HEALTH
UNIVERSITY OF UTAH

Table of Contents

Annual Report 2023

HSC CORES Facilities

Overall Financial Summary

Revenue & Expenses

- HSC Core Facilities budgeted $10.9 million for FY23, with expenses totaling $10.3 million. Approximately $6.1 million in expenses went to salaries and benefits while $4.18 million was spent on equipment and operating supplies.
- In FY23, $8.3 million in services were billed, and collected from all units combined. An overhead fee of 5% ($379,448) was used for administrative support.

Core Research Facilities

Core	Total Expenses	Equipment Expenses	Total Revenue	SVPHS	VPR	RIF/Match
Administration	$1,542,888		$1,722,567	$630,000	$331,211	
Biomedical Imaging & Data	$99,124		$84,832			
Cell Imaging	$377,366		$593,359	$225,000		
Data Science Services	$1,449,033		$1,487,894	$785,000		
DNA Peptide	$281,505		$309,065	$60,000		
DNA Sequencing	$241,925		$274,115			
Drug Discovery	$177,229		$191,029	$75,000		
Electron Microscopy	$745,731		$960,657		$25,000	$68,600
Flow Cytometry	$1,071,712	$349,470	$740,092	$40,000		
Genomics	$141,019		$119,306			
Machine Shop	$282,033		$261,132	$60,000		
Mass Spectrometry & Proteomics	$422,402		$1,156,688	$185,000		$656,260
Metabolic Phenotyping	$249,761		$328,863	$85,000		$82,608
Metabolomics	$696,788		$783,061	$240,000		
Mutation Generation & Detection	$131,839		$161,758	$70,000		
Nuclear Magnetic Resonance	$130,516		$99,196	$70,000		
PreClinical Imaging	$259,863		$303,260	$100,000	$85,000	
Small Animal Ultrasound	$23,262		$52,111	$20,000		
Transgenic Mouse	$654,083		$593,192	$334,603		
UTAH Center Genetic Discovery	$1,095,401		$966,892			

Service Recharge Centers

Service Recharge Center	Total Expenses	Equipment Expenses	Total Revenue	College	VPR	RIF
Anticonvulsant Drug Dev.	$15,516		$15,564			
Behavioral Health Innovation	$26,337		$26,120			
BioMedical Microfluids	$24,704		$33,542			
Center for Human Toxicology	$26,268		$159,099			
CRUS Center	$22,528		$7,024			
Genetic Science Learning CTR	$1,728,431		$2,161,655			
Iron & Heme	$20,081		$47,238			
MCL Meldrum	$135,803		$157,865			
Nanofab Administration	$1,106,296	$142,239	$892,784	$677,998	$185,200	
Nanofab Cleanroom	$1,129,376		$922,906	$359,124	$50,000	
Nanofab EMSAL Surface Analysis	$581,171		$879,475	$326,551	$50,000	$76,356
Powder	$13,088		$101,450			
Scalable Analytics & Informatics	$44,826		$80,247			

Cores Administration

Overview

The Health Sciences Center (HSC) Core Facilities administratively reports to the Director Dr. James Cox, who reports to Dr. Rachel Hess. The administrative office is managed by Ms. Brenda Smith, with assistance from Ms. Iryna Wiley, Ms. Terra Curley, and Mr. Derek Schlotfeldt. Responsibilities of the Core Administration office include - personnel management, budget preparation, financial affairs, ordering of supplies, and tracking expenses for all 35 Core Facilities and Service Recharge Centers. In addition, the Administrative Core supports general research infrastructure for the community, e.g. maintaining the X-ray film developer in the SOM and the research irradiator logging and access requests. All cores and recharge centers operate on a charge-back basis, with the Administration Core recovering 5% of the revenue collected for billing and collection services.

Personnel

- James E. Cox, Ph.D., Director HSC Core Facilities
- Brenda Smith, Administrative Director
- Derek Schlotfeldt, Manager Administrative
- Terra Curley, Senior Accountant
- Iryna Wiley, Accountant
- Elliot Francis, Principal Software Engineer
- Megan Bowler, Principal Software Engineer

Advisory Board Committee

Last meeting date: March 31st, 2022

- James Cox Ph.D., Director of Cores Research Facilities
- Rachel Hess M.D. M.S., Associate Vice President for Research, SOM
- Chris Hill D.Phil., Vice Dean of Research, SOM
- Kevin Whitty Ph.D., Associate Dean for Research, College of Engineering
- Scott Summers Ph.D., Professor and Chair, Nutrition & Integrative Physiology
- Joe Yost Ph.D., Professor, Neurobiology and Anatomy
- Martin McMahon Ph.D., Professor, Dermatology
- Dean Tantin Ph.D., Professor, Pathology
- Eric Schmidt Ph.D., Professor, Medicinal Chemistry

FY23 Annual Update

- In FY23 the core billed $8.3M; however, what is most impressive the collection rate for billed services remains at **100%**. We have developed an account management system to allow each Director to view revenue and expenses in real time. The tracking system stores fiscal data so that historical comparisons between revenue and expenses can be performed as well as validation of expenses, and operational analysis.
- Three new Service/Recharge Centers; the Center for Human Toxicology (CHT), BioMedical Microfluidics, and ECE Packaging are now managed through the administrative office to increase accountability and reduce expenses associated with billing and collections.
- The annual retreat was held in person in September 2022

- The Admin Core created an updated ordering system to replace an existing FileMaker Pro deployment. This update included a move to a UIT managed server, a new web-based User Interface and a transfer of all historical data. The new ordering system brings the ordering system fully under Cores control as a mission critical operation support application. This system is anticipated to expand access and ease of ordering for all participating facilities.
- The electronic inventory system remains in active use by many organizations across campus. Newly added users for FY2023 include the Office of Comparative Medicine and the USTAR Center for Genetic Discovery. Minor updates include expanded support for the new university provided RFID inventory tags in addition to the HS Cores printed tags. This system is scheduled for a feature review and major update in FY2024.

FY24 Goals

- Major website overhaul
- Expand core evaluations
- Update inventory system
- Promotion of new ordering system

Cores Administration Revenue & Expenses

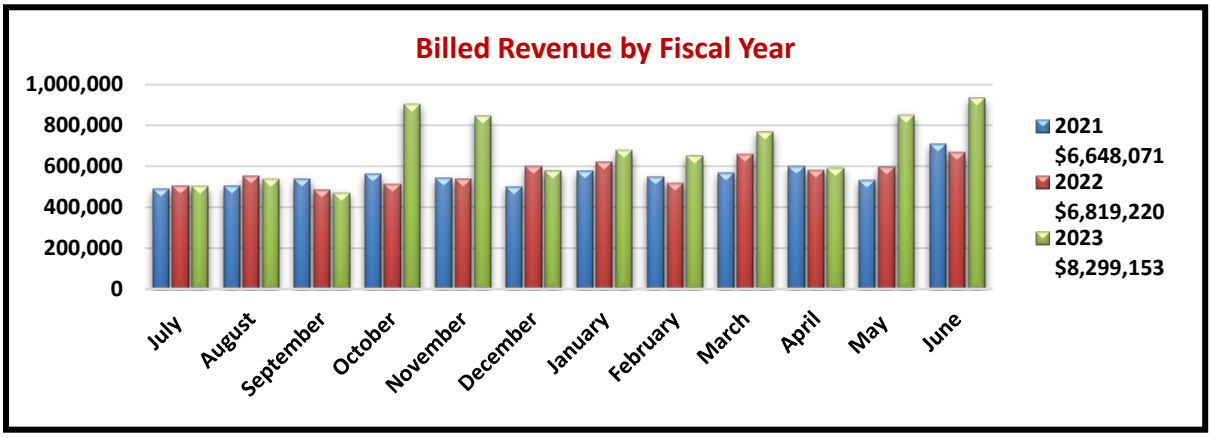
FY23 Expenses: Total $1,542,888

The Cores Administration Budget covers the following expenses:

- Salaries/Benefits: $918,277
- Fixed Expenses (IT Support for 76 staff, developer, x-ray, software, COVID Expenses): $526,565.
- Unanticipated equipment repairs and replacement: $98,046

FY23 Revenues: Total $1,722,567

- VP of Health Sciences Support: $630,000
- Other Support: $295,608
- FY23 Revenue Generated from Services: $465,748
- FY23 VP for Research: $331,211 (COVID Support for Sal/Benefits and Supplies)



* 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.

Addendum

The administrative core ensures that all cores maintain a regular faculty advisory committee meeting that conforms to the following guidelines:
http://cores.utah.edu/wp-content/uploads/2015/09/Faculty-Advisory-Committee-Responsibilities-2.pdf

Biomedical Imaging & Data Science Core

Overview

The mission of the Biomedical Imaging and Data Science Core (BIDAC) facility is to provide advanced medical computing, scientific visualization and data science services to research groups at the University of Utah. Our areas of expertise include machine learning and deep learning, building end-to-end AI-based solutions for image classification, regression and segmentation tasks. These application-oriented services leverage the expertise, computational resources and software development infrastructure of the Scientific Computing and Imaging (SCI) Institute. In partnership with CHPC and the HSC Core imaging facilities, we have developed services that are based on the needs of HSC researchers and core users. As a resource for advanced image analysis, data science and data analytics, our goal is to further the scientific mission of the University of Utah by significantly enhancing the capabilities and competitiveness of HSC research laboratories.

Services

BIDAC offers a range of services including consulting, training, image processing, image analysis, image visualization, workflow development, software prototyping, and algorithm development.

Examples of services that have been developed and/or used include:

- **Deep learning analysis (AI-based solutions) for image classification, regression and segmentation tasks.** We developed expertise in building, comparing and fine-tuning state-of-the-art Convolutional Neural Networks (CNN) and Deep Neural Networks (DNN). Applications include brain aneurysm identification and segmentation from 3D TOF-MRA acquisitions, and classification of multi-magnification electron microscopy data.
- **Big data engineering workflow for inpatient and outpatient medical imaging, enabling subsequent machine learning analysis.** In partnership with researchers from Radiology, the Enterprise Data Warehouse (EDW) and the Center for High Performance Computing (CHPC), we developed software and hardware infrastructure to support secured data transfer (from the hospital PACS), HIPAA-compliant data storage and data management of large radiological datasets to enable deep learning and natural language processing analyses. Clinical studies of interest use retrospective 2D chest X-ray and 3D CT images.

Personnel

- Clement Vachet, Director

Advisory Board Committee

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

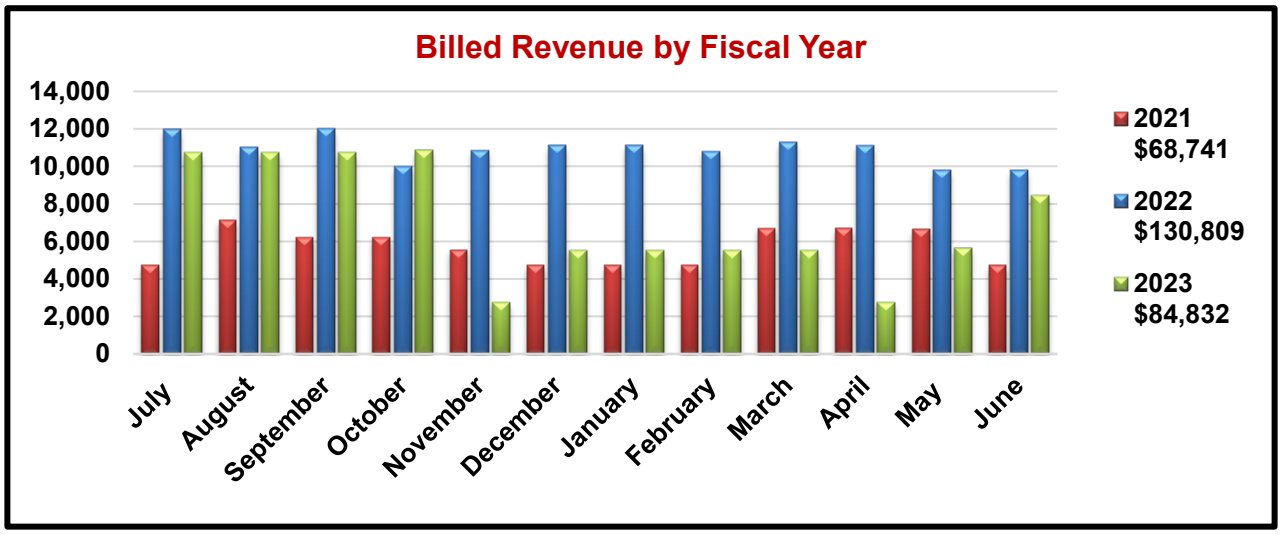
FY23 Annual Update
Grant Support - BIDAC performed preliminary work and/or provided letters of support for the following grant/contract submissions:

- NSF SBIR Phase II – Rudy Wilcox, RefloDx LLC.

Revenue/Expenses

FY23 Expenses: **Total $99,124**
FY23 Revenue: **Total $84,832**

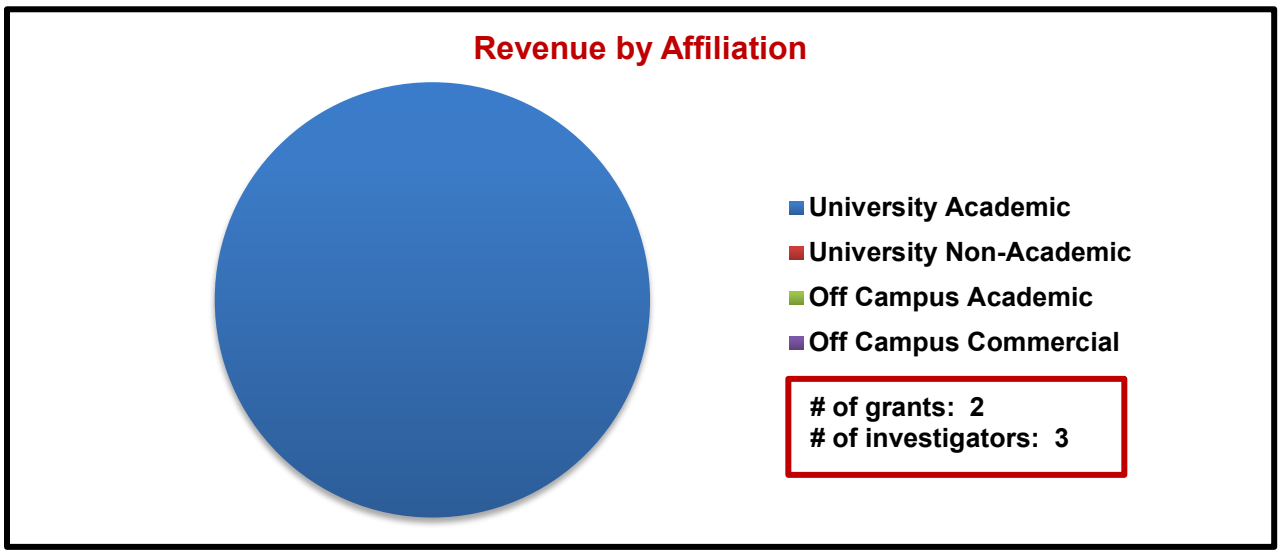
- VP of Health Sciences Support: $ 0
- FY23 Revenue generated from services: $84,832

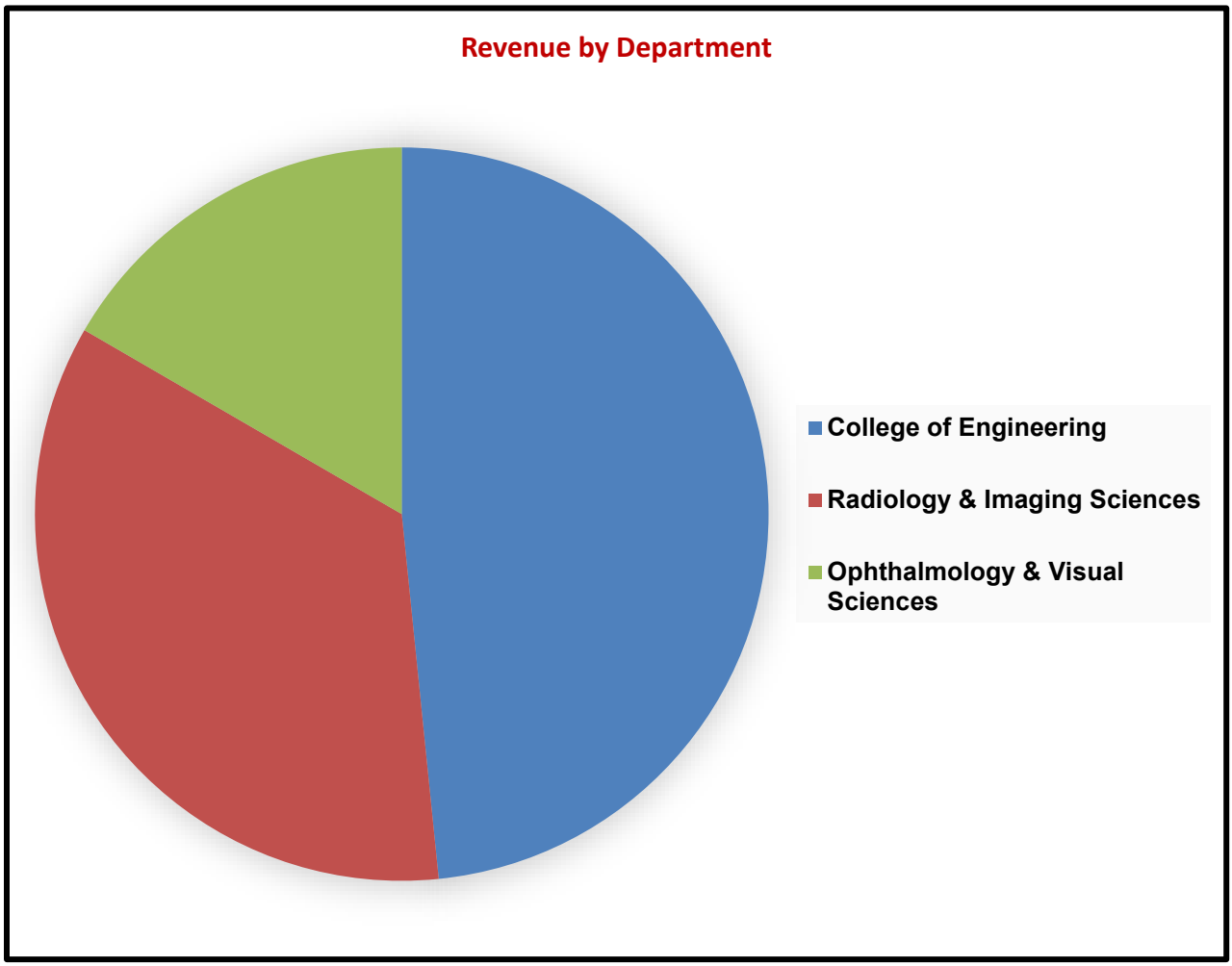


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support

Revenue Generated (see charts following):





Top Users

1	Tolga Tasdizen	Elphel Inc
2	Satoshi Minoshima	Department
3	Bryan Jones	NIH

Publications

No known publications acknowledged this facility in FY23.

Cell Imaging

Overview

The Cell Imaging Facility provides training and consultation on the use of confocal, automated widefield, TIRF, and two-photon microscopy, as well as the software tools for quantitative analysis of image data. The facility has a Zeiss 880 Airyscan confocal, a Leica SP8 White light laser confocal, a Leica SP8 405/488/561/633 confocal, one Olympus FV1000 Spectral confocal, one Nikon A1R confocal, one Zeiss 700 confocal, and two multi-photon microscopes from Prairie/Bruker. In addition, one Nikon Ti automated widefield microscope, one DeltaVision Ultra widefield microscope and a spinning disk confocal (CSUW1) are available for live cell imaging. STEDYCON, a super-resolution microscope from Abberior-instruments that is integrated for resolving 40nm resolution is now available. A Zeiss Axioscan Z1 slide scanner is available for automated archiving of histology and fluorescence data. A Nikon Spinning Disk Confocal with dual cameras combined with additional TIRF and photoactivation functions is available. Automated microscopes with one of four different stage incubators are available (CO_2, temperature, humidity, hypoxia) for live cell imaging. Imaris, Nikon Elements AI, FluoRender, and ImageJ 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 to be within proximity to the user base.

FY24 Goals

Optimizing acknowledgement of the core in published manuscripts with data generated from the core is very important in developing a strategy to acquire additional equipment.

Equipment Location

HSC Location

- Zeiss 700 Confocal Microscope
- Nikon A1R Confocal Microscope
- 2x Prairie Multi-Photon Microscope
- Zeiss Axioscan Z1 automated slide scanner with a 100 slide loader
- EVOS FL Widefield Microscope
- Imaris/Nikon Elements AI Work Station

HCI Location

- Leica SP8 confocal with white light laser
- Leica SP8 confocal with 405, 488, 561, 633nm lasers
- Nikon Ti Automated Microscope
- Ibidi stage incubator with CO2, temperature and hypoxia control
- Imaris Work Station

Biology ASB/Crocker Location

- Olympus FV1000 Confocal Microscope
- Zeiss 880 Airyscan Confocal
- Vutara super resolution
- STEDYCON super resolution
- Leica Cryostat

EEJMRB Location

- Spinning Disk Confocal Microscope
- DeltaVision Ultra Widefield Microscope
- Nikon Spinning Disk Confocal, TIRF and Photoactivation Microscope

Personnel

- Xiang Wang, Ph.D., Director
- Michael J. Bridge, Ph.D., Research Associate
- Anton Classen, Ph.D., Research Associate
- William (Bill) L. James, Ph.D., Lab Specialist

Advisory Board Committee

Last meeting date: Oct 17th, 2022

- Marcus Babst, Professor, Biology
- Sophie Caron, Associate Professor, Biological Sciences
- James Cox, HSC Cores Director
- Bruce Edgar, Professor, Oncological Sciences
- Gabrielle Kardon, Professor, Human Genetics
- Michelle Mendoza, Assistant Professor, Oncological Sciences
- Minna Roh-Johnson, Assistant Professor, Biochemistry
- Alex Shcheglovitov, Associate Professor, Neurobiology and Anatomy
- Mark Smith, Research Assistant Professor, Oncological Sciences

FY23 Annual Update

New Services

- Consultation is available at four locations: Building 5 CSC, 555 HCI, 565 EEJMRB and 585 HSC

New Equipment

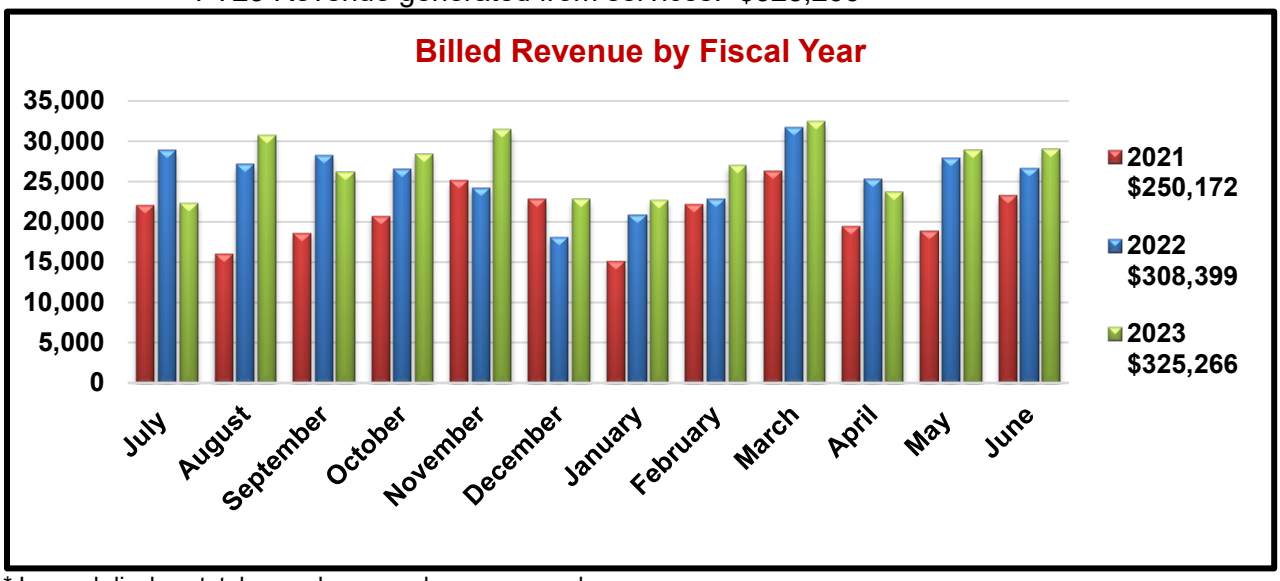
- Nikon Spinning Disk Confocal, TIRF and Photoactivation Microscope

Revenue/Expenses

FY23 Expenses: Total $377,366

FY23 Revenue: Total $550,266

- VP of Health Sciences Support: $225,000
- FY23 Revenue generated from services: $325,266

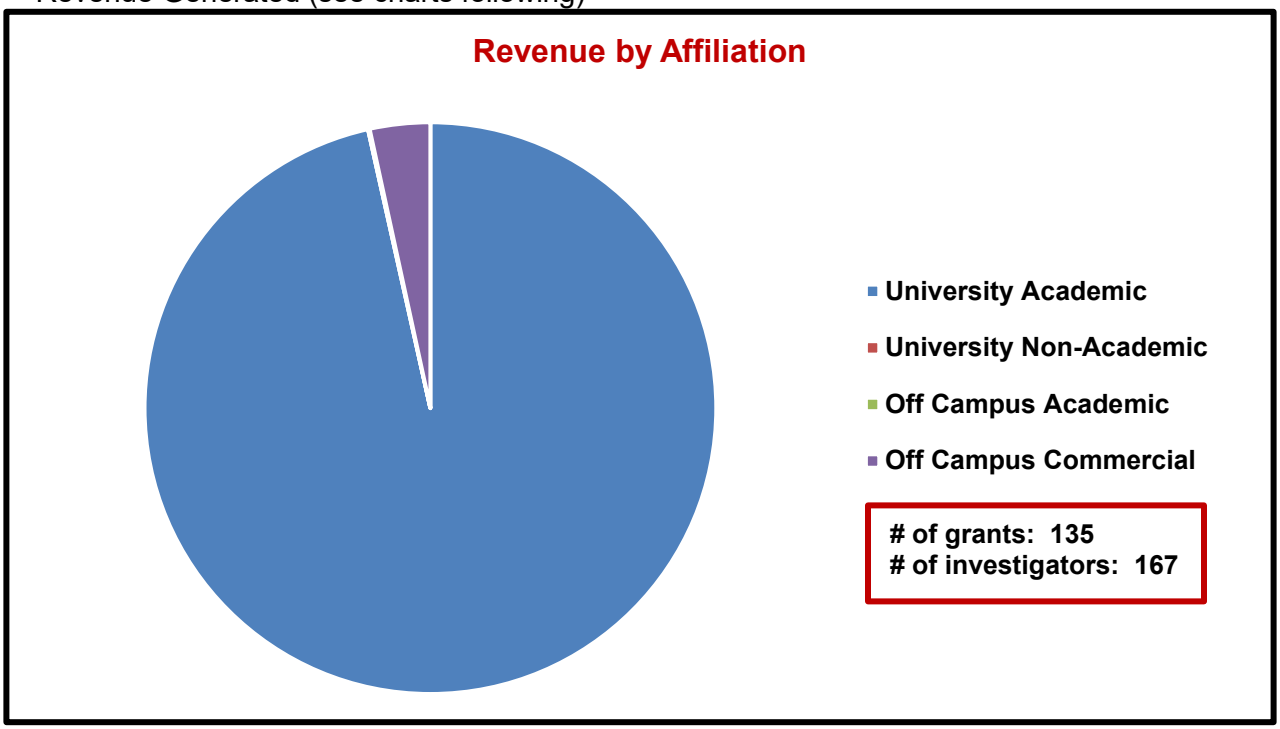


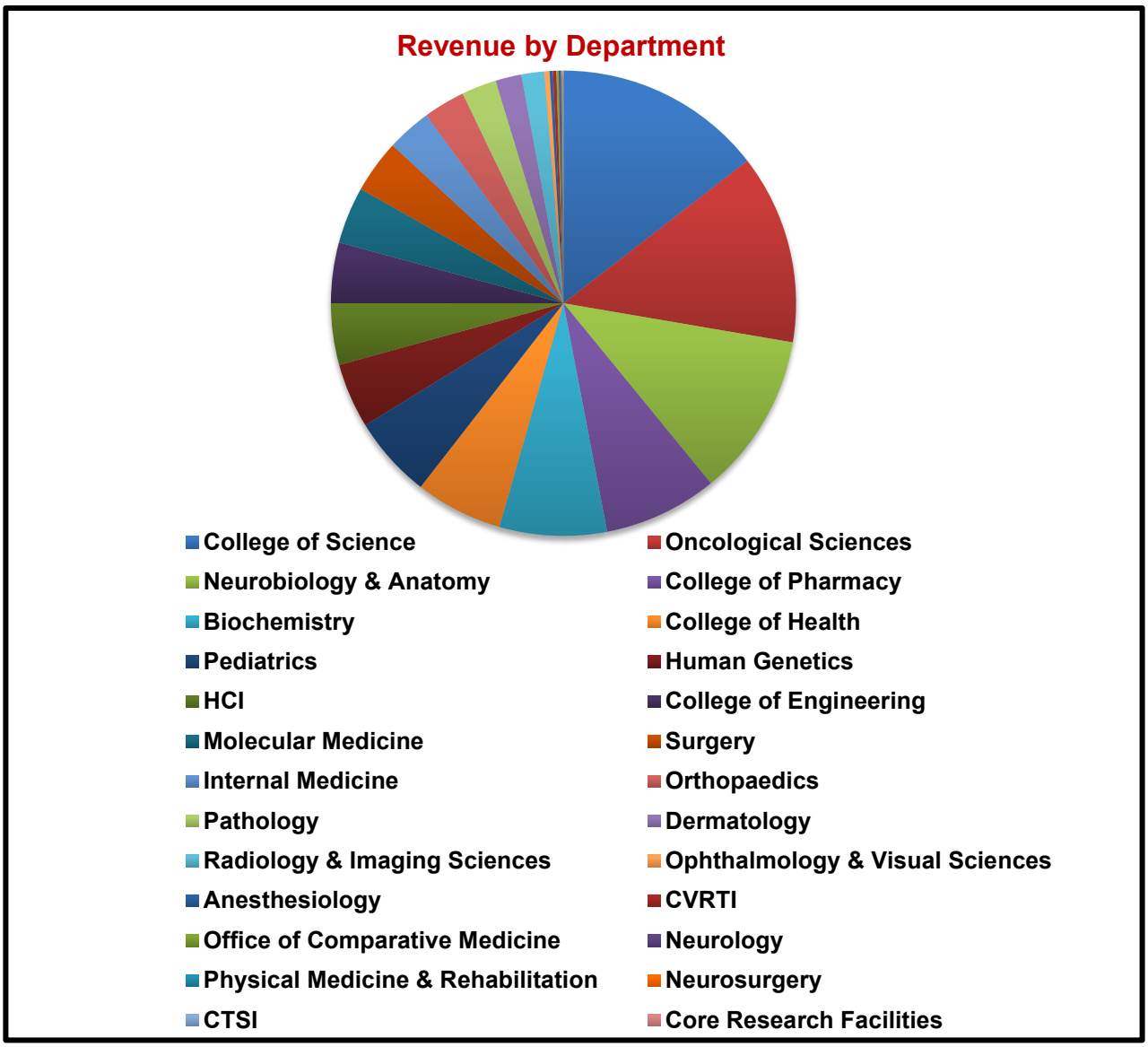
* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following)





Top Users

1	Sophie Caron	NIH, NSF
2	Erik Jorgensen	Department
3	Micah Drummond	Department, NIH, Utah State University
4	Josh Bonkowsky	Department
5	Katharine Diehl	Department, NIH
6	Jessica Osterhout	Department, NIH
7	Minna Roh-Johnson	Department, NIH
8	Gabrielle Kardon	Department, NIH
9	Oleksandr Shcheglovitov	NIH
10	Bruce Edgar	Department, NIH

Publications

1. Almanzar, D. E., S. G. Gordon, C. Bristow, A. Hamrick, L. von Diezmann, H. Liu and O. Rog (2023). Meiotic DNA exchanges in C. elegans are promoted by proximity to the synaptonemal complex. Life Sci Alliance **6**(4).10.26508/lsa.202301906
2. Anderl, W. J., N. Pearson, M. I. Converse, S. M. Yu and K. L. Monson (2023). Strain-induced collagen denaturation is rate dependent in failure of cerebral arteries. Acta Biomater **164**: 282-292.10.1016/j.actbio.2023.04.032
3. Ellis, K. E., S. Bervoets, H. Smihula, I. Ganguly, E. Vigato, T. O. Auer, R. Benton, A. Litwin-Kumar and S. J. C. Caron (2023). Evolution of connectivity architecture in the Drosophila mushroom body. bioRxiv.10.1101/2023.02.10.528036
4. Eshima, H., J. L. Shahtout, P. Siripoksup, M. J. Pearson, Z. S. Mahmassani, P. J. Ferrara, A. W. Lyons, J. A. Maschek, A. D. Peterlin, A. R. P. Verkerke, J. M. Johnson, A. Salcedo, J. J. Petrocelli, E. R. Miranda, E. J. Anderson, S. Boudina, Q. Ran, J. E. Cox, M. J. Drummond and K. Funai (2023). Lipid hydroperoxides promote sarcopenia through carbonyl stress. Elife **12**.10.7554/eLife.85289
5. Espino-Sanchez, T. J., H. Wienkers, R. G. Marvin, S. A. Nalder, A. E. Garcia-Guerrero, P. E. VanNatta, Y. Jami-Alahmadi, A. Mixon Blackwell, F. G. Whitby, J. A. Wohlschlegel, M. T. Kieber-Emmons, C. P. Hill and P. A. Sigala (2023). Direct tests of cytochrome c and c(1) functions in the electron transport chain of malaria parasites. Proc Natl Acad Sci U S A **120**(19): e2301047120.10.1073/pnas.2301047120
6. Ferrara, P. J., P. T. Reidy, J. J. Petrocelli, E. M. Yee, D. K. Fix, Z. S. Mahmassani, J. A. Montgomery, A. I. McKenzie, N. de Hart and M. J. Drummond (2023). Global deletion of CCL2 has adverse impacts on recovery of skeletal muscle fiber size and function and is muscle specific. J Appl Physiol (1985) **134**(4): 923-932.10.1152/japplphysiol.00444.2022
7. Hagen-Lillevik, S., J. Johnson and K. Lai (2022). Early postnatal alterations in follicular stress response and survival in a mouse model of Classic Galactosemia. J Ovarian Res **15**(1): 122.10.1186/s13048-022-01049-2
8. Hagen-Lillevik, S., J. Johnson, A. Siddiqi, J. Persinger, G. Hale and K. Lai (2022). Harnessing the Power of Purple Sweet Potato Color and Myo-Inositol to Treat Classic Galactosemia. Int J Mol Sci **23**(15).10.3390/ijms23158654
9. He, Y., B. Anderson, Q. Hu, R. B. Hayes, K. Huff, J. Isaacson, K. S. Warner, H. Hauser, M. Greenberg, V. Chandra, K. Kauser and S. A. Berceli (2023). Photochemically Aided Arteriovenous Fistula Creation to Accelerate Fistula Maturation. Int J Mol Sci **24**(8).10.3390/ijms24087571
10. Kidwell, C. U., J. R. Casalini, S. Pradeep, S. D. Scherer, D. Greiner, D. Bayik, D. C. Watson, G. S. Olson, J. D. Lathia, J. S. Johnson, J. Rutter, A. L. Welm, T. A. Zangle and M. Roh-Johnson (2023). Transferred mitochondria accumulate reactive oxygen species, promoting proliferation. Elife **12**.10.7554/eLife.85494
11. LaJoie, D., A. M. Turkmen, D. R. Mackay, C. C. Jensen, V. Aksenova, M. Niwa, M. Dasso and K. S. Ullman (2022). A role for Nup153 in nuclear assembly reveals differential requirements for targeting of nuclear envelope constituents. Mol Biol Cell **33**(13): ar117.10.1091/mbc.E22-05-0189
12. Merrill, C. B., I. Titos, M. A. Pabon, A. B. Montgomery, A. R. Rodan and A. Rothenfluh (2023). Iterative assay for transposase-accessible chromatin by sequencing to isolate functionally relevant neuronal subtypes. bioRxiv: 2023.2004.2014.536950.10.1101/2023.04.14.536950
13. Petrocelli, J. J., N. de Hart, M. J. Lang, E. M. Yee, P. J. Ferrara, D. K. Fix, A. Chaix, K. Funai and M. J. Drummond (2023). Cellular senescence and disrupted proteostasis induced by myotube atrophy are prevented with low-dose metformin and leucine cocktail. Aging (Albany NY) **15**(6): 1808-1832.10.18632/aging.204600
14. Preston, A. J., A. Rogers, M. Sharp, G. Mitchell, C. Toruno, B. B. Barney, L. N. Donovan, J. Bly, R. Kennington, E. Payne, A. Iovino, G. Furukawa, R. Robinson, B. Shamloo, M. Buccilli, R. Anders, S. Eckstein, E. A. Fedak, T. Wright, C. C. Maley, W. K. Kiso, D. Schmitt, D. Malkin, J. D. Schiffman and L. M. Abegglen (2023). Elephant TP53-RETROGENE 9 induces transcription-independent apoptosis at the mitochondria. Cell Death Discov **9**(1): 66.10.1038/s41420-023-01348-7
15. Rush, C. M., Z. Blanchard, J. T. Polaski, K. S. Osborne, K. Osby, J. M. Vahrenkamp, C. H. Yang, D. H. Lum, C. R. Hagan, K. K. Leslie, M. A. Pufall, K. W. Thiel and J. Gertz (2022). Characterization of HCI-EC-23 a novel estrogen- and progesterone-responsive endometrial cancer cell line. Sci Rep **12**(1): 19731.10.1038/s41598-022-24211-8
16. Sefton, E. M., M. Gallardo, C. E. Tobin, B. C. Collins, M. P. Colasanto, A. J. Merrell and G. Kardon (2022). Fibroblast-derived Hgf controls recruitment and expansion of muscle during morphogenesis of the mammalian diaphragm. Elife **11**.10.7554/eLife.74592
17. Simeone, C. A., J. L. Wilkerson, A. M. Poss, J. A. Banks, J. V. Varre, J. L. Guevara, E. J. Hernandez, B. Gorsi, D. L. Atkinson, T. Turapov, S. G. Frodsham, J. C. F. Morales, K. O'Neil, B. Moore, M. Yandell, S. A. Summers, A. S. Krolewski, W. L. Holland and M. G. Pezzolesi (2022). A dominant negative ADIPOQ mutation in a diabetic family with renal disease, hypoadiponectinemia, and hyperceramidemia. NPJ Genom Med **7**(1): 43.10.1038/s41525-022-00314-z

18. Smith, M. A., E. Blankman, C. C. Jensen, L. M. Hoffman, K. S. Ullman and M. C. Beckerle (2022). Nuclear pore complexes concentrate on Actin/LINC/Lamin nuclear lines in response to mechanical stress in a SUN1 dependent manner. Heliyon **8**(12): e12147.10.1016/j.heliyon.2022.e12147
19. Stover, J. D., M. A. Trone, B. Lawrence and R. D. Bowles (2023). Multiplex epigenome editing of ion channel expression in nociceptive neurons abolished degenerative IVD-conditioned media-induced mechanical sensitivity. JOR Spine **6**(2): e1253.10.1002/jsp2.1253
20. Wang, Y., S. Chiola, G. Yang, C. Russell, C. J. Armstrong, Y. Wu, J. Spampanato, P. Tarboton, H. M. A. Ullah, N. U. Edgar, A. N. Chang, D. A. Harmin, V. D. Bocchi, E. Vezzoli, D. Besusso, J. Cui, E. Cattaneo, J. Kubanek and A. Shcheglovitov (2022). Modeling human telencephalic development and autism-associated SHANK3 deficiency using organoids generated from single neural rosettes. Nat Commun **13**(1): 5688.10.1038/s41467-022-33364-z
21. Warde, K. M., L. J. Smith, L. Liu, C. J. Stubben, B. K. Lohman, P. W. Willett, J. L. Ammer, G. Castaneda-Hernandez, S. O. Imodoye, C. Zhang, K. D. Jones, K. Converso-Baran, H. A. Ekiz, M. Barry, M. R. Clay, K. Kiseljak-Vassiliades, T. J. Giordano, G. D. Hammer and K. J. Basham (2023). Senescence-induced immune remodeling facilitates metastatic adrenal cancer in a sex-dimorphic manner. Nat Aging **3**(7): 846-865.10.1038/s43587-023-00420-2
22. Wenzel, D. M., D. R. Mackay, J. J. Skalicky, E. L. Paine, M. S. Miller, K. S. Ullman and W. I. Sundquist (2022). Comprehensive analysis of the human ESCRT-III-MIT domain interactome reveals new cofactors for cytokinetic abscission. Elife **11**.10.7554/eLife.77779
23. Xue, Q., S. R. S. Varady, T. Q. A. Waddell, M. R. Roman, J. Carrington and M. Roh-Johnson (2023). Lack of Paxillin phosphorylation promotes single-cell migration in vivo. J Cell Biol 222(3).10.1083/jcb.202206078
24. Zhang, C., Y. Jin, M. Marchetti, M. R. Lewis, O. T. Hammouda and B. A. Edgar (2022). EGFR signaling activates intestinal stem cells by promoting mitochondrial biogenesis and beta-oxidation. Curr Biol **32**(17): 3704-3719 e3707.10.1016/j.cub.2022.07.003

Data Science Services

Overview

Data science is the discipline of extracting knowledge from data and medical informatics is the science of how to use data, information, and knowledge to improve healthcare. Data Science Services (DSS) is a research analytics team that provides integrated data science and informatics expertise and serves as the research data concierge for the UHealth Enterprise Data Warehouse (EDW), Epic electronic health record (2.5+ million UHealth patients), and Epic Cosmos (200+ million patients from 200+ healthcare organizations) data. DSS provides analytic, technical, and consultative support, education, and training to clinicians and researchers on healthcare data, self-service tools, and the effective use of all available resources to answer complex, data-intensive research questions.

Services

Datasets: we provide raw data, analytic datasets, controlled medical vocabularies, metadata, and other types of supporting documentation during the post-award through publication stages.

Analytics: we provide broad healthcare analytics development and support for research including techniques like machine learning, data visualization, and various business intelligence approaches.

Feasibility: we support research from the early design stage onwards through consultations, feasibility estimates, preliminary analyses, pre-award support, pre-IRB submission cohort size estimations, etc.

Tools and applications: we provide access and ongoing support for various EDW research tools like Epic SlicerDicer, Business Objects Enterprise (BOE) Clinical Universe, Human Subjects Recruitment Tool, Warthog, DWCell, etc.

Clinical trials: we enhance clinical trials recruitment through the Human Subject Recruitment Tool (HSRT), automated BOE and Tableau reports, etc. to meet accrual goals and reduce cost.

Natural Language Processing (NLP): we provide clinical NLP support for retrospective as well as prospective studies using commercial products like CliniThink and text-searches using EDW tools like Oracle Text and Warthog.

Data management: we host research datasets within the EDW and other UHealth repositories and provide comprehensive support for datasets, recurring reports, automatically refreshed datasets, etc.

Collaborations and training: we support multi-center studies through Epic Cosmos and other research networks, research registries, etc., and conduct seminars, workshops, and hands-on training for departments and divisions on healthcare data.

Personnel

- Vikrant G. Deshmukh, PhD, JD, MS, MSc – Director of Data Science Services and Adj. Asst. Professor, Population Health Sciences, Biomedical Informatics, and Nursing.
- Mingyuan Zhang, MS – Senior Medical Informaticist, DSS.
- Ann M. Lyons, PhD, MS, RN – Medical Informaticist, DSS.
- Vasee Sivaloganathan, MS – Medical Informaticist, DSS.
- Mihai Virtosu, MS – Medical Informaticist, DSS.
- Lama Albarqawi, MS – Medical Informaticist, DSS.
- Sam Kozloff, MD –Clinical Assistant Professor, Internal Medicine, and Research Assistant (part-time), DSS.

Academic Oversight Committee

- **Chair**: Yves Lussier, MD, FACMI (Professor and Chair, Biomedical Informatics Biomedical Informatics).
- **Vice-Chair**: Carl V. Asche, PhD, MSc, MBA (Research Professor, Dept. of Pharmacotherapy).
- Michael B. Strong, MD, FHM (Clinical Professor, Internal Medicine; Chief Medical Information Officer, University of Utah Hospital).
- Andrea S. Wallace, PhD, RN, FAAN (Assoc. Professor and Assoc. Dean of Research, College of Nursing).
- Julie Fritz, PhD, PT, ATC (Distinguished Professor and Assoc. Dean for Research, College of Health).
- Srinivasan Beddhu, MD (Professor and Clinical Research Medical Director, Internal Medicine).
- Carole Stipelman, MD, MPH, FAAP (Clinical Professor, Pediatrics; Medical Director, UHealth Pediatric Clinic and Sugarhouse Pediatrics).
- Jacob Kean, PhD, MA, MEd (Assoc. Professor, Population Health Sciences).
- Julio Facelli, PhD, FACMI (Professor and Vice-Chair, Biomedical Informatics).

Contact

- Pulse site: https://pulse.utah.edu/site/DSS
- Team email: datascience@hsc.utah.edu

FY23 Annual Update

Team updates – DSS completed the first full fiscal year with the Health Sciences Cores after having transitioned from the University Hospital to HSC Cores in Nov. 2021. In FY'23, two senior DSS team members left to pursue other opportunities, and we are thrilled to have Mr. Mihai Virtosu and Ms. Lama Albarqawi join the team in their place, and to have Dr. Sam Kozloff join us in a part-time role.

Grant support – DSS provided letters of support for the following grant/contract submissions in FY'23:

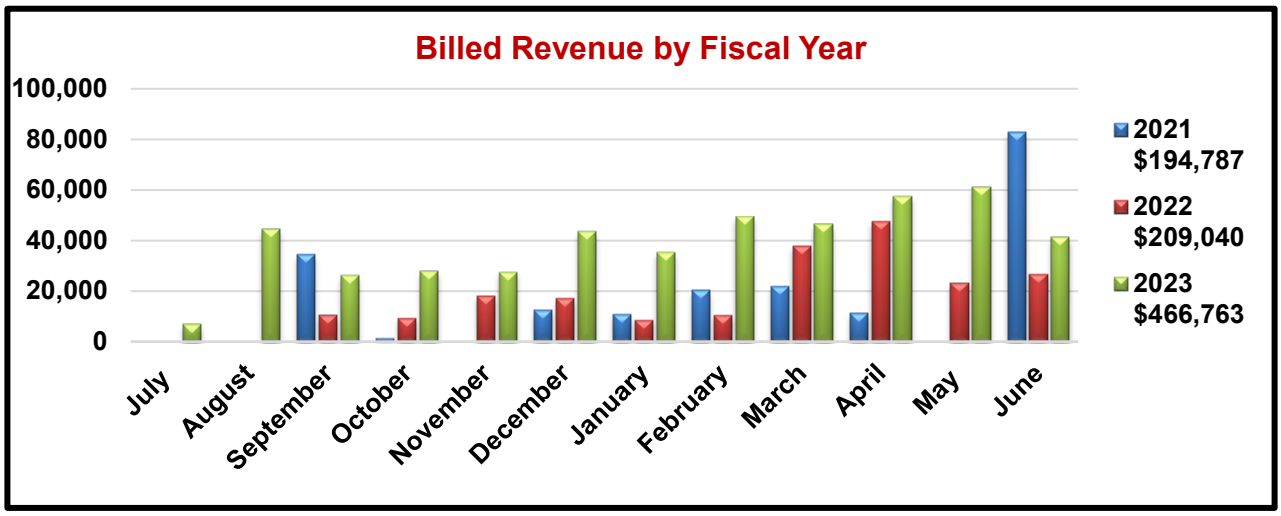
- NIH – Alycia A. Bristol, PhD, RN, AGCNS-BC and Andrea S. Wallace, PhD, RN, FAAN (College of Nursing).
- NIH – Elissa M. Ozanne, PhD and Tracey Onega, PhD (Population Health Sciences).
- NIH - J. Robinson Singleton, MD (Neurology).
- NIH - Fiemu E. Nwariaku, MD, FACS, MBA and Thomas K. Varghese Jr., MD, MS, MBA, FACS (Surgery).
- NIH - Tanya M. Halliday, PhD, RD and Christopher M Depner (College of Health).

- NCI – Raquel Reisinger (Human Genetics).
- Other - Anne Thackeray, PT, PhD, MPH (College of Health).
- Other - Julia Scialla, MD, MHS, FASN (University of Virginia).

Revenue/Expenses

FY23 Expenses: **Total $1,449,033**
FY23 Revenue: **Total $1,487,894**

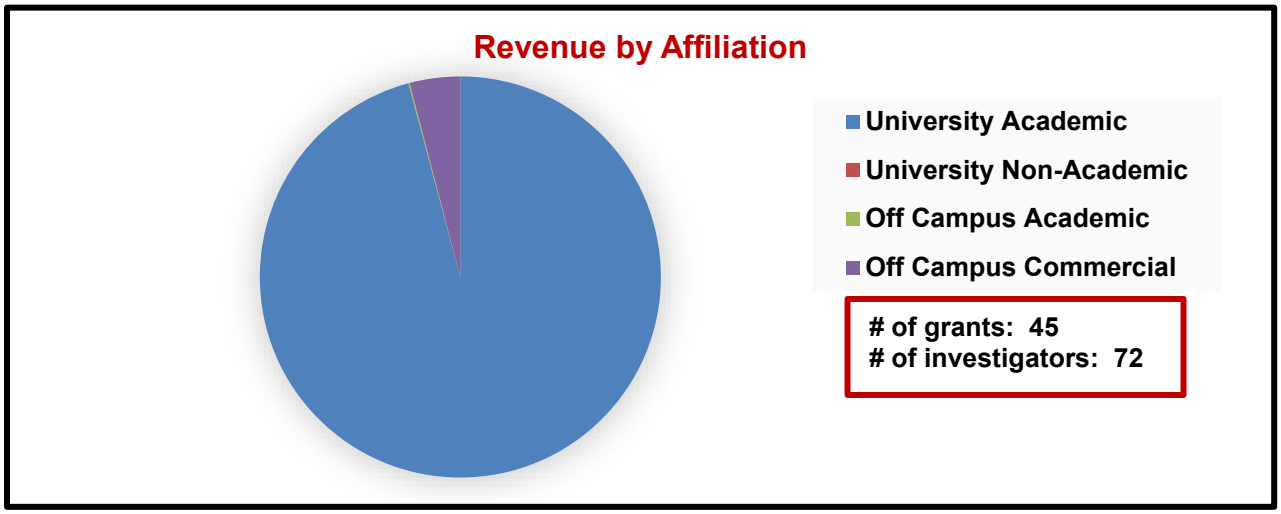
- VP of Health Sciences Support: $785,000
- Internal Medicine: $155,940
- Surgery: $80,191
- FY23 Revenue generated from services: $466,763

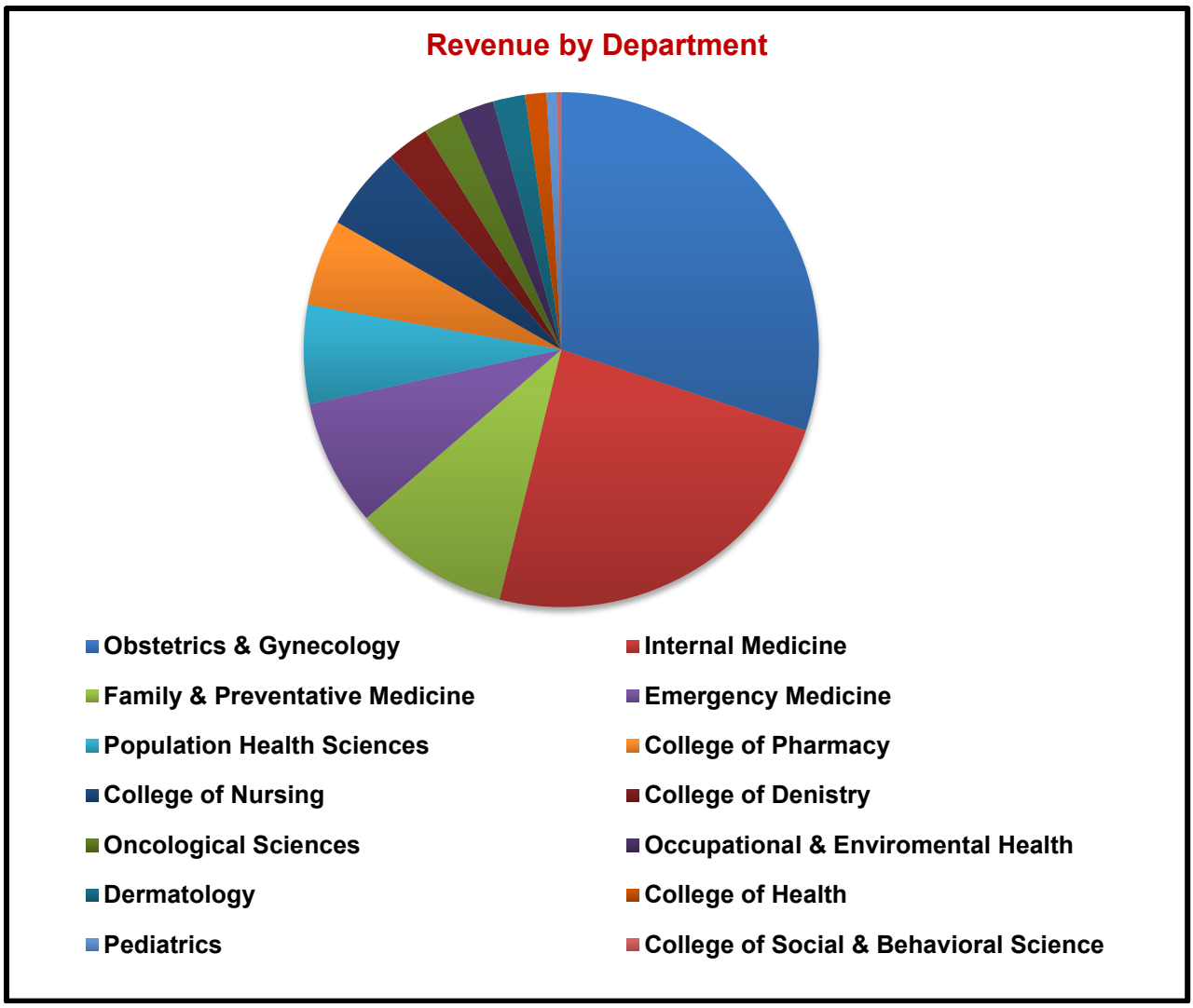


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support

Revenue Generated (see charts following):





Top Users

1	Vikrant Deshmukh	Internal Medicine, OSVPHS, Surgery
2	Marcela Smid	The Task Force for Global Health
3	Benjamin Steinberg	NIH
4	C-Path	Commercial
5	Hilary Coon	NIH
6	Diana Brixner	Department, Aruene Corporation
7	Darin Young	Department
8	Kola Okuyemi	NIH
9	Brandon Creswell	Department
10	Sara Simonsen	Department, NIH

Publications

1. Abedin, Z., M. Herner, M. Torre, y. Zhang, C. Orton, A. Lyons, R. Butcher and B. A. Steinberg (2022). Abstract 14452: Do Patient-Reported Symptoms on Ambulatory Electrocardiogram Correlate With Atrial Arrhythmia Episodes? Circulation **146**(Suppl_1): A14452-A14452.doi:10.1161/circ.146.suppl_1.14452
2. Adams, T. D., H. Meeks, A. Fraser, L. E. Davidson, J. Holmen, M. Newman, A. R. Ibele, N. Richards, S. C. Hunt and J. Kim (2023). Long-term all-cause and cause-specific mortality for four bariatric surgery procedures. Obesity (Silver Spring) **31**(2): 574-585.10.1002/oby.23646
3. Alderden, J., S. M. Kennerly, A. Wilson, J. Dimas, C. McFarland, D. Y. Yap, L. Zhao and T. L. Yap (2022). Explainable Artificial Intelligence for Predicting Hospital-Acquired Pressure Injuries in COVID-19-Positive Critical Care Patients. Comput Inform Nurs **40**(10): 659-665.10.1097/CIN.0000000000000943
4. Allen-Brady, K., K. J. Colletier, S. Woller, K. Eliason, A. M. Uchida, G. Ro, M. Newman and K. A. Peterson (2023). Eosinophilic Gastritis and Enteritis Are Increased in Families With Eosinophilic Esophagitis. Am J Gastroenterol **118**(2): 263-268.10.14309/ajg.0000000000002021
5. Allen-Brady, K. L., M. B. Christensen, A. D. Sandberg and A. W. Pastuszak (2022). Significant familial clustering of Peyronie's disease in close and distant relatives. Andrology **10**(7): 1361-1367.10.1111/andr.13223
6. Anzai, Y., C. P. Chang, K. Rowe, J. Snyder, V. Deshmukh, M. Newman, A. Fraser, K. Smith, A. Date, C. Galvao, M. Monroe and M. Hashibe (2023). Surveillance Imaging with PET/CT and CT and/or MRI for Head and Neck Cancer and Mortality: A Population-based Study. Radiology **307**(2): e212915.10.1148/radiol.212915
7. Azizi, M., F. Mahfoud, M. A. Weber, A. S. P. Sharp, R. E. Schmieder, P. Lurz, M. D. Lobo, N. D. L. Fisher, J. Daemen, M. J. Bloch, J. Basile, K. Sanghvi, M. Saxena, P. Gosse, J. S. Jenkins, T. Levy, A. Persu, B. Kably, L. Claude, H. Reeve-Stoffer, C. McClure, A. J. Kirtane and R.-H. Investigators (2022). Effects of Renal Denervation vs Sham in Resistant Hypertension After Medication Escalation: Prespecified Analysis at 6 Months of the RADIANCE-HTN TRIO Randomized Clinical Trial. JAMA Cardiol **7**(12): 1244-1252.10.1001/jamacardio.2022.3904
8. Azizi, M., M. Saxena, Y. Wang, J. S. Jenkins, C. Devireddy, F. Rader, N. D. L. Fisher, R. E. Schmieder, F. Mahfoud, J. Lindsey, K. Sanghvi, T. M. Todoran, J. Pacella, J. Flack, J. Daemen, A. S. P. Sharp, P. Lurz, M. J. Bloch, M. A. Weber, M. D. Lobo, J. Basile, L. Claude, H. Reeve-Stoffer, C. K. McClure, A. J. Kirtane, R. I. Investigators and Collaborators (2023). Endovascular Ultrasound Renal Denervation to Treat Hypertension: The RADIANCE II Randomized Clinical Trial. JAMA **329**(8): 651-661.10.1001/jama.2023.0713
9. Barnard, M. E., T. Martheswaran, M. Van Meter, S. S. Buys, K. Curtin and J. A. Doherty (2022). Body Mass Index and Mammographic Density in a Multiracial and Multiethnic Population-Based Study. Cancer Epidemiol Biomarkers Prev **31**(7): 1313-1323.10.1158/1055-9965.EPI-21-1249
10. Baron, K. G., B. M. Appelhans, H. J. Burgess, L. Quinn, T. Greene and C. M. Allen (2023). Circadian Timing, Information processing and Metabolism (TIME) study: protocol of a longitudinal study of sleep duration, circadian alignment and cardiometabolic health among overweight adults. BMC Endocr Disord **23**(1): 26.10.1186/s12902-023-01272-y
11. Chang, C. P., C. M. Wilson, K. Rowe, J. Snyder, M. Dodson, V. Deshmukh, M. Newman, A. Fraser, K. Smith, A. Date, J. B. Stanford, D. Gaffney, K. Mooney and M. Hashibe (2022). Sexual dysfunction among gynecologic cancer survivors in a population-based cohort study. Support Care Cancer **31**(1): 51.10.1007/s00520-022-07469-6
12. Chang, C. P., T. F. Ho, J. Snyder, M. Dodson, V. Deshmukh, M. Newman, A. Date, N. L. Henry and M. Hashibe (2023). Breast cancer survivorship and sexual dysfunction: a population-based cohort study. Breast Cancer Res Treat **200**(1): 103-113.10.1007/s10549-023-06953-9
13. Chapman, A. B., K. S. Peterson, E. Rutter, M. Nevers, M. Zhang, J. Ying, M. Jones, D. Classen and B. Jones (2022). Development and evaluation of an interoperable natural language processing system for identifying pneumonia across clinical settings of care and institutions. JAMIA Open **5**(4): ooac114.10.1093/jamiaopen/ooac114
14. Charles, J. E., J. Baylis, M. C. Smid and G. Cochran (2023). Nonfatal Overdoses Among Pregnant Individuals With Opioid Use Disorder. Obstet Gynecol **141**(5): 961-963.10.1097/AOG.0000000000005129

