HEALTH
UNIVERSITY OF UTAH

2017 Annual Report

HSC CORES
UNIVERSITY OF UTAH

HSC Cores Research Facilities

Table of Contents

Annual Report FY17 **Page**

HSC CORES Facilities

Overall Financial Summary

Return to Table of Contents

Revenue & Expenses

- The Core Facilities budget for FY17 was $5.521 million with an expense total of $5.601 million. Approximately $3.4 million in expenses went to salaries and benefits while $2.2 million was spent on equipment and operating supplies.
- In FY17, $4.03 million in services were billed, and collected. A 5% overhead fee of $188,000 was used for administrative support.

Core Research Facilities

Core	FY17 Expenses	Total Revenue	SVPHS	VPR	RIF
Administration	$556,086	$531,138	$343,000		
BIDAC	$111,631	$119,469	$50,000		
Cell Imaging	$362,995	$353,000	$165,000		
DNA Peptide	$424,380	$433,535			
DNA Sequencing	$401,756	$367,665			
Drug Discovery	$196,090	$157,596	$80,000		
Electron Microscopy	$781,774	$763,813	$20,000	$50,000	
Flow Cytometry	$408,915	$454,958			$63,380
Genomics	$181,856	$160,863			
Machine Shop	$216,191	$208,499	$15,000		
Mass Spectrometry & Proteomics	$297,381	$393,416	$262,000		
Metabolic Phenotyping	$157,732	$174,942	$85,000		$19,820
Metabolomics	$448,828	$418,928	$260,000		
Mutation Generation & Detection	$168,688	$143,240	$15,000		
Nuclear Magnetic Resonance	$129,527	$136,544	$100,000		
Small Animal Imaging	$244,183	$296,748	$50,000	$100,000	$38,000
Small Animal Ultrasound	$26,494	$24,550	$10,000		
Zebrafish	$417,021	$418,819	$105,000		

Service Recharge Centers

Service Recharge Center	FY17 Expenses	Total Revenue	SVPHS	VPR	RIF
Genetics Science Learning Center	$504,284	$452,351			
Iron & Hematology	$110	$1,546			
Material Sciences-Engineering	$34,533	$32,983			
Nuclear Engineering	$613	$5,000			
Scalable Analytics & Informatics	$100,992	$89,164			

Cores Administration

Return to Table of Contents

Overview

The Health Sciences Center (HSC) Core Facilities operate under central administration headed by Dr. John Phillips, who reports to Dr. Monica Vetter. The administrative office is managed by Ms. Brenda Smith, with assistance from Ms. Audrey Grisham, Ms. Terra Curley, and Mr. Jonathan Conger. The Cores Administration office is responsible for the personnel management, budget preparation, financial affairs, ordering of supplies, and tracking expenses for all 24 Core Facilities and Service Recharge Centers. In addition, the administrative office 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 operate on a charge-back basis, with the Administration Core charging 5% of collected revenue for these 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
- Terra Curley, Accountant
- Audrey Grisham, Administrative Officer
- Jonathan Conger, Administrative Assistant

2017 Annual Update

- The administrative team continues to refine the electronic scheduling and billing services to make as user friendly as possible. In 2017, improvements were made to the system to improve performance and security.
- The Genomix LIMS system for the DNA Sequencing Core was managed by HCI. This has now been incorporated into our billing/scheduling system which resulted in a $30,000 savings per year.
- In FY17, the Cores Administration office was successfully able to process billing in 1 business day even though the amount of billed revenue has increased to 23 labs. The new HSC scheduling/billing system validates chartfields with the University's CIS system which has eliminated the majority of billing errors.
- In FY17 the core billed 4.03 million; however, what is most impressive of this past year was the collection rate for billed services was 100%. The internal tracking system that was created lists each account balance in real time. Each director can access the system by logging in and reviewing their reports. The tracking system currently stores fiscal data that can be accessed to perform historical comparisons, expense validation, and operation analysis.
- A new website was created for the HSC Cores: www.cores.utah.edu.
- The two new Service/Recharge Centers (Genetics Science Learning Center and Transgenic Mouse) are managed through the administrative office to increase accountability and reduce expenses.
- The fourth annual retreat was held on September 25th. 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, Genetic Science Learning Center, Materials Characterization all made presentations showing their services.

- The electronic inventory system has added additional user group. As of October 2017 there are 52 Organizations, 43 Departments, and 1,811 items entered into the system. These items are located in 43 buildings and 391 rooms across campus. The total asset value of these items is $42.7 million. This system continues to expand and is free to use by any group on campus.

FY2018 Goals

- Upgrade the electronic inventory system
- Develop new purchasing ordering system

Cores Administration Revenue & Expenses

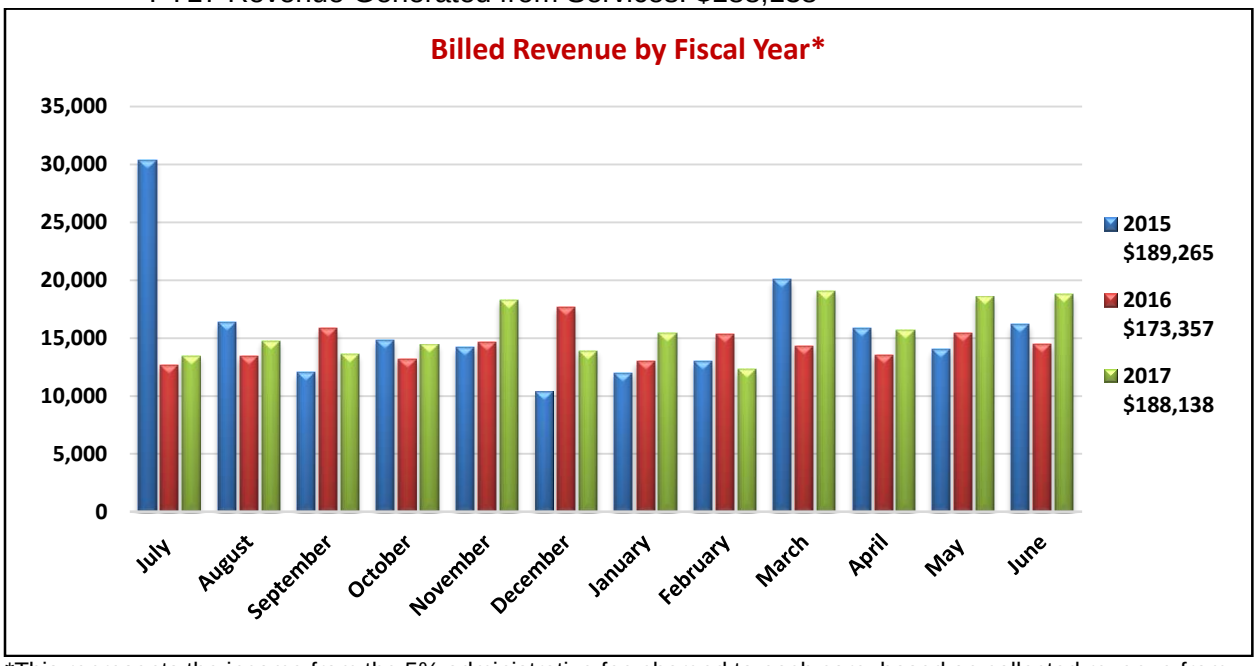
FY17 Expenses: Total $556,086

The Cores Administration Budget covers the following expenses:

- Salaries/Benefits: $352,796
- Fixed Expenses (IT Support for 76 staff, x-ray developer, software): $124,000
- Unanticipated equipment repairs and replacement: $79,290

FY17 Revenues: Total $531,138

- VP of Health Sciences Support: $343,000
- FY17 Revenue Generated from Services: $188,138



*This represents the income from the 5% administrative fee charged to each core, based on collected revenue from billed services; legend displays 5% of annual revenue collected for each fiscal year.

Advisory Board Committee

Last meeting date: January 18th, 2017

- Andy Weyrich[1], Associate Dean for Basic and Translational Sciences
- Joseph Yost[1], Professor, Neurobiology and Anatomy
- Mark Yandell, Professor, Human Genetics
- John Phillips[1], Director, Core Facilities
- Dennis Winge, Professor, Hematology
- David Stillman[1], Professor, Pathology
- Wes Sundquist, Professor, Biochemistry
- Brad Cairns[1], 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 guidelines that can be found here.

Biomedical Image & Data Analysis Core

Return to Table of Contents

Overview

The mission of the Biomedical Image and Data Analysis Core (BIDAC) facility is to provide advanced image analysis and visualization services to research laboratories at the University of Utah. We offer services and consulting that range from basic image processing (denoising, image reconstruction, image registration) to more advanced image segmentation and morphometric analysis. BIDAC leverages the computational resources and software development infrastructure of the Scientific Computing and Imaging (SCI) Institute. In partnership with the HSC Core imaging facilities (Cell, Small Animal, EM) we are actively developing new services that are based on the needs of HSC researchers and Core users. As a resource for advanced image and data analysis, 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 used during FY2017 include:

- **Statistical shape modeling (SSM).** SSM is a computational branch of morphometrics that is rapidly becoming a standard tool for modern clinical research and medical device engineering. SSM is also now commonly used in many areas of basic biological research, including genetic phenotyping and neurobiology. BIDAC has significant expertise in SSM and uses custom software for group-wise analysis of both 2D and 3D anatomical shapes.
- **Image archiving and automated image processing via the XNAT open-source imaging and informatics software platform** (www.xnat.org). In partnership with clinical researchers and the Center for High Performance Computing (CHPC), we have developed infrastructure to support local and distributed health sciences research projects that involve image acquisition, collection, and analysis (for example, clinical trials and registries). An XNAT server is hosted in a protected environment at CHPC to store PHI data. Our services include custom automated image processing workflows, such as image de-identification, quality control, inter-modality registration, FreeSurfer processing and Diffusion Tensor Imaging analysis.

Personnel

- Clement Vachet, Director

2017 Annual Update

Grant Support - BIDAC performed preliminary work and/or provided letters of support for the following grant submissions:

- NIH R24 - Chris Butson, PhD, SCI Institute and Dept. Neurology
- DOD - Extramural Medical Research – Giavonni Lewis, MD, Dept. Surgery
- NIH R21 - Josh Bonkowsky, PhD, Dept. of Pediatrics

Inter-Disciplinary Collaborations

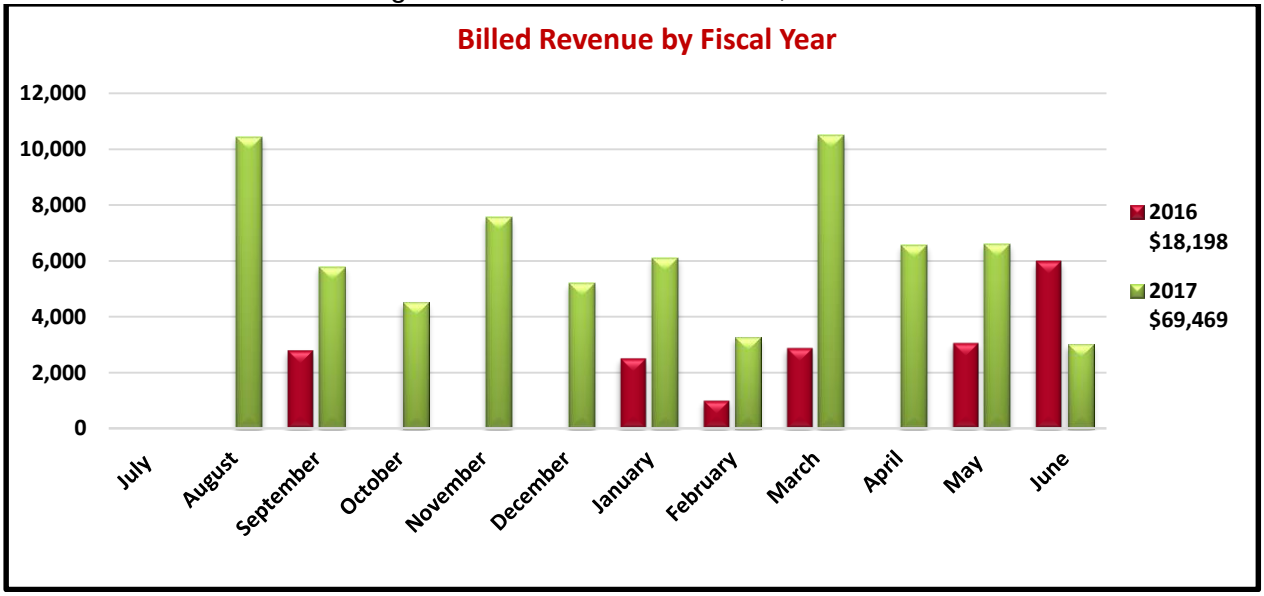
Projects to enhance imaging capabilities have been performed with the Center for High Performance Computing (CHPC) and with several Health Sciences Cores (directly or involving end-users), including Small Animal Imaging Facility, Cell Imaging Facility and Electron Microscopy Facility.

Revenue/Expenses

FY17 Expenses: **Total $111,631**

FY17 Revenue: **Total $119,469**

- VP of Health Sciences Support: $ 50,000
- FY17 revenue generated from services: $69,469



* Legend displays total annual revenue by year earned.

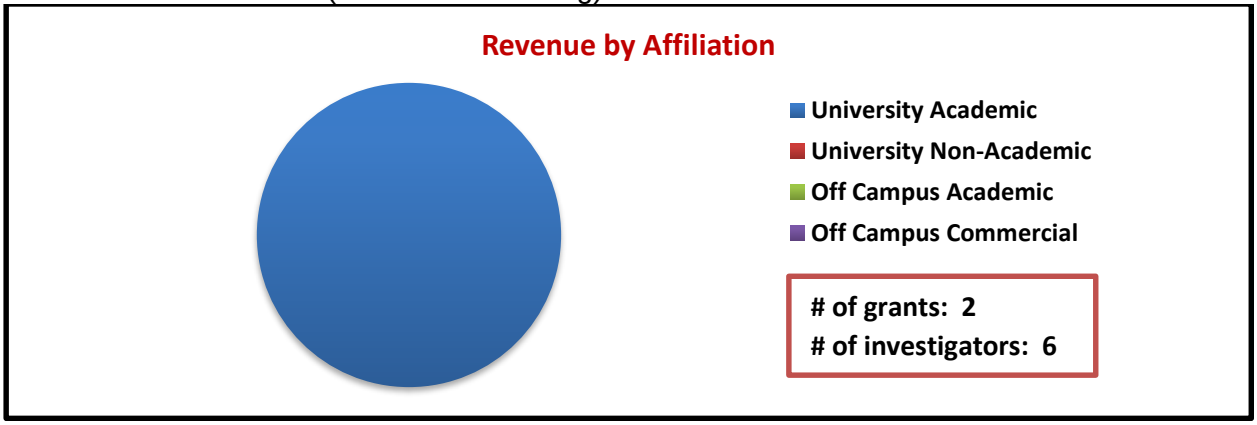
Advisory Board Committee

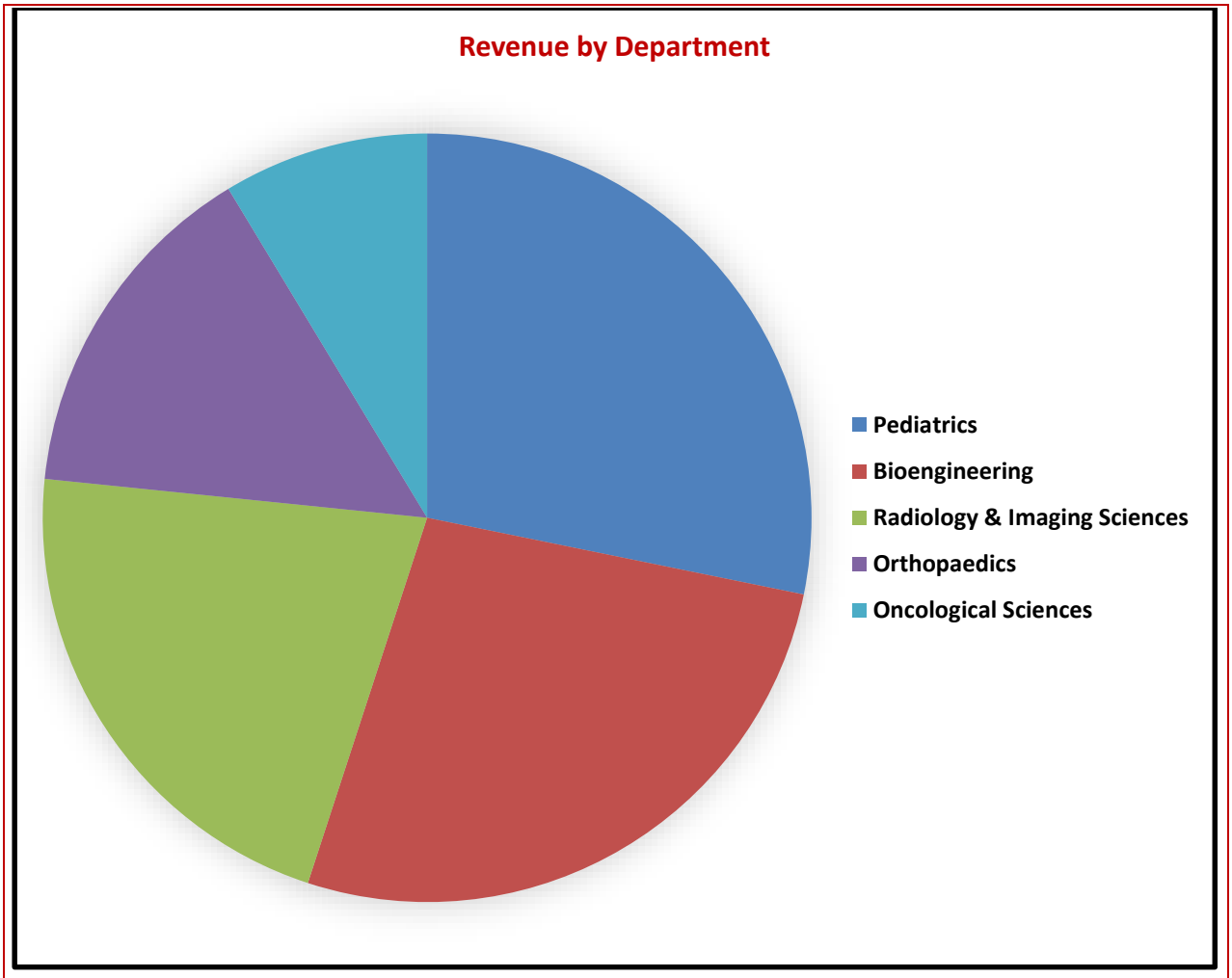
- Edward DiBella, PhD, Prof. Radiology and Imaging Sciences, Director UCAIR
- Florian Solzbacher, PhD, Professor Electrical & Computer Engineering, Director CEI
- Tolga Tasdizen, PhD, Associate Professor Electrical & Computer Engineering

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Butson, Christopher	Department
2	Jones, Gregory	Department
3	Casper, Theron	Department
4	Henninger, Heath	Department
5	Mendoza, Michelle	NIH
6	Bonkowsky, Josh	NIH

Cell Imaging Facility

Return to Table of Contents

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, Three Olympus FV1000 Spectral confocals, two Nikon A1 confocals, and a Multi-photon confocal from Prairie. In addition, two Nikon Ti automated microscope and a spinning disk confocal 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. A custom SPIM station is available for light sheet imaging of zebrafish and other live samples. 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.

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
- SPIM light sheet microscope

HCI Location

- Leica SP8 confocal with white light laser
- Nikon Ti Automated Microscope
- Nikon Ti Automated Microscope with Spinning disk confocal
- Ibidi stage incubator with C02, temperature and hypoxia control

SMBB Location

- Olympus FV1000 Confocal Microscope

Biology ASB Location

- Olympus IX81 Automated Microscope
- Olympus FV1000 Confocal 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
- Michael Redd, Ph.D., Research Associate

2017 Annual Update

New Services

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

New Equipment

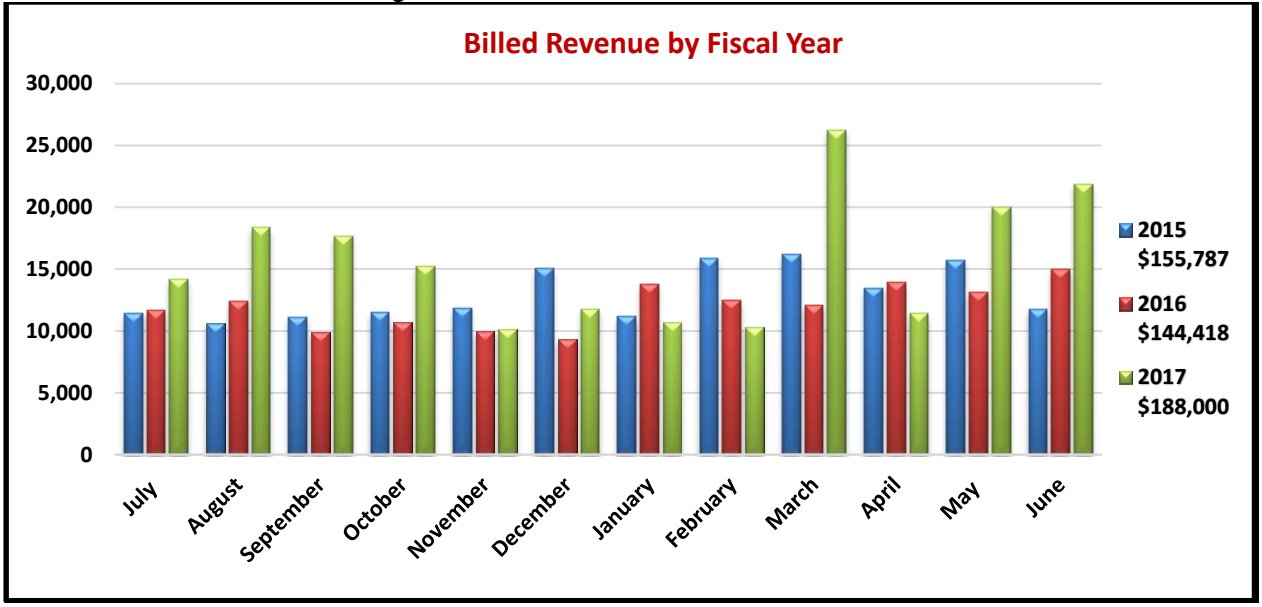
- Zeiss 880 Airyscan confocal at 230ASB Biology Dept.
- Leica SP8 White light laser confocal at HCI
- Huntsman Cancer Center Location now has a Spinning Disk Confocal with a Stage incubator with controls for C02, and temperature.
- Ibidi Hypoxia controller and stage incubator: labtek, Ibidi and well plate adaptors allow incubation with hypoxia shift, C02, temperature and humidity

Revenue/Expenses

FY17 Expenses: **Total $362,995**

FY17 Revenue: **Total $353,000**

- VP of Health Sciences Support for normal operating expenses: $165,000
- FY17 revenue generated from services: $188,000



* Legend displays total annual revenue by year earned.

Advisory Board Committee

Last meeting date: June 16th, 2015.

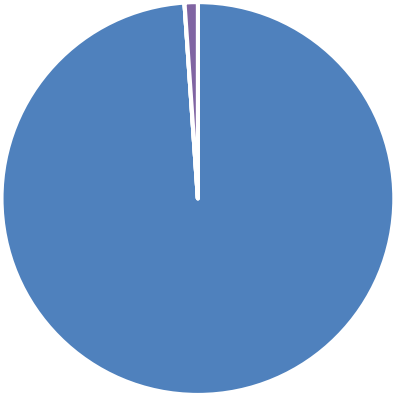
- Kristen Kwan, Assistant Professor, Human Genetics
- Gabrielle Kardon, Associate Professor, Human Genetics
- Jody Rosenblatt, Assistant Professor, Oncological Sciences
- Josh Bonkowsky, Associate Professor, Neurobiology and Anatomy
- Adam Douglass, Assistant Professor, Neurobiology and Anatomy
- Jason Shepherd, Assistant Professor, Neurobiology and Anatomy
- Matt Wachowiak, Associate Professor, Neurobiology and Anatomy

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):

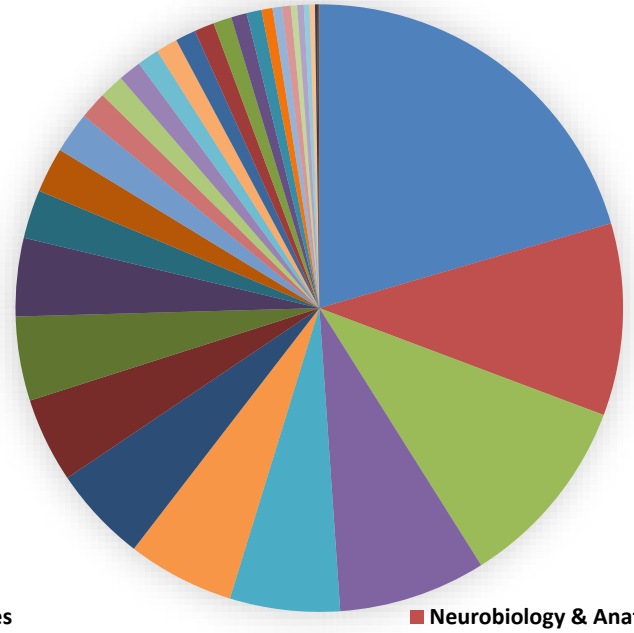
Revenue by Affiliation



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

# of grants: 111
# of investigators: 140

Revenue by Department



- Oncological Sciences
- Human Genetics
- Pathology
- Biology
- Biochemistry
- Bioengineering
- Pharmaceutics & Pharmaceutical Chemistry
- Radiation Oncology
- Pharmacology & Toxicology
- SOM
- Neurosurgery
- Huntsman Cancer Institute
- Chemistry
- College of Engineering
- Nutrition & Integrative Physiology
- Pharmacy
- Chemical Engineering
- Neurobiology & Anatomy
- Internal Medicine
- Pediatrics
- Orthopaedics
- Surgery
- Mechanical Engineering
- Neurology
- Radiology
- Medicinal Chemistry
- Dentistry
- Physical Therapy
- Exercise & Sport Science
- College of Pharmacy
- Dermatology
- Anesthesiology
- Core Research Facilities

Top Users

1	Rosenblatt, Jody	NIH, American Asthma Foundation
2	Yost, H Joseph	NIH
3	Mendoza, Michelle	NIH
4	Odelberg, Shannon	NIH
5	Bonkowsky, Josh	NIH
6	Weiss, Jeffrey	NIH, Georgia Tech University
7	Lane, Thomas	NIH
8	Shaw, Janet	HHMI, Department
9	Thummel, Carl	NIH
10	Kardon, Gabrielle	NIH

Publications

1. Duncan, R. N., et al. (2016). "Hypothalamic radial glia function as self-renewing neural progenitors in the absence of Wnt/β-catenin signaling." Development 143(1): 45-53.
2. Gudipaty, S. A., et al. (2017). "Mechanical stretch triggers rapid epithelial cell division through Piezo1." Nature 543(7643): 118-121.
3. Keefe, M. D. and J. L. Bonkowsky (2017). "Transvection Arising from Transgene Interactions in Zebrafish." Zebrafish 14(1): 8-9.
4. Schell, J. C., et al. (2017). "Control of intestinal stem cell function and proliferation by mitochondrial pyruvate metabolism." Nat Cell Biol 19(9): 1027-1036.
5. Schuler, M. H., et al. (2017). "Miro1-mediated mitochondrial positioning shapes intracellular energy gradients required for cell migration." Mol Biol Cell 28(16): 2159-2169.
6. Son, J.-H., et al. (2016). "Transgenic FingRs for Live Mapping of Synaptic Dynamics in Genetically-Defined Neurons." 6: 18734.
7. Strachan, L. R., et al. (2017). "A zebrafish model of X-linked adrenoleukodystrophy recapitulates key disease features and demonstrates a developmental requirement for abcd1 in oligodendrocyte patterning and myelination." Hum Mol Genet 26(18): 3600-3614.
8. Tharkar-Promod, S., et al. (2017). "HDAC1,2 inhibition and doxorubicin impair Mre11-dependent DNA repair and DISC to override BCR-ABL1-driven DSB repair in Philadelphia chromosome-positive B-cell precursor acute lymphoblastic leukemia." Leukemia.

Centralized Zebrafish Animal Resource Facility

Return to Table of Contents

Overview

The CZAR Core Facility provides state-of-the-art systems for housing, breeding, and doing experiments with zebrafish, an emerging vertebrate model system. The CZAR underwent a major renovation/expansion in FY2016, increasing its capacity from 5000 to 8000 fish 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. Currently it is used by 10 laboratories that have large-scale commitments to zebrafish research and ten additional small-scale user groups.

The expanded facility houses approximately 135,000-170,000 fish, including a large number of wildtype 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 wildtype 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 on an individual basis
- 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.
- Monitoring husbandry success through mating success data and nursery survival rates.
- Propagating individual lab WT or transgenic lines for a nominal fee. This service can now 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 - Dedicated Nursery Manager

2017 Annual Update

New Equipment

- October 2016, the CZAR opened the newly expanded facility to users. The renovation/expansion increased its capacity from 5000 to 8000 fish 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.

New Services

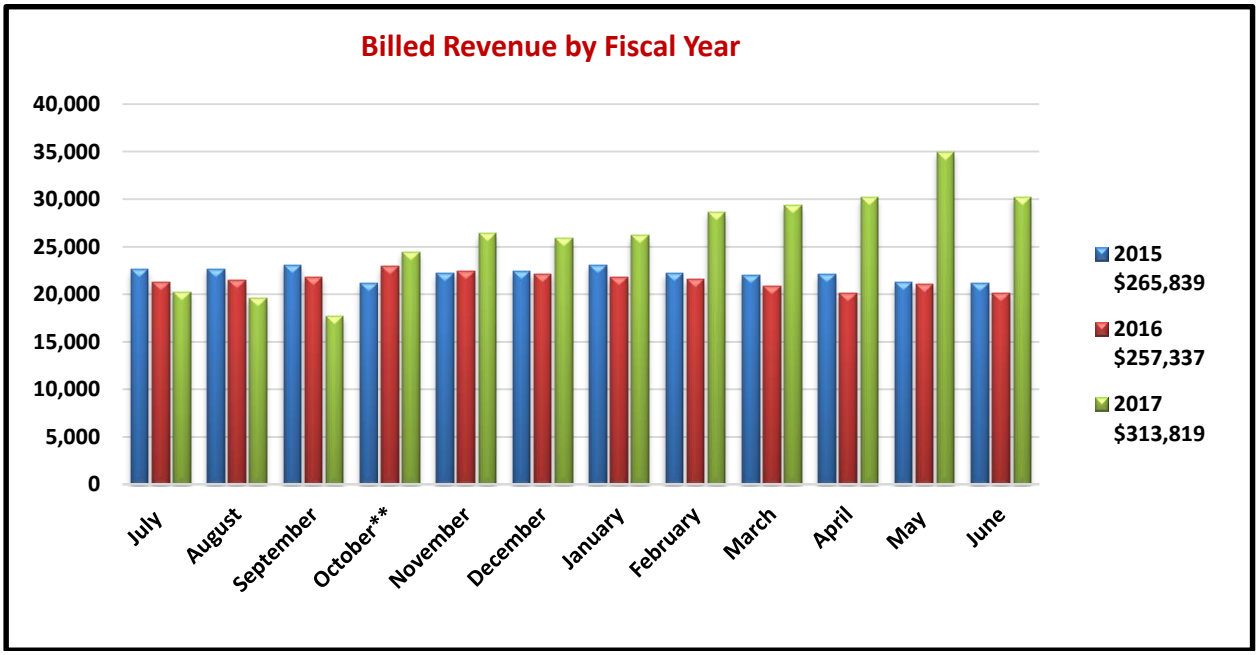
No new services for FY17.

