators: 21

Revenue by Department

- Radiology & Imaging Sciences
- Internal Medicine
- Bioengineering
- Surgery
- Core Research Facilities
- Biology
- Orthopaedics
- Pediatrics
- Neurosurgery
- Geology & Geophysics
- Obstetrics & Gynecology
- Pharmaceutics & Pharmaceutical Chemistry
Top Users

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Publications

Small Animal Ultrasound

Overview
The Small Animal Ultrasound Facility has two state-of-the-art VisualSonics 2100 ultrasound machines capable of imaging mice, rats, and other animal models with excellent spatial and temporal resolution. The facility has probes that cover the spectrum from 9-70 MHz (standard human clinical ultrasound covers the spectrum from 2.5-12 MHz). These machines are capable of real-time 2D imaging as well as a full spectrum of Doppler techniques (pulsed-wave, color, tissue, power). One of the two machines is also capable of 3D imaging and contrast imaging (both targeted and non-targeted). Software is available for advanced image analysis of cardiac mechanics with speckle tracking that allows analysis of strain and strain rate. These tools allow near histologic resolution imaging of live animals, and are well suited to challenging applications such as the resolving the rapid heart rates of mice, or the microscopic size and function of early and mid-gestation embryos, and everything in between. The facility has long been an extremely important tool in the practice of clinical medicine because it offers real-time imaging providing understanding of anatomy and physiology, is non-invasive, and can be repeated serially.

Services
The facility has the capability for anesthesia and monitoring of mice and rats, and will support training laboratory personnel in the design of protocols and the use of the equipment for acquiring images. An off-line image analysis station is also available for later review and analysis of studies.
- Ultrasound imaging access
- Training in use of equipment
- Experiment design and assistance with protocol optimization
- Off-line image review and analysis

Equipment
- Two VisualSonics 2100 ultrasound machines
- Off-line image analysis station and network storage for backing-up data files

Personnel
Kevin Whitehead, M.D., Director
Kandis Carter, Laboratory Technician
Tiehua Chen, Laboratory Technician
Revenue/Expenses
FY18 Expenses: Total $42,720
FY18 Revenue: Total $32,256
- VP of Health Sciences Support: $10,000
- FY18 revenue generated from services: $22,256

Billed Revenue by Fiscal Year

Legend displays total annual revenue by year earned.

Advisory Board Committee
Last meeting date: April 15, 2013.
Andy Weyrich, Associate Dean for Basic and Translational Sciences
Craig Selzman, Associate Professor, Cardiothoracic Surgery
Brent Wilson, Assistant Professor, Cardiology

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

# of grants: 14
# of investigators: 14
**Top Users**

1. Drakos, Stavros | Doris Duke Foundation
2. Franklin, Sarah | NIH
3. Selzman, Craig | USTAR
4. Boudina, Sihem | NIH
5. Shiu, Yan-Ting | NIH
6. Sachse, Frank | Nora Eccles Treadwell Foundation
7. Odelberg, Shannon | NIH
8. Donato, Anthony | NIH
9. Rutter, Jared | HHMI, Nora Eccles Treadwell Foundation
10. Lesniewski, Lisa | NIH

**Publications**

Service Recharge Centers

Overview

The HSC Administration Office also manages Service/Recharge Centers. These Centers are not cores but follow most of the same guidelines as the HSC Cores. The Administration Office processes the billing, collections and ordering of supplies for these Centers. Each Center receives monthly reports showing revenue and expenses and has access to the internal tracking system which shows in real time what their account balances are. The Administration Office charges a fee of 5% on revenue collected from billed services. These Centers are listed on the HSC Cores website under Service/Recharge Centers. If it is determined at a later time that a Center would benefit from becoming a Core, then all guidelines must be followed. Service/Recharge Centers are primarily created to provide services to the University Community but can also provide services to external customers. The administration of these facilities is performed by the home department. Only recharge activity for these groups is managed by the Administrative Office, this is partly due to the efficient billing system that has been developed in collaboration with our IT support group managed by Mr. Rick Haycock.
Genetic Science Learning Center

Overview
The GSLC specializes in translating complex science and health concepts for those who are not experts in a particular field. They produce award-winning educational materials and programs that make science and health easy for everyone to understand.

Uniqueness
The GSLC produces the most highly used online life science education resource in the world. Each year its Learn.Genetics and Teach.Genetics websites are visited by over 16 million individuals who view over 60 million pages and come from every country. These sites, thus, provide an unparalleled, international dissemination mechanism for educational materials developed through collaborative projects with faculty.