15. Charron, E., A. White, K. Carlston, W. Abdullah, J. D. Baylis, S. Pierce, M. S. Businelle, A. J. Gordon, E. E. Krans, M. C. Smid and G. Cochran (2023). Prospective acceptability of digital phenotyping among pregnant and parenting people with opioid use disorder: A multisite qualitative study. Front Psychiatry **14**: 1137071.10.3389/fpsyt.2023.1137071
16. Chavez-Yenter, D., M. S. Goodman, Y. Chen, X. Chu, R. L. Bradshaw, R. Lorenz Chambers, P. A. Chan, B. M. Daly, M. Flynn, A. Gammon, R. Hess, C. Kessler, W. K. Kohlmann, D. M. Mann, R. Monahan, S. Peel, K. Kawamoto, G. Del Fiol, M. Sigireddi, S. S. Buys, O. Ginsburg and K. A. Kaphingst (2022). Association of Disparities in Family History and Family Cancer History in the Electronic Health Record With Sex, Race, Hispanic or Latino Ethnicity, and Language Preference in 2 Large US Health Care Systems. JAMA Network Open **5**(10): e2234574.10.1001/jamanetworkopen.2022.34574
17. Cohan JN, Horns JJ, Allen-Brady K. Diverticulitis as a Familial Disease: Evidence from a Population-Based Analysis. Journal of the American College of Surgeons 2022;235(5):S13-S13. DOI: 10.1097/01.XCS.0000895716.54971.6a.
18. Cohan, J. N., J. J. Horns, H. A. Hanson, K. Allen-Brady, M. C. Kieffer, L. C. Huang and B. S. Brooke (2023). The Association Between Family History and Diverticulitis Recurrence: A Population-Based Study. Dis Colon Rectum **66**(2): 269-277.10.1097/DCR.0000000000002178
19. DeVilbiss, E. A., L. A. Sjaarda, C. M. Peterson, J. M. Hotaling, J. L. Mills, P. Mendola, D. T. Carrell, E. Johnstone, Z. Chen, N. J. Perkins, G. Ryan, E. F. Schisterman and S. L. Mumford (2022). Longitudinal semen parameter assessments and live birth: variability and implications for treatment strategies. Fertil Steril **118**(5): 852-863.10.1016/j.fertnstert.2022.08.012
20. Duffley, G., A. Szabo, B. J. Lutz, E. C. Mahoney-Rafferty, C. W. Hess, A. Ramirez-Zamora, P. Zeilman, K. D. Foote, S. Chiu, M. H. Pourfar, C. Goas Cnp, J. L. Wood, I. U. Haq, M. S. Siddiqui, M. Afshari, M. Heiry, J. Choi, M. Volz, J. L. Ostrem, M. San Luciano, N. Niemann, A. Billnitzer, D. Savitt, A. Tarakad, J. Jimenez-Shahed, C. C. Aquino, M. S. Okun and C. R. Butson (2023). Interactive mobile application for Parkinson's disease deep brain stimulation (MAP DBS): An open-label, multicenter, randomized, controlled clinical trial. Parkinsonism Relat Disord **109**: 105346.10.1016/j.parkreldis.2023.105346
21. Etheridge, T., B. J. Brintz, M. S. Jensen, E. Peralta, A. Ayesha, A. Jebaraj and D. P. Marx (2023). Incidence and severity of asymptomatic ocular injury in adult and pediatric orbital fractures. Orbit **42**(3): 273-278.10.1080/01676830.2022.2095648
22. Gao, M. M., R. D. Vlisides-Henry, P. R. Kaliush, L. Thomas, J. Butner, K. L. Raby, E. Conradt and S. E. Crowell (2023). Dynamics of mother-infant parasympathetic regulation during face-to-face interaction: The role of maternal emotion dysregulation. Psychophysiology **60**(6): e14248.10.1111/psyp.14248
23. Gavile, C. M., N. H. Kazmers, K. A. Novak, H. D. Meeks, Z. Yu, J. L. Thomas, C. Hansen, T. Barker and M. J. Jurynec (2022). Familial Clustering and Genetic Analysis of Severe Thumb Carpometacarpal Joint Osteoarthritis in a Large Statewide Cohort. J Hand Surg Am **47**(10): 923-933.10.1016/j.jhsa.2022.08.004
24. Gimbel, L. A., A. A. Allshouse, D. Neff, R. M. Silver, E. Conradt and S. E. Crowell (2022). Mental health symptom changes in pregnant individuals across the COVID-19 pandemic: a prospective longitudinal study. BMC Pregnancy Childbirth **22**(1): 897.10.1186/s12884-022-05144-6
25. Glotzbach, J. P., H. A. Hanson, J. E. Tonna, J. J. Horns, C. McCarty Allen, A. P. Presson, C. L. Griffin, M. Zak, V. Sharma, M. Tristani-Firouzi and C. H. Selzman (2023). Familial Associations of Prevalence and Cause-Specific Mortality for Thoracic Aortic Disease and Bicuspid Aortic Valve in a Large-Population Database. Circulation.10.1161/CIRCULATIONAHA.122.060439
26. Hayes, H. A., R. Marcus, G. J. Stoddard, M. McFadden, J. Magel and R. Hess (2022). Is the Activity Measure for Postacute Care "6-Clicks" Tool Associated With Discharge Destination Postacute Stroke? Arch Rehabil Res Clin Transl **4**(4): 100228.10.1016/j.arrct.2022.100228
27. Herner, M., Z. Abedin, M. Torre, y. Zhang, C. Orton, A. Lyons, R. Butcher and B. A. Steinberg (2022). Abstract 13449: Patient-Triggered Symptomatic Events Poorly Predict Presence of Atrial Arrhythmia on Ambulatory Electrocardiogram Monitors in Heart Failure Patients. Circulation **146**(Suppl_1): A13449-A13449.doi:10.1161/circ.146.suppl_1.13449
28. Hesterman, M., B. Fallon, P. Wilson and M. L. Weller (2022). 1243. Hepatitis D Virus and Hepatitis B Virus Epidemiology in Utah. Open Forum Infectious Diseases **9**(Supplement_2).10.1093/ofid/ofac492.1074

29. Himbert, C., J. Ose, B. Gigic, R. Viskochil, K. Santuci, T. Lin, A. Ashworth, J. N. Cohan, C. L. Scaife, J. Jedrzkiewicz, V. Damerell, K. M. Atkins, J. Gong, M. G. Mutch, C. Bernadt, S. Felder, J. Sanchez, S. A. Cohen, M. K. Krane, N. Hinkle, E. Wood, A. R. Peoples, J. C. Figueiredo, A. T. Toriola, E. M. Siegel, C. I. Li, D. Shibata, K. Boucher, J. L. Round, A. B. Ulrich, M. Schneider, L. C. Huang, S. Hardikar and C. M. Ulrich (2023). Associations of combined physical activity and body mass index groups with colorectal cancer survival outcomes. BMC Cancer **23**(1): 300.10.1186/s12885-023-10695-8
30. Hopkins, Z. H., G. Kuceki, V. L. Taliercio, A. M. Snyder, G. J. Stoddard, K. C. Duffin, R. Hess and A. M. Secrest (2023). Evaluation of Skindex-16 construct validity in routinely collected psoriasis data: a retrospective analysis of the relationship between overall physician global assessment scores and Skindex-16 and measure discordance. Arch Dermatol Res **315**(5): 1151-1159.10.1007/s00403-022-02491-4
31. Horns, J. J., K. Fendereski, J. M. Ramsay, J. Halpern, I. N. Iko, E. Ferlic, B. R. Emery, K. Aston and J. Hotaling (2023). The impact of socioeconomic status on bulk semen parameters, fertility treatment, and fertility outcomes in a cohort of subfertile men. Fertil Steril **120**(1): 72-79.10.1016/j.fertnstert.2023.02.015
32. Horwitz, L. I., T. Thaweethai, S. B. Brosnahan, et al (2023). Researching COVID to Enhance Recovery (RECOVER) adult study protocol: Rationale, objectives, and design. PLoS One **18**(6): e0286297.10.1371/journal.pone.0286297
33. Ilham, S., C. Willis, K. Kim, K. C. Chung, B. M. Wood, M. S. Tan, C. J. Tan, D. T. Nguyen, D. I. Brixner and D. D. Stenehjem (2023). Cancer incidence in immunocompromised patients: a single-center cohort study. BMC Cancer **23**(1): 33.10.1186/s12885-022-10497-4
34. Kaliush, P. R., P. K. Kerig, K. L. Raby, S. E. Maylott, D. Neff, B. Speck, N. C. Molina, A. E. Pappal, U. D. Parameswaran, E. Conradt and S. E. Crowell (2023). Examining implications of the developmental timing of maternal trauma for prenatal and newborn outcomes. Infant Behav Dev **72**: 101861.10.1016/j.infbeh.2023.101861
35. Karsy, M., J. C. Hunsaker, F. Hamrick, M. N. Sanford, A. Breviu, W. T. Couldwell and D. Horton (2022). A Retrospective Cohort Study Evaluating the Use of the Modified Early Warning Score to Improve Outcome Prediction in Neurosurgical Patients. Cureus **14**(8): e28558.10.7759/cureus.28558
36. Kim, J., J. Kelley, S. Ikramuddin, J. Magel, N. Richards and T. Adams (2023). Association of Pre-operative Arthritis with Long-Term Mortality Following Bariatric Surgery. J Gastrointest Surg **27**(5): 895-902.10.1007/s11605-023-05580-5
37. Kim, J., J. Kelley, S. Ikramuddin, J. Magel, N. Richards and T. Adams (2023). Pre-Operative Substance Use Disorder is Associated with Higher Risk of Long-Term Mortality Following Bariatric Surgery. Obes Surg **33**(6): 1659-1667.10.1007/s11695-023-06564-9
38. Kim, J., J. Kelley, K. Kleinschmit, N. Richards and T. Adams (2023). Development of dementia in patients who underwent bariatric surgery. Surg Endosc **37**(5): 3507-3521.10.1007/s00464-022-09837-z
39. Kirtane, A. J., A. S. P. Sharp, F. Mahfoud, N. D. L. Fisher, R. E. Schmieder, J. Daemen, M. D. Lobo, P. Lurz, J. Basile, M. J. Bloch, M. A. Weber, M. Saxena, Y. Wang, K. Sanghvi, J. S. Jenkins, C. Devireddy, F. Rader, P. Gosse, M. Sapoval, N. C. Barman, L. Claude, D. Augustin, L. Thackeray, C. M. Mullin, M. Azizi, R. Investigators and Collaborators (2023). Patient-Level Pooled Analysis of Ultrasound Renal Denervation in the Sham-Controlled RADIANCE II, RADIANCE-HTN SOLO, and RADIANCE-HTN TRIO Trials. JAMA Cardiol **8**(5): 464-473.10.1001/jamacardio.2023.0338
40. Kiser, A. C., K. C. Schliep, M. Yandell and K. Eilbeck (2022). A BAYESIAN NETWORK FOR COMPLEX PAIN-RELATED FEATURES OF ENDOMETRIOSIS. Fertility and Sterility **118**(4): e222.10.1016/j.fertnstert.2022.08.629
41. Leekha, S., G. Robinson, J. T. Jacob, S. Fridkin, A. L. Shane, A. Sick-Samuels, A. Milstone, R. Nair, E. N. Perencevich, M. Puig-Asensio, T. Kobayashi, J. Mayer, J. Lewis, S. C. Bleasdale, E. Wenzler, A. J. Mena Lora, J. Baghdadi, G. M. Schrank, G. Nadimpalli and A. Harris (2022). 1666. Sources and Preventability of Hospital-onset Bacteremia and Fungemia in the United States: Evaluation of a Potential Healthcare Quality Measure. Open Forum Infectious Diseases **9**(Supplement_2).10.1093/ofid/ofac492.132
42. Luebker, S., T. Frech, S. Assassi, B. Skaug, J. K. Gordon, K. Lakin, et al (2023). CONQUER Scleroderma: association of gastrointestinal tract symptoms in early disease with resource utilization. Rheumatology (Oxford).10.1093/rheumatology/kead176

43. Macielak, R. J., A. M. Selleck, A. Kocharyan, J. B. Hunter, A. Patro, E. L. Perkins, C. A. Hamilton, N. S. Patel, R. K. Gurgel, A. D. Sweeney, K. D. Brown, M. J. Link and M. L. Carlson (2023). Approach to Cochlear Implantation in Patients With Ventriculoperitoneal Shunts. Otolaryngol Head Neck Surg 168(6): 1485-1493.10.1002/ohn.220
44. Marsiglio, J., M. Kovacsovics, X. Wang, S. Hardikar, A. Young, J. Doherty, J. Hyngstrom, J. McPherson, B. Haaland and S. Hu-Lieskovan (2022). 1251 Immune checkpoint inhibitor-induced type 1 diabetes mellitus is associated with long-term response and survival in patients with melanoma. Journal for ImmunoTherapy of Cancer **10**(Suppl 2): A1299-A1299.10.1136/jitc-2022-SITC2022.1251
45. Mendenhall, S. D., E. M. Graham, S. Memmott, H. Frederiksen, D. Rioux-Forker, A. A. Wang and D. T. Hutchinson (2023). A New Source of Mutilating Hand Injuries: The Side-by-Side Utility-Terrain Vehicle. Plast Reconstr Surg.10.1097/PRS.0000000000010453
46. Miele, K., S. Y. Kim, R. Jones, et al (2023). Medication for Opioid Use Disorder During Pregnancy - Maternal and Infant Network to Understand Outcomes Associated with Use of Medication for Opioid Use Disorder During Pregnancy (MAT-LINK), 2014-2021. MMWR Surveill Summ **72**(3): 1-14.10.15585/mmwr.ss7203a1
47. Miotke, L., C. Nevala-Plagemann, J. Ying, V. Florou, B. Haaland and I. Garrido-Laguna (2022). Treatment outcomes in recurrent versus de novo metastatic pancreatic adenocarcinoma: a real world study. BMC Cancer **22**(1): 1054.10.1186/s12885-022-10130-4
48. Myhre, L., J. Featherall, D. O'Neill, D. Rothberg, J. Haller, T. Higgins and L. Marchand (2023). Patient-reported Anxiety Scores Are Associated With Lower Physical Function in Patients Experiencing Orthopaedic Trauma. Clin Orthop Relat Res **481**(5): 967-973.10.1097/CORR.0000000000002516
49. Myhre, L., L. Steffenson, T. F. Higgins, D. L. Rothberg, J. M. Haller and L. S. Marchand (2023). Butterfly fragments in diaphyseal tibial fractures heal unpredictably: Should we be adopting other strategies for these high risk fractures? Injury **54**(2): 738-743.10.1016/j.injury.2022.12.024
50. Network, H.-R., M. G. Thompson, S. K. Yoon, et al (2022). Association of mRNA Vaccination With Clinical and Virologic Features of COVID-19 Among US Essential and Frontline Workers. JAMA **328**(15): 1523-1533.10.1001/jama.2022.18550
51. Nolan, M. B., T. M. Piasecki, S. S. Smith, T. B. Baker, M. C. Fiore, et al (2023). Relations of Current and Past Cancer with Severe Outcomes among 104,590 Hospitalized COVID-19 Patients: The COVID EHR Cohort at the University of Wisconsin. Cancer Epidemiol Biomarkers Prev **32**(1): 12-21.10.1158/1055-9965.EPI-22-0500
52. Ocier, K., S. Abdelaziz, S. Kim, K. Rowe, J. Snyder, V. Deshmukh, M. Newman, A. Fraser, K. Smith, C. Porucznik, K. Shoaf, J. Stanford, C. Lee and M. Hashibe (2023). Contributions of cancer treatment, comorbidities, and obesity to aging-related disease risks among non-Hodgkin lymphoma survivors. Cancer Causes Control **34**(2): 171-180.10.1007/s10552-022-01652-0
53. ONeil, B., L. A. Coombs, B. Haaland, J. Ying, J. P. McPherson, A. C. Kirchhoff, C. Ulrich, J. S. Huber, A. C. Beck and K. Mooney (2022). Exploring cost and utilization outcomes of Huntsman at Home: Which patients benefit most from a novel oncology hospital at home program? Journal of Clinical Oncology **40**(28_suppl): 15-15.10.1200/JCO.2022.40.28_suppl.015
54. Ose, J., B. Gigic, S. Hardikar, T. Lin, C. Himbert, C. A. Warby, A. R. Peoples, C. L. Lindley, J. Boehm, P. Schrotz-King, J. C. Figueiredo, A. T. Toriola, E. M. Siegel, C. I. Li, A. Ulrich, M. Schneider, D. Shibata and C. M. Ulrich (2022). Presurgery Adhesion Molecules and Angiogenesis Biomarkers Are Differently Associated with Outcomes in Colon and Rectal Cancer: Results from the ColoCare Study. Cancer Epidemiol Biomarkers Prev **31**(8): 1650-1660.10.1158/1055-9965.EPI-22-0092
55. Patil, A., C. Swiston, R. T. Wallace, C. Paulson, M. E. Conley, L. McCoy, C. Chaya and B. Wirostko (2022). Exfoliation Syndrome and Exfoliation Glaucoma in the Navajo Nation. Vision (Basel) **6**(4).10.3390/vision6040061
56. Patil, A., M. Conley, C. Pompoco, C. Paulson, S. Taylor, C. Swiston, J. S. Herrick, R. Ritch, K. Curtin and B. Wirostko (2023). Abdominal aortic aneurysm and exfoliation syndrome in Utah. Acta Ophthalmol **101**(4): 449-456.10.1111/aos.15306
57. Paulson, C., D. Barker, C. Pompoco, S. Taylor, M. Conley, A. Patil, N. Amakiri, B. Stagg, R. Ritch, J. Kang, J. Wiggs, K. Curtin and B. Wirostko (2022). Association of Non-Melanoma Skin Carcinomas and UV Exposure with Exfoliation Syndrome in Utah. Medical Research Archives **10**(10).10.18103/mra.v10i10.3262

58. Peralta, D. L., D. Moore and R. Bierer (2023). Neonatologists' Perspectives on Exploring Parental Spirituality in Prenatal Consultations. Palliat Med Rep **4**(1): 92-99.10.1089/pmr.2022.0052
59. Piasecki, T. M., S. S. Smith, T. B. Baker, et al (2023). Smoking Status, Nicotine Medication, Vaccination, and COVID-19 Hospital Outcomes: Findings from the COVID EHR Cohort at the University of Wisconsin (CEC-UW) Study. Nicotine Tob Res **25**(6): 1184-1193.10.1093/ntr/ntac201
60. Ramsay, J. M., K. Fendereski, J. J. Horns, J. A. VanDerslice, H. A. Hanson, B. R. Emery, J. A. Halpern, K. I. Aston, E. Ferlic and J. M. Hotaling (2023). Environmental exposure to industrial air pollution is associated with decreased male fertility. Fertil Steril.10.1016/j.fertnstert.2023.05.143
61. Richards Steed, R., A. V. Bakian, K. R. Smith, N. Wan, S. Brewer, R. Medina and J. VanDerslice (2022). Evidence of transgenerational effects on autism spectrum disorder using multigenerational space-time cluster detection. Int J Health Geogr **21**(1): 13.10.1186/s12942-022-00313-4
62. Rock, C., O. Abosi, S. Bleasdale, E. Colligan, D. J. Diekema, P. Dullabh, A. P. Gurses, K. Heaney-Huls, J. T. Jacob, S. Kandiah, S. Lama, S. Leekha, J. Mayer, A. J. Mena Lora, D. J. Morgan, P. Osei, S. Pau, J. L. Salinas, E. Spivak, E. Wenzler and S. E. Cosgrove (2022). Clinical Decision Support Systems to Reduce Unnecessary Clostridioides difficile Testing Across Multiple Hospitals. Clin Infect Dis **75**(7): 1187-1193.10.1093/cid/ciac074
63. Sherrod, B. A., R. Kim, J. Hunsaker, C. Rada, C. Christensen, G. J. Stoddard, D. Brodke, M. A. Mahan, M. D. Mazur, E. F. Bisson and A. T. Dailey (2023). Postoperative ileus risk after posterior thoracolumbar fusion performed with total intravenous anesthesia versus inhaled anesthesia. J Neurosurg Spine **38**(3): 307-312.10.3171/2022.9.SPINE22520
64. Sideris, K., M. Zhang, A. F. Siu, P. Wohlfahrt, et al (2023). HEALTH RELATED QUALITY OF LIFE AS PREDICTOR OF OUTCOMES IN HEART FAILURE WITH PRESERVED EJECTION FRACTION. Journal of the American College of Cardiology **81**(8_Supplement): 613-613.doi:10.1016/S0735-1097(23)01057-4
65. Smid, M., M. Williams, E. Iacob, R. Pentecost, G. Latendresse and S. Simonsen (2023). Mixed method approach to understanding participation barriers in a perinatal depression group telehealth intervention trial. American Journal of Obstetrics and Gynecology **228**(1): S356.10.1016/j.ajog.2022.11.624
66. Spivak, A. M., B. J. Barney, T. Greene, R. Holubkov, C. S. Olsen, J. Bridges, R. Srivastava, B. Webb, F. Sebahar, A. Huffman, C. F. Pacchia, J. M. Dean and R. Hess (2023). A Randomized Clinical Trial Testing Hydroxychloroquine for Reduction of SARS-CoV-2 Viral Shedding and Hospitalization in Early Outpatient COVID-19 Infection. Microbiol Spectr **11**(2): e0467422.10.1128/spectrum.04674-22
67. Swiston, C. J., K. S. Hu, A. Simpson, E. Burton, B. J. Brintz and A. Lin (2022). Prevention of Exposure Keratopathy in the Intensive Care Unit: Evaluation of an EMR-Based Lubrication Order Protocol for Ventilated Patients. J Acad Ophthalmol (2017) **14**(2): e141-e146.10.1055/s-0042-1750020
68. Tao, R., Y. Chen, S. Kim, K. Ocier, S. Lloyd, M. M. Poppe, C. J. Lee, M. J. Glenn, K. R. Smith, A. Fraser, V. Deshmukh, M. G. Newman, J. Snyder, K. G. Rowe, D. K. Gaffney, B. Haaland and M. Hashibe (2022). Mental health disorders are more common in patients with Hodgkin lymphoma and may negatively impact overall survival. Cancer **128**(19): 3564-3572.10.1002/cncr.34359
69. Tward, J. D., S. B. Johnson, K. E. Kokeny, S. Lloyd, D. M. Cannon, C. B. Dechet, B. ONeil, R. Stephenson, K. M. Boucher, S. Gupta, U. Swami, B. L. Maughan and N. Agarwal (2023). Initial results of a phase 2 pilot study of radium-223 and radiotherapy in untreated hormone-naïve men with oligometastatic prostate cancer to bone. Journal of Clinical Oncology **41**(6_suppl): 156-156.10.1200/JCO.2023.41.6_suppl.156
70. Vazquez, S. R., A. S. Wilson and D. M. Witt (2022). Management of potential drug-drug interactions with nirmatrelvir-ritonavir and oral anticoagulants: a case series. J Thromb Thrombolysis **54**(4): 583-586.10.1007/s11239-022-02707-4
71. Verrilli, L., E. Johnstone, C. Welt and K. Allen-Brady (2023). Primary ovarian insufficiency has strong familiality: results of a multigenerational genealogical study. Fertil Steril **119**(1): 128-134.10.1016/j.fertnstert.2022.09.027
72. Wallace, R. T., M. Murri, L. McCoy, E. Peralta, J. H. Pettey and C. J. Chaya (2022). Patterns of Blindness in the Navajo Nation: A 9-Year Study. Vision (Basel) **6**(3).10.3390/vision6030043

73. Willis, C., D. A. Sallman, M. Tan, M. Brendle, V. L. Williams, C. Comperatore, T. Au, S. K. Tantravahi, N. Al Ali, J. A. Gilreath, T. Kovacsovics, X. Cao, I. Sadek, R. S. Komrokji and D. Stenehjem (2022). Treatments and Outcomes for Patients at Academic Cancer Centers with Myelodysplastic Syndrome (MDS) By Revised International Prognostic Scoring System (IPSS-R) Scores. Blood **140**(Supplement 1): 5291-5292.10.1182/blood-2022-162622
74. Workalemahu, T., J. M. Page, H. Meeks, Z. Yu, E. Guinto, A. Fraser, M. W. Varner, L. H. Theilen, A. Quinlan, H. Coon, D. A. Enquobahrie, C. V. Ananth, F. Tekola-Ayele, L. B. Jorde and R. M. Silver (2023). Familial aggregation of stillbirth: A pedigree analysis of a matched case-control study. BJOG **130**(5): 454-462.10.1111/1471-0528.17301
75. Young, A., M. Y. Lim, J. Sanders, D. W. Branch and S. E. Simonsen (2023). Pregnancy and childbirth in women with bleeding disorders: A retrospective cohort study. Haemophilia 29(1): 240-247.10.1111/hae.14688
76. Zheutlin, A. R., M. Zhang and M. B. Conroy (2023). Clinical encounter length and initiation of statin therapy for primary prevention among adults with elevated atherosclerotic cardiovascular disease risk. Am J Prev Cardiol 13: 100450.10.1016/j.ajpc.2022.100450

DNA Peptide

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 click compatible modifications. The goal of the facility is to provide quality service with rapid turnaround times.

Services

- Routine and custom DNA synthesis
- Routine and custom RNA synthesis
- Routine and custom peptide synthesis
- Peptide purification

Equipment

- Dr. Oligo 192 DNA Synthesizer
- ABI 3900 DNA Synthesizer
- K&A H-8 Synthesizer (2)
- ABI 394 DNA Synthesizer (1)
- 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
- Andrea Koehler, Lab Technician
- Meredith Ford, Lab Technician

Advisory Board Committee

Last meeting date: June 2023

- Raphael Franzini, Professor, College of Pharmacy
- Ming Hammond, Professor, Chemistry Department
- Mahesh Chandrasekharan, Professor, Radiation Oncology

FY23 Annual Update

New Equipment

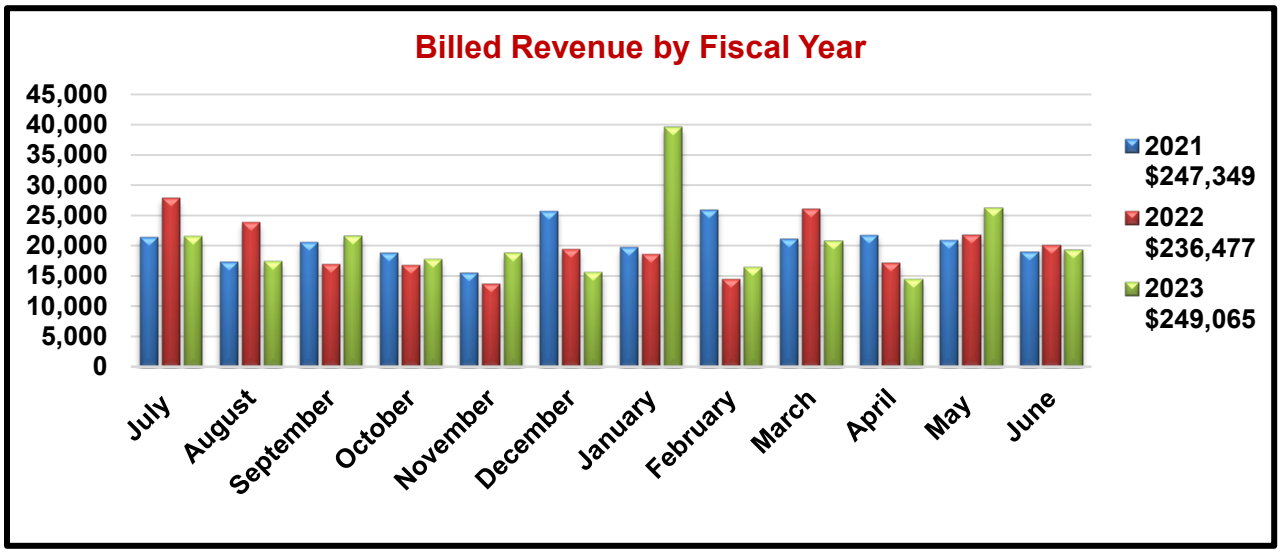
- The DNA Peptide Facility can now synthesize RNA oligos up 120 bases. The RNA can be used for CRISPR genome editing projects.

Revenue/Expenses

FY23 Expenses: **Total $281,505**

FY23 Revenue: **Total $309,065**

- VP of Health Sciences Support: $60,000
- FY23 Revenue Generated from Services: $249,065

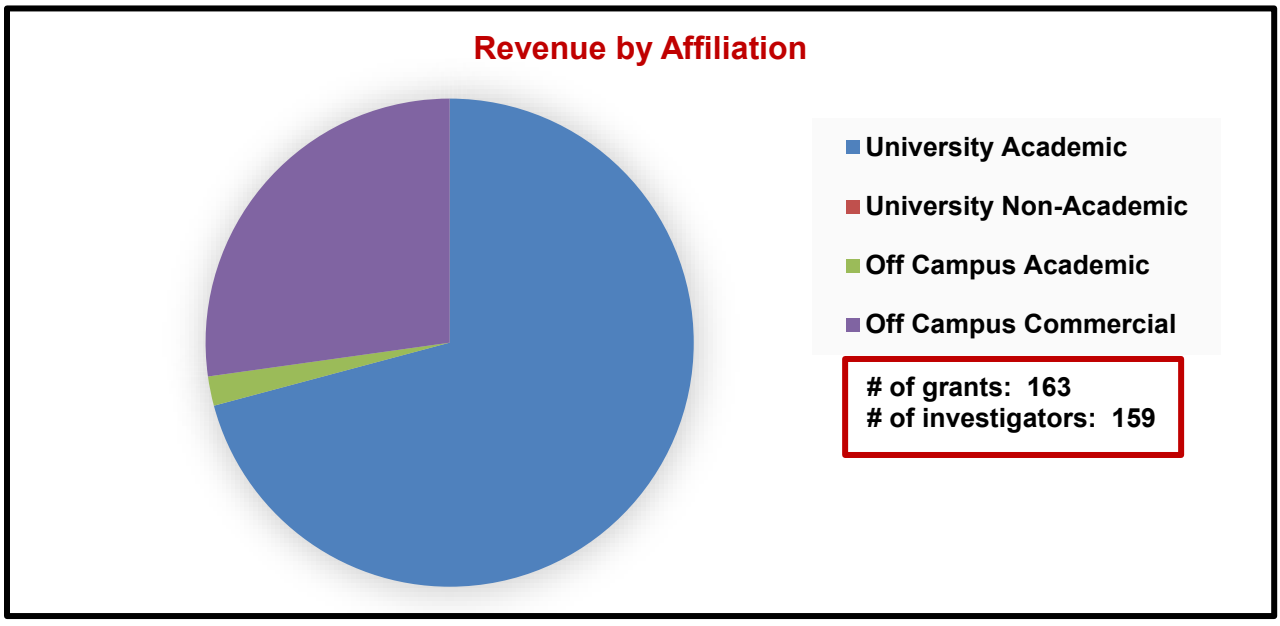


* Legend displays total annual revenue by year earned.

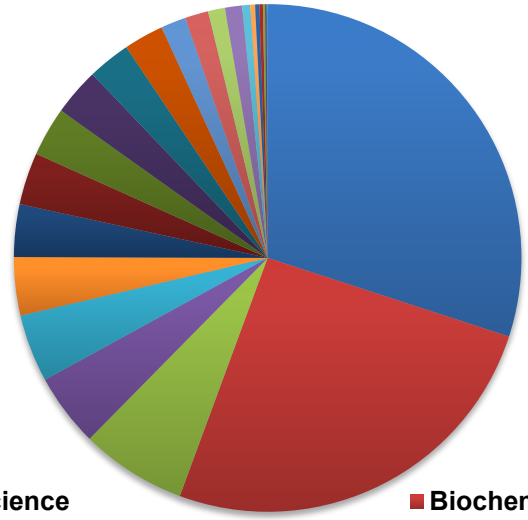
FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):



Revenue by Department



- College of Science
- Biochemistry
- College of Pharmacy
- Pathology
- Neurobiology & Anatomy
- Oncological Sciences
- Molecular Medicine
- Internal Medicine
- Pediatrics
- HCI
- Human Genetics
- HSC Core Research Facilities
- Orthopaedics
- College of Engineering
- Dermatology
- College of Health
- CVRTI
- Neurosurgery
- Ophthalmology & Visual Sciences
- Neurology
- Surgery
- Psychiatry
- CTSI

Top Users

1	BioFire Diagnostics	Commercial
2	Cynthia Burrows	NIH
3	Jared Rutter	Brigham & Women's Hospital, Department, NIH
4	SeekLabs	Commercial
5	Wesley Sundquist	Department, Gilead Sciences, NIH
6	Silicon Therapeutics	Commercial
7	Ming Hammond	Department, NIH, NSF
8	Crystal Davey Hicks	Department
9	Eric Schmidt	NIH, NSF
10	Justin English	NIH

Publications

1. Aderounmu, A. M., P. J. Aruscavage, B. Kolaczkowski and B. L. Bass (2023). Ancestral protein reconstruction reveals evolutionary events governing variation in Dicer helicase function. Elife **12**.10.7554/eLife.85120
2. Batistatou, N. and J. A. Kritzer (2023). Investigation of Sequence-Penetration Relationships of Antisense Oligonucleotides. Chembiochem **24**(9): e202300009.10.1002/cbic.202300009
3. Bauer, K. M., M. C. Nelson, W. W. Tang, T. R. Chiaro, D. G. Brown, A. Ghazaryan, S. H. Lee, A. M. Weis, J. H. Hill, K. A. Klag, V. B. Tran, J. W. Thompson, A. G. Ramstead, J. K. Monts, J. E. Marvin, M. Alexander, W. P. Voth, W. Z. Stephens, D. M. Ward, A. C. Petrey, J. L. Round and R. M. O'Connell (2022). CD11c+ myeloid cell exosomes reduce intestinal inflammation during colitis. JCI Insight **7**(19).10.1172/jci.insight.159469
4. Campbell, R. A., B. K. Manne, M. Banerjee, E. A. Middleton, A. Ajanel, H. Schwertz, F. Denorme, C. Stubben, E. Montenont, S. Saperstein, L. Page, N. D. Tolley, D. L. Lim, S. M. Brown, C. K. Grissom, D. W. Sborov, A. Krishnan and M. T. Rondina (2022). IFITM3 regulates fibrinogen endocytosis and platelet reactivity in nonviral sepsis. J Clin Invest **132**(23).10.1172/JCI153014
5. Fleming, A. M. and C. J. Burrows (2023). Nanopore sequencing for N1-methylpseudouridine in RNA reveals sequence-dependent discrimination of the modified nucleotide triphosphate during transcription. Nucleic Acids Res **51**(4): 1914-1926.10.1093/nar/gkad044
6. Fleming, A. M., R. Tran, C. A. Omaga, S. A. Howpay Manage, C. J. Burrows and J. C. Conboy (2022). Second Harmonic Generation Interrogation of the Endonuclease APE1 Binding Interaction with G-Quadruplex DNA. Anal Chem **94**(43): 15027-15032.10.1021/acs.analchem.2c02951
7. Ghazaryan, A., J. A. Wallace, W. W. Tang, C. Barba, S. H. Lee, K. M. Bauer, M. C. Nelson, C. N. Kim, C. Stubben, W. P. Voth, D. S. Rao and R. M. O'Connell (2023). miRNA-1 promotes acute myeloid leukemia cell pathogenesis through metabolic regulation. Front Genet **14**: 1192799.10.3389/fgene.2023.1192799
8. Howpay Manage, S. A., J. Zhu, A. M. Fleming and C. J. Burrows (2023). Promoters vs. telomeres: AP-endonuclease 1 interactions with abasic sites in G-quadruplex folds depend on topology. RSC Chem Biol **4**(4): 261-270.10.1039/d2cb00233g
9. Howpay Manage SA, Fleming AM, Chen HN, Burrows CJ. Cysteine Oxidation to Sulfenic Acid in APE1 Aids G-Quadruplex Binding While Compromising DNA Repair. ACS Chem Biol. 2022 Sep 16;17(9):2583-2594. doi: 10.1021/acschembio.2c00511. Epub 2022 Aug 29.
10. Manuel, B. A., S. Das, A. Sanford, M. C. Jenkins, M. G. Finn and J. M. Heemstra (2023). Modular Catalysis: Aptamer Enhancement of Enzyme Kinetics in a Nanoparticle Reactor. Biomacromolecules **24**(4): 1934-1941.10.1021/acs.biomac.3c00144
11. Montoya, A. L., M. Glavatskikh, B. J. Halverson, L. H. Yuen, H. Schuler, D. Kireev and R. M. Franzini (2023). Combining pharmacophore models derived from DNA-encoded chemical libraries with structure-based exploration to predict Tankyrase 1 inhibitors. Eur J Med Chem **246**: 114980.10.1016/j.ejmech.2022.114980
12. Myres, G. J. and J. M. Harris (2023). Nanomolar Binding of an Antibiotic Peptide to DNA Measured with Raman Spectroscopy. Langmuir **39**(11): 4150-4160.10.1021/acs.langmuir.3c00099
13. Myres GJ, Harris JM. Stable Immobilization of DNA to Silica Surfaces by Sequential Michael Addition Reactions Developed with Insights from Confocal Raman Microscopy. Anal Chem. 2023 Feb 14;95(6):3499-3506. doi: 10.1021/acs.analchem.2c05594. Epub 2023 Jan 31.
14. Smith, M. A., E. Blankman, C. C. Jensen, L. M. Hoffman, K. S. Ullman and M. C. Beckerle (2022). Nuclear pore complexes concentrate on Actin/LINC/Lamin nuclear lines in response to mechanical stress in a SUN1 dependent manner. Heliyon **8**(12): e12147.10.1016/j.heliyon.2022.e12147
15. Wenzel, D. M., D. R. Mackay, J. J. Skalicky, E. L. Paine, M. S. Miller, K. S. Ullman and W. I. Sundquist (2022). Comprehensive analysis of the human ESCRT-III-MIT domain interactome reveals new cofactors for cytokinetic abscission. Elife **11**.10.7554/eLife.77779
16. Winter, J. M., H. L. Fresenius, C. N. Cunningham, P. Wei, H. R. Keys, J. Berg, A. Bott, T. Yadav, J. Ryan, D. Sirohi, S. R. Tripp, P. Barta, N. Agarwal, A. Letai, D. M. Sabatini, M. L. Wohlever and J. Rutter (2022). Collateral deletion of the mitochondrial AAA+ ATPase ATAD1 sensitizes cancer cells to proteasome dysfunction. Elife **11**.10.7554/eLife.82860

DNA Sequencing

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 DNA sequencers and lab robotics such as the Element Biosciences AVITI sequencer (sequencing by avidity), Oxford Nanopore P2Solo (long read sequencer), 10x Genomics and the Biomek FXp for liquid handling needs. For Illumina sequencing we also have the capability of sending samples out for sequencing with approximately 3-week turnaround time run on both the Illumina NovaSeq and the MiSeq instruments. In addition, we have a MinIon from Oxford Nanopore that we can work with you on completing runs of long read sequencing for your projects. Data from standard DNA sequencing services are typically reported to customers the same day as they are run. Sample information can be submitted online and sequencing data files are available for download using a simple and secure interface.

Services

DNA Sequencing

- Element Biosciences AVITI Sequencing (Sequencing by avidity)
- Standard Sanger DNA sequencing
- Primer walking on clones
- Mutation detection and resequencing custom projects
- Pyrosequencing
- 10x Genomics libraries for single cell sequencing
- Oxford Nanopore MinIon runs
- Illumina Sequencing with 3-week turnaround
- Oxford Nanopore Sequencing

Cell Line Authentication

- Human cell line authentication by STR

Robotics

- Biomek FXp with Span-8 and 96 head

Fragment Analysis

- Fragment sizing and concentrations

10x Genomics Chromium Controller

- Single Cell RNA Seq
- ATAC Seq
- Immune cell profiling

Other Services

- Lab consumables for sample submission
- Life Technologies freezer program

Equipment

Sequencers

- Qiagen Q24 Pyrosequencer
- Applied Biosystems 3730xl
- Element Biosciences AVITI
- Oxford Nanopore P2Solo Long Read Sequencer
- Oxford Nanopore MinIon Long Read Sequencer

Liquid Handlers

- 1 Biomek FXp programmable liquid sample dispenser

Fragment Analysis

- AATI Fragment Analyzer

Personnel

- Derek Warner, Director
- Michael Powers, Senior Laboratory Specialist

Advisory Board Committee

Last meeting date: November 10th, 2022

- Lynn Jorde Ph.D., Professor, Human Genetics
- Colin Dale Ph.D., Professor, Biology
- Robert Weiss Ph.D., Professor, Human Genetics
- Aaron Quinlan Ph.D., Professor, Human Genetics

FY23 Annual Update

New Equipment

- BioMek FXp replaced the BioMek FX that became obsolete.

New Services

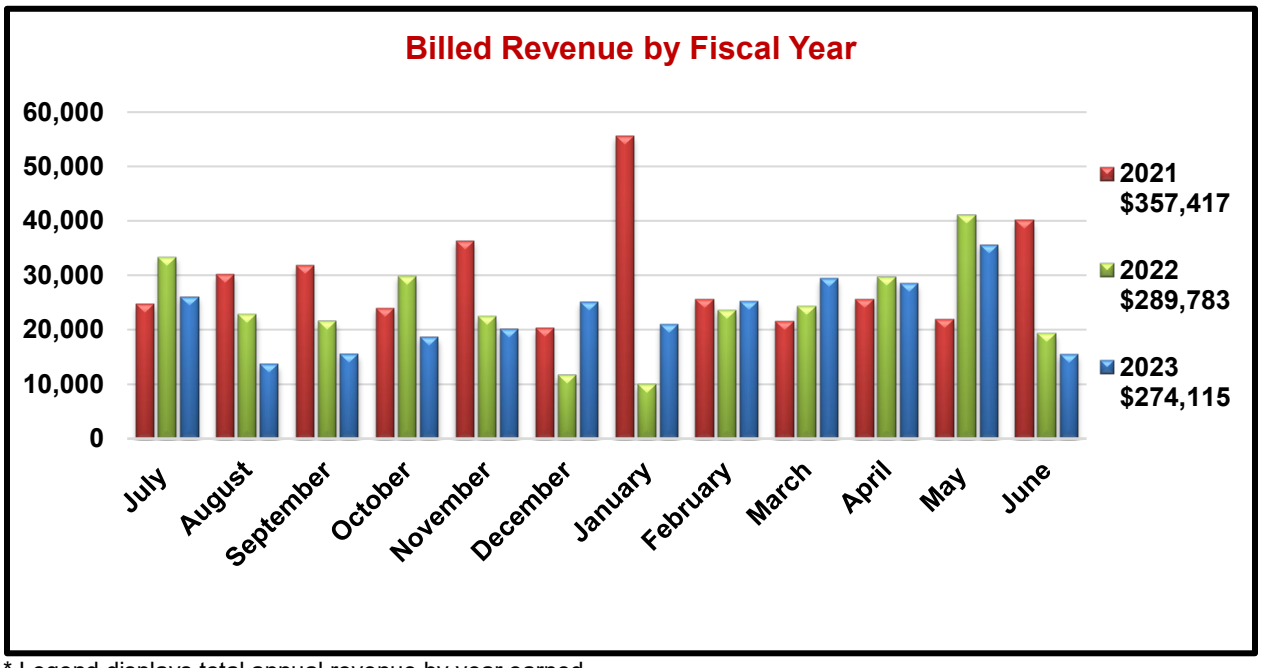
- The Sequencing Core added whole genome sequencing through the purchase of an Element Biosciences AVITI in FY23.

Revenue/Expenses

FY23 Expenses: **Total $241,925**

FY23 Revenue: **Total $274,115**

- VP of Health Sciences Support: $0
- FY23 Revenue generated from services: $274,115

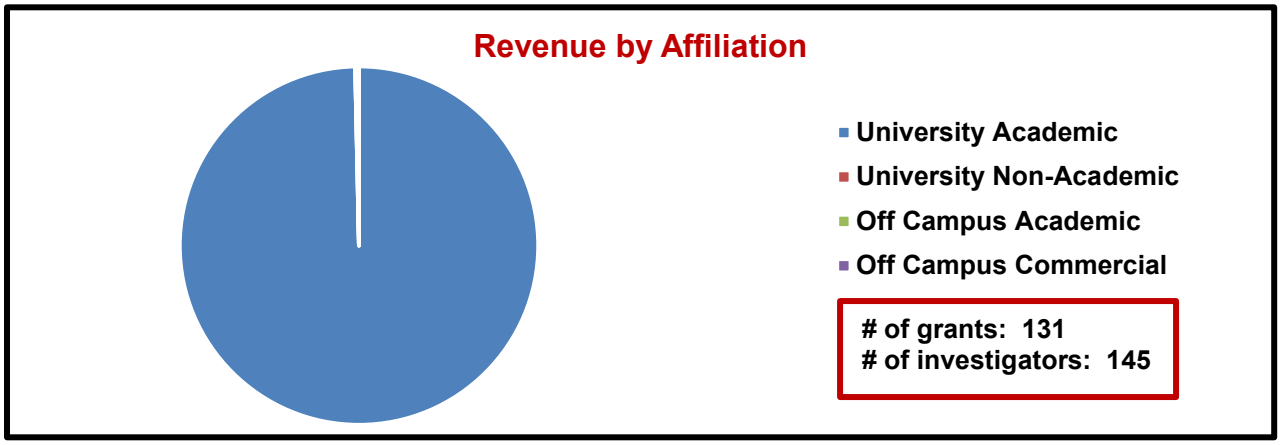


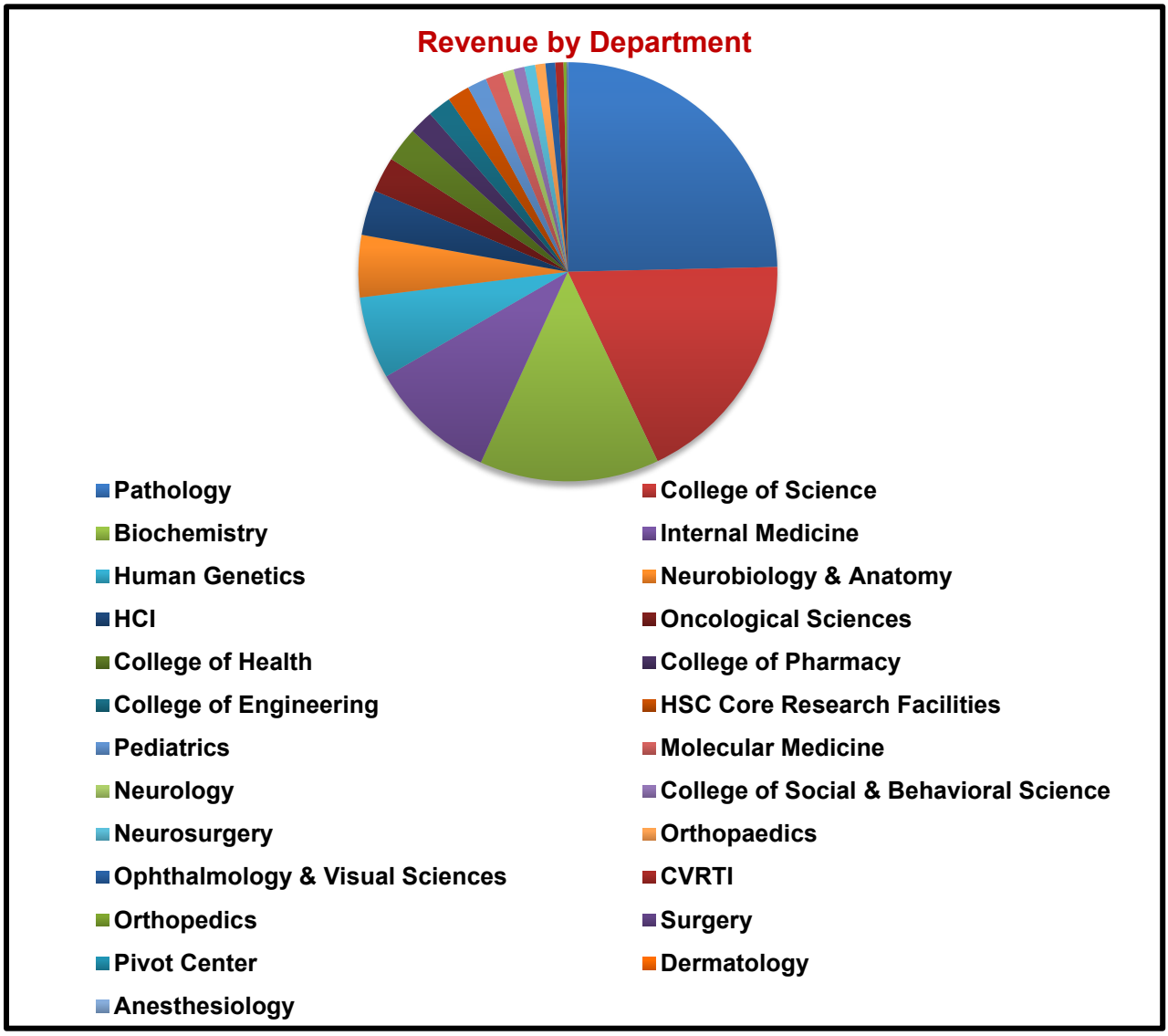
* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Tracey Lamb	Department, NIH
2	Wesley Sundquist	Cleveland CF, Department, Gilead Sciences, NIH
3	Jessica Brown	Department, NIH
4	John Parkinson	NIH
5	Willard Dere	Department
6	Brian Evavold	Department
7	Maria Bettini	NIH
8	Zemin Zhou	Department
9	Sean Tavtigian	Department, NIH
10	Ming Hammond	NIH, NSF

Publications

1. Balakrishnan, B., R. Altassan, R. Budhraja, W. Liou, A. Lupo, S. Bryant, A. Mankouski, S. Radenkovic, G. J. Preston, A. Pandey, S. Boudina, T. Kozicz, E. Morava-Kozicz and K. Lai (2023). AAV-based gene therapy prevents and halts the progression of dilated cardiomyopathy in a mouse model of phosphoglucomutase 1 deficiency (PGM1-CDG). Transl Res **257**: 1-14.10.1016/j.trsl.2023.01.004
2. Demir, M., L. P. Russelburg, W. J. Lin, C. H. Trasvina-Arenas, B. Huang, P. K. Yuen, M. P. Horvath and S. S. David (2023). Structural snapshots of base excision by the cancer-associated variant MutY N146S reveal a retaining mechanism. Nucleic Acids Res **51**(3): 1034-1049.10.1093/nar/gkac1246
3. Flack, C. E. and J. S. Parkinson (2022). Structural signatures of Escherichia coli chemoreceptor signaling states revealed by cellular crosslinking. Proc Natl Acad Sci U S A **119**(28): e2204161119.10.1073/pnas.2204161119
4. Fleming, A. M. and C. J. Burrows (2023). Nanopore sequencing for N1-methylpseudouridine in RNA reveals sequence-dependent discrimination of the modified nucleotide triphosphate during transcription. Nucleic Acids Res 51(4): 1914-1926.10.1093/nar/gkad044
5. Fleming, A. M., R. Tran, C. A. Omaga, S. A. Howpay Manage, C. J. Burrows and J. C. Conboy (2022). Second Harmonic Generation Interrogation of the Endonuclease APE1 Binding Interaction with G-Quadruplex DNA. Anal Chem **94**(43): 15027-15032.10.1021/acs.analchem.2c02951
6. Gerstner, C. D., M. Reed, T. M. Dahl, G. Ying, J. M. Frederick and W. Baehr (2022). Arf-like Protein 2 (ARL2) Controls Microtubule Neogenesis during Early Postnatal Photoreceptor Development. Cells **12**(1).10.3390/cells12010147
7. Giglio, M. L., P. F. Salcedo, M. Watkins and B. Olivera (2023). Insights into a putative polychaete-gastropod symbiosis from a newly identified annelid worm that predates upon Conus ermineus eggs. Contributions to Zoology **92**(2): 97-111.https://doi.org/10.1163/18759866-bja10038
8. Hackney, C. M., P. F. Salcedo, E. Mueller, L. D. Kjelgaard, M. Watkins, L. G. Zachariassen, J. R. McArthur, D. J. Adams, A. S. Kristensen, B. Olivera, R. K. Finol-Urdaneta, H. Safavi-Hemami, J. P. Morth and L. Ellgaard (2022). Identification of a sensory neuron Cav2.3 inhibitor within a new superfamily of macro-conotoxins. bioRxiv: 2022.2007.2004.498665.10.1101/2022.07.04.498665
9. Happ, J. T., C. D. Arveseth, J. Bruystens, D. Bertinetti, I. B. Nelson, C. Olivieri, J. Zhang, D. S. Hedeen, J. F. Zhu, J. L. Capener, J. W. Brockel, L. Vu, C. C. King, V. L. Ruiz-Perez, X. Ge, G. Veglia, F. W. Herberg, S. S. Taylor and B. R. Myers (2022). A PKA inhibitor motif within SMOOTHENED controls Hedgehog signal transduction. Nat Struct Mol Biol **29**(10): 990-999.10.1038/s41594-022-00838-z
10. Howpay Manage, S. A., A. M. Fleming, H. N. Chen and C. J. Burrows (2022). Cysteine Oxidation to Sulfenic Acid in APE1 Aids G-Quadruplex Binding While Compromising DNA Repair. ACS Chem Biol **17**(9): 2583-2594.10.1021/acschembio.2c00511
11. Howpay Manage, S. A., J. Zhu, A. M. Fleming and C. J. Burrows (2023). Promoters vs. telomeres: AP-endonuclease 1 interactions with abasic sites in G-quadruplex folds depend on topology. RSC Chem Biol **4**(4): 261-270.10.1039/d2cb00233g
12. Leng, A. M., K. S. Radmall, P. K. Shukla and M. B. Chandrasekharan (2022). Quantitative Assessment of Histone H2B Monoubiquitination in Yeast Using Immunoblotting. Methods Protoc **5**(5).10.3390/mps5050074
13. McKnite, A., H. S. Kim, J. Silva and J. L. Christian (2023). Lack of evidence that fibrillin1 regulates bone morphogenetic protein 4 activity in kidney or lung. Dev Dyn **252**(6): 761-769.10.1002/dvdy.578

14. Radmall, K. S., P. K. Shukla and M. B. Chandrasekharan (2023). A system for in vivo evaluation of protein ubiquitination dynamics using deubiquitinase-deficient strains. bioRxiv: 2023.2006.2018.545485.10.1101/2023.06.18.545485
15. Reed, M., K. I. Takemaru, G. Ying, J. M. Frederick and W. Baehr (2022). Deletion of CEP164 in mouse photoreceptors post-ciliogenesis interrupts ciliary intraflagellar transport (IFT). PLoS Genet **18**(9): e1010154.10.1371/journal.pgen.1010154
16. Scoles, D. R., M. Gandelman, S. Paul, T. Dexheimer, W. Dansithong, K. P. Figueroa, L. T. Pflieger, S. Redlin, S. C. Kales, H. Sun, D. Maloney, R. Damoiseaux, M. J. Henderson, A. Simeonov, A. Jadhav and S. M. Pulst (2022). "A quantitative high-throughput screen identifies compounds that lower expression of the SCA2-and ALS-associated gene ATXN2." J Biol Chem **298**(8): 102228.10.1016/j.jbc.2022.102228
17. Simeone, C. A., J. L. Wilkerson, A. M. Poss, J. A. Banks, J. V. Varre, J. L. Guevara, E. J. Hernandez, B. Gorsi, D. L. Atkinson, T. Turapov, S. G. Frodsham, J. C. F. Morales, K. O'Neil, B. Moore, M. Yandell, S. A. Summers, A. S. Krolewski, W. L. Holland and M. G. Pezzolesi (2022). "A dominant negative ADIPOQ mutation in a diabetic family with renal disease, hypoadiponectinemia, and hyperceramidemia." NPJ Genom Med **7**(1): 43.10.1038/s41525-022-00314-z
18. Shukla, P. K., J. E. Bissell, S. Kumar, S. Pokhrel, S. Palani, K. S. Radmall, O. Obidi, T. J. Parnell, J. Brasch, D. C. Shrieve and M. B. Chandrasekharan (2023). Structure and functional determinants of Rad6-Bre1 subunits in the histone H2B ubiquitin-conjugating complex. Nucleic Acids Res **51**(5): 2117-2136.10.1093/nar/gkad012
19. Shukla, P. K., K. S. Radmall and M. B. Chandrasekharan (2023). Rapid purification of rabbit immunoglobulins using a single-step, negative-selection chromatography. Protein Expr Purif **207**: 106270.10.1016/j.pep.2023.106270
20. Shukla, P. K., D. Sinha, A. M. Leng, J. E. Bissell, S. Thatipamula, R. Ganguly, K. S. Radmall, J. J. Skalicky, D. C. Shrieve and M. B. Chandrasekharan (2022). Mutations of Rad6 E2 ubiquitin-conjugating enzymes at alanine-126 in helix-3 affect ubiquitination activity and decrease enzyme stability. J Biol Chem **298**(11): 102524.10.1016/j.jbc.2022.102524
21. Utzman, P. H., V. P. Mays, B. C. Miller, M. C. Fairbanks, W. J. Brazelton and M. P. Horvath (2023). Metagenome mining and functional analysis reveal oxidized guanine DNA repair at the Lost City Hydrothermal Field. bioRxiv: 2023.2004.2005.535768.10.1101/2023.04.05.535768
22. Walker, M. F., J. Zhang, W. Steiner, P.-I. Ku, J.-F. Zhu, Z. Michaelson, Y.-C. Yen, A. B. Long, M. J. Casey, A. Poddar, I. B. Nelson, C. D. Arveseth, F. Nagel, R. Clough, S. LaPotin, K. M. Kwan, S. Schulz, R. A. Stewart, J. J. G. Tesmer, T. Caspary, R. Subramanian, X. Ge and B. R. Myers (2023). GRK2 Kinases in the Primary Cilium Initiate SMOOTHENED-PKA Signaling in the Hedgehog Cascade. bioRxiv: 2023.2005.2010.540226.10.1101/2023.05.10.540226
23. Workalemahu, T., C. Avery, S. Lopez, N. R. Blue, A. Wallace, A. R. Quinlan, H. Coon, D. Warner, M. W. Varner, D. W. Branch, L. B. Jorde and R. M. Silver (2023). Whole-genome sequencing analysis in families with recurrent pregnancy loss: A pilot study. PLoS One **18**(2): e0281934.10.1371/journal.pone.0281934

Drug Discovery

Overview

The Drug Discovery Facility provides small molecule compound collections for screening in biologic assays. The facility delivers low-cost and efficient access to chemical libraries for screening, a diverse array of equipment for automation, and synthetic chemistry support for the characterization and validation of compounds to be further developed as therapeutics, diagnostics and biological sensors or 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/Screening
- Assay development
- Consultation on target identification/validation, hit to lead optimization, PK/PD/Efficacy
- Chemical support for drug discovery

CRISPR Knockout/Knockin Cell Line Production – In collaboration with the Mutation Generation and Detection Core, we started to offer a full cell line generation service from sgRNA design/construction to final cell line generation/verification.