Revenue/Expenses

FY17 Expenses: **Total $417,021**

FY17 Revenue: Total $418,819

- VP of Health Sciences Support: $105,000
- Total FY17 Revenue Generated from Services: $313,819



* 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

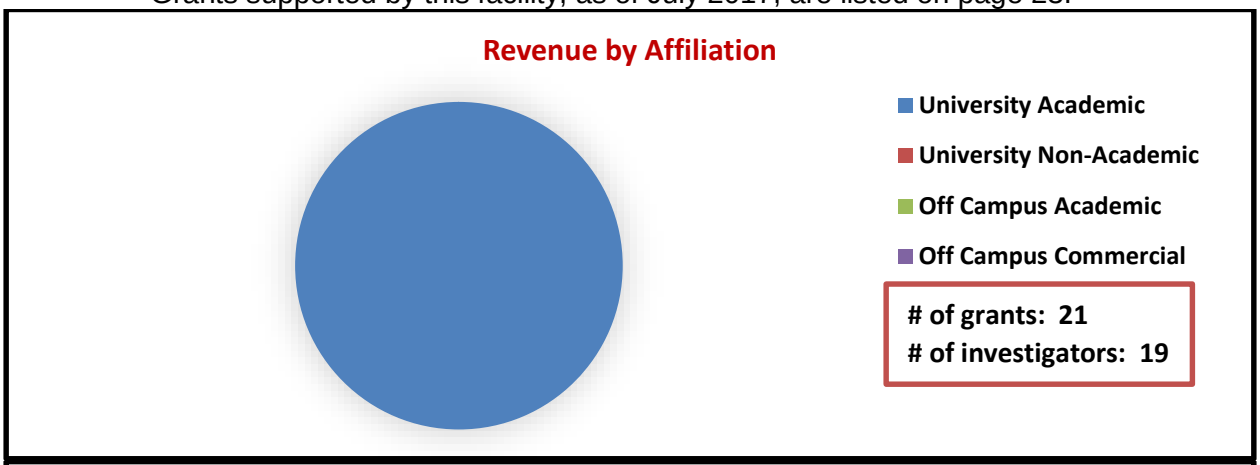
Advisory Board Committee
Last meeting date: 02/13/2017

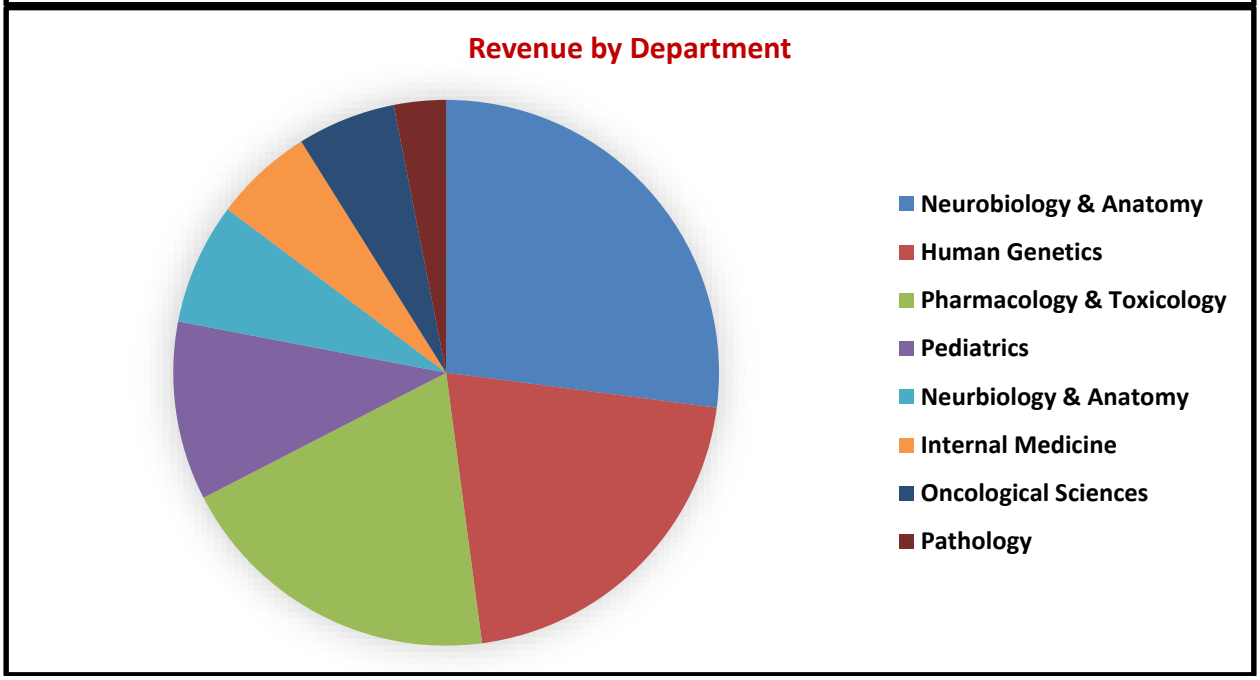
- Richard Dorsky, Associate Professor, Neurobiology and Anatomy- Chair
- David Jonah Grunwald, Professor, Human Genetics
- Joshua Bonkowsky, Associate Professor, Neurobiology and Anatomy and Pediatrics
- Kristen Kwan, Assistant Professor, Human Genetics
- Amnon Schlegel, Assistant Professor, Internal 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

FY17 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 facility, as of July 2017, are listed on page 23.





Top Users

1	Keefe, Kristen	Department
2	Yost, H Joseph	NIH
3	Grunwald, David	NIH
4	Bonkowsky, Josh	NIH
5	Kwan, Kristen	NIH, NEH
6	Dorsky, Richard	NIH, Craig H Neilsen Foundation
7	Schlegel, Amnon	Department
8	Douglass, Adam	Department
9	Rosenblatt, Jody	NIH, American Asthma Foundation
10	Tavtigian, Sean	Department

Publications

1. Barber, A. E., et al. (2016). "Similarly Lethal Strains of Extraintestinal Pathogenic Escherichia coli Trigger Markedly Diverse Host Responses in a Zebrafish Model of Sepsis." mSphere 1(2).
2. Benitez-Santana, T., et al. (2017). "Role of Intestinal LXRalpha in Regulating Post-prandial Lipid Excursion and Diet-Induced Hypercholesterolemia and Hepatic Lipid Accumulation." Front Physiol 8: 280.
3. Bryan, C. D., et al. (2016). "Loss of laminin alpha 1 results in multiple structural defects and divergent effects on adhesion during vertebrate optic cup morphogenesis." Developmental Biology 416(2): 324-337.
4. Dukes, A. A., et al. (2016). "Live imaging of mitochondrial dynamics in CNS dopaminergic neurons in vivo demonstrates early reversal of mitochondrial transport following MPP(+) exposure." Neurobiol Dis 95: 238-249.
5. Eisenhoffer, G. T., et al. (2016). "A toolbox to study epidermal cell types in zebrafish." Journal of Cell Science.
6. Gudipaty, S. A., et al. (2017). "Mechanical stretch triggers rapid epithelial cell division through Piezo1." Nature 543(7643): 118-121.
7. Hugo, S. E. and A. Schlegel (2017). "A Genetic Model to Study Increased Hexosamine Biosynthetic Flux." Endocrinology 158(8): 2420-2426.
8. Hugo, S. E. and A. Schlegel (2017). "A genetic screen for zebrafish mutants with hepatic steatosis identifies a locus required for larval growth." Journal of Anatomy 230(3): 407-413.
9. Keefe, M. D. and J. L. Bonkowsky (2017). "Transvection Arising from Transgene Interactions in Zebrafish." Zebrafish 14(1): 8-9.
10. Kjelstrup, C. K., et al. (2017). "Escherichia coli O78 isolated from septicemic lambs shows high pathogenicity in a zebrafish model." Veterinary Research 48(1): 3.
11. May, M., et al. (2015). "ZC4H2, an XLID gene, is required for the generation of a specific subset of CNS interneurons." Hum Mol Genet 24(17): 4848-4861.
12. Milash, B., et al. (2016). "Temporal Dysynchrony in brain connectivity gene expression following hypoxia." BMC Genomics 17(1): 334.
13. Morrow, Z. T., et al. (2017). "tbx6l and tbx16 are redundantly required for posterior paraxial mesoderm formation during zebrafish embryogenesis." Dev Dyn 246(10): 759-769.
14. Shankaran, S. S., et al. (2017). CRISPR/Cas9-Directed Gene Editing for the Generation of Loss-of-Function Mutants in High-Throughput Zebrafish F0 Screens. Current Protocols in Molecular Biology, John Wiley & Sons, Inc.
15. Xie, Y. and R. I. Dorsky (2017). "Development of the hypothalamus: conservation, modification and innovation." Development 144(9): 1588-1599.
16. Yabe, T., et al. (2016). "Quadruple zebrafish mutant reveals different roles of Mesp genes in somite segmentation between mouse and zebrafish." Development 143(15): 2842-2852.

Active Grant Support of Zebrafish Research
Associated with the UofU CZAR Core Facility 2017

Zebrafish Investigator	Grant Title	Funding Source	Annual Amount of Direct Cost Funding
Bonkowsky	Trans-Cellular Activation Of Transcription To Analyze Dopaminergic Axon Reorganization	NIH/NIMH	$300,000
Bonkowsky	Characterization Of Genetic Pathways Regulating Connectivity Disruption In Hypoxic Injury	March Of Dimes	$88,000
Cairns	Howard Hughes Medical Institute	HHMI	$619,981
Dorsky	Regulation Of Hypothalamic Radial Glia By Wnt Signaling	NIH/NINKS	$250,000
Grunwald	Expansion of a Zebrafish Research Core Facility	NIH Office of the Director	$500,000
Grunwald	Gene targeting in zebrafish: building models to assay disease genes	NIH NTNL INST CHILD	$182,525
Grunwald	A toolkit for gene-targeting in zebrafish	NIH NTNL INST CHILD	$383,170
Kwan	Hedgehog Signaling and Cilia in Choroid Fissure Morphogenesis and Coloboma	NIH NTNL EYE INSTITUTE	$335,250
Li	Endothelial Toll-Like Receptor Signaling and Inflammation		$366,912
Mulvey	Bacterial Invasion And Trafficking Within The Bladder	NIH/NIAIDIA BETE	$250,000
Rosenblatt	The Role Of Extrusion In Controlling Epithelial Homeostasis	NIH/NIGMED	$207,475
Rosenblatt	The Role Of Extrusion In Controlling Epithelial Homeostasis	NIH/NIGMED	$75,000
Schlegel	Molecular Genetics Of Lipid Metabolism	NIH/NIDDIABETE	$209,888
Stewart	Foxd3-Dependent Pathways In Neural Crest Migration And Metastasis	American Cancer Society	$150,000
Tavtigian	Classifying DNA Mismatch Repair Gene Variants of Unknown Significance	NCI	$520,565
Tristani-Firouzi	“Zebrafish Model Organism Core For The Cardiovascular	NIH	$164,000
Yost	Genome-Wide Analysis Of Cardiac Development In Zebrafish	NIH/NHLBI	$1,570,415
Yost	Developmental Biology Training Grant	NIH/NICHD	$253,526
		Total Current Grants, Annual Direct Costs:	**$7,130,167**

DNA Peptide Facility

Return to Table of Contents

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
- Sara Munzert, Lab Aide
- Meredith Ford, Lab Technician
- Christine McGarry, Lab Technician

2017 Annual Update

New Equipment

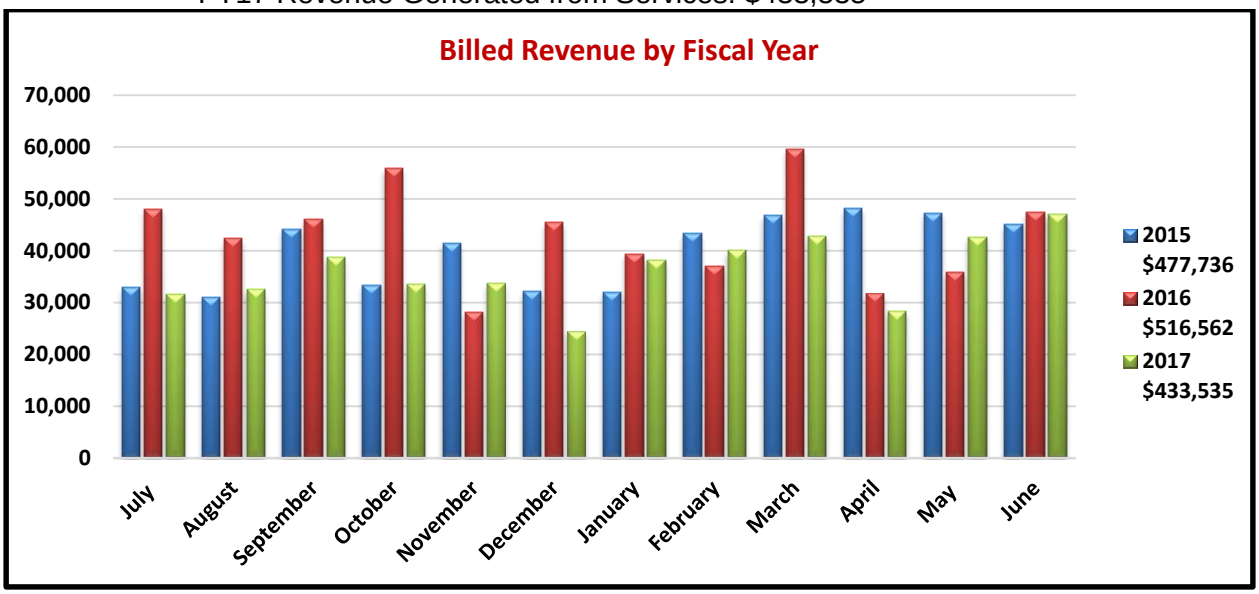
- The DNA Peptide Facility now offers a 25 nmole DNA Synthesis service. These prices make the facility much more competitive with commercial vendors.

Revenue/Expenses

FY17 Expenses: **Total $424,380**

FY17 Revenue: **Total $433,535**

- VP of Health Sciences Support: $0
- FY17 Revenue Generated from Services: $433,535



* Total billed annual revenue displayed in legend.

Advisory Board Committee

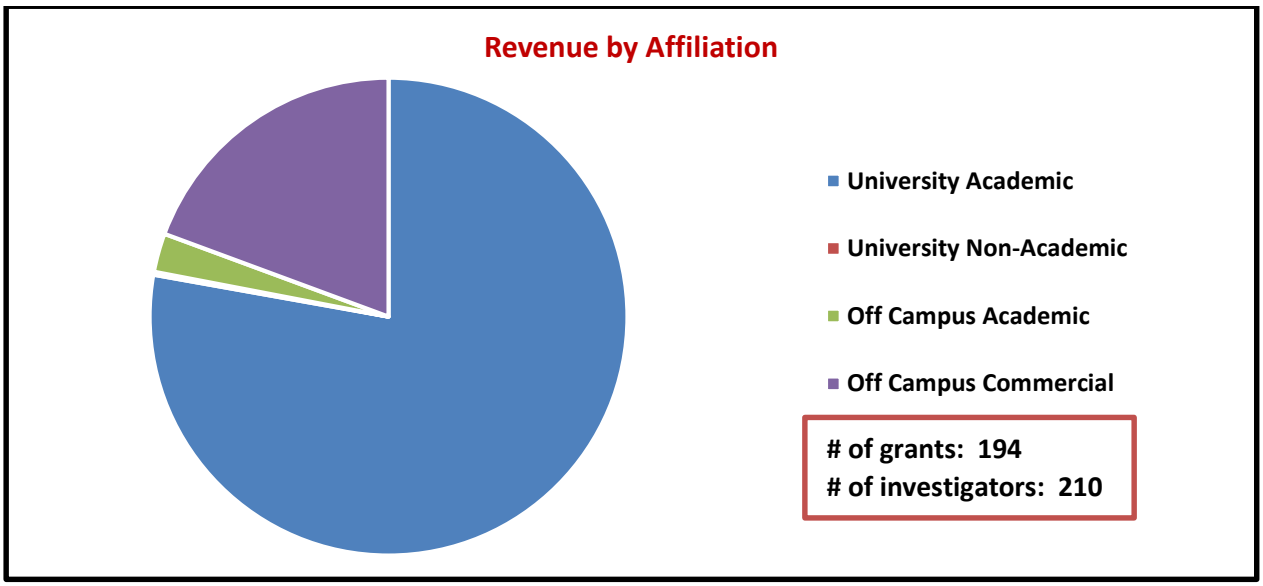
Last meeting date: August 2014.

- Eric Schmidt, Professor, College of Pharmacy
- Jen Heemstra, Assistant Professor, Chemistry
- John Weis, Professor, Pathology

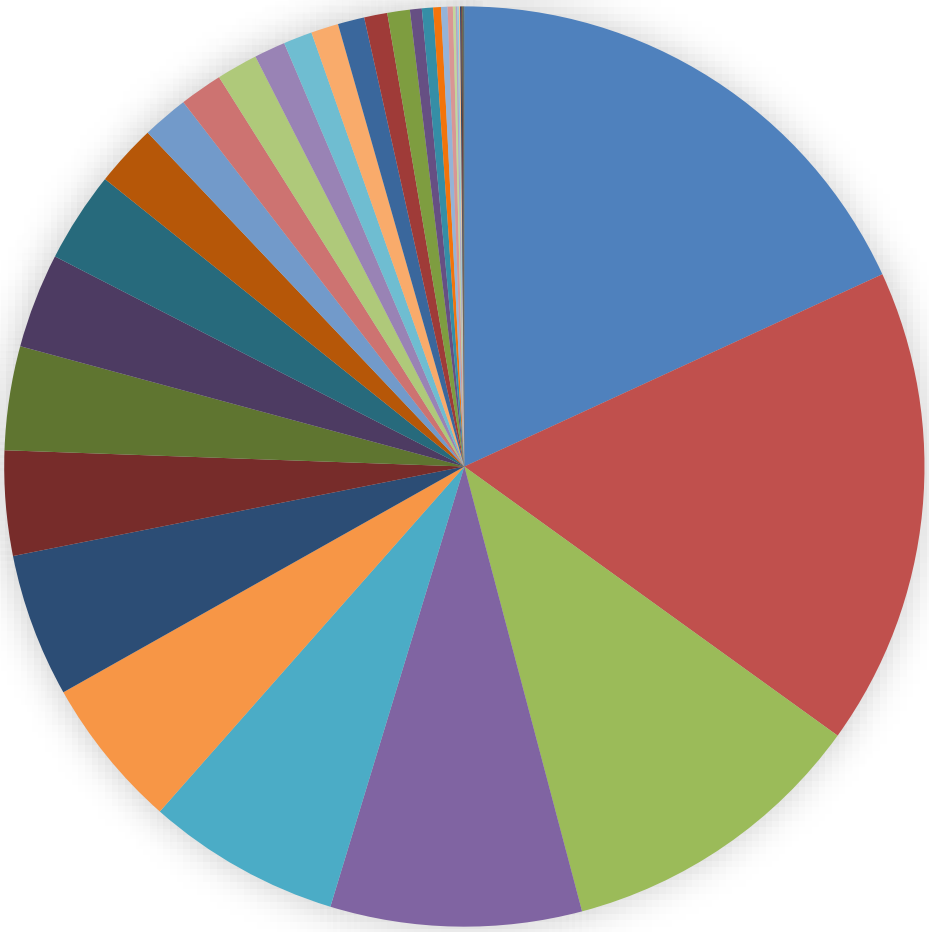
FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):



Revenue by Department



- Chemistry
- Biochemistry
- Pathology
- Internal Medicine
- Oncological Sciences
- Human Genetics
- Biology
- Bioengineering
- Medicinal Chemistry
- Pediatrics
- Core Research Facilities
- Neurobiology & Anatomy
- Neurology
- Molecular Medicine
- Ophthalmology & Visual Sciences
- Surgery
- Pharmaceutics & Pharmaceutical Chemistry
- Orthopaedics
- College of Pharmacy
- Exercise & Sport Science
- Huntsman Cancer Institute
- Civil & Environmental Engineering
- Psychiatry
- Pharmacology & Toxicology
- Radiation Oncology
- Cardiology
- Dermatology
- Pulmonary
- Nutrition & Integrative Physiology
- Obstetrics & Gynecology
- Dentistry
- Radiology
- Anesthesiology
- Family & Preventative Medicine
- Neurosurgery

Top Users

1	Burrows, Cynthia	NIH
2	BioFire Diagnostics	Off Campus
3	Heemstra, Jennifer	Department, NIH, DHHS
4	Bass, Brenda	NIH
5	Sundquist, Wesley I	NIH, DHHS
6	Wittwer, Carl	Department
7	Deans, Tara	NSF, Office of Naval Research
8	Rutter, Jared	HHMI
9	Dahlem, Timothy	HSC Cores
10	Hill, Christopher	Department, NIH

Publications

1. Stability of Oligonucleotide-Small Molecule Conjugates to DNA-Deprotection Conditions Yuen LH, Franzini RM.; Bioconjug Chem. 2017 Apr 19;28(4):1076-1083
2. Reversible Oligonucleotide Chain Blocking Enables Bead Capture and Amplification of T-Cell Receptor α and β Chain mRNAs. Hanson WM, Chen Z, Jackson LK, Attaf M, Sewell AK, Heemstra JM, Phillips JD. J Am Chem Soc. 2016 Sep 7;138(35):11073-6
3. Application of Thiol–yne/Thiol–ene Reactions for Peptide and Protein Macrocyclizations Y. Wang, B. J. Bruno, S. Cornillie, J. M. Nogieira, D. Chen, T. E. Cheatham, C. S. Lim, D. H.-C. Chou, *Chem. Eur. J.* 2017, *23*, 7087
4. Gene-based Therapy in a Mouse Model of Blue Cone Monochromacy. Zhang Y, Deng W-T, Du W, Zhu P,Li J, Su Jn, Xu F, Sun J, Gerstner CD, Baehr W, Boye SL, Zhao C,Hauswirth WW, Pang J 2017 Sci. Reports, in press.
5. Binary function of ARL3-GTP revealed by gene knockouts. Hanke-Gogokhia C, Frederick JM, Zhang H, Baehr W 2017 *Adv Exp Med Biol,* in press.
6. Ciliopathy-associated IQCB1/NPHP5 protein is required for mouse photoreceptor outer segment formation. Ronquillo CC, Hanke-Gogokhia C, Revelo MP, Frederick JM, Jiang L, Baehr W. FASEB J. 2016 Oct;30(10):3400-3412.
7. Small GTPases Rab8a and Rab11a Are Dispensable for Rhodopsin Transport in Mouse Photoreceptors. Ying G, Gerstner CD, Frederick JM, Boye SL, Hauswirth WW, Baehr W. PLoS One. 2016 Aug 16;11(8):e0161236.
8. Sequencing DNA for the Oxidatively Modified Base 8-Oxo-7,8-Dihydroguanine. Fleming AM, Ding Y, Burrows CJ. Methods Enzymol. 2017; 591:187-210
9. 4n-1 Is a "Sweet Spot" in DNA i-Motif Folding of 2'-Deoxycytidine Homopolymers. Fleming AM, Ding Y, Rogers RA, Zhu J, Zhu J, Burton AD, Carlisle CB, Burrows CJ. J Am Chem Soc. 2017 Apr 5;139(13):4682-4689
10. Interrogation of Base Pairing of the Spiroiminodihydantoin Diastereomers Using the α-Hemolysin Latch. Zeng T, Fleming AM, Ding Y, White HS, Burrows CJ. Biochemistry. 2017 Mar 21;56(11):1596-1603
11. Oxidative DNA damage is epigenetic by regulating gene transcription via base excision repair. Fleming AM, Ding Y, Burrows CJ. Proc Natl Acad Sci U S A. 2017 Mar 7;114(10):2604-2609
12. Zika Virus Genomic RNA Possesses Conserved G-Quadruplexes Characteristic of the Flaviviridae Family. Fleming AM, Ding Y, Alenko A, Burrows CJ. ACS Infect Dis. 2016 Oct 14;2(10):674-681

DNA Sequencing Facility

Return to Table of Contents

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 also 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

Robotics

- Biomek FX with Span-8 and 96 head

Other Services

- Lab consumables for sample submission
- Life Technologies freezer program

Equipment

Sequencers

- Ion Torrent PGM
- Ion Torrent Proton
- Qiagen Q24 Pyrosequencer
- Applied Biosystems 3730xl

Liquid Handlers

- 2 Biomek FX programmable liquid sample dispensers

Personnel

- Derek Warner, Director
- Michael Powers, Senior Laboratory Specialist
- Jinlan Wang, Lab Specialist

2017 Annual Update

New Equipment

No new instrumentation this year.

New Services

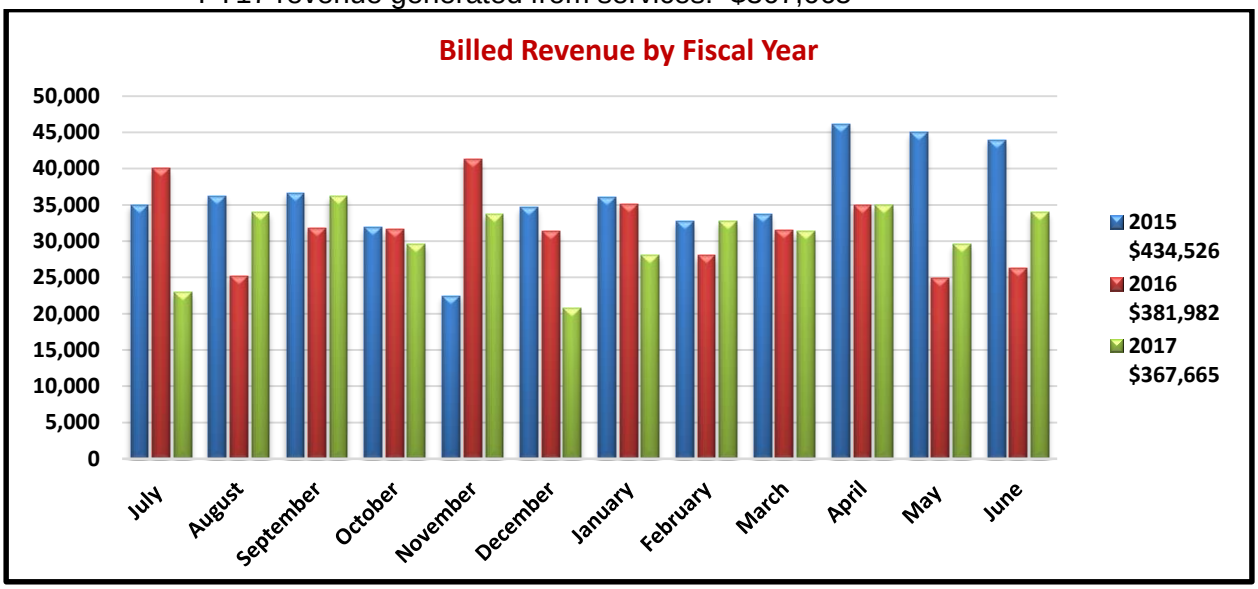
We added Cell Line Authentication this year in response to the NIH requirement to test cell lines before, during, and after research with them as well as many journals' requirements to do the same.

Revenue/Expenses

FY17 Expenses: **Total $401,756**

FY17 Revenue: **Total $367,665**

- VP of Health Sciences Support: $0
- FY17 revenue generated from services: $367,665



* Total annual revenue displayed in legend

Advisory Board Committee

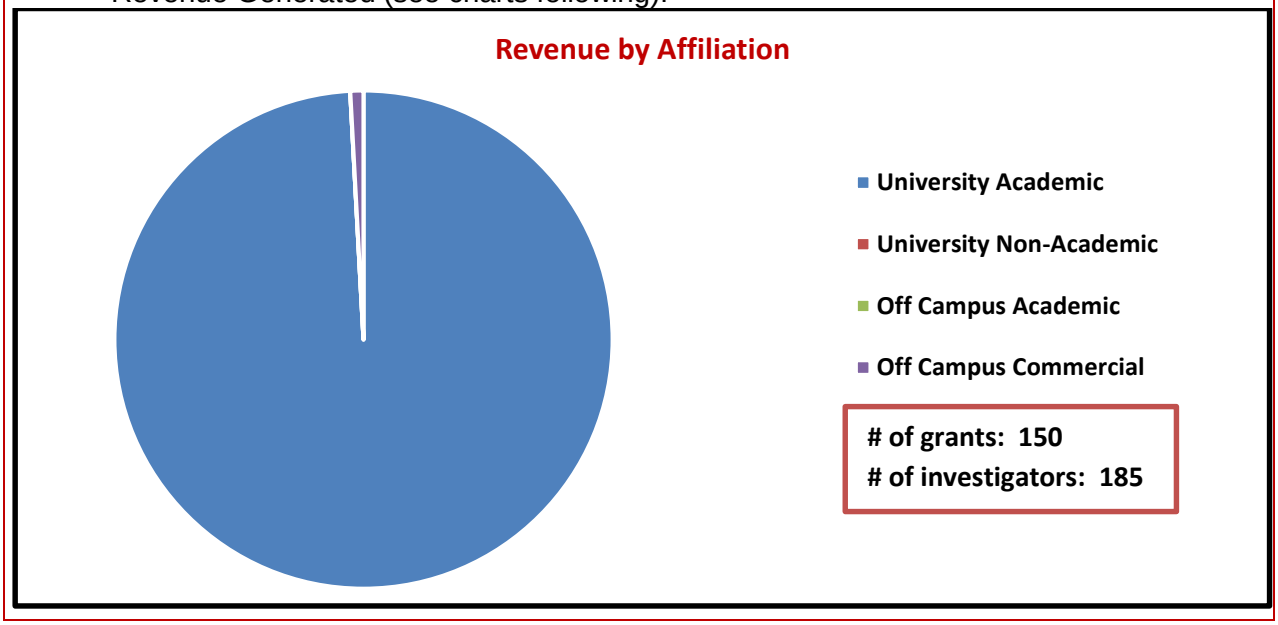
Last meeting date: July 20, 2015

- Monica Vetter, Professor, Neurobiology & Anatomy
- Colin Dale, Associate Professor, Biology
- Robert Weiss, Professor, Human Genetics

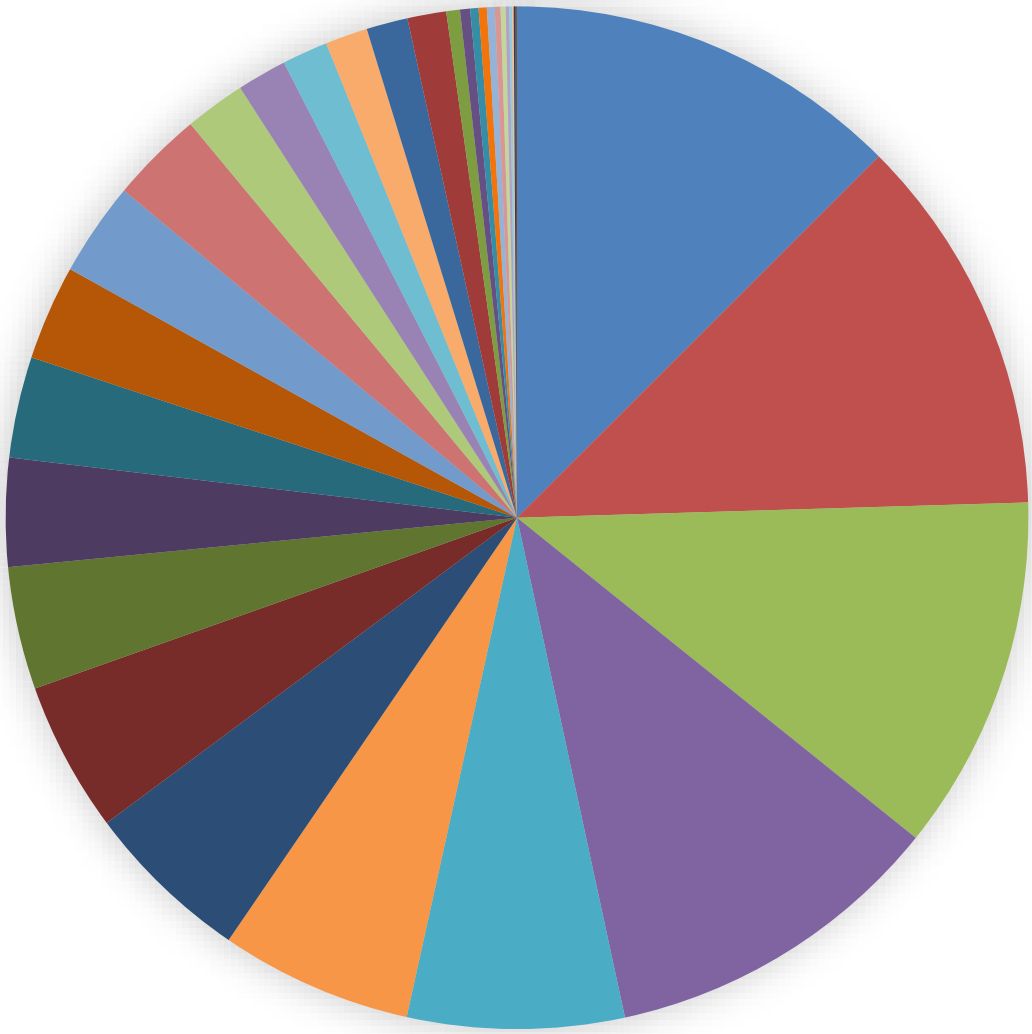
FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):



Revenue by Department



- Biochemistry
- Biology
- Pediatrics
- Pathology
- Neurobiology & Anatomy
- Oncological Sciences
- Surgery
- Physical Therapy & Athletic Training
- Bioengineering
- HSC Cores
- Neurosurgery
- Infectious Disease
- Obstetrics/Gynecology
- Anthropology
- Physics & Astronomy
- Otolaryngology
- Dentistry
- Internal Medicine
- Human Genetics
- Ophthalmology/Visual Sciences
- Chemistry
- Psychiatry
- Neurology
- HCI
- Medicinal Chemistry
- Pharmacology & Toxicology
- Dermatology
- College Of Health
- Nephrology
- Civil & Environmental Engineering
- Family & Preventive Medicine
- Nutrition & Integrative Physiology
- Pharmaceutics & Pharmaceutical Chemistry

Top Users

1	Hageman, Gregory	Department
2	Parkinson, John	NIH
3	Sundquist, Wesley I	NIH
4	Olivera, Baldomero	NIH
5	Coon, Hilary	NIH, NIMH
6	Pulst, Stefan	Department
7	Deininger, Michael	NIH, V Foundation for Cancer Research
8	Schiffman, Joshua	NIH
9	Kwan, Kristen	NIH, NEH
10	Rutter, Jared	Department, HHMI

Publications

1. Bosco, A., et al. (2016). "Glial coverage in the optic nerve expands in proportion to optic axon loss in chronic mouse glaucoma." Exp Eye Res 150: 34-43.
2. Breen, K. T., et al. (2016). "Loss of Fractalkine Signaling Exacerbates Axon Transport Dysfunction in a Chronic Model of Glaucoma." Front Neurosci 10: 526.
3. Deering-Rice, C. E., et al. (2016). "Characterization of Transient Receptor Potential Vanilloid-1 (TRPV1) Variant Activation by Coal Fly Ash Particles and Associations with Altered Transient Receptor Potential Ankyrin-1 (TRPA1) Expression and Asthma." J Biol Chem 291(48): 24866-24879.
4. Di Gioia, S. A., et al. (2017). "A defect in myoblast fusion underlies Carey-Fineman-Ziter syndrome." Nat Commun 8: 16077.
5. Farhang, N., et al. (2017). "* CRISPR-Based Epigenome Editing of Cytokine Receptors for the Promotion of Cell Survival and Tissue Deposition in Inflammatory Environments." Tissue Eng Part A 23(15-16): 738-749.
6. Feusier, J., et al. (2017). "Discovery of rare, diagnostic AluYb8/9 elements in diverse human populations." Mobile DNA 8(1): 9.
7. Fleming, A. M. and C. J. Burrows (2017). "8-Oxo-7,8-dihydroguanine, friend and foe: Epigenetic-like regulator versus initiator of mutagenesis." DNA Repair (Amst) 56: 75-83.
8. Fleming, A. M., et al. (2017). Chapter Eight - Sequencing DNA for the Oxidatively Modified Base 8-Oxo-7,8-Dihydroguanine. Methods in Enzymology. B. F. Eichman, Academic Press. 591: 187-210.
9. Fleming, A. M., et al. (2017). "Oxidative DNA damage is epigenetic by regulating gene transcription via base excision repair." Proc Natl Acad Sci U S A 114(10): 2604-2609.
10. Frank, V., et al. (2016). "Networked Chemoreceptors Benefit Bacterial Chemotaxis Performance." MBio 7(6).
11. Hanke-Gogokhia, C., et al. (2016). "The Function of Arf-like Proteins ARL2 and ARL3 in Photoreceptors." Adv Exp Med Biol 854: 655-661.
12. Hoshijima, K., et al. (2016). "Precise Editing of the Zebrafish Genome Made Simple and Efficient." Developmental cell 36(6): 654-667.
13. Hoshijima, K., et al. (2016). "Precise genome editing by homologous recombination." Methods in cell biology 135: 121-147.
14. Irimia, R.-E. and M. Gottschling (2016). "Taxonomic revision of Rochefortia Sw. (Ehretiaceae, Boraginales)." Biodiversity Data Journal(4): e7720.
15. Khorashad, J. S., et al. (2016). "Rapid conversion of chronic myeloid leukemia to chronic myelomonocytic leukemia in a patient on imatinib therapy." Leukemia 30(11): 2275-2279.
16. Lai, R. Z., et al. (2017). "Signaling Consequences of Structural Lesions that Alter the Stability of Chemoreceptor Trimers of Dimers." J Mol Biol 429(6): 823-835.