The GSLC has received numerous awards for the educational materials it produces. Among others, these include the first award of the Science Prize for Online Resources in Education from *Science Magazine* and AAAS.

The GSLC has over 20 years of experience in producing educational materials for patients, the public, and students and teachers at the K-12 and higher education levels. They collaborate with faculty and more to produce materials for large and small projects.

The GSLC’s team is unique among US academic institutions that produce science and health education materials, in that it includes expertise in science and health writing, science research, instructional and educational material design, multimedia animation and interactivity, graphic design, video production, video game and app development, original music composition and audio engineering, and research and evaluation of educational materials and programs; other groups outsource some of these functions.

Services
- Educational material design and production, including materials that are culturally and linguistically appropriate for diverse audiences
- Science and health writing
- Instructional design
- Multimedia animation and interactivity
- 3D animation
- Graphic design for online and print-based materials
- Video production, including script writing and videography
- Original music composition and audio engineering for video and multimedia materials
- Video game development
- App development
- Website development
- Developing and providing culturally and linguistically appropriate education programs for the lay public, and grade K to 12 students and teachers
- Science and health education research studies
- Evaluation of education materials and programs (small-scale projects)
- Development of valid assessment (test) items for evaluating the efficacy of educational materials and programs
An initial consultation is provided in order to define a project’s scope and budget. For grant proposals, text describing the GSLC and its contributions to the project, a budget and justification are provided. Once a project is agreed to and/or funded, a project lead is assigned, who serves as the primary GSLC contact for the project.

Personnel
Louisa A. Stark, PhD, Director
Kevin Pompei, MEd, Administrative Director
Peter Anderson, BFA, Creative Director
Kagan Breitenbach, BMu, Specialty Media Coordinator
Dina Drits-Esser, PhD, Senior Research Associate
Kristin Fenker, PhD, Post-doctoral Fellow
Amy J. Hawkins, PhD, Post-doctoral Fellow
Sheila Homburger, MS, Science Content Manager
John Maxwell Kelly, BFA, Graphic Artist
Molly Malone, BS, Senior Education Specialist
Ryan Perkins, BFA, Graphic Designer
Julia Peterson, Graphic Artist
Steve Reest, BS, MLS, Program Assistant
Harmony Starr, BS, Media Production Manager

Goals for FY18
The GSLC will continue to produce high quality, award-winning educational materials. We will work to inform researchers and units across the University of Utah campus and elsewhere about our capabilities and our availability to collaborate on projects. In this way, we will seek to increase our visibility and expand our users.

Revenue/Expenses
FY18 Expenses: $531,961
FY18 Revenue: $816,428
- Other Revenue Sources: $349,016
- FY18 revenue generated from services: $467,412

* Legend displays total annual revenue by year earned.
** Management by Core Administration 2017.
Management Meeting
  Last meeting date: May 22nd, 2018
  Louisa Stark, PhD, GSLC Director
  Kevin Pompei, MEd, Administrative Director
  John Phillips, PhD, HSC Core Research Facility, Director
  Brenda Smith, Associate Director, Accounting and Finance, HSC Core Research Facility Operations
  Cynthia Best, MBA, Associate Dean, SOM Finance
  Amy Tanner, Director, Research & Science, SVPHS Research Unit
  Wendy Kwan, Associate Director, Training & Development SOM Finance
  Natalie Johnson, Manager, Administration, Department of Human Genetics

FY18 Scientific Impact
Research Support
Revenue Generated (see charts):

Revenue by Affiliation
- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 7
# of investigators: 11

Revenue by Department
- U of U Hospital
- Population Health Sciences
- Surgery
- Biology
- Genetic Science Learning Center
- Nursing
- Public Affairs
- Internal Medicine
- Human Genetics
Top Users

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Educational Modules Published Online

1. Evolution: DNA and the Unity of Life  
   [http://teach.genetics.utah.edu/content/evolution/](http://teach.genetics.utah.edu/content/evolution/)

2. Sensory Systems: The Neuroscience of Our Senses  
   [http://learn.genetics.utah.edu/content/senses/](http://learn.genetics.utah.edu/content/senses/)  
   [http://teach.genetics.utah.edu/content/senses/](http://teach.genetics.utah.edu/content/senses/)

3. Cotton  
   [http://learn.genetics.utah.edu/content/cotton/](http://learn.genetics.utah.edu/content/cotton/)

4. Insect Herbivores vs. Plants  
   [http://learn.genetics.utah.edu/content/herbivores/](http://learn.genetics.utah.edu/content/herbivores/)

Publications


Iron & Heme

Overview
The Iron and Heme Core provides analysis of metals, precursor porphyrins and heme. The core also measures activity of the enzymes responsible for heme biosynthesis. Analysis and quantification of heme and its precursors can be obtained for cell pellets, tissue, whole blood, urine, feces and other complex biological materials. Analysis of enzyme activity can be provided for cell pellets, tissue and blood. An Agilent 7900-ICP mass spectrometer is used to measure iron content (as well as other metals) in biological samples.