Viral Packaging Service

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

FY24 Goals

- Expand CRISPR Screening Service
- Increase user base/revenue
- Present services in various department seminar series

Equipment/Compound Collection

Automated Liquid Handling Stations:

- Tecan EVO100/MCA96 Liquid Handler with sterile bio-hoods
- Tecan EVO100/MCA384 Liquid Handler with sterile bio-hoods
- HP D300 Digital Dispenser
- Axygen Platemax semi-automatic plate sealer
- KingFisher Duo Prime System – Automated DNA/RNA Extraction and Protein/Cell Purification

Automated Detection Systems:

- Molecular Devices ImageXpress XLS Automated High-Content System
- Bio-tek Plate Neo 2 Plate Reader with stacker

CRISPR Libraries:

- The genome-scale CRISPR-Cas9 knockout (GeCKO) v2 library
- The human CRISPR Brunello lentiviral pooled libraries
- Subset CRISPR libraries: a) human Lentiviral sgRNA library-kinases, and b) human Lentiviral sgRNA library-nuclear proteins

Commercial Compound Libraries:

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

Private/Proprietary Chemical Collections:

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

Personnel

- Bai Luo, Ph.D., Director

Advisory Board Committee

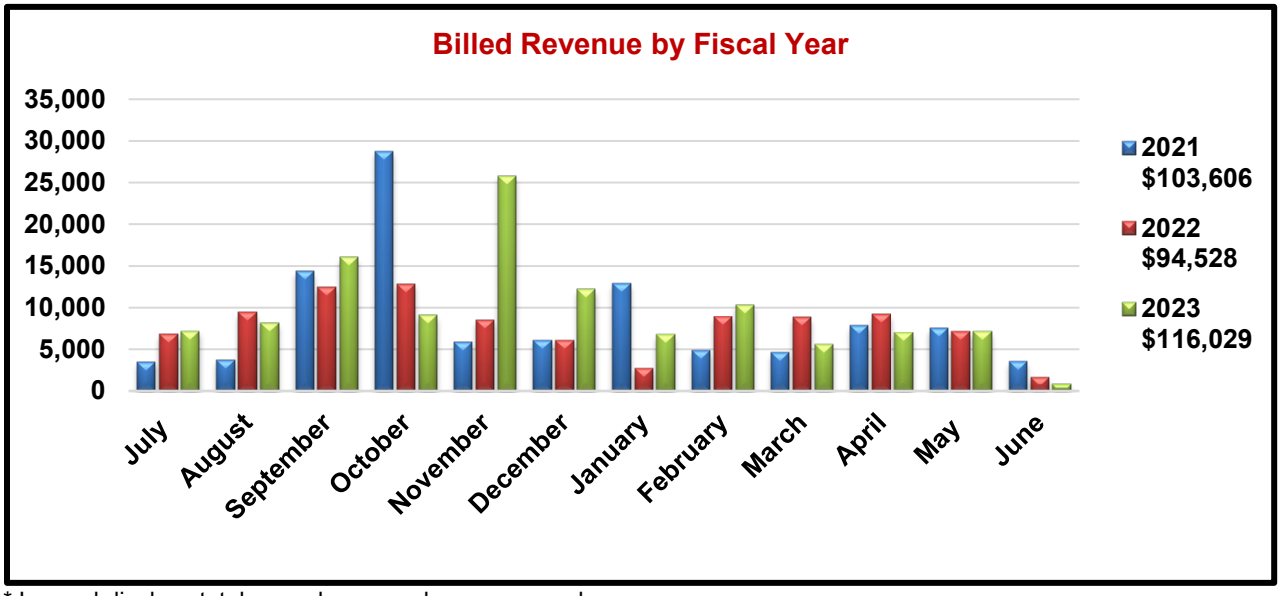
- Darrell Davis, Ph.D., Professor, College of Pharmacy
- Ryan Looper, Ph.D., Professor, Chemistry Department
- John Phillips, Ph.D., Professor, Internal Medicine
- Jared Rutter, Ph.D., Professor, Department of Biochemistry
- Bryan Welm, Ph.D., Professor, HCI

Revenue/Expenses

FY23 Expenses: **Total $177,229**

FY23 Revenue: **Total $191,029**

- VP of Health Sciences Support: $75,000
- FY23 Revenue Generated from Services: $116,029

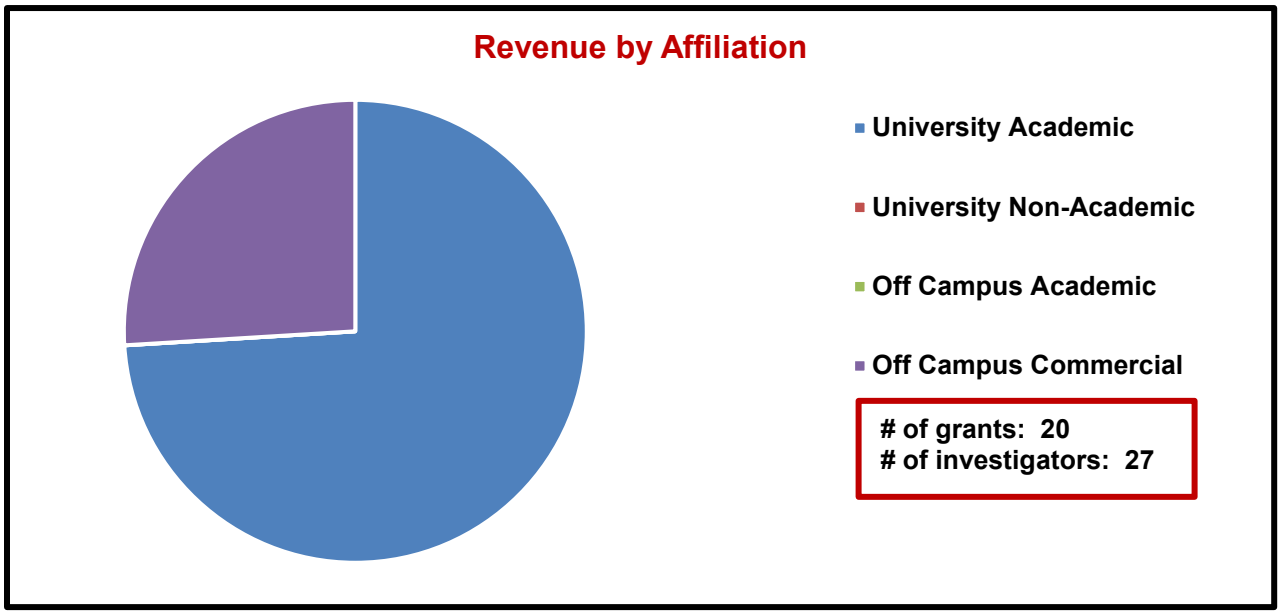


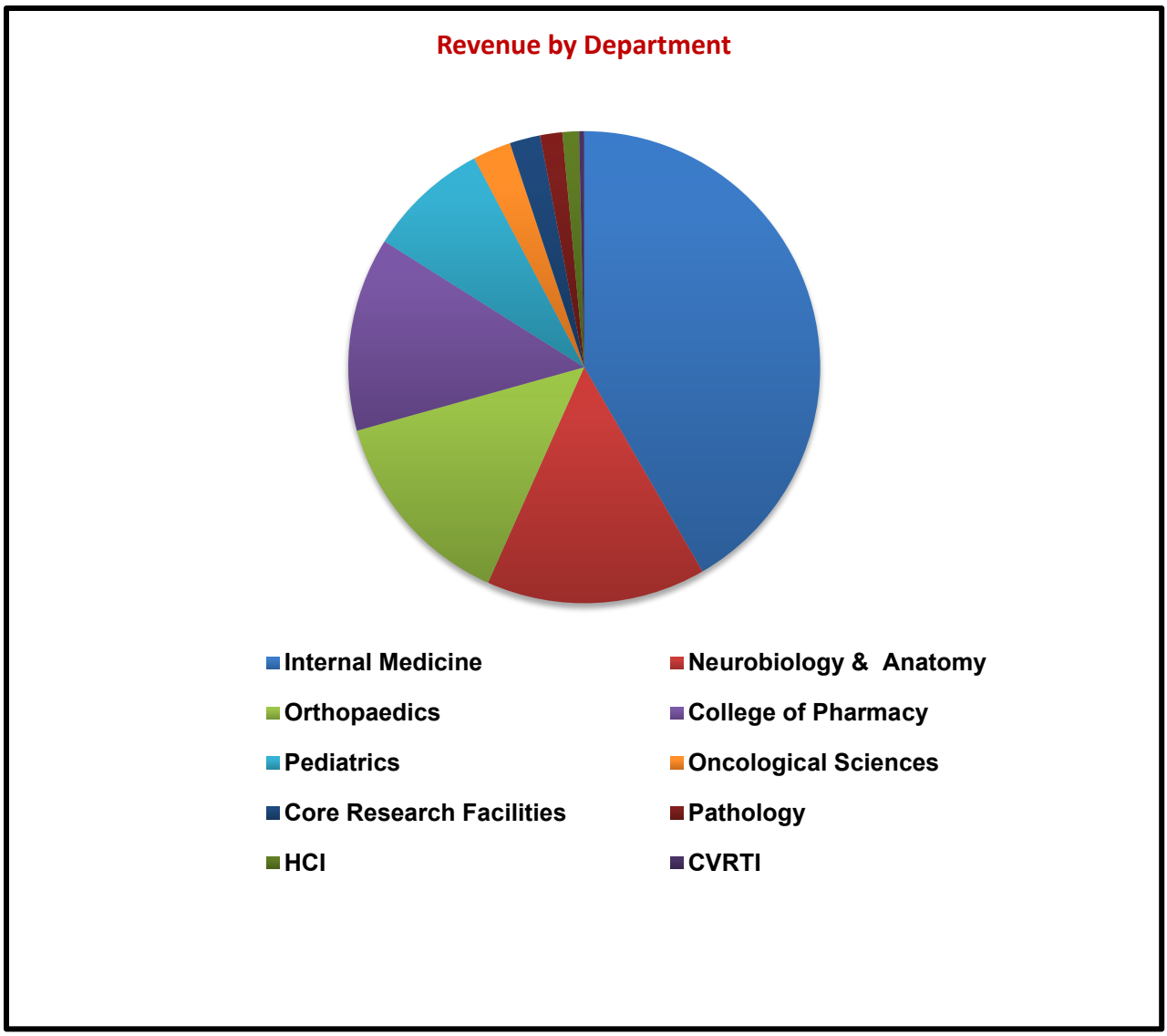
* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Tianxin Yang	NIH
2	Ladder Therapeutics Inc	Commercial
3	Darrel Brodke	Skaggs Foundation for Research
4	Jonathan Constance	Department, NIH
5	Raphael Franzini	Department, NIH, NSF
6	Stefano Brigidi	Department
7	Katharine Diehl	Department, NIH
8	John Phillips	Department
9	Jason Shepherd	Silicon Valley Community Foundation
10	Christopher Reilly	NIH

Publications

1. Hicks, K. G., A. A. Cluntun, H. L. Schubert, S. R. Hackett, J. A. Berg, P. G. Leonard, M. A. Ajalla Aleixo, Y. Zhou, A. J. Bott, S. R. Salvatore, F. Chang, A. Blevins, P. Barta, S. Tilley, A. Leifer, A. Guzman, A. Arok, S. Fogarty, J. M. Winter, H. C. Ahn, K. N. Allen, S. Block, I. A. Cardoso, J. Ding, I. Dreveny, W. C. Gasper, Q. Ho, A. Matsuura, M. J. Palladino, S. Prajapati, P. Sun, K. Tittmann, D. R. Tolan, J. Unterlass, A. P. VanDemark, M. G. Vander Heiden, B. A. Webb, C. H. Yun, P. Zhao, B. Wang, F. J. Schopfer, C. P. Hill, M. C. Nonato, F. L. Muller, J. E. Cox and J. Rutter (2023). Protein-metabolite interactomics of carbohydrate metabolism reveal regulation of lactate dehydrogenase. Science 379(6636): 996-1003.10.1126/science.abm3452
2. McCullough, B. S., H. Wang and A. M. Barrios (2022). Inhibitor Screen Identifies Covalent Inhibitors of the Protein Histidine Phosphatase PHPT1. ACS Med Chem Lett **13**(7): 1198-1201.10.1021/acsmedchemlett.2c00053

Electron Microscopy

Overview

The Electron Microscopy (EM) Core Laboratory utilizes transmission electron microscopy and scanning electron microscopy to determine cellular structures, the morphology of biological macromolecules, the three-dimensional structures of biological macromolecules and cells, and the size and structure of nanoparticles and other small particles. The EM facility also prepares specimens for the microscope. The EM facility has two spatially distinct locations to serve research groups. The main facility is in SMBB, and one transmission electron microscope (TEM) and one scanning electron microscope are located there. Two TEMs and one scanning electron microscope (SEM) are located in CSC.

Services

Research Services:

- Training on the TEMs, SEM, microtomes, sample preparation, and 2D and 3D image processing
- Sections ("thick" and "thin") cut on microtome or ultramicrotome
- Prepare tissue and cellular specimens via embedding, drying, osmification, thin-sectioning, and cryogenic methods.
- Prepare particulate and macromolecular samples by staining, metal coating, and cryogenic methods
- Record SEM images
- Record TEM images of dry specimens or cryogenic, hydrated specimens
- Image specimens via three-dimensional electron microscopy, including tomography
- High-resolution imaging (in many cases distances < 3 Å can be resolved)
- Remote access to TEMs and SEM

FY24 Goals

- Continue obtaining high-quality TEM data from Titan Krios microscope
- Develop capabilities of Aquilos 2
- Increase research usage
- Increase usage of underutilized microscopes
- Improve efficiency of lab to serve all who wish to use our services
- Develop more image processing capabilities
- Become more proficient at tomography and start doing micro electron diffraction

Equipment:

- JEOL JEM-1400 Plus, transmission electron microscope
- ThermoFisher Tecnai F20, transmission electron microscope, with Gatan K2 Summit direct electron detector
- ThermoFisher Titan Krios, transmission electron microscope, with Ceta camera, Gatan energy filter, Volta phase plate, and Gatan K3 direct electron detector

- ThermoFisher Aquilos 2, scanning electron microscope with focused-ion-beam milling (designed for cryogenic specimens)
- Zeiss GeminiSEM 300 scanning electron microscope
- Leica UC7 ultramicrotome, with cryogenic attachments
- Two Leica UC6 ultramicrotomes
- Leica UCT ultramicrotome
- Reichert Ultracut E ultramicrotome
- Leica JUNG RM2055, microtome
- ThermoFisher Vitrobot, vitrification robot
- Two automatic tissue processors
- Pelco laboratory microwave oven
- Glow discharger
- Access to high-pressure freezer and freeze-substitution machine
- Critical-point dryer
- High-performance computing nodes (maintained by CHPC)

Personnel

- David Belnap, Ph.D., Director
- Nancy Chandler, Senior Laboratory Specialist
- Willisa Liou, Ph.D., Senior Laboratory Specialist
- Linda Nikolova, Senior Laboratory Specialist
- Barbie Pornillos, Ph.D., Director of Cryo-EM

Advisory Board Committee

Last in-person meeting date: March 2, 2017. Email contact since.

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

Cryo-EM Implementation Committee

Last meeting date: July 20, 2023.

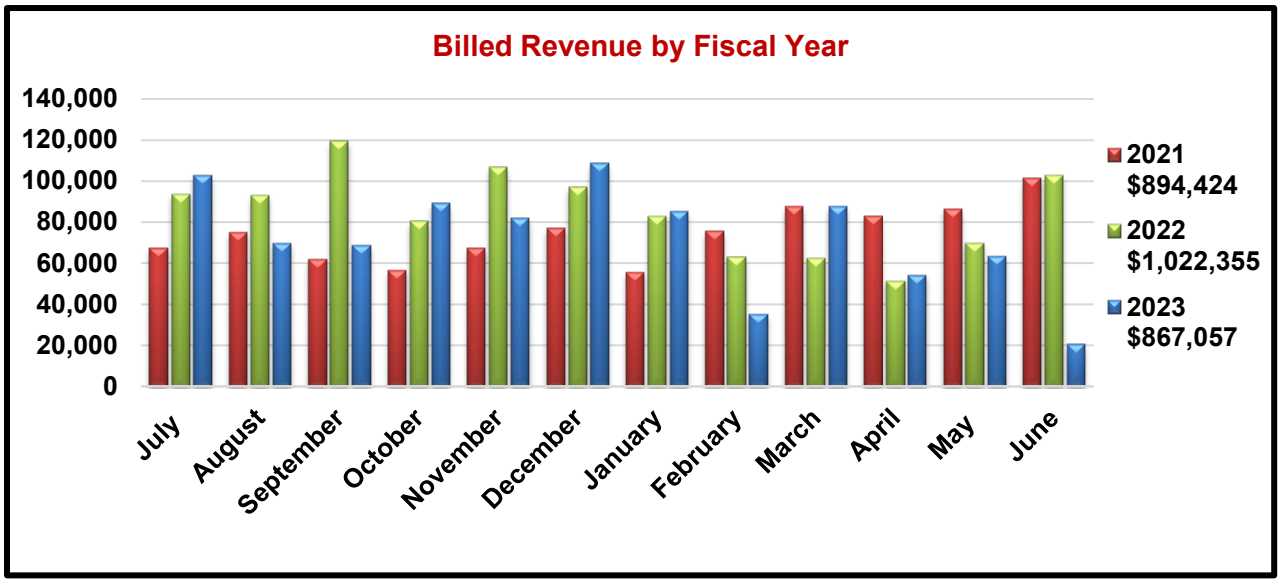
- Brenda Bass, Ph.D., Distinguished Professor, Department of Biochemistry
- Julia Brasch Ph.D., Assistant Professor, Department of Biochemistry
- Erhu Cao Ph.D., Associate Professor, Department of Biochemistry
- Christopher Hill D.Phil., Distinguished Professor, Department of Biochemistry
- Owen Pornillos, Ph.D., Professor, Department of Biochemistry
- Wesley Sundquist Ph.D., Distinguished Professor & Chair, Department of Biochemistry
- Peter Shen Ph.D., Assistant Professor, Department of Biochemistry
- Heidi Schubert Ph.D., Research Professor, Department of Biochemistry

Revenue/Expenses

FY23 Expenses: Total $745,731

FY23 Revenue: Total $960,657

- RIF Funds: $68,600
- VP of Research Support : $25,000
- FY23 Revenue generated from services: $867,057

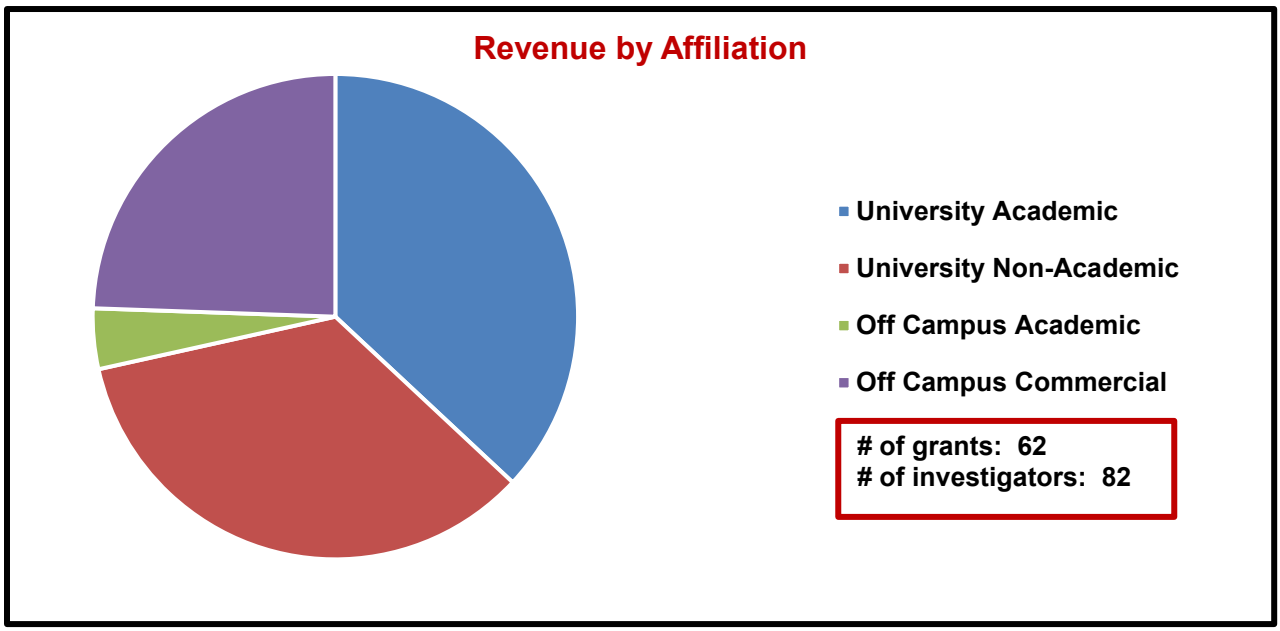


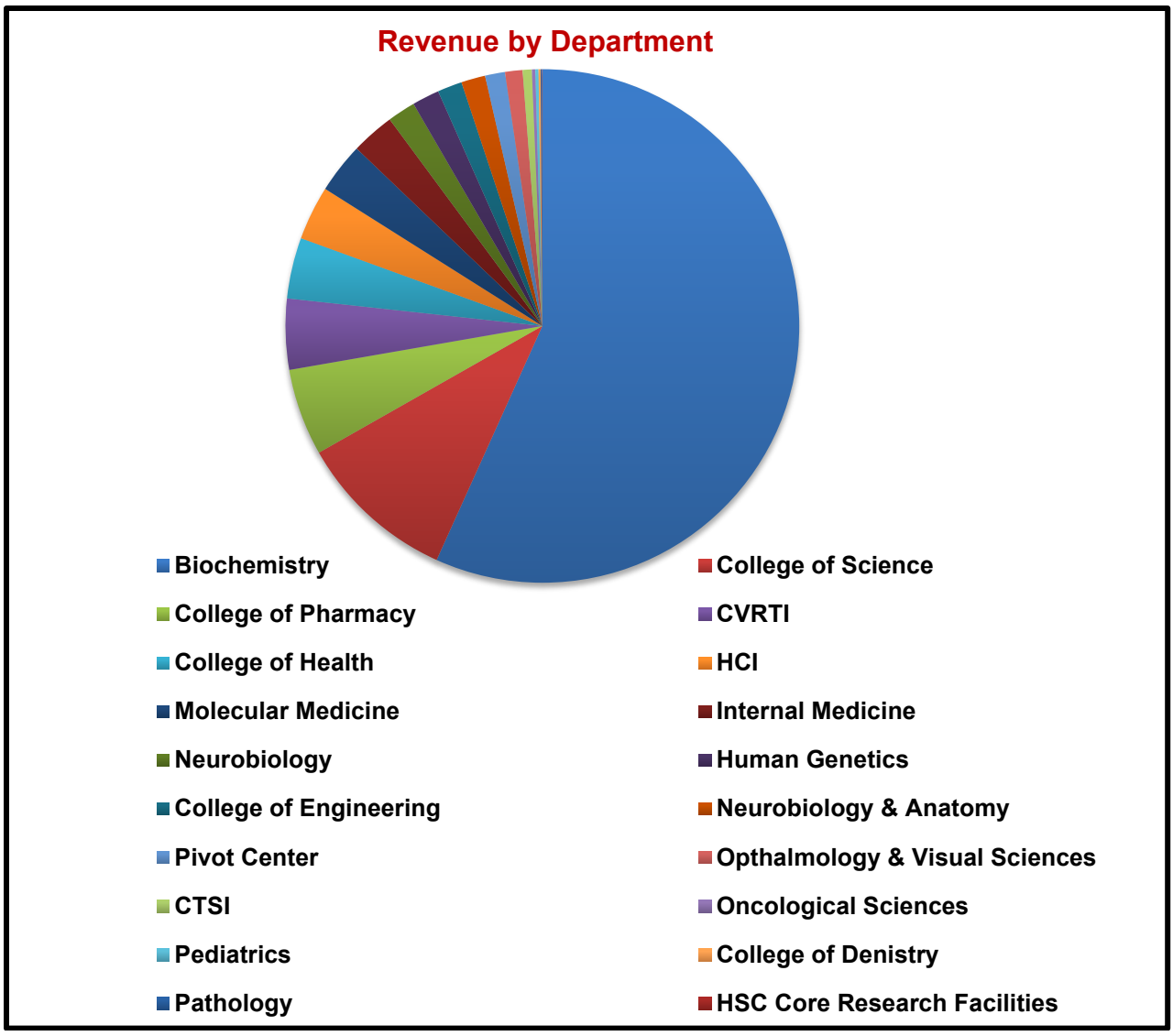
*Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	ARUP	University Non-Academic
2	Wesley Sundquist	Cleveland CF, Gilead Sciences, NIH, Department
3	Science Exchange Inc.	Commercial
4	Sanofi	Commercial
5	Peter Shen	Department, NIH, Northwestern University, BYU
6	Erhu Cao	NIH, Pew Charitable Trusts
7	Treeline Biosciences	Commercial
8	Bristol-Myers Squibb	Commercial
9	Erik Jorgensen	Department
10	Utah State University	Off Campus Educational

Publications

1. Adriaenssens, E., B. Asselbergh, P. Rivera-Mejías, S. Bervoets, L. Vendredy, V. De Winter, K. Spaas, R. de Rycke, G. van Isterdael, F. Impens, T. Langer and V. Timmerman (2023). Small heat shock proteins operate as molecular chaperones in the mitochondrial intermembrane space. Nat Cell Biol **25**(3): 467-480.10.1038/s41556-022-01074-9
2. Ashkarran, A. A., H. Gharibi, J. W. Grunberger, A. A. Saei, N. Khurana, R. Mohammadpour, H. Ghandehari and M. Mahmoudi (2023). Sex-Specific Silica Nanoparticle Protein Corona Compositions Exposed to Male and Female BALB/c Mice Plasmas. ACS Bio Med Chem Au **3**(1): 62-73.10.1021/acsbiomedchemau.2c00040
3. Backman, T., S. M. Latorre, L. Eads, S. Som, D. Belnap, A. M. Manuel, H. A. Burbano and T. L. Karasov (2023). A weaponized phage suppresses competitors in historical and modern metapopulations of pathogenic bacteria. bioRxiv: 2023.2004.2017.536465.10.1101/2023.04.17.536465
4. Barnard, D. L., D. M. Belnap, P. Azadi, C. Heiss, D. S. Snyder, S. C. Bock and T. W. Konowalchuk (2022). Examining the interactions of Galahad compound with viruses to develop a novel inactivated influenza A virus vaccine. Heliyon 8(7): e09887.10.1016/j.heliyon.2022.e09887
5. Beenken, A., G. Cerutti, J. Brasch, Y. Guo, Z. Sheng, H. Erdjument-Bromage, Z. Aziz, S. Y. Robbins-Juarez, E. Y. Chavez, G. Ahlsen, P. S. Katsamba, T. A. Neubert, A. W. P. Fitzpatrick, J. Barasch and L. Shapiro (2023). Structures of LRP2 reveal a molecular machine for endocytosis. Cell **186**(4): 821-836.e813.https://doi.org/10.1016/j.cell.2023.01.016
6. Cooney, I., D. C. Mack, A. J. Ferrell, M. G. Stewart, S. Wang, H. M. Donelick, D. Tamayo-Jaramillo, D. L. Greer, D. Zhu, W. Li and P. S. Shen (2023). Lysate-to-grid: Rapid Isolation of Native Complexes from Budding Yeast for Cryo-EM Imaging. Bio Protoc **13**(2).10.21769/BioProtoc.4596
7. Cooney, I., H. L. Schubert, K. Cedeno, H.-J. L. Lin, J. C. Price, C. P. Hill and P. S. Shen (2023). Visualization of the Cdc48 AAA+ ATPase protein unfolding pathway. bioRxiv: 2023.2005.2013.540638.10.1101/2023.05.13.540638
8. Gilcrease, E. B., S. R. Casjens, A. Bhattacharjee and R. Goel (2023). A Klebsiella pneumoniae NDM-1+ bacteriophage: Adaptive polyvalence and disruption of heterogenous biofilms. Front Microbiol **14**: 1100607.10.3389/fmicb.2023.1100607
9. Green, Y. S., M. C. Ferreira Dos Santos, D. G. Fuja, E. C. Reichert, A. R. Campos, S. J. Cowman, K. Acuña Pilarte, J. Kohan, S. R. Tripp, E. A. Leibold, D. Sirohi, N. Agarwal, X. Liu and M. Y. Koh (2022). ISCA2 inhibition decreases HIF and induces ferroptosis in clear cell renal carcinoma. Oncogene **41**(42): 4709-4723.10.1038/s41388-022-02460-1
10. Grunberger, J. W. and H. Ghandehari (2023). Layer-by-Layer Hollow Mesoporous Silica Nanoparticles with Tunable Degradation Profile. Pharmaceutics **15**(3).10.3390/pharmaceutics15030832
11. Momont, C., H. V. Dang, F. Zatta, K. Hauser, C. Wang, J. di Iulio, A. Minola, N. Czudnochowski, A. De Marco, K. Branch, D. Donermeyer, S. Vyas, A. Chen, E. Ferri, B. Guarino, A. E. Powell, R. Spreafico, S. S. Yim, D. R. Balce, I. Bartha, M. Meury, T. I. Croll, D. M. Belnap, M. A. Schmid, W. T. Schaiff, J. L. Miller, E. Cameroni, A. Telenti, H. W. Virgin, L. E. Rosen, L. A. Purcell, A. Lanzavecchia, G. Snell, D. Corti and M. S. Pizzuto (2023). A pan-influenza antibody inhibiting neuraminidase via receptor mimicry. Nature **618**(7965): 590-597.10.1038/s41586-023-06136-y
12. Patel, N., M. A. Johnson, N. Vapniarsky, M. W. Van Brocklin, T. K. Williams, S. T. Youngquist, R. Ford, N. Ewer, L. P. Neff and G. L. Hoareau (2023). Elamipretide mitigates ischemia-reperfusion injury in a swine model of hemorrhagic shock. Sci Rep **13**(1): 4496.10.1038/s41598-023-31374-5
13. Szulik, M. W., S. Valdez, M. Walsh, K. Davis, R. Bia, E. Horiuchi, S. O'Very, A. K. Laxman, L. Sandaklie-Nicolova, D. R. Eberhardt, J. R. Durrant, H. Sheikh, S. Hickenlooper, M. Creed, C. Brady, M. Miller, L. Wang, J. Garcia-Llana, C. Tracy, S. G. Drakos, K. Funai, D. Chaudhuri, S. Boudina and S. Franklin (2023). SMYD1a protects the heart from ischemic injury by regulating OPA1-mediated cristae remodeling and supercomplex formation. Basic Res Cardiol 118(1): 20.10.1007/s00395-023-00991-6
14. Wang, S., M. I. Sass, Y. Kwon, W. G. Ludlam, T. M. Smith, E. J. Carter, N. E. Gladden, M. Riggi, J. H. Iwasa, B. M. Willardson and P. S. Shen (2023). Visualizing the chaperone-mediated folding trajectory of the G protein β5 β-propeller. bioRxiv.10.1101/2023.05.04.539424
15. Zheng, Z., W. Zuo, R. Ye, J. W. Grunberger, N. Khurana, X. Xu, H. Ghandehari and F. Chen (2023). Silica Nanoparticles Promote Apoptosis in Ovarian Granulosa Cells via Autophagy Dysfunction. Int J Mol Sci **24**(6).10.3390/ijms24065189

Flow Cytometry

Overview

The Flow Cytometry Facility offers quantitative, multi-parameter fluorescence analysis, and cell sorting services that assist 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 an instrumentation-based service lab. However, we believe that education is a crucial component for the growth and sustainability of the facility. First, facility staff are encouraged to maintain state of the art knowledge to pass this information along to the users for obtaining optimal experimental results. Secondly, we believe that education in the field of flow cytometry for users will lead to more complex experimental design that ensures positive outcomes that in turn will increase overall usage. To this end, we provide multiple levels of education from one-on-one consultation to routine seminars covering a variety of topics. Although this may not be unique when compared to other Core facilities, it is a noticeable quality of our services when compared to other non-centralized instrumentation on campus.

Services

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

- DNA content/cell cycle measurement
- Immunofluorescence analyses
- Characterization of cell populations based on scattered light intensity measurements and autofluorescence
- Cell sorting including viable, sterile cell sorting
- Intracellular calcium flux
- A range of apoptosis assays
- Fluorescence Resonance Energy Transfer (FRET)
- Nanoparticle characterization
- Bivariate and univariate chromosome analysis
- Receptor-ligand interactions
- Cell proliferation studies including BrdU incorporation and CFSE tracking
- Viability assays (membrane exclusion and metabolic viability)
- Various function assays including oxidative metabolism, neutrophil function (oxidative burst, phagocytosis) cytoplasmic pH, membrane potential
- Kinetic analyses
- Signal transduction pathway analyses (simultaneous assessment of multiple intracellular phosphorylated epitopes combined in complex multi-color assays)
- Sample preparation and staining

Consultation and training are provided 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
- Cytek Aurora Cell Sorter

Analyzers

- BD FACSCanto
- BD LSRFortessa
- Beckman Coulter Cytoflex LX
- Beckman Coulter Cytoflex S
- Beckman Coulter Cytoflex
- BD Celesta
- Cytek DxP
- Cytek Aurora
- Amnis Imagestream

Personnel

- James Marvin, Director
- Tessa Galland, Senior Lab Technician
- Eduardo Salustiano Jesus dos Santos, Senior Lab Technician
- Rebecca Marvin, Senior Lab Specialist
- Sreeja Govindarajan, Lab Specialist

Advisory Board Committee

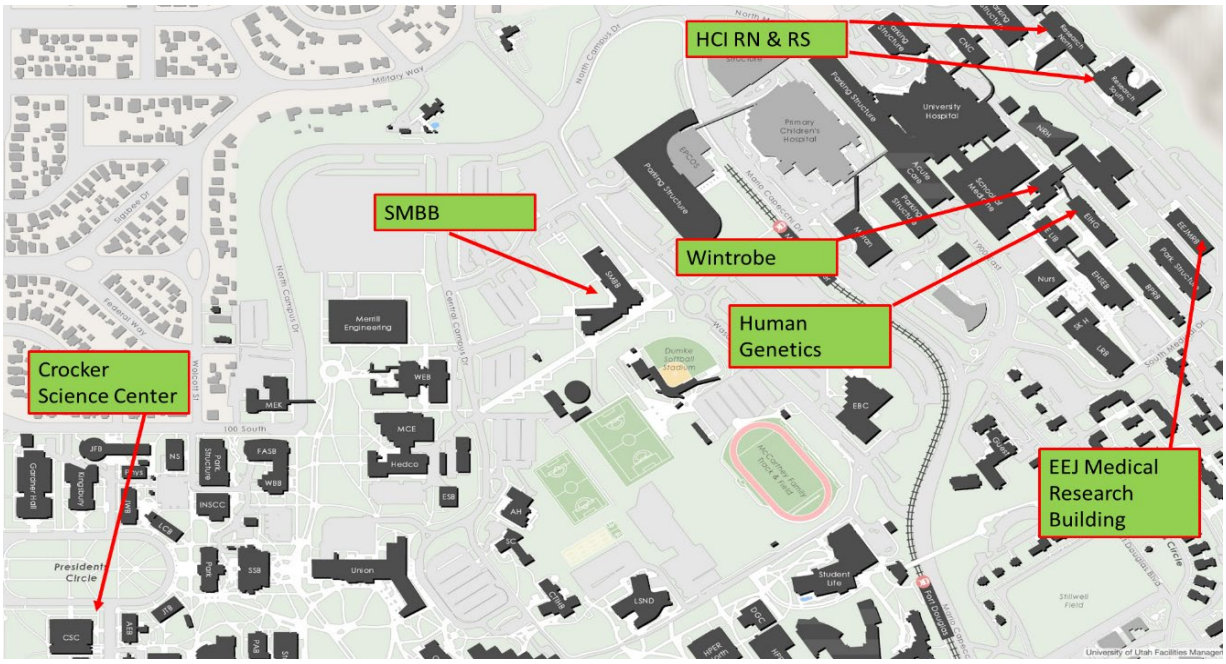
Last meeting date: August 4th, 2022

- Matthew Williams Ph.D., Professor, Pathology Advisory Board Chair
- Ryan O'Connell Ph.D., Professor, Pathology
- Anna Beaudin Ph.D., Associate Professor, Hematology
- Daniel Leung M.D., Associate Professor, Internal Medicine
- Alessandro Venosa Ph.D., Assistant Professor, Pharm and Toxicology
- Matthew VanBrocklin Ph.D., Associate Professor, Dept of Surgery HCI

FY23 Annual Update

New Equipment

The Flow Core added another cell sorter in FY23. Over the last few years, the University has purchased 3 Cytek Aurora Analyzers. These instruments have 5 lasers and 64 detectors. The Flow Core previously maxed out at 18 detectors for cell sorting. This meant that any panels developed on analyzers were not capable of being translated to the cell sorter, which is a common pipeline or approach. With the help of the VP office for research, Allesandro Venosa, Anna Beaudin, 3I initiative, Division of M&I, and the Biochemistry department we were able to purchase a Cytek Aurora Cell Sorter with matching capabilities to the Cytek analyzers. This instrument has tremendous sensitivity and will serve both the high parameter sorting needs as well as a workhorse for virtually any fluorophore on the market.



Staffing

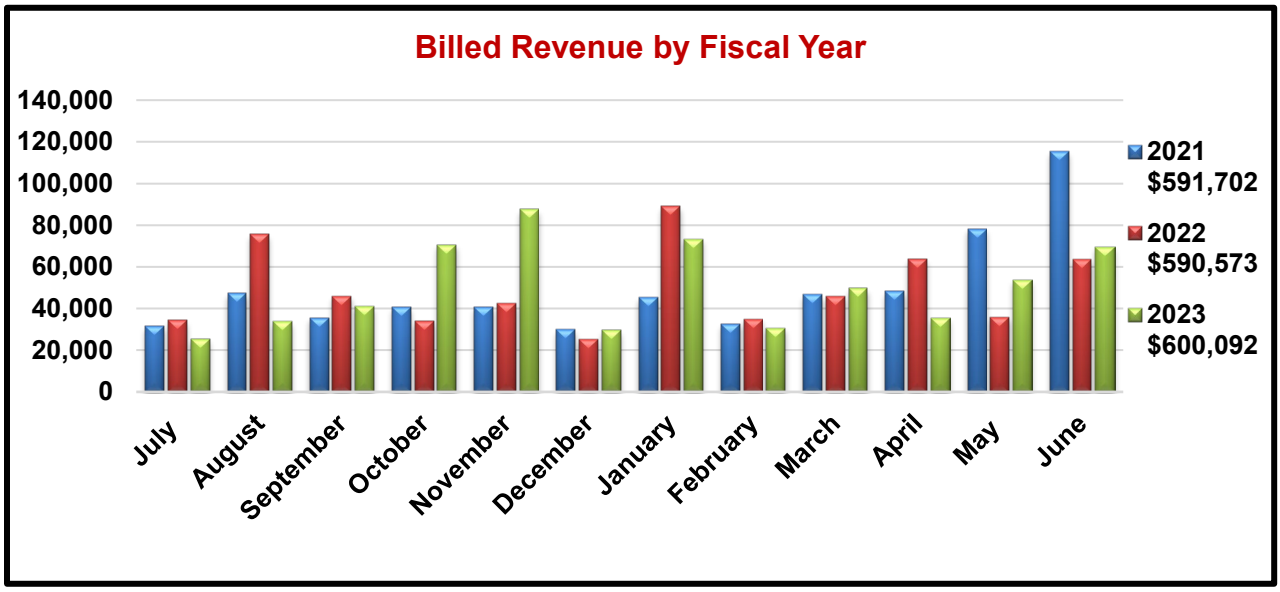
There were significant staffing changes in the Flow Core in FY23. Josh Monts and Ashley Taylor both left the facility with Eduardo Salustiano Jesus dos Santos and Sreeja Govindarajan taking their place.

Revenue/Expenses

FY23 Expenses: Total $1,071,712

FY23 Revenue: Total $740,092

- FY23 Revenue generated from services: $600,092
- VP Support: $40,000
- Equipment Support: $100,000

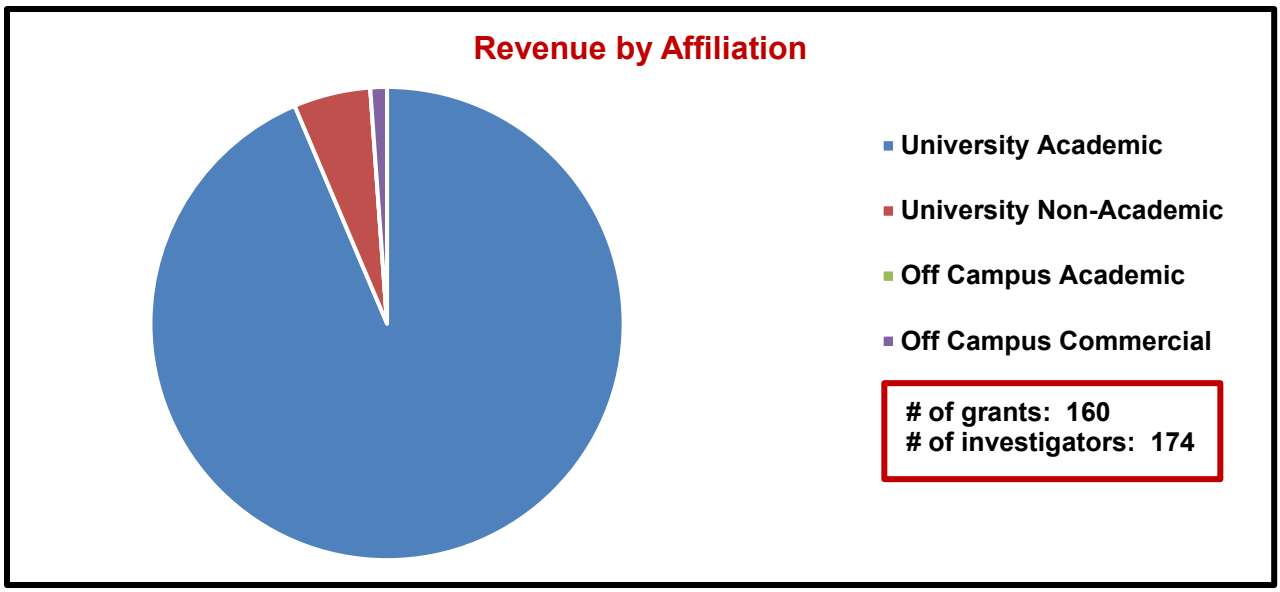


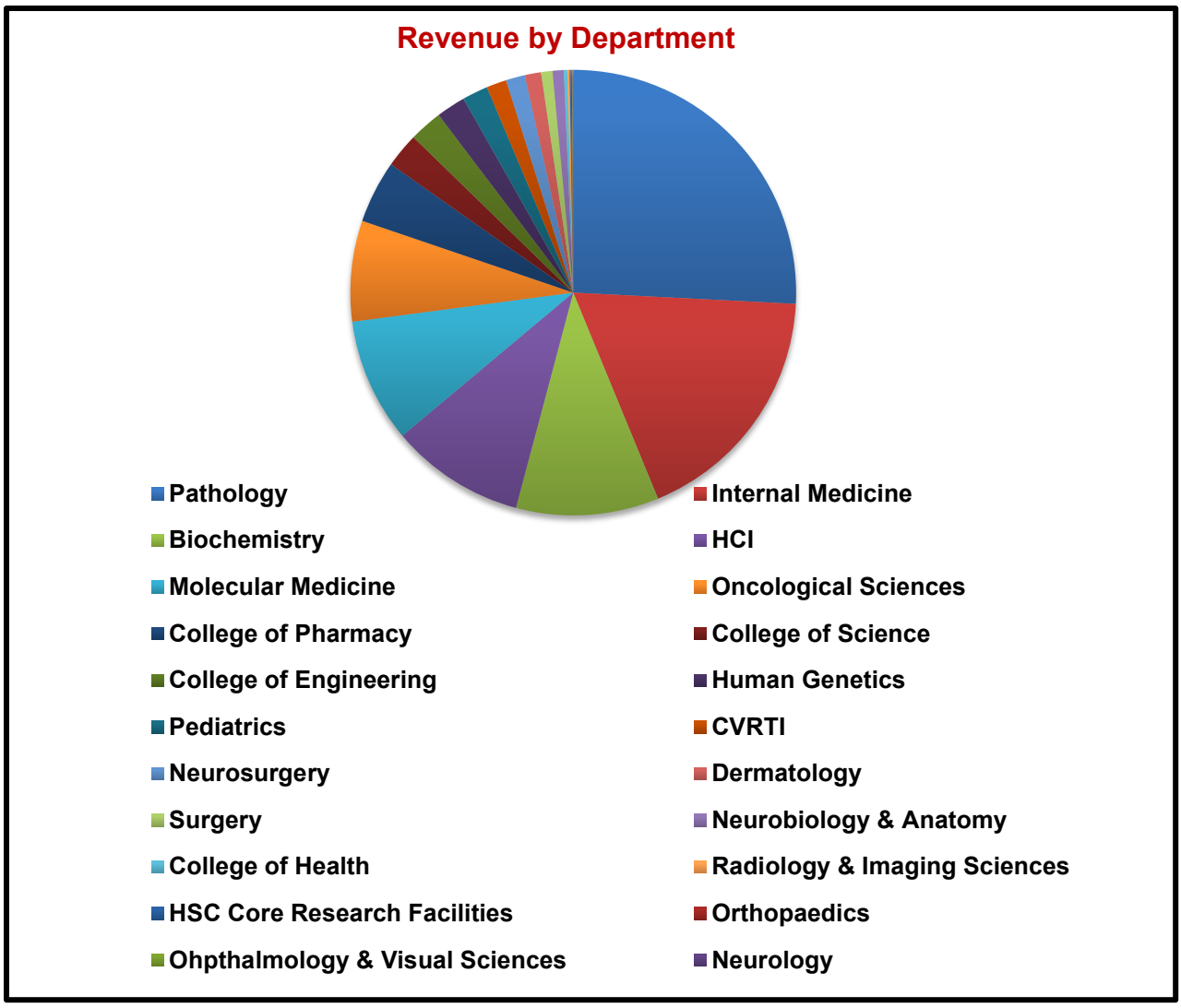
*Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Matthew Williams	Department, DOD, NIH
2	Deborah Stephens	Department
3	Anna Beaudin	Department, NIH, Pew Charitable Trusts
4	ARUP	University Non-Academic
5	Brian Evavold	Department, NIH
6	Shannon Buckley	Department, NIH
7	Eric Snyder	American Cancer Society Inc, American Lung Association, Cincinnati's Children's Hospital, LCRF, NIH
8	Minna Roh-Johnson	Department, NIH, DID
9	Tara Deans	NIH
10	Scott Hale	Department, NIH

Publications

1. Dunn, C. M., S. Kameishi, Y.-K. Cho, S. U. Song, D. W. Grainger and T. Okano (2022). Interferon-Gamma Primed Human Clonal Mesenchymal Stromal Cell Sheets Exhibit Enhanced Immunosuppressive Function. Cells **11**(23): 3738.10.3390/cells11233738
2. Garritson, J. D., J. Zhang, A. Achenbach, M. Ferhat, E. Eich, C. J. Stubben, P. L. Martinez, A. R. Ibele, K. I. Hilgendorf and S. Boudina (2023). BMPER is a marker of adipose progenitors and adipocytes and a positive modulator of adipogenesis. Communications Biology **6**(1): 638.10.1038/s42003-023-05011-w
3. Happ, J. T., C. D. Arveseth, J. Bruystens, D. Bertinetti, I. B. Nelson, C. Olivieri, J. Zhang, D. S. Hedeen, J.-F. Zhu, J. L. Capener, J. W. Bröckel, L. Vu, C. C. King, V. L. Ruiz-Perez, X. Ge, G. Veglia, F. W. Herberg, S. S. Taylor and B. R. Myers (2022). A PKA inhibitor motif within SMOOTHENED controls Hedgehog signal transduction. Nature Structural & Molecular Biology 29(10): 990-999.10.1038/s41594-022-00838-z
4. Jensen, O., S. Trivedi, K. Li, J. Aubé, J. S. Hale, E. T. Ryan and D. T. Leung (2022). Use of a MAIT-Activating Ligand, 5-OP-RU, as a Mucosal Adjuvant in a Murine Model of Vibrio cholerae O1 Vaccination. Pathogens & Immunity 7(1): 122-144.10.20411/pai.v7i1.525
5. Kidwell, C. U., J. R. Casalini, S. Pradeep, S. D. Scherer, D. Greiner, D. Bayik, D. C. Watson, G. S. Olson, J. D. Lathia, J. S. Johnson, J. Rutter, A. L. Welm, T. A. Zangle and M. Roh-Johnson (2023). Transferred mitochondria accumulate reactive oxygen species, promoting proliferation. eLife 12: e85494.10.7554/eLife.85494
6. Labuz, D., J. Cacioppo, K. Li, J. Aubé and D. T. Leung (2023). Enhancing Mucosal-Associated Invariant T Cell Function and Expansion with Human Selective Serum. ImmunoHorizons 7(1): 116-124.10.4049/immunohorizons.2200082
7. Labuz, D. R., G. Lewis, I. D. Fleming, C. M. Thompson, Y. Zhai, M. A. Firpo and D. T. Leung (2023). Targeted multi-omic analysis of human skin tissue identifies alterations of conventional and unconventional T cells associated with burn injury. eLife 12: e82626.10.7554/eLife.82626
8. Preston, A. J., A. Rogers, M. Sharp, G. Mitchell, C. Toruno, B. B. Barney, L. N. Donovan, J. Bly, R. Kennington, E. Payne, A. Iovino, G. Furukawa, R. Robinson, B. Shamloo, M. Buccilli, R. Anders, S. Eckstein, E. A. Fedak, T. Wright, C. C. Maley, W. K. Kiso, D. Schmitt, D. Malkin, J. D. Schiffman and L. M. Abegglen (2023). Elephant TP53-RETROGENE 9 induces transcription-independent apoptosis at the mitochondria. Cell Death Discovery 9(1): 66.10.1038/s41420-023-01348-7
9. Silvis, M. R., D. Silva, R. Rohweder, S. Schuman, S. Gudipaty, A. Truong, J. Yap, K. Affolter, M. McMahon and C. Kinsey (2023). MYC-mediated resistance to trametinib and HCQ in PDAC is overcome by CDK4/6 and lysosomal inhibition. The Journal of Experimental Medicine 220(3): e20221524.10.1084/jem.20221524
10. Trivedi, S., D. Labuz, C. E. Deering-Rice, C. U. Kim, H. Christensen, S. Aamodt, T. Huecksteadt, K. Sanders and K. J. Warren (2022). IL-33 induces NF-κB activation in ILC2 that can be suppressed by in vivo and ex vivo 17β-estradiol. Frontiers in Allergy 3: 1062412.10.3389/falgy.2022.1062412
11. Warde, K. M., L. Liu, L. J. Smith, B. K. Lohman, C. J. Stubben, H. A. Ekiz, J. L. Ammer, K. Converso-Baran, T. J. Giordano, G. D. Hammer and K. J. Basham (2022). Senescence-Induced Immune Remodeling Facilitates Metastatic Adrenal Cancer in a Sex-Dimorphic Manner.10.1101/2022.04.29.488426
12. Warde, K. M., L. J. Smith, L. Liu, C. J. Stubben, B. K. Lohman, P. W. Willett, J. L. Ammer, G. Castaneda-Hernandez, S. O. Imodoye, C. Zhang, K. D. Jones, K. Converso-Baran, H. A. Ekiz, M. Barry, M. R. Clay, K. Kiseljak-Vassiliades, T. J. Giordano, G. D. Hammer and K. J. Basham (2023). Senescence-induced immune remodeling facilitates metastatic adrenal cancer in a sex-dimorphic manner. Nature Aging 3(7): 846-865.10.1038/s43587-023-00420-2
13. Xue, Q., S. R. S. Varady, T. Q. A. i. Waddell, M. R. Roman, J. Carrington and M. Roh-Johnson (2023). Lack of Paxillin phosphorylation promotes single-cell migration in vivo. The Journal of Cell Biology 222(3): e202206078.10.1083/jcb.202206078

Genomics

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 whole-genome genotyping and copy number variation analysis
- Methylation analysis
- Open array genotyping

Real Time PCR

- Gene expression

Equipment

- One AB 7900HT system
- Illumina iScan
- Quantstudio 12k Flex real-time PCR System

Personnel

- Derek Warner, Director
- Michael Klein, Manager

FY23 Annual Update

New Equipment

- The Genomics Facility did not acquire new equipment in FY23.

New Services

- The Genomics Facility did not implement additional services in FY23.

Advisory Board Committee

Last meeting date: July 6th, 2021

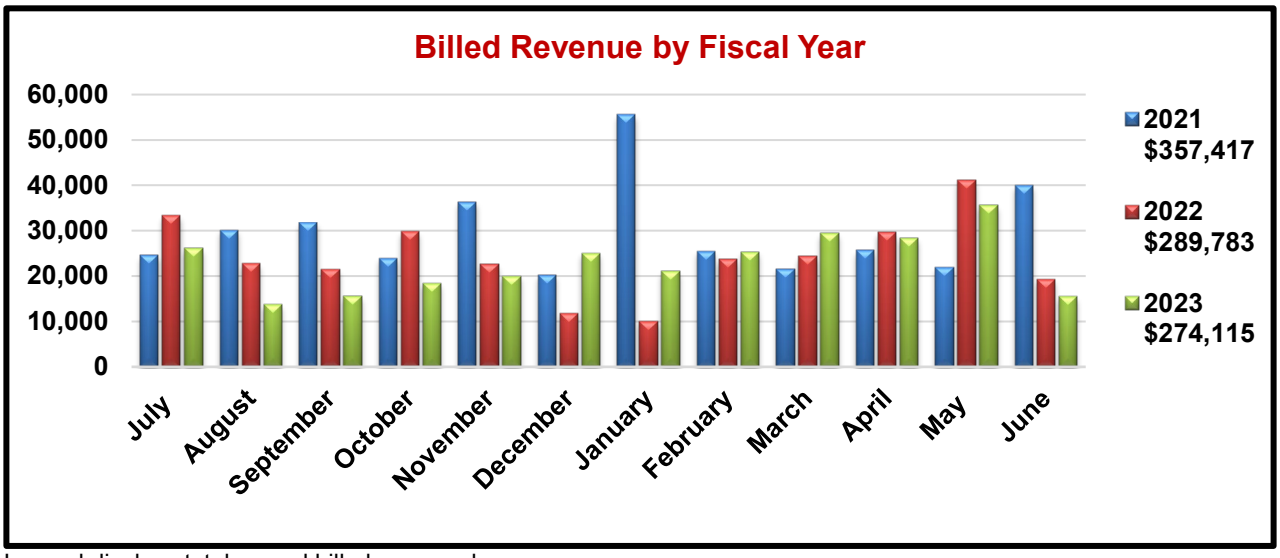
- Gerald Krueger M.D., Professor, Dermatology
- Deborah Neklason Ph.D., Research Associate Professor, Huntsman Cancer Institute
- Nicola Camp Ph.D., Professor, Department of Pathology

Revenue/Expenses

FY23 Expenses: Total $141,019

FY23 Revenue: Total $274,115

- VP of Health Sciences Support: $0
- FY23 Revenue generated from services: $274,115

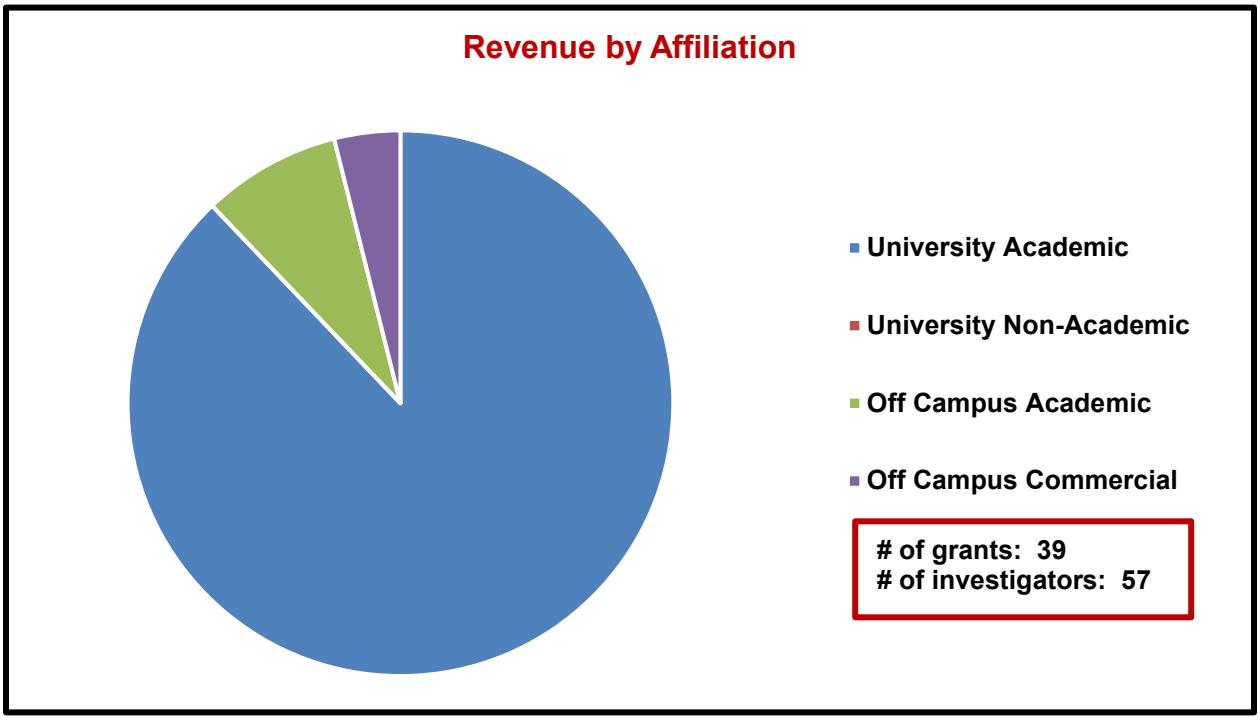


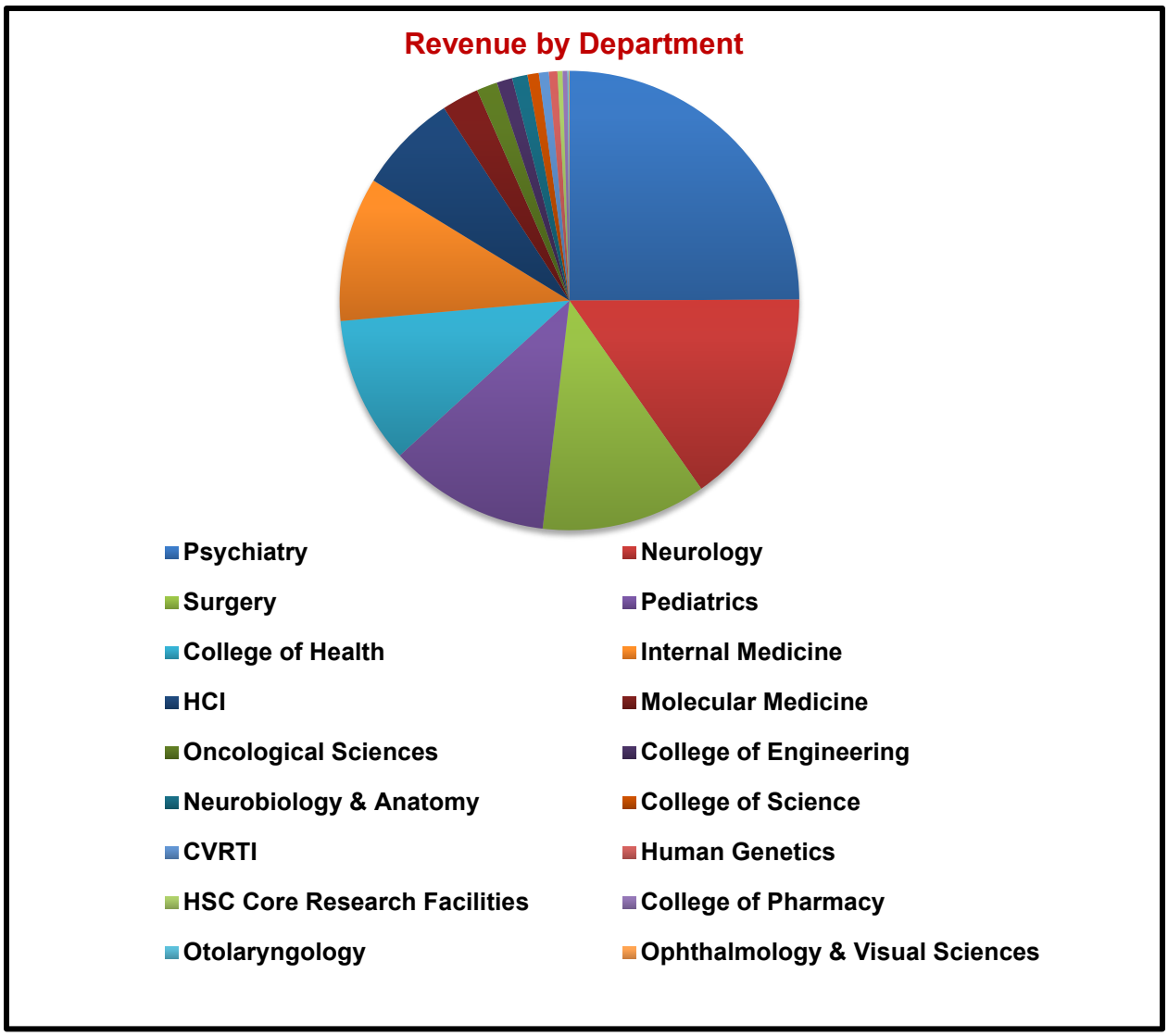
* Legend displays total annual billed revenue by year.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Anna Docherty	NIH
2	Wanda Penovich	Department
3	Kenneth Aston	Department, Oregon Health & Science Univ.
4	Willard Dere	Department
5	Scott Summers	NIH
6	Russell Butterfield	Department, IONIS Pharmaceuticals Inc
7	Josh Bonkowsky	Department
8	Kevin Jones	NIH
9	University of Montana	Off Campus Educational
10	University of Texas San Antonio	Off Campus Educational