17. Lai, R. Z., et al. (2017). "Signaling Consequences of Structural Lesions that Alter the Stability of Chemoreceptor Trimers of Dimers." J Mol Biol 429(6): 823-835.
18. Lai, R. Z., et al. (2017). "Signaling Consequences of Structural Lesions that Alter the Stability of Chemoreceptor Trimers of Dimers." J Mol Biol 429(6): 823-835.
19. Mason, C. C., et al. (2016). "Age-related mutations and chronic myelomonocytic leukemia." Leukemia 30(4): 906-913.
20. McKnight, R. A., et al. (2016). "Intrauterine growth restriction inhibits expression of eukaryotic elongation factor 2 kinase, a regulator of protein translation." Physiol Genomics 48(8): 616-625.
21. Monroe, N., et al. (2017). "Structural basis of protein translocation by the Vps4-Vta1 AAA ATPase." Elife 6.
22. Morrow, Z. T., et al. (2017). "tbx6l and tbx16 are redundantly required for posterior paraxial mesoderm formation during zebrafish embryogenesis." Dev Dyn 246(10): 759-769.
23. Neti, S. S., et al. (2016). "Construction of Functional Monomeric Type 2 Isopentenyl Diphosphate:Dimethylallyl Diphosphate Isomerase." Biochemistry 55(30): 4229-4238.
24. Parker, G. J., et al. (2016). "Demonstration of Protein-Based Human Identification Using the Hair Shaft Proteome." PLoS One 11(9): e0160653.
25. Ronquillo, C. C., et al. (2016). "Ciliopathy-associated IQCB1/NPHP5 protein is required for mouse photoreceptor outer segment formation." Faseb j 30(10): 3400-3412.
26. Stover, J. D., et al. (2017). "CRISPR Epigenome Editing of AKAP150 in DRG Neurons Abolishes Degenerative IVD-Induced Neuronal Activation." Molecular Therapy 25(9): 2014-2027.
27. Stover, J. D., et al. (2017). "CRISPR Epigenome Editing of AKAP150 in DRG Neurons Abolishes Degenerative IVD-Induced Neuronal Activation." Molecular Therapy 25(9): 2014-2027.
28. Tian, B., et al. (2016). "Defining the Product Chemical Space of Monoterpenoid Synthases." PLoS Comput Biol 12(8): e1005053.
29. VanderLinden, R. T., et al. (2017). "Structure and energetics of pairwise interactions between proteasome subunits RPN2, RPN13, and ubiquitin clarify a substrate recruitment mechanism." J Biol Chem 292(23): 9493-9504.
30. Wagle, M., et al. (2016). "A role for FOXO1 in BCR–ABL1-independent tyrosine kinase inhibitor resistance in chronic myeloid leukemia." Leukemia 30(7): 1493-1501.
31. Ying, G., et al. (2016). "Small GTPases Rab8a and Rab11a Are Dispensable for Rhodopsin Transport in Mouse Photoreceptors." PLoS One 11(8): e0161236.
32. Zabriskie, M. S., et al. (2016). "Extreme mutational selectivity of axitinib limits its potential use as a targeted therapeutic for BCR-ABL1-positive leukemia." Leukemia 30(6): 1418-1421.
33. Zhang, Y., et al. (2017). "Gene-based Therapy in a Mouse Model of Blue Cone Monochromacy." Scientific Reports 7(1): 6690.

Drug Discovery Facility

Return to Table of Contents

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 stuides, 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's 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 start-up biotechnology companies.

Services

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

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

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

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

2017 Annual Update

New Equipment:

- **Axygen Platemax Semi-Automatic Plate Sealer** ----- Heat sealing is a highly effective method for sealing assay plates, storage plates and PCR plates. The tabletop PlateMax offers an easy-to-use system, in a compact design, for sealing individual plates and seals. The intuitive control system allows accurate setting of sealing temperature and sealing time for optimal results.

New Service:

- **Lentiviral Production**
  The Core has been certified as BSL2+ lab and has started to offer service for lentiviral production.
- **Whole Genome CRISPR Screening**
  The Core has two sets of human genome-scale CRISPR libraries and started to offer service for CRISPR screening.

New Compound Collection:

- **Approved Oncology Drugs Set II:** The current set (AODVII) consists of 129 agents and is intended to enable cancer research, drug discovery and combination drug studies.
- **Natural Products Set IV:** The Natural Products Set IV consists of 419 compounds that were selected from the DTP Open Repository collection of 140,000 compounds.

- **Mechanistic Set III:** The Mechanistic Set III, which consists of 813 compounds, was derived from the 37,836 open compounds that have been tested in the NCI human tumor 60 cell line screen. This mechanistic diversity set was chosen to represent a broad range of growth inhibition patterns in the 60 cell line screen, based on the GI50 activity of the compounds.

Location update:

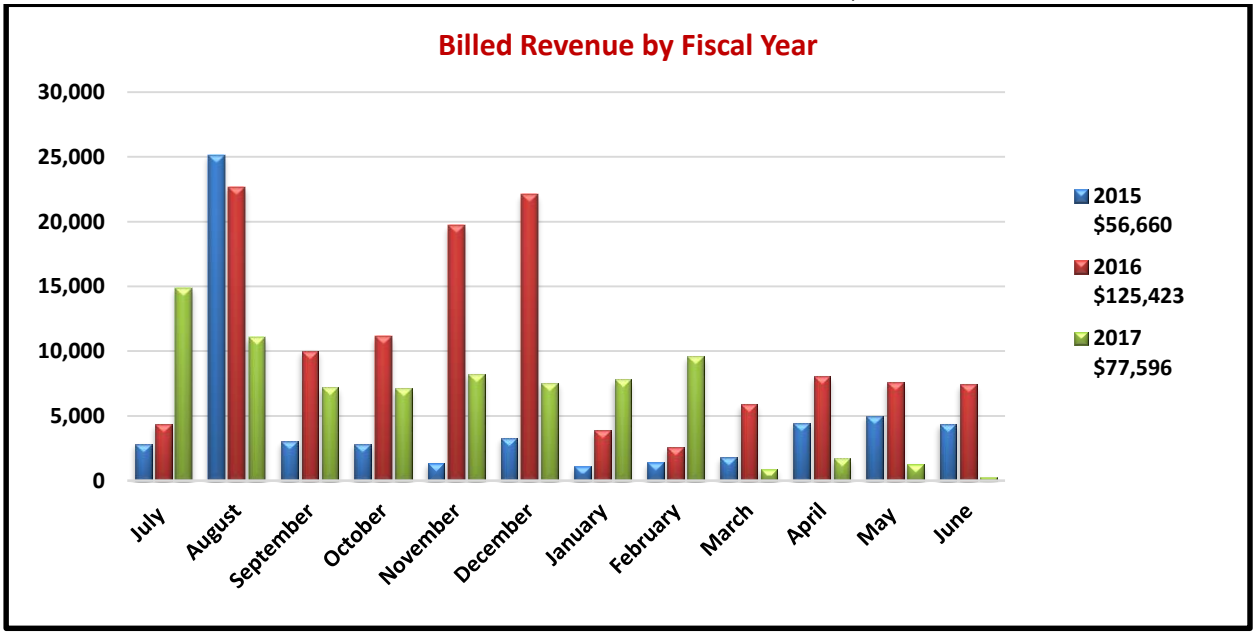
The core has moved to Skaggs Pharmacy building, 3rd floor

Revenue/Expenses

FY17 Expenses: **Total $196,090**

FY17 Revenue: **Total $157,596**

- VP of Health Sciences Support: $80,000
- FY17 Revenue Generated from Services: $77,596



* Total annual revenue displayed in legend.

Advisory Board Committee

Last meeting date: Feb 05, 2017.

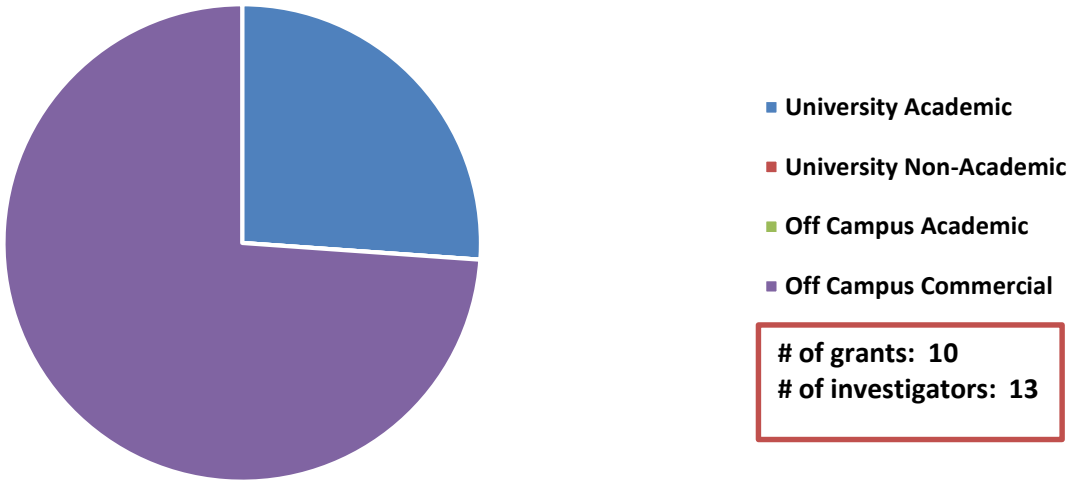
- Darrell Davis, Professor, College of Pharmacy
- Ryan Looper, Associate Professor, Chemistry Department
- John Phillips, Professor, Internal Medicine
- Jared Rutter, Professor, Department of Biochemistry
- Hari Vankayalapati, Research Assistant Professor, HCI

FY17 Scientific Impact

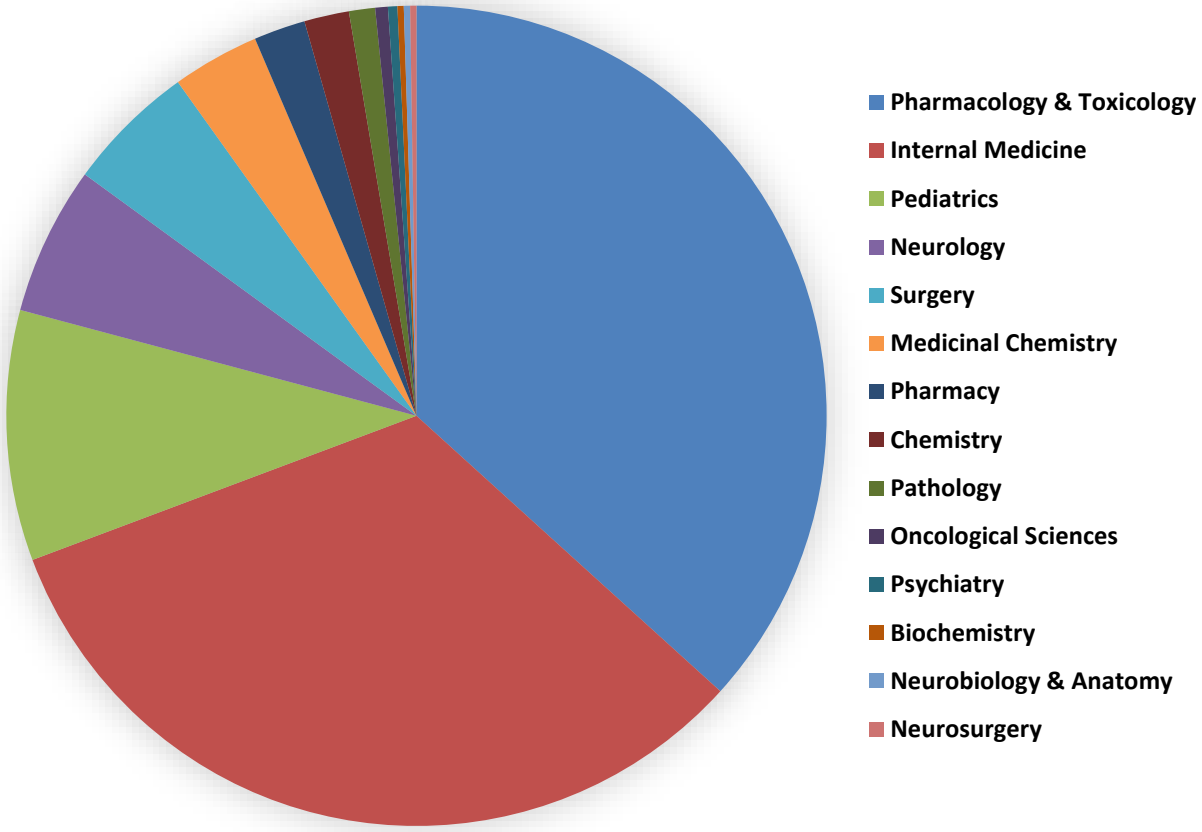
Research Support

Revenue Generated (see charts following):

Revenue by Affiliation



Revenue by Department



Top Users

1	Recursion Pharmaceuticals Inc.	Off Campus
2	Bild, Andrea	NIH, Boston University
3	Phillips, John	NIH
4	Constance, Jonathan	Department
5	Gibson, Summer	Department
6	Holmen, Sheri	NIH
7	Vettore Bio	Off Campus
8	Schmidt, Eric	NIH
9	Bardsley, David	Department
10	Looper, Ryan	American Chemical Society

Goals for FY18

Expand Capabilities

- Start lentiviral production service
- Start CRISPR Screening
- Enhance Utility of UUPCC Library
- Make a selective/proprietary UUPCC library (300-400 compounds)

Expand Business

- Expand service to other USTAR associated users in the state
- Better advertise DDC services to U. research community

Publications

1. Bray MA et al. Cell Painting, a high-content image-based assay for morphological profiling using multiplexed fluorescent dyes. Nature Protocols, 2016 Sep;11(9):1757-74
2. Rahman M et al. Activity of distinct growth factor receptor network components in breast tumors uncovers two biologically relevant subtypes. Genome Med. 2017 Apr 26;9(1):40.

Electron Microscopy

Return to Table of Contents

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 four 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, and ASB. Experiments requiring SEM are done in collaboration with the microscopes owned by the Surface Analysis Laboratory.

Services

Clinical Services:

- Thin-section electron microscopy of tissue biopsies (technical portion 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
- Procedures for observing tissues and cellular specimens including embedding, drying, osmification, and storage
- Procedures for observing particulate and macromolecular samples including staining, metal coating, drying, and cryogenic TEM

Equipment

- FEI Tecnai 12, transmission electron microscope
- JEOL JEM-1400 Plus, transmission electron microscope
- Two Hitachi 7100, transmission electron microscopes
- FEI Tecnai F20, transmission electron microscope
- FEI Titan Krios, transmission electron microscope, delivery November 2017
- Leica (UC7, UC6, and UCT) and Reichert (Ultracut E), ultramicrotomes
- Leica JUNG RM2055, microtome
- Two FEI Vitrobots, vitrification robots
- Gatan K2 Summit, direct electron detector (mounted on FEI Tecnai F20)
- Gatan K2/K3, direct electron detector, to be mounted on Krios
- Gatan BioQuantum energy filter, to be mounted on Krios
- Two automatic tissue processors
- Two laboratory microwave ovens
- Sputter coater
- Glow discharger
- High-pressure freezer
- Freeze substitution machine
- Critical-point dryer
- 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
- Megan Kent, Laboratory Specialist
- Guilherme Cordovil, Laboratory Specialist
- Kalavathy Ramachandran, Laboratory Technician
- Ashley Rodriquez, Laboratory Technician

2017 Annual Update

New Services

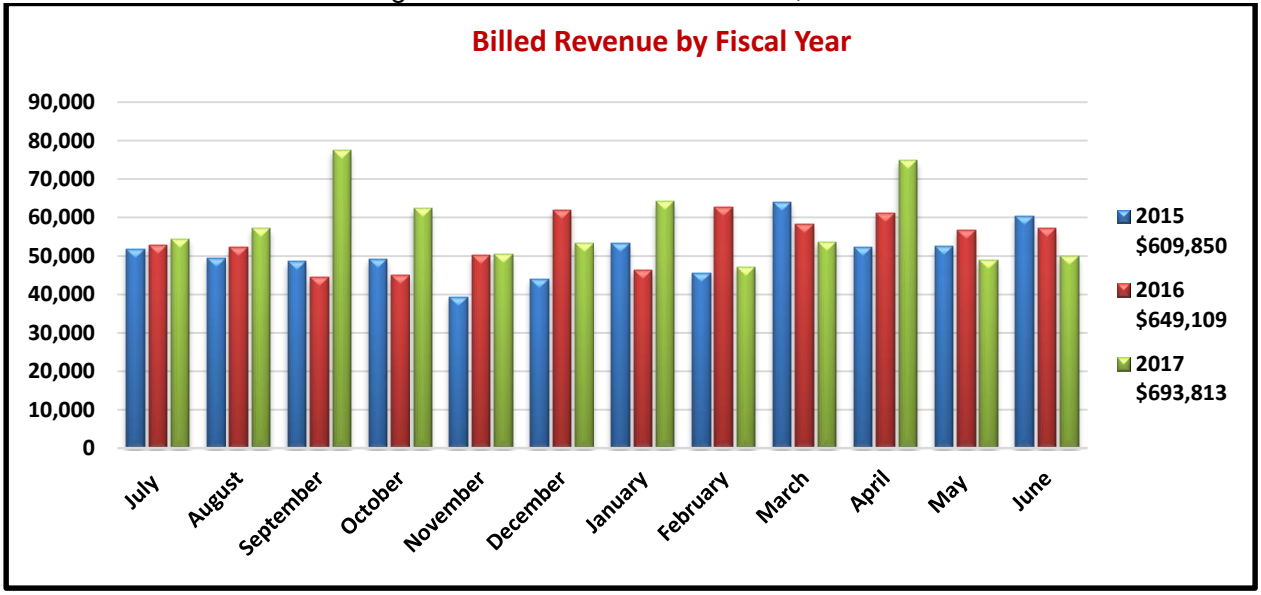
No new services for FY17.

Revenue/Expenses

FY17 Expenses: Total $781,774

FY17 Revenue: Total $763,813

- VP of Health Sciences Support: $20,000
- VP of Research Support : $50,000
- FY17 revenue generated from services: $693,813



*Legend displays total annual revenue by year earned.

Advisory Board Committee

Last meeting date: March 2, 2017.

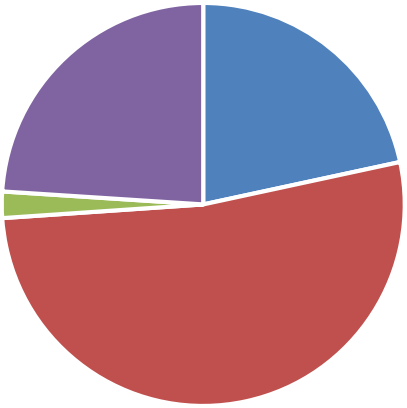
- Erik Jorgensen, Distinguished Professor, Department of Biology
- Patricia Revelo, Professor, Department of Pathology
- Erhu Cao, Assistant Professor, Department of Biochemistry
- Richard Rabbitt, Professor, Department of Bioengineering

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):

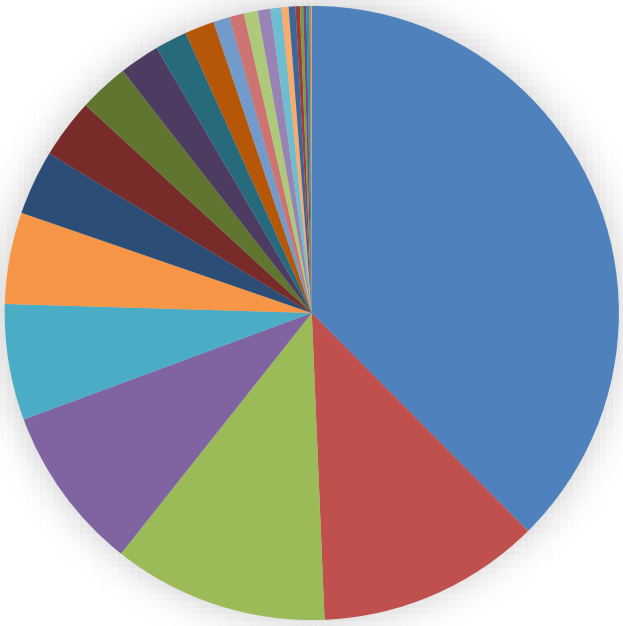
Revenue by Affiliation



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

# of grants: 72
# of investigators: 79

Revenue by Department



- Biochemistry
- Biology
- Neurobiology & Anatomy
- Chemistry
- Bioengineering
- HCI
- Medicinal Chemistry
- Neurology
- Neurosurgery
- Civil & Environmental Engineering
- Surgery
- Pathology
- Oncological Sciences
- Pharmaceutics & Pharmaceutical Chemistry
- Internal Medicine
- Human Genetics
- Pediatrics
- Physics & Astronomy
- Mechanical Engineering
- Chemical Engineering
- Pharmacy
- Material Science & Engineering
- Dentistry
- Opthalmology & Visual Sciences
- Metallurgical Engineering
- Core Research Facilities

Top Users

1	ARUP	Off Campus
2	Saint John's	Off Campus
3	TriCore	Off Campus
4	Primary Children's Medical Center	Off Campus
5	Sundquist, Wesley I	NIH, DHHS, Department
6	Ghandehari, Hamidreza	NIH
7	Jorgensen, Erik	HHMI
8	Hill, Christopher	NIH
9	Scripps Clinic	Off Campus
10	Intermountain Healthcare	Off Campus

Goals for FY18

- Obtain high-quality TEM data from new Titan Krios microscope
- Maintain high-quality clinical services
- Increase usage of main-campus microscopes

Publications

1. Votteler, J., Ogohara, C., Yi, S., Hsia, Y., Nattermann, U., Belnap, D.M., King, N.P., and Sundquist, W.I. (2016). Designed proteins induce the formation of nanocage-containing extracellular vesicles. *Nature* 540, 292-295.
2. Monroe, N., Han, H., Shen, P.S., Sundquist, W.I., Hill, C.P. (2017) Structural basis of protein translocation by the Vps4-Vta1 AAA ATPase. *eLife* 6, e24487.
3. Shen, P.S., Yang, X., DeCaen, P.G., Liu, X., Bulkley, D., Clapham, D.E., Cao, E. (2016). The Structure of the Polycystic Kidney Disease Channel PKD2 in Lipid Nano discs. *Cell* 167, 763-773.

Flow Cytometry Facility

Return to Table of Contents

Overview

The Flow Cytometry Facility offers quantitative, multiparameter 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 for the most part as instrumentation based service lab. However, we believe that education is a crucial component for the growth and sustainability of the facility. First of all, 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 which 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 absolutely 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

FY17 Annual Update

New Equipment

Throughout FY16 3 instruments were added to the flow core. In FY17 many of these instruments were upgraded to match the needs of our growing user base. First and most significantly, the FACSAria cell sorter acquired from ARUP laboratories was upgraded from a 2 laser 6 color instrument, to a 4 laser 12 color instrument. Adding the yellow 561nm and violet 405nm laser opens that instrument up to a significantly larger user base. Previously most multicolor cell sorting projects were restricted to the heavily utilized 5 laser FACSAria. Now those projects can be spread across these two instruments. Next, a UV laser was added to the BD Fortessa that is located at HCI. This instrument is now the only analytical flow cytometer on campus with a UV laser. Not only does it open the door for previously unusable dyes like Indo-1, it also allows the detection of 2 popular UV excited dyes for immunofluorescence antibody staining. Finally, a 2 Beckman Coulter Cytoflex was also acquired. This instrument offers enhanced sensitivity with an extremely easy process for adding new lasers and capabilities at a later point.

Staffing

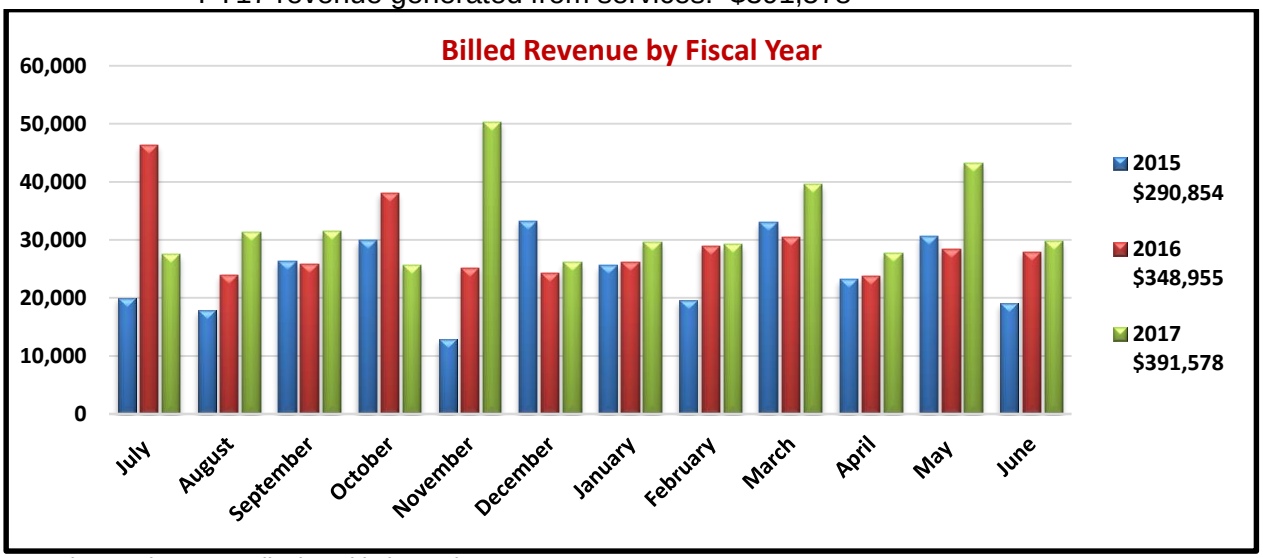
After Chris Leukel left the lab in June of 2016, Tessa Galland, was hired as a lab technician and she began working in the lab on July 11th. In February of 2017 Nidhi Choksi was also added to the lab as a Lab Technician. Both of these employees came with little flow cytometry experience but are catching on incredibly quickly and a becoming very self-sufficient. This will be key if the flow core decides to expand cell sorting operations into a satellite facility at HCI.

Revenue/Expenses

FY17 Expenses: Total $408,915

FY17 Revenue: Total $454,958

- VP of Research Support (RIF): $63,380
- FY17 revenue generated from services: $391,578



***** Total annual revenue displayed in legend.

Advisory Board Committee

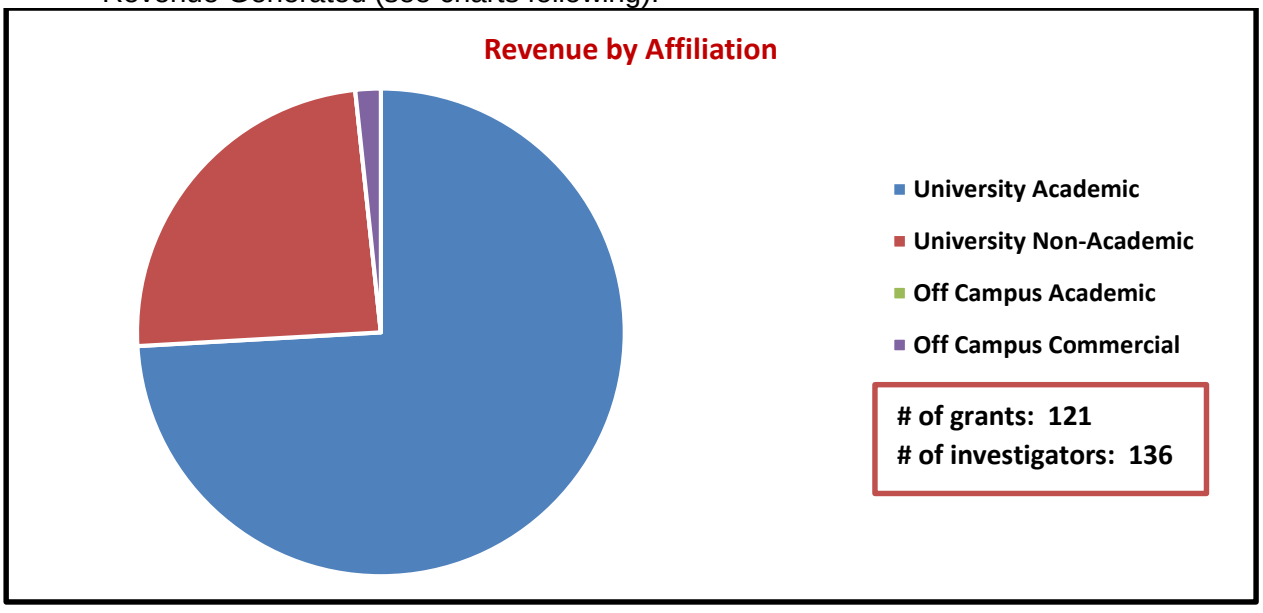
Last meeting date: July 2016

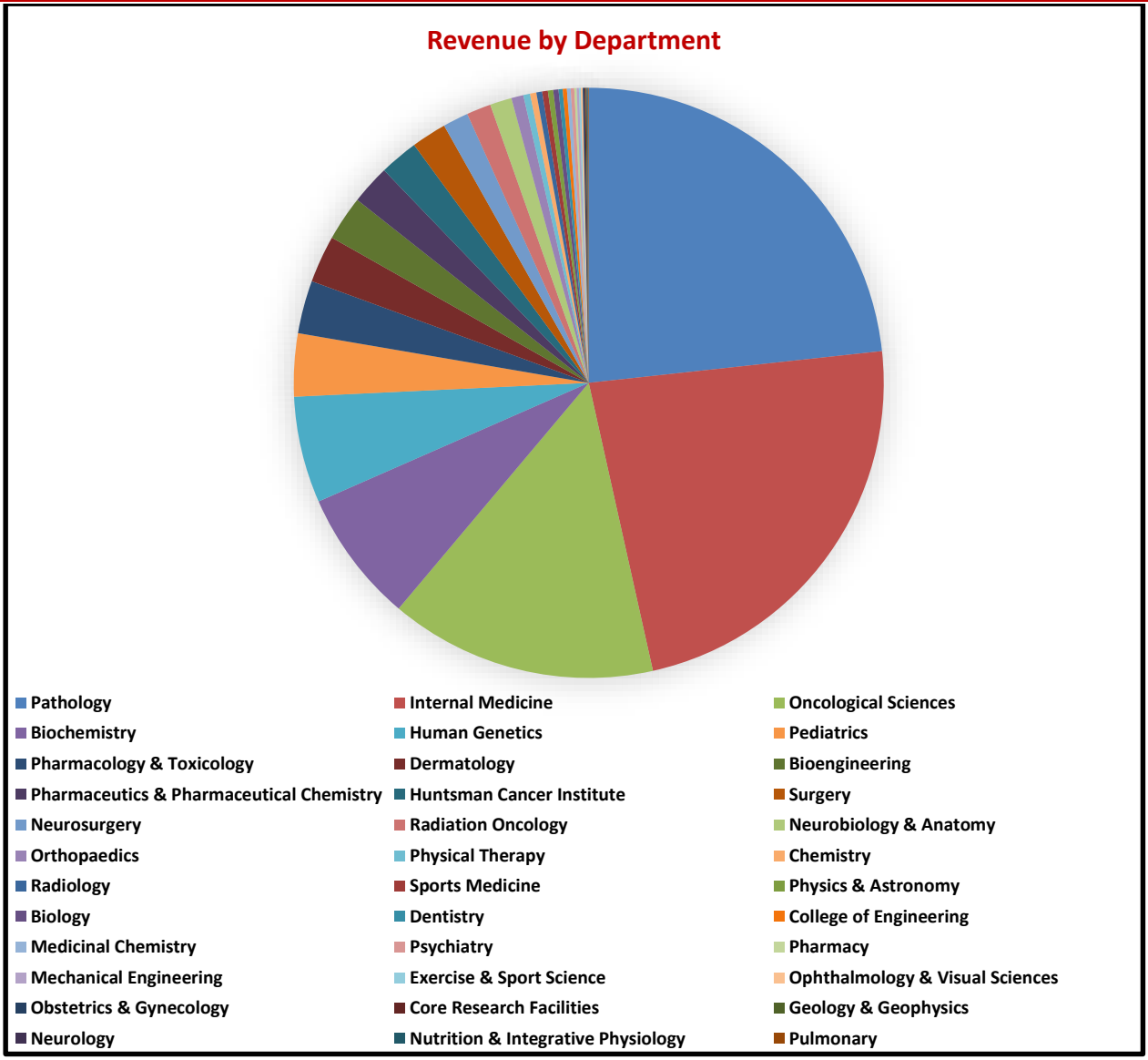
- Ryan O'Connell, Assistant Professor, Pathology
- Thomas O'Hare, Associate Professor, Hematology
- Daniel Leung, Assistant Professor, Internal Medicine
- Matthew Williams, Assistant Professor, Pathology

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	ARUP	Off Campus
2	Deininger, Michael	NIH, V Foundation for Cancer Research, Kineta Inc.
3	Williams, Matthew	NIH
4	Snyder, Eric	V Foundation for Cancer Research, Department
5	Welm, Alana	Army Medical Research Acquisition, Gift
6	Kumanovics, Attila	Department
7	Cairns, Bradley	Department, HHMI
8	Rutter, Jared	Nora Eccles Treadwell Foundation, HHMI
9	Atanackovic, Djordje	Department, HCI, Gift
10	Leung, Daniel	NIH, Army Medical Research Acquisition

Goals for FY18

Overall, the influx of instrumentation, upgrades to computers and software, and turnover of staff has been very beneficial for the facility. However, development of new training and educational material as well as maintaining a regular schedule for ongoing seminar series has declined as a result of this rapid expansion. As facility staff becomes more independent, a much stronger emphasis on user training is beginning to normalize. A new tutorial for fluorescent compensation and instrument settings will be completed and integrated into the ongoing “Flow Basics, and Data Analysis” presentations. Also, within the last year the facility increased its analytical capabilities from 8 color to 18 color. This is an entirely new frontier that involves intimate understanding of the instrumentation as well as reagents involved in high paramicity fluorescent data. In FY18 a project evaluating 30 of the most common fluorophores for both brightness and spectral characteristics will be completed and disseminated to our users. Finally, as facility staff becomes more independent, we also hope to initiate a much more scheduled and consistent procedure for instrumentation maintenance. This will include measures to ensure sterility on cell sorters and increasing the overall quality assurance of the rapidly expanding instrumentation in the facility.