Uniqueness
The Iron and Heme Core provides a service, not available at most universities. I am unaware of any other U.S. academic service center that provides experienced UPLC/HPLC analysis of heme and porphyrin content, or assays for activity of enzymes involved in heme biosynthesis. Because of our uniqueness and relevance to the hematology community, we receive requests for service from academic laboratories all over the United States. In the past year, our lab has provided this unique service (paid and unpaid) for investigators from eight other research institutions across the country, in addition to serving the Iron and Heme research community at the University of Utah.

Services
The Iron and Heme Core’s primary mission is to facilitate research into the role of heme, heme precursors and transition metals in both normal and disease states. The iron and heme core lab has extensive experience with the separation and identification of tetrapyrroles and with running and developing heme biosynthesis pathway enzyme assays. We specialize in iron (and other lesser metals) analysis by ICP-MS and also test for other metals. We are offering the following services:

- Metal analysis by ICP-MS
- UPLC Analysis of Total Heme and protoporphyrin IX
- Spectral Analysis of Heme
- UPLC analysis of porphyrins
- Assays for the following Heme Biosynthetic Enzymes (ALAS, ALAD/PBGS, PBGD, U3S, UROD, COPOX & FECH)

Equipment

Metal Analysis:
- Agilent 7900-ICP mass spectrometer
- Agilent SPS4 autosampler

Heme and Porphyrin analysis:
- Waters Acquity ultra performance liquid chromatography (UPLC) system, equipped with a reverse phase C18 column, a photodiode array detector and a fluorescence detector for reversed phase analytical work
- Agilent 8453 diode array spectrophotometer
- HPLC Waters 2795 Alliance HT separations module with a Waters 474 Scanning Fluorescence Detector and a Waters 2996 PDA Detector (photodiode array)
Personnel
Laurie Jackson, Core Director
Hector Bergonia, Lab Specialist Tetrapyrrole Biochemistry

Revenue/Expenses
FY18 Total Expenses: $12,929
FY18 Total Revenue: $24,255
- VP of Research Support: $0
- FY18 revenue generated from services: $24,255

Advisory Board Committee (CIHD Operations Committee)
Last meeting date: October 4, 2017
John D. Phillips
James Cox
Diane M Ward
Dennis Winge

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

* Legend displays total annual revenue by year earned.
Top Users

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<td>Leibold, Elizabeth</td>
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<td>East Carolina University</td>
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Goals for FY18

- Improve efficiency of workflow
- Increase awareness of our services

Publications

3. Y. Y. Yien et al. Mutation in human CLPX elevates levels of delta-aminolevulinate synthase and protoporphyrin IX to promote erythropoietic protoporphyrria (2017, September 5) PNAS E8045-E8052.
4. E. R. Rocha et al. Bacteroides fragilis requires the ferrous-iron transporter FeoAB and the CobN-like proteins BtuS1 and BtuS2 for assimilation of iron released from heme. MicrobiologyOpen. Published online before inclusion in issue as Early View e00669.
Materials Characterization Lab

Overview

The Materials Characterization Lab (MCL) is a user research facility managed by the Materials Science and Engineering (MSE) Department at the University of Utah. The lab offers clients access to a wide range of analytical instrumentation and services for a variety of biochemical, organic, inorganic, and environmental samples.

The MCL provides researchers with training on the care and operation of equipment used in materials characterization. In addition to providing training for new users, our staff is available to help users in the design of experiments and the interpretation of results.

The MCL maintains a ~1300 sq. ft. lab facility, including optical and metallographic microscopes, two scanning electron microscopes (SEM), an energy dispersive X-ray spectrometer (EDS), a Fourier transform infrared (FTIR) spectrometer, an ultraviolet-visible-near-infrared (UV-Vis-NIR) spectrophotometer, two X-ray diffractometers (XRD), a differential scanning calorimeter (DSC), a dilatometer, an Instron mechanical testing system, a BET surface area and pore size analyzer, carbon and gold sputter coaters, a compression mounting press, and a grinding and polishing system.