Publications

24. Balakrishnan, B., R. Altassan, R. Budhraja, W. Liou, A. Lupo, S. Bryant, A. Mankouski, S. Radenkovic, G. J. Preston, A. Pandey, S. Boudina, T. Kozicz, E. Morava-Kozicz and K. Lai (2023). AAV-based gene therapy prevents and halts the progression of dilated cardiomyopathy in a mouse model of phosphoglucomutase 1 deficiency (PGM1-CDG). Transl Res **257**: 1-14.10.1016/j.trsl.2023.01.004
25. Demir, M., L. P. Russelburg, W. J. Lin, C. H. Trasvina-Arenas, B. Huang, P. K. Yuen, M. P. Horvath and S. S. David (2023). Structural snapshots of base excision by the cancer-associated variant MutY N146S reveal a retaining mechanism. Nucleic Acids Res **51**(3): 1034-1049.10.1093/nar/gkac1246
26. Flack, C. E. and J. S. Parkinson (2022). Structural signatures of Escherichia coli chemoreceptor signaling states revealed by cellular crosslinking. Proc Natl Acad Sci U S A **119**(28): e2204161119.10.1073/pnas.2204161119
27. Fleming, A. M. and C. J. Burrows (2023). Nanopore sequencing for N1-methylpseudouridine in RNA reveals sequence-dependent discrimination of the modified nucleotide triphosphate during transcription. Nucleic Acids Res 51(4): 1914-1926.10.1093/nar/gkad044
28. Fleming, A. M., R. Tran, C. A. Omaga, S. A. Howpay Manage, C. J. Burrows and J. C. Conboy (2022). Second Harmonic Generation Interrogation of the Endonuclease APE1 Binding Interaction with G-Quadruplex DNA. Anal Chem **94**(43): 15027-15032.10.1021/acs.analchem.2c02951
29. Gerstner, C. D., M. Reed, T. M. Dahl, G. Ying, J. M. Frederick and W. Baehr (2022). Arf-like Protein 2 (ARL2) Controls Microtubule Neogenesis during Early Postnatal Photoreceptor Development. Cells **12**(1).10.3390/cells12010147
30. Giglio, M. L., P. F. Salcedo, M. Watkins and B. Olivera (2023). Insights into a putative polychaete-gastropod symbiosis from a newly identified annelid worm that predates upon Conus ermineus eggs. Contributions to Zoology **92**(2): 97-111.https://doi.org/10.1163/18759866-bja10038
31. Hackney, C. M., P. F. Salcedo, E. Mueller, L. D. Kjelgaard, M. Watkins, L. G. Zachariassen, J. R. McArthur, D. J. Adams, A. S. Kristensen, B. Olivera, R. K. Finol-Urdaneta, H. Safavi-Hemami, J. P. Morth and L. Ellgaard (2022). Identification of a sensory neuron Cav2.3 inhibitor within a new superfamily of macro-conotoxins. bioRxiv: 2022.2007.2004.498665.10.1101/2022.07.04.498665
32. Happ, J. T., C. D. Arveseth, J. Bruystens, D. Bertinetti, I. B. Nelson, C. Olivieri, J. Zhang, D. S. Hedeen, J. F. Zhu, J. L. Capener, J. W. Brockel, L. Vu, C. C. King, V. L. Ruiz-Perez, X. Ge, G. Veglia, F. W. Herberg, S. S. Taylor and B. R. Myers (2022). A PKA inhibitor motif within SMOOTHENED controls Hedgehog signal transduction. Nat Struct Mol Biol **29**(10): 990-999.10.1038/s41594-022-00838-z
33. Howpay Manage, S. A., A. M. Fleming, H. N. Chen and C. J. Burrows (2022). Cysteine Oxidation to Sulfenic Acid in APE1 Aids G-Quadruplex Binding While Compromising DNA Repair. ACS Chem Biol **17**(9): 2583-2594.10.1021/acschembio.2c00511
34. Howpay Manage, S. A., J. Zhu, A. M. Fleming and C. J. Burrows (2023). Promoters vs. telomeres: AP-endonuclease 1 interactions with abasic sites in G-quadruplex folds depend on topology. RSC Chem Biol **4**(4): 261-270.10.1039/d2cb00233g
35. Leng, A. M., K. S. Radmall, P. K. Shukla and M. B. Chandrasekharan (2022). Quantitative Assessment of Histone H2B Monoubiquitination in Yeast Using Immunoblotting. Methods Protoc **5**(5).10.3390/mps5050074
36. McKnite, A., H. S. Kim, J. Silva and J. L. Christian (2023). Lack of evidence that fibrillin1 regulates bone morphogenetic protein 4 activity in kidney or lung. Dev Dyn **252**(6): 761-769.10.1002/dvdy.578
37. Radmall, K. S., P. K. Shukla and M. B. Chandrasekharan (2023). A system for in vivo evaluation of protein ubiquitination dynamics using deubiquitinase-deficient strains. bioRxiv: 2023.2006.2018.545485.10.1101/2023.06.18.545485
38. Reed, M., K. I. Takemaru, G. Ying, J. M. Frederick and W. Baehr (2022). Deletion of CEP164 in mouse photoreceptors post-ciliogenesis interrupts ciliary intraflagellar transport (IFT). PLoS Genet **18**(9): e1010154.10.1371/journal.pgen.1010154
39. Scoles, D. R., M. Gandelman, S. Paul, T. Dexheimer, W. Dansithong, K. P. Figueroa, L. T. Pflieger, S. Redlin, S. C. Kales, H. Sun, D. Maloney, R. Damoiseaux, M. J. Henderson, A. Simeonov, A. Jadhav and S. M. Pulst (2022). "A quantitative high-throughput screen identifies compounds that lower expression of the SCA2-and ALS-associated gene ATXN2." J Biol Chem **298**(8): 102228.10.1016/j.jbc.2022.102228
40. Simeone, C. A., J. L. Wilkerson, A. M. Poss, J. A. Banks, J. V. Varre, J. L. Guevara, E. J. Hernandez, B. Gorsi, D. L. Atkinson, T. Turapov, S. G. Frodsham, J. C. F. Morales, K. O'Neil, B. Moore, M. Yandell, S. A. Summers, A. S. Krolewski, W. L. Holland and M. G. Pezzolesi (2022). "A dominant negative ADIPOQ mutation in a diabetic family with renal disease, hypoadiponectinemia, and hyperceramidemia." NPJ Genom Med **7**(1): 43.10.1038/s41525-022-00314-z
41. Shukla, P. K., J. E. Bissell, S. Kumar, S. Pokhrel, S. Palani, K. S. Radmall, O. Obidi, T. J. Parnell, J. Brasch, D. C. Shrieve and M. B. Chandrasekharan (2023). Structure and functional determinants of Rad6-Bre1 subunits in the histone H2B ubiquitin-conjugating complex. Nucleic Acids Res **51**(5): 2117-2136.10.1093/nar/gkad012

42. Shukla, P. K., K. S. Radmall and M. B. Chandrasekharan (2023). Rapid purification of rabbit immunoglobulins using a single-step, negative-selection chromatography. Protein Expr Purif **207**: 106270.10.1016/j.pep.2023.106270
43. Shukla, P. K., D. Sinha, A. M. Leng, J. E. Bissell, S. Thatipamula, R. Ganguly, K. S. Radmall, J. J. Skalicky, D. C. Shrieve and M. B. Chandrasekharan (2022). Mutations of Rad6 E2 ubiquitin-conjugating enzymes at alanine-126 in helix-3 affect ubiquitination activity and decrease enzyme stability. J Biol Chem **298**(11): 102524.10.1016/j.jbc.2022.102524
44. Utzman, P. H., V. P. Mays, B. C. Miller, M. C. Fairbanks, W. J. Brazelton and M. P. Horvath (2023). Metagenome mining and functional analysis reveal oxidized guanine DNA repair at the Lost City Hydrothermal Field. bioRxiv: 2023.2004.2005.535768.10.1101/2023.04.05.535768
45. Walker, M. F., J. Zhang, W. Steiner, P.-I. Ku, J.-F. Zhu, Z. Michaelson, Y.-C. Yen, A. B. Long, M. J. Casey, A. Poddar, I. B. Nelson, C. D. Arveseth, F. Nagel, R. Clough, S. LaPotin, K. M. Kwan, S. Schulz, R. A. Stewart, J. J. G. Tesmer, T. Caspary, R. Subramanian, X. Ge and B. R. Myers (2023). GRK2 Kinases in the Primary Cilium Initiate SMOOTHENED-PKA Signaling in the Hedgehog Cascade. bioRxiv: 2023.2005.2010.540226.10.1101/2023.05.10.540226
46. Workalemahu, T., C. Avery, S. Lopez, N. R. Blue, A. Wallace, A. R. Quinlan, H. Coon, D. Warner, M. W. Varner, D. W. Branch, L. B. Jorde and R. M. Silver (2023). Whole-genome sequencing analysis in families with recurrent pregnancy loss: A pilot study. PLoS One **18**(2): e0281934.10.1371/journal.pone.0281934

Machine Shop

Overview

The Machine Shop Facility is equipped with a full complement of lathes, drills, mills, welders, grinders, and CNC lathe and milling systems, staffed by experienced CNC machinists and engineers capable of turning an idea into reality. The shop staff provides consultation to assist with the design process for products ranging from precise surgical instruments to large-scale testing equipment. The shop can 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. The shop provides microscope parts, stages and assemblies, surgery tool modifications, replications, alterations and reverse engineering.

Services

- Device design/engineering from basic concept to finished product
- Manufacturability consulting
- CNC and manual 3 axis milling machines 2D and 3D machining
- CNC Tormach lathe and manual lathes
- CNC routing services and sign making capabilities
- Laser cutting and engraving services, 3D printing
- Silver soldering and brazing
- MIG, TIG, welding of steel, aluminum, and other types of fabrication
- Anodizing, powder coating and laser cutting project assistance.
- Repair and maintenance of specialty surgery equipment
- Fast surgery tool replication/modifications
- Onsite assessments, pickup, delivery of equipment and repairs

Equipment

- Two CNC mills
- One Shapeoko XL CNC Router
- One Matter Hackers Pulse XE 3D printer
- One EPAX E10 4K resolution resin 3D printer
- Two traditional mills
- Four manual lathes
- Two laser cutter/engraving machines.
- Grinders
- MIG, TIG, gas, arc, and spot welders
- Wood working equipment shop
- Band & table saws
- Polishing equipment

Personnel

- Shawn Colby, Machinist, Director
- Joshua Tenny, Machinist, Surgery Tool Repair Specialist

Advisory Board Committee

- Perry Renshaw M.D. Ph.D., Professor, Psychiatry
- Michelle Ford, Materials Management Facilitator, Facilities Engineering
- Kyle Thomson Ph.D., Researcher, Pharm/Tox

FY23 Annual Update

New Equipment

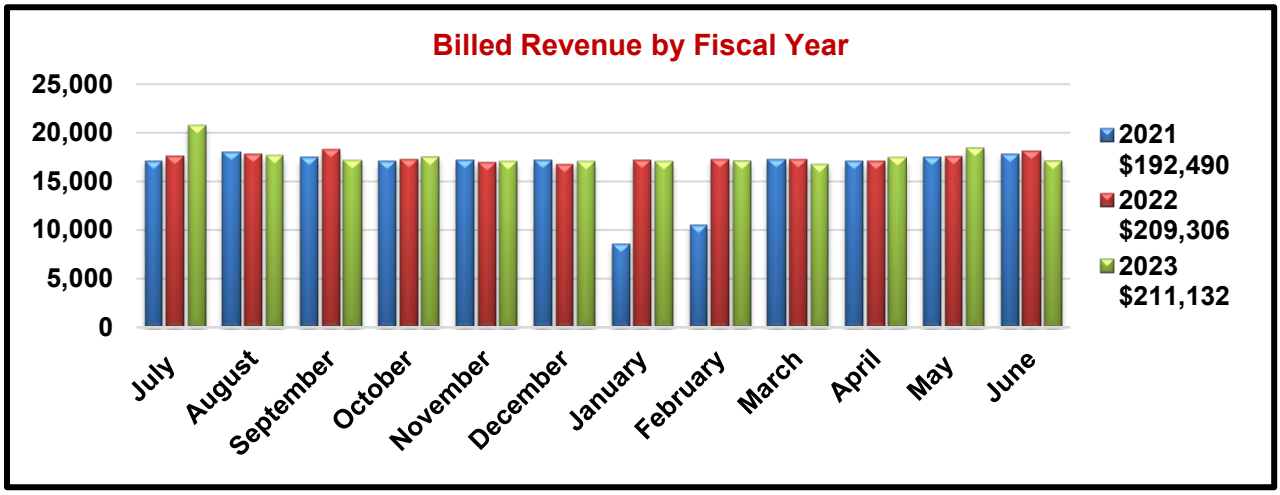
- One Epax E10 4K resolution resin 3D printer
- One Shapeoko XL CNC router
- Omtech 130 watt laser acrylic cutter 3x5 ft bed

Revenue/Expenses

FY23 Expenses: **Total $282,033**

FY23 Revenue: Total $261,132

- VP of Health Sciences Support: $50,000
- FY23 Revenue generated from services: $211,132

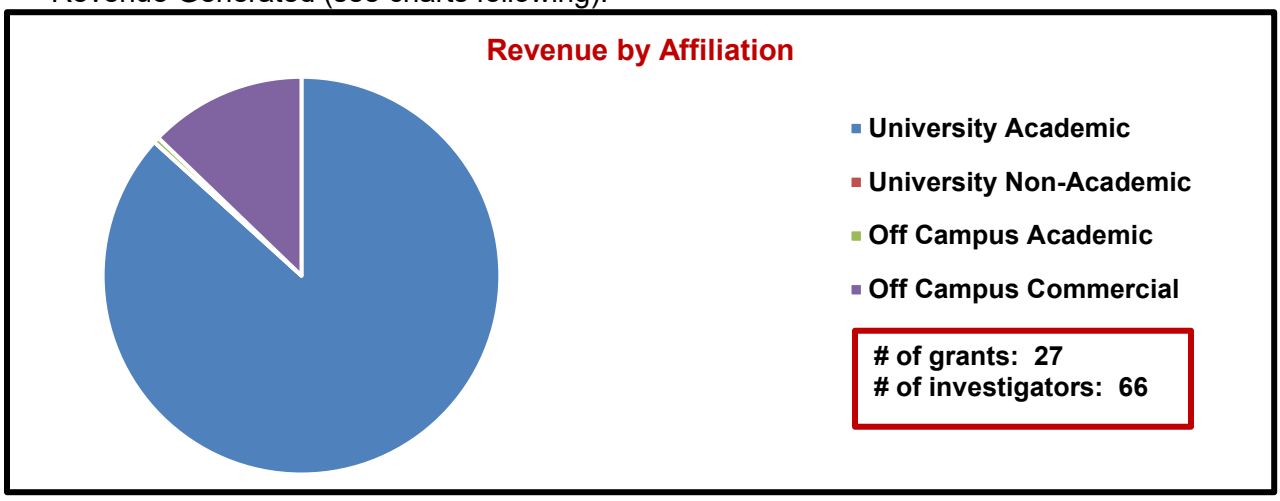


* Legend displays total annual revenue by year generated.

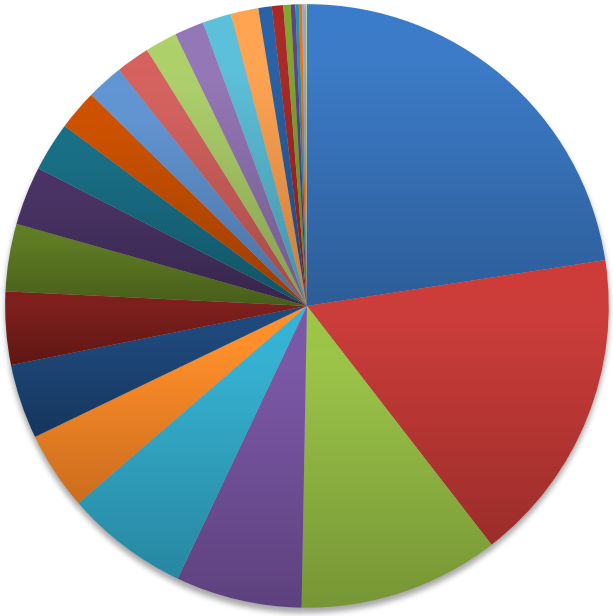
FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):



Revenue by Department



- Hospital Operating Room
- College of Engineering
- Hospital Perioperative Services
- ACC Operating Room
- Molecular Medicine
- Radiation Oncology
- Neurobiology & Anatomy
- Hospital Surgical Services
- Human Genetics
- HSC Core Research Facilities
- Orthopaedics
- College of Pharmacy
- Pathology
- Hospital Materials Management
- Surgery
- Physical Medicine & Rehabilitation
- Hospital Sterile Processing
- College of Health
- Biochemistry
- Moran
- Comparative Medicine
- Oncological Sciences
- Dermatology
- Radiology
- Neurosurgery
- College of Science
- Radiology & Imaging Sciences

Top Users

1	Russ Maag	Department
2	Catherine Hiatt	Department
3	Brent Klev	Department
4	Darren Peacock	Department
5	Katsuhiko Funai	NIH
6	Sarah Keddington	Department
7	UUOC Diagnostic Radiology	Commercial
8	Steve Meisner	HCH
9	Joey Henderson	Department
10	Gabrielle Kardon	Kardon Pew

Publications

No known publications acknowledged this facility in FY23

Mass Spectrometry & Proteomics

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. These include natural products, small synthetic molecules, peptides, large intact proteins, and nucleic acids. The facility is equipped with several high-performance mass spectrometers, including a Thermo QExactive HF, a Bruker Maxis 2 with ETD and a new Bruker timsTOF Pro 2. All are equipped with nano-LC/MS/MS 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. In July of 2022, the Core added a new proteomics specialist, Allison Manuel Ph.D., to add bandwidth to the Core.

Services
A range of proteomics and general mass spectrometry services are available. 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 LC-MS/MS and accurate mass de novo sequencing
- "Top-Down" and "Bottom-Up" proteomics
- Protein quantification analysis using TMT, SILAC, and label free strategies.
- Custom database searching
- Protein accurate mass measurement

General MS Services
- ESI-MS
- ESI-MS/MS
- Nucleic acids
- LC/MS
- LC-MS/MS
- Special project/method development

Equipment

Mass Spectrometers
- Thermo QExactive HF for proteomics
- Bruker Maxis II HD for high mass accuracy intact protein and small molecule analysis.
- Bruker timsTOF Pro 2

HPLC Systems
- Agilent 1260 Preparative HPLC for MudPIT peptide preparation

Personnel

- James Cox Ph.D., Director
- Sandra Osburn-Staker Ph.D., Research Associate
- Allison Manuel Ph.D., Research Associate

Advisory Board Committee

Last meeting date: September 20, 2023

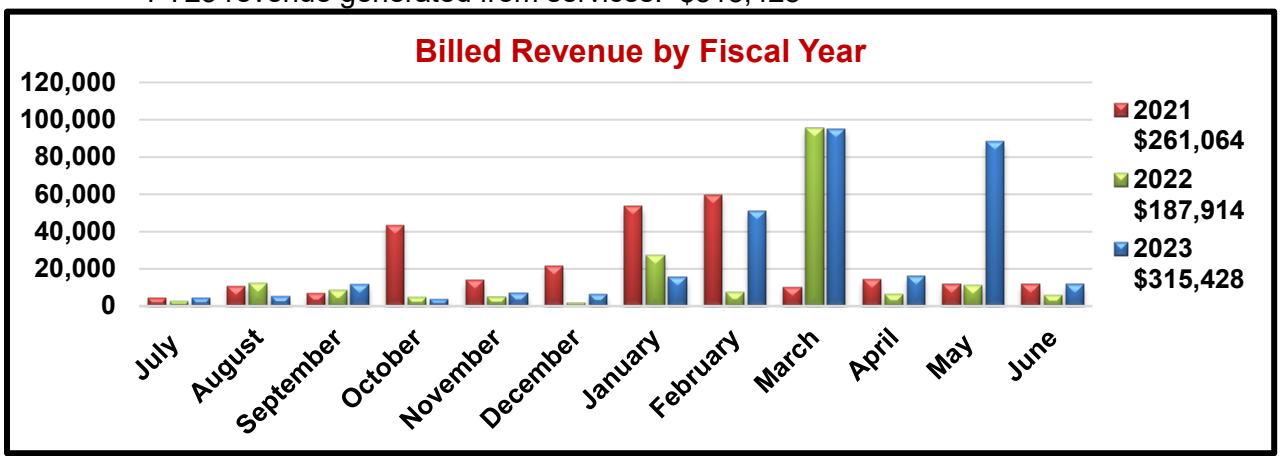
- Chris Hill, DPhil. Professor, Biochemistry
- Hans Haecker, M.D., Ph.D., Professor, Pathology
- Sarah Franklin, Ph.D., Associate Professor, Internal Medicine
- Helena Safavi-Hemami, Ph.D., Assistant Professor, Biochemistry
- Martin Golkowski, Ph.D. Assistant Professor, Pharmacology and Toxicology

Revenue/Expenses

FY23 Expenses: **Total $422,402**

FY23 Revenue: **Total $1,156,688**

- VP of Health Sciences Support: $185,000
- Equipment Support: $656,260
- FY23 revenue generated from services: $315,428

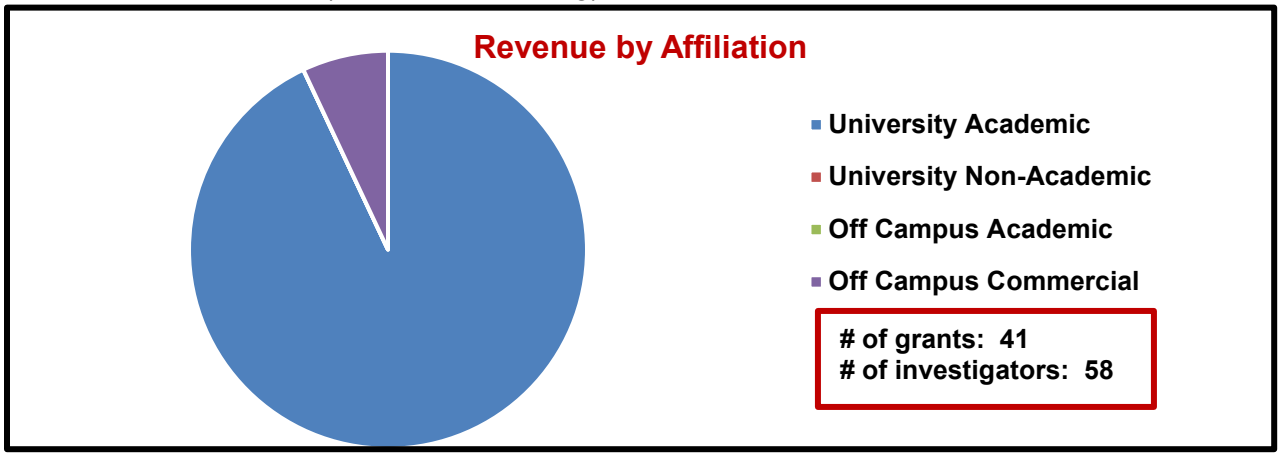


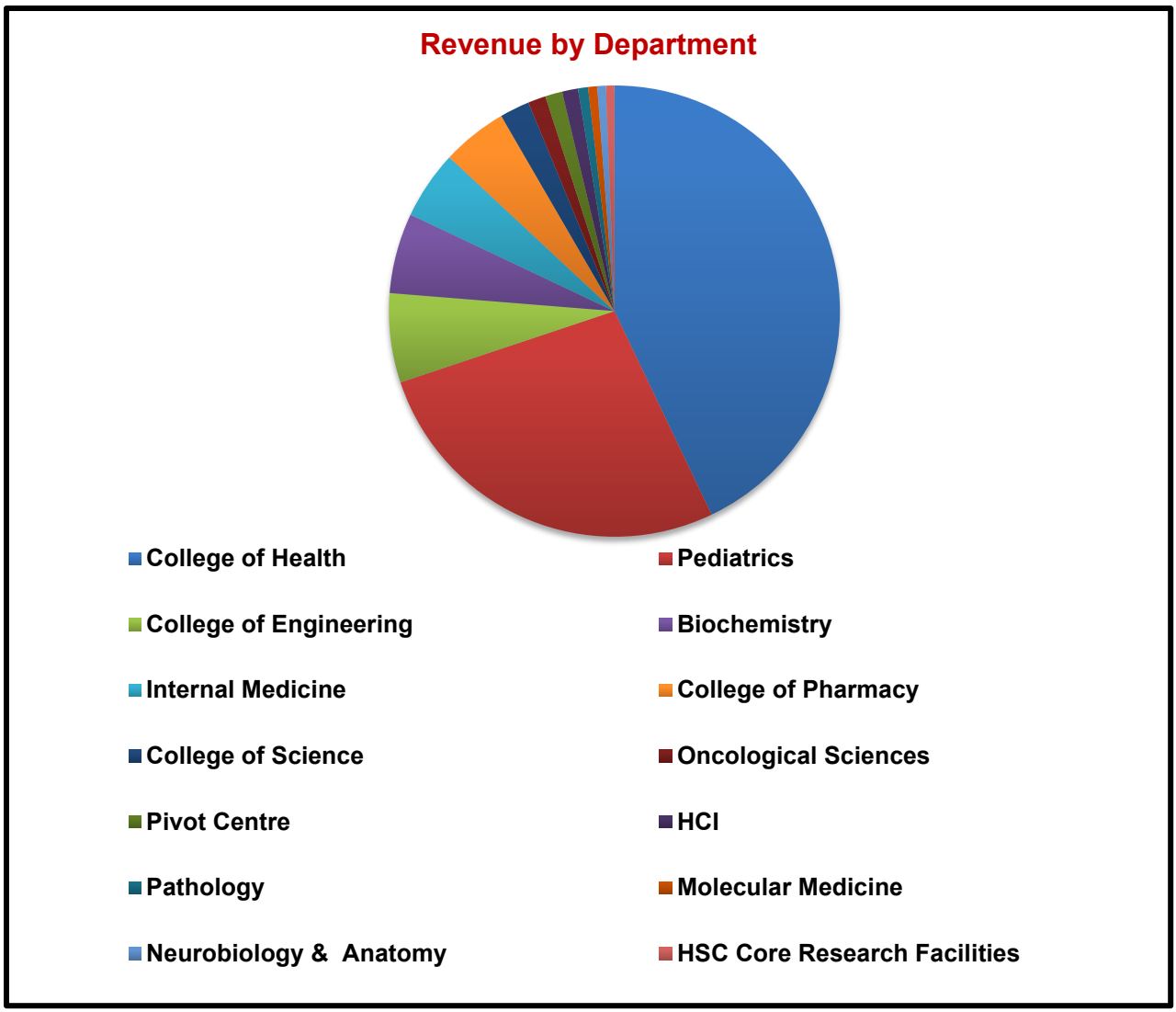
* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Mary Playdon	NIH
2	Julie Korenberg	NIH
3	Jeffrey Weiss	NIH
4	3Helix	Commercial
5	Francesca Di Cara	Commercial
6	Wesley Sundquist	Department, NIH
7	Eric Schmidt	NIH, NSF
8	Nirupama Ramkumar	Department
9	Tianxin Yang	NIH
10	Amy Barrios	NIH, NSF

Publications

1. Espino-Sanchez, T. J., H. Wienkers, R. G. Marvin, S. A. Nalder, A. E. Garcia-Guerrero, P. E. VanNatta, Y. Jami-Alahmadi, A. Mixon Blackwell, F. G. Whitby, J. A. Wohlschlegel, M. T. Kieber-Emmons, C. P. Hill and P. A. Sigala (2023). Direct tests of cytochrome c and c(1) functions in the electron transport chain of malaria parasites. Proc Natl Acad Sci U S A 120(19): e2301047120.10.1073/pnas.2301047120
2. Luke, E. N., P. Ratnatilaka Na Bhuket, S. M. Yu and J. A. Weiss (2023). Targeting damaged collagen for intra-articular delivery of therapeutics using collagen hybridizing peptides. J Orthop Res.10.1002/jor.25577
3. Subrahmanyam, N., B. Yathavan, J. Kessler, S. M. Yu and H. Ghandehari (2023). HPMA copolymer-collagen hybridizing peptide conjugates targeted to breast tumor extracellular matrix. J Control Release 353: 278-288.10.1016/j.jconrel.2022.10.017
4. Wenzel, D. M., D. R. Mackay, J. J. Skalicky, E. L. Paine, M. S. Miller, K. S. Ullman and W. I. Sundquist (2022). Comprehensive analysis of the human ESCRT-III-MIT domain interactome reveals new cofactors for cytokinetic abscission. Elife 11.10.7554/eLife.77779

Metabolic Phenotyping

Overview

The Metabolic Phenotyping Core (MPC) is an important University-sponsored resource that performs several standardized and high-quality metabolic and physiologic tests for phenotypic characterization of variable organism models developed by UofU investigators. This invaluable resource supports research on human diseases such as diabetes, cardiovascular disorders, kidney diseases, neurological diseases, and cancer. The 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 CLAMS/Oxymax system, determination of body composition by Bruker Minispec NMR and determination of circulating hormones, growth factors and cytokine concentrations using the Luminex xMAP multiplex systems (MAGPIX and Luminex 200), measurement of analyte (metabolites, ions, gases, enzymes) concentration in the body fluids such as serum, plasma, urine and cerebrospinal fluid using Vitros 350 chemistry analyzer. In addition, MPC performs tests to map the metabolic phenotype of different cell types and tissues using Agilent-Seahorse XF_e96 analyzers. The MPC also helps scientists to design and optimize phenotyping tests. The overall goal of MPC is to expedite biomedical research efforts by providing academic and non-academic researchers access to advanced metabolic phenotyping tests at a reasonable price.

Services

- Mitochondrial bioenergetics using an Agilent-Seahorse XF_e96 extracellular flux analyzers
- Cellular energy metabolism using an Agilent-Seahorse XF_e96 extracellular flux analyzers
- Assessment of energy balance in mice using CLAMS metabolic chambers
- Body composition (lean mass, fat mass and water content) using Bruker Minispec NMR
- High throughput biomarker screening and quantification using Luminex technology
- Multiplexed protein analyte (hormone, growth factors, cytokines, adipokines, myokines, and signaling molecules) quantification using MagPix and Luminex-200
- Multiplexed high throughput quantification of metabolites in body fluids such as serum, plasma, urine, and cerebrospinal fluid using Vitros 350 chemistry analyzer
- Whole-body glucose metabolism and insulin sensitivity- glucose and insulin tolerance tests

Equipment

- Seahorse Flux Analyzer XF_e96
- Eight Columbus Instruments metabolic chambers equipped with temperature-controlled enclosure.
- Eight Columbus Instruments CLAMS metabolic chambers equipped with running wheels and with the capability to measure core body temperature and heart rate.
- Bruker Minispec NMR
- Luminex MAGPIX
- Ortho Clinical Vitros 350 chemistry analyzer
- Powers Scientific rodent incubators
- Bruker EPS

Personnel

- Ying Li Ph.D., Director
- Xue Yin, Laboratory Technician

Advisory Board Committee

Last meeting date: August 2022

- Jared Rutter Ph.D., Professor, Biochemistry
- Scott Summers Ph.D., Professor, Nutrition, and Integrative Physiology
- William Holland Ph.D., Associate Professor, Nutrition, and Integrative Physiology
- Katsuhiko Funai Ph.D., Associate Professor, Nutrition, and Integrative Physiology
- Amandine Chaix Ph.D., Assistant Professor Nutrition and Integrative Physiology,
- James Cox Ph.D., Director HSC Cores

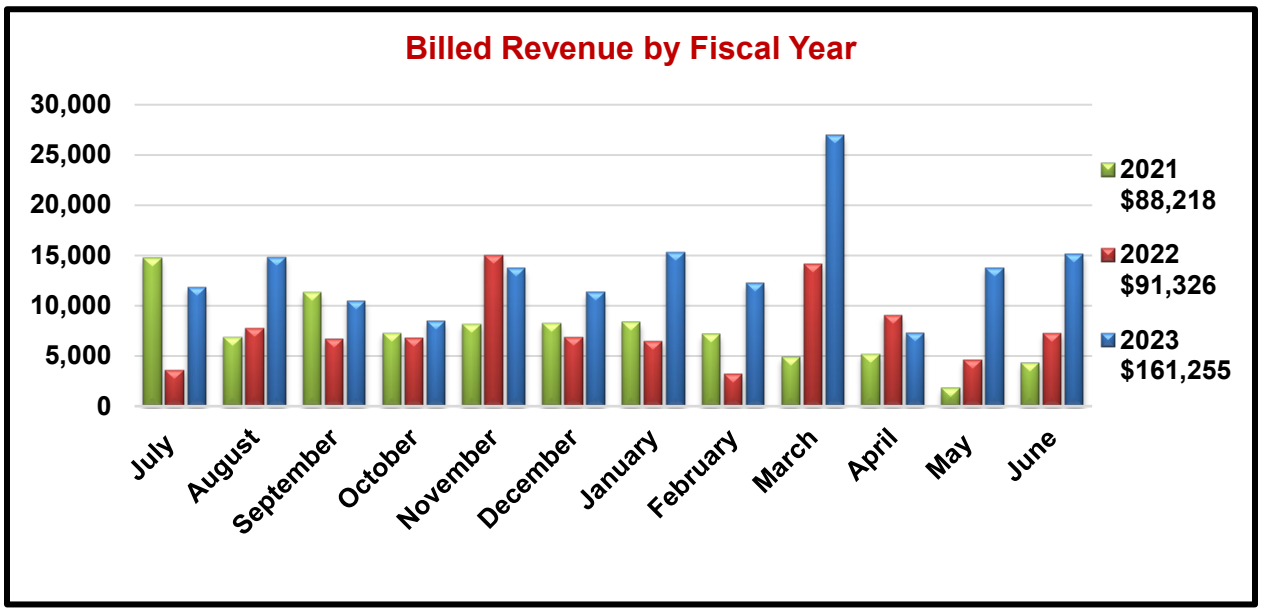
FY23 Annual Update

We submitted a S10 grant for a new Promethion Metabolic Phenotyping System.
We hired a new technician.
We retired a Luminex 200 to surplus.
We turned room 156 into a small lab to accommodate a rodent incubator.

Revenue/Expenses

FY23 Expenses: Total $249,761
FY23 Revenue: Total $328,863

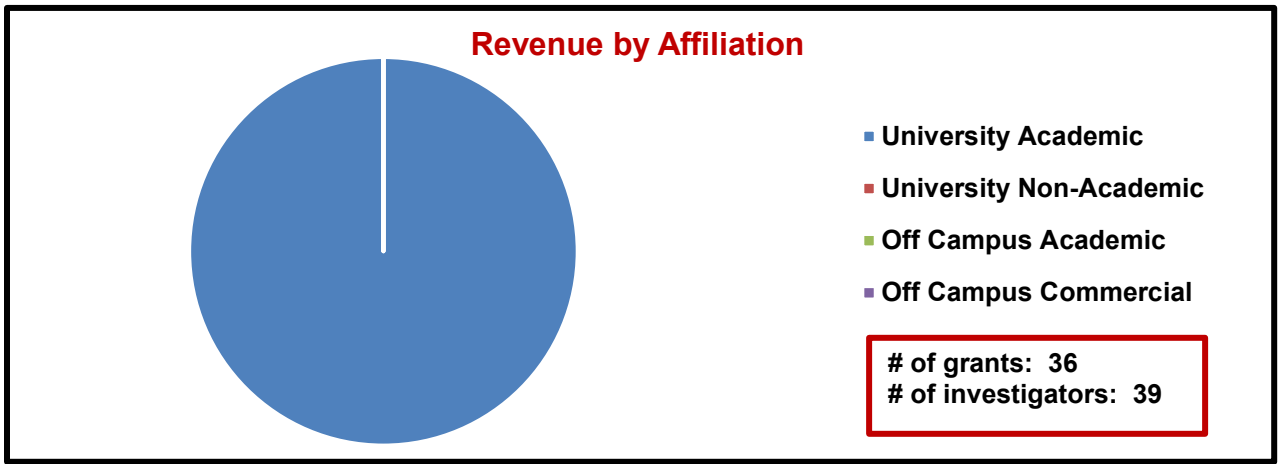
- VP of Health Sciences Support: $ 85,000
- Equipment Support: $82,608
- FY23 revenue generated from services: $161,255

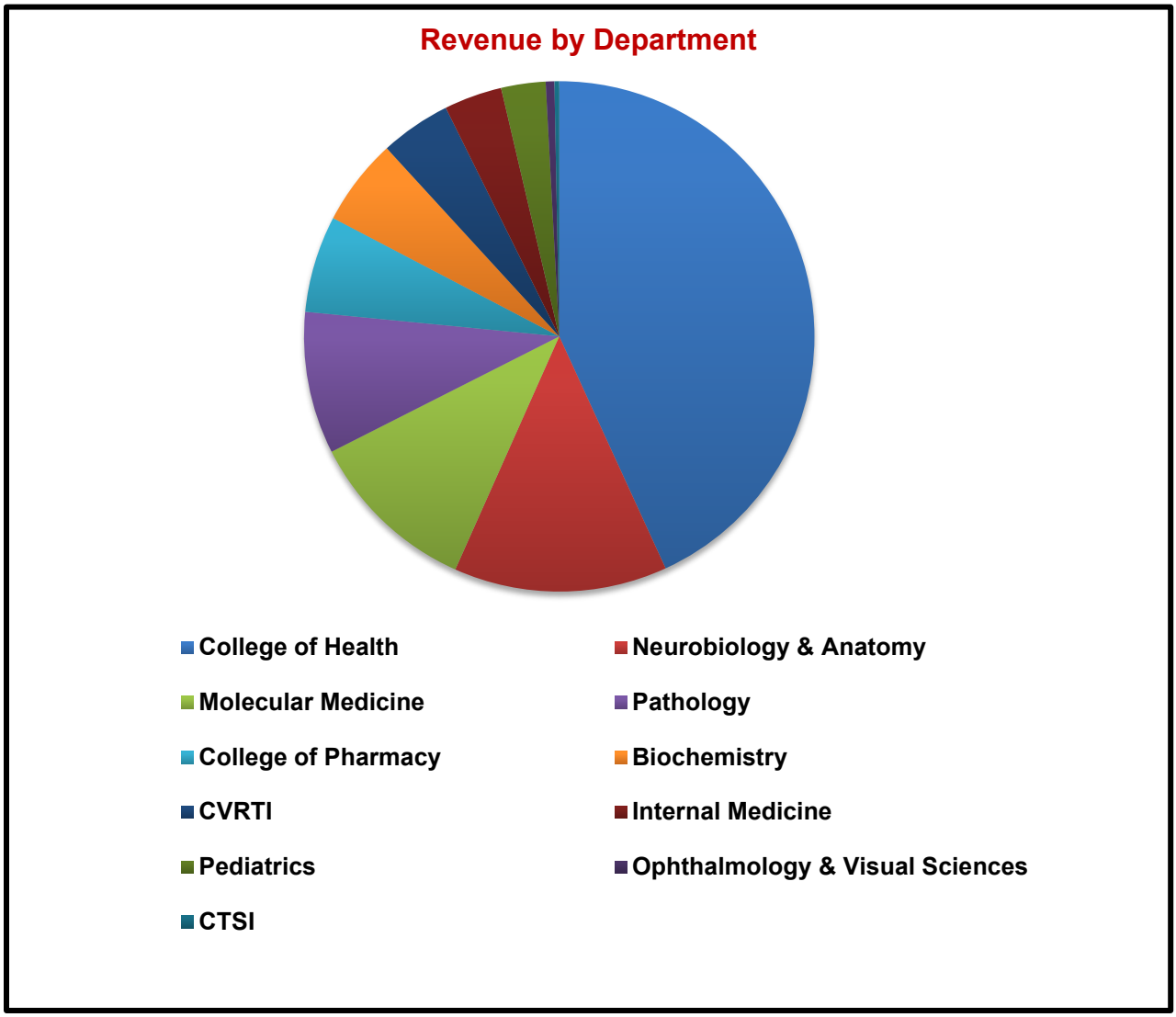


*Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support

Revenue Generated (see charts following):





Top Users

1	Amandine Chaix	Department, NIH
2	Christopher Gregg	NIH
3	Scott Summers	NIH
4	Katsuhiko Funai	NIH
5	Jared Rutter	Brigham & Women's Hospital, Department
6	Micah Drummond	Department, NIH
7	TingTing Hong	Department
8	Patrice Mimche	NIH
9	Dipayan Chaudhuri	NIH
10	Robert Campbell	NIH

Publications

No known publications acknowledged this facility in FY23.

Metabolomics

Overview

The Metabolomics Core at the University of Utah is a recognized leader in the field of metabolomics, lipidomics and metabolic tracer analysis. It was established 18 years ago with a mission to perform comprehensive global metabolomics and lipidomics analyses. Over the years the Metabolomics Core has developed methods to analyze the metabolome and lipidome of a variety of biological systems and samples. The core is highly equipped with state-of-the-art instrumentation and expert staff. It provides both non-targeted analysis for biomarker discovery as well as targeted quantitation of metabolites for discovery validation. New, highly capable instrumentation has been acquired over the past several years to enhance our capabilities to perform these studies. No one method is fully capable of completely profiling the metabolome. To maximize the number of metabolites observed, the facility is equipped with two chemical analysis platforms, GC-MS and LC-MS.

Services

The primary mission of the facility is the metabolomics/lipidomics 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 samples 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

- Two Agilent 5977B gas chromatograph-quadrupole mass spectrometers (GC-MS) for metabolic tracer analysis.
- Agilent 5973 gas chromatograph-quadrupole mass spectrometer (GC-MS) for fatty acid analysis.
- Agilent 7200 gas chromatograph-quadrupole time of flight mass spectrometer (GC-QTOF-MS) for discovery metabolomics.
- Agilent 6545A Ultra Pressure Liquid Chromatograph-Quadrupole Time of Flight Mass-Spectrometer (UPLC-QToF-MS) for discovery lipidomics.

- Agilent 6545B Ultra Pressure Liquid Chromatograph-Quadrupole Time of Flight Mass-Spectrometer (UPLC-QTOF-MS) for discovery metabolomics.
- Agilent 6490 Triple quadrupole UPLC-MS for the targeted quantification of metabolites, lipids and peptides
- Sciex 6500 QTRAP Triple quadrupole UPLC-MS for the targeted quantification of metabolites, lipids and peptides
- Thermo QExactive Plus UPLC-MS for isotope tracer analysis.
- Sciex 7600 UPLC-QToF for metabolomics and lipidomics

Personnel

- James Cox, PhD, Director
- Alan Maschek, PhD, Research Associate
- Leon Catrow, PhD, Research Associate
- Quentinn Pierce, BS, Research Associate
- Jordan Reelitz, BS, Research Specialist

Advisory Board Committee

Last meeting date: September 15, 2023

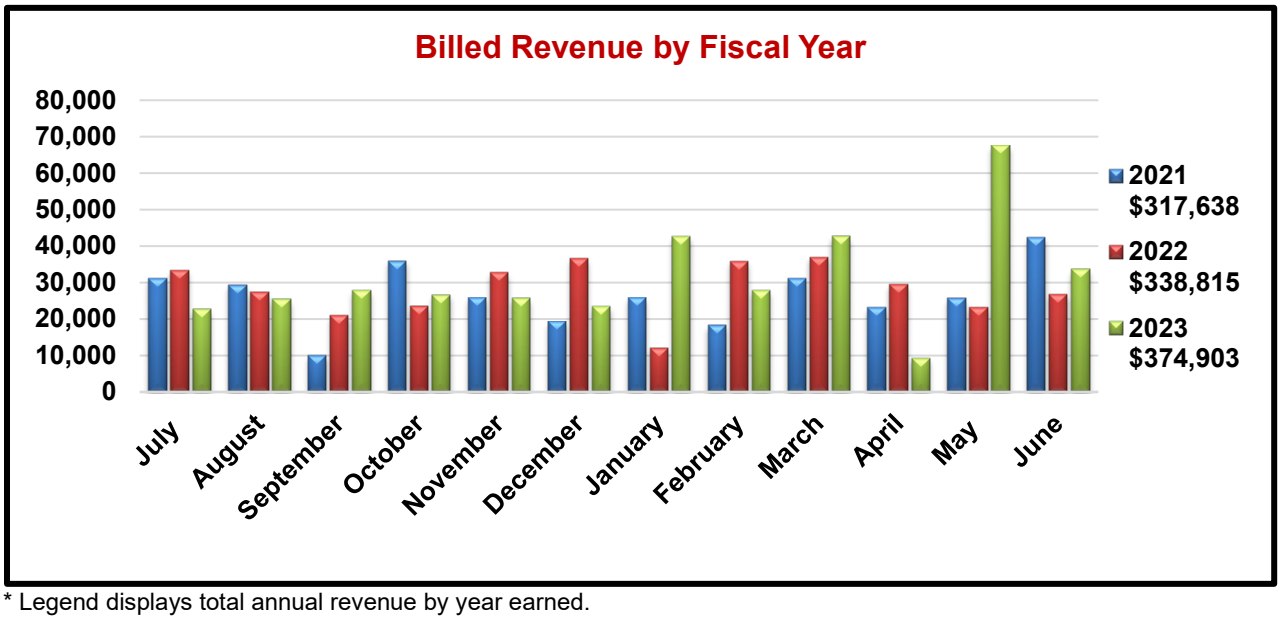
- Greg Ducker, PhD, Assistant Professor, Department of Biochemistry
- Keke Fairfax, PhD, Associate Professor, Department of Pathology
- William Holland, PhD, Associate Professor, Nutrition & Integrative Physiology
- Katsu Funai, PhD, Associate Professor, Nutrition & Integrative Physiology
- Jared Rutter, PhD, Professor, Department of Biochemistry

Revenue/Expenses

FY23 Expenses: **Total $696,788**

FY23 Revenue: **Total $614,903**

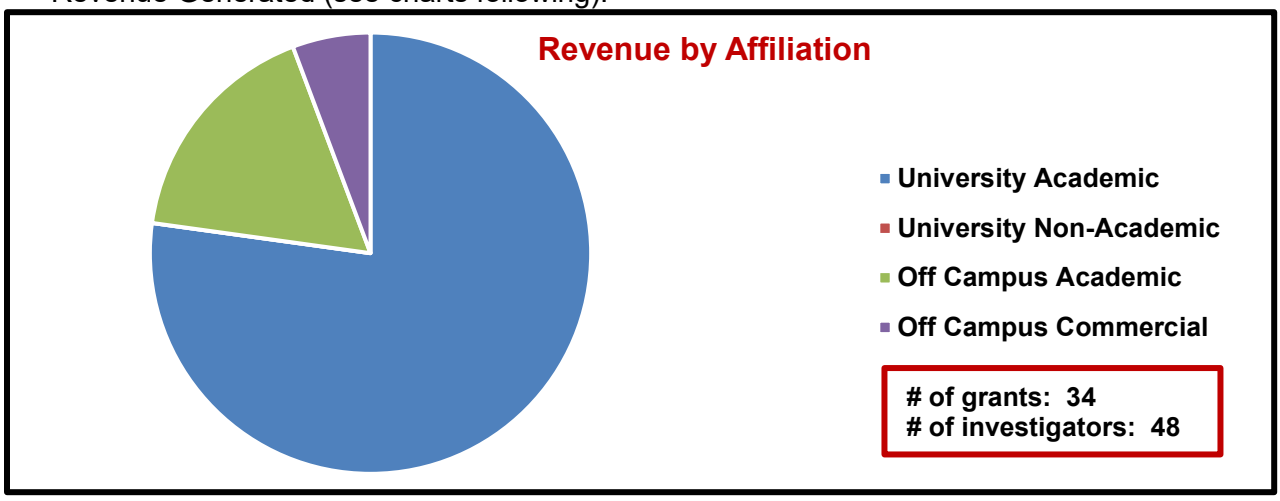
- VP of Health Sciences Support: $240,000
- FY23 Revenue generated from services: $374,903

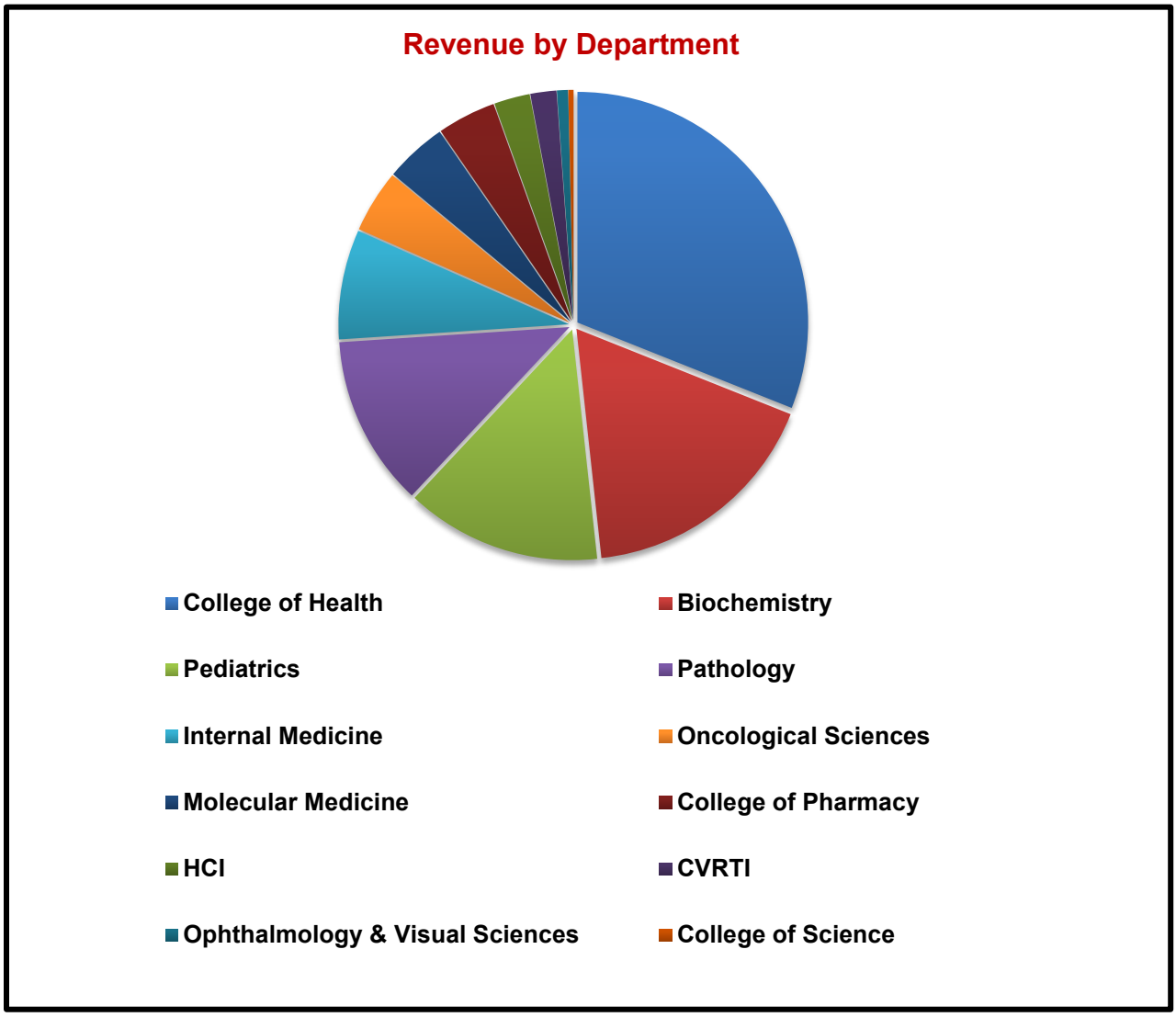


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support

Revenue Generated (see charts following):





Top Users

1	Scott Summers	NIH
2	Adam Hughes	NIH, Department
3	Julie Korenberg	NIH
4	Jared Rutter	Department
5	Marcus Pezzolesi	DHHS
6	Arabella Young	Department
7	Katsuhiko Funai	NIH
8	The Children's Hospital of Philadelphia	Off Campus Educational
9	Bruce Edgar	Department, NIH
10	Indiana University	Off Campus Educational

Publications

1. Balakrishnan, B., R. Altassan, R. Budhraja, W. Liou, A. Lupo, S. Bryant, A. Mankouski, S. Radenkovic, G. J. Preston, A. Pandey, S. Boudina, T. Kozicz, E. Morava-Kozicz and K. Lai (2023). AAV-based gene therapy prevents and halts the progression of dilated cardiomyopathy in a mouse model of phosphoglucomutase 1 deficiency (PGM1-CDG). Transl Res 257: 1-14.10.1016/j.trsl.2023.01.004
2. Berg, J. A., Y. Zhou, Y. Ouyang, A. A. Cluntun, T. C. Waller, M. E. Conway, S. M. Nowinski, T. Van Ry, I. George, J. E. Cox, B. Wang and J. Rutter (2023). Metaboverse enables automated discovery and visualization of diverse metabolic regulatory patterns. Nat Cell Biol 25(4): 616-625.10.1038/s41556-023-01117-9
3. Eshima, H., J. L. Shahtout, P. Siripoksup, M. J. Pearson, Z. S. Mahmassani, P. J. Ferrara, A. W. Lyons, J. A. Maschek, A. D. Peterlin, A. R. P. Verkerke, J. M. Johnson, A. Salcedo, J. J. Petrocelli, E. R. Miranda, E. J. Anderson, S. Boudina, Q. Ran, J. E. Cox, M. J. Drummond and K. Funai (2023). Lipid hydroperoxides promote sarcopenia through carbonyl stress. Elife 12.10.7554/eLife.85289
4. Ferrara, P. J., M. J. Lang, J. M. Johnson, S. Watanabe, K. L. McLaughlin, J. A. Maschek, A. R. P. Verkerke, P. Siripoksup, A. Chaix, J. E. Cox, K. H. Fisher-Wellman and K. Funai (2023). Weight loss increases skeletal muscle mitochondrial energy efficiency in obese mice. Life Metab 2(2).10.1093/lifemeta/load014
5. Hicks, K. G., A. A. Cluntun, H. L. Schubert, S. R. Hackett, J. A. Berg, P. G. Leonard, M. A. Ajalla Aleixo, Y. Zhou, A. J. Bott, S. R. Salvatore, F. Chang, A. Blevins, P. Barta, S. Tilley, A. Leifer, A. Guzman, A. Arok, S. Fogarty, J. M. Winter, H. C. Ahn, K. N. Allen, S. Block, I. A. Cardoso, J. Ding, I. Dreveny, W. C. Gasper, Q. Ho, A. Matsuura, M. J. Palladino, S. Prajapati, P. Sun, K. Tittmann, D. R. Tolan, J. Unterlass, A. P. VanDemark, M. G. Vander Heiden, B. A. Webb, C. H. Yun, P. Zhao, B. Wang, F. J. Schopfer, C. P. Hill, M. C. Nonato, F. L. Muller, J. E. Cox and J. Rutter (2023). Protein-metabolite interactomics of carbohydrate metabolism reveal regulation of lactate dehydrogenase. Science 379(6636): 996-1003.10.1126/science.abm3452
6. Johnson, J. M., A. D. Peterlin, E. Balderas, E. G. Sustarsic, J. A. Maschek, M. J. Lang, A. Jara-Ramos, V. Panic, J. T. Morgan, C. J. Villanueva, A. Sanchez, J. Rutter, I. J. Lodhi, J. E. Cox, K. H. Fisher-Wellman, D. Chaudhuri, Z. Gerhart-Hines and K. Funai (2023). Mitochondrial phosphatidylethanolamine modulates UCP1 to promote brown adipose thermogenesis. Sci Adv 9(8): eade7864.10.1126/sciadv.ade7864
7. Miljkovic, M., A. Seguin, X. Jia, J. E. Cox, J. L. Catrow, H. Bergonia, J. D. Phillips, W. Z. Stephens and D. M. Ward (2023). Loss of the mitochondrial protein Abcb10 results in altered arginine metabolism in MEL and K562 cells and nutrient stress signaling through ATF4. J Biol Chem 299(7): 104877.10.1016/j.jbc.2023.104877
8. Nikkanen, J., Y. A. Leong, W. C. Krause, D. Dermadi, J. A. Maschek, T. Van Ry, J. E. Cox, E. J. Weiss, O. Gokcumen, A. Chawla and H. A. Ingraham (2022). An evolutionary trade-off between host immunity and metabolism drives fatty liver in male mice. Science 378(6617): 290-295.10.1126/science.abn9886
9. Oka, S. I., K. Sreedevi, T. S. Shankar, S. Yedla, S. Arowa, A. James, K. G. Stone, K. Olmos, A. D. Sabry, A. Horiuchi, K. M. Cawley, A. O'Very S, M. Tong, J. Byun, X. Xu, S. Kashyap, Y. Mourad, O. Vehra, D. Calder, T. Lunde, T. Liu, H. Li, J. A. Mashchek, J. Cox, Y. Saijoh, S. G. Drakos and J. S. Warren (2022). PERM1 regulates energy metabolism in the heart via ERRalpha/PGC-1alpha axis. Front Cardiovasc Med 9: 1033457.10.3389/fcvm.2022.1033457
10. Sharma, R., A. Antypiuk, S. Z. Vance, D. Manwani, Q. Pearce, J. E. Cox, X. An, K. Yazdanbakhsh and F. Vinchi (2023). Macrophage metabolic rewiring improves heme-suppressed efferocytosis and tissue damage in sickle cell disease. Blood 141(25): 3091-3108.10.1182/blood.2022018026
11. Zhang, P., G. Wu, S. C. Heard, C. Niu, S. A. Bell, F. Li, Y. Ye, Y. Zhang and J. M. Winter (2022). Identification and Characterization of a Cryptic Bifunctional Type I Diterpene Synthase Involved in Talaronoid Biosynthesis from a Marine-Derived Fungus. Org Lett 24(38): 7037-7041.10.1021/acs.orglett.2c02904

HEALTH
UNIVERSITY OF UTAH

Mutation Generation & Detection

Overview

The Mutation Generation & Detection (MGD) Core Facility supports researchers by securing, developing, and optimizing the latest DNA nuclease technologies, reagents, and protocols for targeted genome modification. Currently, the MGD core specializes in providing customized CRISPR reagents for gene editing in multiple model systems, including but not limited to *M. musculus*, *D. rerio*, *D. melanogaster*, *C. elegans*, *S. cerevisiae* and mammalian cell lines. Beyond reagent production, the MGD Core has established partnerships with the Mouse Transgenic Facility, the Centralized Zebrafish Resource Center and the Drug Discovery Core to create engineered mouse models, zebrafish models and cell lines respectively. The MGD Cores also provides custom genotyping services including High Resolution Melt Analysis (HRMA), CRISPR validation services, homology directed repair donor template synthesis, custom cloning services and targeted sequencing services. To date the MGD Core has helped further the research of over 100 different laboratories around the world by providing more than 500 unique reagents.