Publications

1. Barrott, J. J., Kafchinski, L. A., Jin, H., Potter, J. W., Kannan, S. D., Kennedy, R., Mosbruger, T., Wang, W. L., Tsai, J. W., Araujo, D. M., Liu, T., Capecchi, M. R., Lazar, A. J., and Jones, K. B. (2016) Modeling synovial sarcoma metastasis in the mouse: PI3'-lipid signaling and inflammation. The Journal of experimental medicine 213, 2989-3005
2. Bosque, A., Nilson, K. A., Macedo, A. B., Spivak, A. M., Archin, N. M., Van Wagoner, R. M., Martins, L. J., Novis, C. L., Szaniawski, M. A., Ireland, C. M., Margolis, D. M., Price, D. H., and Planelles, V. (2017) Benzotriazoles Reactivate Latent HIV-1 through Inactivation of STAT5 SUMOylation. Cell reports 18, 1324-1334
3. Breen, K. T., Anderson, S. R., Steele, M. R., Calkins, D. J., Bosco, A., and Vetter, M. L. (2016) Loss of Fractalkine Signaling Exacerbates Axon Transport Dysfunction in a Chronic Model of Glaucoma. Frontiers in neuroscience 10, 526
4. Chiaro, T. R., Soto, R., Zac Stephens, W., Kubinak, J. L., Petersen, C., Gogokhia, L., Bell, R., Delgado, J. C., Cox, J., Voth, W., Brown, J., Stillman, D. J., O'Connell, R. M., Tebo, A. E., and Round, J. L. (2017) A member of the gut mycobiota modulates host purine metabolism exacerbating colitis in mice. Science translational medicine 9
5. Cusick, M. F., Libbey, J. E., Doty, D. J., DePaula-Silva, A. B., and Fujinami, R. S. (2017) The role of peripheral interleukin-6 in the development of acute seizures following virus encephalitis. Journal of neurovirology
6. Farhang, N., Brunger, J. M., Stover, J. D., Thakore, P. I., Lawrence, B., Guilak, F., Gersbach, C. A., Setton, L. A., and Bowles, R. D. (2017) CRISPR-Based Epigenome Editing of Cytokine Receptors for the Promotion of Cell Survival and Tissue Deposition in Inflammatory Environments. Tissue engineering. Part A
7. Gardiner, J. D., Abegglen, L. M., Huang, X., Carter, B. E., Schackmann, E. A., Stucki, M., Paxton, C. N., Lor Randall, R., Amatruda, J. F., Putnam, A. R., Kovar, H., Lessnick, S. L., and Schiffman, J. D. (2017) C/EBPbeta-1 promotes transformation and chemoresistance in Ewing sarcoma cells. Oncotarget 8, 26013-26026
8. Jin, H., Barrott, J. J., Cable, M. G., Monument, M. J., Lerman, D. M., Smith-Fry, K., Nollner, D., and Jones, K. B. (2017) The Impact of Microenvironment on the Synovial Sarcoma Transcriptome. Cancer microenvironment: official journal of the International Cancer Microenvironment Society
9. Khamsi, R. (2017) Medicine's movable feast: What jumping genes can teach us about treating disease. Nature medicine 23, 791-795
10. Libbey, J. E., Cusick, M. F., Doty, D. J., and Fujinami, R. S. (2017) Complement Components Are Expressed by Infiltrating Macrophages/Activated Microglia Early Following Viral Infection. Viral immunology 30, 304-314

11. Shih, L., Kaplan, D., Kraiss, L. W., Casper, T. C., Pendleton, R. C., Peters, C. L., Supiano, M. A., Zimmerman, G. A., Weyrich, A. S., and Rondina, M. T. (2016) Platelet-Monocyte Aggregates and C-Reactive Protein are Associated with VTE in Older Surgical Patients. Scientific reports 6, 27478
12. Soto, R., Petersen, C., Novis, C. L., Kubinak, J. L., Bell, R., Stephens, W. Z., Lane, T. E., Fujinami, R. S., Bosque, A., O'Connell, R. M., and Round, J. L. (2017) Microbiota promotes systemic T-cell survival through suppression of an apoptotic factor. Proceedings of the National Academy of Sciences of the United States of America 114, 5497-5502
13. Spivak, A. M., Larragoite, E. T., Coletti, M. L., Macedo, A. B., Martins, L. J., Bosque, A., and Planelles, V. (2016) Janus kinase inhibition suppresses PKC-induced cytokine release without affecting HIV-1 latency reversal ex vivo. Retrovirology 13, 88
14. Tharkar-Promod, S., Johnson, D. P., Bennett, S. E., Dennis, E. M., Banowsky, B. G., Jones, S. S., Shearstone, J. R., Quayle, S. N., Min, C., Jarpe, M., Mosbruger, T., Pomicter, A. D., Miles, R. R., Chen, W. Y., Bhalla, K. N., Zweidler-McKay, P. A., Shrieve, D. C., Deininger, M. W., Chandrasekharan, M. B., and Bhaskara, S. (2017) HDAC1,2 inhibition and doxorubicin impair Mre11-dependent DNA repair and DISC to override BCR-ABL1-driven DSB repair in Philadelphia chromosome-positive B-cell precursor acute lymphoblastic leukemia. Leukemia Trott, D. W., Henson, G. D., Ho, M. H., Allison, S. A., Lesniewski, L. A., and Donato, A. J. (2016) Age-related arterial immune cell infiltration in mice is attenuated by caloric restriction or voluntary exercise. Experimental gerontology
15. Votteler, J., Ogohara, C., Yi, S., Hsia, Y., Nattermann, U., Belnap, D. M., King, N. P., and Sundquist, W. I. (2016) Designed proteins induce the formation of nanocage-containing extracellular vesicles. Nature 540, 292-295
16. Westenfelder, C., Gooch, A., Hu, Z., Ahlstrom, J., and Zhang, P. (2017) Durable Control of Autoimmune Diabetes in Mice Achieved by Intraperitoneal Transplantation of "Neo-Islets," Three-Dimensional Aggregates of Allogeneic Islet and "Mesenchymal Stem Cells". Stem cells translational medicine 6, 1631-1643
17. White, C. H., Moesker, B., Beliakova-Bethell, N., Martins, L. J., Spina, C. A., Margolis, D. M., Richman, D. D., Planelles, V., Bosque, A., and Woelk, C. H. (2016) Transcriptomic Analysis Implicates the p53 Signaling Pathway in the Establishment of HIV-1 Latency in Central Memory CD4 T Cells in an In Vitro Model. PLoS pathogens 12, e1006026

Genomics Facility

Return to Table of Contents

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

DNA Sequencing

- Mutation Detection

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

2017 Annual Update

New Equipment

No new instrumentation for FY17.

New Services

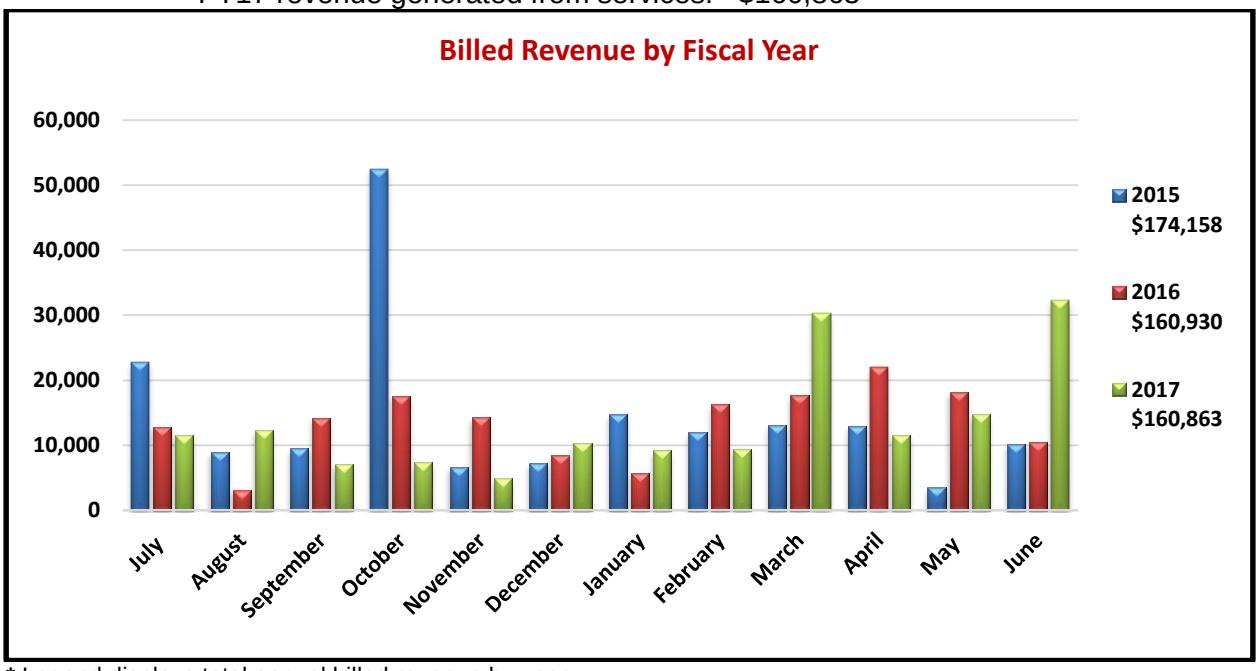
No new services for FY17.

Revenue/Expenses

FY17 Expenses: **Total $181,856**

FY17 Revenue: **Total $160,863**

- VP of Health Sciences Support: $0
- FY17 revenue generated from services: $160,863



***** Legend displays total annual billed revenue by year.

Advisory Board Committee

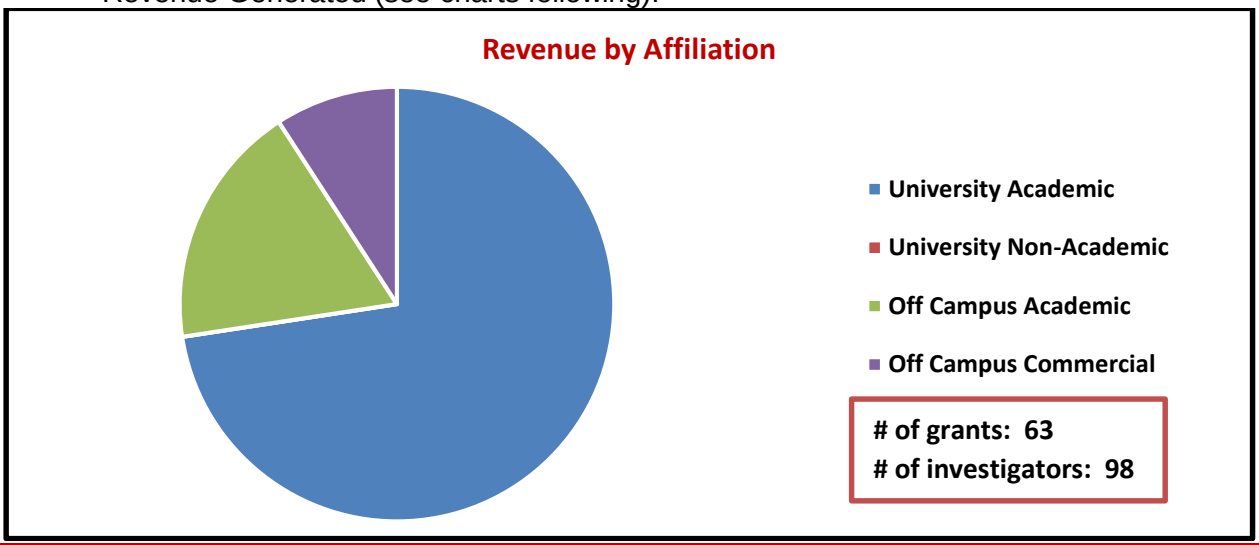
Last meeting date: July 20, 2015

- Gerald Krueger, Professor, Dermatology
- Deborah Neklason, Research Associate Professor, Huntsman Cancer Institute
- Nicola Camp, Professor, Genetic Epidemiology

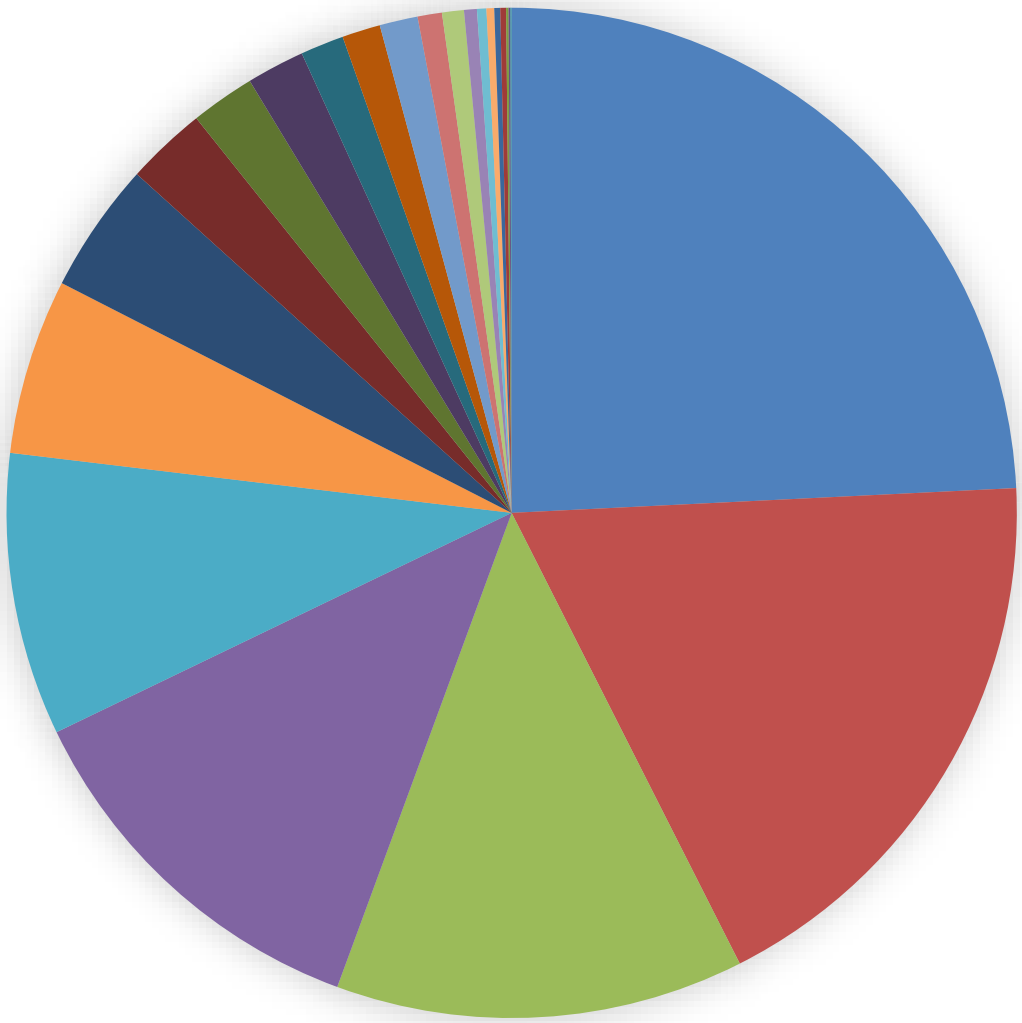
FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):



Revenue by Department



- Neurology
- Internal Medicine
- Psychiatry
- Oncological Sciences
- Pediatrics
- Human Genetics
- College of Pharmacy
- Biology
- Surgery
- Nutrition
- Neurobiology & Anatomy
- Pathology
- Pharmacology & Toxicology
- Chemistry
- Obstetrics & Gynecology
- Orthopaedics
- Exercise & Sport Science
- Biochemistry
- Bioengineering
- Anthropology
- Ophthalmology & Visual Sciences
- Pharmacy
- Pulmonary

Top Users

1	Pulst, Stefan	Department
2	Coon, Hilary	National Institute of Mental Health
3	Tavtigian, Sean	NIH, HCI, Department
4	Recursion Pharmaceuticals	Off Campus
5	University of Puget Sound	Off Campus Academic
6	Cannon-Albright, Lisa	Inova Dwight & Martha Schar Cancer Institute, MD Anderson Cancer Center
7	University of Arizona	Off Campus Academic
8	Peterson, Randall	Department
9	Tulane University	Off Campus Academic
10	Boudina, Sihem	NIH

Publications

1. Bosco, A., et al. (2016). "Glial coverage in the optic nerve expands in proportion to optic axon loss in chronic mouse glaucoma." Exp Eye Res 150: 34-43.
2. Breen, K. T., et al. (2016). "Loss of Fractalkine Signaling Exacerbates Axon Transport Dysfunction in a Chronic Model of Glaucoma." Front Neurosci 10: 526.
3. Deering-Rice, C. E., et al. (2016). "Characterization of Transient Receptor Potential Vanilloid-1 (TRPV1) Variant Activation by Coal Fly Ash Particles and Associations with Altered Transient Receptor Potential Ankyrin-1 (TRPA1) Expression and Asthma." J Biol Chem 291(48): 24866-24879.
4. Farhang, N., et al. (2017). "* CRISPR-Based Epigenome Editing of Cytokine Receptors for the Promotion of Cell Survival and Tissue Deposition in Inflammatory Environments." Tissue Eng Part A 23(15-16): 738-749.
5. Pflieger, L. T., et al. (2017). "Gene co-expression network analysis for identifying modules and functionally enriched pathways in SCA2." Hum Mol Genet 26(16): 3069-3080.
6. Scoles, D. R., et al. (2017). "Antisense oligonucleotide therapy for spinocerebellar ataxia type 2." Nature 544(7650): 362-366.
7. Stover, J. D., et al. (2017). "CRISPR Epigenome Editing of AKAP150 in DRG Neurons Abolishes Degenerative IVD-Induced Neuronal Activation." Molecular Therapy 25(9): 2014-2027.

Machine Shop

Return to Table of Contents

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

2017 Annual Update

New Equipment

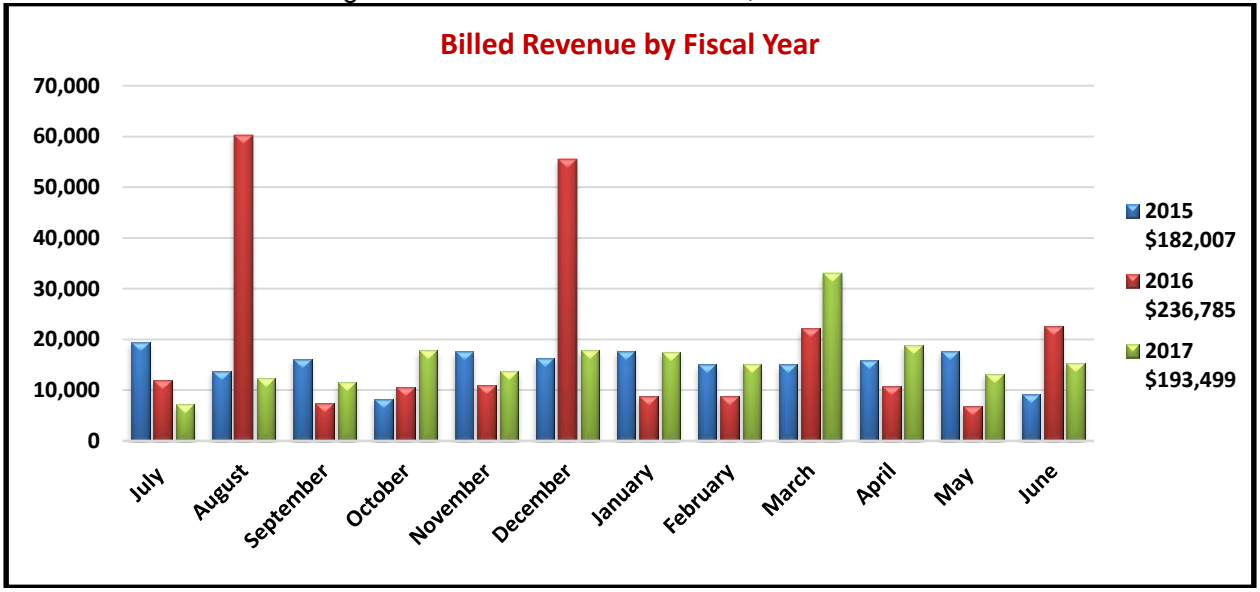
- No new equipment

Revenue/Expenses

FY17 Expenses: **Total $216,191**

FY17 Revenue: Total $208,499

- VP of Health Sciences Support: $15,000
- FY17 revenue generated from services: $193,499



* Legend displays total annual revenue by year generated.

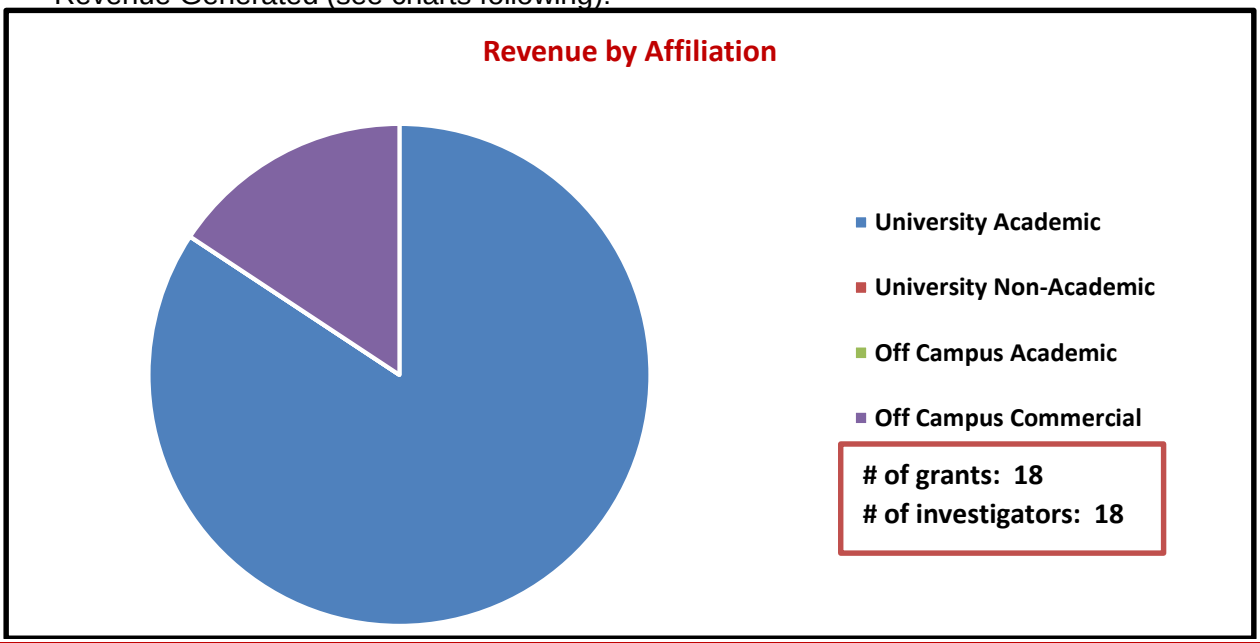
Advisory Board Committee

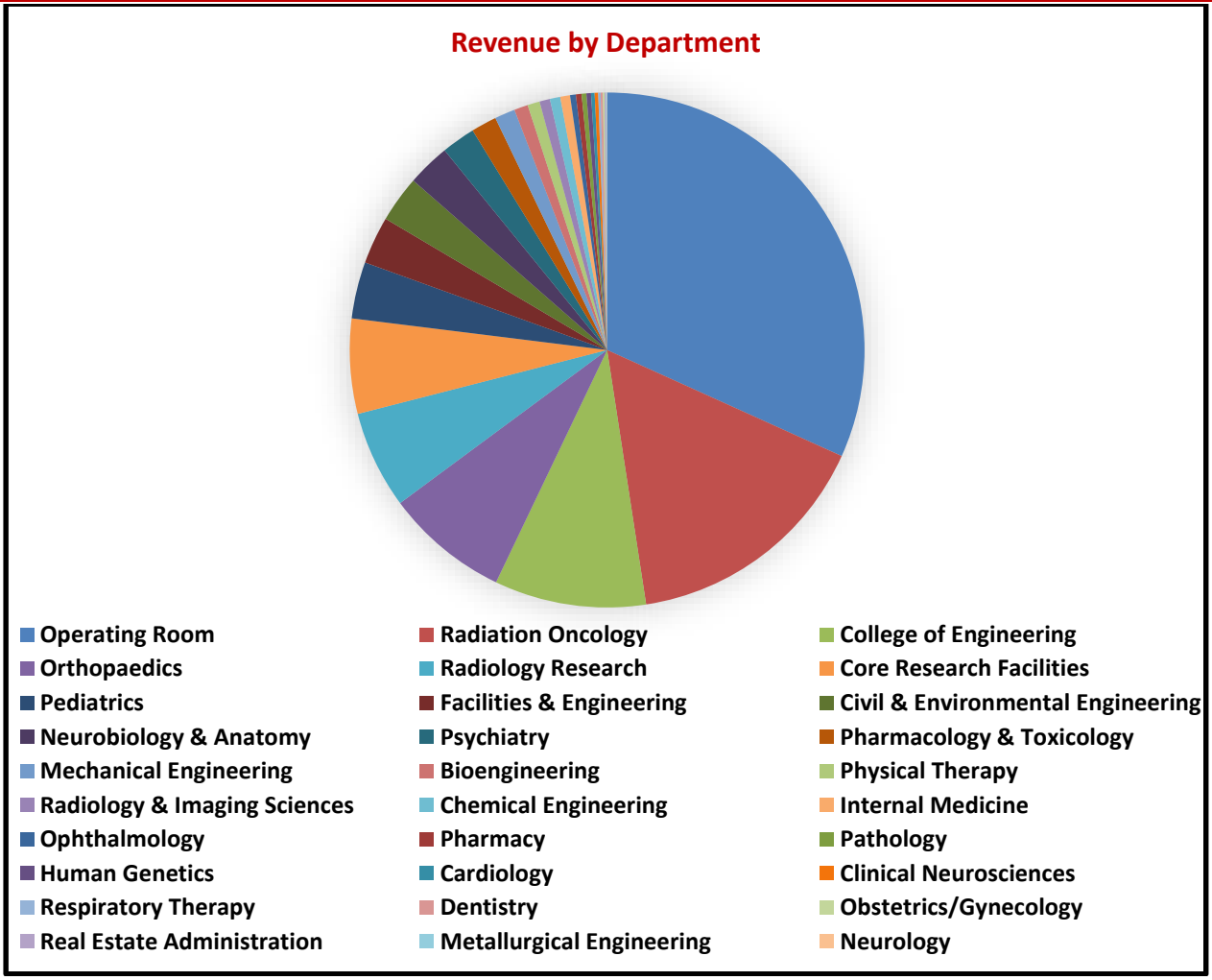
- Perry Renshaw, Professor, Psychiatry
- Michelle Ford, Materials Management Facilitator, Facilities Engineering
- Kyle Thomson, Researcher, Add Program

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Ford, Michelle	U of U Hospital
2	Meisner, Steve	Radiation Oncology
3	Primary Childrens Medical Center	Off Campus
4	Kingstedt, Owen	Department
5	Minoshima, Satoshi	Department
6	Rodesch, Chris	Department
7	Korenberg, Julie	NIH
8	Clausing, Alishia	Department
9	McDonald, Luther	US Department of Defense
10	Bachus, Kent	Department

Publications

No publications acknowledged this facility in FY17.