Uniqueness

The MCL has an extensive history of successful collaborations with academia, government, and industry clients ranging from startups to multinational corporations in the aerospace, automotive, coatings, geochemical, medical, semiconductor, and other markets.

MSE faculty and staff serve as resources in the following areas of specialization: biofuel cells, ceramics, composites, computational electronic materials and polymers, electronic materials and assemblies, explosive sensing, nanomaterials, nanotechnology, and more.

The MCL has expertise in:
- Biomedical materials and devices
- Ceramics
- Composites
- Electronic materials
- Metals and metal oxides
- Polymers

The MCL provides the following:
- Cross-sectional analysis
- Materials analysis, comparison, and identification
- Microphotography suitable for advertising and training purposes
- Routine analysis for quality assurance and control
- Workforce training / education
Services
The MCL staff provide consultations and experiment design suggestions based on the needs of the user. The services offered by the MCL include materials characterization with the following techniques:

Microscopy
- Optical microscopy & metallography
- Scanning electron microscopy (SEM) with secondary electron (SE), backscatter electron (BSE), and energy dispersive X-ray spectroscopy (EDS) detectors

Spectroscopy
- Fourier transform infrared (FTIR) spectroscopy
- Ultraviolet-visible-near infrared (UV-Vis-NIR) spectrophotometry

X-Ray Diffraction (XRD)
- Lattice parameters
- Percent crystallinity
- Phase identification
- Phase quantification

Macroscopic & Physical Testing
- Differential scanning calorimetry (DSC)
- Dilatometry
- Instron mechanical testing – tensile, compression, and flexure testing
- Surface area and pore size analysis

Sample Preparation
- Carbon and gold sputtering
- Cross-sectioning / microsectioning
- Grinding and polishing

The MCL also serves as a facility for Materials Science and Engineering undergraduate and graduate level courses that involve materials characterization.

Equipment

Optical Microscopy
- Olympus BH2 Series System Microscope with UC50 5 Megapixel Digital Color Camera
- Olympus Tokyo PME Inverted Stage / Metallographic Microscope
- Olympus VANOX Universal Research Microscope

Scanning Electron Microscopy
- Hitachi S-3000N Scanning Electron Microscope (SEM) with Secondary Electron (SE), Backscatter Electron (BSE), and EDAX HIT S3000N Energy Dispersive X-ray Spectroscopy (EDS) Detectors
- Hitachi TM3030Plus Tabletop Microscope (SEM) with SE and BSE Detectors

Spectroscopy
- Varian 3100 Excalibur Series Fourier Transform Infrared Spectrometer (FTIR) with Attenuated Total Reflectance (ATR) and Transmission Accessories
- Perkin-Elmer LAMBDA 950 UV-Vis-NIR Spectrophotometer with 150 mm Integrating Sphere, 2D Detector Module, and Universal Reflectance Acc.(URA)

X-Ray Diffraction
- Philips PANalytical X’Pert X-Ray Diffractometer (XRD)
- Bruker D2 Phaser X-Ray Diffractometer (XRD)
Macroscopic & Physical Testing
- NETZSCH DSC 3500 Sirius Differential Scanning Calorimeter (DSC)
- Anter Corporation Work Horse IB Dilatometer
- Instron 5969 Dual Column Tabletop Testing System
- Micromeritics Gemini V BET Surface Area and Pore Size Analyzer
- Micromeritics FlowPrep 060 Sample Degas System
- METTLER AE100 Analytical Balance

Sample Preparation
- Cressington 108carbon/A Carbon Coater for Conductive Carbon Coatings
- Cressington 108auto Sputter Coater for Conductive Gold Coatings

Cross-Sectioning / Microsectioning
- Buehler SimpliMet II Mounting Press
- LECO Spectrum System 1000 with Oscillating Polishing Head and Six Sample Holder

Personnel
Taylor Sparks, Ph.D., Director, Assistant Professor, Faculty Advisor
Angela Nelson, Administrative Officer
Kimberly Watts, Lab Manager

Goals for FY19
- Increase lab usage and revenue
- Create standard training videos and materials for interns and users alike
- Formulate and enact lab organization practices that will decrease turnaround time for lab results

Revenue/Expenses
FY18 Expenses: Total $74,716
FY18 Revenue: Total $63,485
- VP of Research Support: $0
- FY18 revenue generated from services: $63,485