Main Services

CRISPR Services

- CRISPR sgRNA
- High fidelity Cas9 protein
- Custom CRISPR plasmid design and construction
  - CRISPRa, CRISPRi, AAV, Cas12a and other CRISPR based technologies

High Resolution Melt Analysis

- HRMA PCR plates (10 pack)
- HRMA PCR sealing film (10 pack)
- MeltDoctor™ HRM Master Mix 100 rxns
- MeltDoctor™ HRM Master Mix 500 rxns
- Mineral Oil (500ml bottle)
- HRMA Training
- Help with optimization and analysis of HRMA assays
- Custom Mutation Detection upon request

Genotyping Services

- Custom RFLP genotyping of mutant and transgenic mice
- Detection of transgene insertion
- Custom HRMA genotyping
- Sequence verification of genome edits

Other Services

- Custom cloning of mammalian and bacterial expression vectors
- Custom cloning of homology directed repair vectors
- Plasmid purification services
- Short ssDNA homology directed repair donor design and production
- Long ssDNA homology directed repair design and production
- Production of CRISPR constructs for generating transgenic *D. melanogaster*
- Mouse transgenic injection (partnership with Mouse Transgenic Facility)
- Blastocyst validation of CRISPR reagents (partnership with Mouse Transgenic Facility)
- Generation of modified cell lines (partnership with Drug Discovery Core)
- Production of mutant *D. rerio* using CRISPR reagents

Equipment

- BioFire LightScanner
- 3X Eppendorf Mastercycler ProS
- Eppendorf centrifuge 5430
- 2X Eppendorf 5424 microcentrifuges
- Innova 43 bacterial shaker
- Innova 42 bacterial shaker
- Frigidaire -20°C freezer
- Lonza 4D Nucleofector system:
    - 4D-Nucleofector Core Unit
    - 4D-Nucleofector X Unit
    - 4D-Nucleofector Y Unit
    - 4D-Nucleofector 96-well Shuttle
- CCI biological safety cabinet
- NapCo Model 6300 CO_2 incubator
- ThermoFisher TSX600 -80 ºC freezer
- Sorvall RT 6300 centrifuge

Personnel

- Crystal Davey, Ph.D., Director
- Lilian Hayes, B.S., Lab Technician

Advisory Board Committee

Last meeting date: August 12th, 2022

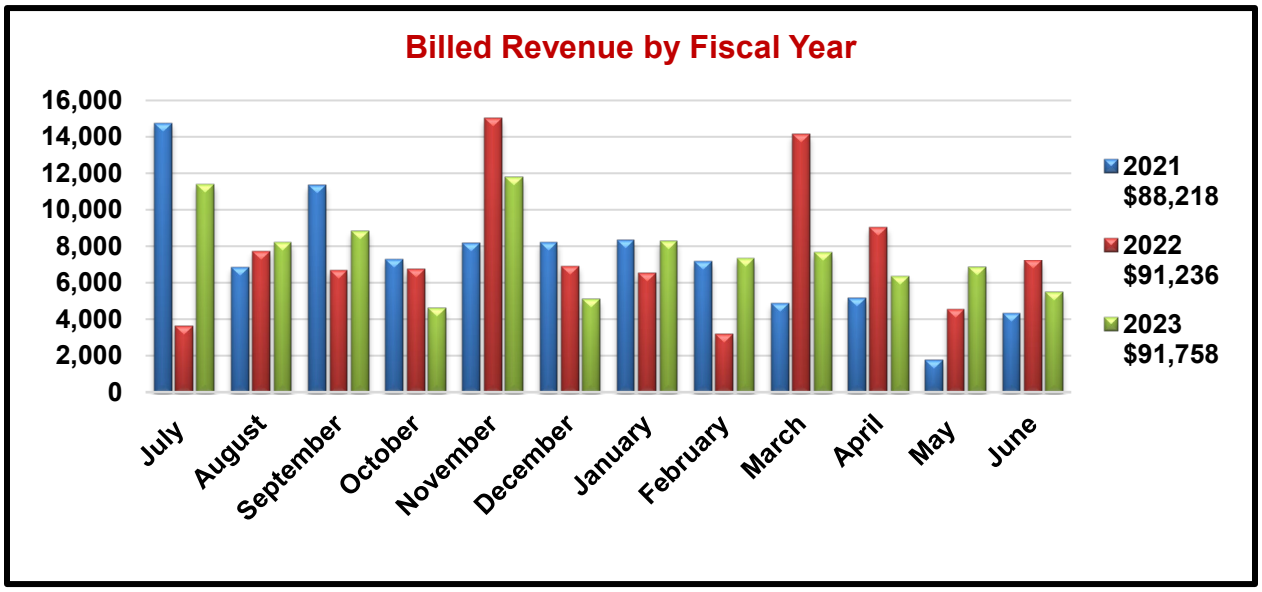
- David Grunwald, Ph.D., Professor, Department of Human Genetics (Senior Faculty Advisor)
- Dana Carroll, Ph.D., Professor, Department of Biochemistry
- Christopher Gregg, Ph.D., Associate Professor, Department of Neurobiology & Anatomy
- Lewis Charles Murtaugh, Ph.D., Associate Professor, Department of Human Genetics

Revenue/Expenses

FY23 Expenses: **Total $131,838**

FY23 Revenue: **Total $161,758**

- VP of Health Sciences Support: $70,000
- FY23 Revenue generated from services: $91,758

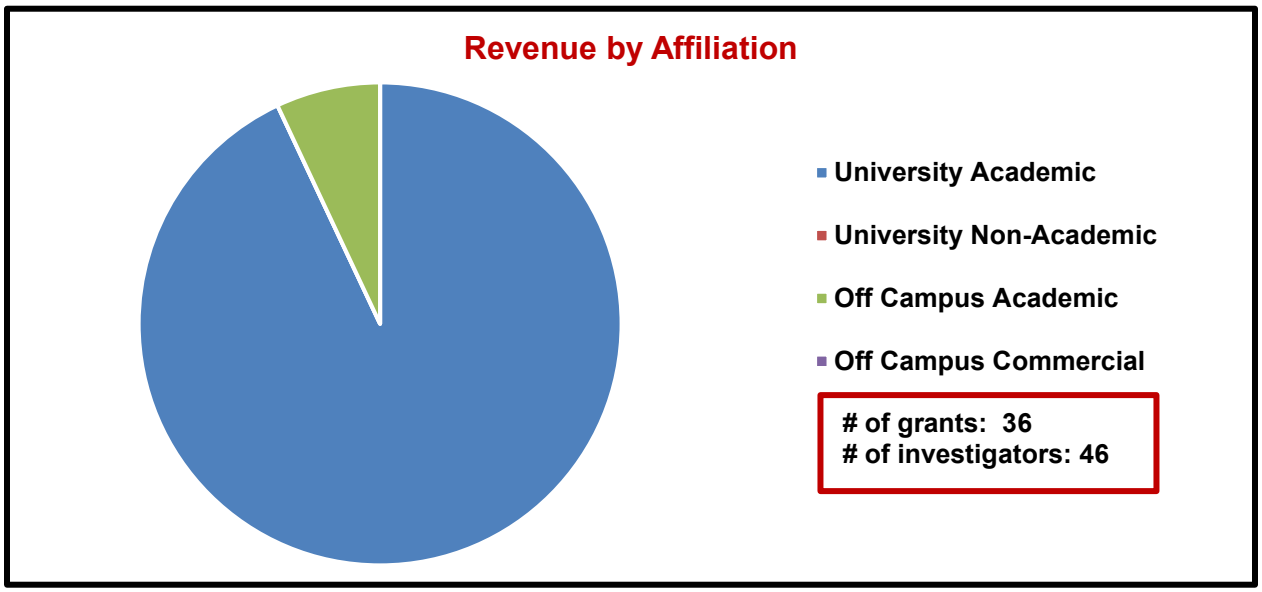


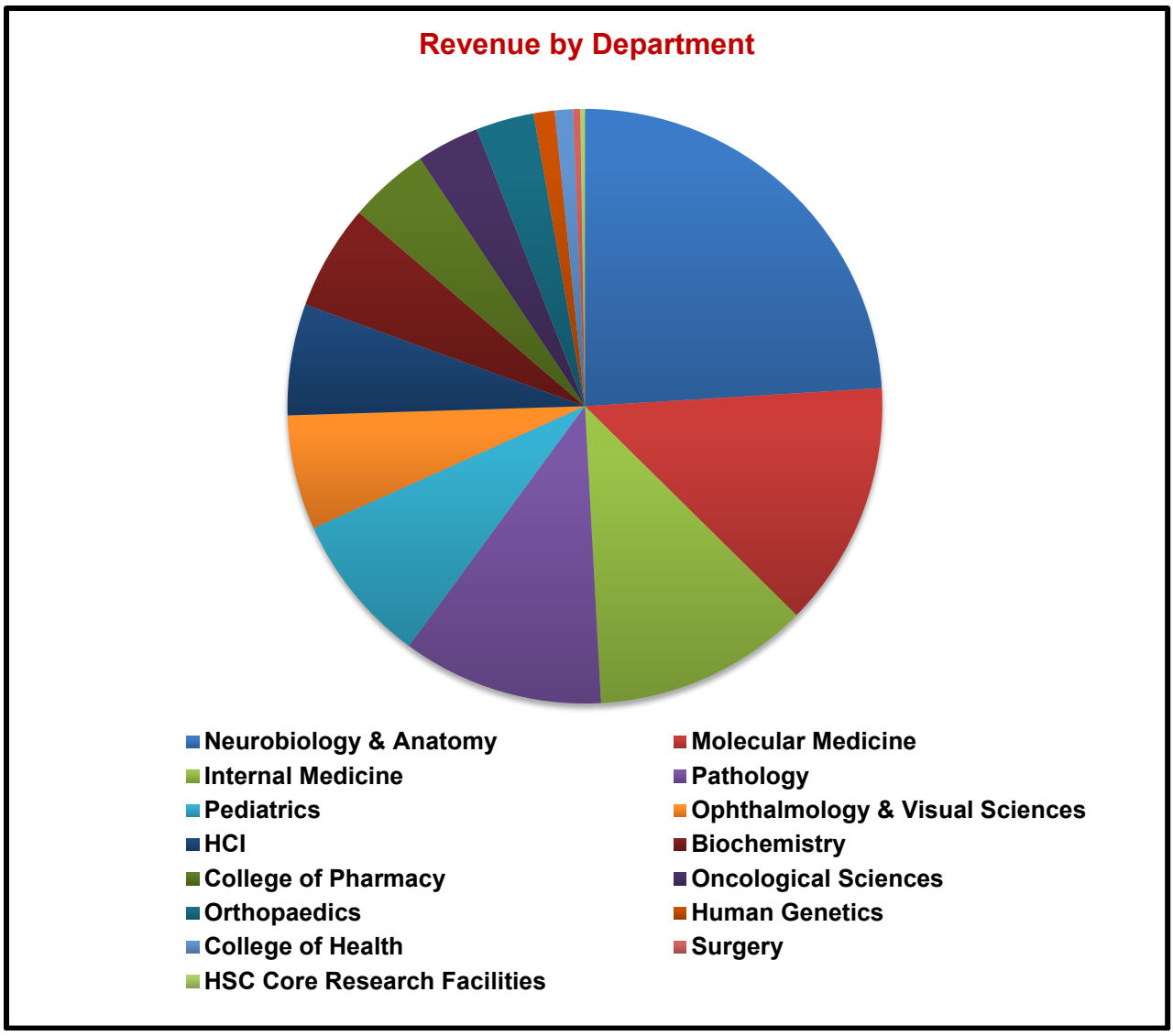
* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Christopher Gregg	NIH
2	Katsuhiko Funai	NIH
3	Mary Hartnett	Department
4	Scott Summers	NIH
5	Jan Christian	NIH
6	Kimberley Evason	Department
7	Dipayan Chaudhuri	Department
8	Josh Bonkowsky	Department
9	Matt Wachowiak	University of Colorado Boulder, Research Institute at Nationwide Children's Hospital
10	Wesley Sundquist	NIH

Collaboration and Support of Other HSC and University Facilities:

- **DNA Sequencing Facility**

The MGD Core spent $4,393 with the DNA Sequencing Core in FY23.

- **DNA Peptide Facility**

The MGD Core spent $4,473 with the DNA/Peptide Synthesis Core in FY23.

- **Drug Discovery Facility**

During FY23 the MGD Core's partnership with the Drug Discovery Facility to produce genetically modified cell lines and to package viral vectors brought in 6 different projects totaling $11,764 in chargebacks for that facility.

- **Mouse Transgenic Facility**

During FY23 the MGD Core's partnership with the Mouse Transgenic Facility to produce transgenic mouse models brought in 26 different projects to the Mouse Transgenic Facility totaling $100,640 in chargebacks for that facility.

Total FY23 chargeback impact of the MGD Core on other University Core Research facilities is $121,270.

Non-billable Invoice Hours

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

Letters of Support
Written and provided to faculty and trainees for support of grant applications:

1. LOS for Dr. Rajeshwary Ghosh's grant: "Targeted Clearance of Cardiac Mutant Proteins by Chaperone Mediated Autophagy-Based Viral Transgene Technology.", September 2022
2. LOS for Dr. Bijina Balakrishnan's grant: "Elucidation the role of the glycosylation of Merosin in cardiac functions – Insights from a mouse model of PGM1- CDG.", October 2022
3. LOS for Dr. Mahesh Chandrasekharan's R01 grant: "Understanding the roles for EZH2 gain-of-function mutations in epigenetic and oncogenic mechanisms.", October 2022
4. LOS and methods section for Dr. Laith F. Al-Rabadi's grant: "The Serine Protease HTRA1 Antigen: A Gateway to Elucidating Membranous Nephropathy Pathogenesis.", November 2022
5. LOS for Ph.D. candidate Alexis Rousek's F31 proposal to use CRISPR-Cas9 to analyze the effect of *tlr5* knock-down on flagella shedding phenotypes in injected zebrafish embryos., November 2022
6. LOS for Dr. Mark Perfetto's F32 application proposing to research how CLPX activates PPOX and FECH and the role CLPX plays during erythropoiesis., November 2022
7. LOS and grant figure for Dr. Mary Harnett's proposal to use CRIPSR mediated homology directed repair to generate a Kdr^{Y1173F} and a Kdr^{Y1212F} mutant mouse model., May 2023
8. LOS and grant figure for Dr. Dean Tantin's NIH proposal use engineered CRISPR-Cas9 to disrupt the POU2F1 (OCT1) gene in human ESCs/iPSCs., June 2023

Publications

1. Barba, C., H. A. Ekiz, W. W. Tang, A. Ghazaryan, M. Hansen, S. H. Lee, W. P. Voth and R. M. O'Connell (2023). Interferon Gamma-Inducible NAMPT in Melanoma Cells Serves as a Mechanism of Resistance to Enhance Tumor Growth. Cancers (Basel) 15(5).10.3390/cancers15051411
2. Casey, M. J., A. M. Call, A. V. Thorpe, C. A. Jette, M. E. Engel and R. A. Stewart (2023). The scaffolding function of LSD1/KDM1A reinforces a negative feedback loop to repress stem cell gene expression during primitive hematopoiesis. iScience 26(1): 105737.10.1016/j.isci.2022.105737
3. Feng, S., C. Rastogi, R. Loker, W. J. Glassford, H. Tomas Rube, H. J. Bussemaker and R. S. Mann (2022). Transcription factor paralogs orchestrate alternative gene regulatory networks by context-dependent cooperation with multiple cofactors. Nat Commun 13(1): 3808.10.1038/s41467-022-31501-2
4. Garritson, J. D., J. Zhang, A. Achenbach, M. Ferhat, E. Eich, C. J. Stubben, P. L. Martinez, A. R. Ibele, K. I. Hilgendorf and S. Boudina (2023). BMPER is a marker of adipose progenitors and adipocytes and a positive modulator of adipogenesis. Commun Biol 6(1): 638.10.1038/s42003-023-05011-w
5. Hicks, K. G., A. A. Cluntun, H. L. Schubert, S. R. Hackett, J. A. Berg, P. G. Leonard, M. A. Ajalla Aleixo, Y. Zhou, A. J. Bott, S. R. Salvatore, F. Chang, A. Blevins, P. Barta, S. Tilley, A. Leifer, A. Guzman, A. Arok, S. Fogarty, J. M. Winter, H. C. Ahn, K. N. Allen, S. Block, I. A. Cardoso, J. Ding, I. Dreveny, W. C. Gasper, Q. Ho, A. Matsuura, M. J. Palladino, S. Prajapati, P. Sun, K. Tittmann, D. R. Tolan, J. Unterlass, A. P. VanDemark, M. G. Vander Heiden, B. A. Webb, C. H. Yun, P. Zhao, B. Wang, F. J. Schopfer, C. P. Hill, M. C. Nonato, F. L. Muller, J. E. Cox and J. Rutter (2023). Protein-metabolite interactomics of carbohydrate metabolism reveal regulation of lactate dehydrogenase. Science 379(6636): 996-1003.10.1126/science.abm3452
6. Jia, S., E. M. Ratzan, E. J. Goodrich, R. Abrar, L. Heiland, B. Tarchini and M. R. Deans (2023). The dark kinase STK32A regulates hair cell planar polarity opposite of EMX2 in the developing mouse inner ear. Elife 12.10.7554/eLife.84910
7. Smith, M. A., E. Blankman, C. C. Jensen, L. M. Hoffman, K. S. Ullman and M. C. Beckerle (2022). Nuclear pore complexes concentrate on Actin/LINC/Lamin nuclear lines in response to mechanical stress in a SUN1 dependent manner. Heliyon 8(12): e12147.10.1016/j.heliyon.2022.e12147
8. Tarasov, M., H. L. Struckman, Y. Olgar, A. Miller, M. Demirtas, V. Bogdanov, R. Terentyeva, A. M. Soltisz, X. Meng, D. Min, G. Sakuta, I. Dunlap, A. D. Duran, M. P. Foster, J. P. Davis, D. Terentyev, S. Gyorke, R. Veeraraghavan and P. B. Radwanski (2023). NaV1.6 dysregulation within myocardial T-tubules by D96V calmodulin enhances proarrhythmic sodium and calcium mishandling. J Clin Invest 133(7).10.1172/JCI152071
9. Wang, H., A. Ramshekar, T. Cung, C. Wallace-Carrete, C. Zaugg, J. Nguyen, G. J. Stoddard and M. E. Hartnett (2023). 7-Ketocholesterol Promotes Retinal Pigment Epithelium Senescence and Fibrosis of Choroidal Neovascularization via IQGAP1 Phosphorylation-Dependent Signaling. Int J Mol Sci 24(12).10.3390/ijms241210276
10. Zheng, D., G. Mohapatra, L. Kern, Y. He, M. D. Shmueli, R. Valdes-Mas, A. A. Kolodziejczyk, T. Prochnicki, M. B. Vasconcelos, L. Schorr, F. Hertel, Y. S. Lee, M. C. Rufino, E. Ceddaha, S. Shimshy, R. J. Hodgetts, M. Dori-Bachash, C. Kleimeyer, K. Goldenberg, M. Heinemann, N. Stettner, A. Harmelin, H. Shapiro, J. Puschhof, M. Chen, R. A. Flavell, E. Latz, Y. Merbl, S. K. Abdeen and E. Elinav (2023). Epithelial Nlrp10 inflammasome mediates protection against intestinal autoinflammation. Nat Immunol 24(4): 585-594.10.1038/s41590-023-01450-z

Nuclear Magnetic Resonance

Overview

Nuclear Magnetic Resonance (NMR) is a powerful and widely used research tool in medical research, chemistry, medicinal chemistry, pharmacy, biochemistry, biology and others. The NMR core supports drug discovery, natural products characterization, synthetic chemistry, and structural biology. This core contains several high-field NMR spectrometers located in BPRB and Skaggs Hall (spectrometer and location list below). NMR pulse programs and software are implemented for a wide range of applications, from synthetic chemistry and small molecule characterization to protein structure determination. Data are collected, processed, analyzed, and visualized using the software packages OpenVnmrJ-v3.1, Mnova, nmrPipe, NMRFAM-SPARKY, nmrDraw, XPLOR, ROSETTA, CYANA, and PYMOL. The suite of software is installed on three dedicated workstations and at the University of Utah Center for High Performance Computing (CHPC). The NMR core facility is available to the entire University of Utah research community, regional universities, and not-for-profit and for-profit companies. NMR training is required for all users. Use of spectrometers requires an advance reservation. The University of Utah is also a full member of the Rocky Mountain NMR Consortium and we have access to the Colorado 900 at Anschutz Medical Campus in Denver, Colorado. Data collection is usually collected through a secure network portal. Finally, Jack Skalicky (NMR Core Director and Associate Research Professor of Biochemistry) is an experienced NMR spectroscopist willing to share his immense NMR background that spans NMR theory to countless types of application. Advanced NMR training and formal NMR spectroscopy courses are available for those interested.

HSC Core Varian INOVA 600 MHz NMR spectrometer. The INOVA console comes with three full radio frequency (RF) channels and a fourth dedicated ^{2}H decoupling accessory. Four probes are available: **(1)** 5 mm triple resonance (^{1}H,^{13}C,^{15}N) cryogenic probe with Z-axis pulsed field gradient (PFG) capability and ^{1}H signal/noise of 4800/1; **(2)** Nalorac 5 mm triple resonance (^{1}H,^{13}C,^{15}N) room temperature (RT) probe with Z-axis PFG capability; **(3)** Nalorac 8 mm triple resonance (^{1}H,^{13}C,^{15}N) RT probe with Z-axis PFG capability; **(4)** and a Nalorac 5 mm quad resonance (^{1}H,^{13}C,^{15}N,^{31}P) RT probe with Z-axis PFG capability. This instrument is our work horse for NMR of proteins, peptides, and natural products.

HSC Core Varian INOVA 500 MHz spectrometer. The NOVA console comes with has three full RF channels and a fourth dedicated ^{2}H decoupling accessory. Three probes are available: **(1)** 5 mm Nalorac triple resonance HCN (^{1}H,^{13}C,^{15}N) RT probe with Z-axis PFG capability; **(2)** 5 mm Nalorac triple resonance HXC (^{1}H,X=50-203 MHz,^{13}C) with Z-axis PFG capability, **(3)** and a 3 mm Nalorac MDBG500 Dual Broadband (^{1}H/^{19}F, X=50-203 MHz) RT probe with PFG capability.

HSC Core Varian MERCURY 400 MHz spectrometer. The Mercury console comes with three RF channels. This instrument is equipped with a 4NG400-5+ 5 mm four nuclei (^{1}H,^{19}F,^{31}P,^{13}C) RT probe with PFG capability.

Rocky Mountain NMR Consortium Varian 900 MHz NMR spectrometer. We are full members of the Rocky Mountain NMR consortium and have access to a Varian DirectDrive 900 housed at University of Colorado Anschutz Medical Campus in Denver. This instrument is "fully loaded" and includes four complete RF channels, XYZ-axis Pulsed Field Gradient, and salt-tolerant and carbon-enhanced triple resonance cryogenic probe. The instrument is used primarily for TROSY and NOESY experiments for protein structure determination. Proton signal/noise is 7500/1.

Services

- NMR consultation
- NMR data collection and analysis
- NMR training for individuals and groups
- Formal course in NMR spectroscopy

Equipment

- Varian Mercury 400 MHz NMR (University of Utah)
- Varian Inova 500 MHz NMR (University of Utah)
- Varian Inova 600 MHz NMR with HCN cryogenic probe (University of Utah)
- Varian DD2 900 MHz NMR with HCN cryogenic probe (University of Colorado Anschutz Medical Campus)

Personnel

- Jack Skalicky, Ph.D., NMR Core Director, Research Associate Professor of Biochemistry
- Dennis Edwards, RF Technician; 40+ years of experience with NMR hardware repair

Advisory Board Committee

Last updates: June/July 2017.

- Darrell Davis Ph.D., Eric Schmidt Ph.D., and Jaclyn Winter Ph.D., Department of Medicinal Chemistry
- Wesley Sundquist Ph.D., Department of Biochemistry
- Jessica Kramer Ph.D., Department of Bioengineering

FY23 Annual Update

New Equipment

- Rebuild of 600 cryogenic system
- Installation of openVnmrJ (open source software) on Utah spectrometers.

New Services

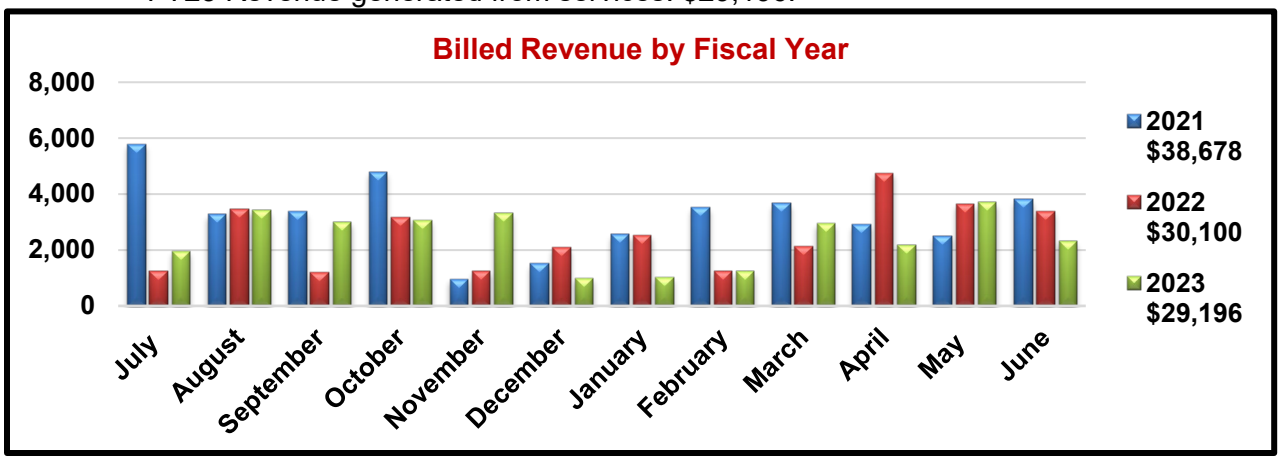
- The NMR Facility did not implement additional services in FY23

Revenues/Expenses

FY23 Expenses: **Total $130,516**

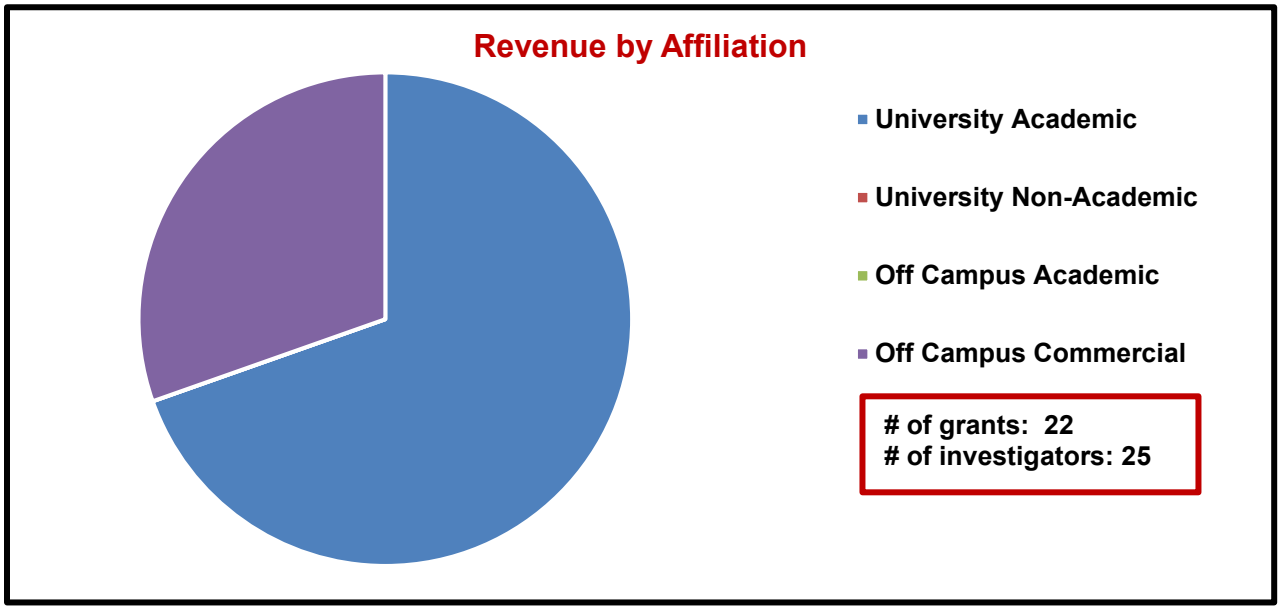
FY23 Revenue: **Total $99,196**

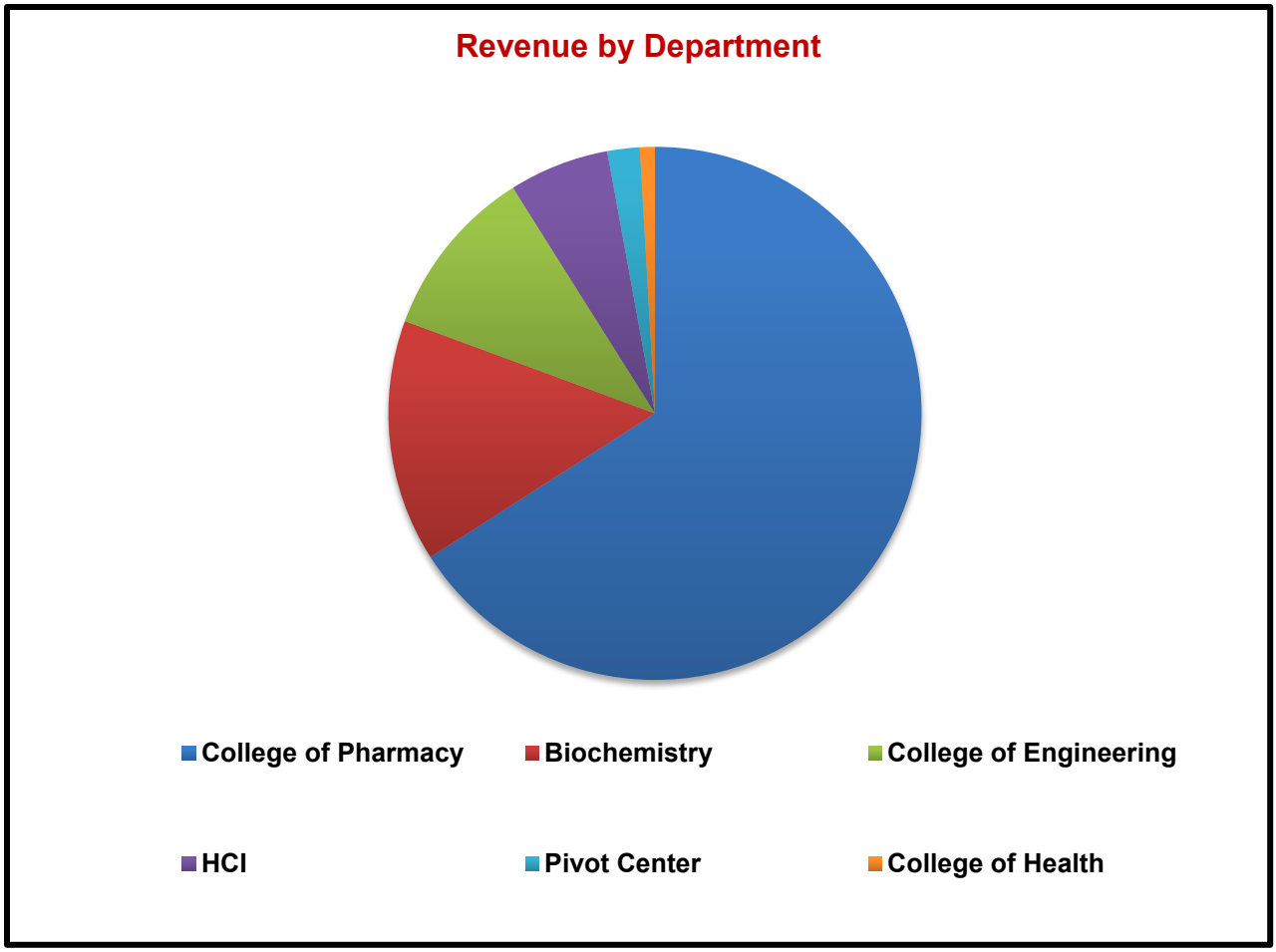
- VP of Health Sciences Support: $70,000
- FY23 Revenue generated from services: $29,196.



* Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support
Revenue Generated: (see charts following)





Top Users

1	Eric Schmidt	NIH
2	Echelon Biosciences	Commercial
3	Jaclyn Winter	NIH
4	Wesley Sundquist	Department
5	Raphael Franzini	Department
6	Darrell Davis	Department
7	Ling Zang	Commercial
8	Intronex, LLC	Commercial
9	Jessica Kramer	NIH
10	Hami-Darwin-Freesh, Inc	Commercial

Publications

1. Almomen, A., N. B. Alsaleh, A. M. El-Toni, M. A. El-Mahrouky, A. A. Alhowyan, M. Alkholief, A. Alshamsan, N. Khurana and H. Ghandehari (2023) In Vitro Safety Assessment of In-House Synthesized Titanium Dioxide Nanoparticles: Impact of Washing and Temperature Conditions. International Journal of Molecular Sciences 24 DOI: 10.3390/ijms24129966. Ashkarran, A. A., Gharibi, H., Grunberger, J. W., Saei, A. A., Khurana, N., Mohammadpour, R., Ghandehari, H., and Mahmoudi, M. (2023) Sex-Specific Silica Nanoparticle Protein Corona Compositions Exposed to Male and Female BALB/c Mice Plasmas. ACS Bio & Med Chem Au 3, 62-73
2. Chen, F., J. Sun, Y. Wang, J. W. Grunberger, Z. Zheng, N. Khurana, X. Xu, X. Zhou, H. Ghandehari and J. Zhang (2023). Silica nanoparticles induce ovarian granulosa cell apoptosis via activation of the PERK-ATF4-CHOP-ERO1α pathway-mediated IP3R1-dependent calcium mobilization. Cell Biol Toxicol 39(4): 1715-1734.10.1007/s10565-022-09776-4
3. Clauss, Z. S., R. Meudom, B. Su, M. A. VandenBerg, S. S. Saini, M. J. Webber, D. H. Chou and J. R. Kramer (2023). Supramolecular Protein Stabilization with Zwitterionic Polypeptide-Cucurbit[7]uril Conjugates. Biomacromolecules 24(1): 481-488.10.1021/acs.biomac.2c01319
4. Cong, Y., P. D. Scesa and E. W. Schmidt (2022). AgeMTPT, a Catalyst for Peptide N-Terminal Modification. ACS Synth Biol 11(11): 3699-3705.10.1021/acssynbio.2c00312
5. Detwiler, R. E. and J. R. Kramer (2022). Preparation and applications of artificial mucins in biomedicine. Curr Opin Solid State Mater Sci 26(6).10.1016/j.cossms.2022.101031
6. Griswold, E., J. Cappello and H. Ghandehari (2022). Silk-elastinlike protein-based hydrogels for drug delivery and embolization. Adv Drug Deliv Rev 191: 114579.10.1016/j.addr.2022.114579
7. Grunberger, J. W. and H. Ghandehari (2023). Layer-by-Layer Hollow Mesoporous Silica Nanoparticles with Tunable Degradation Profile. Pharmaceutics 15(3).10.3390/pharmaceutics15030832
8. Jensen, M. M., Ø. Hatlevik, D. D. Steinhauff, E. D. Griswold, X. Wei, K. J. Isaacson, Z. B. Barber, E. Huo, P. Taussky, J. Jedrzkiewicz, J. Cappello, D. Cheney and H. Ghandehari (2022). Protein-based polymer liquid embolics for cerebral aneurysms. Acta Biomater 151: 174-182.10.1016/j.actbio.2022.08.003
9. Khurana, N., E. Babajanian, H. McCrary, A. Pulsipher, H. Ghandehari, J. A. Alt and R. B. Cannon (2023). Vascular permeability in HPV+ oropharyngeal cancers aids in fluorescent image-guided transoral robotic surgery using indocyanine green. Head Neck 45(7): 1728-1740.10.1002/hed.27384
10. Khurana, N., T. Sünner, O. Hubbard, C. Imburgia, G. J. Stoddard, V. Yellepeddi, H. Ghandehari and K. M. Watt (2023). Micellar Encapsulation of Propofol Reduces its Adsorption on Extracorporeal Membrane Oxygenator (ECMO) Circuit. Aaps j 25(4): 52.10.1208/s12248-023-00817-2
11. Kim, M. C., J. M. Winter, R. Cullum, A. J. Smith and W. Fenical (2023). Expanding the Utility of Bioinformatic Data for the Full Stereostructural Assignments of Marinolides A and B, 24- and 26-Membered Macrolactones Produced by a Chemically Exceptional Marine-Derived Bacterium. Mar Drugs 21(6).10.3390/md21060367
12. Kohout, V. R., C. L. Wardzala and J. R. Kramer (2022). Synthesis and biomedical applications of mucin mimic materials. Adv Drug Deliv Rev 191: 114540.10.1016/j.addr.2022.114540
13. McCullough, B. S., H. Wang and A. M. Barrios (2022). Inhibitor Screen Identifies Covalent Inhibitors of the Protein Histidine Phosphatase PHPT1. ACS Med Chem Lett 13(7): 1198-1201.10.1021/acsmedchemlett.2c00053

14. Montoya, A. L., M. Glavatskikh, B. J. Halverson, L. H. Yuen, H. Schüler, D. Kireev and R. M. Franzini (2023). Combining pharmacophore models derived from DNA-encoded chemical libraries with structure-based exploration to predict Tankyrase 1 inhibitors. Eur J Med Chem 246: 114980.10.1016/j.ejmech.2022.114980
15. Nervig, C. S., S. T. Hatch and S. C. Owen (2022). Complementation Dependent Enzyme Prodrug Therapy Enables Targeted Activation of Prodrug on HER2-Positive Cancer Cells. ACS Med Chem Lett 13(11): 1769-1775.10.1021/acsmedchemlett.2c00394
16. Sarkar, S., W. Gu and E. W. Schmidt (2022). Applying Promiscuous RiPP Enzymes to Peptide Backbone N-Methylation Chemistry. ACS Chem Biol 17(8): 2165-2178.10.1021/acschembio.2c00293
17. Schmidt, E. W. and Z. Lin (2022). Translating Marine Symbioses toward Drug Development. mBio 13(6): e0249922.10.1128/mbio.02499-22
18. Subrahmanyam, N., B. Yathavan, J. Kessler, S. M. Yu and H. Ghandehari (2023). HPMA copolymer-collagen hybridizing peptide conjugates targeted to breast tumor extracellular matrix. J Control Release 353: 278-288.10.1016/j.jconrel.2022.10.017
19. Subrahmanyam, N., B. Yathavan, S. M. Yu and H. Ghandehari (2023). Targeting Intratibial Osteosarcoma Using Water-Soluble Copolymers Conjugated to Collagen Hybridizing Peptides. Mol Pharm 20(3): 1670-1680.10.1021/acs.molpharmaceut.2c00880
20. Wang, H., R. Gaston, Jr., K. T. Ahmed, G. B. Dudley and A. M. Barrios (2023). Derivatives of the Fungal Natural Product Illudalic Acid Inhibit the Activity of Protein Histidine Phosphatase PHPT1. ChemMedChem 18(15): e202300187.10.1002/cmdc.202300187
21. Wardzala, C. L., Z. S. Clauss and J. R. Kramer (2022). Principles of glycocalyx engineering with hydrophobic-anchored synthetic mucins. Front Cell Dev Biol 10: 952931.10.3389/fcell.2022.952931
22. Wenzel, D. M., D. R. Mackay, J. J. Skalicky, E. L. Paine, M. S. Miller, K. S. Ullman and W. I. Sundquist (2022). Comprehensive analysis of the human ESCRT-III-MIT domain interactome reveals new cofactors for cytokinetic abscission. Elife 11.10.7554/eLife.77779
23. Yathavan, B., A. Ellis, J. Jedrzkiewicz, N. Subrahmanyam, N. Khurana, A. Pulsipher, J. A. Alt and H. Ghandehari (2023). Systemic administration of budesonide in pegylated liposomes for improved efficacy in chronic rhinosinusitis. J Control Release 360: 274-284.10.1016/j.jconrel.2023.06.030
24. Zhang, P., G. Wu, S. C. Heard, C. Niu, S. A. Bell, F. Li, Y. Ye, Y. Zhang and J. M. Winter (2022). Identification and Characterization of a Cryptic Bifunctional Type I Diterpene Synthase Involved in Talaronoid Biosynthesis from a Marine-Derived Fungus. Org Lett 24(38): 7037-7041.10.1021/acs.orglett.2c02904
25. Zheng, Z., W. Zuo, R. Ye, J. W. Grunberger, N. Khurana, X. Xu, H. Ghandehari and F. Chen (2023). Silica Nanoparticles Promote Apoptosis in Ovarian Granulosa Cells via Autophagy Dysfunction. Int J Mol Sci 24(6).10.3390/ijms24065189

Preclinical Imaging

Overview

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

Services

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

7 Tesla small animal MRI system

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

CT/PET/SPECT Scanners

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

Equipment

- 7 Tesla Bruker BioSpec MRI Scanner
- Siemens Inveon CT/PET/SPECT

Personnel

- Edward Hsu, Ph.D., Director
- Stewart Yeoh, Ph.D., Manager
- Tyler Slater, Research Assistant

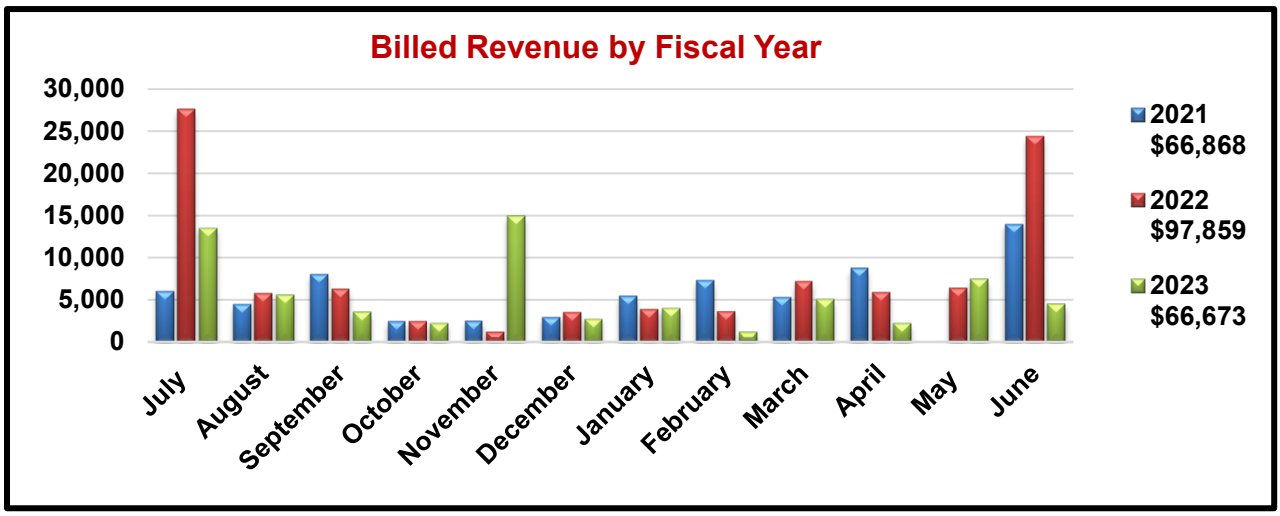
Advisory Board Committee
Last meeting date: April 1, 2018

- Rob MacLeod Ph.D., Professor, Bioengineering/SCI/CVRTI
- John Phillips Ph.D., Professor, Hematology
- Edward DiBella Ph.D., Professor, Radiology
- Donna Cross Ph.D., Associate Professor, Radiology

Revenue/Expenses

FY23 Expenses: **Total $259,863**
FY23 Revenue: **Total $255,330**

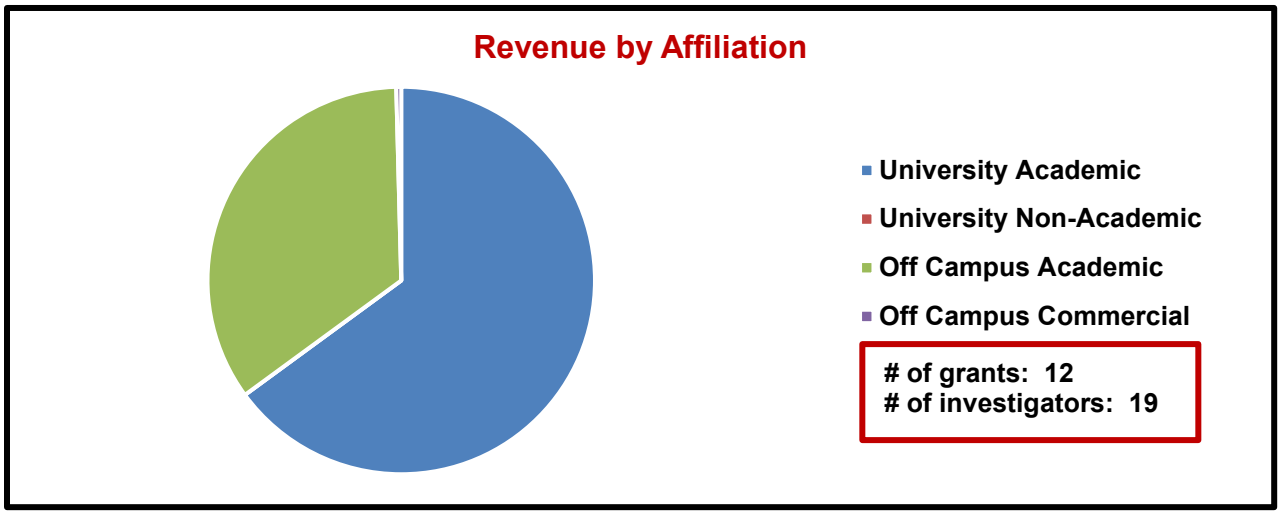
- VP of Health Sciences Support: $135,657
- VP of Research Support: $50,000
- FY23 Revenue generated from services: $66,673

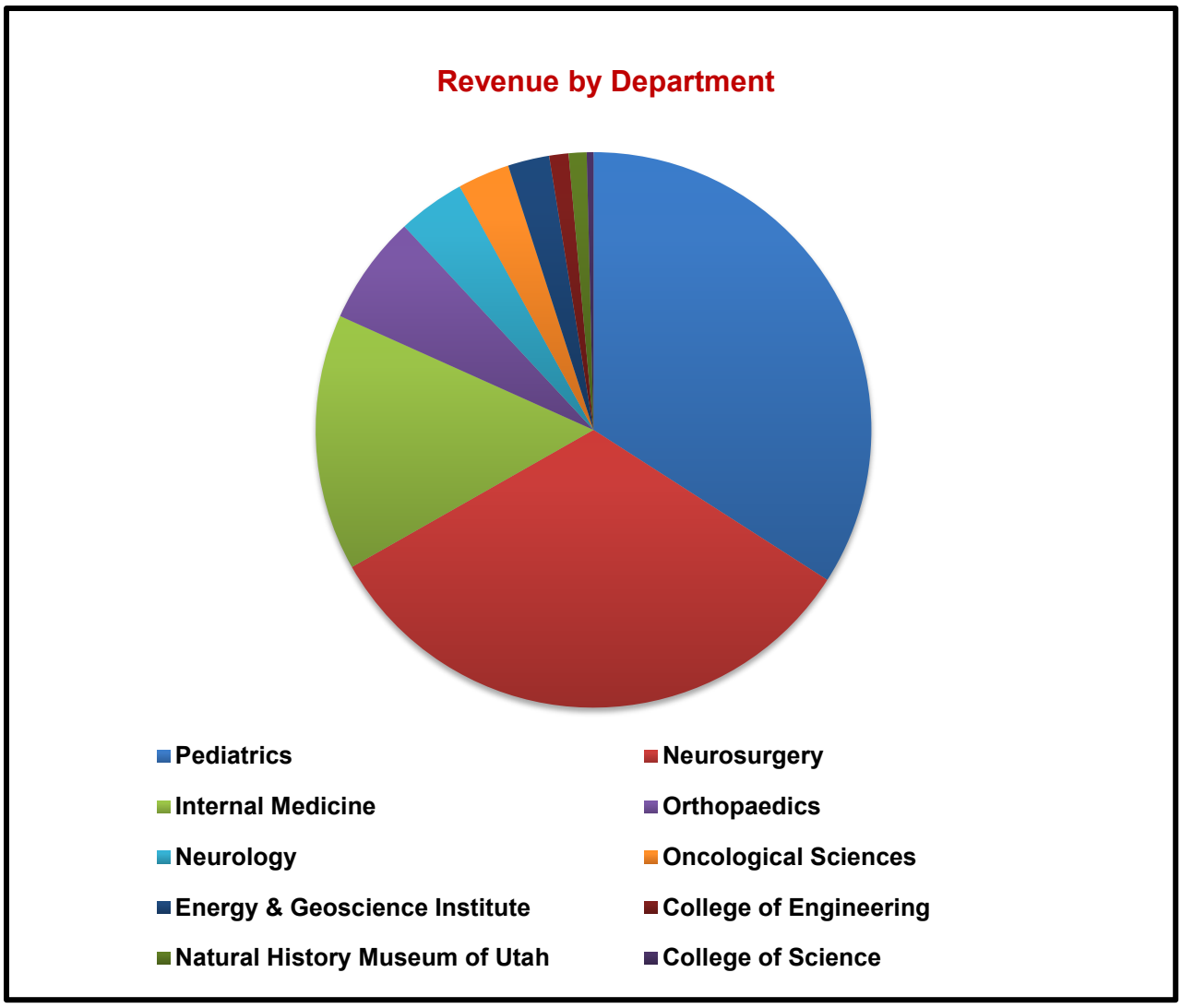


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support

Revenue Generated (see charts following)





Top Users

1	Brigham Young University	Off Campus Academic
2	Michelle Schober	NIH
3	Kevin Jones	Department, NIH
4	University of California San Diego	Off Campus Academic
5	Ravi Ranjan	Nora Eccles Treadwell Foundation
6	Brian McPherson	NEW MEXICO INSTITUTE OF MINING
7	Josh Bonkowsky	Department
8	Katsuhiko Funai	NIH
9	Micah Drummond	Department
10	Washington State University	Off Campus Academic

Publications

1. Kamali, R., E. Kwan, M. Regouski, T. J. Bunch, D. J. Dosdall, E. Hsu, R. S. Macleod, I. Polejaeva and R. Ranjan (2023). Contribution of atrial myofiber architecture to atrial fibrillation. PLoS One 18(1): e0279974.10.1371/journal.pone.0279974
2. Mendiola, E. A., S. Neelakantan, Q. Xiang, S. Merchant, K. Li, E. W. Hsu, R. A. F. Dixon, P. Vanderslice and R. Avazmohammadi (2023). Contractile Adaptation of the Left Ventricle Post-myocardial Infarction: Predictions by Rodent-Specific Computational Modeling. Ann Biomed Eng 51(4): 846-863.10.1007/s10439-022-03102-z
3. Pritz, M. B., R. M. Elsey, T. N. Thompson and E. W. Hsu (2023). A rare case of partial skull and brain duplication in a hatchling Alligator mississippiensis. Anat Rec (Hoboken) 306(3): 494-501.10.1002/ar.25087
4. Thompson, T. N., A. Vickrey, M. D. Shapiro and E. Hsu (2023). A computer vision framework for quantification of feather growth patterns. Front Bioinform 3: 1073918.10.3389/fbinf.2023.1073918

Small Animal Ultrasound

Overview

The Small Animal Ultrasound Facility has two state-of-the-art VisualSonics 2100 ultrasound machines capable of imaging mice, rats, and other animal models with excellent spatial and temporal resolution. The facility has probes that cover the spectrum from 9-70 MHz (standard human clinical ultrasound covers the spectrum from 2.5-12 MHz). These instruments 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 resolving the rapid heart rates of mice, 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 an 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 offline image analysis station is also available for later review and analysis of studies.

- Ultrasound imaging access
- Training in the 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

- Ying Li, M.D., Director
- Xue Yin, Laboratory Technician

Advisory Board Committee

Last meeting date: April 15, 2013.

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

FY23 Annual Update

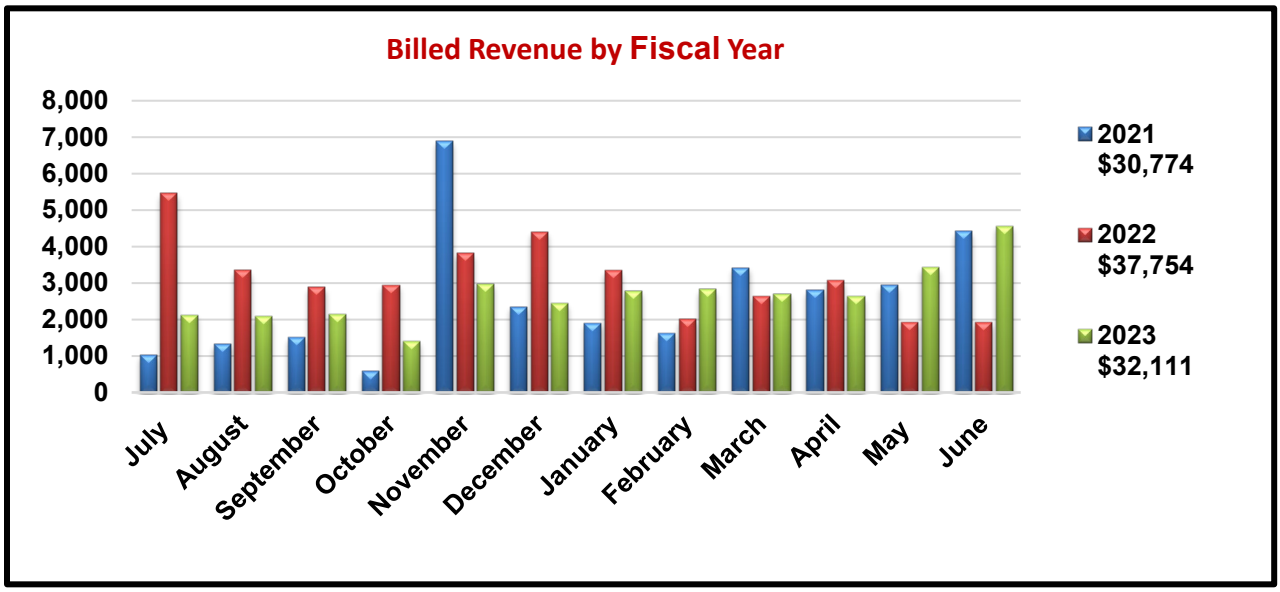
We moved two Ultrasound machines to room 158, Radiobiology building.

Revenue/Expenses

FY23 Expenses: **Total $23,262**

FY23 Revenue: **Total $52,111**

- VP of Health Sciences Support: $20,000
- FY23 Revenue generated from services: $32,111

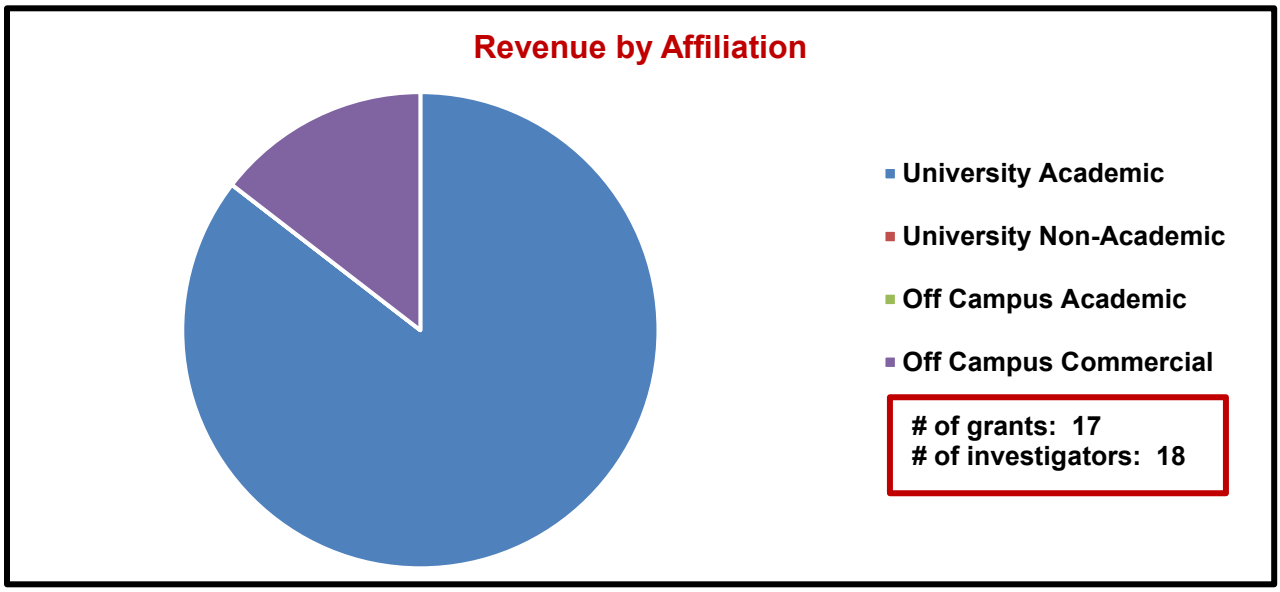


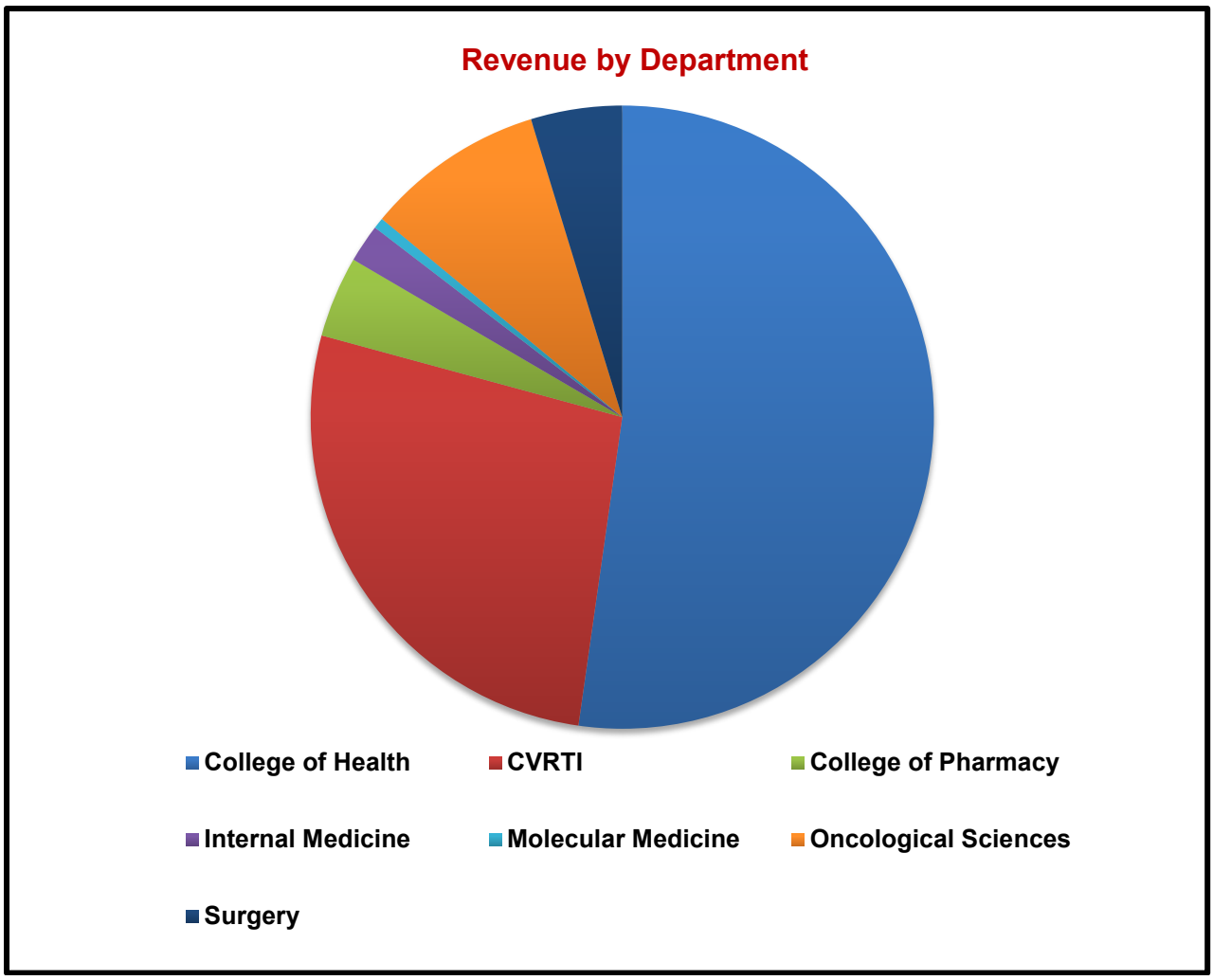
* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Stavros Drakos	NIH, Nora Eccles Treadwell Foundation, VA, Virginia Polytechnic Institute
2	Sihem Boudina	Department
3	William Holland	Margolis Foundation
4	Kaitlin Basham	Department
5	Katsuhiko Funai	NIH
6	Joseph Palatinus	Department
7	Scott Summers	NIH
8	Dipayan Chaudhuri	NIH
9	Craig Selzman	Department
10	TingTing Hong	Department

Publications

No known publications acknowledged this facility in FY23.

Transgenic & Gene Targeting

Overview

The goal of the Transgenic & Gene Targeting (TGT) Core Facility is to provide state of the art service and assistance in the field of mouse transgenesis and gene targeting. The TGT core develops gene targeting technology, possesses state of the art equipment, provides project consultation and assists in the execution of research to maintain a position as a leader in the field of mouse genetic modification.