Mass Spectrometry & Proteomics

Return to Table of Contents

Overview

The Mass Spectrometry & Proteomics Facility is geared toward supporting proteomics research as well as providing basic mass spectrometry (MS) support 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 mission of this facility is 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. The following services are provided to investigators:

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
- Software Data Processing and Image Generation-by User

Equipment

Mass Spectrometers

- Thermo LTQ-FT
- Bruker UltrafleXtreme
- Waters Q-ToF-2
- Bruker Maxis II HD for high mass accuracy intact protein analysis.
- Thermo Orbitrap XL

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

Advisory Board Committee

- Darrell Davis, Professor, Medicinal Chemistry
- Wes Sundquist, Professor, Biochemistry
- Michael Kay, Professor, Biochemistry

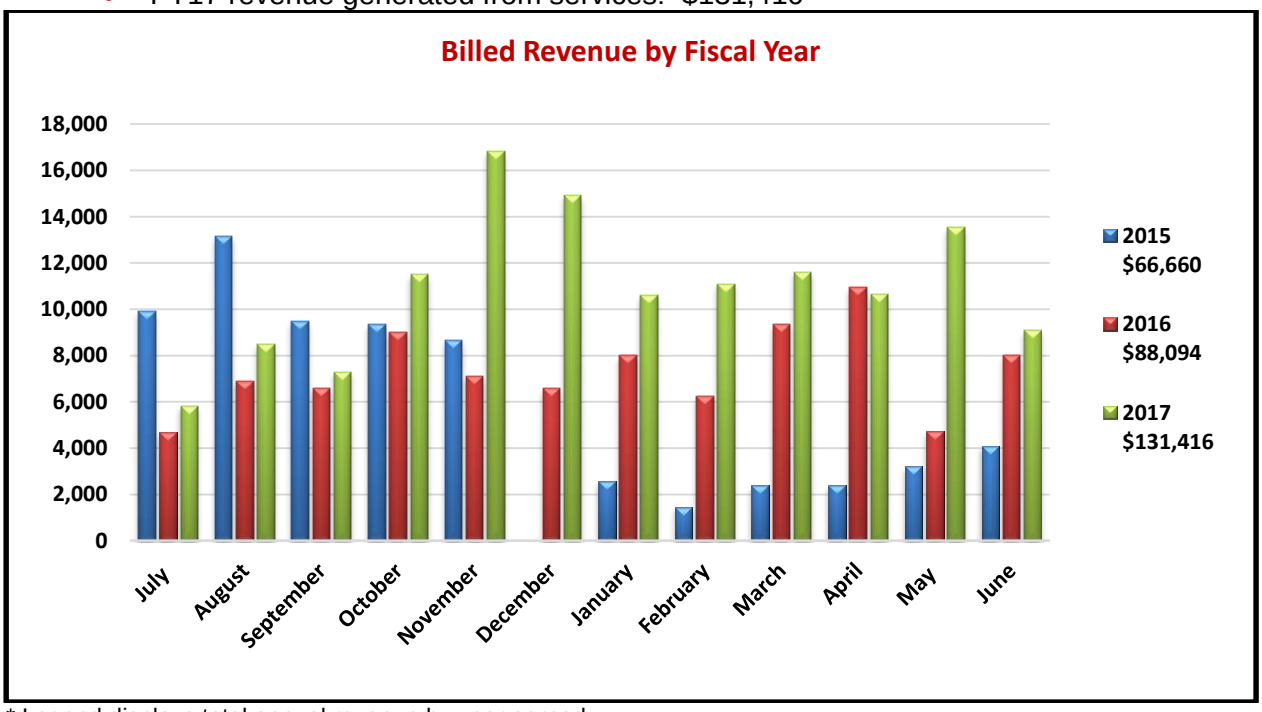
2017 Annual Update

Revenue/Expenses

FY17 Expenses: **Total $297,381**

FY17 Revenue: **Total $393,416**

- VP of Health Sciences Support: $262,000
- FY17 revenue generated from services: $131,416

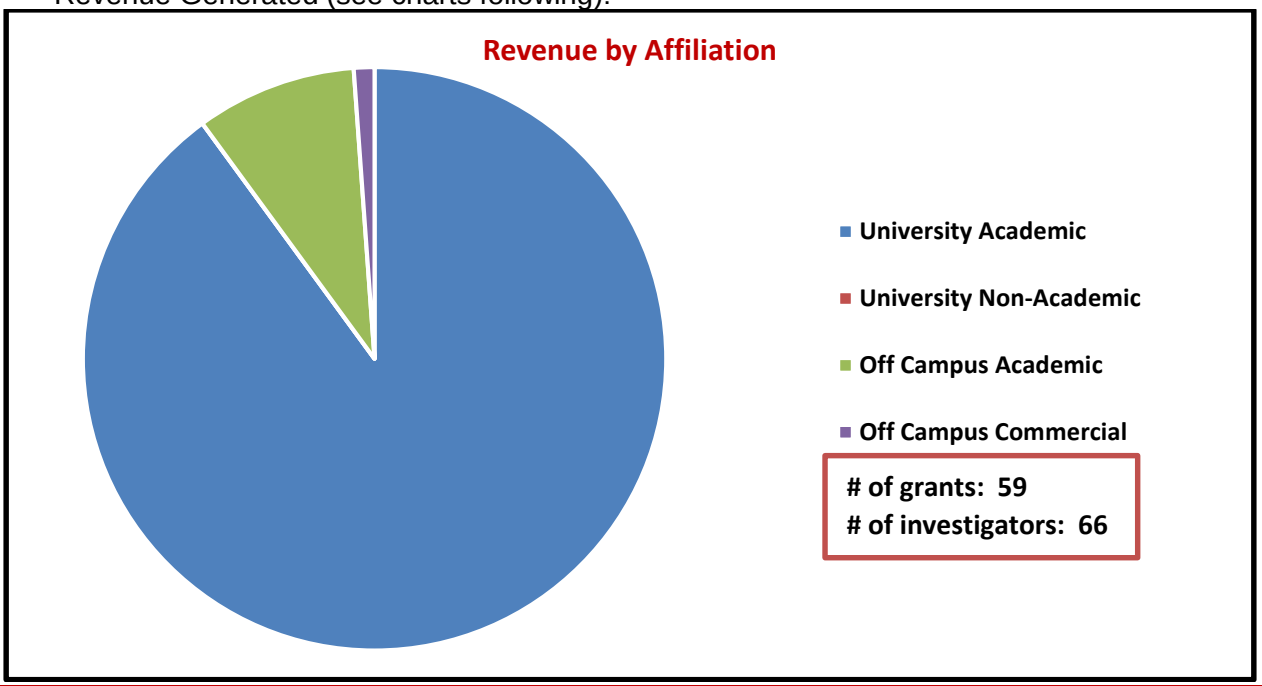


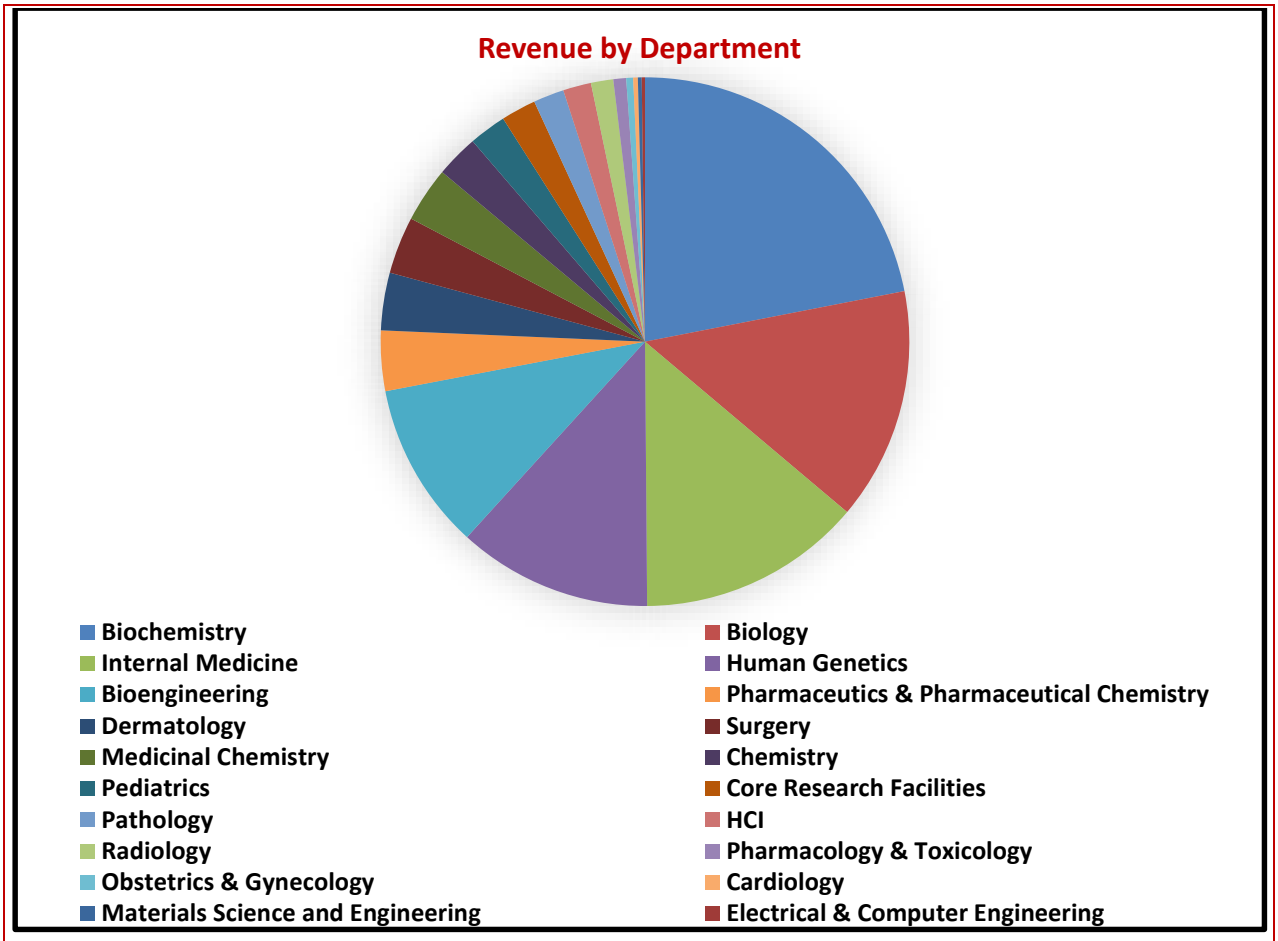
* Legend displays total annual revenue by year earned.

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Howard, Michael	NIH
2	Hill, Christopher	NIH
3	Yu, Michael	NIH
4	Olivera, Baldomera	NIH
5	NuSkin	Off Campus Commerical
6	Texas A&M University	Off Campus Academic
7	Vankayalapati, Hari	Taylor Endowment Cancer Research
8	Sundquist, Wesley I	NIH, DHHS
9	McMahon, Martin	NIH, Gift
10	Hughes, Kelly	NIH

Publications

1. Vanderlinden, R. T. *et al.* Structural Basis for the Activation and Inhibition of the UCH37 Deubiquitylase. *Molecular Cell* 61, 487 (2016).
2. Bennink LL, Smith DJ, Foss CA, Pomper MG, Li Y, Yu SM. High Serum Stability of Collagen Hybridizing Peptides and Their Fluorophore Conjugates. Mol Pharm. 2017 Jun 5;14(6):1906-1915.

Metabolic Phenotyping

Return to Table of Contents

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 XFe96 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.

As of December 2016, Dr. Anil Laxman replaced Dr. Sihem Boudina as the director for the Metabolic Phenotyping Core.

Services

- Mitochondrial Bioenergetics Agilent-Seahorse XFe96 extracellular flux analyzers
- Cellular energy metabolism using Agilent-Seahorse XF24 and XFe96 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
- Glucose and insulin tolerance tests
- Euglycemic-hyperinsulinemic clamp
- Isolation of Pancreatic islets
- Chronic exposure of mice to cold/warm temperature

Equipment

- Seahorse Flux Analyzer XF24
- Seahorse Flux Analyzer XFe96
- Eight Columbus Instruments metabolic chambers equipped with temperature-controlled enclosure.
- Bruker Minispec NMR
- Luminex MAGPIX
- Luminex 200 System
- Powers Scientific rodent incubators

Personnel

- Anil Laxman, Ph.D., Director

2017 Annual Update

Equipment

- Powers Scientific rodent incubators

New Services

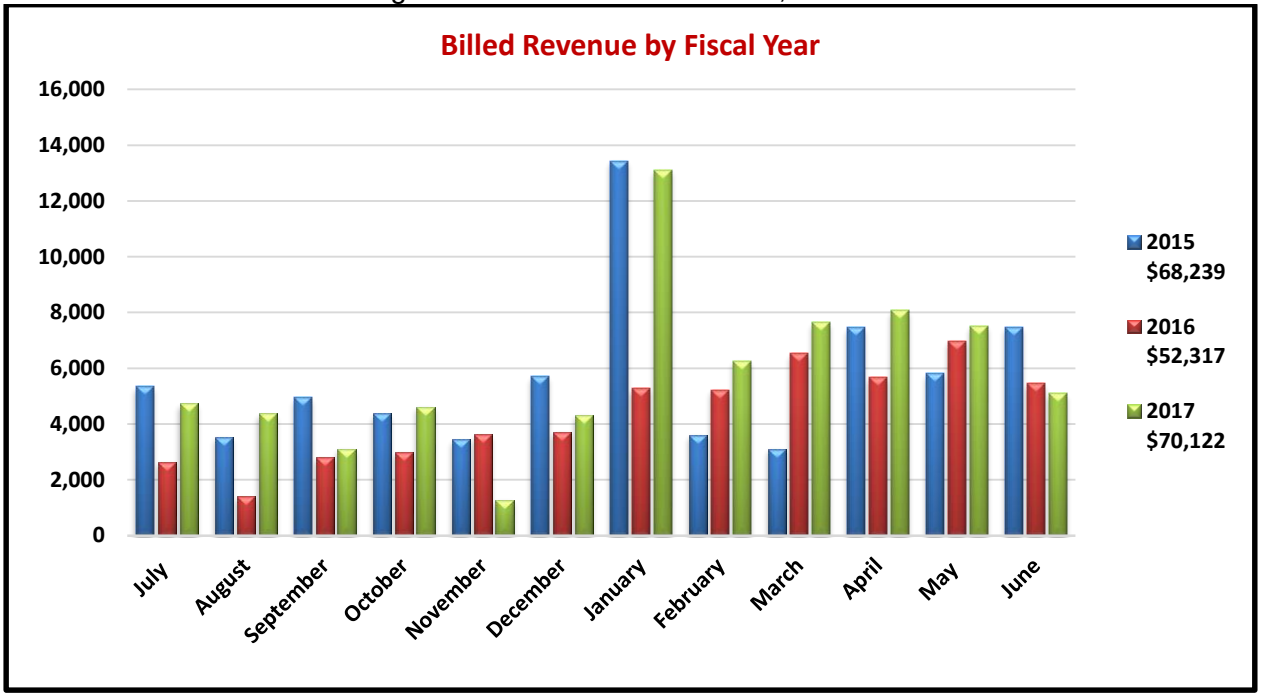
- MPC has purchased three rodent incubators using funds from a RIF and generous contributions from Diabetes and Metabolism Center and College of Health. These chambers will allow investigators to study the effects of long-term cold exposure on energy metabolism in intact animals.

Revenue/Expenses

FY17 Expenses: **Total $157,732**

FY17 Revenue: Total $174,942

- VP of Health Sciences Support: $85,000
- VP of Research Support (RIF): $19,820 (for Rodent Incubators)
- FY17 revenue generated from services: $70,122



* Legend displays total annual revenue by year earned.

Advisory Board Committee

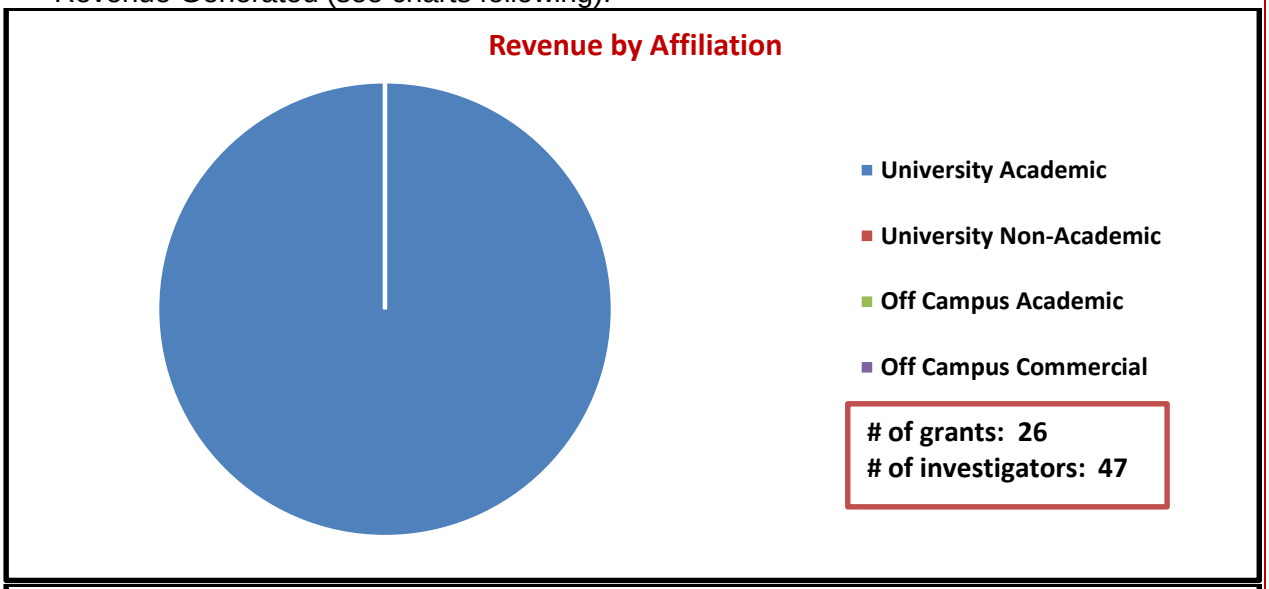
Last meeting date: January, 2016.

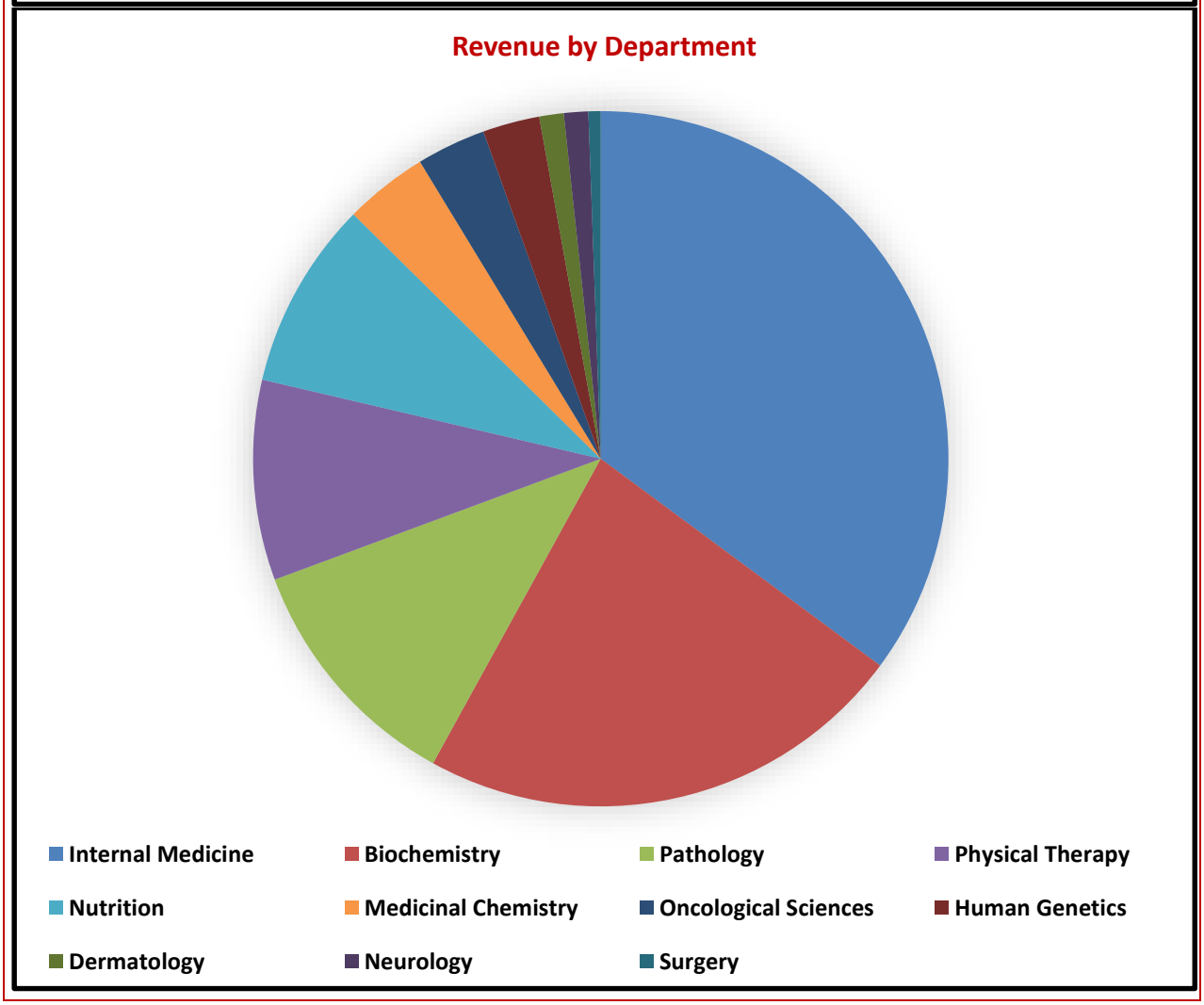
- Jared Rutter, Professor, Biochemistry
- Carl Thummel, Professor, Human Genetics
- Simon J. Fisher, Professor, Internal Medicine

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Rutter, Jared	Nora Eccles Treadwell Foundation, HHMI
2	Boudina, Sihem	NIH
3	Drummond, Micah	NIH, Orthopaedic Trauma Association
4	Deininger, Michael	NIH, V Foundation for Cancer Research
5	Summers, Scott	Department, NIH
6	O'Connell, Ryan	Department, NIH
7	Oldelberg, Shannon	NIH
8	Balagurunathan, Kuberan	DHHS, Virginia Commonwealth
9	Drakos, Stavors	Doris Duke Foundation, NIH
10	Villanueva, Claudio	Department

Letter of Support for grants:

1. LOS for Claudio J. Villanueva, Ph.D, American Diabetes Association research proposal titled "Investigation of a Type 2 diabetes risk gene TCF7L2 in adipocyte biology"
2. LOS for Simon Fisher, M.D. Ph.D, R01 application titled "Hypoglycemia mediated fatal arrhythmias"
3. LOS for Soumya Yandamuri, F31 grant application titled "Studies on axonal mitochondrial damage in a viral model of multiple sclerosis"

Publications

1. Schuler *et al.* Miro1-mediated mitochondrial positioning shapes intracellular energy gradients required for cell migration. *Molecular Biology of the Cell* **28**(16): 2159-2169 (2017).
2. Tanner et al. EWS/FLI is a master regulator of metabolic reprogramming in Ewing sarcoma. *Molecular Cancer Research* (2017, July 18, Epub ahead of print)

Metabolomics Facility

Return to Table of Contents

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

- Waters GCT Premier gas chromatograph-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

- Agilent 5977B gas chromatograph-quadrupole mass spectrometer (GC-MS).

Personnel

- James Cox, Ph.D., Director
- Alan Maschek, Ph.D., Research Associate
- Leon Catrow, Ph.D., Research Associate
- Tyler Van Ry, B.S. Technician

2017 Annual Update

New Services

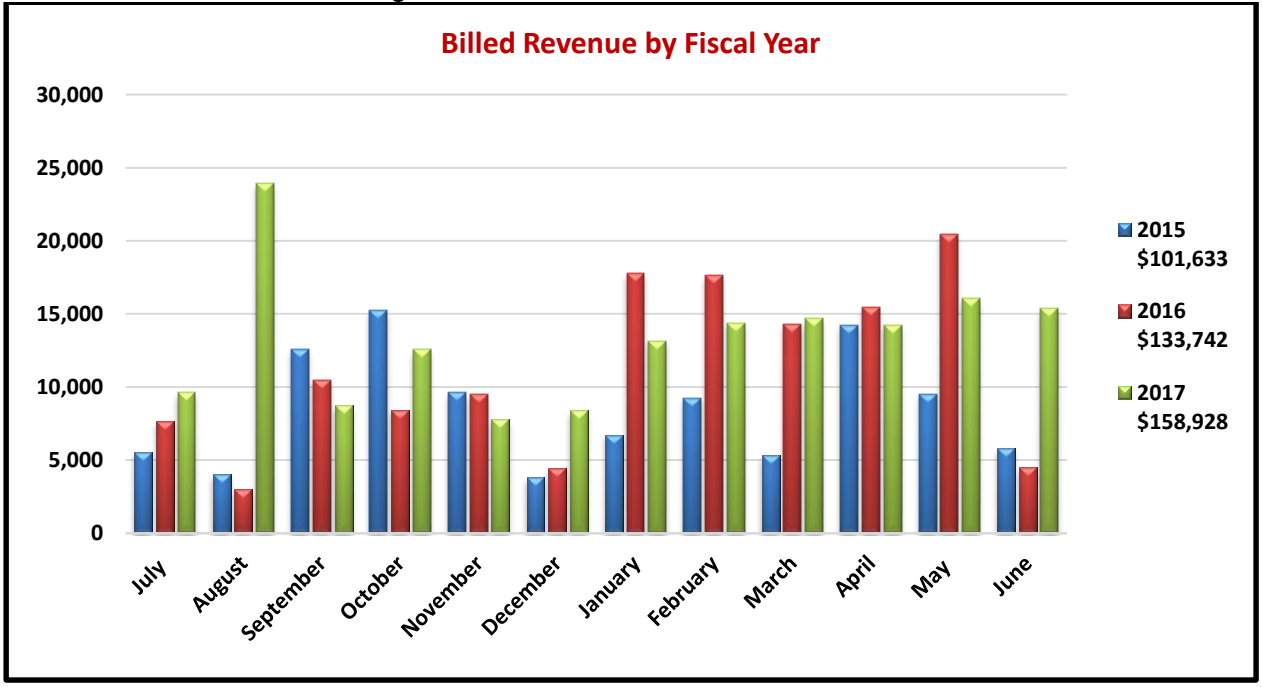
- Flux analysis using a GC-MS based approach.
- Lipidomics analysis using a LC-MS based approach

Revenue/Expenses

FY17 Expenses: **Total $448,828**

FY17 Revenue: **Total $418,928**

- VP of Health Sciences Support: $260,000
- FY17 revenue generated from services: $158,928



* Legend displays total annual revenue by year earned.

Advisory Board Committee

Last meeting date: February 03, 2015.

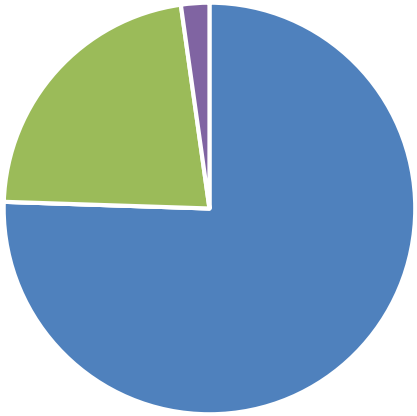
- Dennis Winge, Professor, Hematology
- Carl Thummel, Professor, Department of Human Genetics
- Eric Schmidt, Professor, Medicinal Chemistry
- Jared Rutter, Professor, Biochemistry

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):

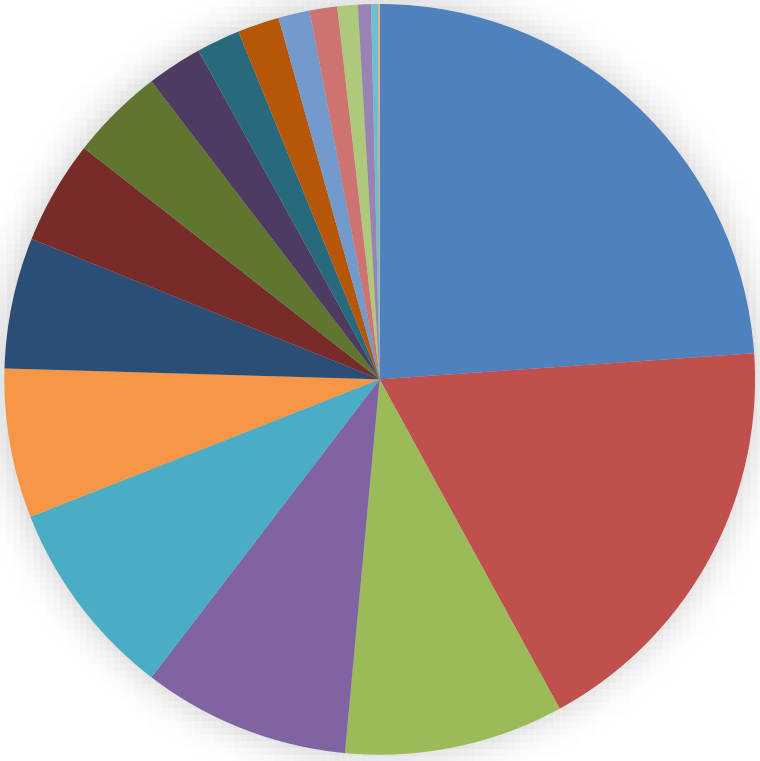
Revenue by Affiliation



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

# of grants: 32
# of investigators: 76

Revenue by Department



- Biochemistry
- Internal Medicine
- Physical Therapy
- Surgery
- Nutrition & Integrative Physiology
- Oncological Sciences
- Pediatrics
- Medicinal Chemistry
- Pathology
- Human Genetics
- Biology
- Dermatology
- Pharmacology & Toxicology
- College of Pharmacy
- Ophthalmology & Visual Sciences
- Orthopaedics
- Chemistry
- Neurosurgery

Top Users

1	Rutter, Jared	HHMI
2	University of Iowa	Off Campus Academic
3	Drummond, Micah	NIH, Orthopaedic Trauma Association
4	Summers, Scott	Department, NIH
5	Weyrich, Andy	NIH
6	Villanueva, Claudio	Department
7	Grossman, Douglas	Skaggs Foundation for Research
8	Abel, Dale	American Heart Association
9	Joss-Moore, Lisa	Department
10	Indiana University	Off Campus Academic

Publications

1. Chiaro, T. R., et al. (2017). "A member of the gut mycobiota modulates host purine metabolism exacerbating colitis in mice." Science Translational Medicine 9(380).
2. Cox, J. E., et al. (2017). "Metabolomic Studies in Drosophila." Genetics 206(3): 1169-1185.
3. Diakos, N. A., et al. (2016). "Evidence of Glycolysis Up-Regulation and Pyruvate Mitochondrial Oxidation Mismatch During Mechanical Unloading of the Failing Human Heart: Implications for Cardiac Reloading and Conditioning." JACC: Basic to Translational Science 1(6): 432-444.
4. Li, H., et al. (2017). "Drosophila larvae synthesize the putative oncometabolite L-2-hydroxyglutarate during normal developmental growth." Proc Natl Acad Sci U S A 114(6): 1353-1358.
5. McClelland, E. E., et al. (2016). "A Small Protein Associated with Fungal Energy Metabolism Affects the Virulence of Cryptococcus neoformans in Mammals." PLoS Pathog 12(9): e1005849.
6. Robinson, G. L., et al. (2016). "In vitro visualization and characterization of wild type and mutant IDH homo- and heterodimers using Bimolecular Fluorescence Complementation." Cancer Res Front 2(2): 311-329.
7. Schell, J. C., et al. (2017). "Control of intestinal stem cell function and proliferation by mitochondrial pyruvate metabolism." Nat Cell Biol 19(9): 1027-1036.
8. Shen, Z., et al. (2017). "Enforcement of developmental lineage specificity by transcription factor Oct1." Elife 6.

Mutation Generation & Detection Facility

Return to Table of Contents

Overview

The Mutation Generation & Detection (MGD) Core Facility specializes in providing customized Engineered DNA Nucleases in either the TALEN or CRISPR-Cas9 formats. These DNA Nucleases are cutting edge technologies used to perform targeted genomic engineering that modifies a specific genomic region of interest. The system works 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. In the last year, the MGD Core has also become a member of the Utah Center for Iron and Heme Disorders.

Main 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
- 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 HRMA genotyping in *D. rerio*, *D. melanogaster*, and mouse embryos
- Production of transgenic *D. rerio* using CRISPR reagents

Equipment

- BioFire LightScanner
- 3X Eppendorf Mastercycler ProS
- Eppendorf Centrifuge 5430
- 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
- 2X Eppendorf 5424 Microcentrifuges
- 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

Personnel

- Timothy Dahlem, Ph.D., Director
- Trang Satterlee, Lab Technician

New Equipment

- NapCo Model 6300 CO2 Incubator
- ThermoFisher TSX600 -80C Freezer
- Sorvall RT 6300 Centrifuge

New Services

The MGD Core has developed two new services within the last fiscal year, while also continuing to expanded the functionality of its current services by constructing new unique Crispr expression constructs. The MGD Core has also acquired reagents useful to the production of transgenic *D. melanogaster* organisms.

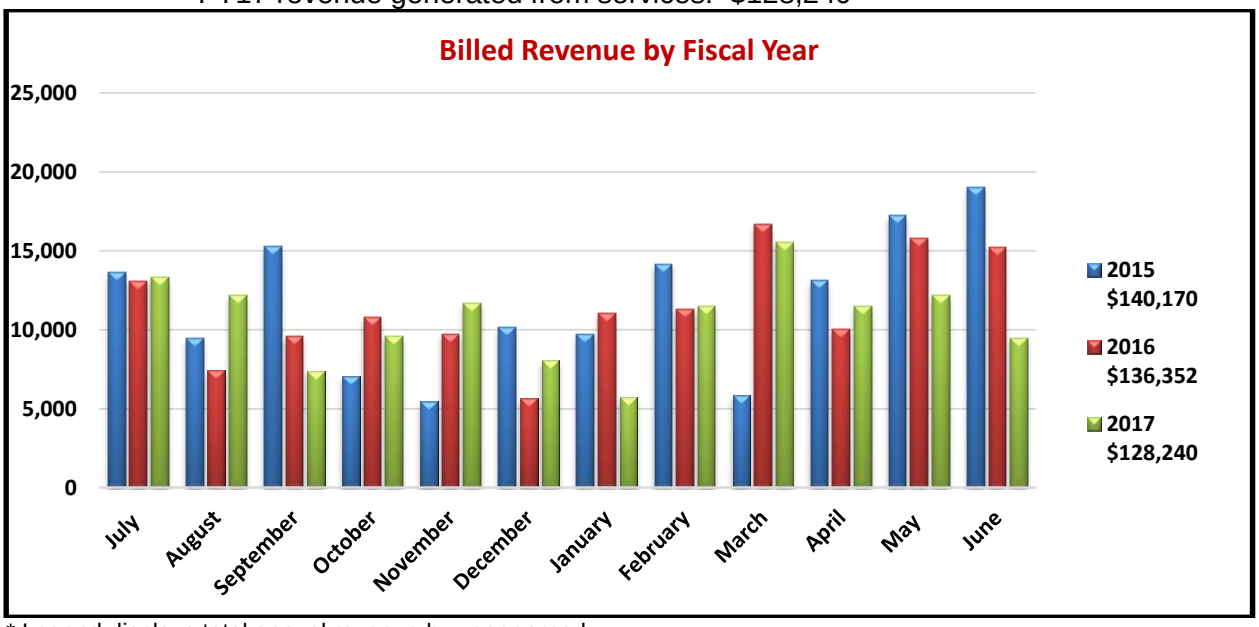
- Production of Long ssDNA donors
- Production of Crispr sgRNA RNA
- H1 2XsgRNA CrisprLentiviral construct
- Mixed H1_U6 2XsgRNA CrisprLentiviral construct
- Crispr Transfection Reagents with mCherry marker gene
- Crispr Transfection Reagents with Blasticidin selection gene

Revenue/Expenses

FY17 Expenses: **Total $168,688**

FY17 Revenue: **Total $143,240**

- VP of Health Sciences Support: $15,000
- FY17 revenue generated from services: $128,240



* Legend displays total annual revenue by year earned.