* Legend displays total annual revenue by year earned.
Advisory Board Committee
Last meeting date: June 20, 2017
Taylor Sparks, Ph.D., Assistant Professor
Mike Scarpulla, Ph.D., Associate Professor
Dmitry Bedrov, Ph.D., Associate Professor

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation
- University Academic
- University Non-Academic
- Off Campus Academic
- Off Campus Commercial

# of grants: 36
# of investigators: 41

Revenue by Department
- Civil & Environmental Engineering
- Electrical & Computer Engineering
- Chemistry
- Metallurgical Engineering
- Surgery
- Pharmaceutics & Pharmaceutical Chemistry
- Materials Science & Engineering
- Chemical Engineering
- Mechanical Engineering
- Ophthalmology & Visual Sciences
- Physics & Astronomy
- Core Research Facilities
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National Center for Veterans Studies

Overview
The mission of the National Center for Veterans Studies (NCVS) at The University of Utah is to engage in research, education, outreach, and advocacy for improving the lives of military personnel, veterans, and their families. The NCVS conducts research primarily focused on suicide prevention and PTSD among service members and veterans, and provides evidence-based treatments to this community at no cost. NCVS staff also conduct training workshops and educational presentations for healthcare providers and the public.

Services
NCVS offers a range of services including consulting, training, and psychological treatments. Main services that have been developed and used during FY2018 include:

- **Suicide prevention training workshops.** The NCVS provides a range of training workshops to licensed mental healthcare providers, certified peer specialists, and other members of the community. These workshops focus on translating the results of NCVS research into a range of settings in order to better prepare healthcare providers and communities to assist high-risk service members and veterans.

- **Psychological treatments for service members, veterans, and first responders.** The NCVS offers evidence-based treatments for the military, veteran, and first responder communities at no-cost. The NCVS has pioneered innovative treatment delivery methods shown to yield more rapid recovery from posttraumatic stress disorder (PTSD) and suicidal thinking. The primary treatments offered by the NCVS include cognitive processing therapy for PTSD and brief cognitive behavioral therapy for suicide prevention. Service members, veterans, and first responders interested in receiving these therapies can contact the NCVS to schedule an initial consultation at ncv@utah.edu or 801-587-7978.

Personnel
Craig Bryan, PsyD, ABPP, Executive Director
AnnaBelle Bryan, MS, Director of Operations
Feea Leifker, PhD, Director of Clinical Services
David Rozek, PhD, Director of Training
Revenue/Expenses
FY18 Expenses: Total $1,416
FY18 Revenue: Total $24,010
- VP of Research Support: $0
- FY18 revenue generated from services: $24,010

* Legend displays total annual revenue by year earned.
** Management by Core Administration 2018.

Grant Support
The NCVS has been awarded the following research grants this year:
- Department of Defense – Peer to Peer Programs for Military Suicide Prevention
- The Boeing Company – Suicide & Trauma Reduction Initiative for VEterans (STRIVE)
- Bob Woodruff Foundation – R&R Program
- Department of Defense – Brief Cognitive Behavioral Therapy Replication Trial
- Department of Defense – Project Safe Guard (Prime: University of Southern Mississippi)

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

# of grants: 0
# of investigators: 4
Top Users

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Publications

NCVS researchers have published 27 scientific papers thus far in 2018, and published a total of 21 scientific papers in 2017.
Overview
UNEP provides state-of-the-art laboratories used for alpha, beta, gamma and neutron radiation detection, irradiation of material samples to study various effects of various types of radiation, and neutron activation analysis techniques (nondestructive technique to find a sample elemental composition). UNEP maintains a 7,500 sq ft nuclear engineering and radiochemistry facility, including a fully operable 100 kW TRIGA Mark-1 nuclear reactor, 3 High Purity Germanium (HPGe) gamma detectors, liquid scintillation counting, and alpha spectrometry.

Uniqueness
The Utah Nuclear Engineering Facility is the only nuclear research reactor in the State of Utah, and one of the few in the Intermountain West area. We offer a number of unique, non-destructive testing techniques for analyzing isotopic and chemical composition of a wide variety of samples. UNEP has been at the forefront of establishing a safety culture and practices, already implemented at large scale commercial power plants, in a research reactor environment. UNEP also allows students from the University of Utah, as well as other local universities, to train for and obtain a Reactor Operator (RO) license from the Nuclear Regulatory Commission (NRC).