Our main service is to generate transgenic and gene targeted mouse models for researchers. The TGT core uses CRISPR technology to generate knockout, knockin, and conditionally targeted alleles in mice. This method allows for the efficient and relatively inexpensive generation of mice with specific genetic mutations. Other services include conventional gene targeting of mouse ESCs (embryonic stem cells) followed by injection of targeted cells to produce germline chimeras, and production of traditional transgenic mice where the transgene is randomly inserted into the genome. In addition, the TGT core has expertise in mouse research procedures including embryo and sperm cryopreservation, *in vitro* fertilization (IVF), karyotyping of ESCs, rederivation of mice from frozen embryos and derivation of primary ESCs. Our facility consists of a cell culture hood, incubators, three microinjection stations for both pronuclear and blastocyst injections, a surgery area, and a mouse room for housing and breeding. The TGT core staff has a vast array of experience in the gene targeting and transgenic mouse field. Our lab works closely with University of Utah regulatory groups and is in compliance with strict IACUC and USDA guidelines.

Services

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

Equipment

- Nikon Eclipse Ti2 microinjection station, with fluorescence, CO_2, heating/cooling stage
- Leica Dmi8 microinjection stations (2)
- Eppendorf Transferman NK2 micromanipulators
- Eppendorf Femtojet microinjectors
- Eppendorf Peizo drills
- Leica S9i stereomicroscopes (2)
- Olympus SZX16 dissection microscopes (2), one with fluorescence option
- Nikon Eclipse TS100 inverted microscopes
- Zeiss Stemi508 stereomicroscope
- Sutter P-97 pipette puller
- Narashige MF-900 microforges
- TMC vibration isolation tables (3)
- ESCO, Forma, New Brunswick CO2 incubators
- MINC IVF incubator
- Brinkman benchtop autoclave
- Forma cell culture hood
- BioRad Gene Pulser Xcell electroporator
- NepaGene21 Electroporator system, with concave electrodes for in vivo GONAD, and with glass slide electrode for ZEN
- 96-well VeritiPro PCR thermal cycler (2)
- ProFlex 3 x 32-well PCR system
- Thermo Cryomed controlled rate embryo freezer
- Thermo TSX Series -80°C freezer
- 340L Thermo Scientific CryoPlus liquid nitrogen storage system (2)
- Centrifuges, microfuges

Personnel

- Crystal Davey, Ph.D., Director
- He Lan, Ph.D., Research Associate
- Nick Black, Lab Specialist
- Lilian Hayes, B.S., Lab Technician

Advisory Board Committee

Last meeting date: July 14, 2023

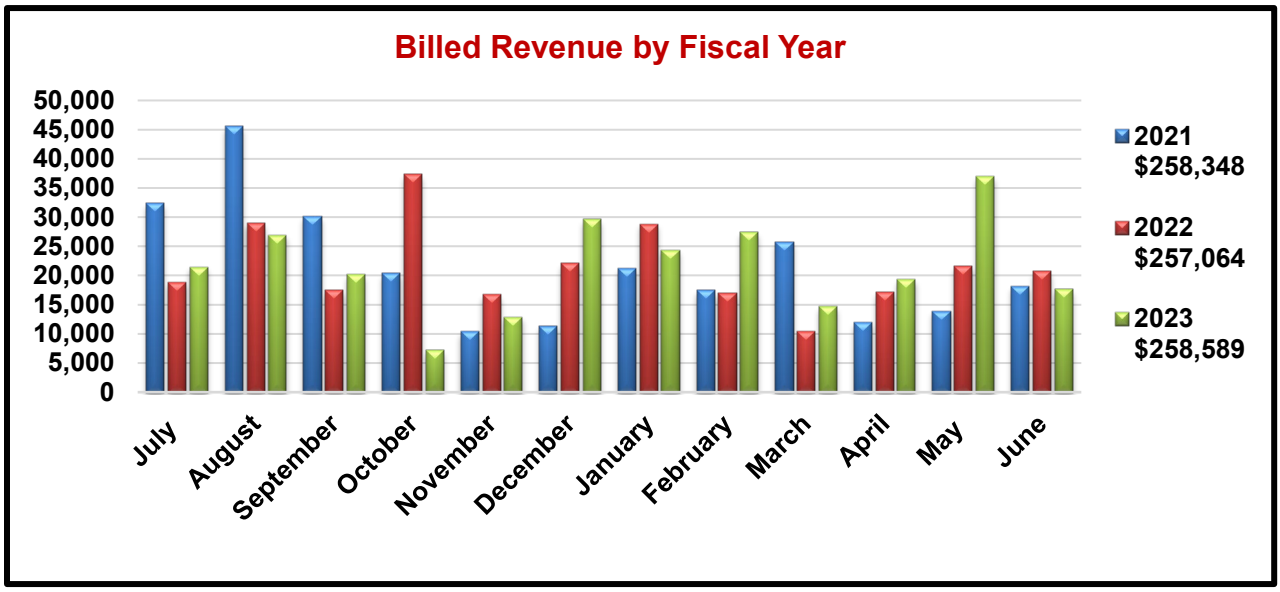
- Lewis Charles Murtaugh, Ph.D., Associate Professor, Department of Human Genetics (Sr. Faculty Advisor)
- Christopher Gregg, Ph.D., Associate Professor, Department of Neurobiology & Anatomy
- Kevin B. Jones, MD, Professor, Huntsman Cancer Institute
- Dean Tantin, Ph.D., Professor, Department of Pathology

Revenue/Expenses

FY23 Expenses: **Total $654,083**

FY23 Revenue: Total $593,192

- VP of Health Sciences Support: $334,603
- FY23 Revenue generated from services: $258,589.

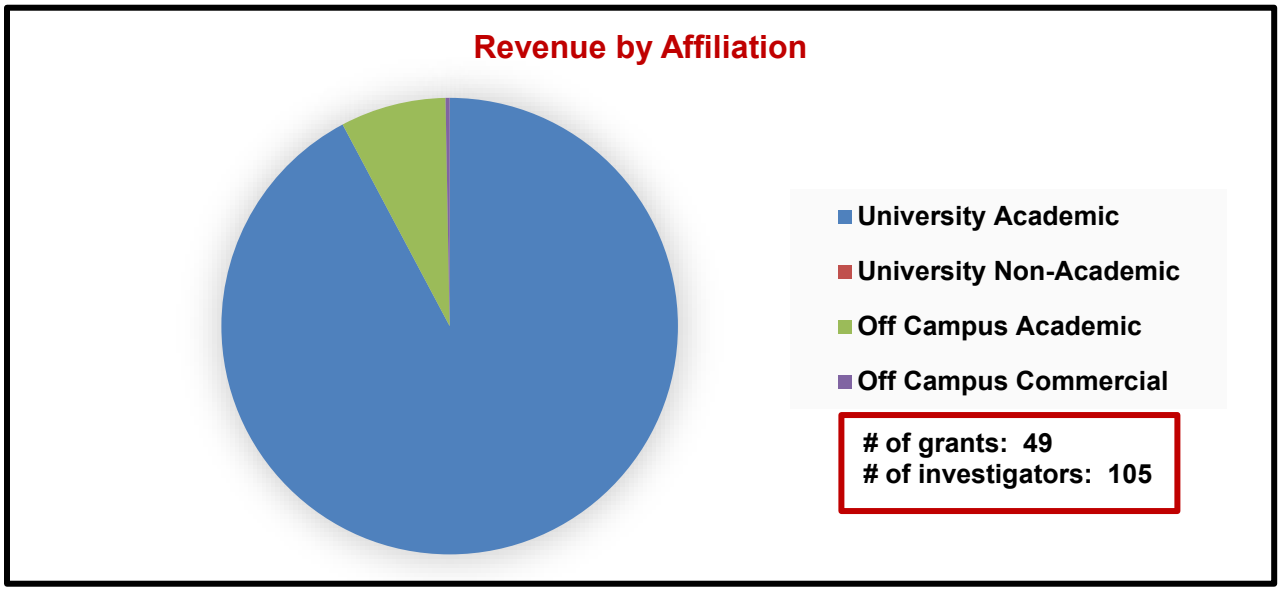


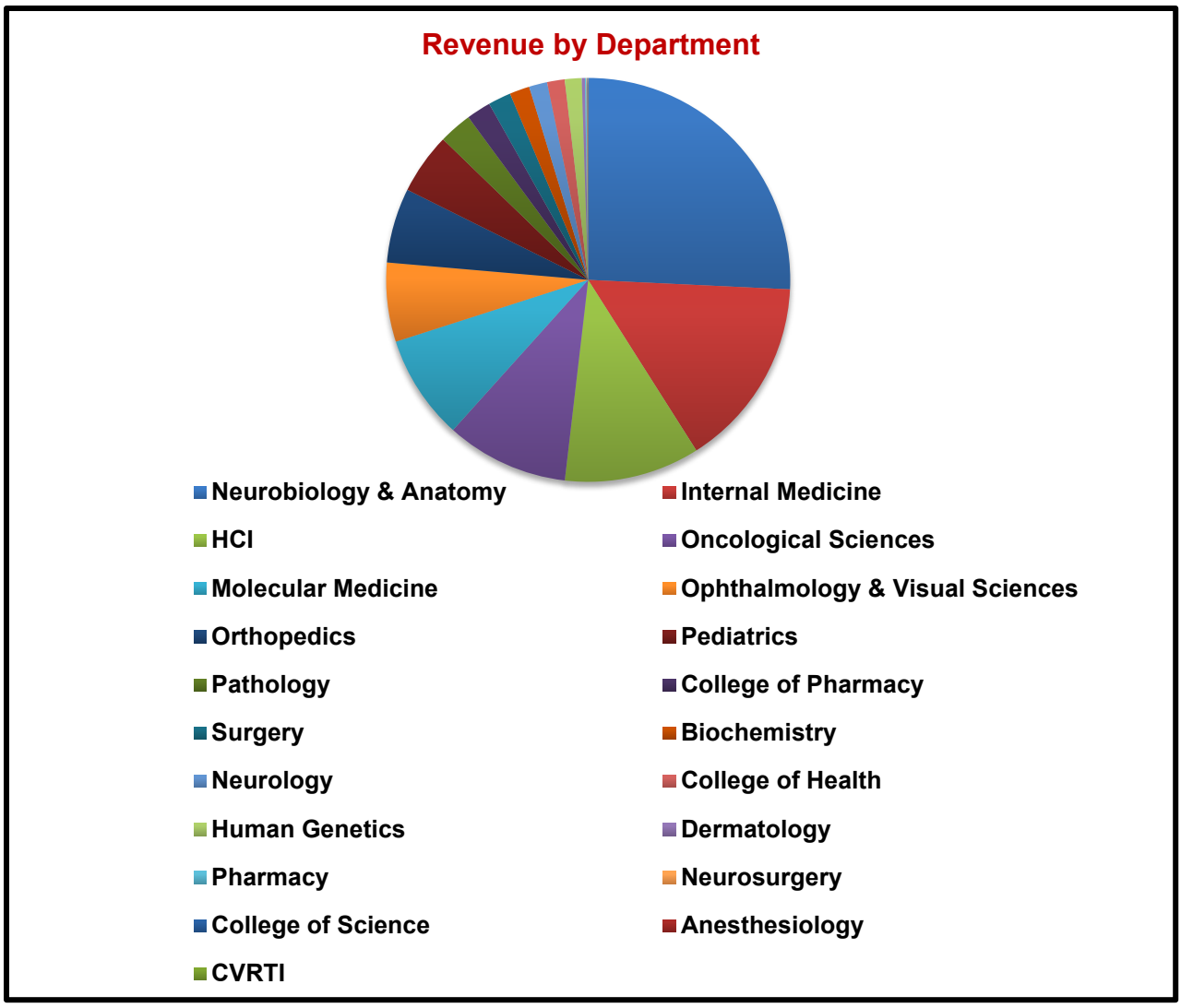
* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Christopher Gregg	NIH
2	Jan Christian	NIH
3	Darrel Brodke	Skaggs Foundation for Research
4	Katsuhiko Funai	NIH
5	Matt Wachowiak	Department, University of Colorado Boulder
6	Mary Hartnett	Department
7	University of Pittsburgh	Off Campus Educational
8	Kent Lai	Bridgebio Pharma LLC, Department
9	Alisha Schlichter	Howard Hughes Medical Institute
10	Laith Al-Rabadi	Department

Letters of Support

Written and provided to faculty and trainees for support of grant applications:

9. LOS for Dr. Bijina Balakrishnan's grant: "Elucidation the role of the glycosylation of Merosin in cardiac functions – Insights from a mouse model of PGM1- CDG.", October 2022
10. LOS for Dr. Mahesh Chandrasekharan's R01 grant: "Understanding the roles for EZH2 gain-of-function mutations in epigenetic and oncogenic mechanisms.", October 2022
11. LOS and methods section for Dr. Laith F. Al-Rabadi's grant: "The Serine Protease HTRA1 Antigen: A Gateway to Elucidating Membranous Nephropathy Pathogenesis.", November 2022
12. LOS for Dr. Mark Perfetto's F32 application proposing to research how CLPX activates PPOX and FECH and the role CLPX plays during erythropoiesis., November 2022
13. LOS and grant figure for Dr. Mary Harnett's proposal to use CRIPSR mediated homology directed repair to generate a Kdr^{Y1173F} and a Kdr^{Y1212F} mutant mouse model., May 2023

Publications

11. Garritson, J. D., J. Zhang, A. Achenbach, M. Ferhat, E. Eich, C. J. Stubben, P. L. Martinez, A. R. Ibele, K. I. Hilgendorf and S. Boudina (2023). BMPER is a marker of adipose progenitors and adipocytes and a positive modulator of adipogenesis. Commun Biol 6(1): 638.10.1038/s42003-023-05011-w
12. Gerstner, C. D., M. Reed, T. M. Dahl, G. Ying, J. M. Frederick and W. Baehr (2022). Arf-like Protein 2 (ARL2) Controls Microtubule Neogenesis during Early Postnatal Photoreceptor Development. Cells 12(1).10.3390/cells12010147
13. Jia, S., E. M. Ratzan, E. J. Goodrich, R. Abrar, L. Heiland, B. Tarchini and M. R. Deans (2023). The dark kinase STK32A regulates hair cell planar polarity opposite of EMX2 in the developing mouse inner ear. Elife 12.10.7554/eLife.84910
14. Kee, T. R., J. L. Wehinger, P. E. Gonzalez, E. Nguyen, K. C. McGill Percy, S. A. Khan, D. Chaput, X. Wang, T. Liu, D. E. Kang and J. A. Woo (2022). Pathological characterization of a novel mouse model expressing the PD-linked CHCHD2-T61I mutation. Hum Mol Genet 31(23): 3987-4005.10.1093/hmg/ddac083
15. Tarasov, M., H. L. Struckman, Y. Olgar, A. Miller, M. Demirtas, V. Bogdanov, R. Terentyeva, A. M. Soltisz, X. Meng, D. Min, G. Sakuta, I. Dunlap, A. D. Duran, M. P. Foster, J. P. Davis, D. Terentyev, S. Gyorke, R. Veeraraghavan and P. B. Radwanski (2023). NaV1.6 dysregulation within myocardial T-tubules by D96V calmodulin enhances proarrhythmic sodium and calcium mishandling. J Clin Invest 133(7).10.1172/JCI152071
16. Wang, H., A. Ramshekar, T. Cung, C. Wallace-Carrete, C. Zaugg, J. Nguyen, G. J. Stoddard and M. E. Hartnett (2023). 7-Ketocholesterol Promotes Retinal Pigment Epithelium Senescence and Fibrosis of Choroidal Neovascularization via IQGAP1 Phosphorylation-Dependent Signaling. Int J Mol Sci 24(12).10.3390/ijms241210276
17. Zhang, J., J. M. Roberts, F. Chang, J. Schwakopf and M. L. Vetter (2023). Jarid2 promotes temporal progression of retinal progenitors via repression of Foxp1. Cell Rep 42(3): 112237.10.1016/j.celrep.2023.112237
18. Zheng, D., G. Mohapatra, L. Kern, Y. He, M. D. Shmueli, R. Valdes-Mas, A. A. Kolodziejczyk, T. Prochnicki, M. B. Vasconcelos, L. Schorr, F. Hertel, Y. S. Lee, M. C. Rufino, E. Ceddaha, S. Shimshy, R. J. Hodgetts, M. Dori-Bachash, C. Kleimeyer, K. Goldenberg, M. Heinemann, N. Stettner, A. Harmelin, H. Shapiro, J. Puschhof, M. Chen, R. A. Flavell, E. Latz, Y. Merbl, S. K. Abdeen and E. Elinav (2023). Epithelial Nlrp10 inflammasome mediates protection against intestinal autoinflammation. Nat Immunol 24(4): 585-594.10.1038/s41590-023-01450-z
19. Zhou, C., R. Uluisik, J. W. Rowley, C. David, C. L. Jones, C. D. Scharer, L. Noetzli, M. H. Fisher, G. D. Kirkpatrick, K. Bark, J. M. Boss, C. J. Henry, E. M. Pietras, J. Di Paola and C. C. Porter (2022). Germline ETV6 mutation promotes inflammation and disrupts lymphoid development of early hematopoietic progenitors. Exp Hematol 112-113: 24-34.10.1016/j.exphem.2022.06.002

Utah Center for Genetic Discovery

Overview

The UCGD Core supports bioinformatic analysis at the University of Utah with expertise in massively scalable data processing, and it maintains shared computational infrastructure as well as web-based data portals for data access and collaborative analysis. We help investigate the genetic basis for human disease by providing whole exome and genome sequence analyses for research and clinical projects. We also provide analysis of RNA-seq, metagenomic, lipidomic, and other related datasets to support the Immunology, Inflammation, and Infectious Disease (3i) Initiative as well as other research projects. Our shared genomics infrastructure consists of 3088 CPU cores, over 5.4 PB of disk storage, and an expansive library of computational software tools and workflows.

Services

- Sequence alignment and variant calling in NGS datasets to identify small nucleotide variants (SNVs), small insertions/deletions (INDELs), and structural variants (SVs).
- Prioritization and interpretation of variants using filtering and/or statistical methods.
- Disease gene discovery in cohorts and families.
- Project and data management using our HIPAA compliant Mosaic data sharing portal.
- Bulk and single cell RNA-seq processing and analysis.
- Microbial Isolate Genome Assembly and Annotation.
- Metagenomics and metatranscriptomics analysis.
- Marker Gene Sequencing Analysis (16S, ITS or other single gene amplicon analysis with preferred taxonomic reference).
- Custom computational workflow development.

Personnel

- Carson Holt Ph.D., UCGD Core Director
- Barry Moore, Director of Research and Science
- Shawn Rynearson, Senior Software Developer
- Steven Boyden Ph.D., Director of Research and Science
- Joselin Hernandez Ph.D., Research Associate
- Marco Marchetti Ph.D., Research Associate

Advisory Board Committee

- Mark Yandell, PhD, Professor of Human Genetics
- Gabor Marth, DSc, Professor of Human Genetics
- Aaron Quinlan, PhD, Professor of Human Genetics
- Joseph Yost, PhD, Professor and Vice Chairman for Basic Science Research, Department of Pediatrics
- Daniel Leung, MD/MSc, Associate Professor of Internal Medicine

FY23 Annual Update

Grant Support – UCGD Core supported the following grant submissions in FY23:

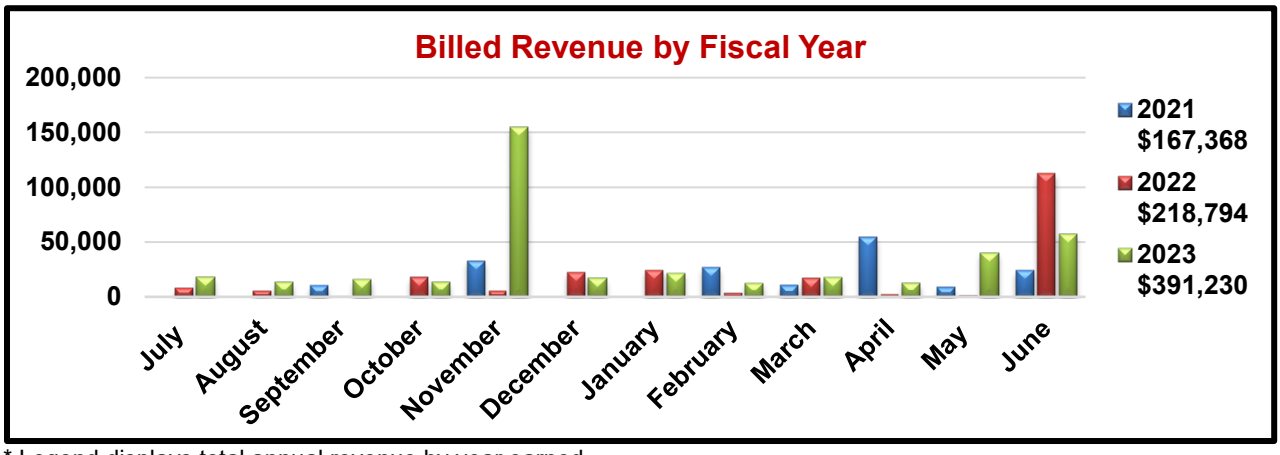
- *The NHGRI Genomic Data Science Analysis, Visualization, and Informatics Lab-space Clinical Resource **(R01)**. PI: Gabor Marth*
- *Democratizing genomic medicine with the AnVIL Clinical Resource* **(U24)**. PI: Gabor Marth
- *A Standardized Unbiased Genomic Medicine Approach for Critically Ill Newborns* **(UG3/UH3)**. PI: Martin Tristani-Firouzi
- *The Role of cRel and RelA coordination in regulating long-lasting humoral immunity* **(R01)**. PI: Koushik Roy
- *Mucosal-Associated Invariant T Cells for Immunotherapy of Colorectal Cancer* **(DoD)**. PI: Ellen Beswick and Daniel Leung
- *MK2 pathway is a potential therapeutic target for pancreatic neuroendrocrine tumors* **(ACS)**. PI: Ellen Beswick
- *Determining the Immunomodulatory Roles of Hyaluronan in Health and Disease* **(R35)**. PI: Aaron Petrey
- *Delineating signaling circuits that orchestrate T cell ignorance* **(R21)**. PI: Wan-Lin Lo
- *Lustre data storage* **(S10).** PI: Carson Holt
- *A state-of-the-art web platform for collaborative, longitudinal genome diagnostics* **(SBIR)**. PI: Alistair Ward (Frameshift Genomics)
- *Inherited and de novo genetic variants relevant to familial, recurrent and sporadic stillbirth* **(R01)**. PI: Tsegaselassie Workalemahu
- *A translational platform for rapid genomic medicine* **(UM1)**. Martin Tristani-Firouzi
- *Platform for enabling responsible research with restricted data* **(Federal Legislative Earmark)**. PI: Erin Rothwell
- *Availability and Activity of Bioactive Lipids in the Developing Lung **(R01)*** PI: Lisa Joss-Moore

Revenue/Expenses

FY23 Expenses: **Total $1,095,401**

FY23 Revenue: **Total $966,230**

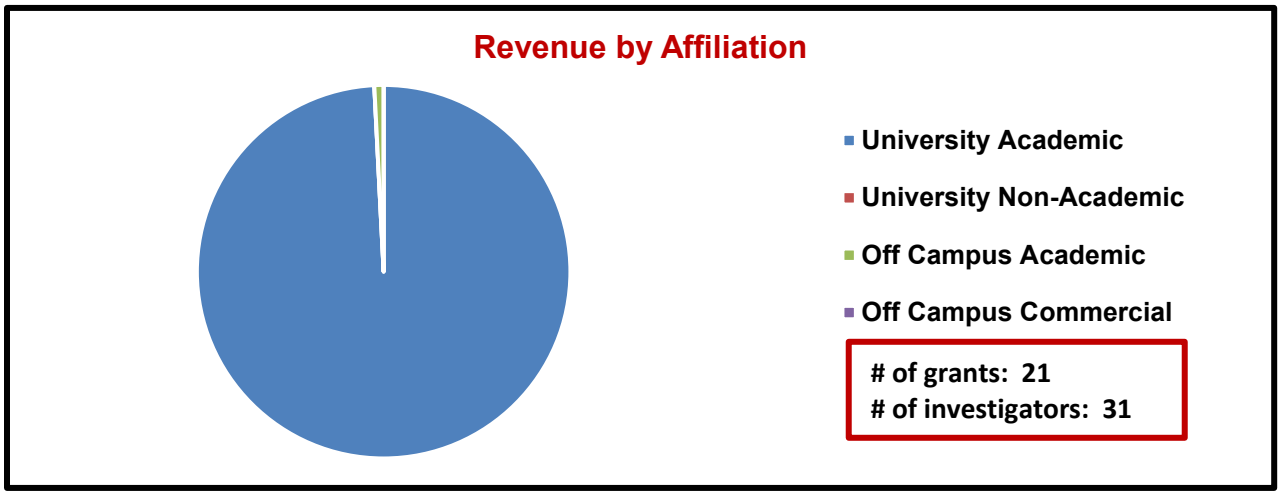
- VP of Health Sciences Support 3I: $250,000
- VP of Health Sciences Support UCGD: $285,000
- Other Support Software: $40,000
- FY23 Revenue generated from services: $391,230

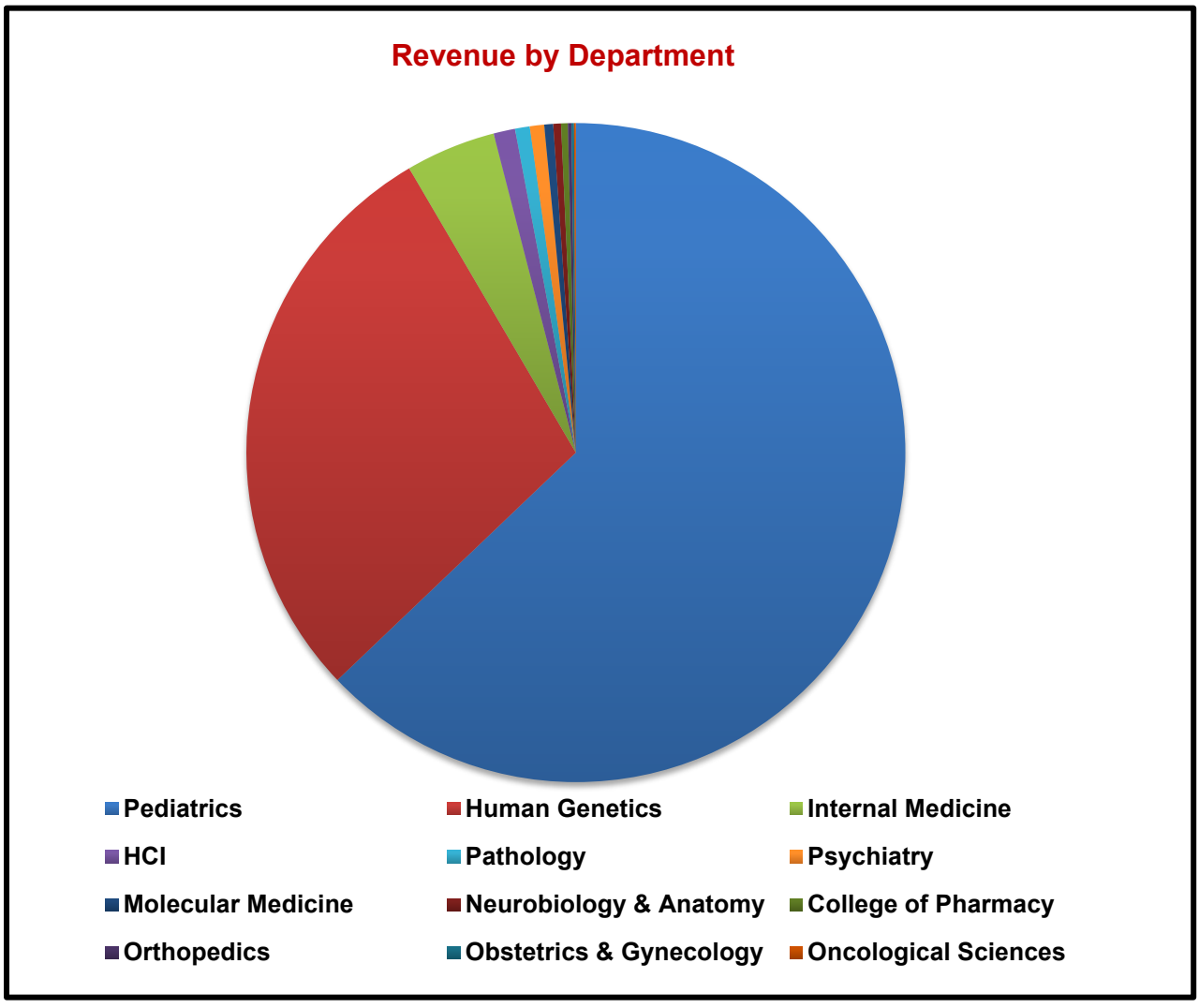


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support

Revenue Generated (see charts following):





Top Users

1	Sabrina Malone-Jenkins	Department
2	Carson Holt	Department
3	Nicholas Carr	Department
4	Katharine Walter	NIH, University of Utah Research Foundation
5	Lorenzo Botto	Department, NIH
6	Lynn Jorde	NIH
7	Corrine Welt	NIH, Massachusetts General Hospital
8	Mahesh Chandrasekharan	NIH
9	Martin Tristani-Firouzi	NIH
10	Afaf Osman	Intramural HCI

Publications

1. Johnstone, E. B., B. Gorsi, E. Coelho, B. Moore, A. M. Farr, A. R. Cooper, E. R. Mardis, A. Rajkovic, C. Y. Chow, M. Yandell and C. K. Welt (2023). DIS3 Variants are Associated with Primary Ovarian Insufficiency: Importance of Transcription/Translation in Oogenesis. J Clin Endocrinol Metab.10.1210/clinem/dgad126
2. Miller, T. A., E. J. Hernandez, J. W. Gaynor, M. W. Russell, J. W. Newburger, W. Chung, E. Goldmuntz, J. F. Cnota, S. C. Zyblewski, W. T. Mahle, V. Zak, C. Ravishankar, J. R. Kaltman, B. W. McCrindle, S. Clarke, J. K. Votava-Smith, E. M. Graham, M. Seed, N. Rudd, D. Bernstein, T. M. Lee, M. Yandell and M. Tristani-Firouzi (2023). Genetic, demographic and clinical variables act synergistically to impact neurodevelopmental outcomes in children with single ventricle heart disease. medRxiv: 2022.2010.2001.22280594.10.1101/2022.10.01.22280594
3. Peterson, B., E. J. Hernandez, C. Hobbs, S. Malone Jenkins, B. Moore, E. Rosales, S. Zoucha, E. Sanford, M. N. Bainbridge, E. Frise, A. Oriol, L. Brunelli, S. F. Kingsmore and M. Yandell (2023). Automated prioritization of sick newborns for whole genome sequencing using clinical natural language processing and machine learning. Genome Med **15**(1): 18.10.1186/s13073-023-01166-7
4. Reynolds, H. M., T. Wen, A. Farrell, R. Mao, B. Moore, S. E. Boyden, P. Bayrak-Toydemir, T. J. Nicholas, S. Rynearson, C. Holt, C. Miller, K. Noble, D. Bentley, R. Palmquist, B. Ostrander, S. Manberg, J. L. Bonkowsky, B. J. Shayota and S. M. Jenkins (2022). Rapid genome sequencing identifies a novel de novo SNAP25 variant for neonatal congenital myasthenic syndrome. Cold Spring Harb Mol Case Stud **8**(7).10.1101/mcs.a006242
5. Simeone, C. A., J. L. Wilkerson, A. M. Poss, J. A. Banks, J. V. Varre, J. L. Guevara, E. J. Hernandez, B. Gorsi, D. L. Atkinson, T. Turapov, S. G. Frodsham, J. C. F. Morales, K. O'Neil, B. Moore, M. Yandell, S. A. Summers, A. S. Krolewski, W. L. Holland and M. G. Pezzolesi (2022). A dominant negative ADIPOQ mutation in a diabetic family with renal disease, hypoadiponectinemia, and hyperceramidemia. NPJ Genom Med **7**(1): 43.10.1038/s41525-022-00314-z
6. Workalemahu, T., C. Avery, S. Lopez, N. R. Blue, A. Wallace, A. R. Quinlan, H. Coon, D. Warner, M. W. Varner, D. W. Branch, L. B. Jorde and R. M. Silver (2023). Whole-genome sequencing analysis in families with recurrent pregnancy loss: A pilot study. PLoS One **18**(2): e0281934.10.1371/journal.pone.0281934
7. Yang, G., H. M. A. Ullah, E. Parker, B. Gorsi, M. Libowitz, C. Maguire, J. B. King, H. Coon, M. Lopez-Larson, J. S. Anderson, M. Yandell and A. Shcheglovitov (2023). Neurite outgrowth deficits caused by rare PLXNB1 mutation in pediatric bipolar disorder. Mol Psychiatry.10.1038/s41380-023-02035-w

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. Harold Nez.

Anticonvulsant Drug Development (ADD) Program

Overview

The Anticonvulsant Drug Development (ADD) Program is an established laboratory experienced in the preclinical identification and evaluation of investigational compounds for the treatment of epilepsy.

Uniqueness

Current investigators at the program have held multiple contracts with biopharmaceutical and government partners for testing of novel compounds in seizure models. The program has considerable experience in performing efficacy and tolerability assessments of novel and established antiseizure drugs (ASDs) using multiple routes of administration [intraperitoneal (i.p.), intravenous (i.v.), oral (per os, p.o.), subcutaneous (s.c.), intramuscular (i.m.), and intracerebroventricular (i.c.v.)] in models for epilepsy.

Services

The models we offer include maximal electroshock (MES)-induced seizure, 6 Hz seizure (varying stimulus intensities), corneal kindled seizure test, lamotrigine-resistant amygdala kindled model, genetic model of Dravet Syndrome (monotherapy and polytherapy testing), viral-induced epilepsy model (Theiler's murine encephalomyelitis virus [TMEV] model), spontaneous bursting model (*in vitro* slice electrophysiology assay), and post kainate, status epilepticus (SE)-induced chronically seizing rat and mouse models. In parallel, our staff routinely evaluates the effect of investigational compounds on motor impairment in the rotarod test, the open field locomotor assay, the minimal motor impairment (MMI) assay, and the modified Functional Observation Battery (FOB, or Irwin test). Our facilities include state-of-the-art multi-channel monitoring units to allow for continuous video-electroencephalographic (v-EEG) monitoring of spontaneous seizures. We also offer chronic administration of any compound to rats or mice using a drug-in-food model. Using our automated feeder system, drugs can be delivered on a fixed schedule, 24/7 for any requested length of time. Food pellets containing compounds are formulated either by outsourcing or can be custom made in-house. Prices will be determined based on the requirements of the planned study.

Goals for FY24

- Continue Established Operations
- Reaching out to new users

Personnel

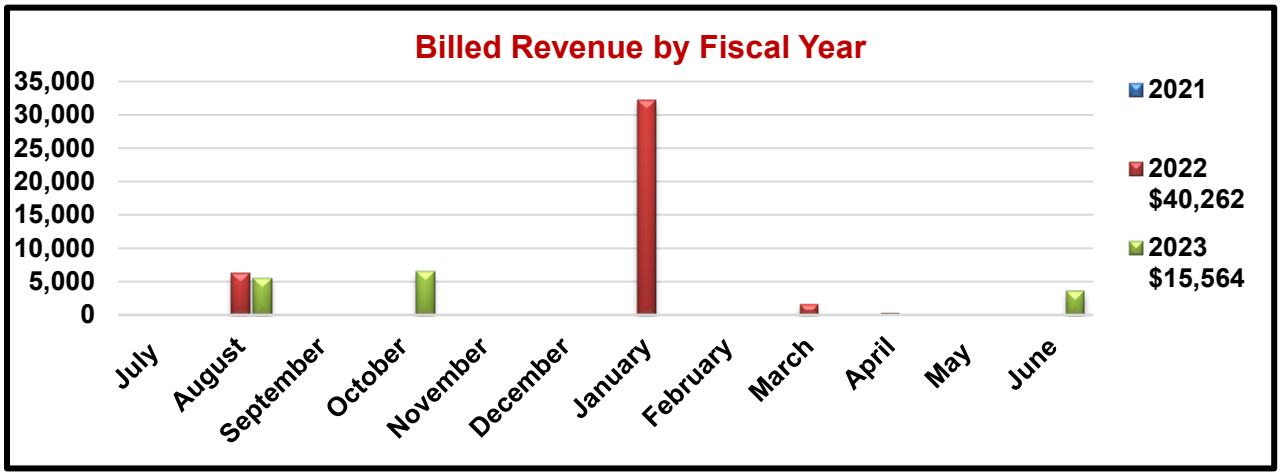
- Karen S. Wilcox Ph.D., Director
- Cameron Metcalf Ph.D., Associate Director
- Peter West Ph.D., Research Associate Professor
- Misty Smith Ph.D., Research Assistant Professor
- Kristina Johnson, Laboratory Manager
- Elisa Koehler, Project Administrator
- Vanja Panic Ph.D., Sr. Research Analyst
- Carolina Moncion Ph.D., Sr. Research Analyst

Revenue/Expenses- New Service Recharge June 2021

FY23 expenses: $15,516

FY23 revenue: $15,564

- Revenue generated from services: $15,564

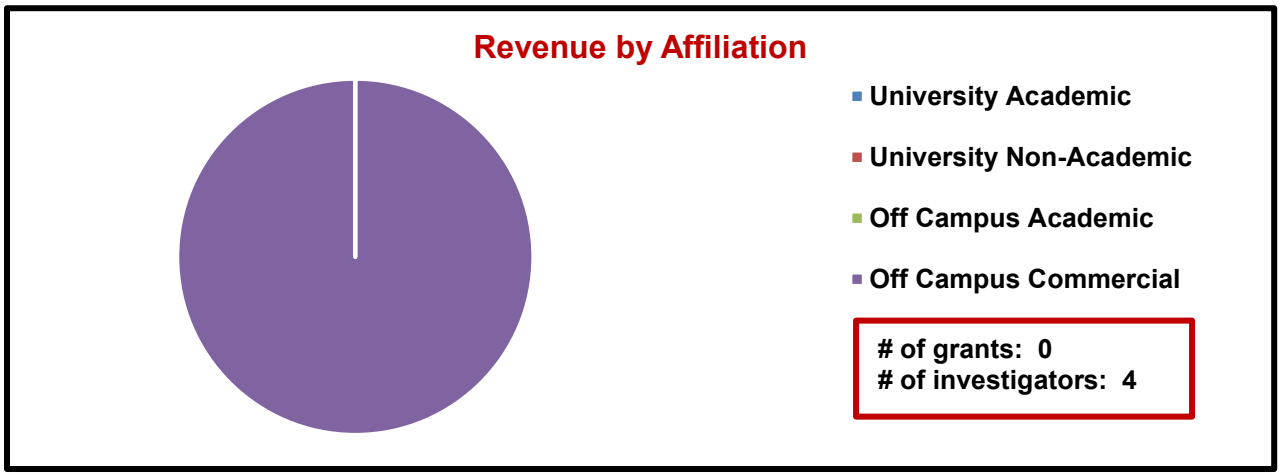


* Legend displays total annual revenue by fiscal year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts):



Top Users

1	Rapport Therapeutics	Off Campus Commercial
2	Ventus Therapeutics	Off Campus Commercial
3	Sea Pharmaceuticals	Off Campus Commercial
4	ADInstruments	Off Campus Commercial

Publications

1. Wojtalewicz, S., S. Erickson, J. Vizmeg, J. Shuckra, K. Barger, A. Cleveland, J. Davis, S. Niederauer, M. Beeman, V. Panic, K. Wilcox, C. Metcalf, J. Agarwal, C. Lade and B. Davis (2023). Assessment of glyceride-structured oleogels as an injectable extended-release delivery system of bupivacaine. Int J Pharm **637**: 122887.10.1016/j.ijpharm.2023.122887

Behavioral Health Innovation and Dissemination Center

Overview

The mission of the Behavioral Health Innovation and Dissemination Center (BHIDC) at The University of Utah (U of U) is to develop, test, and implement behavioral health interventions as well as to train U of U students to deliver them and make these and other state of the art interventions available to the public. The BHIDC conducts research primarily focused on cognitive-behavioral interventions for adults and couples, and provides low cost, evidence-based treatments to Utah residents. BHIDC staff also began conducting training workshops and educational presentations for healthcare providers and the public in FY2022.

Services

BHIDC offered a range of services including consulting, training, and psychological treatments beginning in FY22.

Personnel

- Brian Baucom, PhD, Co-Director
- Feea Leifker, MPH, PhD, Co-Director
- Abigail Boggins, B.A., Research Associate
- Sara Valerious, CSW, Research Assistant
- Andy Godfrey, PhD, Postdoctoral Fellow

Advisory Board Committee

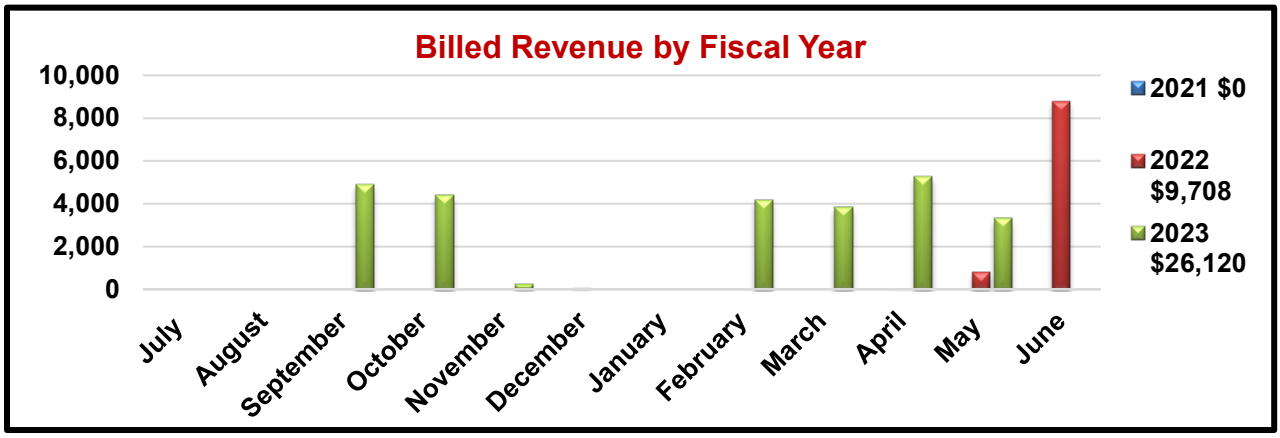
- Cynthia Berg Ph.D., Distinguished Professor of Psychology
- Lee Ellington Ph.D., Professor, College of Nursing
- Rebecca Utz Ph.D., Professor, Department of Sociology
- Lori Kowaleski-Jones Ph.D., Associate Professor, Department of Family & Consumer Studies

Revenue/Expenses

FY23 Expenses**: Total $26,337**

FY23 Revenue: Total $26,120

- FY23 Revenue generated from services: $26,120

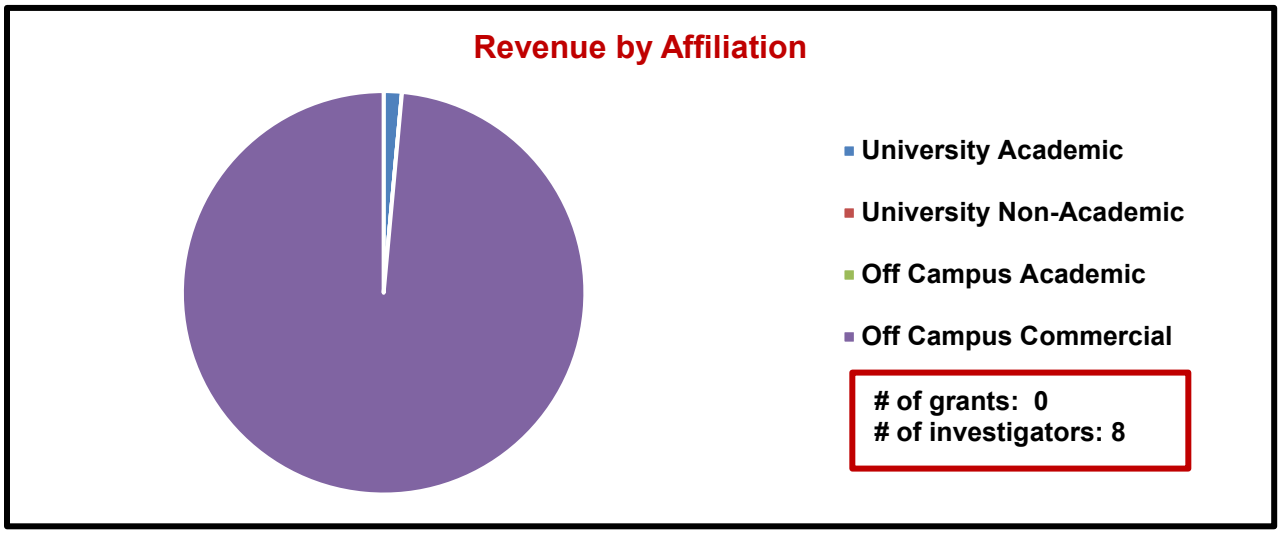


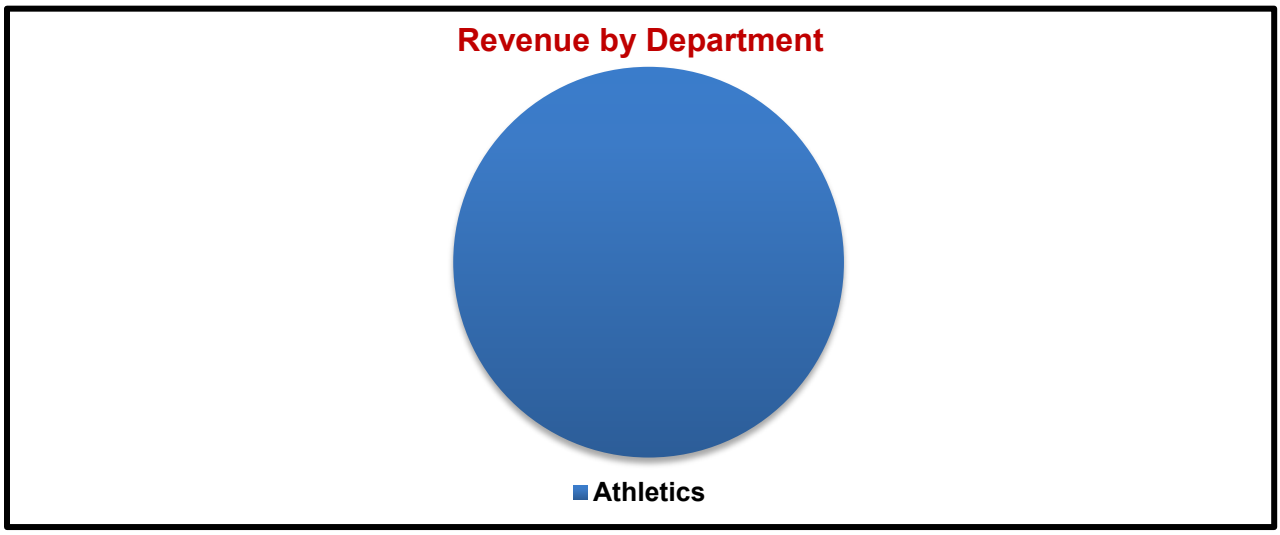
*Legend displays total annual revenue by year

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Victoria Povilaitis	Off Campus Commercial
2	Laurie Browne	Off Campus Commercial
3	Brandy Stephens	Off Campus Commercial
4	Terra Bueno	Off Campus Commercial
5	David Burns	Off Campus Commercial
6	Layne Hilton	Off Campus Commercial
7	April Morse	Off Campus Commercial
8	Gregory Stadler	Off Campus Commercial

Publications

1. Baron, K. G., W. M. Troxel, S. Galway, S. Kharidia, G. DeVettori, A. Gilles, K. M. Sundar and M. H. Watt (2022). Couples-based interventions to promote PAP adherence among older adults: a qualitative study of patients, partners and providers. J Clin Sleep Med.10.5664/jcsm.10180
2. Baron, K. G., A. Gilles, K. M. Sundar, B. R. W. Baucom, K. Duff and W. Troxel (2022). Rationale and study protocol for We-PAP: a randomized pilot/feasibility trial of a couples-based intervention to promote PAP adherence and sleep health compared to an educational control. Pilot Feasibility Stud **8**(1): 171.10.1186/s40814-022-01089-x
3. Bar-Sella, A., Nof, A., Baucom, B.R.W., & Zilcha-Mano, S. (in press). The prognostic role of emotion regulation dynamics in the treatment of major depressive disorder. Journal of Consulting and Clinical Psychology.
4. Baucom, K. J. W., Baucom, B.R.W., & Leifker, F. R. (in press). Supervising work with couples. To appear in M. Terjesen & T. Del Vecchio, Handbook of Training and Supervision in Cognitive Behavioral Therapy. Springer Publications.
5. Botanov, Y., Williams, A. J., Sakaluk, J. K., & Kilshaw, R. E. (in press). Harmful mental health interventions. In Stea, J. N., & Hupp, S. (Eds.), Investigating clinical psychology: Pseudoscience, fringe science, and controversies. Routledge.
6. Jaggers, J. W., C. A. Modrowski, P. K. Kerig, R. E. Kilshaw, C. Cambron and A. K. Allen Latent Profiles of Responding on the Massachusetts Youth Screening Instrument-2 Subscale Scores by Race/Ethnicity among Juvenile Justice-Involved Boys and Girls. Youth Violence and Juvenile Justice 0(0): 15412040231153116.10.1177/15412040231153116Lubeznik-Warner, R. P., & Rosen, N., & (Accepted). Supporting staff supports youth well-being at summer camp. Journal of Youth Development
7. Povilaitis, Victoria; Warner, Robert; and Wheatley, Katie McGregor (2023) "The Lasting Benefits of Multiyear Camp Programming for Youth from Low-Income Backgrounds," Journal of Youth Development: Vol. 18: Iss. 1, Article 7. DOI: 10.34068/JYD.18.01.07
8. Swerdlow, B. A., S. N. Baker, F. R. Leifker, C. L. Straud, D. C. Rozek and L. M. Sippel (2023). The impact of trauma-focused psychotherapy for posttraumatic stress disorder on interpersonal functioning: A systematic review and meta-analysis of randomized clinical trials. J Trauma Stress 36(3): 496-510.10.1002/jts.22906
9. Shi, Q., J. Butner, R. Kilshaw, A. Munion, P. Deboeck, Y. Oh and C. Berg (2022). A Comparison of Models for Inferring Longitudinal Reciprocal Relationships Between Constructs: A Case Example with Internalizing and Externalizing Problems. Review of Social Development 32.10.1111/sode.12628
10. Terrill, A., M. Reblin, J. MacKenzie, B. Baucom, J. Einerson, B. Cardell, L. Richards and J. Majersik (2023). Promoting Resilience After Stroke in Dyads (ReStoreD): A Supplemental Analysis. Archives of Physical Medicine and Rehabilitation.10.1016/j.apmr.2023.03.024
11. Warner, R. P. (2022). Considering the importance of attachment in youth programming outcomes: A conceptual case study of summer camp. Journal of Youth Development, 17(4), 8–25. https://doi.org/10.5195/jyd.2022.1259
12. Weber, D. M., B. R. W. Baucom, D. H. Baucom, M. S. Fischer, K. Ramos, J. M. Romano, L. S. Porter and S. L. Langer (2023). Concurrent and Prospective Associations Between Communicated Emotional Arousal and Adjustment Among Couples Coping With Cancer. Annals of Behavioral Medicine.10.1093/abm/kaad017

HEALTH
UNIVERSITY OF UTAH

BioMedical Microfluids Lab

Overview

The Biomedical Microfluidics Core (BMC) is a user research facility managed by the State of Utah Center of Excellence for Biomedical Microfluidics managed by Bruce Gale and the Department of Mechanical Engineering. The lab offers clients design, engineering, and prototyping services for a wide variety of biomedical assays, medical devices, and high-throughput automation instruments. These devices can be custom designed and focused on answering specific research questions or optimized for commercial manufacturing.

The BMC has significant experience with a wide range of microfluidic devices and manufacturing methods. The BMC can prototype devices using a wide range of polymers, glass, and semiconductors (such as Si). Devices can be manufactured using photolithography tools (in conjunction with the Nanofab), soft lithography, laminates, 3D printing, or molding processes. The BMC has significant experience in including a variety of pumps, valves, sensors, separation components, analytical elements, input/output components, and flow control devices, which combined allow for rapid development of custom devices. Past applications include: bacteria and virus detection, cell sorting, high speed PCR devices, chemical analysis, complex reaction engineering, multiplexed cell culture and analysis, drug delivery, nanoparticle generation and analysis, and miniature medical devices for blood vessel and peripheral nervous system repair. The BMC is especially adept at working with companies developing new products.

Uniqueness

The BMC has an extensive history of successful collaborations with academia, government, and industry clients ranging from startups to multinational corporations in the medical, chemical, drug development, drug delivery, analytical, and other markets.

The BMC staff can help with custom design of microfluidic devices to fit your research and analytical needs. The BMC staff can also help with the design of custom microfluidic devices that have key characteristics for commercialization, including low-cost manufacturing, high repeatability, and simplification of complex operations.

The BMC has expertise in:

- Biomedical materials and devices
- Packaging and interfaces
- Automated sample preparation
- Sensor integration
- High throughput analysis
- General biomedical miniaturization

Services & Equipment

The BMC provides the following services:

- Custom microfluidic device design
- Microfluidic device prototyping
- Device engineering
- Device testing
- Low volume manufacturing
- Consulting services for commercialization of microfluidic devices

FY24 Goals

- Expand the range of services offered.

Personnel

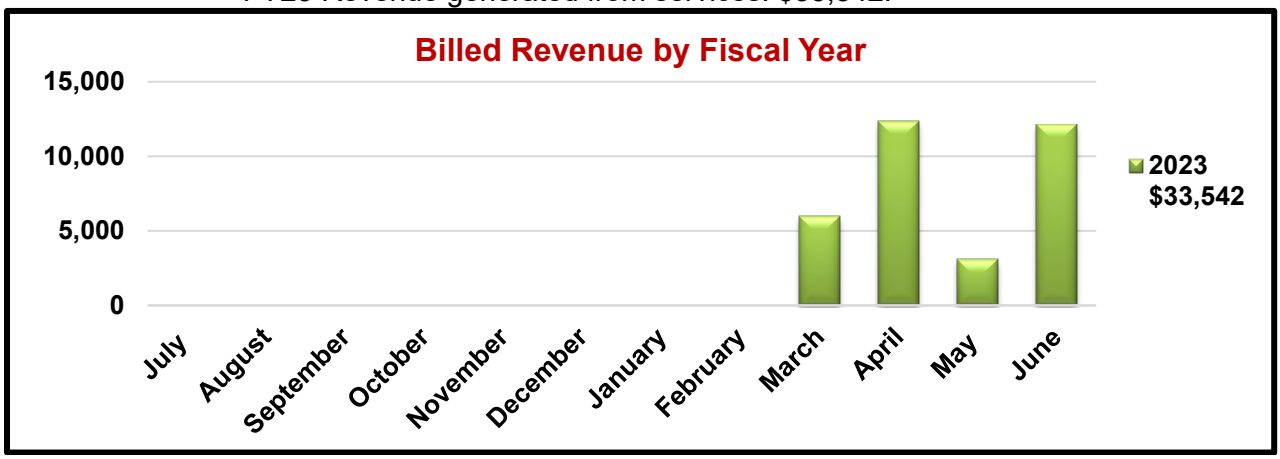
- Bruce Gale, Director

Revenue/Expenses

FY23 Expenses: Total $24,704

FY23 Revenue: Total $33,542

- VP of Research Support: $ 0
- FY23 Revenue generated from services: $33,542.

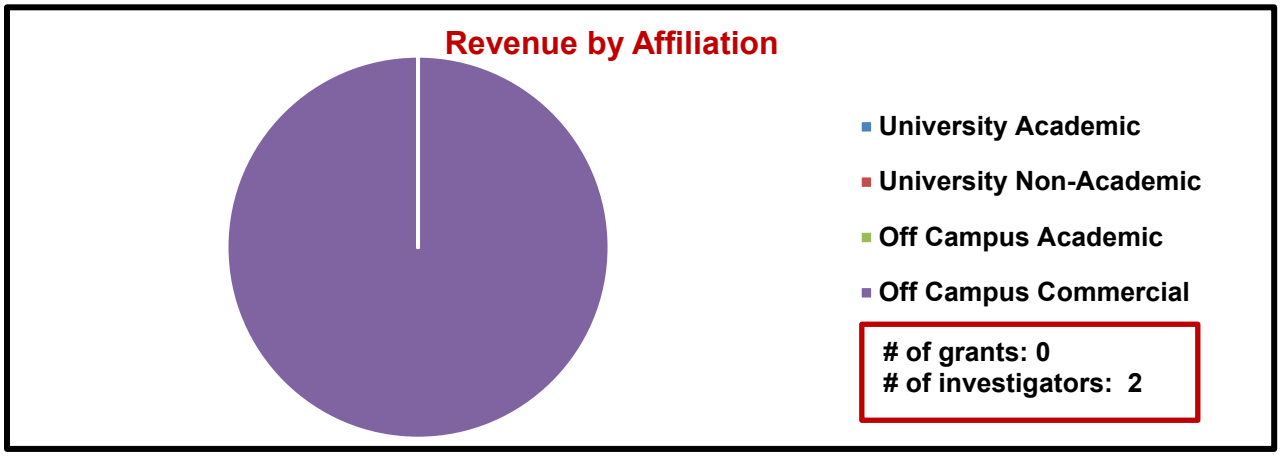


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):



Top Users

1	Paterna Biosciences	Off Campus Commercial
2	NanoSpot, Inc.	Off Campus Commercial

Publications

No known publications acknowledged this facility in FY23.

HEALTH
UNIVERSITY OF UTAH

Center for Human Toxicology

Overview

The Center for Human Toxicology (CHT) provides targeted, quantitative bioanalysis that supports studies throughout the drug development pipeline. The Center offers customized assay development and sample analysis to generate data for a vast array of therapeutically active compounds.

Uniqueness

The CHT's ability to develop customized quantitative assays for targeted novel therapeutic compounds and adapt previously published assays for use within the Center is a unique service within the University of Utah. The capability to provide these services have been honed over 30+ years of serving as the contract bioanaltyical laboratory for NIDA, in addition to the directorship leading cutting-edge forensic toxicology and clinical pharmacology research throughout the storied history of the Center.

The CHT is home to several liquid chromatography-tandem mass spectrometery (LC-MS/MS) systems that are maintained and operated by experienced staff members. LC-MS/MS instrumentation requires infrastructure and costs that are prohibitive for many laboratories. By providing these resources to investigators on- and off-campus, the Center facilitates critical drug studies by academic researchers in both basic and clinical sciences.

In contrast to external Clinical Research Organizations (CROs) offering similar services, the CHT provides transparent, high quality analyses at affordable prices, which is of particular benefit to academic investigators seeking preliminary data that will support a grant application. Furthermore, the CHT can help investigators design sample collection schemes within a study and conduct advanced pharmacokinetics analyses after data collection to support the broader utility of data generated within the Center.