Advisory Board Committee

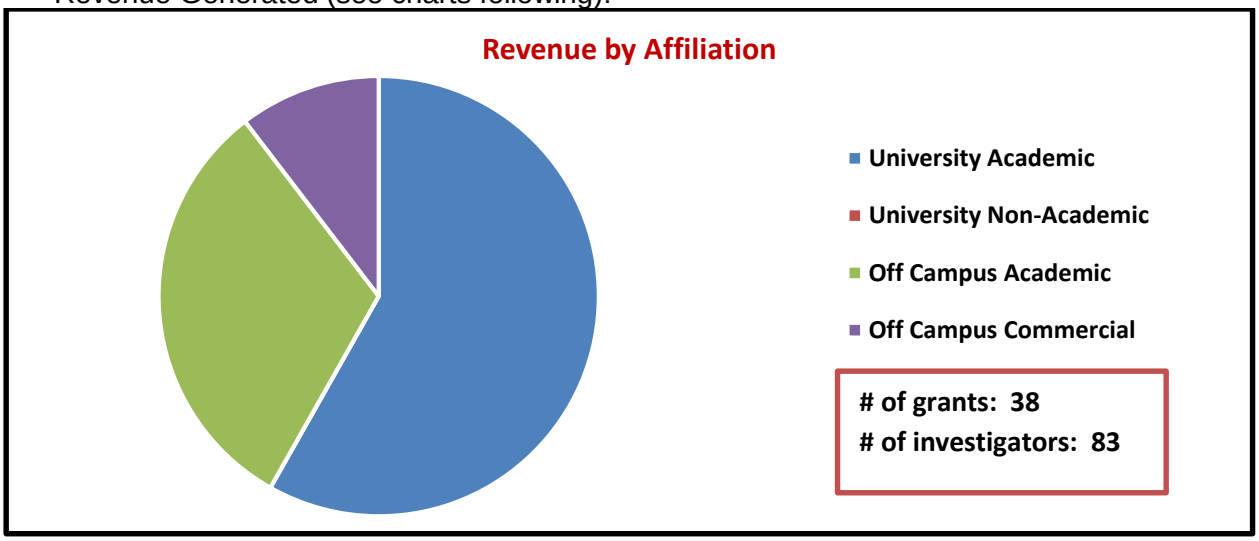
Last meeting date: September 9, 2016.

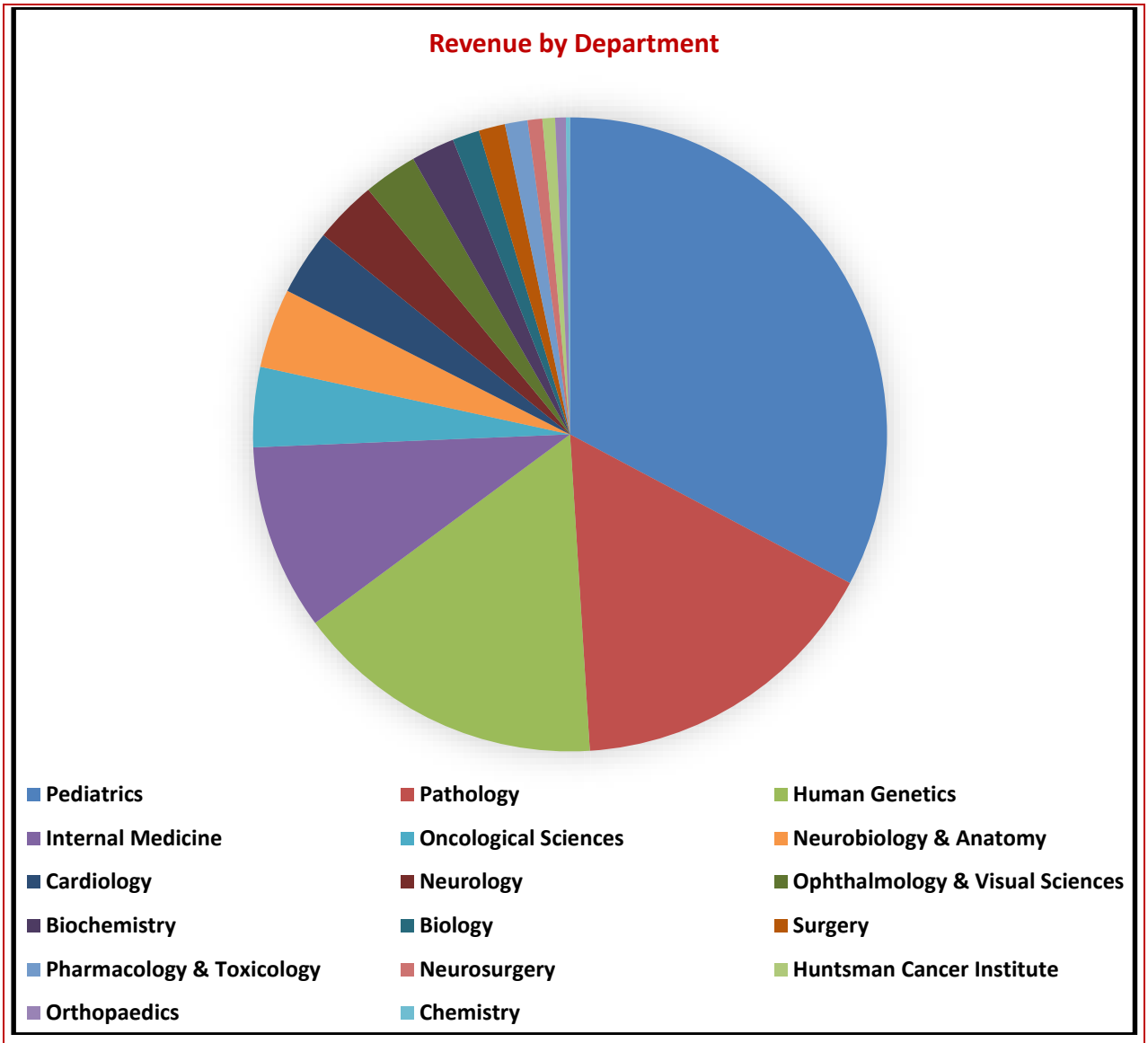
- David Grunwald, Department of Human Genetics (Senior Faculty Advisor)
- Dana Carroll, Department of Biochemistry
- Ryan O'Connell, Department of Pathology
- Lewis Charles Murtaugh, Department of Human Genetics

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Bonkowsky, Josh	NIH
2	Weizmann Institute of Science	Off Campus Academic
3	Evason, Kimberley	NIH
4	Knudra Transgenics	Off Campus
5	Grunwald, David	NIH
6	Ohio State University	Off Campus Academic
7	Kwan, Kristen	NIH, NEH
8	Georgetown University	Off Campus Academic
9	Harvard University	Off Campus Academic
10	Tel Aviv University	Off Campus Academic

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 has covered 5% of the MGD Core Director's salary requirements for the first six months of FY'17 and 3% of the MGD Core Director's salary requirements for the last six months of FY'17

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). Due to the MGD Core's membership in the 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 FY17.

DNA Peptide Facility

The MGD Core spent $9583.92 with the DNA/Peptide Synthesis Core in FY17.

Mouse Transgenic Facility

The MGD Core's partnership with the Mouse Transgenic Facility to produce transgenic mouse models has directly brought in 29 different projects to the Mouse Transgenic Facility totaling at least $72,750 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 for 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.

Publications

1. Appel, E., et al. (2016). "An ensemble of regulatory elements controls Runx3 spatiotemporal expression in subsets of dorsal root ganglia proprioceptive neurons." Genes & development 30(23): 2607-2622.
2. Gorelik, A., et al. (2017). "Developmental activities of the complement pathway in migrating neurons." Nature Communications 8: 15096.
3. Gorelik, A., et al. (2017). "Serping1/C1 Inhibitor Affects Cortical Development in a Cell Autonomous and Non-cell Autonomous Manner." Frontiers in Cellular Neuroscience 11: 169.
4. Moore, J. C., et al. (2016). "Single-cell imaging of normal and malignant cell engraftment into optically clear prkdc-null SCID zebrafish." The Journal of Experimental Medicine 213(12): 2575-2589.
5. Shin, C. H., et al. (2017). "HBEGF promotes gliomagenesis in the context of Ink4a/Arf and Pten loss." Oncogene 36(32): 4610-4618.
6. Shin, C. H., et al. (2017). "HBEGF promotes gliomagenesis in the context of Ink4a/Arf and Pten loss." Oncogene 36(32): 4610-4618.
7. Wallace, J. A., et al. (2017). "miR-155 promotes FLT3-ITD–induced myeloproliferative disease through inhibition of the interferon response." Blood 129(23): 3074-3086.

Letters of Support

Written and provided to faculty for support of grant applications:

1. LOS for Dr. Josh Bonkowsky R21 proposal: "Translatomics of EIF2B in Myelin Development and Disease " September 2016
2. LOS for Dr. Josh Bonkowsky R21 proposal: “Development and Validation of a Zebrafish Model for Vanishing White Matter Disease.” Febuary 2017
3. LOS for Dr. Josh Bonkowsky R01 proposal: “Mechanisms of Dopamine in Neuromotor Development.” June 2017
4. LOS for Dr. Harry A. Dailey, May 2017
5. LOS for Dr. Kimberley Evason ACS Research Scholar Grant: “Serotonergic antidepressants as liver tumor preventives” October 2016
6. LOS for Dr. Kimberley Evason NIH/NCI Grant: “Serotonergic antidepressants as liver tumor preventives” January 2017
7. LOS for Dr. Kimberley Evason NIH/NIDDK Research Project Grant: “Serotonin signaling in liver development and regeneration” January 2017
8. LOS for Dr. Kimberley Evason ACS Research Scholar Grant: “Serotonergic antidepressants as liver tumor preventives” March 2017
9. LOS for Dr. Kimberley Evason 2017 V Foundation Scholar Award, May 2017
10. LOS for Dr. Anne Moon proposal: “Role of the CAPERα/MLL1 coactivator in breast cancer”. September 2016
11. LOS for Dr. Anne Moon proposal: “Role of the CAPERα/MLL1 coactivator in breast cancer”. September 2016
12. LOS for Dr. Matt Mulvey R01 proposal. October 2016
13. LOS for Dr. Sungjin Park. September 2016
14. LOS for Dr. Sungjin Park. February 2017
15. LOS for Dr. Josef Prchal. May 2017
16. LOS for Dr. Dean Tantin RO1 proposal, “Role of transcription coactivator OCA-B in gene poising and immunological memory.” October 2016

Active Grant Support of Mutation Generation & Detection

Associated with the UofU CZAR Core Facility 2017

PD/PI	Grant Title	Funding Source	Annual Amount of Direct Cost Funding
Phillips	Center for Iron and Heme Disorders (CIHD)	NIDDK Cooperative Hematology Specialized Core Centers	$4,190,184
Evason	Serotonergic antidepressants as liver tumor preventives	NIH/NCI	$1,904,175
Evason	Serotonin signaling in liver development and regeneration	NIH/NIDDK	$1,904,175
Evason	Serotonergic antidepressants as liver tumor preventives	American Cancer Society	$792,000
Bonkowsky	Mechanisms of Dopamine in Neuromotor Development	NIH	$1,906,020
Bonkowsky	Translatomics of EIF2B in Myelin Development and Disease	NIH	$419,002
Bonkowsky	Development and Validation of a Zebrafish Model for Vanishing White Matter Disease	IGNITE	$1,140,306
Bonkowsky	Genetic Tools to Dissect Connectivity Mechanisms in the Developing and Hypoxic CNS	NIH	$1,905,628
Park	Signaling mechanism for synapse formation and function regulated by the release of GPI-anchored synaptogenic factors from astrocytes	NIH/NINDS	$1,657,030
Park	Role of GPI-anchorage in the formation of the Tectorial membrane	NIH/ NIDCD	$836,260
		Total Current Grants, Annual Direct Costs:	**$16,654,780**

Nuclear Magnetic Resonance Core Facility

Return to Table of Contents

Overview

This core facility provides NMR services for the University of Utah research community, other academic institutions, and for-profit companies. We provide access to five 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 cryogenic HCN probes. The 800 and 900 are state-of-art NMR consoles while the 400, 500, and 600 are older but still fully capable of recording all NMR experiments. We have multiple off-line Linux workstations dedicated for data processing and analysis located in the SBCC in the department of biochemistry. We also have full member access to SBGrid; (www.sbgrid.org) that provides updated software for NMR data processing, analysis, and structure calculation.

Our staff has substantial experience characterizing small molecules, natural products, nucleic acids, carbohydrates, and proteins using NMR spectroscopy. The business model for this core is user-driven 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 when demand warrants. On a limited basis we also provide a fee for NMR service model.

Services

- NMR data collection and analysis with/without staff collaboration
- 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
- Jay Olsen, NMR Technician; 35+ years solution state NMR experience

2017 Annual Update

New Equipment

- New LINUX Centos operating system for NMR workstations; VnmrJ4A software upgrade
- Rm 50 BPRB Facility remodeled; 10 Gigabit Ethernet installed (500 and 600)
- New CCC cold head for HCN cryogenic probe installed (600)

New Services

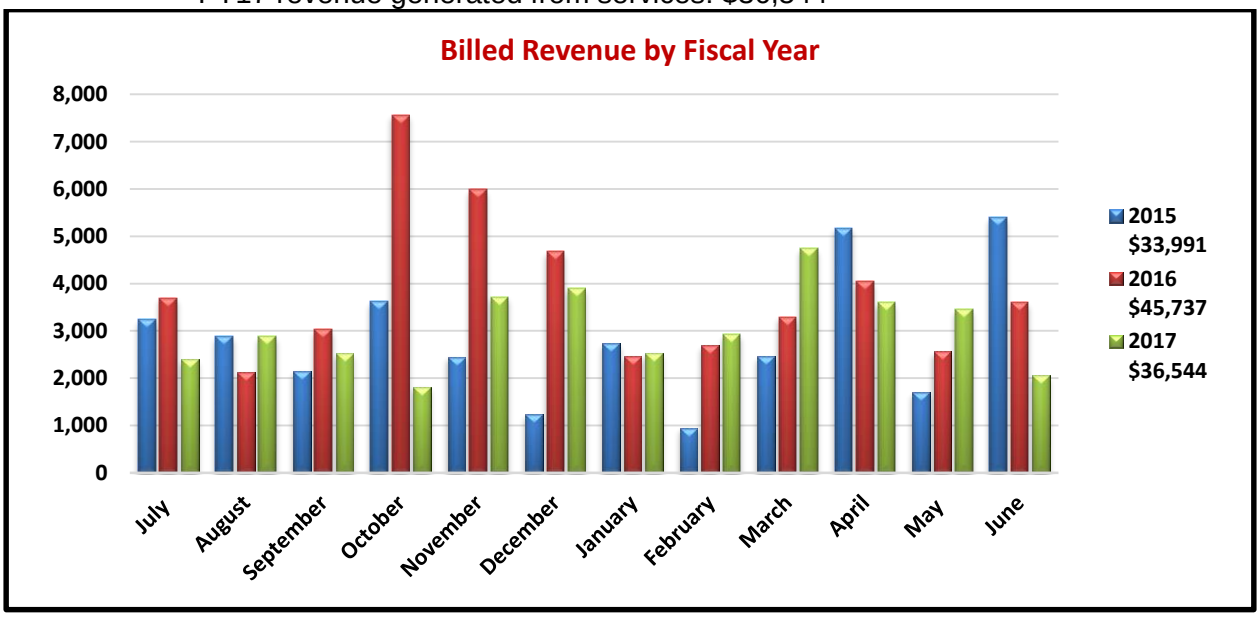
- The NMR Facility did not implement additional services in FY17

Revenues/Expenses

FY17 Expenses: **Total $129,527**

FY17 Revenue: **Total $136,544**

- VP of Health Sciences Support: $100,000
- FY17 revenue generated from services: $36,544



* Legend displays total annual revenue by year earned.

Advisory Board Committee

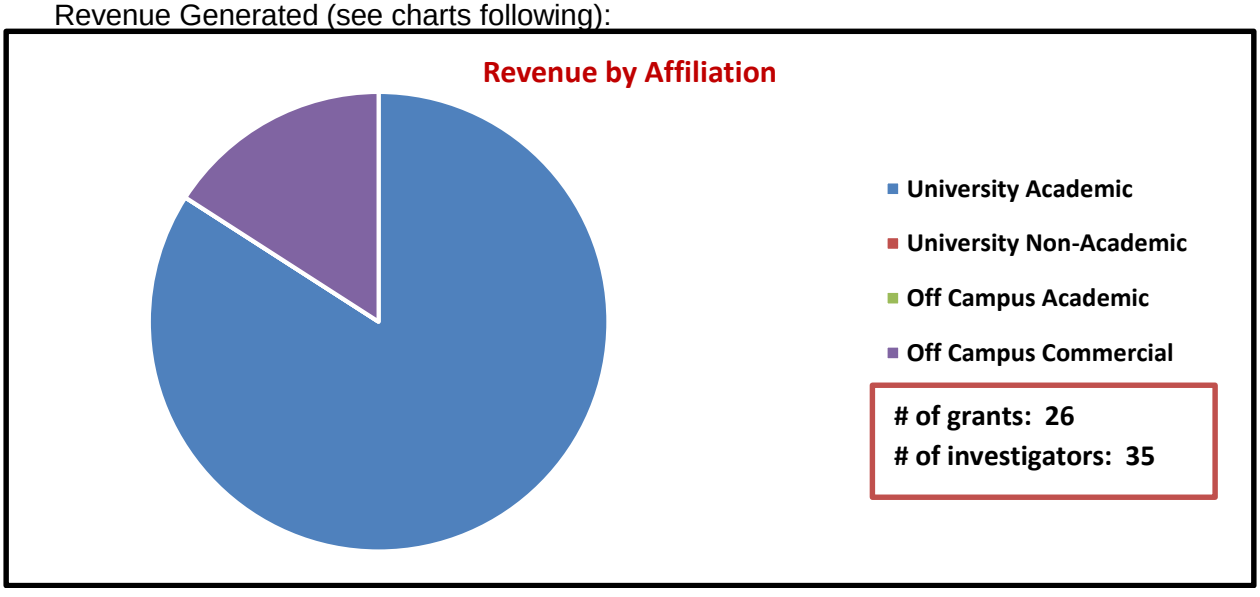
Last updates: June/July 2017.

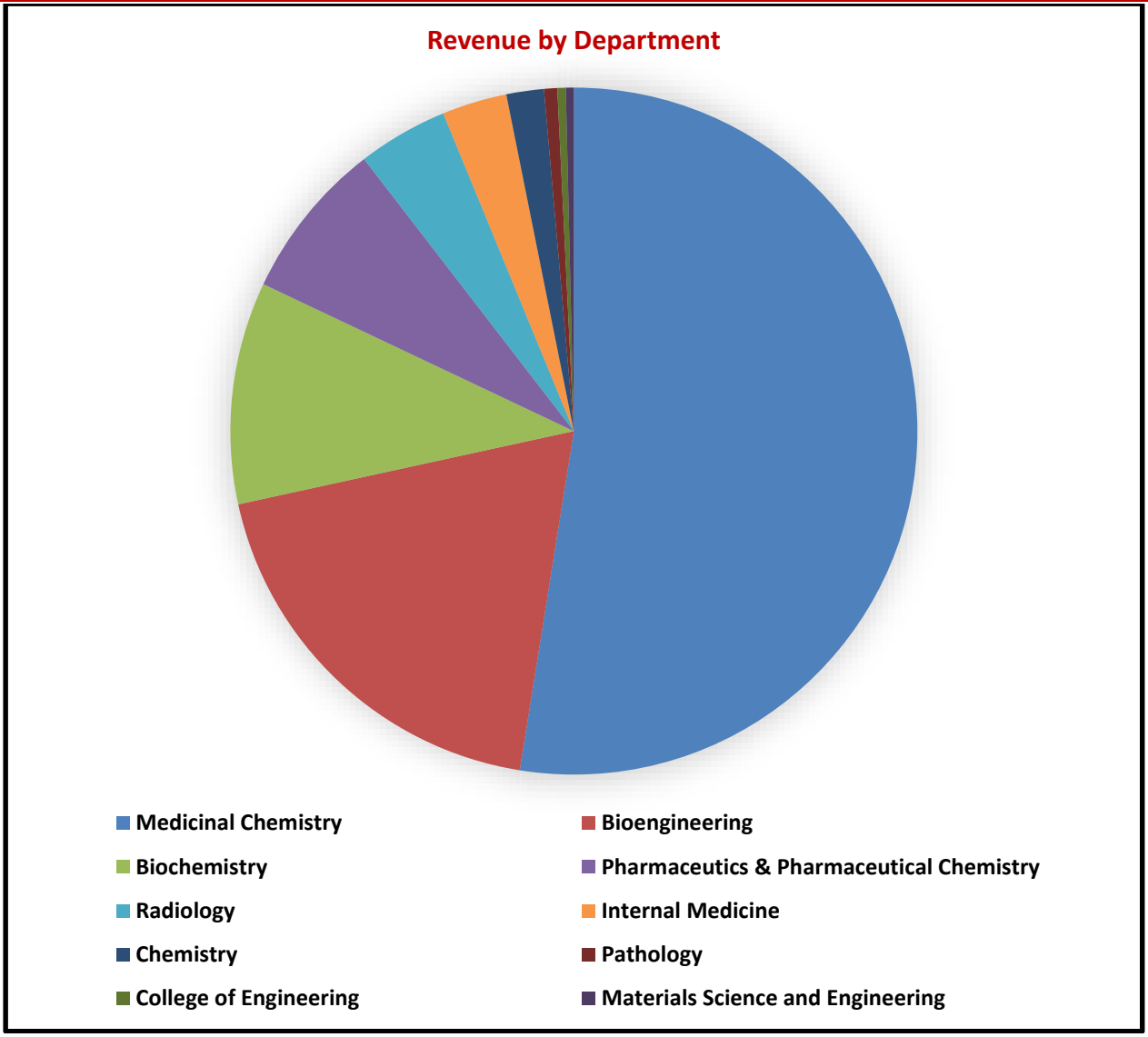
- Darrell Davis, Professor, College of Pharmacy
- Wesley Sundquist, Professor, Department of Biochemistry
- Eric Schmidt, Professor, College of Pharmacy

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Sundquist, Wesley I	NIH, DHHS, Department
2	Schmidt, Eric	NIH, Department
3	Franzini, Raphael	Department, USTAR
4	Winter, Jaclyn	Department
5	Foldax	Off Campus
6	Balchem Corporation	Off Campus
7	Prestwich, Glenn	Department
8	Wang, Xuli	NIH, Army Medical Research Acquisition
9	Chou, Hung-Chieh	American diabetes Association, Juvenile Diabetes Research Foundation
10	Ghandehari, Hamidreza	NIH

Publications

1. Xu, M., Tu, J., and Franzini, R. M. (2017) Rapid and efficient tetrazine-induced drug release from highly stable benzonorbornadiene derivatives, *Chem Commun (Camb) 53*, 6271-6274.
2. Wu, N., Zhang, Y., Wang, C., Slattum, P. M., Yang, X., and Zang, L. (2017) Thermoactivated Electrical Conductivity in Perylene Diimide Nanofiber Materials, *J Phys Chem Lett 8*, 292-298.
3. Wu, G., Nielson, J. R., Peterson, R. T., and Winter, J. M. (2017) Bonnevillamides, Linear Heptapeptides Isolated from a Great Salt Lake-Derived Streptomyces sp, *Mar Drugs 15*.
4. Wang, Y., Bruno, B. J., Cornillie, S., Nogieira, J. M., Chen, D., Cheatham, T. E., 3rd, Lim, C. S., and Chou, D. H. (2017) Application of Thiol-yne/Thiol-ene Reactions for Peptide and Protein Macrocyclizations, *Chemistry 23*, 7087-7092.
5. Sardar, D., Hao, Y., Lin, Z., Morita, M., Nair, S. K., and Schmidt, E. W. (2017) Enzymatic N- and C-Protection in Cyanobactin RiPP Natural Products, *J Am Chem Soc 139*, 2884-2887.
6. Peng, Y., Hansen, A. L., Bruschweiler-Li, L., Davulcu, O., Skalicky, J. J., Chapman, M. S., and Bruschweiler, R. (2017) The Michaelis Complex of Arginine Kinase Samples the Transition State at a Frequency That Matches the Catalytic Rate, *J Am Chem Soc 139*, 4846-4853.
7. Lane, D. D., Fessler, A. K., Goo, S., Williams, D. L., and Stewart, R. J. (2017) Sustained tobramycin release from polyphosphate double network hydrogels, *Acta Biomater 50*, 484-492.
8. Davulcu, O., Peng, Y., Bruschweiler, R., Skalicky, J. J., and Chapman, M. S. (2017) Elevated mus-ms timescale backbone dynamics in the transition state analog form of arginine kinase, *J Struct Biol*.
9. Currie, S. L., Lau, D. K. W., Doane, J. J., Whitby, F. G., Okon, M., McIntosh, L. P., and Graves, B. J. (2017) Structured and disordered regions cooperatively mediate DNA-binding autoinhibition of ETS factors ETV1, ETV4 and ETV5, *Nucleic Acids Res 45*, 2223-2241.
10. Chen, D., Disotuar, M. M., Xiong, X., Wang, Y., and Chou, D. H. (2017) Selective N-terminal functionalization of native peptides and proteins, *Chem Sci 8*, 2717-2722.
11. Biswas, S., McCullough, B. S., Ma, E. S., LaJoie, D., Russell, C. W., Garrett Brown, D., Round, J. L., Ullman, K. S., Mulvey, M. A., and Barrios, A. M. (2017) Dual colorimetric and fluorogenic probes for visualizing tyrosine phosphatase activity, *Chem Commun (Camb) 53*, 2233-2236.
12. Zhang, L., Zhang, R., Yang, J., Wang, J., and Kopecek, J. (2016) Indium-based and iodine-based labeling of HPMA copolymer-epirubicin conjugates: Impact of structure on the in vivo fate, *J Control Release 235*, 306-318.
13. Wu, N., Wang, C., Bunes, B. R., Zhang, Y., Slattum, P. M., Yang, X., and Zang, L. (2016) Chemical Self-Doping of Organic Nanoribbons for High Conductivity and Potential Application as Chemiresistive Sensor, *ACS Appl Mater Interfaces 8*, 12360-12368.
14. Won, Y. W., Ankone, M., Engbersen, J. F., Feijen, J., and Kim, S. W. (2016) Poly(Amido Amine)s Containing Agmatine and Butanol Side Chains as Efficient Gene Carriers, *Macromol Biosci 16*, 619-626.
15. Tianero, M. D., Pierce, E., Raghuraman, S., Sardar, D., McIntosh, J. A., Heemstra, J. R., Schonrock, Z., Covington, B. C., Maschek, J. A., Cox, J. E., Bachmann, B. O., Olivera, B. M., Ruffner, D. E., and Schmidt, E. W. (2016) Metabolic model for diversity-generating biosynthesis, *Proc Natl Acad Sci U S A 113*, 1772-1777.
16. Ryskamp, D. A., Frye, A. M., Phuong, T. T., Yarishkin, O., Jo, A. O., Xu, Y., Lakk, M., Iuso, A., Redmon, S. N., Ambati, B., Hageman, G., Prestwich, G. D., Torrejon, K. Y., and Krizaj, D. (2016) TRPV4 regulates calcium homeostasis, cytoskeletal remodeling, conventional outflow and intraocular pressure in the mammalian eye, *Sci Rep 6*, 30583.
17. Ramamoorthy, G., Phan, R. M., and Poulter, C. D. (2016) Synthesis and Enzymatic Studies of Isoprenoid Thiolo Bisubstrate Analogues, *J Org Chem 81*, 5093-5100.
18. Neti, S. S., and Poulter, C. D. (2016) Site-Selective Synthesis of (15)N- and (13)C-Enriched Flavin Mononucleotide Coenzyme Isotopologues, *J Org Chem 81*, 5087-5092.
19. Bergonzo, C., Hall, K. B., and Cheatham, T. E., 3rd. (2016) Divalent Ion Dependent Conformational Changes in an RNA Stem-Loop Observed by Molecular Dynamics, *J Chem Theory Comput*.
20. Ashton, N. N., Pan, H., and Stewart, R. J. (2016) Connecting caddisworm silk structure and mechanical properties: combined infrared spectroscopy and mechanical analysis, *Open Biol 6*.

Small Animal Imaging Facility

Return to Table of Contents

Overview

The 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 Small Animal 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 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 Multimodality 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

2017 Annual Update

New Equipment

No major equipment was added in FY17

New Services

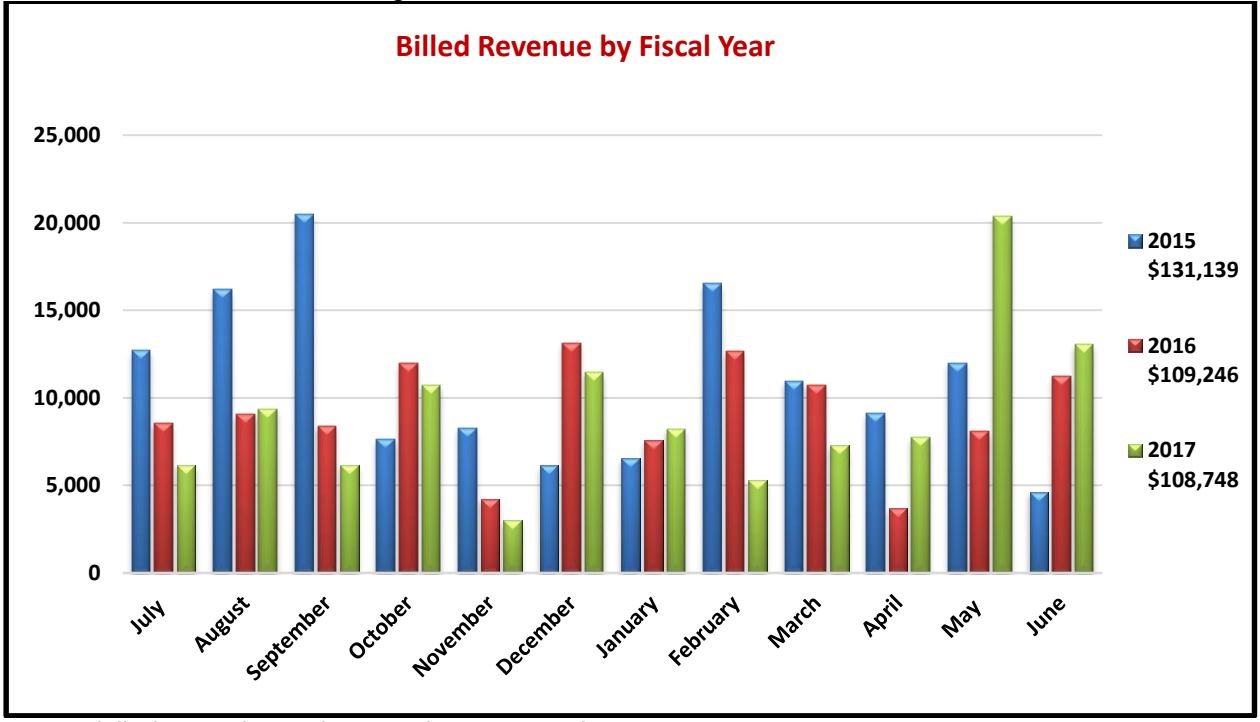
No major new service was added in FY17.

Revenue/Expenses

FY17 Expenses: **Total $244,183**

FY17 Revenue: **Total $296,748**

- VP of Health Sciences Support: $50,000
- VP of Research Support: $100,000, (RIF) $38,000 (Spectral Camera ASM)
- FY17 revenue generated from services: $108,748



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

Advisory Board Committee

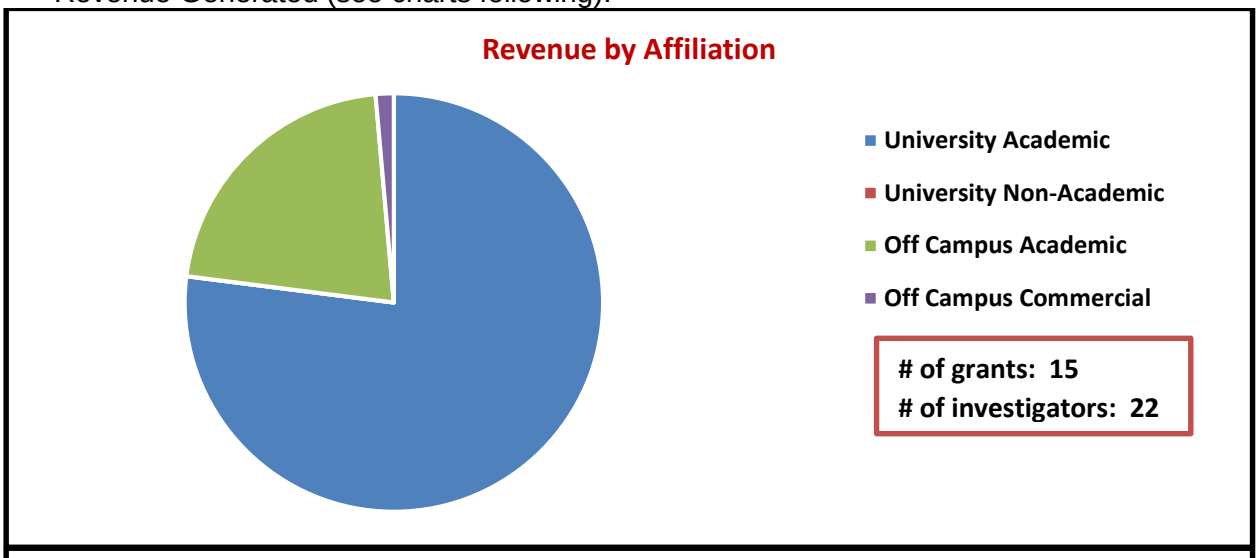
Last meeting date: September 21, 2015.