Services
The types of services offered by UNEP include material characterization by chemical composition analysis and radiation resistance of samples placed in high radiation environments. Example services are as follows:
- Neutron Activation Analysis (NAA)
- Sample Irradiation
- Electronics Hardness Testing
- Radioisotope Generation
- Passive Gamma Spectroscopy
- Alpha Spectroscopy
- Liquid Scintillation Counting
- Fission Track Analysis

Because of the uniqueness and lack of familiarity that often encompasses a research reactor an important aspect of our work is consulting with researchers and PIs at the early stages of their research in order to establish an efficient and cost effective plan with utilizing our TRIGA reactor and wide variety of radiation detectors.

Equipment
Radiation Detectors
- Canberra Alpha Analyst
- Canberra HPGe detectors
  - BEGe 3830
  - REGe 4020
  - GC 4020
- Beckman Liquid Scintillation Counter
- TRIGA Research Reactor
Personnel
Matthew Lund, Reactor Supervisor
Amanda Foley, Reactor Operator
Lucas Albricht, Reactor Operator
Steven Pappas, Operator in Training
Alexander Reifsnyder, Operator in Training
Donavan Feist, Lab Analyst

Revenue/Expenses
FY18 expenses: $10,610
FY18 revenue: $16,972
- FY18 revenue generated from services: $16,972

* Legend displays total annual revenue by year earned.

Advisory Board Committee
Last meeting date: March 27, 2017
Jim Byrne, Reactor Safety Committee Chair
Terry Ring, Professor, Chemical Engineering
Greg Moffitt, Former Reactor Supervisor
FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

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<th># of investigators</th>
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Top Users

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<tr>
<td>1</td>
<td>Minoshima, Satoshi</td>
<td>U of U Research Foundation, Department</td>
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<td>2</td>
<td>Okayama University</td>
<td>Off Campus Academic</td>
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</tbody>
</table>

Goals for FY18

- Characterize and begin utilizing pneumatic irradiator
- Alpha spectrometry
- More consistent user base
- International 2 Week Training course with Okayama University
- Possible labs/classes with outside entities
Overview

The University of Utah Center for Scalable Analytics and Informatics (USAI) provides support to research and operations groups inside and outside the University of Utah. These services include Annotation and Chart Review, Natural Language Processing, EMR-driven Clinical Trial Recruitment, Analytics and Data Services, and Enterprise Architecture and Application Development.

Uniqueness

Utah Scalable Analytics and Informatics provides multiple services for researchers utilizing electronic medical records. EMR-driven Clinical Trial Recruitment provides the ability to identify patients during an encounter with a healthcare provider that potentially could participate in a clinical trial and could drastically reduce cost and increase recruitment. Annotation products help machines and humans mark-up data for classification. Natural Language Processing (NLP) processes test data to extract structured data to infer concepts that can be understood by machines and humans for further analysis. USAI’s annotation product line focuses on easing the burden and increasing consistency of manual chart review and annotation tasks. While annotation and chart review are time consuming and expensive, they are vital to many part of the research process: data exploration, feasibility, defining study variables, identifying information in text notes, classifying information within a document, at the document level, at the encounter or patient level, and validating study results. USAI provides Enterprise Architecture and Application Development and has developed annotation tools to support Natural Language Processing, which improves outcomes in health services research and reduces the costs to the researcher. Education is also important to USAI and therefore USAI has recruited and trained computer science students.

Services

- Annotation and Chart Review
- Natural Language Processing
- EMR-driven Clinical Trial Recruitment
- Analytics and Data Services
- Enterprise Architecture and Application Development

Consultation is provided in order to define a project’s scope and budget in the early stages of development to make optimal and efficient use of USAI’s services. The staff will also handle regulatory requirements and project management if needed.

Specialized Software

Chart Review
- eHOST
- ChartReview

Natural Language Processing
- Leo
- Chex

Data Exploration and Visualization
- FirstLook
Goals for FY19
USAI will continue to offer and expand its services to University and Industry members in health sciences research by providing EMR-driven patient trial recruitment, annotation and chart review, natural language processing, enterprise architecture and application development and data analysis. To meet increasing demand of USAI’s services, the team has brought on board several new staff members to include health science research specialists, computer programmers, data managers and administrative support.

Revenue/Expenses
FY18 Expenses: $77,036  
FY18 Revenue: $169,425
- VP of Research Support: $0  
- FY18 revenue generated from services: $169,425

* Legend displays total annual revenue by year earned.