Services

- Schedule 1 DEA License
- Custom Assay Development by LC-MS/MS
- Sample Analysis by LC-MS/MS
- Sample Analysis by ELISA
- Optimal Sampling Design
- Non-Compartmental Pharmacokinetic Analysis
- Pharmacometric Modeling

Equipment

LC-MS/MS

- ThermoScientific Vanquish Flex LC and Velos Pro MS
- ThermoScientific Vanquish Flex LC and TSQ Quantis Plus MS/MS
- ThermoScientific Accela LC and TSQ Vantage MS/MS
- Waters Acquity UPLC and ThermoScientific TSQ Quantum Access MS/MS
- Waters Acquity UPLC and Micromass Quattro Premier XE MS/MS

Developed Assays

Compounds (Matrix)

- Cannabis and metabolites (plasma, urine, hair)
- Buprenorphine and metabolites (plasma)
- Ganciclovir (plasma, dried blood spots, tissue)
- Methamphetamine/Amphetamine (plasma, oral fluid)
- Amlodipine (plasma)
- Cefazolin (plasma, cerebrospinal fluid)
- Methylprednisolone (plasma)
- Furosemide (plasma)
- Opioids [morphine, oxycodone, fentanyl, and metabolites] (plasma, urine)
- Anti-Seizure Medications [clobazam, valproate, carbazamepine, stiripentol, levetiracetam] and their metabolites (plasma, brain tissue)

Personnel

- Christopher Reilly, Ph.D., ATS, Director
- Joseph Rower, Ph.D., DABCP, Associate Director
- Cassandra Deering-Rice, Ph.D. Assistant Director
- David Anderson, MS, Laboratory Manager
- Olga Averin, MS
- Tia Freeman, BS
- Logan Hoggard, MS

FY24 Goals

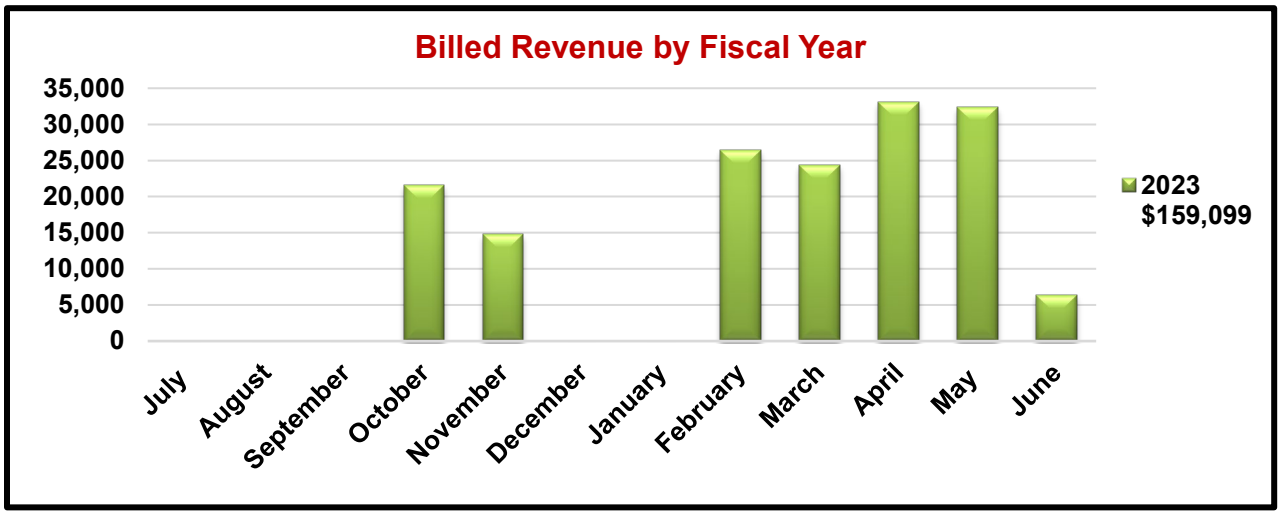
- Increase user base/revenue
- Expand knowledge of our services across campus
- Streamline assay development procedures

Revenue/Expenses

FY23 Expenses: **Total $26,268**

FY23 Revenue: **Total $159,099**

- FY23 Revenue generated from services: $159,099.

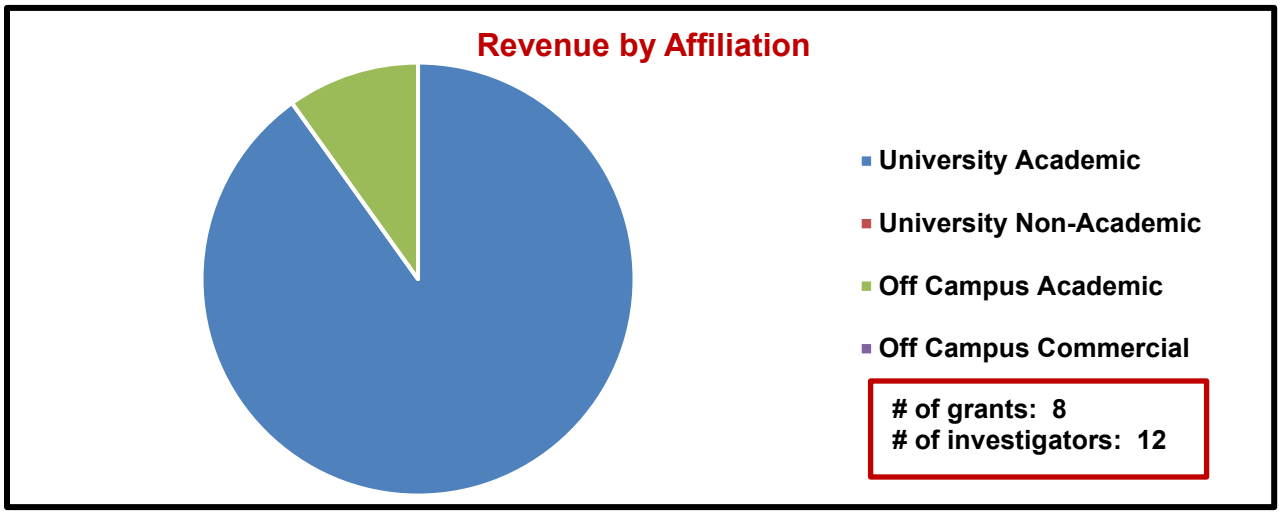


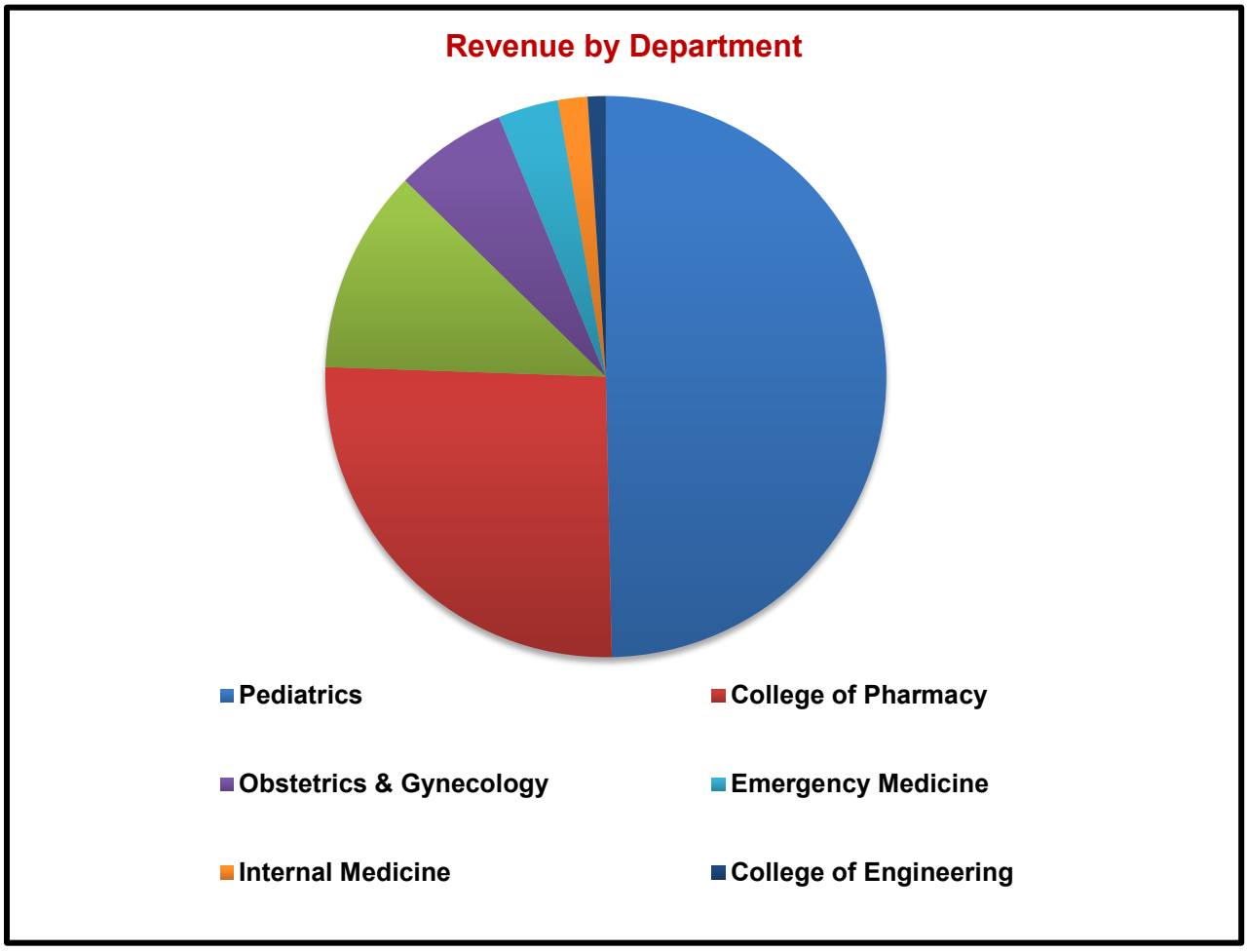
* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Kevin Watt	NIH, Thrasher Research Fund
2	Jace King	State of Utah
3	Christopher Reilly	Heluna Health
4	University of Georgia	Off Campus Academic
5	Elena Enioutina	Young Living Essential Oils Lc
6	Marcela Smid	NIH
7	Kathleen Job	Department
8	Joseph Rower	Cures Within Reach
9	University of Minnesota	Off Campus Academic
10	Cori Ward	Department

Publications

1. Mensah, J. A., K. Johnson, C. A. Reilly, K. S. Wilcox, J. E. Rower and C. S. Metcalf (2022). Evaluating the efficacy of prototype antiseizure drugs using a preclinical pharmacokinetic approach. Epilepsia 63(11): 2937-2948.10.1111/epi.17402
2. Yellepeddi, V. K., M. Battaglia, S. J. C. Davies, J. Alt, S. Ashby, P. Shipman, D. J. Anderson, J. E. Rower, C. Reilly, M. Voight and S. R. Mim (2023). Pharmacokinetics of intranasal amiloride in healthy volunteers. Clin Transl Sci 16(6): 1075-1084.10.1111/cts.13514

Crus Center

Overview

The Crus Center 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 analytical instrumentation and services for a variety of samples.

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

The Crus Center also supports the undergraduate Crus Scholar program which allows students to get paid for certain research projects, generously supported by Dawn and Roger Crus.

Uniqueness

The Crus Center is an open space dedicated to research both within the MSE department, as well as across the University of Utah campus.

Services & Equipment

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

Staff also provide consultations and experiment design suggestions based on the needs of the user. The services offered by the Crus Center include characterization with the following techniques:

- Hitachi S-4800 FE-SEM
  - Ultra high resolution down to 1 nm
  - Back Scatter, Secondary, and Energy Dispersive X-Ray Spectroscopy
- Rigaku Miniflex 600 x-ray diffraction
  - Powder diffraction
  - 5-sample auto-sampler
- TA Instrtuments Q600 SDT – DSC, TGA
  - Room temp to 600 Celsius
  - Argon purge gas
- Anto nPaar SurPASS 3 Electrokinetic Analyzer (EKA)
  - Automated isostatic point detection
  - pH-relative zeta potential
- Denton Vacuum Desk V – Thin Film Deposition System
  - Automatic timed gold sputtering
- Thermo Scientific Niton XL3T 500 XRF
  - Elemental analysis

FY24 Goals

- Free up space from broken or unused equipment to make room for more techniques.
- Increase online visibility.

Personnel

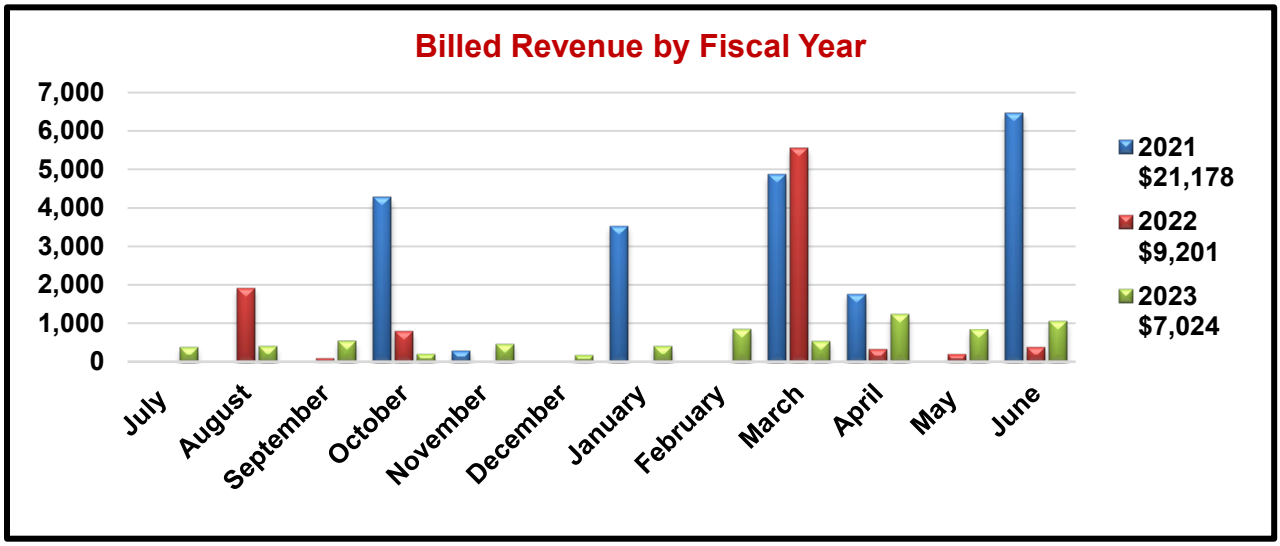
- Bobby Mohanty, Faculty Director
- Kimberly Watts, Lab Manager
- Joy Walker, Executive Secretary
- Christian Norman, Technician

Revenue/Expenses

FY23 Expenses: Total $22,528

FY23 Revenue: Total $7,024

- VP of Research Support: $ 0
- FY23 Revenue generated from services: $7,024

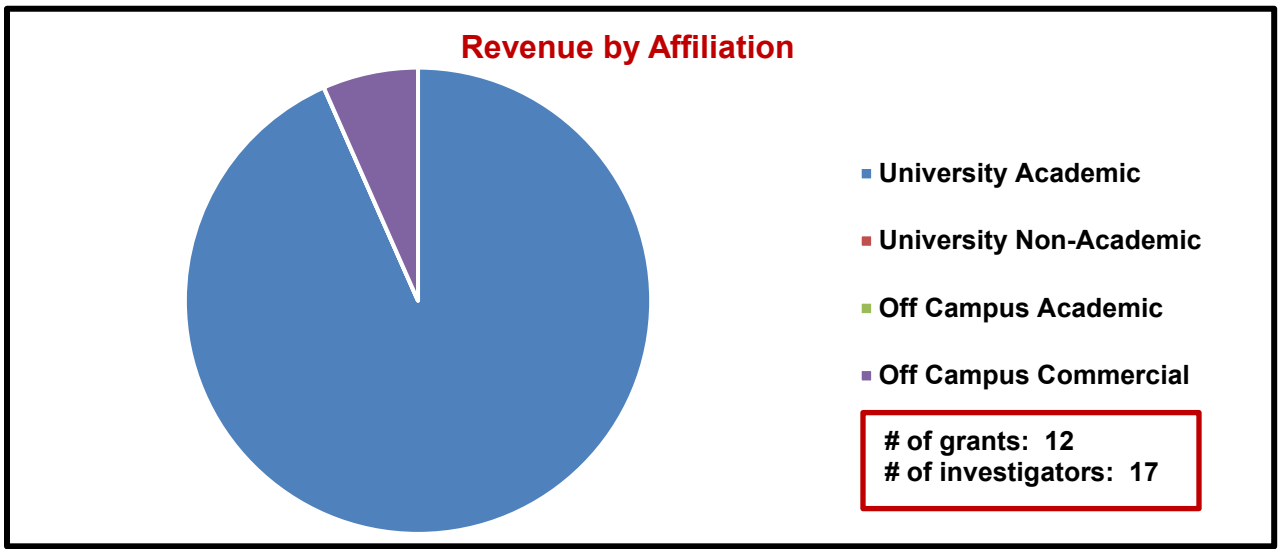


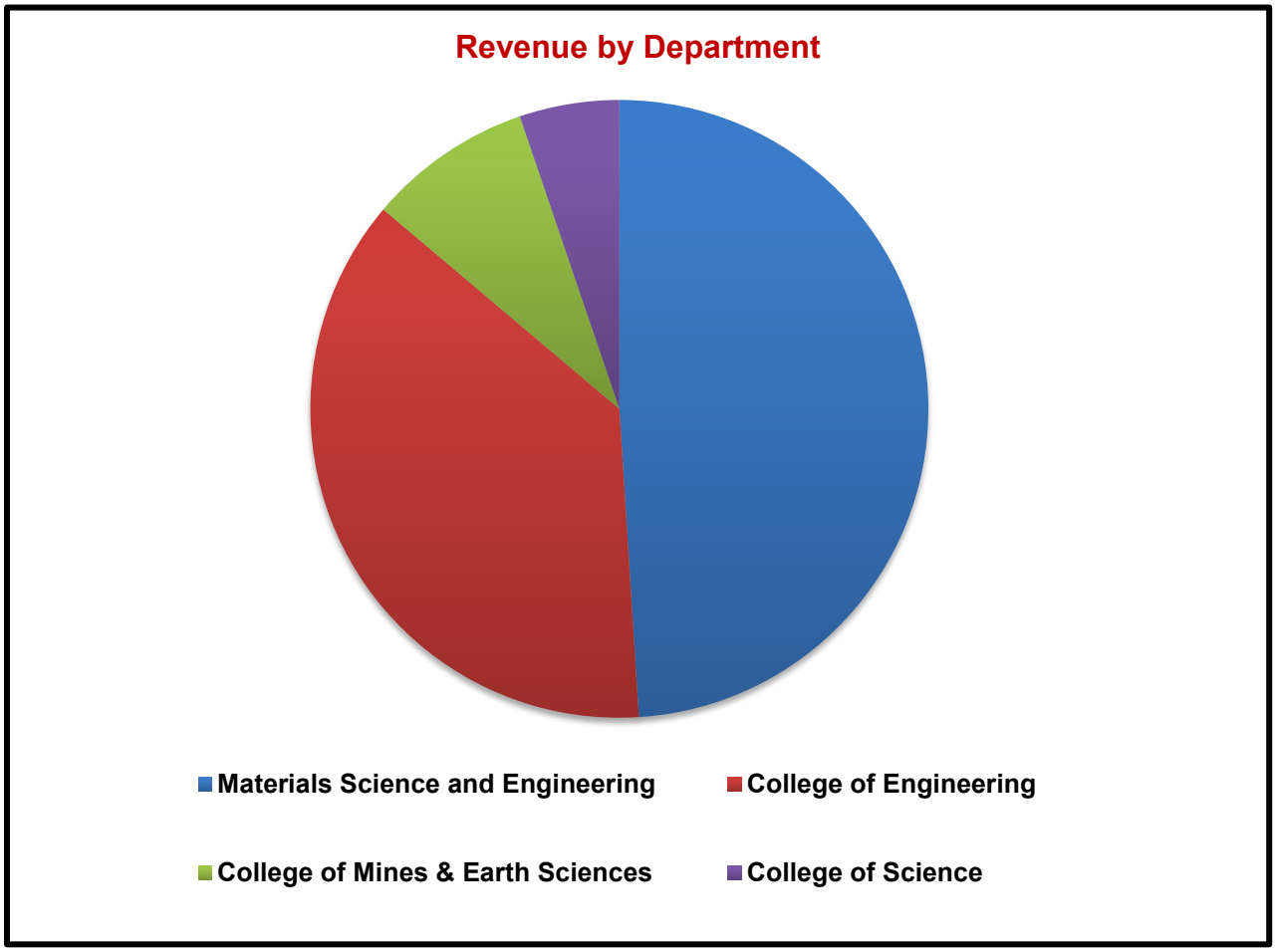
* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Zak Fang	Blacksand Technology LLC
2	Hong Yong Sohn	Department, National Institute of Aerospace
3	Phospholutions	Commerical
4	K.S. Ravi Chandran	DOE
5	Connor Bischak	Department
6	Jeff Bates	Department
7	Swomitra Mohanty	Department
8	Krista Carlson	Department
9	Vikram Deshpande	NSF
10	Jan Miller	Newmont Mining Corporation

Publications

No known publications acknowledged this facility in FY23.

HEALTH
UNIVERSITY OF UTAH

Genetic Science Learning Center

Overview

The GSLC specializes in making science and health easy for everyone to understand, with a focus on digital interventions, applications, and educational materials. The team collaborates with investigators and research teams to develop all components of digital health interventions from "front end" patient/caregiver/user experience to "back end" and data collection.

Uniqueness

The GSLC brings together in one team synergistic expertise in design and production of digital interventions, applications, and educational materials. Its team is unique among similar groups at US academic institutions in that it includes expertise in multimedia animation and interactivity, graphic design, video production, website and app development, instructional design, science and health writing, community and patient engagement, and research and evaluation; other groups outsource some of these functions.

The GSLC designs and produces digital materials for research studies, clinical trial recruitment, patient education, decision aids for shared decision making, simplified informed consent materials, education and training materials, and Broader Impacts for NSF grants.

Services

The GSLC offers the following services:

Digital Materials Development

- Digital design and software development
  - Web apps and websites
  - Mobile apps and games
  - Decision aids
  - Interactive multimedia
  - Animation (2D and 3D)
  - Embedding data collection for interventions via REDCap and other methods
- Video production
  - Script writing, production and scheduling, videography, editing, and post-production
- Music and audio production
  - Original music composition and scoring, and audio engineering
- Multimedia and visual design
  - Animated segments for videos
  - Illustration
  - Graphic design and layout
  - Brochures and infographics
- Science and health writing
  - Translate complex concepts for patients and other lay audiences
  - Video and multimedia scripts
  - Website and app content

- Educational and recruitment materials
- Instructional design

Research and Evaluation Services

- Evaluation of educational training programs and materials via:
  - Quantitative, qualitative and mixed-methods designs
  - Developing valid knowledge assessment (test) items
  - Developing surveys
  - Conducting focus groups and key informant or participant interviews

A project's scope and budget are discussed during an initial consultation(s). 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 MOU is prepared, outlining project deliverables, expectations by both parties, a timeline, and budget. A project lead is assigned, who serves as the primary GSLC contact for the project.

FY24 Goals

The GSLC will continue to produce high-quality digital interventions, applications, and materials, as well as conduct evaluations of training programs. 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.

Personnel

- Louisa A. Stark, PhD, Director
- Claudia Morales, BA, Project Manager
- Arthur Veenema, BS, Video Producer/Director
- Kagan Breitenbach, BMu, Specialty Media Coordinator
- Muhammad Irfan, MS, Web Systems Manager
- Brooklee Watters, AS, User Experience Developer
- John Maxwell Kelly, BFA, Multimedia Manager
- Nathan Holland, BA, Graphic Designer
- Moriah Davies, AA, Graphic Designer
- Kristin Fenker, PhD, Science Writing Lead
- Paul Gabrielsen, MS, Science Writer
- Molly Malone, MS, Senior Education Specialist
- Jen Taylor, BS, Education Specialist
- Rochelle Cassells, PhD, Assistant Director for Research and Evaluation
- Harini Krishnan, PhD, Research Associate
- Marissa Morley, BMS, Administrative Assistant

Management Meeting

Last meeting date: July 1, 2022

- Louisa Stark, PhD, GSLC Director
- James Cox, HSC Core Research Facility, Director
- Brenda Smith, Director, Accounting and Finance, HSC Core Research Facility Operations

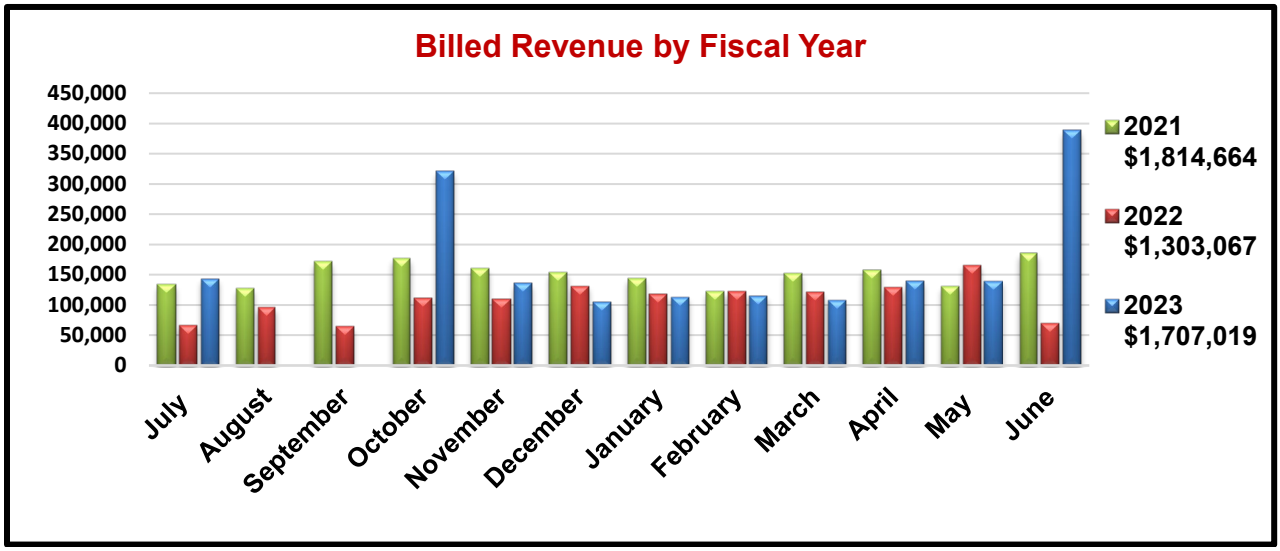
FY23 Annual Update
New Services

Evaluation of training programs

Revenue/Expenses

FY23 Expenses: $1,728,431
FY23 Revenue: $2,161,655

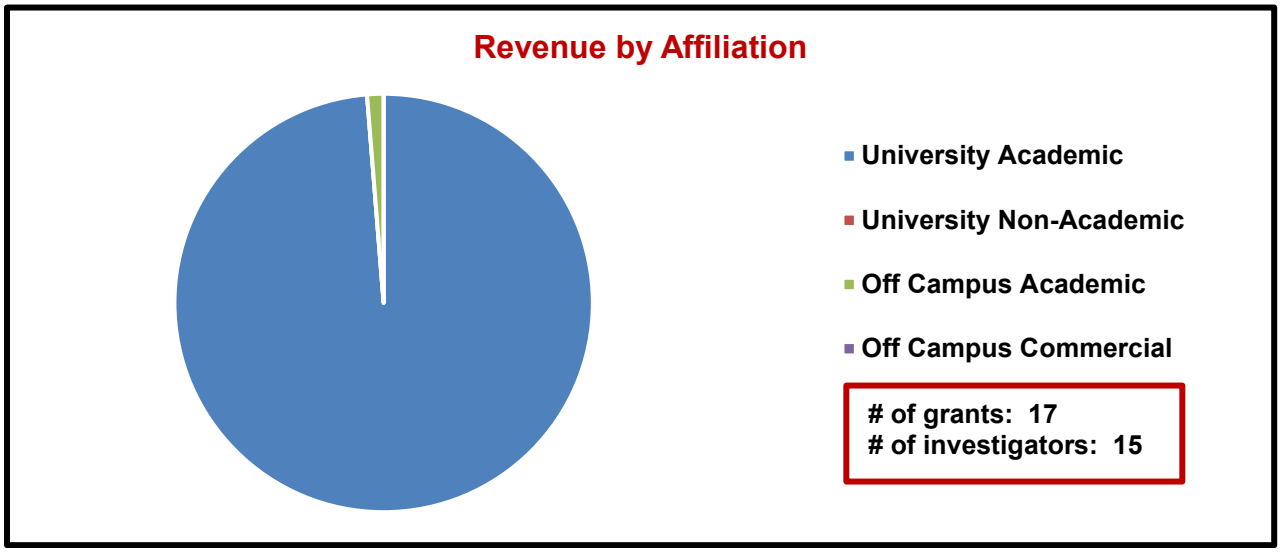
- Other Revenue Sources: $374,636
- Benning Award: $80,000
- FY23 revenue generated from services: $1,707,019

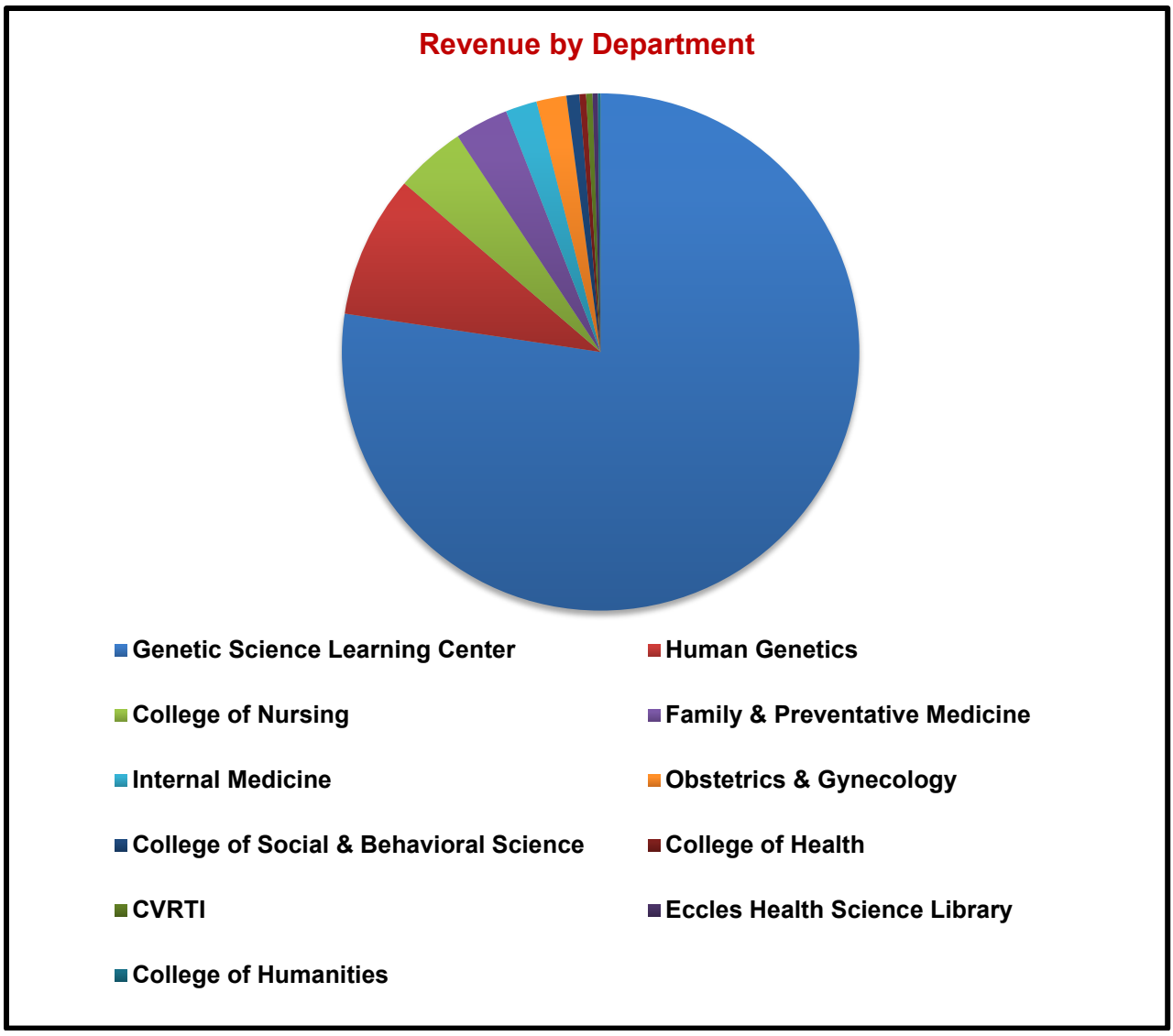


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support

Revenue Generated (see charts):





Top Users

1	Louisa Stark	NIH, NSF
2	Kara Dassel	NIH
3	Kola Okuyemi	NIH
4	Erin Rothwell	NIH
5	John Phillips	Department, NIH
6	University of Georgia	Off Campus Educational
7	Rebecca Utz	NIH
8	Linda Edelman	University of North Dakota
9	Joseph Yost	NIH
10	Alexandra Terrill	NIH

Educational Modules Published Online

1. Cells in Context [Web]. Available: https://teach.genetics.utah.edu/content/cells/#item2 and https://learn.genetics.utah.edu/content/cells/
2. Exploring Genetics Through Genetic Disorders [Web]. Available https://teach.genetics.utah.edu/content/genetics/ and https://learn.genetics.utah.edu/content/genetics/
3. Virtual Lab: All About PCR [Web]. Available: https://learn.genetics.utah.edu/content/labs/pcr/

Materials Developed for the NIH *All of Us* Research Program

1. Viruses & Vaccines educational materials. [Web; 13 sections]. https://virusinfo.joinallofus.org
2. How the *All of Us* Research Program Protects My Information video [Web]. https://www.youtube.com/watch?v=ghQ8oqJbulQ

Materials Developed for Clinical Trials

1. Decision aid for parents of babies diagnosed with severe, life-threatening congenital heart disease (English and Spanish). PI: Angie Fagerlin, PhD, UU Department of Population Health Science.
2. Online tool to assist caregivers of adults with Alzheimer's Disease and other dementias in planning their respite time. PI: Rebecca Utz, PhD, UU Department of Sociology.
3. Interactive, multimedia educational modules for children and teens who have developed psychological distress after being hospitalized for an injury, and for their parents. PIs: Heather Keenan, MD, PhD, MPH; UU Department of Pediatrics; Linda Ewing-Cobbs, PhD, University of Texas Health Science Center at Houston; Shari Wade, PhD, Cincinnati Children's Hospital.
4. Video series for Hispanic women to normalize discussion with their healthcare providers about pelvic floor issues that can develop after giving birth. PI: Ingrid Nygaard, MD, MS, UU Health Obstetrics and Gynecology.
5. Video and brochure to improve prenatal healthcare delivery by enhancing congenital cytomegalovirus (CMV) awareness, teaching preventative measures, and facilitating neonatal screening (English and Spanish). PI: Marissa Diener, PhD, UU Department of Family and Consumer Studies.
6. Two educational videos for patients aged 10–18 at high risk for developing melanoma. PI: Yelena Wu, PhD, UU Department of Dermatology and Huntsman Cancer Institute.
7. Video to inform potential participants about the ValEAR clinical trial. PI: Albert Park, MD, UU Health Pediatric Otolaryngology.

Evaluation Studies for Training Programs

1. GURU: Graduate and Undergraduate Researchers of UCEER program. PIs: James Tabery, PhD, UU Department of Philosophy, and Erin Rothwell, PhD, UU Department of Obstretrics and Gynecology.
2. Genomics Summer Research for Minorities: A Pathway to Promote Diversity in Science Research. PI: Joseph Yost, PhD, UU Department of Pediatrics.
3. Huntsman Cancer Institute PathMaker Programs for Cancer Research. PIs: Donald Ayer, Huntsman Cancer Institute, and Kolawole Okuyemi, UU Department of Family and Preventive Medicine.
4. Geriatrics Workforce Enhancement Program – HRSA. PI: Linda Edelman, UU College of Nursing.

Evaluation Studies for Other Programs

1. Community Wellness Liaisons: Resources for Hypertension and Diabetes. Community Collaboration & Engagement Team, Utah Clinical & Translational Sciences Institute

Developed Websites

2. Cooperative Centers of Excellence in Hematology [Web]. https://cheh.io/

Publications

1. Asnaani, A., A. Sanchez-Birkhead, K. Kaur, V. Mukundente, E. Napia, F. Tavake-Pasi, J. Villalta, D. Lee, L. Stark, H. Brown and S. Crowell (2022). Utilizing Community Partnerships to Devise a Framework for Cultural Adaptations to Evidence-Based Mental Health Practice in Diverse Communities. Cognitive and Behavioral Practice.https://doi.org/10.1016/j.cbpra.2022.06.006

Iron & Heme

Overview

The Iron and Heme Core Facility provides analyses of the compounds involved in the heme biosynthesis pathway, together with the activities of the enzymes involved in this essential process. The core also provides analyses of biologically important metals. Quantification of heme and its precursors can be performed on cell pellets, tissue, whole blood, urine, feces and other complex biological materials. Analysis of enzyme activity can be provided for cell pellets, tissue and blood. An Agilent 7900-ICP mass spectrometer is used to measure iron content (as well as other metals) in biological samples.

Uniqueness

The Iron and Heme Core provides service not available at most universities. We perform UPLC/HPLC analyses of heme, porphyrin and tetrapyrrole precursors (ALA and PBG). We assay for activities of enzymes involved in heme biosynthesis. We receive and process samples and provide service for academic laboratories all over the United States. We are able to measure activity for each of the eight heme biosynthetic intermediates from tissue and cell sources. We specialize in small, biological samples (cells, tissue, blood, urine, feces). We homogenize and measure protein content for sample normalization, unusual for metal analysis centers and important for biological research.

Services

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

- UPLC analysis of total heme and protoporphyrin IX
- UPLC analysis of intermediate porphyrins in heme biosynthesis
- Assays for the following heme biosynthetic enzymes (ALAS, ALAD/PBGS, PBGD, U3S, UROD, COPOX, PPOX & FECH)
- Metal analysis by ICP-MS
- Spectral analysis of hemes
- Sample homogenization (cells & tissues) with protein quantification
- Related biological compounds like bilins; and enzyme activities as in reverse ferrochelatase

FY24 Goals

- Increase awareness of our services
- Increase core efficiency and reduce turnaround time.

Major Equipment

Heme and Porphyrin analysis:

- Two Waters Corporation ultra-performance liquid chromatography (UPLC) systems, ACQUITY UPLC classic and ACQUITY UPLC H-class PLUS (each including a sample manager, a solvent manager, a photodiode array detector, a fluorescence detector, a column heater and a reverse phase C18 column
- Agilent 8453 diode array spectrophotometer

Metal Analysis:

- Agilent 7900-ICP mass spectrometer system

Personnel

- Hector A. Bergonia, MS, Lab Specialist Tetrapyrrole Biochemistry, Core Account Executive
- Alexander K. Anderson, BS, Lab Technician

Advisory Board Committee (CIHD Operations Committee)

Last meeting date: 08-18-2023

John D. Phillips, PhD, Hematology

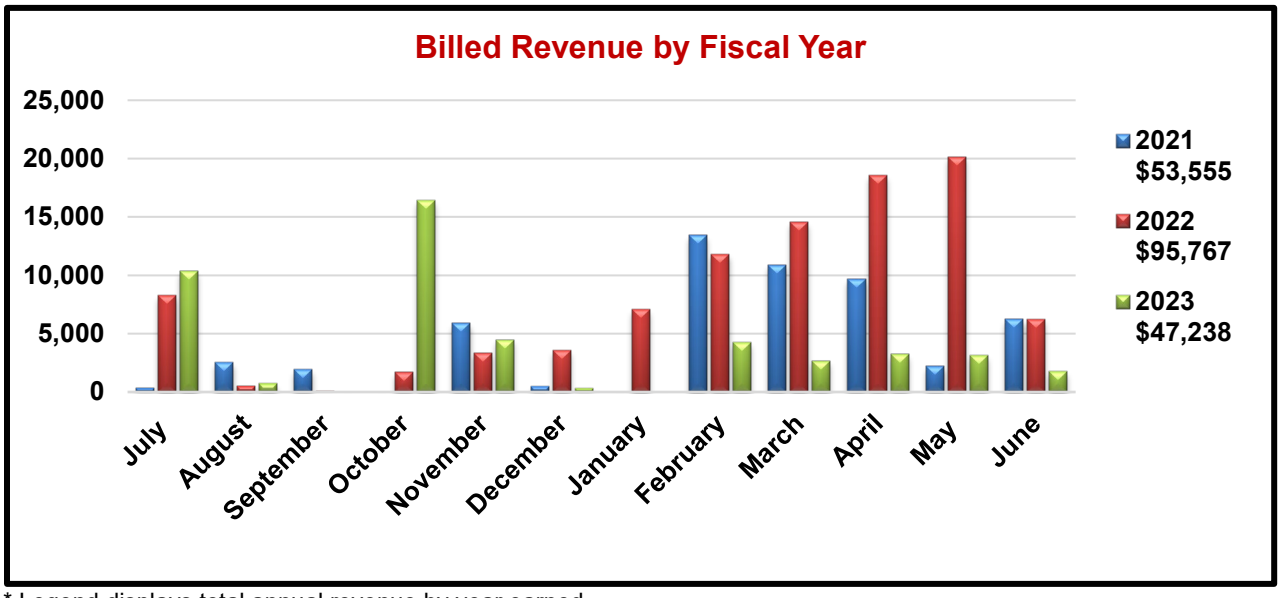
- James Cox, PhD, Biochemistry
- Diane M Ward, PhD, Pathology
- Dennis Winge, PhD, Hematology

Revenue/Expenses

FY23 Total Expenses: **$20,081**

FY23 Total Revenue: **$47,238**

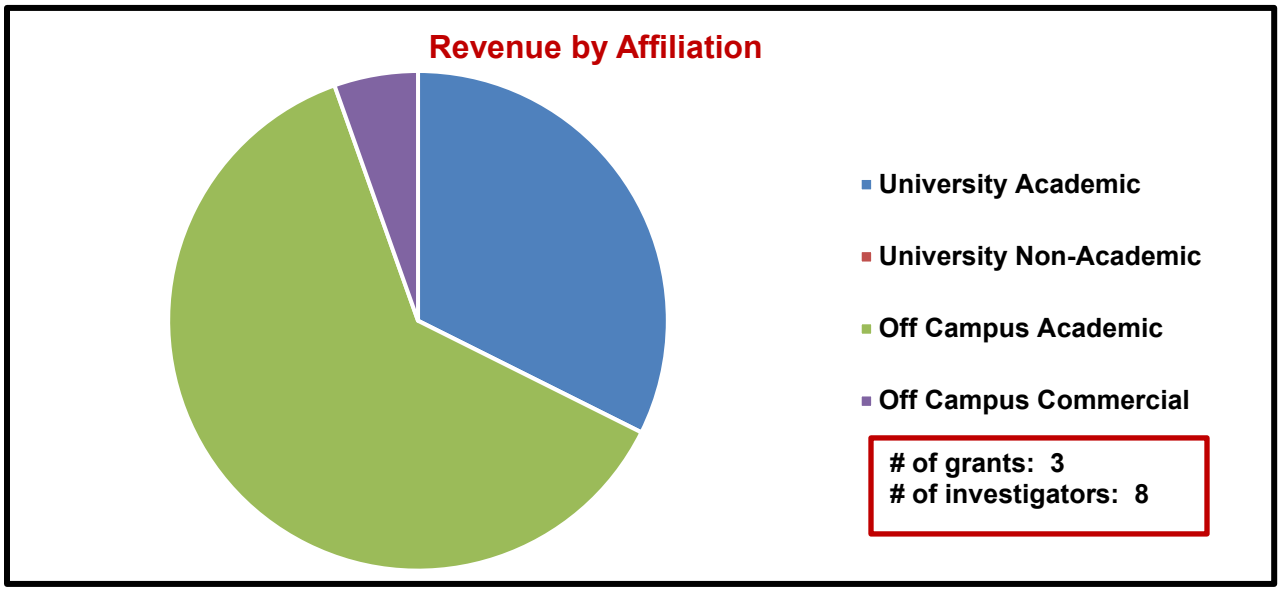
- VP of Research Support: $0
- FY23 Revenue generated from services: $47,238

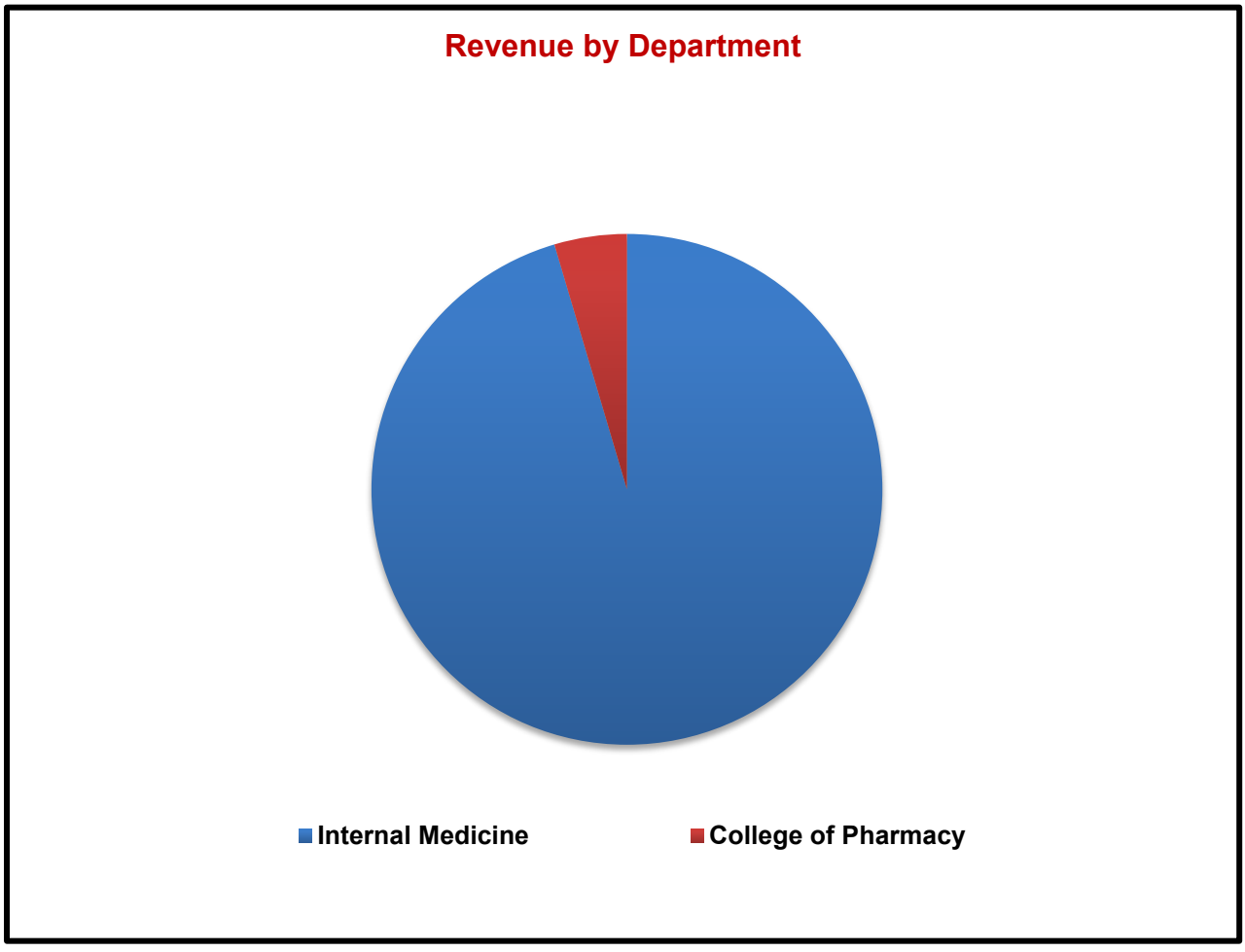


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support

Revenue Generated (see charts following):





Top Users

1	Boston Children's Hospital	Commercial
2	John Phillips	NIH
3	Icahn School of Medicine at Mount Sinai	Off Campus Educational
4	Vanderbilt University Medical Center	Off Campus Educational
5	Emory University	Off Campus Educational
6	Colorado Biolabs, Inc.	Commercial
7	Mei Yee Koh	NIH
8	University of Nebraska-Lincoln	Off Campus Educational

Publications

1. Miljkovic M, Seguin A, Jia X, Cox JE, Catrow JL, Bergonia H, Phillips JD, Stephens WZ, Ward DM (2023) Loss of the mitochondrial protein Abcb10 results in altered arginine metabolism in MEL and K562 cells and nutrient stress signaling through ATF4. J Biol Chem 299 (7):104877. doi:10.1016/j.jbc.2023.104877

Materials Characterization Lab

Overview

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

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

The MCL maintains a ~1300 sq. ft. lab facility, including optical and electron microscopy, x-ray diffraction, thermal analysis, surface analysis, mechanical testing, physical testing, spectrophotometry along with some sample preparation resources.

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

Services & Equipment

The MCL serves as a facility for Materials Science and Engineering undergraduate and graduate level courses that involve materials characterization. In addition to supporting undergraduate classes, student interns can work for two semesters in the lab to gain experience with machines and professional communication.

The MCL staff also provide consultations and experiment design suggestions based on the needs of the user. The services offered by the MCL include materials characterization with the following techniques:

Optical Microscopy

- Olympus BH2 Series System Microscope
- Olympus Tokyo PME Inverted Stage / Metallographic Microscope
- Olympus VANOX Universal Research Microscope

Scanning Electron Microscopy

- Hitachi TM3030Plus Tabletop Microscope (SEM) with SE, BSE detectors, and Thermo Scientific Pathfinder SDD energy dispersive x-ray spectrometer (EDS).

Spectroscopy

- Nicolet iS50 FT-IR with Diamond ATR attachment
- 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) with powder diffraction and thin film detectors.
- Bruker D2 Phaser X-Ray Diffractometer (XRD) with Phi axis rotation abilities.

Thermal Analysis

- Anter Corporation Work Horse IB Dilatometer
- NETZSCH DSC 3500 Sirius Differential Scanning Calorimeter (DSC)
- TA Instruments SDT 650 thermogravimetric analyzer and differential scanning calorimeter (DSC-TGA) with autosampler

Macroscopic & Physical Testing

- TA Instruments DHR 20 Rheometer with Dynamic Mechanical Analysis (DMA) and dielectric testing mode
- Anton Paar MCR viscometry, rheology, and tribology
- Anton Paar Ultrapyc 5000 helium pycnometer
- Instron 5969 Dual Column Tabletop Testing System
- Micromeritics 3Flex physisorption analyzer for BET surface area and pore size
- Micromeritics FlowPrep 060 Sample Degas System
- Beckman Coulter LS230 particle size analyzer (PSA) with polarized light detectors
- MetrOhm Karl Fisher Titrator

Sample Preparation

- Mettler AE100 Analytical Balance
- Cressington 108carbon/A Carbon Coater for Conductive Carbon Coatings
- Cressington 108auto Sputter Coater for Conductive Gold and other precious metal Coatings

Cross-Sectioning / Microsectioning

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

FY24 Goals

- Improve sample submission turnaround times.

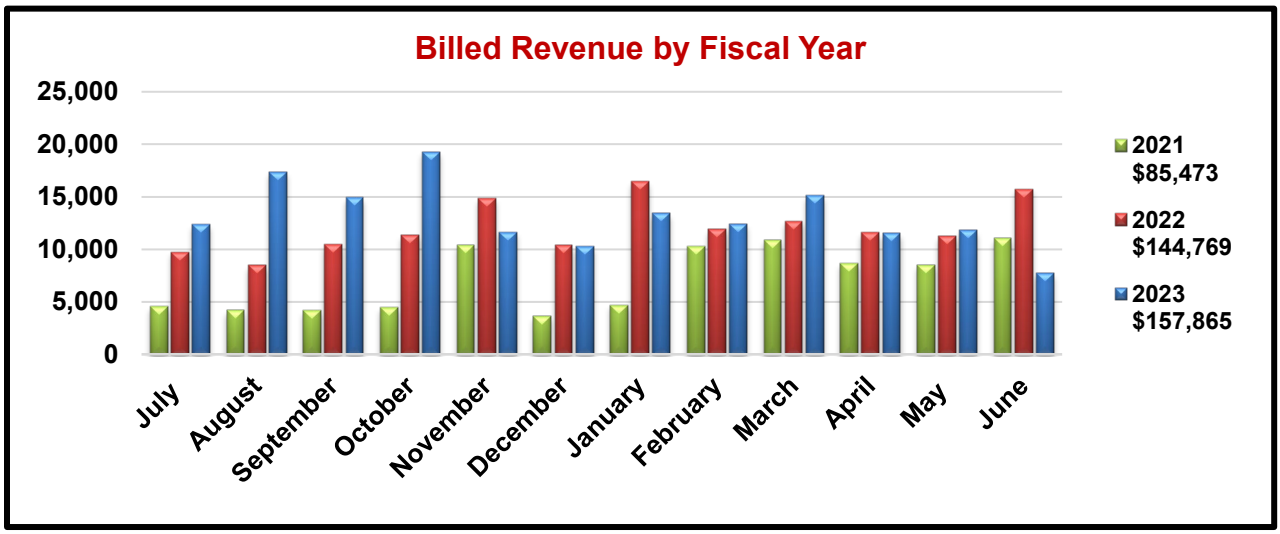
Personnel

- Angela Nelson, Administrative Officer
- Kimberly Watts, Lab Manager
- Joy Walker, Executive Secretary
- Hannah Braeger, Technician

Revenue/Expenses

FY23 Expenses: Total $135,803
FY23 Revenue: Total $157,865

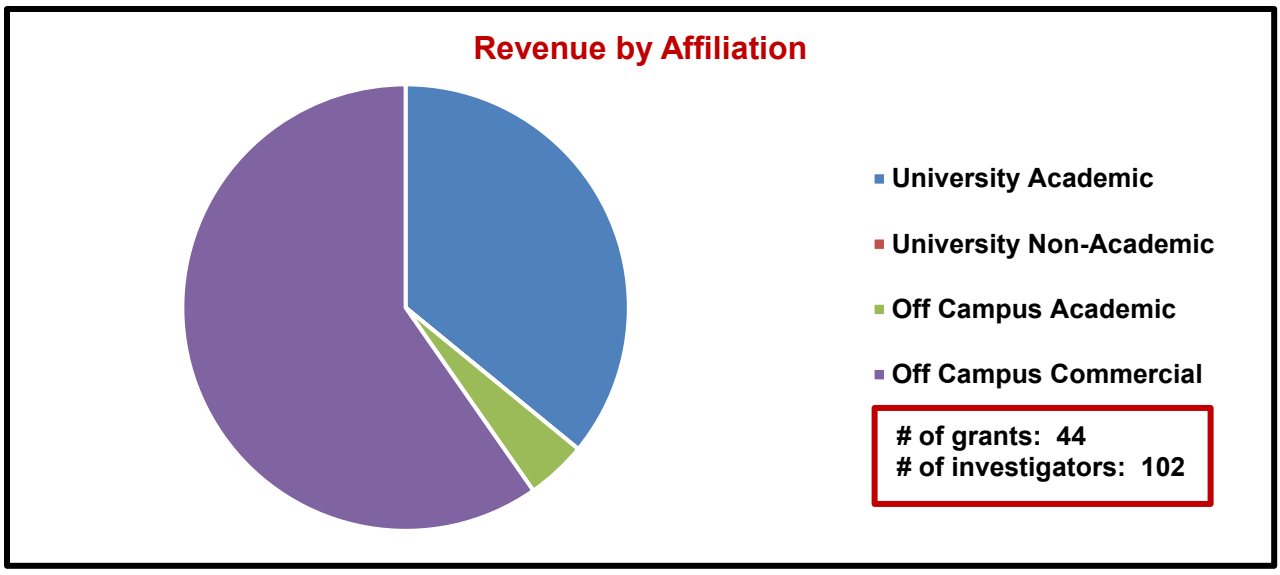
- VP of Research Support: $ 0
- FY23 Revenue generated from services: $157,865.

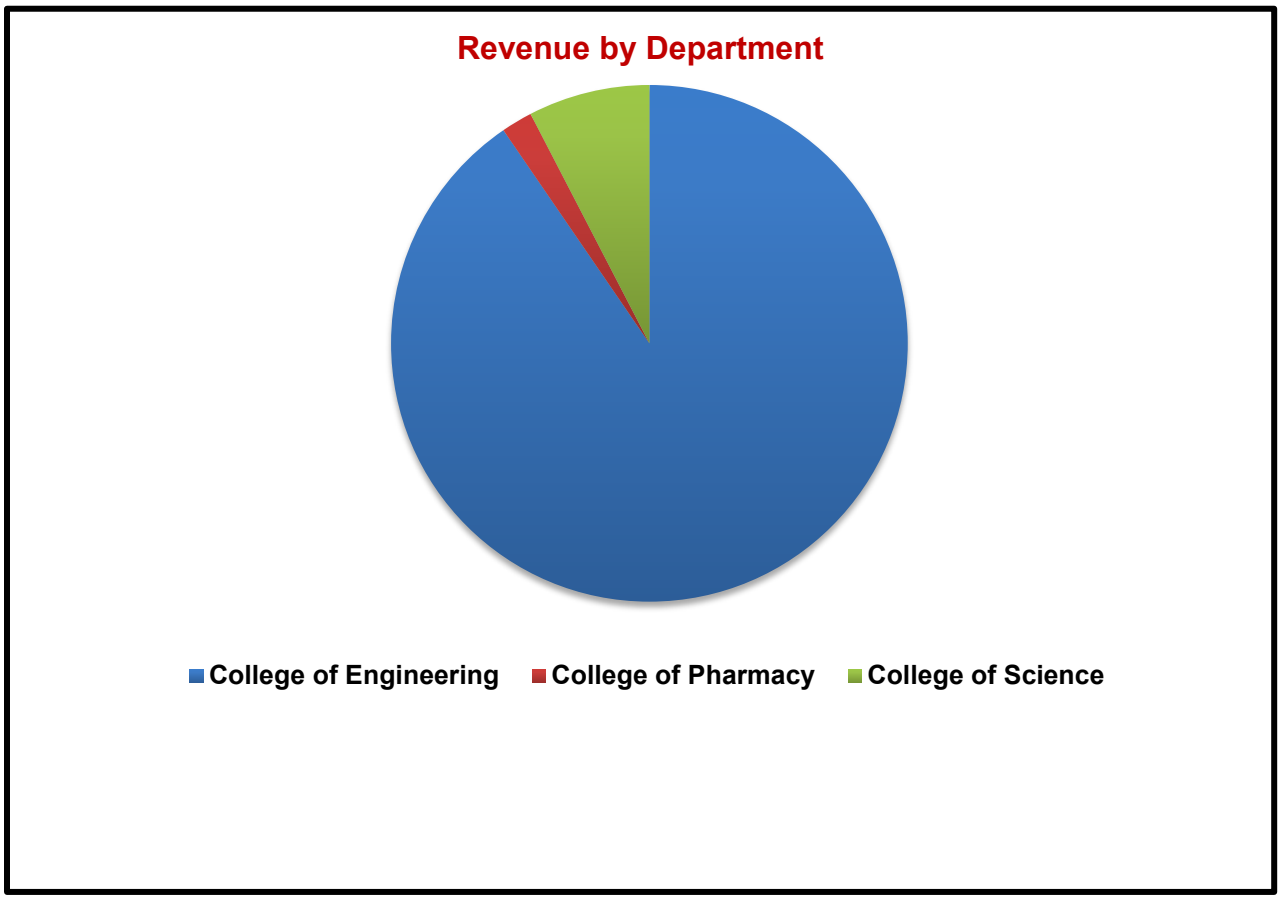


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support

Revenue Generated (see charts following):





Top Users

1	OxEon Energy	Commercial
2	Piersica	Commercial
3	HiFunda, LLC	Commercial
4	Darryl Butt	Department, DOE
5	Eric Eddings	Combustion Resources Partners LLC, DOE, Department
6	Phospholutions	Commercial
7	Qnergy Inc.	Commercial
8	Chen Wang	Department
9	Co-Diagnostics, Inc.	Commercial
10	Lipocine Inc.	Commercial

Publications

No known publications acknowledged this facility in FY23.

Utah Nanofab Administration

Overview

The Utah Nanofab is made up of two labs: a cleanroom, and an electron microscopy and materials characterization lab – the EMSAL. This is the largest academic Nanofab Lab in the Northwestern US, with ~23,000 sq. ft of lab space. The cleanroom has the facilities to fabricate small scale devices and has equipment for: lithography, thin film deposition, etching, packaging, micro 3D printing, laser patterning and more. The EMSAL is the leading EM and materials characterization lab on campus, with 4 SEMs, the only analytical TEM/STEM on campus, XRD, and a variety of other techniques to image and measure the chemical, electrical, optical and mechanical properties of materials. The technical expertise of the Nanofab's staff is essential in making sure that students are properly trained in these capabilities.

In FY23, Utah Nanofab (Cleanroom and EMSAL) have $20M in equipment. There were 104 faculty, 247 students, 15 academic institutions and 73 private companies that used our facilities. The Utah Nanofab is a hub of activity on campus, where our staff guided 35 tours last year for 470 visitors. These include: departmental faculty recruitments, graduate student recruitments, undergraduate and graduate level class demos, local industry representatives and state government officials. Having an outstanding set of instrumentation is critical for attracting the best new faculty to the university. We also teach and host 9 university courses, which teach 150 students. The staff and equipment in the Nanofab are integral to these classes.

https://www.nanofab.utah.edu/

Personnel

- Hanseup Kim, Ph.D., Director
- Berardi Sensale Rodrigez, Ph.D., Associate Director and Faculty Advocate/Cleanroom
- Luisa Whittaker-Brooks, Ph.D., Associate Director and Faculty Advocate/Electron Microscopy and Surface Analysis Lab
- Amy Lash, Administrative Manager
- Brian Baker, Cleanroom Manager
- Brian Van Devener, Ph.D., EMSAL Manager
- Rachel Henderson, Accountant

FY23 Annual Update

- In August 2022, the Utah Nanofab transitioned from Coral to the HSC Cores instrument reservation and billing system.
- In August 2022, the Utah Nanofab transitioned to the HSC ordering and expense tracking system.