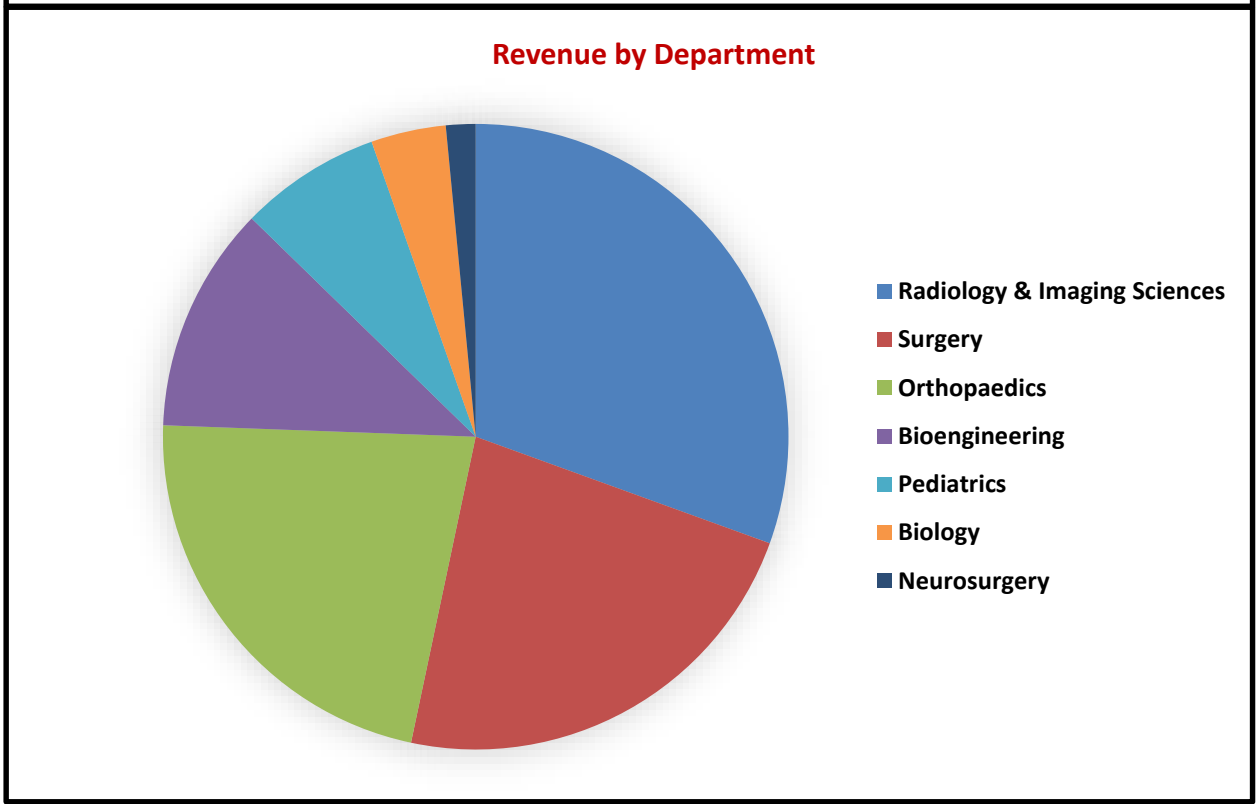
- Rob MacLeod, Professor, Bioengineering/SCI/CVRTI
- John Phillips, Research Associate Professor, Hematology
- Roger Van Andel, Director, Office of Comparative Medicine
- Edward DiBella, Professor, Radiology
- Donna Cross, Associate Professor, Radiology

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Idaho State University	Off Campus Academic
2	Jones, Kevin	4Nathalie, Clementia Pharmaceuticals, Cure Childhood Cancer Association
3	Homen, Sheri	NIH
4	Cross, Donna	Department
5	McNally, Joseph	Radiological Society of North America
6	Ranjan, Ravi	NIH
7	Hsu, Edward	Department
8	Shapiro, Michael	NSF
9	Korenberg, Julie	NIH
10	Alt, Jeremiah	University of Utah Research Foundation

Publications

1. Aojula, A. *et al.* Diffusion tensor imaging with direct cytopathological validation: characterisation of decorin treatment in experimental juvenile communicating hydrocephalus. *Fluids Barriers CNS Fluids and Barriers of the CNS* 13, (2016).
2. Bogdanov, V. B. *et al.* Susceptibility of Primary Sensory Cortex to Spreading Depolarizations. *Journal of Neuroscience* 36, 4733–4743 (2016).
3. Gignac, P. M. *et al.* Diffusible iodine-based contrast-enhanced computed tomography (diceCT): an emerging tool for rapid, high-resolution, 3-D imaging of metazoan soft tissues. *J. Anat. Journal of Anatomy* 228, 889–909 (2016)..
4. Merchant, S. S., Gomez, A. D., Morgan, J. L. & Hsu, E. W. Parametric Modeling of the Mouse Left Ventricular Myocardial Fiber Structure. *Annals of Biomedical Engineering Ann Biomed Eng* 44, 2661–2673 (2016).
5. Merchant, S. S., Kosaka, Y., Yost, H. J., Hsu, E. W. & Brunelli, L. Micro-Computed Tomography for the Quantitative 3-Dimensional Assessment of the Compact Myocardium in the Mouse Embryo. *Circulation Journal Circ J* 80, 1795–1803 (2016).
6. Winters, A. A. *et al.* Evaluation of Multiple Biological Therapies for Ischemic Cardiac Disease. *Cell Transplantation cell transplant* 25, 1591–1607 (2016).
7. Sun, C.-Y. *et al.* Assessment of the Characteristics of Orientation Distribution Functions in HARDI Using Morphological Metrics. *PLOS ONE PLoS ONE* 11, (2016).

Small Animal Ultrasound Facility

Return to Table of Contents

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

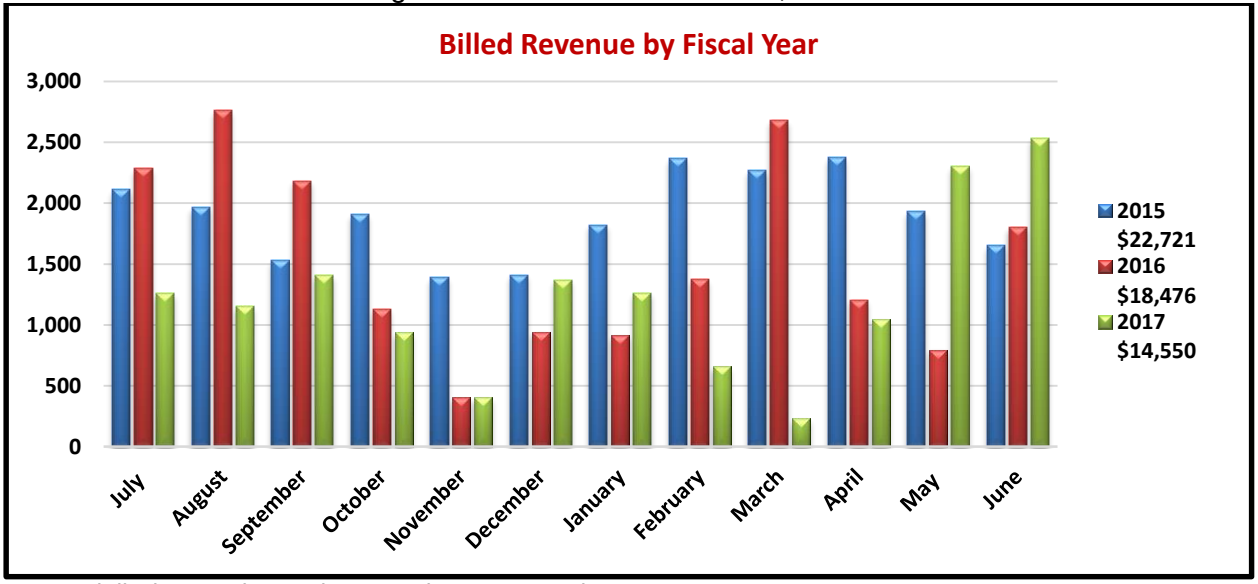
2017 Annual Update

Revenue/Expenses

FY17 Expenses: **Total $26,494**

FY17 Revenue: **Total $24,550**

- VP of Health Sciences Support: $10,000
- FY17 revenue generated from services: $14,550



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

Advisory Board Committee

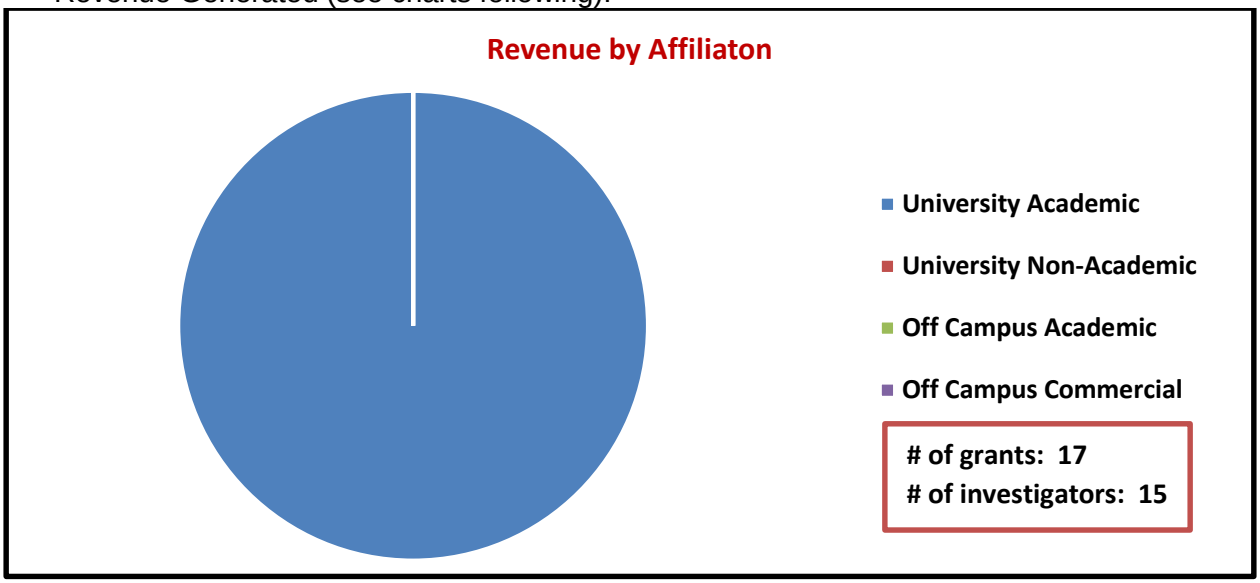
Last meeting date: April 15, 2013.

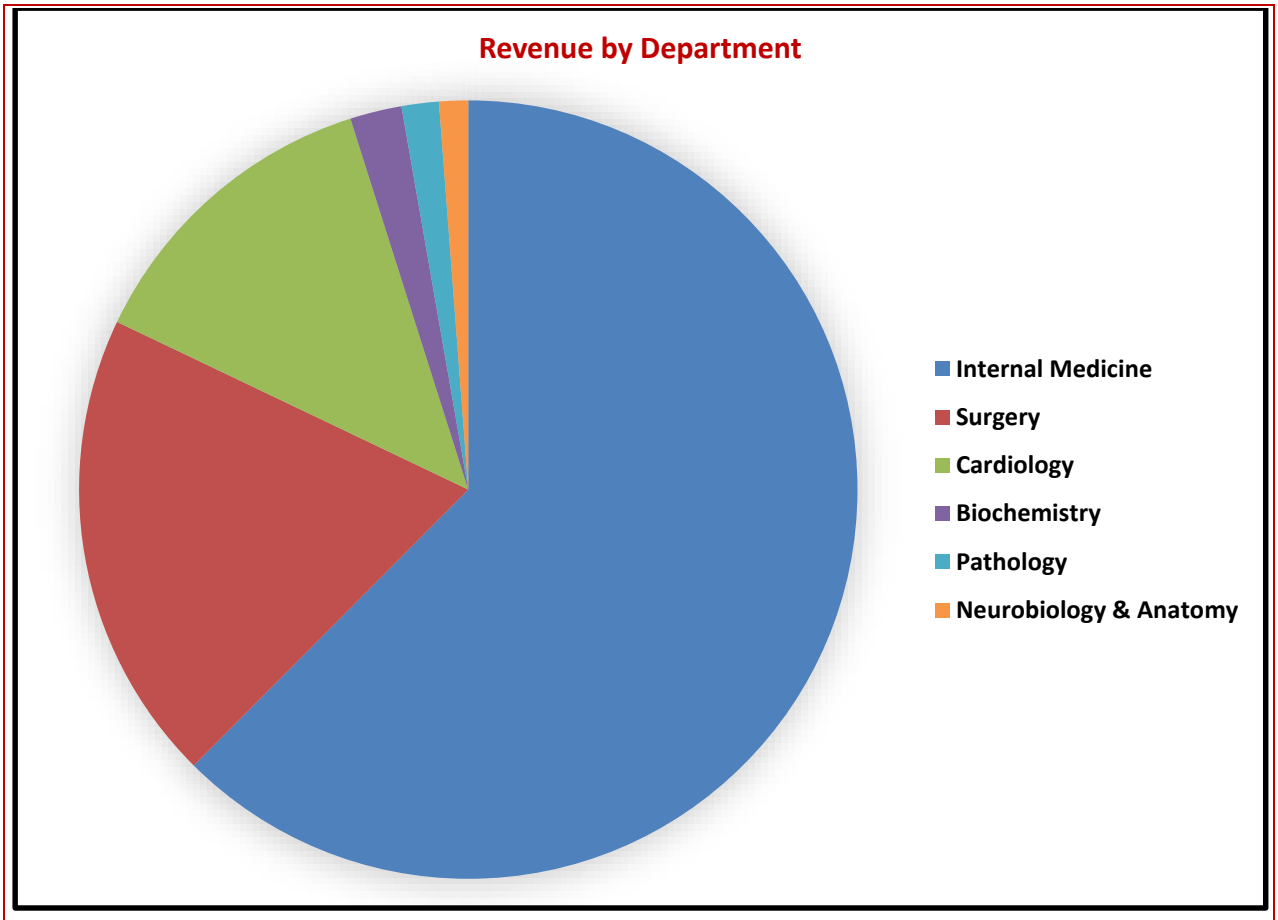
- Andy Weyrich, Associate Dean for Basic and Translational Sciences
- Craig Selzman, Associate Professor, Cardiothoracic Surgery
- Brent Wilson, Assistant Professor, Cardiology

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





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

1. Franklin, Sarah., *et al*. The chromatin-binding protein Smyd1 restricts adult mammalian heart growth. *American Journal of Physiology* 311**,** H1234-H1247 (2016).
2. Machin, D. R., Leary, M. E., He, Y., Shiu, Y. T., Tanaka, H., Donato, A. J. Ultrasound Assessment of Flow-Mediated Dilation of the Brachial and Superficial Femoral Arteries in Rats. *J. Vis. Exp.* (117), e54762, doi:10.3791/54762 (2016).

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.

Genetics Science Learning Center

Return to Table of Contents

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 lay public, students at the K-12 and higher education levels, and K-12 teachers. They successfully collaborate with faculty and others in producing materials for both large and small projects.

The GSLC's team is unique among groups at 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

The GSLC offers the following 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, Speciality Media Coordinator
- Heather Coulter, MEd, Community Liaison
- Dina Drits-Esser, PhD, Senior Research Associate
- 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
- Steve Reest, BS, Program Assistant
- Harmony Starr, BS, Media Production Manager

FY17 Annual Update

New Services

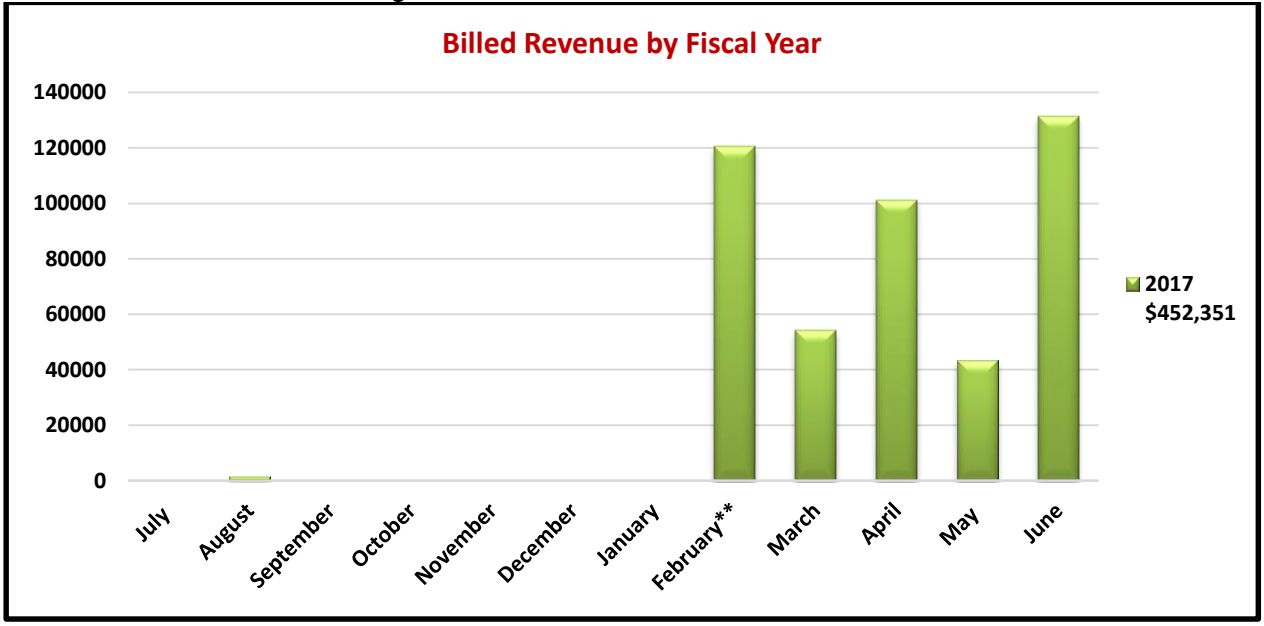
No new services for FY17

Revenue/Expenses

FY17 Expenses: **$504,284**

FY17 Revenue: **$452,351**

- VP of Research Support: $0
- FY17 revenue generated from services: $452,351



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

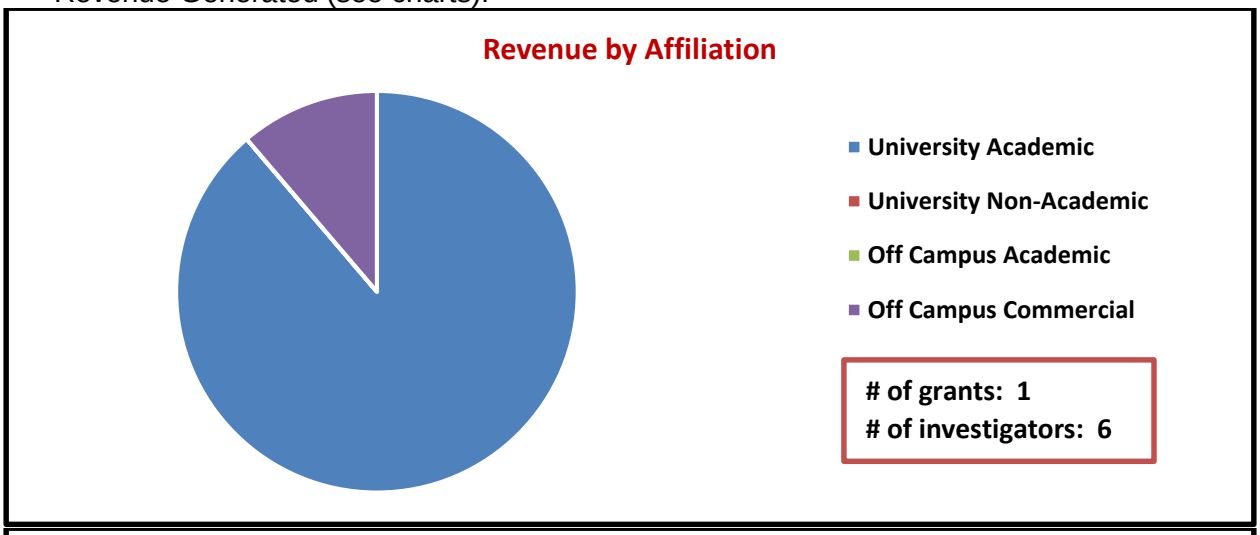
Management Meeting
Last meeting date: September 27, 2017

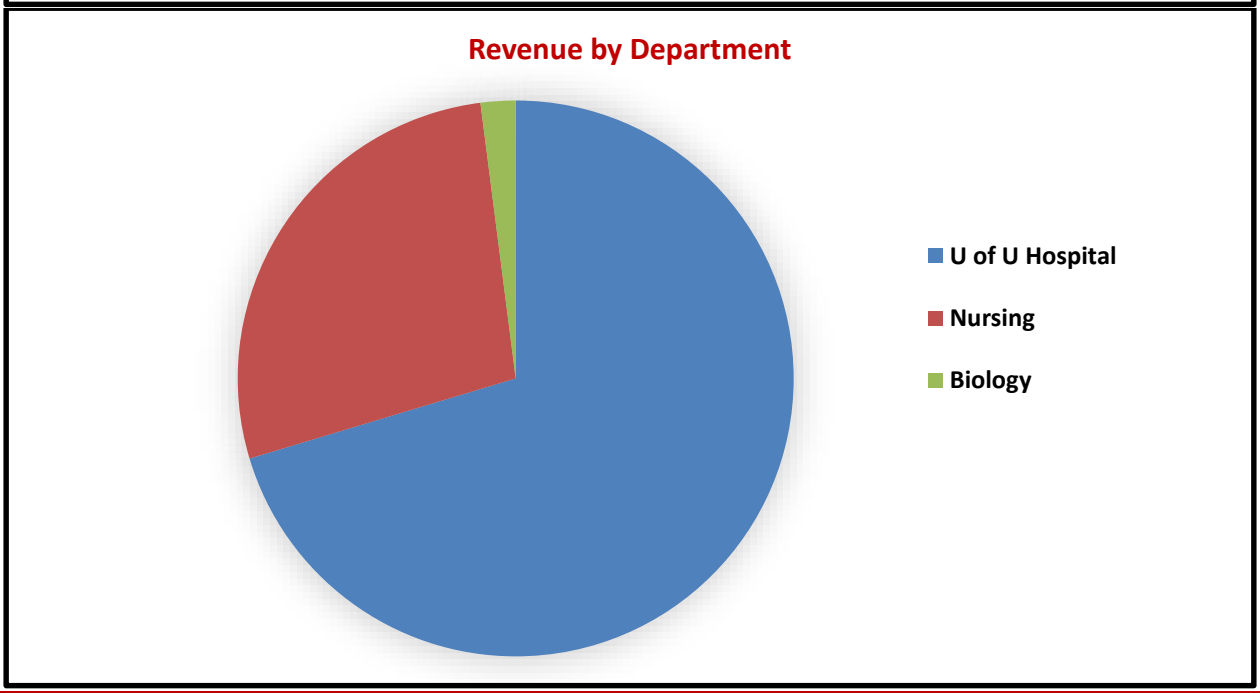
- Louisa Stark, PhD, GSLC Director
- Kevin Pompei, MEd, Administrative Director
- John Phillips, PhD, HSC Core Research Facility, Director
- Brenda Smith, Associate Director, Accounting and Finance, HSC Core Research Facility Operations
- Cynthia Best, MBA, Associate Dean, SOM Finance
- Amy Tanner, Director, Research & Science, SVPHS Research Unit
- Wendy Kwan, Associate Director, Training & Development SOM Finance
- Natalie Johnson, Manager, Administration, Department of Human Genetics

FY17 Scientific Impact

Research Support

Revenue Generated (see charts):





Top Users

1	Patterson, Brittany	Department
2	Rothwell, Erin	NIH
3	Clyne, Rosemary	Off Campus Academic
4	Rossi, Hugo	Department
5	Clark, Richard	NSF
6	Bintz, Jody	Biological Sciences Curriculum Study

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.

Publications

1. Bass, K. M., Drits-Esser, D., & Stark, L. A. (2016). A Primer for Developing Measures of Science Content Knowledge for Small-Scale Research and Instructional Use. *CBE-Life Sciences Education, 15*(2). doi:10.1187/cbe.15-07-0142
2. Botkin, J. R., Rothwell, E., Anderson, R. A., & et al. (2016). Prenatal education of parents about newborn screening and residual dried blood spots: A randomized clinical trial. *JAMA Pediatrics, 170*(6), 543-549. doi:10.1001/jamapediatrics.2015.4850
3. Hawkins, A. J. and L. A. Stark (2016). "Bringing Climate Change into the Life Science Classroom: Essentials, Impacts on Life, and Addressing Misconceptions." CBE-Life Sciences Education 15(2).
4. Drits-Esser, D., et al. (2017). "Examining the sustainability of teacher learning following a year-long science professional development programme for inservice primary school teachers." Professional Development in Education 43(3): 375-396.
5. Hawkins, A. J. and L. A. Stark (2017). "More Than Metaphor: Online Resources for Teaching Cancer Biology." CBE-Life Sciences Education 16(3).
6. Oerter, E., et al. (2017). "Every apple has a voice: using stable isotopes to teach about food sourcing and the water cycle." Hydrol. Earth Syst. Sci. 21(7): 3799-3810.

Educational Modules Published Online

1. Metabolism: From Food to Fuel:
   - http://learn.genetics.utah.edu/content/metabolism/
   - http://teach.genetics.utah.edu/content/metabolism/
2. Memory, Attention, and Distraction:
   - http://learn.genetics.utah.edu/content/memory/
   - http://teach.genetics.utah.edu/content/memory/
3. Precision Medicine:
   - http://learn.genetics.utah.edu/content/precision/
   - http://teach.genetics.utah.edu/content/precision/

Iron & Heme

Return to Table of Contents

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).

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 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 are offering the following services:

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

Equipment

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)

Metal Analysis:

- Agilent 7900-ICP mass spectrometer
- Agilent SPS4 autosampler

Personnel

- Laurie Jackson, Core Director
- Hector Bergonia, Lab Specialist Tetrapyrrole and Iron Biochemistry

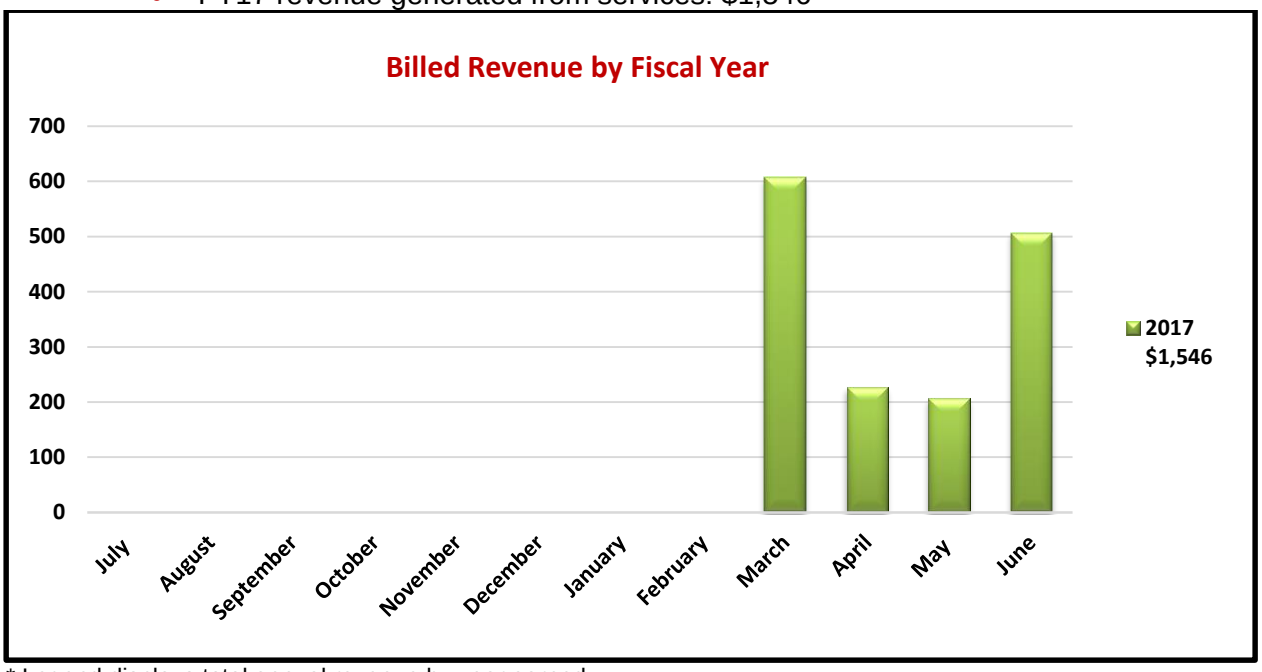
2017 Annual Update

Revenue/Expenses

FY17 Total Expenses: **$110**

FY17 Total Revenue: **$1,546**

- VP of Research Support: $0
- FY17 revenue generated from services: $1,546



* Legend displays total annual revenue by year earned.

Advisory Board Committee (CIHD Operations Committee)

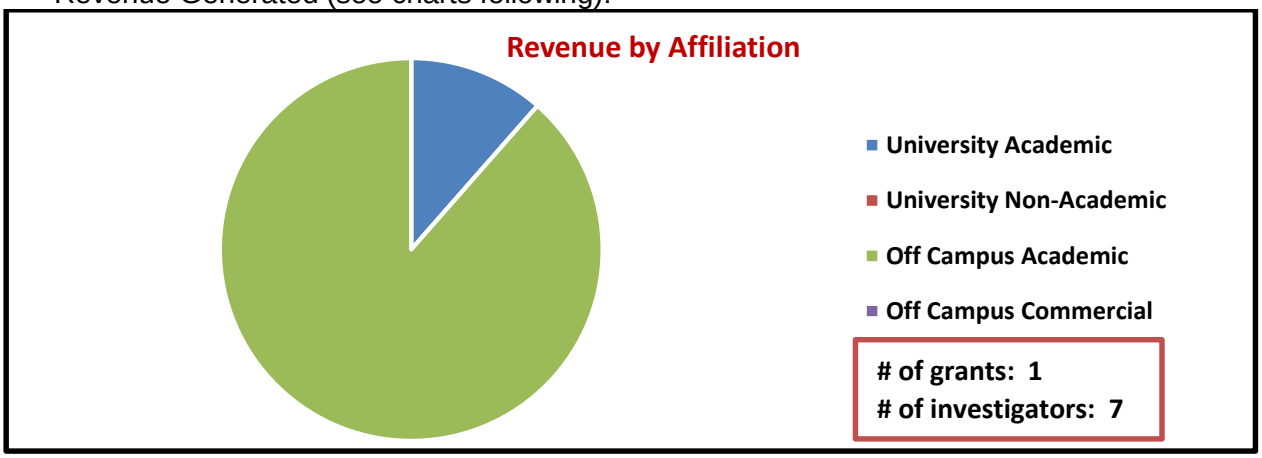
Last meeting date: October 4, 2017

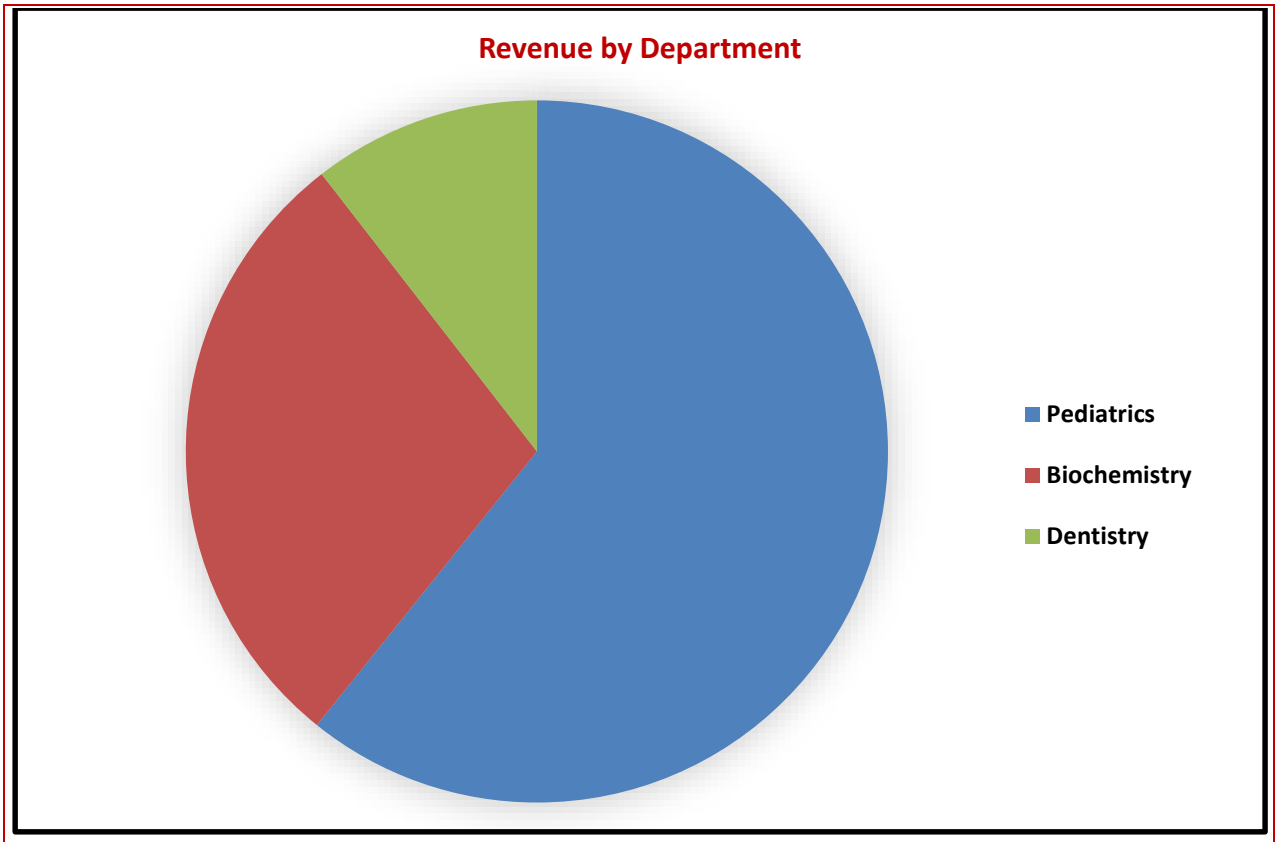
- John D. Phillips
- James Cox
- Diane M Ward
- Dennis Winge

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	University of Texas Southwestern	Off Campus Academic
2	University of Connecticut Health	Off Campus Academic
3	East Carolina University	Off Campus Academic
4	University of Wisconsin-Madison	Off Campus Academic
5	Engel, Michael	Department
6	Hughes, Adam	NIH
7	Weller, Melodie	Department

Goals for FY18

- Improve efficiency of workflow
- Increase awareness of our services

Publications

1. J. Chung et al. Erythropoietin signaling regulates heme biosynthesis (2017 May 29) eLIFE 6:e24767.
2. Seguin et al. Reductions in the mitochondrial ABC transporter Abcb10 affect the transcriptional profile of heme biosynthesis genes (2017 August 14) J. Biol. Chem. 292(39):16284.
3. Y. Y. Yien et al, Mtation in human *CLPX* elevates levels of delta-aminolevulinate synthase and protoporphyrin IX to promote erythropoietic protoporphyria (2017, September 5) PNAS E8045-E8052.