Management Meeting
Last meeting date: Aug 10, 2017  
Scott L DuVall, PhD, Director  
Ryan Heugly, Program Manager  
Christopher Ledding, MBA, Financial Analyst
FY18 Scientific Impact
Research Support
Revenue Generated (see charts):

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### Revenue by Affiliation

- **University Academic**
- **University Non-Academic**
- **Off Campus Academic**
- **Off Campus Commercial**

- **# of grants:** 3
- **# of investigators:** 8

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### Revenue by Department

- **Population Health Sciences**
- **Biomedical Informatics**
- **Surgery**

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### Top Users

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<td>Dartmouth College</td>
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<td>Bucher, Brian</td>
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</table>
Publications


Overview

The Transgenic & Gene Targeting Core (TGTC) provides world-class service and assistance in the field of mouse transgenesis, gene targeting, and related mouse endeavors to the scientific community. The complex technology, expensive equipment, precise techniques and expertise provided by TGTC continues to be a critical tool in maintaining the University of Utah’s position at the cutting edge of scientific research and a leader in the field of mouse genetic modification.

Our main services provide transgenic and gene targeted mice to researchers. CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) technology has allowed researchers, even those not adept at molecular biology, to obtain specific gene targeted mice for their research in a more direct manner than traditional methods. TGTC uses CRISPR technology to generate knockout, knockin, and conditional targeted mice. This method allows for faster, more efficient and less expensive generation of mice with specific genetic mutations.

Other services include conventional gene targeting of ES (embryonic stem) cells followed by injection of targeted cells to produce germline chimeras, and production of traditional transgenic mice where the transgene is randomly inserted into the genome. In addition, TGTC has expertise in mouse-related procedures including embryo and sperm cryopreservation, in vitro fertilization (IVF), intracytoplasmic sperm injection (ICSI), karyotyping of ES cells, rederivation of mice from frozen embryos, and derivation of primary ES cells. Our facility consists of two cell culture hoods and incubators, two microinjection stations for both pronuclear and blastocyst injections, three surgery areas, and a mouse room for housing and breeding the necessary animals. All of the people in the TGTC have several years of vast experience in the transgenic mouse field.

Services

- Mouse generation of targeted mutations using CRISPR/Cas technology to create specific genetic mutations including knockout, knockin, and conditional knockout
  - via microinjection of reagents
  - via ZEN (zygote electroporation of nucleases)
  - via GONAD (genome editing via oviductal nucleic acids delivery)
- In vivo Validation of CRISPR reagents
- Blastocyst injection of targeted ES embryonic stem cells
- Pronuclear injection of DNA to produce transgenic mice
- Gene targeting of ES embryonic stem cells
- Primary ES cell generation
- Sperm cryopreservation
- Embryo cryopreservation
- IVF, in vitro fertilization
- Rederivation of mouse lines via embryo transfer
- Ovary transfer
- Import/export sperm and/or embryos
- Karyotyping of ES embryonic stem cells
- Sperm and embryo long-term storage
Equipment

- Zeiss Axio Observer.Z1 microinjection station
- Nikon Diaphot 300 microinjection station
- Eppendorf Transman NK2 micromanipulators
- Eppendorf Femtojet microinjector
- Nikon SMZ645 dissection microscopes
- Olympus SZX10 dissection microscopes
- Nikon Eclipse TS100 inverted microscopes
- Sutter P-97 pipette puller
- Narashige MF-900 microforges
- ESCO, Forma, New Brunswick CO2 incubators
- MINC IVF incubator
- Brinkman benchtop autoclave
- ESCO cell culture hood
- Forma cell culture hood
- BioRad Gene Pulser Xcell electroporator
- Thermo Cryomed controlled rate embryo freezer
- Thermo ULT -80 freezer
- Thermo -135 freezer
- Centrifuges, microfuges

Personnel

Susan Tamowski, Director
Wenhua Li, Senior Lab Specialist
Kyle O’Connor, Senior Lab Specialist
He Lan, Senior Lab Specialist
Nick Black, Lab Specialist

2018 Annual Update

New Equipment

- BEX Pulse Generator CUY21 EDITII GONAD machine, on loan from Japan, used for in vivo electroporation of CRISPR reagents into mouse embryos

New Services

- New technology includes GONAD, a direct in vivo method of generating mutant mice using CRISPR/Cas
Revenue/Expenses

FY18 Expenses: Total $631,931
FY18 Revenue: Total $652,982
- VP of Health Sciences Support: $437,369
- FY18 revenue generated from services: $215,343

* Legend displays total annual revenue by year earned.