Materials Characterization Lab

Return to Table of Contents

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 is a primarily a user-based facility whereby researchers are trained on the care and handling of the equipment. 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 types of 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 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 (URA) Accessories

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
- Sean Clancy, Ph.D., Associate Director, Program Manager
- Angela Nelson, Administrative Officer
- Garrett Meeks, Outgoing Lab Manager
- Kimberly Watts, Senior Lab Staff
- Danielle Beatty, Lab Staff
- Logan Kiefer, Lab Staff
- Ashlea Patterson, Lab Staff
- Sarai Patterson, Lab Staff
- Christian Robert, Lab Staff

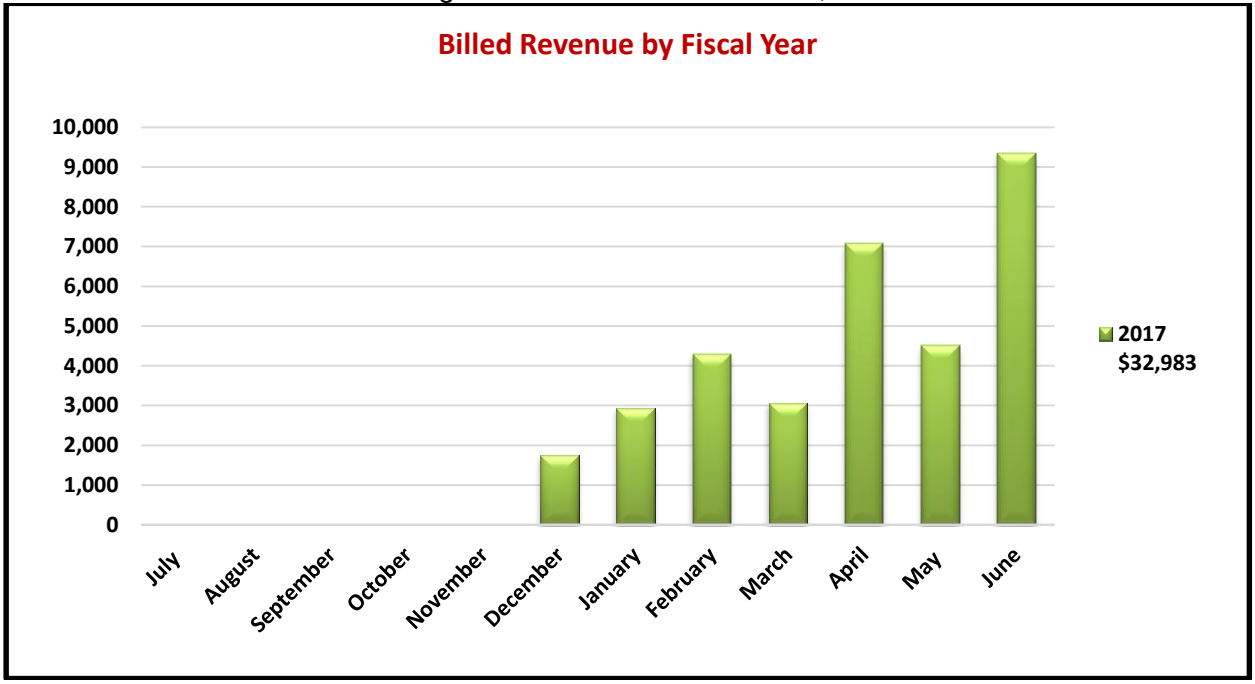
2017 Annual Update

Revenue/Expenses

FY17 Expenses: Total $34,533

FY17 Revenue: Total $32,983

- VP of Research Support: $0
- FY17 revenue generated from services: $32,983



* Legend displays total annual revenue by year earned.

Advisory Board Committee

Last meeting date: June 20, 2017

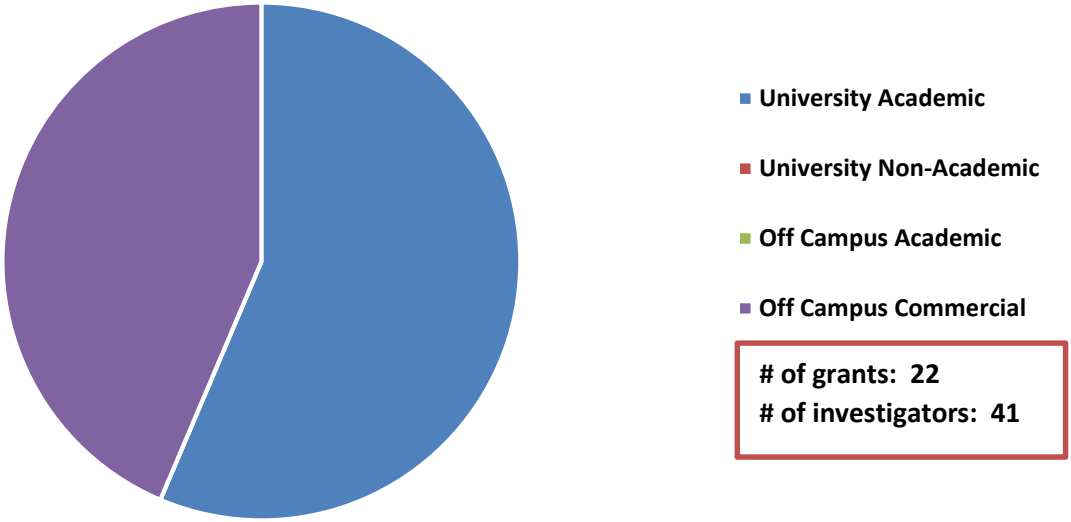
- Taylor Sparks, Ph.D., Assistant Professor
- Mike Scarpulla, Ph.D., Associate Professor
- Dmitry Bedrov, Ph.D., Associate Professor

FY17 Scientific Impact

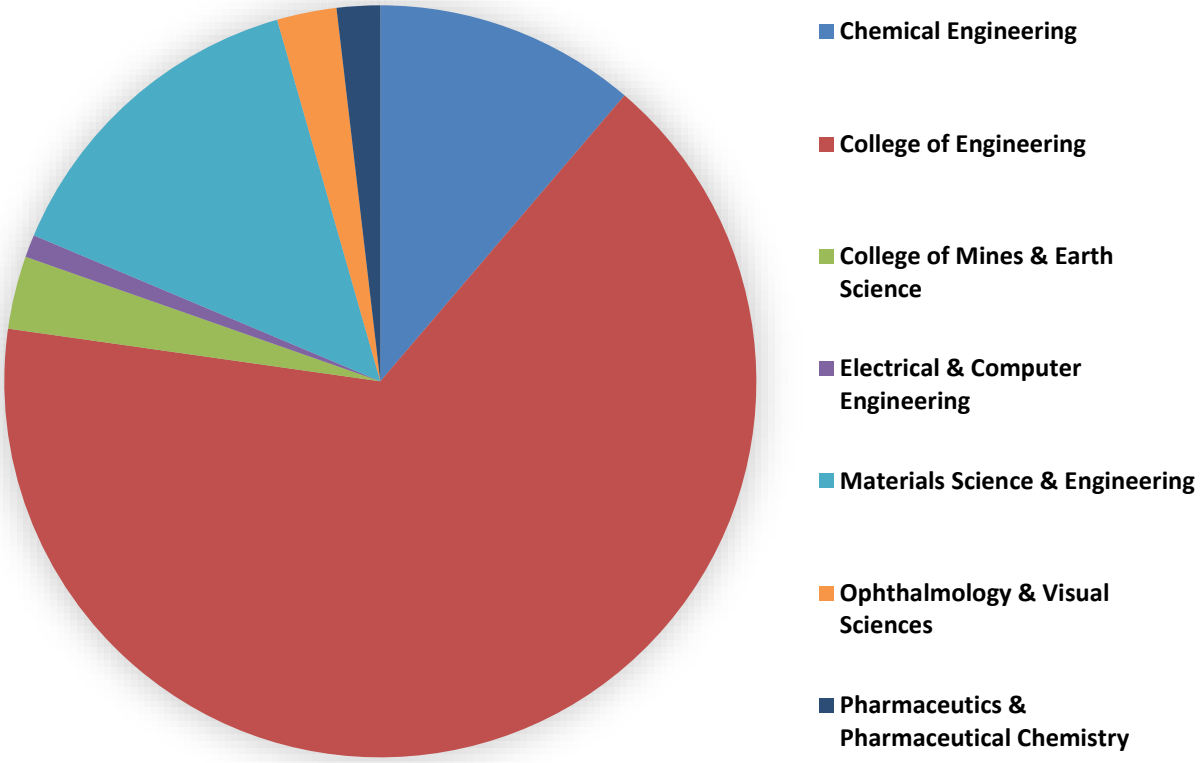
Research Support

Revenue Generated (see charts following):

Revenue by Affiliation



Revenue by Department



Top Users

1	McDonald, Luther	DHS
2	KMR Collaborative	Off Campus
3	Sparks, Taylor	USDOE, NSF, USDOD, USTAR
4	Tiwari, Ashutosh	NSF
5	Deo, Milind	Chevron Corporation
6	Fisher Company	Off Campus
7	Graymont	Off Campus
8	Lipocine Inc.	Off Campus
9	MSI Photogenics	Off Campus
10	Harris Corporation	Off Campus

Goals for FY18

- Develop and start Materials Characterization Lab Internship Program
- Develop standard processes for providing deposition processes as additional revenue streams for the MCL and to include:
    - Deposition Processes for Conductive Materials:
        - Solution Processes:
            - Electroplating
        - Physical Vapor Deposition (PVD) Processes:
            - DC Sputtering
            - Electron-Beam (E-Beam) Evaporation
            - Thermal Evaporation
- Increase lab usage and revenue

Publications

No known publications acknowledged this facility in FY17.

Nuclear Engineering

Return to Table of Contents

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 chemical composition of a wide variety of samples. UNEP has been at the forefront of establishing 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)
- TCA cycle intermediates
- Passive gamma spectroscopy
- Alpha spectroscopy
- Nucleotides
- Liquid scintillation counting

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

- Ryan Schow, Reactor Supervisor
- Matthew Lund, Reactor Supervisor in Training
- Michael Allred, Reactor Technician

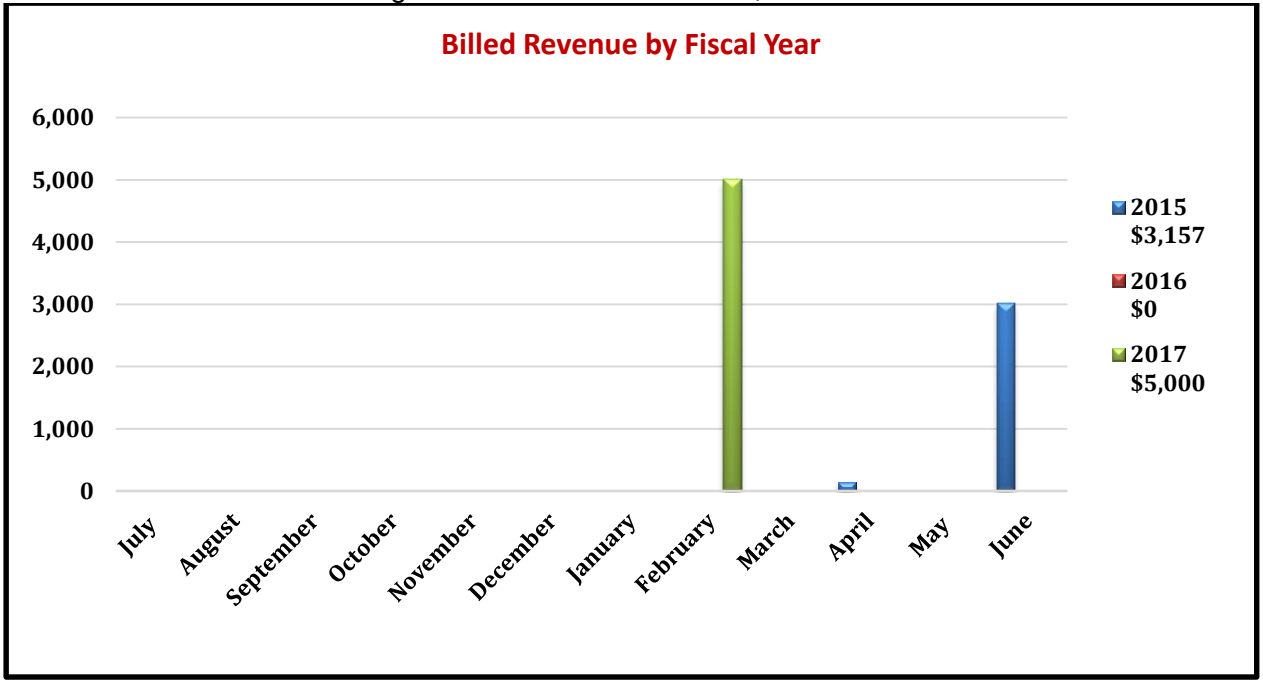
2017 Annual Update

Revenue/Expenses

FY17 expenses: $613

FY17 revenue: $5,000

- FY17 revenue generated from services: $5,000



* Legend displays total annual revenue by year earned.

Advisory Board Committee

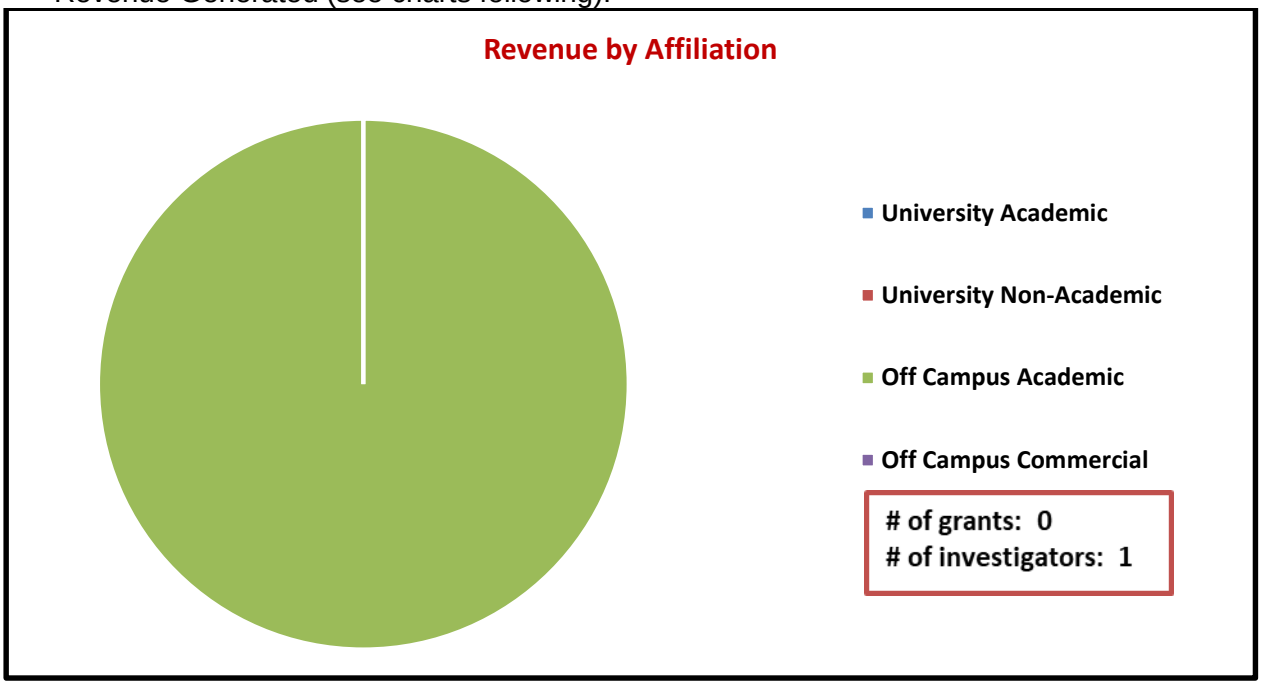
Last meeting date: March 27, 2017

- Jim Byrne, Reactor Safety Committee Chair
- Terry Ring, Professor, Chemical Engineering
- Greg Moffitt, Former Reactor Supervisor

FY17 Scientific Impact

Research Support

Revenue Generated (see charts following):



Top Users

1	Okayama University	Off Campus Academic

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

Scalable Analytics & Informatics

Return to Table of Contents

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

The following services are offered by USAI:

- 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 projects 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

Personnel

- Scott L DuVall, PhD, Director
- Ryan Heugly, Program Manager
- Olga Patterson, Applied NLP Lead
- Ryan Cornia, Architecture and Systems Developer
- Brad Adams, Senior Software Designer and Programmer
- Patrick Alba, Clinical Data Manager
- Corinne Halls, Clinical Research Annotation Manager
- Daniel Denhalter, Clinical Research Annotation Manager

FY17 Annual Update

New Equipment

Computers

New Services

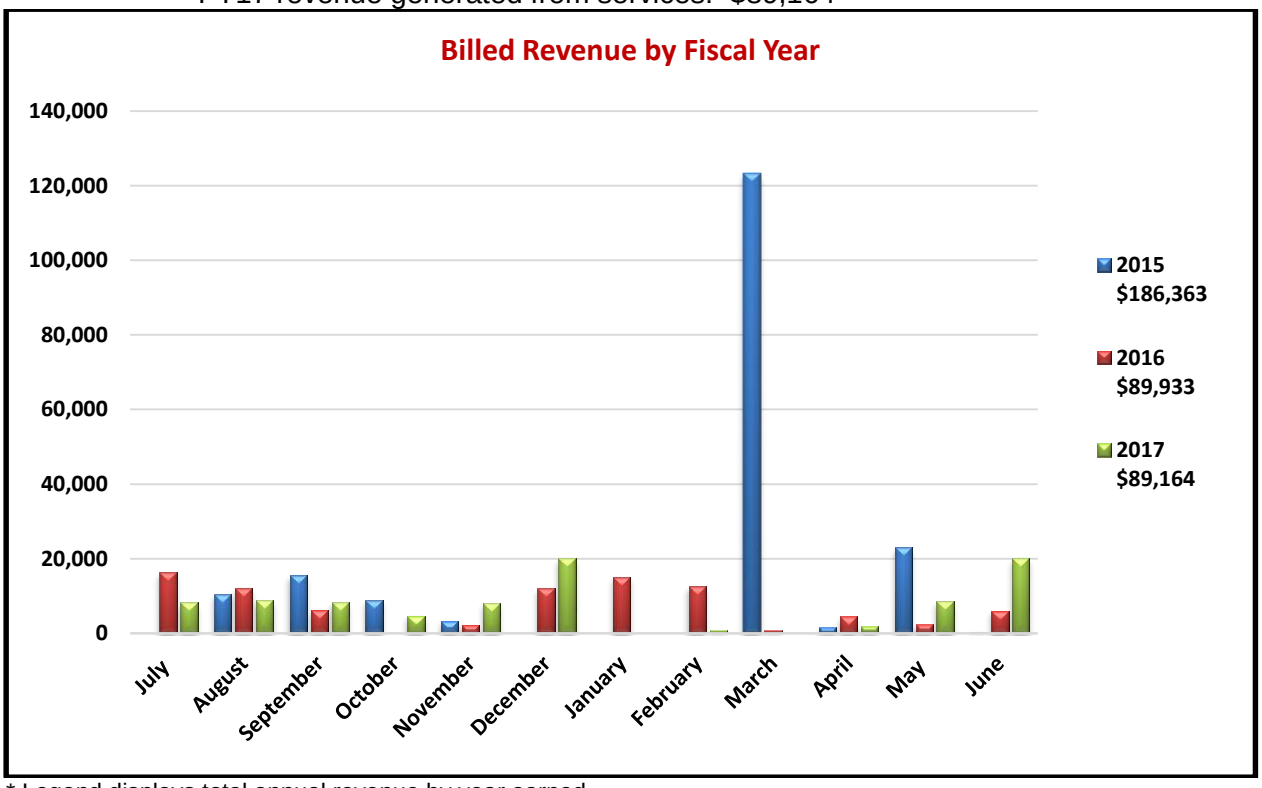
No new services for FY17.

Revenue/Expenses

FY17 Expenses: **$100,992**

FY17 Revenue: **$89,164**

- VP of Research Support: $0
- FY17 revenue generated from services: $89,164



* Legend displays total annual revenue by year earned.

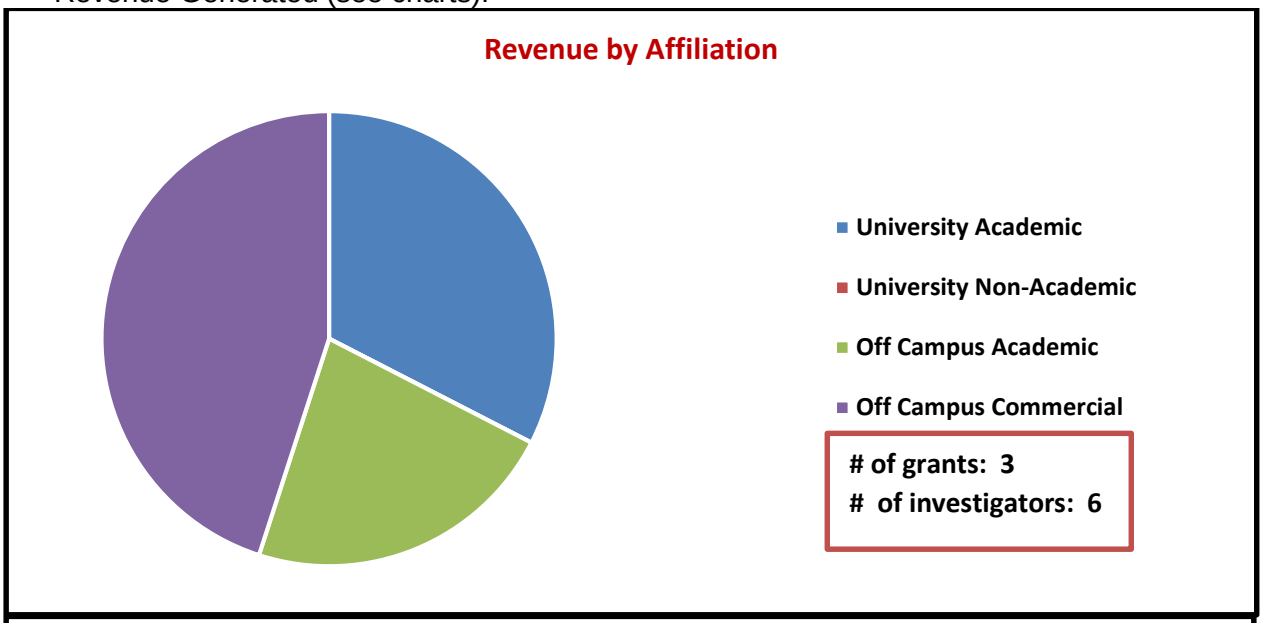
Management Meeting
Last meeting date: May 23, 2017.

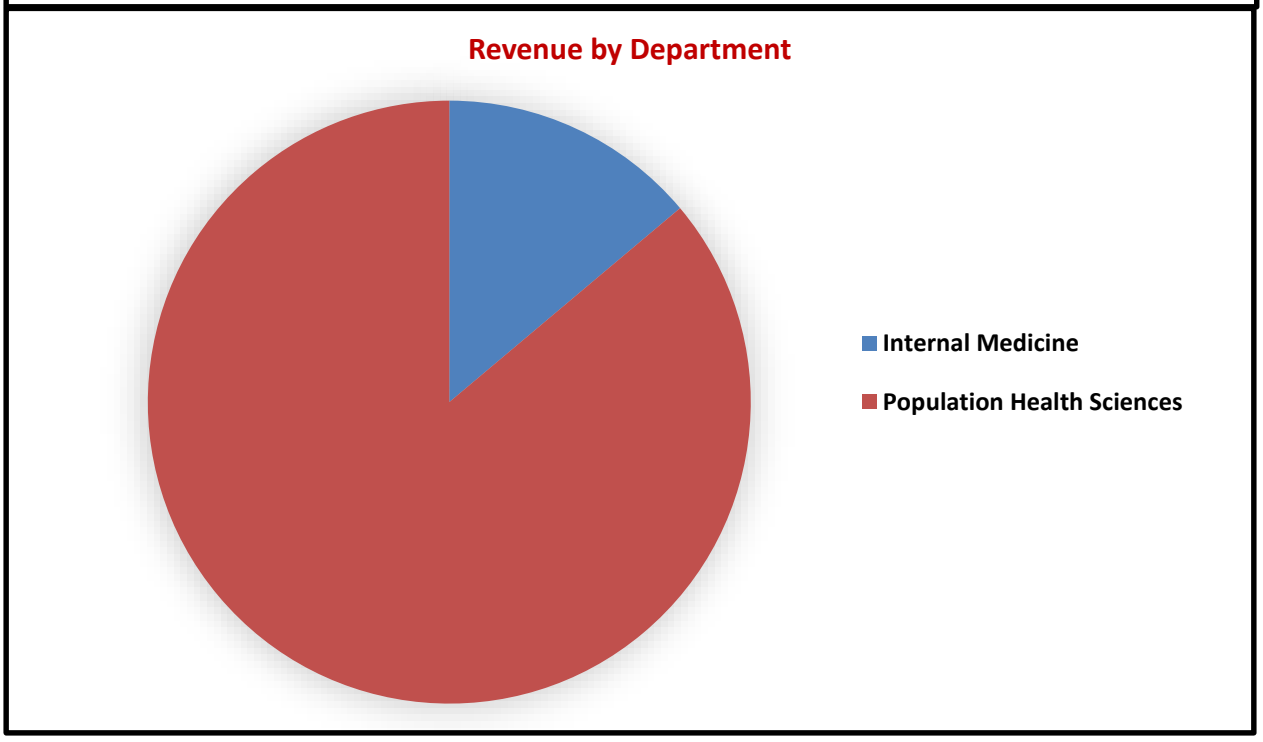
- Scott L DuVall, PhD, Director
- Ramana Seerapu, Program Manager
- Ryan Heugly, Program Manager
- Kevin Malohi, VINCI Deputy Director
- Christopher Ledding, MBA, Budget Analyst

FY17 Scientific Impact

Research Support

Revenue Generated (see charts):





Top Users

1	Bress, Adam	Novartis Pharmaceuticals
2	New York University	Off Campus Academic
3	Chapman, Wendy	NIH, DHHS
4	IHC Health Services Inc.	Off Campus
5	Anolinx	Off Campus
6	Zickmund, Susan	Department

Goals for FY18

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 research health science specialists, computer programmer, data managers and administrative support.

Publications

1. Navarro-Millan I, Yang S, DuVall SL, Chen L, Baddley J, Cannon GW, Delzell ES, Zhang J, Safford MM, Patkar NM, Mikuls TR, Singh JA, Curtis JR (2016). Association of hyperlipidaemia, inflammation and serological status and coronary heart disease among patients with rheumatoid arthritis: data from the National Veterans Health Administration. *Ann Rheum Dis*, *75*(2), 341-7.
2. Bellows BK, DuVall SL, Kamauu AW, Supina D, Pawaskar M, Babcock T, LaFleur J (2016). Characteristics and use of treatment modalities of patients with binge-eating disorder in the Department of Veterans Affairs. *Eat Behav*, *21*, 161-7.
3. Xie Y, LaFleur J, Kamauu A, Knippenberg K, DuVall SL, Haselkorn J, Nelson RE (08/01/2016). Rates of Early Treatment for US Veterans With Multiple Sclerosis. *J Pharm Technol*, *3*(4), 143-9.
4. Cannon GW, DuVall SL, Haroldsen CL, Caplan L, Curtis JR, Michaud K, Mikuls TR, Reimold A, Collier DH, Joseph GJ, Harrison DJ, Sauer BC (2016). Clinical Outcomes and Biologic Costs of Switching Between Tumor Necrosis Factor Inhibitors in US Veterans with Rheumatoid Arthritis. *Adv Ther*, *33*(8), 1347-59.
5. Lynch J, DuVall SL, Berse B, Whatley A, St Pierre C, Oloruntoba O, Hunt CM (2016). Implementation of Pharmacogenetic Testing Within the Veterans Health Administration From 2011 to 2013. *Mil Med*, *181*(10), 1375-1381.
6. Nelson RE, Butler J, LaFleur J, Knippenberg K, C Kamauu AW, DuVall SL (2016). Determining Multiple Sclerosis Phenotype from Electronic Medical Records. *J Manag Care Spec Pharm*, *22*(12), 1377-1382.
7. Schroeck FR, Pattison EA, Denhalter DW, Patterson OV, DuVall SL, Seigne JD, Robertson DJ, Sirovich B, Goodney PP (2016). Early Stage Bladder Cancer: Do Pathology Reports Tell Us What We Need to Know? *Urology*, *98*, 58-63.
8. Chun DS, Berse B, Venne VL, DuVall SL, Filipski KK, Kelley MJ, Meyer LJ, Icardi MS, Lynch JA (2017). BRCA testing within the Department of Veterans Affairs: concordance with clinical practice guidelines. *Fam Cancer*, *16*(1), 41-49.
9. Freiberg MS, Chang CH, Skanderson M, Patterson OV, DuVall SL, Brandt CA, So-Armah KA, Vasan RS, Oursler KA, Gottdiener J, Gottlieb S, Leaf D, Rodriguez-Barradas M, Tracy RP, Gibert CL, Rimland D, Bedimo RJ, Brown ST, Goetz MB, Warner A, Crothers K, Tindle HA, Alcorn C, Bachmann JM, Justice AC, Butt AA (2017). Association Between HIV Infection and the Risk of Heart Failure With Reduced Ejection Fraction and Preserved Ejection Fraction in the Antiretroviral Therapy Era: Results From the Veterans Aging Cohort Study. *JAMA Cardiol*, *2*(5), 536-546.

10. Efimova O, Berse B, Denhalter DW, DuVall SL, Filipski KK, Icardi M, Kelley MJ, Lynch JA (2017). Clinical decisions surrounding genomic and proteomic testing among United States veterans treated for lung cancer within the Veterans Health Administration. *BMC Med Inform Decis Mak*, *17*(1), 71.
11. Lynch KE, Whitcomb BW, DuVall SL (06/01/2017). The impact of residual confounding due to misclassification with the use of electronic health records. *Perspect Health Inf Manag*.
12. Patterson OV, Freiberg MS, Skanderson M, J Fodeh S, Brandt CA, DuVall SL (2017). Unlocking echocardiogram measurements for heart disease research through natural language processing. *BMC Cardiovasc Disord*, *17*(1), 151.
13. Lynch JA, Berse B, Chun D, Rivera D, Filipski KK, Kulich S, Viernes B, DuVall SL, Kelley MJ (2017). Epidermal Growth Factor Receptor Mutational Testing and Erlotinib Treatment Among Veterans Diagnosed With Lung Cancer in the United States Department of Veterans Affairs. *Clin Lung Cancer*, *18*(4), 401-409.

Notes