Advisory Board Committee
Charlie Murtaugh, Co-Director, Professor, Human Genetics
Suzi Mansour, Professor, Human Genetics
Dean Tantin, Associate Professor, Pathology

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

# of grants: 33
# of investigators: 51
## Top Users

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<td>Science Exchange Inc.</td>
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<td>Lamb, Tracey</td>
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Letter of Support for grants:

1. Mark Warren’s application for an NIH grant that includes the generation of a new mouse to study the importance heart arrhythmia and its relationship to cardiac sodium channels. Obtaining this mouse model is a key component in addressing the origin of RVOT vulnerability in BrS patients.

2. Mary Elizabeth Hartnett’s application for an RO1 grant entitled “Mechanisms of Angiogenesis in Retinopathy of Prematurity” to include generating an inducible knockout mouse of EPOR.

3. Corrine Welt’s application for an NIH grant to generate conditional mouse to recreate a stop gain mutation identified in a family with dominant inheritance of primary ovarian insufficiency and autoimmune disease.

4. Dean Tantin’s application for an NIH grant to study the transcription regulators OCA-B and Oct1 and the establishment of poised gene expression states in memory T cells.

5. Matthew Rondini’s application for a 2018 VA Merit Award entitled “Platelet Reprograming during Inflammation” that requires the generation of a platelet specific conditional knockout mouse.

6. Christopher Reilly’s application for a grant entitled “TRP Channels and Air Pollution” that requires the generation of humanized mice using CRISPR/Cas technology.

7. Janis Weis’ application for a grant entitled “Myostatin is a mediator and potential target in Lyme disease” to develop a myostatin deficient mouse to be able to identify quantitative trait loci that regulate the severity of murine Lyme disease.
Overview

The UCGD service recharge center helps investigate the genetic basis for human disease by providing whole exome and genome sequence analyses for research and clinical projects. We specialize in variant calling and disease-gene discovery utilizing tools developed by the UCGD research group, including VAAST, pVAAST, PHEVOR, Lumpy, WHAM, IOBIO, RUFUS, and others. Services offered include alignment and variant calling (SNVs, INDELs, and structural variants) for NGS datasets, joint genotyping, disease gene discovery in cohorts and families, and ad hoc research analyses as dictated by the needs of the project. In total, the UCGD has available 2340 CPU cores and 3.25 PB of disc storage, plus access to additional shared resources. Total capacity for variant calling is approximately ~100,000 genomes per year via a combination of in-house and cloud-based processing. The UCGD is able to provide high-bandwidth transfers of data via parallelized transfer methods such as Globus, Aspera, and others.

Services

- Alignment and variant calling for NGS datasets, including whole genome, exome, and panel sequences using a Sentieon (GATK-based) variant calling pipeline
- Structural variant calling, annotation, and prioritization using the Base2 Genomics platform
- Reference-free variant calling and investigation of de novo variants using RUFUS
- Joint genotyping of separate data sets with ancestry-matched controls
- Disease gene discovery in cohorts and families using VAAST, pVAAST, PHEVOR, GEMINI, IOBIO, and other tools as needed

Personnel

Mary Anne Karren, Director
Barry Moore, Project Director
Shawn Rynearson, Software Developer
Carson Holt, Software Developer
Bushra Gorsi, Programmer/Analyst
Steven Boyden, Director of Research and Science
Chris Fahim, Project Lead
Ad hoc analysts from Yandell, Quinlan, and Marth laboratories including:
  - Javier Hernandez, Matt Velinder, Tom Nicholas, Andrew Farrell

2018 Annual Update

Grant Support – UCGD service recharge center provided service quotes and/or letters of support for the following grant submissions in FY18:

- Center for Fertility, Infertility, and Genomics (P50) Rothwell
- Intermountain West Clinical Site for the Undiagnosed Disease Network (U01) Botto
Revenue/Expenses
FY18 Expenses: Total $34,647
FY18 Revenue: Total $149,315
- VP of Health Sciences Support: $ 0
- FY18 revenue generated from services: $149,315

Advisory Board Committee
Mark Yandell, PhD, Professor of Human Genetics
Gabor Marth, DSc, Professor of Human Genetics
Aaron Quinlan, PhD, Associate Professor of Human Genetics

FY18 Scientific Impact
Research Support
Revenue Generated (see charts following):

Revenue by Affiliation

# of grants: 10
# of investigators: 14
### Top Users

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<td>National Kidney Foundation of Utah</td>
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