Utah Nanofab Administration Revenue & Expenses

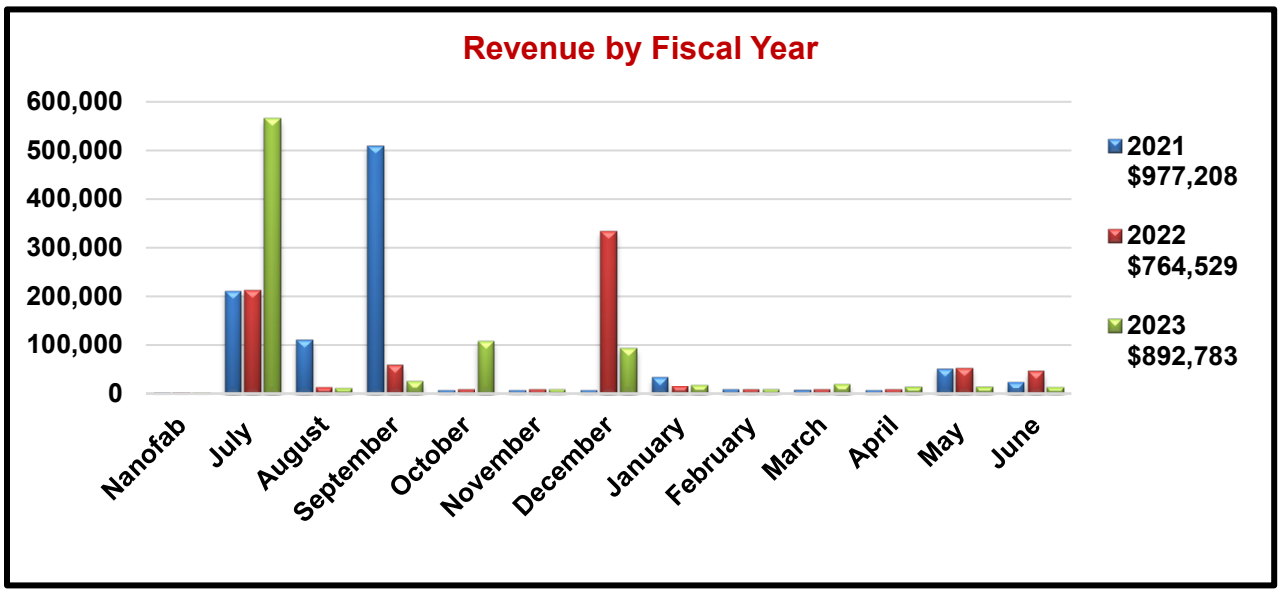
FY23 Expenses: Total $ 1,160,296

The Administration Budget covers the following expenses:

- Salaries/Benefits: $ 290,932
- Fixed Expenses: $ 726,975
- Unanticipated equipment repairs and replacement: $142,389

FY23 Revenues: Total $ 892,783

- FY23 The John & Marcia Price College of Engineering Revenue: $677,998
- Other Sources: $29,586
- FY23 VP for Research: $185,200



* Legend displays total annual revenue by year earned.

Utah Nanofab Cleanroom Facility

Overview
The Utah Nanofab Cleanroom is a state-of-the-art facility that provides access to advanced nanofabrication equipment, expertise, and materials to support research and development across the fields of nanotechnology, microfluidics, nanophotonics, microoptics, microsensors, microelectronics, materials, bio-implantable microdevices, and related areas. Our class 100/1000/10,000 cleanroom provides equipment for nanolithography, thin-film deposition, etching, micro 3D printing, laser patterning, microchip packaging, and more.

Our 4 full-time staff have more than 81 combined years of experience in micro and nanofabrication. The Nanofab Cleanroom has $10M in state-of-the-art equipment available for use. There were 117 students, 62 faculty, 30 private companies and 10 academic institutions that used the Nanofab Cleanroom. Lab members produced 41 peer reviewed publications in 2022-2023.

Services
The Utah Nanofab Cleanroom enables researchers to access facilities, micro/nanofabrication tools, and process design expertise that enable the realization of custom R&D prototype microchips.

- Thin film deposition of insulators, semiconductors, alloys, and precious metals
- Photolithography for patterning micro/nanoscale features on substrates
- Photomask design and fabrication
- Liftoff, wet chemical, and dry plasma etching of thin films on substrates
- Packaging including wafer bonding, wire bonding, and dicing
- 3D printing of micro/nanoscale patterns, devices, and structures
- Microfluidics chip fabrication
- Training and ongoing support to students, researchers, and engineers to enable them to use the equipment and facilities safely, effectively, and efficiently.
- Microchip design and fabrication assistance is available from our professional scientists and engineers. More information at: www.nanofab.utah.edu

FY24 Goals

- Purchase and install e-beam nanolithography tool and install in cleanroom space to enable cutting-edge research in nanoscale devices across the university.
- Purchase and install a replacement for an obsolete and unrepairable Oxford Instruments PECVD/RIE Plasma System.
- Deploy more video training (equipment use and safety) modules for students and researchers.

Equipment (SMBB 2221)

LITHOGRAPHY

- Nanoscribe Professional GT-2 micro/nano 3D printer
- Heidelberg DWL66+ Laser 300nm Pattern Generator
- Heidelberg μPG 101 Laser Pattern Generator (x2)
- Nanofrazor 30nm-200nm nanolithography tool
- EVG EV-420, Suss MA1006 front & backside mask aligner
- Spinners, ovens, hot plates, fume hoods, SRDs, ultrasonic lift-off.

THIN FILM DEPOSITION

- Sputtering: TMV SS-40C, Denton Discovery 18, Denton 635LL, Precious Metals
- Evaporation: Denton e-beam DV-SJ/20C with four hearths
- PECVD: Oxford Plasmalab 80+: □-Si, low-stress Si3N4, SiO2
- CVD: SCS PDS 2010 Parylene-C
- MOCVD: Agnitron Agilis-IH: Gallium Oxide
- ALD: Cambridge Fiji F200 w/ thermal & plasma (Pt, HfO2, ZnO, Al2O3, SiO2, TiO2)
- FURNACES and DIFFUSION (Class 1000)
- LPCVD: Expertech LTO, low-stress Si3N4, polysilicon
- ANNEALING: Allwin 610 RTP/RTA with O2, N2, Ar, H2 forming gas, 200-1250 °C
- FURNACES: ProTemp wet/dry thermal silicon oxidation with DCE

ETCH

- RIE and DRIE: Oxford Plasmalab 100+ ICP DRIE Bosch & cryo, Plasmalab 80+, Plasmatherm 790 metal RIE
- ISOTROPIC: Xactix Xetch XeF2 silicon isotropic dry etch
- WET CHEMICAL: Bold wet benches (acids, bases, organics), Gold wet-etch station

LASER MICROMACHINING

- LaserStar 1900 micro laser welder (1064nm, 150J)
- ULS CO2 flatbed laser (25W + 75W, 1090nm)
- DPSS Samurai UV laser (355nm, 10um spot size, 3 W)

PACKAGING & ASSEMBLY

- EVG 520IS wafer bonder (anodic, eutectic, polymer, fusion)
- Disco DAD 641 & Disco 3220 dicing saws (std or UV tape)
- MEI wedge wirebonder with Au and Al wire

CLEAN MICROFLUIDICS

- SU-8 soft lithography
- Vacuum oven and O_2 RIE for PDMS to glass bonding

CLEANROOM METROLOGY

- JEOL JSM-IT200LV Inspection SEM
- Keyence VHX-5000 3D measuring microscope
- n&k NKT 1500 thin film analyzer with wafer mapping
- Nanometrics NanoSpec 3000 film thickness
- Filmetrics F20 & F40 small spot film thickness
- Magnetron Instruments 4-point probe
- Polyvar Met with DIC + many optical microscopes
- Tencor P-10 and P-20 stylus profilometers
- Tencor Flexus 2320 film stress analyzer

ELECTRICAL TESTING

- Keysight 404A Mixed Signal O-scope
- Keysight E5061B Network Analyzer
- Keithley 4200A semiconductor parameter analyzer probe station

Personnel

- Hanseup Kim PhD, Director
- Brian Baker, Cleanroom Manager
- Eric Fluckiger, Process Engineer
- Joseph Jacob, Research Device Specialist
- Tony Olsen, Process Engineer
- Jim Pierce, Process Engineer
- Steve Pritchett, Process Engineer

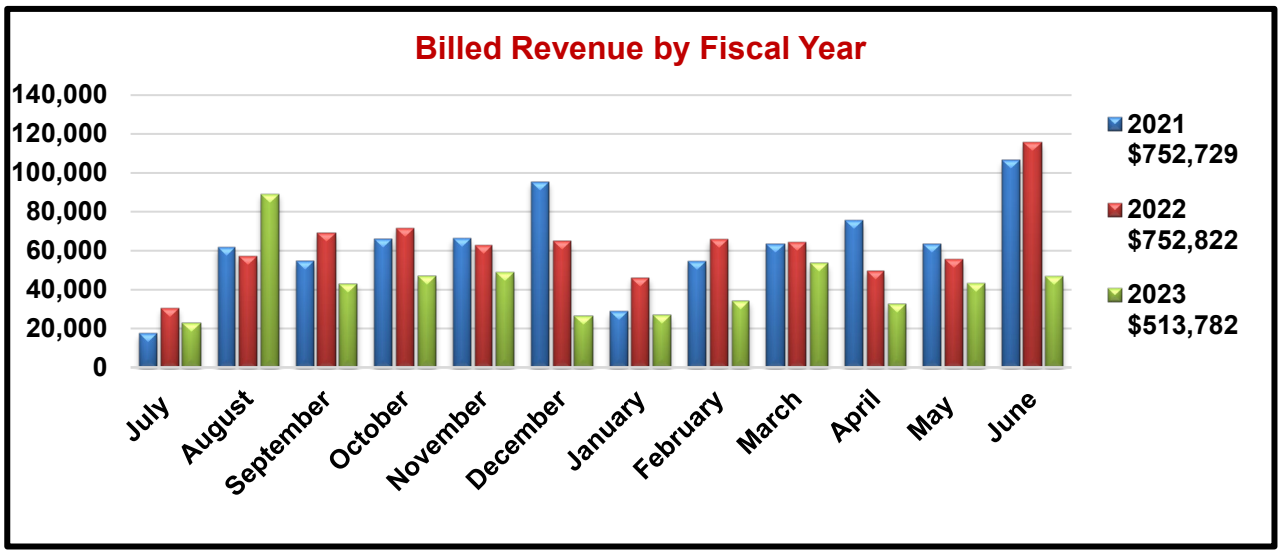
FY23 Annual Update
New Equipment

- Plasmatherm ICP RIE Metal Etcher (Cl_2)
- DPSS Samurai UV Laser
- New UV source for Agnitron MOCVD epitaxial Ga2O3 reactor
- CEE Apogee spinner & hot plate

Revenue/Expenses

FY23 Expenses: **Total $ 1,129,376**
FY23 Revenue: **Total $ 922,906**

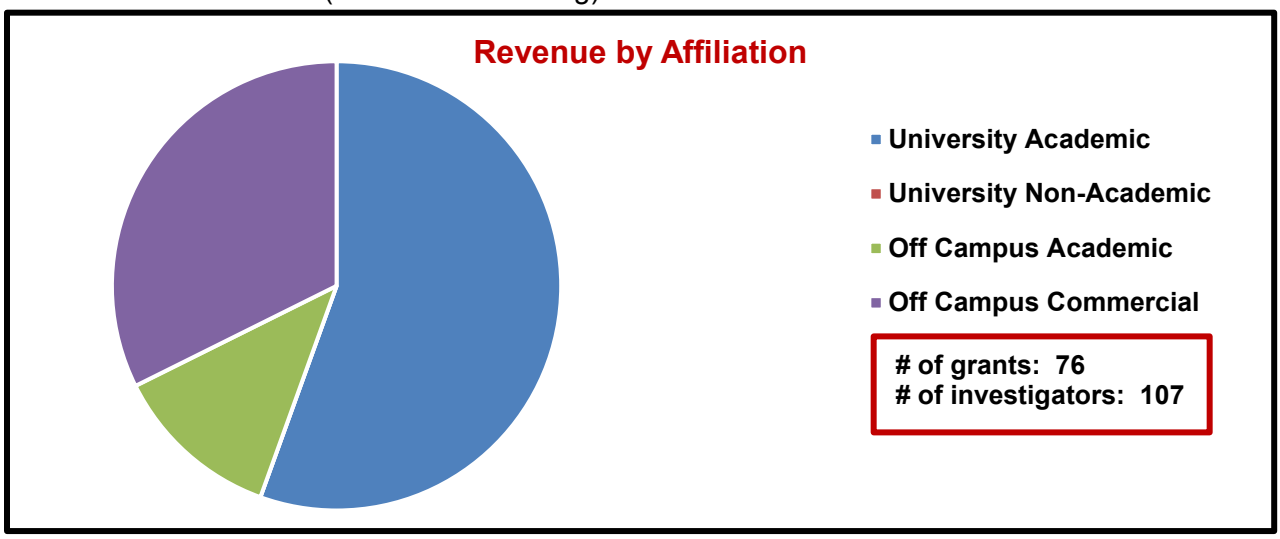
- FY23 Revenue generated from services: $513,782
- VP of Research: $50,000
- The John & Marcia Price College of Engineering: $359,124
- The Nanofab Cleanroom has a monthly cap of $2,500 per total tool use per on-campus lab member, per project. Tool use above the cap is subsidized by the Nanofab Cleanroom. $125,522 in monthly equipment cap credits were issued to on-campus users.

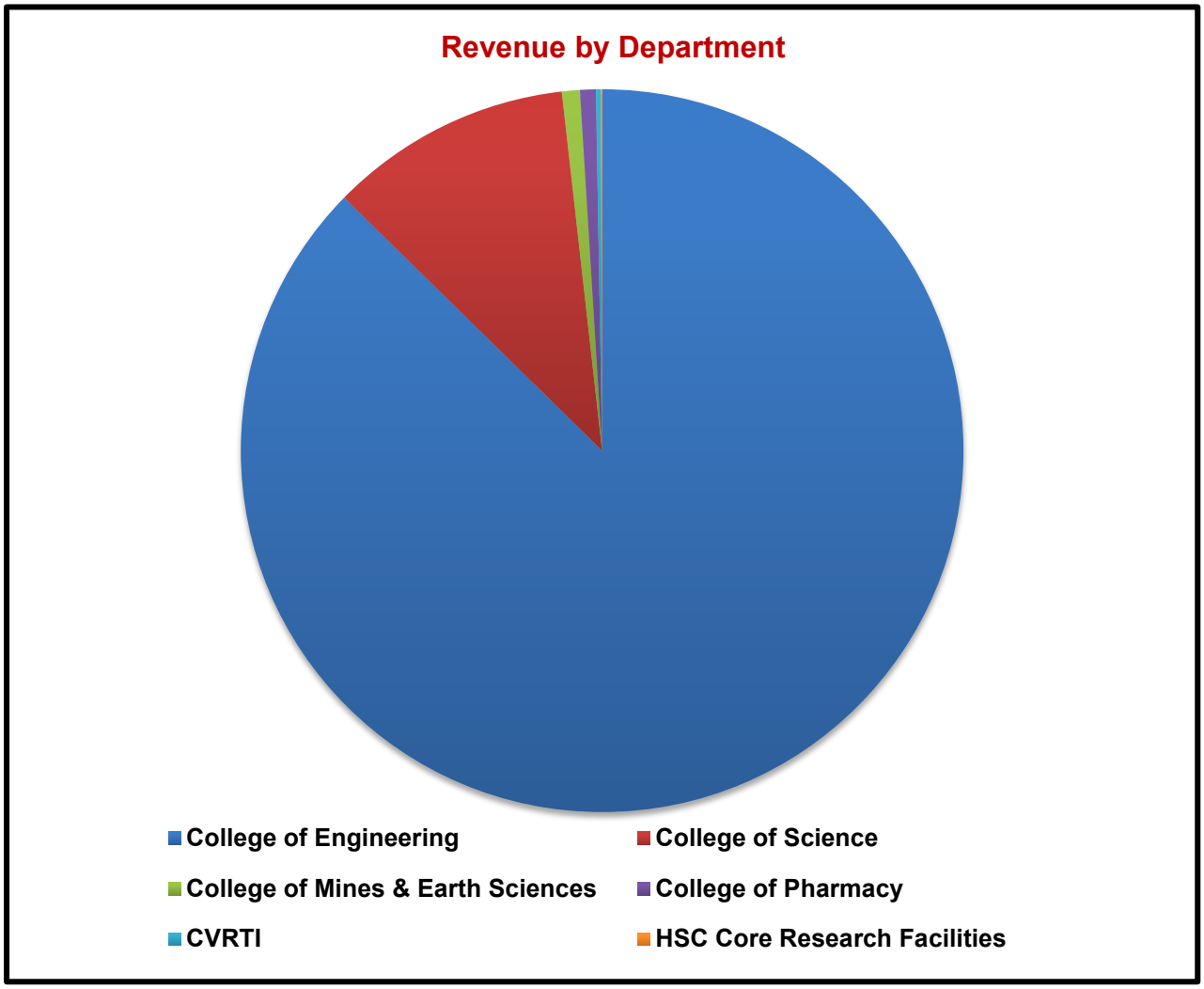


* Legend displays total annual revenue by year earned

FY23 Scientific Impact
Research Support

Revenue Generated (see charts following):





Top Users

1	Mastrangelo, Carlos	Department, DOE, NSF
2	Kim, Hanseup	DOE
3	Texas A&M University	Off Campus Educational
4	Gentex	Commercial
5	Yantao Fan	NIH
6	Blackrock Neurotech	Commercial
7	Electronic Biosciences	Commercial
8	Heayoung Yoon	DOE, NSF
9	1900 Engineering	Commercial
10	Florian Solzbacher	Department, Univ. of Minnesota, Blackrock Microsystem

Publications

1. Bhattacharyya, A., Sharma, S., Alema, F., Ranga, P., Roy, S., Peterson, C., ... & Krishnamoorthy, S. (2022). 4.4 kV β-Ga2O3 MESFETs with power figure of merit exceeding 100 MW cm− 2. Applied Physics Express, 15(6), 061001.
2. Khan, S. U. H., Banerjee, A., Broadbent, S., Noh, S., Kim, K. H., Bulbul, A., ... & Kim, H. (2022). Characterization of a Wake-Up Nano-Gap Gas Sensor for Ultra Low Power Operation. Journal of Microelectromechanical Systems, 31(5), 791-801.
3. Tabib-Azar, M., & Middleton, E. (2022). Electronic Sensors to Detect SARS-CoV-2 Viruses in Real Time. IEEE Sensors Journal.
4. Khan, S. U. H., Karkhanis, M., Hatasaka, B., Tope, S., Noh, S., Bulbul, A., ... & Kim, K. (2022, January). Field Deployment of A Nanogap Gas Sensor For Crop Damage Detection. In 2022 IEEE 35th International Conference on Micro Electro Mechanical Systems Conference (MEMS) (pp. 720-723). IEEE.
5. Ahmad, T., Binder, S., Leber, M., Garrett, T. J., Reiche, C. F., & Solzbacher, F. (2022). Fabrication of polymer membrane-suspended microstructures on printed circuit boards. Journal of Microelectromechanical Systems, 31(3), 435-441.
6. Adhikari, P. R., Reid, R. C., & Mahbub, I. (2022). High power density and bias-free reverse electrowetting energy harvesting using surface area enhanced porous electrodes. Journal of Power Sources, 517, 230726.
7. Estlack, Z., & Kim, J. (2022). Microvalve array fabrication using selective PDMS (polydimethylsiloxane) bonding through Perfluorooctyl-trichlorosilane passivation for long-term space exploration. Scientific Reports, 12(1), 1-10.
8. Kowalchik, T., Khan, F., Roundy, S., & Warren, R. (2022, December). Direct Thermal-to-Electrochemical Energy Conversion Via A Pyroelectrochemical Cell. In 2022 21st International Conference on Micro and Nanotechnology for Power Generation and Energy Conversion Applications (PowerMEMS) (pp. 2-5). IEEE.
9. Kim, J. J., Estlack, Z., Golozar, M., Butterworth, A., & Mathies, R. (2022). Operation of a programmable microfluidic organic analyzer under microgravity conditions simulating space flight environments.
10. Sium, F. S., Khan, S. U. H., Noh, S., Dalapati, R., Zang, L., Mastrangelo, C., & Kim, H. (2022, December). Ultra-Low Power Gas Sensor Based on a 3D Array of Nanogaps. In 2022 21st International Conference on Micro and Nanotechnology for Power Generation and Energy Conversion Applications (PowerMEMS) (pp. 67-70). IEEE.
11. Mahmud, K. R., Bulbul, A., Noh, S., Mastrangelo, C., & Kim, H. (2022, December). Asymmetric Wireless Power Transfer with a Flexible Contact Lens Inductor. In 2022 21st International Conference on Micro and Nanotechnology for Power Generation and Energy Conversion Applications (PowerMEMS) (pp. 54-57). IEEE.
12. Binder, S., Ehrenhofer, A., Ahmad, T., Reiche, C. F., Solzbacher, F., & Wallmersperger, T. (2022, April). Localized actuation of temperature responsive hydrogel-layers with a PCB-based micro-heater array. In Electroactive Polymer Actuators and Devices (EAPAD) XXIV (Vol. 12042, pp. 263-275). SPIE.
13. Fernando, S. I., Martineau, J. T., Vu, T. N., Baker, B., Hobson, R. J., Mueller, B., ... & Gerton, J. M. (2022). A Glass Phase Plate for Wavelength Sensitive Superresolution Microscopy. bioRxiv, 2022-07.
14. Moon, J., Diaz, V., Patel, D., Underwood, R., & Warren, R. (2022). Dissolvable conducting polymer supercapacitor for transient electronics. Organic Electronics, 101, 106412.

15. Ahmed, B., Reiche, C. F., Solzbacher, F., Magda, J., & Körner, J. (2022). Physics-based circuit modeling of the impedance characteristics of a smart hydrogel-actuated bending sensor. Sensors and Actuators A: Physical, 347, 113954.
16. Jia, W., Lou, M., Gopalan, P., Bhattacharyya, A., Krishnamoorthy, S., & Sensale-Rodriguez, B. (2022). On the terahertz response of metal-gratings on anisotropic dielectric substrates and its prospective application for anisotropic refractive index characterization. Journal of Applied Physics, 131(19), 193101.
17. Pandey, S., & Mastrangelo, C. (2022). Towards Transient Electronics through Heat Triggered Shattering of Off-the-Shelf Electronic Chips. Micromachines, 13(2), 242.
18. Ghosh, S., Johnson, M. V., Neupane, R., Hardin, J., Berrigan, J. D., Kalidindi, S. R., & Kong, Y. L. (2022). Machine learning-enabled feature classification of evaporation-driven multi-scale 3D printing. Flexible and Printed Electronics, 7(1), 014011.
19. Estlack, Z., Compton, B., Razu, M. E., & Kim, J. (2022). A simple and reliable microfabrication process for a programmable microvalve array. MethodsX, 9, 101860.
20. Hasan, M., & Blair, S. (2022). Maximizing transmittance in two-photon 3D printed materials for micro-optics in the visible. Optical materials express, 12(3), 895-906.
21. Razaulla, T. M., Young, O. M., Alsharhan, A., Sochol, R. D., & Warren, R. (2022). Deterministic Lateral Displacement Using Hexagonally Arranged, Bottom-Up-Inspired Micropost Arrays. Analytical Chemistry, 94(4), 1949-1957.
22. Majumder, A., Meem, M., Stewart, R., & Menon, R. (2022). Broadband point-spread function engineering via a freeform diffractive microlens array. Optics Express, 30(2), 1967-1975.
23. Ahn, S. Y., Reeder, B., Vazic, B., Dickerson, M., Wheeler, R., & Newell, P. In-Situ Mechanical Characterization of Micro-Architected Porous Structures. Available at SSRN 4276400.
24. Niendorf, K., & Raeymaekers, B. (2022). Using supervised machine learning methods to predict microfiber alignment and electrical conductivity of polymer matrix composite materials fabricated with ultrasound directed self-assembly and stereolithography. Computational Materials Science, 206, 111233.
25. Niendorf, K., & Raeymaekers, B. (2022, April). Fabricating polymer-matrix composite materials with aligned microfibers using ultrasound directed self-assembly and stereolithography. In Proc. of the American Chemical Society Spring Meeting, San Diego, CA (USA), 20-24 March 2022.
26. Powell, K. M., Hsu, Y. L., Roy, E. K., Magginetti, D. J., & Yoon, H. P. (2022, June). Fabrication of Microscale Back-Contact Arrays for Local Charge Transport Measurements. In 2022 IEEE 49th Photovoltaics Specialists Conference (PVSC) (pp. 1-4). IEEE.
27. Feng, H., Patel, D., Magda, J. J., Geher, S., Sigala, P. A., & Gale, B. K. (2022). Multiple-Streams Focusing-Based Cell Separation in High Viscoelasticity Flow. ACS omega, 7(45), 41759-41767.
28. Shiri, F., Feng, H., Petersen, K. E., Sant, H., Bardi, G. T., Schroeder, L. A., ... & Hood, J. L. (2022). Separation of U87 glioblastoma cell-derived small and medium extracellular vesicles using elasto-inertial flow focusing (a spiral channel). Scientific Reports, 12(1), 6146.
29. Feng, H., Jafek, A. R., Wang, B., Brady, H., Magda, J. J., & Gale, B. K. (2022). Viscoelastic particle focusing and separation in a spiral channel. Micromachines, 13(3), 361.
30. Zhao, L., Sidnawi, B., Fan, J., Chen, R., Scully, T., Dietrich, S., ... & Li, B. (2022). Wafer-Scale Full-Coverage Self-Limiting Assembly of Particles on Flexible Substrates. ACS Applied Materials & Interfaces, 14(40), 46095-46102.
31. Bhattacharyya, A., Roy, S., Ranga, P., Peterson, C., & Krishnamoorthy, S. (2022). High-Mobility Tri-Gate β-Ga 2 O 3 MESFETs With a Power Figure of Merit Over 0.9 GW/cm 2. IEEE Electron Device Letters, 43(10), 1637-1640.
32. Alema, F., Peterson, C., Bhattacharyya, A., Roy, S., Krishnamoorthy, S., & Osinsky, A. (2022). Low resistance ohmic contact on epitaxial MOVPE grown β-Ga 2 O 3 and β-(Al x Ga 1− x) 2 O 3 films. IEEE Electron Device Letters, 43(10), 1649-1652.
33. Pourshaban, E., Banerjee, A., Deshpande, A., Ghosh, C., Karkhanis, M. U., Hasan, R., ... & Mastrangelo, C. H. (2022). Flexible and Semi-Transparent Silicon Solar Cells as a Power Supply to Smart Contact Lenses. ACS Applied Electronic Materials, 4(8), 4016-4022.
34. Pourshaban, E., Karkahnis, M. U., Deshpande, A., Hasan, M. R., Rock, N. D., Banerjee, A., ... & Mastrangelo, C. H. (2022, December). Micromachined Flexible Silicon Solar Cells as a Power Supply for Smart Contact Lenses. In 2022 21st International Conference on Micro and Nanotechnology for Power Generation and Energy Conversion Applications (PowerMEMS) (pp. 264-266). IEEE.
35. Cooke, J., Ranga, P., Jesenovec, J., Bhattacharyya, A., Cheng, X., Wang, Y., ... & Sensale-Rodriguez, B. (2022). Photoluminescence microscopy as a noninvasive characterization method for defects in gallium oxide and aluminum gallium oxide epitaxial films. Optical Materials Express, 12(11), 4341-4353.
36. Cooke, J., Ranga, P., Jesenovec, J., McCloy, J. S., Krishnamoorthy, S., Scarpulla, M. A., & Sensale-Rodriguez, B. (2022). Effect of extended defects on photoluminescence of gallium oxide and aluminum gallium oxide epitaxial films. Scientific Reports, 12(1), 3243.

37. Karkhanis, M. U., Banerjee, A., Ghosh, C., Likhite, R., Pourshaban, E., Kim, H., ... & Mastrangelo, C. H. (2022). Compact Models of Presbyopia Accommodative Errors for Wearable Adaptive-Optics Vision Correction Devices. IEEE Access, 10, 68857-68867.
38. Mastrangelo, C. H., Kim, H., & Likhite, R. (2022). U.S. Patent No. 11,408,846. Washington, DC: U.S. Patent and Trademark Office. Laterally actuated amplified capacitive vapor sensor
39. Banerjee, A., Ghosh, C., Karkhanis, M., Deshpande, A., Pourshaban, E., Kim, H., & Mastrangelo, C. H. (2022, November). Microfabricated Low-Profile High Tunable LC Fresnel Lens for Smart Contacts. In 2022 IEEE Photonics Conference (IPC) (pp. 1-2). IEEE.
40. Pourshaban, E., Deshpande, A., Karkhanis, M. U., Banerjee, A., Ghosh, C., Kim, H., & Mastrangelo, C. H. (2022, January). A Micro-Fabricated Aluminum-Air Moving Biofluid Battery For Medical Wearables. In 2022 IEEE 35th International Conference on Micro Electro Mechanical Systems Conference (MEMS) (pp. 608-611). IEEE.
41. Deshpande, A., Ghosh, C., Pourshaban, E., Karkhanis, M. U., Banerjee, A., Kim, H., & Mastrangelo, C. H. (2022, July). High-Toughness Aluminum-N-Doped Polysilicon Wiring for Flexible Electronics. In 2022 IEEE International Conference on Flexible and Printable Sensors and Systems (FLEPS) (pp. 1-4). IEEE.

Utah Nanofab Electron Microscopy and Surface Analysis Lab

Overview

The Nanofab Electron Microscopy and Surface Analysis Lab (EMSAL) provides access, training, and consultation on a wide variety of materials characterization and electron microscopy instruments. We have 4 SEMs, and that capability forms a core part of our services. Three of these are equipped with EDS and EBSD for elemental analysis and crystal orientation mapping, and one is a Focused Ion Beam (dbFIB). We also have the only analytical TEM/STEM on campus, the JEOL 2800. Materials Characterization and Surface Analysis form the next core of our capabilities with: Micro CT, XRD, XPS/AES/ISS/UPS, SAXS/WAXS, XRF, CL, LC MS, nanoindentation, magnetometer, potentiostat, AFM, Ellipsometry, 3D optical profilometry, optical microscopes, and a full suite of sample prep tools for these techniques (coaters, polishers, etc.).

Our 3 full-time staff have more than 45 combined years of experience in electron microscopy and materials characterization. The Nanofab EMSAL has $11.3M in state-of-the-art equipment available for use. There were 199 students, 90 faculty, 64 private companies and 7 academic institutions that used the Nanofab EMSAL last year. Lab members produced 56 peer reviewed publications in 2022-2023.

Services

Microscopy and materials analysis: elemental, chemical, crystal structure, mechanical/electrical/magnetic, optical. Training students to be independent users of all equipment in the lab.

- 2D materials
- Alloys/metals
- Additively manufactured materials
- Medical and dental devices
- Battery materials
- Biomaterials
- Catalysts
- Ceramics
- Composites
- Geologic materials
- Microelectronics
- Nanomaterials and nanoparticles
- Orthopedic implants
- Pharmaceuticals
- Polymers
- Semiconductor materials
- Sensors and devices
- Solar cell materials
- Thin films

FY24 Goals

- Implement a new, annual lab member survey to better serve the faculty and lab members who use the lab.
- Onboard new technical staff member and mentor them to gain proficiency on our equipment and procedures.
- Present a short talk of our capabilities to relevant departments (Chemistry, Biology, Physics, all departments in the John and Marcia Price College of Engineering) at faculty meetings. The goal is to increase faculty awareness of our capabilities and increase utilization of the lab.

Equipment:

Electron Microscopes

- STEM JEOL 2800. Ultrafast EDS, Liquid & gas in-situ TEM, electrochemistry.
- Focused Ion Beam FEI Helios Nanolab 650i. Hi-res, EDS, EBSD, EBL, Pt, W, C dep; XeF2, I2, H2O enhanced etch.
- SEM FEI Quanta 600 FE-ESEM. EDS, EBSD, Environmental SEM, Bruker PI-89 Picoindenter stage.
- SEM FEI Teneo FE-SEM. EDS, EBSD, Trinity imaging detectors.
- SEM JEOL IT200LV. Cleanroom inspection SEM.

Materials Characterization

- Micro CT Zeiss Xradia Versa 620. 4D, non-destructive imaging, in-situ (heating/cooling/tension/compression), Lab DCT (crystallographic imaging).
- XRD Bruker Discover D8 Hi-res. Thin film/powder/crystalline/polycrystalline samples, XRR, RSM, rocking curves, θ/2θ scans, 1100° heating stage.
- Cathodoluminescence (CL) detector (Teneo SEM). Gatan Monarc Pro hyperspectral imaging.
- LC-MS Agilent 6470B.
- SAXS/WAXS/GISAXS Anton Paar SAXSPoint 5.0. In-situ heating/cooling/mechanical loading/humidity.
- XRF EDAX Eagle III Microspot. Microprobe and elemental mapping.
- Nanoindenter Hysitron TI Premier. Heating stage.
- Picoindenter stage for SEM. Bruker PI-89.
- Magnetometer Microsense EZ-7 VSM.
- Potentiostat Gamry Reference 600+

Surface Analysis

- XPS/AES/ISS/UPS Kratos AxisUltra DLD.
- AFM Bruker Icon-PT with KPFM, C-AFM, fluid cell, MFM.
- Ellipsometer Woollam V-VASE spectroscopic.

Optical Microscopes and Profilers

- 3D Optical Profiler Olympus OLS5000 LEXT.
- Optical Comparitor Vertex 220 microVu
- Optical Microscope Reichert Polyvar with BF, DF, DIC.

Sample Preparation

- Sample coating for SEM imaging (Au/Pd, C, Cr): Leica ACE600, Gatan PECS1
- Mechanical polishing: suite of tools for SEM/TEM prep
- Sectioning: Techcut 4 saw
- Ion-milling: Fischione 1060 and Gatan PIPS/PECS

FY23 Annual Update

New Equipment

- Micro CT Zeiss Xradia Versa 620
- XRD Bruker Discover D8 Hi-res
- AFM Bruker Icon-PT: updated and added KPFM and CAFM
- Cathodoluminescence (CL) detector (Teneo SEM)
- LC MS Agilent 6470B
- SEM JEOL IT200LV W-filament SEM

Personnel

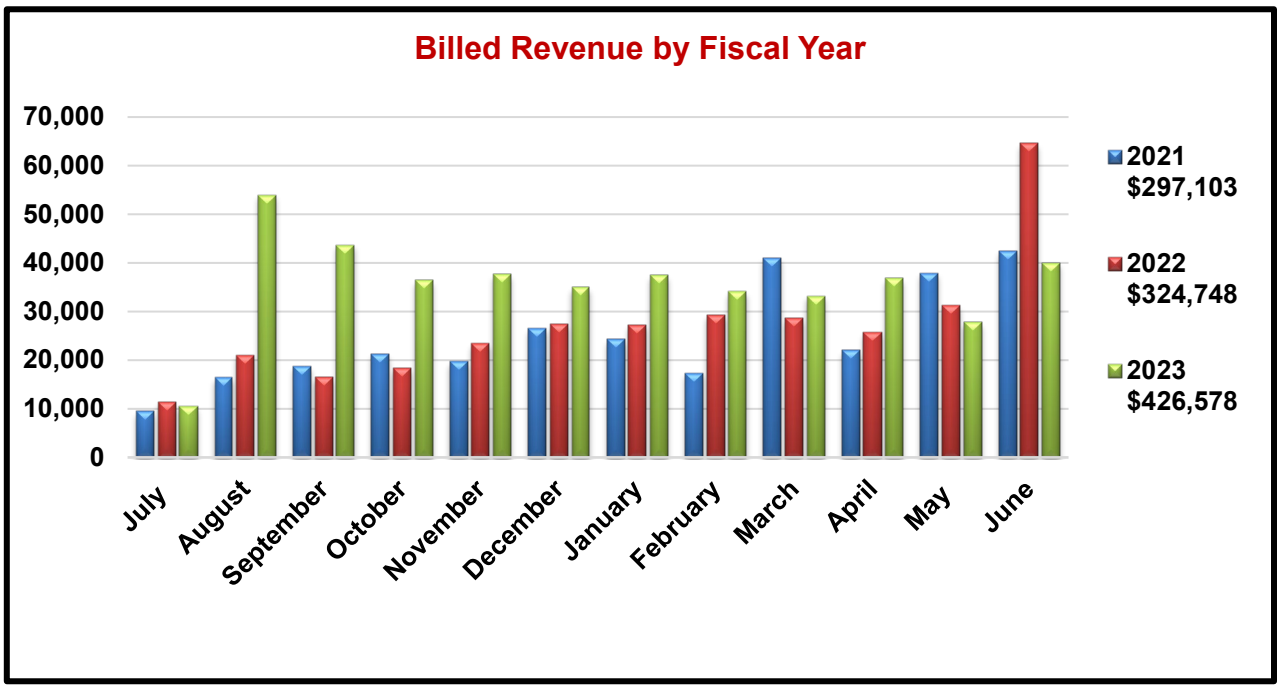
- Hanseup Kim Ph.D., Director
- Brian Van Devener, Ph.D., Lab Manager and Surface Scientist
- Paulo Perez, Ph.D., Materials Scientist
- Randal Polson, Ph.D., Research Associate

Revenue/Expenses

FY23 Expenses: **Total $ 581,171**

FY23 Revenue: **Total $ 879,485**

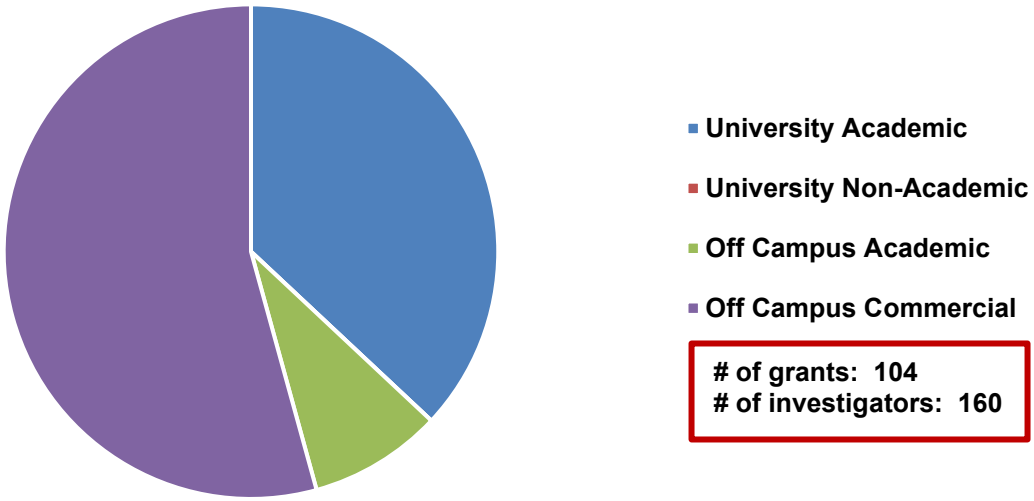
- FY23 VP of Research: $50,000
- FY23 Revenue from Services: $426,578
- FY23 The John & Marcia Price College of Engineering: $326,551
- RIF Award $76,356- Upgrade to AFM



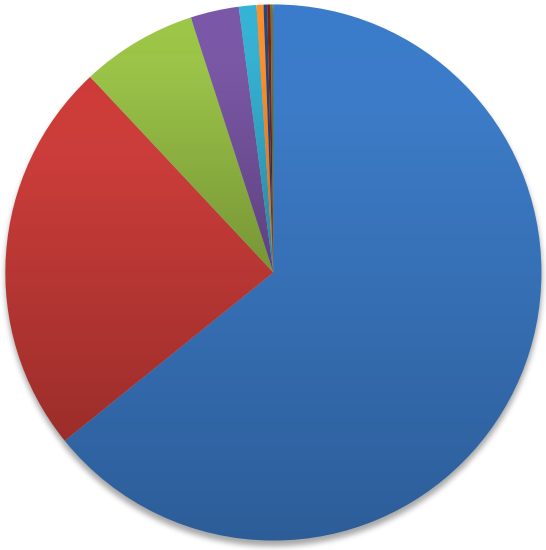
*Legend displays total annual revenue by year earned.

FY23 Scientific Impact
Research Support
Revenue Generated (see charts following)

Revenue by Affiliation



Revenue by Department



Top Users

1	Gentex Corporation	Commercial
2	Comet Research Group	Commercial
3	EVOQ Nano	Commercial
4	Roseanne Warren	Department
5	University of Nevada, Reno	Off Campus Educational
6	Connor Bischak	Department
7	Carterra, Inc.	Commercial
8	Forge Nano	Commercial
9	Ming Lee Tang	Department, DOE, NSF
10	Luther McDonald	DOE

Publications

1. Abali, B.E., B. Vazic, and P. Newell, Influence of microstructure on size effect for metamaterials applied in composite structures. Mechanics Research Communications, 2022. 122.
2. Abbott, E.C., et al., Thermodynamic evaluation of the uranyl peroxide synthetic route on morphology. Journal of Nuclear Materials, 2022. 561.
3. Alnaser, H.F., S.J. Smith, and T.D. Sparks, Structural investigations of the Bi2–xSbxTe3–ySey topological insulator. Journal of Solid State Chemistry, 2023. 320: p. 123868.
4. Banerjee, D. and T.D. Sparks, Comparing transfer learning to feature optimization in microstructure classification. iScience, 2022. 25(2).
5. Baral, P., et al., Efficient and stable perovskite solar cells based on blade-coated CH3NH3PbI3 thin films fabricated using “green” solvents under ambient conditions. Organic Electronics, 2023. 116: p. 106763.
6. Baskaran, K., et al., Membrane synthesis via in-situ pore formation in silica gels through dynamic miscibility with soybean oil. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 2022. 636(5).
7. Brindle, J., S. Abu Sufyan, and M.M. Nigra, Support, composition, and ligand effects in partial oxidation of benzyl alcohol using gold–copper clusters. Catalysis Science and Technology, 2022. 12: p. 3846–3855.
8. Brindle, J. and M.M. Nigra, The role of water and copper oxide in methane oxidation using AuPd nanoparticle catalysts. Chemical Engineering Journal, 2022. 446.
9. Burnett, J.W.H., et al., Supported Pt Enabled Proton-Driven NAD(P)+ Regeneration for Biocatalytic Oxidation. ACS Applied Materials and Interfaces, 2022. 14(18): p. 20943–20952.
10. Cavanaugh, S.J. and J. Weidhaas, Response surface methodology for performance evaluation of insensitive munitions wastewater membrane filtration. Cleaner Engineering and Technology, 2023. 12: p. 100603.
11. Charde, R.P., B. van Devener, and M.M. Nigra, Surfactant- and Ligand-Free Synthesis of Platinum Nanoparticles in Aqueous Solution for Catalytic Applications. Catalysts, 2023. 13(2).
12. Chernyshev, V.S., et al., Dynamic surface tension probe for measuring the concentration of extracellular vesicles. Biochemical and Biophysical Research Communications, 2022. 609: p. 189-194.
13. Cogan, G., et al., Electroencephalography (eeg) electrode arrays and related methods of use. 2022.
14. Cooke, J., Optical and Structural Properties of Gallium Oxide and Aluminum Gallium Oxide Alloys: A Characterization of the Effects of Extended Defects. 2022, University of Utah: Salt Lake City, Utah. p. 24.
15. Cooke, J., et al., Sympetalous defects in metalorganic vapor phase epitaxy (MOVPE)-grown homoepitaxial β-Ga2O3 films. Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films, 2023. 41(1): p. 013406.
16. Cooke, J., et al., Photoluminescence microscopy as a noninvasive characterization method for defects in gallium oxide and aluminum gallium oxide epitaxial films. Optical Materials Express, 2022. 12(11): p. 4341-4353.
17. Cooke, J., et al., Effect of extended defects on photoluminescence of gallium oxide and aluminum gallium oxide epitaxial films. Scientific Reports, 2022. 12: p. 3243.
18. Fernquist, J.R., H.C. Fu, and S.E. Naleway, Improved structural and mechanical performance of iron oxide scaffolds freeze cast under oscillating magnetic fields. Ceramics International, 2022. 48(11): p. 15034-15042.
19. Flannery, L., et al., Voltage Bias Stress Effects and Electronic Stability of π-Conjugated Crosslinked Tin Halide Perovskites. ACS Applied Energy Materials, 2022. 5(12): p. 14720-14731.

20. Freitag, N.H., et al., Simultaneous magnetic field and field gradient mapping of hexagonal MnNiGa by quantitative magnetic force microscopy. Communications Physics, 2023. 6(1): p. 11.
21. Handy, J.V., et al., A “Li-Eye” View of Diffusion Pathways in a 2D Intercalation Material from Topochemical Single-Crystal Transformation. ACS Energy Letters, 2022. 7(6): p. 1960–1962.
22. Harwoodx, S.J., et al., Modular terpene synthesis enabled by mild electrochemical couplings. Science, 2022. 357(6582): p. 745-752.
23. Hayward, T.M., et al., Multilevel diffractive lens in the MWIR with extended depth-of-focus and wide field-of-view. Optics Express, 2023. 31(10): p. 15384-15391.
24. Isaacson, K.J., et al., Liquid-cell transmission electron microscopy for imaging of thermosensitive recombinant polymers. Journal of Controlled Release, 2022. 344: p. 39-49.
25. Jeyapalina, S., et al., Implantable bone scaffolds including at least one integration aid, methods of making and using the same, U.S.P. Office, Editor. 2023, University of Utah Research Foundation UURF: United States.
26. Jeyapalina, S., et al., Fluorapatite and fluorohydroxyapatite apatite surfaces drive adipose-derived stem cells to an osteogenic lineage. Journal of the Mechanical Behavior of Biomedical Materials, 2022. 125(2022): p. 104950.
27. Jin, J., et al., Nanopore networks in colloidal silica assemblies characterized by XCT for confined fluid flow modeling. Journal of Petroleum Science and Engineering, 2022. 208: p. 109780.
28. Khateeb, S.A., et al., Exploration of fluorapatite bio-ceramic thin film deposition by ultrasonic spray pyrolysis. Journal of Materials Research, 2023: p. 1-15.
29. Kowalchik, T., et al., Effect of pore structure on the piezoelectric properties of barium titanate-polyvinylidene fluoride composite films. Nano Energy, 2023. 109: p. 108276.
30. Lim, T., et al., Conductive Polymer Enabled Biostable Liquid Metal Electrodes for Bioelectronic Applications. Advanced Healthcare Materials, 2022. 11(11).
31. Lin, A.H., et al., Collagen fibrils from both positional and energy-storing tendons exhibit increased amounts of denatured collagen when stretched beyond the yield point. Acta Materialia Inc, 2023. 155(461-470).
32. Marthi, R., et al., Role of stacking faults and hydroxyl groups on the lithium adsorption/desorption properties of layered H2TiO3. Materials Today Advances, 2022. 14.
33. Mohammapdour, R. and H. Ghandehari, Mechanisms of immune response to inorganic nanoparticles and their degradation products. Advanced Drug Delivery Reviews, 2022. 180.
34. Mohammed, A.K., et al., Solvent-Influenced Fragmentations in Free-Standing Three-Dimensional Covalent Organic Framework Membranes for Hydrophobicity Switching. Angewandte Chemie International Edition, 2022. 61(13).
35. Moon, J., et al., Dissolvable conducting polymer supercapacitor for transient electronics, Organic Electronics. Organic Electronics, 2022. 101.
36. Nizinski, C.A., et al., Characterization of uncertainties and model generalizability for convolutional neural network predictions of uranium ore concentrate morphology. Chemometrics and Intelligent Laboratory Systems, 2022. 225: p. 104556.
37. Porter, D.L., et al., The melanized layer of Armillaria ostoyae rhizomorphs: Its protective role and functions. Journal of the Mechanical Behavior of Biomedical Materials, 2022. 125(2022): p. 104934.
38. Porter, D.L. and S.E. Naleway, Hyphal systems and their effect on the mechanical properties of fungal sporocarps. Acta Biomaterialia, 2022. 145: p. 272-282.
39. Pourshaban, E., et al., Flexible and Semi-Transparent Silicon Solar Cells as a Power Supply to Smart Contact Lenses. ACS Applied Electronics Materials, 2022. 4(8): p. 4016–4022.
40. Pourshaban, E., et al., Eye Tear Activated Mg-Air Battery Driven by Natural Eye Blinking for Smart Contact Lenses. Advanced Materials Technologies, 2023. 8(1): p. 2200518 (1-10).
41. Rodriguez, B.S., et al., Ultra-compact inductor made of 3D Dirac semimetal, U.S.P. Office, Editor. 2023, The University of Utah Research Foundation.
42. Salehi, S.-D., R. Beal, and O.T. Kingstedt, Dynamic behavior and thermomechanical characterization of laser powder bed fusion and wrought Ti–6Al–4V. International Journal of Impact Engineering, 2023. 176: p. 104552.
43. Salehi, S.-D. and O. Kingstedt, Critical assessment and demonstration of high-emissivity coatings for improved infrared signal quality for Taylor–Quinney coefficient experimentation. International Journal of Impact Engineering, 2023. 178: p. 104593.
44. Scarpulla, M.A., et al., CdTe-based thin film photovoltaics: Recent advances, current challenges and future prospects. Solar Energy Materials and Solar Cells, 2023. 255: p. 112289.
45. Song, Y., et al., Ultra-Wide Band Gap Ga2O3-on-SiC MOSFETs. ACS Applied Materials and Interfaces, 2022. 15(5): p. 7137-7147.
46. Srinivasan, R. and K.R. Chandran, Mechanistic insights into structural parameters maximizing energy storage density in Si mesoporous electrodes for Li-ion batteries. Journal of Power Sources, 2023. 556.
47. Srinivasan, R., et al., In-Operando Neutron Diffraction Investigation of Structural Transitions during Lithiation of Si Electrode in Li-Ion Battery. Journal of The Electrochemical Society, 2022. 169(10): p. 100545.

48. Stein, N., A. Podder, and R. Goel, Biodegradation of insensitive munition (IM) formulations: IMX-101 and IMX-104 using aerobic granule technology. Journal of Hazardous Materials, 2023. 449.
49. Stein, N., et al., Simultaneous reduction of perchlorate and nitrate using fast-settling anoxic sludge. Chemosphere, 2022. 286(2022).
50. Veit, J.G.S., M. Weidow, and M.A. Serban, A versatile, bioengineered skin reconstruction device designed for use in austere environments. Frontiers in Bioengineering and Biotechnology, 2023. 11.
51. Wang, Q., et al., Unveiling the Pitfalls of Comparing Oxygen Reduction Reaction Kinetic Data for Pd-Based Electrocatalysts without the Experimental Conditions of the Current–Potential Curves. ACS Energy Letters, 2022. 7(3): p. 952–957.
52. Weliwatte, N.S., et al., Three-Stage Conversion of Chemically Inert n-Heptane to α-Hydrazino Aldehyde Based on Bioelectrocatalytic C–H Bond Oxyfunctionalization. ACS catalysis, 2022. 13(1): p. 563-572.
53. Xue, Q., et al., CO2-induced evolution of chemical, structural and mechanical properties of reinforced concrete: A review. Construction and Building Materials, 2022. 353: p. 129069.
54. Yang, C. and K.R. Chandran, A critical review of silicon nanowire electrodes and their energy storage capacities in Li-ion cells. RSC advances, 2023. 13(6): p. 3947-3957.
55. Yomogida, Y., et al., Hall effect in gated single-wall carbon nanotube films. Scientific Reports, 2022. 12(101).
56. Zhou, C., et al., In situ formation of nanocrystalline MgH2 through room temperature hydrogenation. Materials and Design, 2022. 218.

HEALTH
UNIVERSITY OF UTAH

POWDER

Overview

POWDER is an end-to-end platform for conducting research on mobile wireless networks. With equipment distributed across the University of Utah campus, POWDER provides radios that are programmable down to the waveform, attached to a network that can be configured by the user, connected to a wide variety of compute, storage, and cloud resources. Each wireless base station in POWDER includes a number of SDRs, an RF front end and antennas, a complement of control hardware for managing and accessing the devices, and a fiber connection to a near-edge compute cluster. Specialized massive multi-input multi-output (mMIMO) base stations consist of SDRs and antennas in a dedicated configuration to support mMIMO research. In addition to base stations, POWDER provides both fixed-location and mobile (shuttle-based) wireless endpoints with SDR, RF, and control resources similar to that found at the base stations. While most of POWDER's wireless sites are outdoors, POWDER includes an indoor lab for performing more controlled and smaller-scale wireless experiments. Researchers can use the POWDER platform to build their own wireless networks, using existing protocols or technologies (such as 4G, 5G, and MIMO), up-and-coming ones (such as massive MIMO), or new ones that they invent and build from the ground up. In this environment, they can experiment with novel networks, devices, and applications.

Services

POWDER provides researchers with remote, over-the-Internet access to equipment, software, configurations, and data for carrying out experiments. A user begins an experiment by visiting POWDER's web portal and provisioning a "slice" of the facility. The researcher interacts with the resources in that slice via standard Internet tools and protocols to orchestrate and conduct experiments. POWDER staff provide training and assistance to users of the facility: e.g., design expertise, on-site equipment management, and problem diagnosis and resolution.

Equipment

- 9 rooftop base stations
- 6 "dense deployment" (lamppost) base stations
- 3 massive MIMO rooftop base stations and 4 clients
- 10 fixed-location wireless endpoints
- 17 mobile wireless endpoints
- 2 portable wireless endpoints
- front-haul fiber network and near-edge compute: CWDM + 19 compute servers + GPU
- metro cloud (Emulab/CloudLab): 100s of compute servers
- indoor over-the-air laboratory: 4 base station-class radios + 4 endpoint-class radios
- indoor controlled RF environment: 8 radios + programmable wired RF switching fabric
- RF bench: 3 directly wired radio pairs

Personnel

- Jacobus Van der Merwe, PhD, PI and Director
- Eric Eide, PhD, Co-PI
- Robert Ricci, PhD, Co-PI

- Kirk Webb, MS, Associate Director
- Jonathon Duerig, BS, Research Associate
- Mike Hibler, MS, Systems Programmer
- David M. Johnson, MS, Research Associate
- Dustin Maas, PhD, Research Associate
- Alex Orange, BS, Research Associate
- Dan Reading, Technician
- Leigh Stoller, MS, Systems Programmer
- Gary Wong, MS, Research Associate
- Sam Zachary, BS, Technician

Advisory Board Committee

Last meeting date: March 10, 2022.

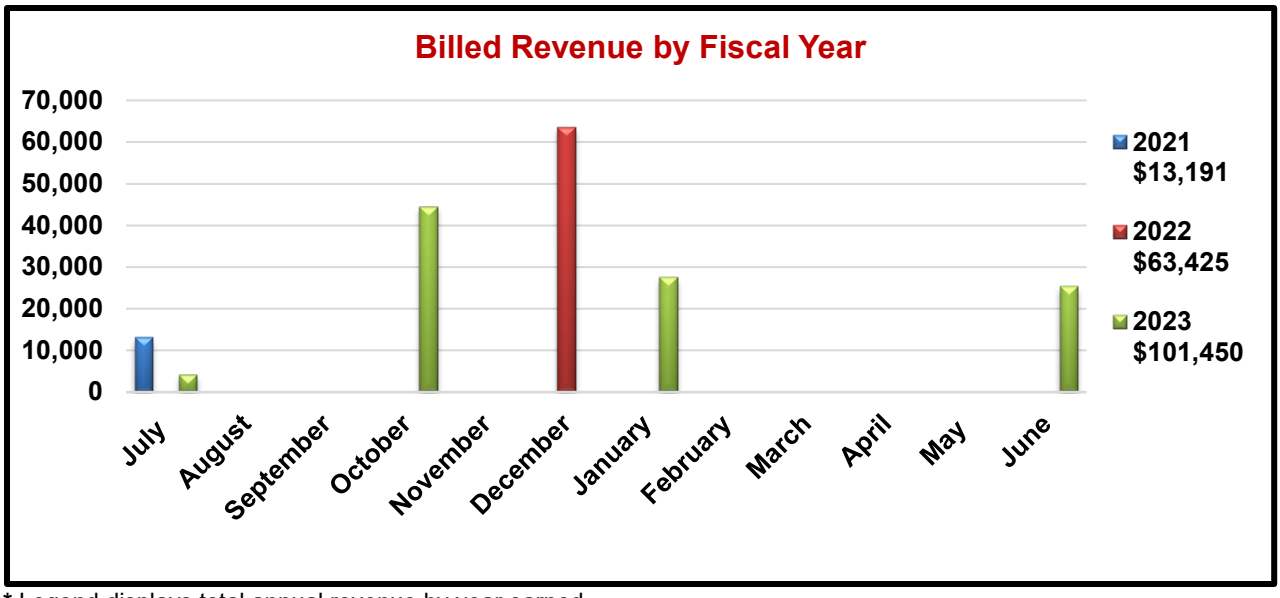
- Suman Banerjee, PhD, Professor, University of Wisconsin-Madison
- Arup Bhuyan, PhD, Technical Director, Idaho National Laboratory
- David DeTienne, PhD, Principal Engineer, Raytheon Technologies
- Monisha Ghosh, PhD, Professor, University of Notre Dame
- Raymond Knopp, PhD, Professor, EURECOM
- Zhi-Li Zhang, PhD, Professor, University of Minnesota
- Lin Zhong, PhD, Professor, Yale University

Revenue/Expenses

FY23 Expenses: **Total $13,088**

FY23 Revenue: **Total $101,450**

- VP of Health Sciences Support: $ 0
- FY23 revenue generated from services: $101,450

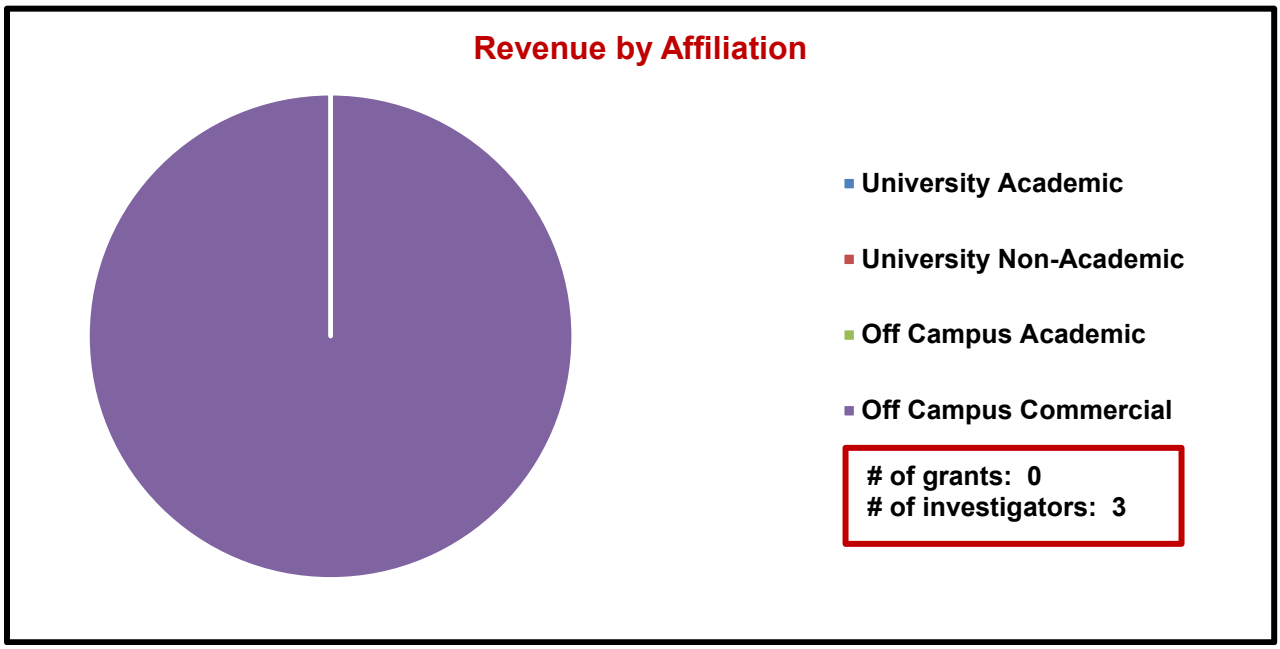


* Legend displays total annual revenue by year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts following):



Top Users

1	O-Ran Alliance	Commercial
2	AT&T	Commercial
3	National Telecommunications and Information Administration	Commercial

Publications

1. Bonati, L., M. Polese, S. D'Oro, S. Basagni and T. Melodia (2023). OpenRAN Gym: AI/ML development, data collection, and testing for O-RAN on PAWR platforms. Computer Networks **220**: 109502.10.1016/j.comnet.2022.109502
2. Chuprov, S., Khokhlov, I., Reznik, L., Shetty, S. (2022, July). Influence of transfer learning on machine learning systems robustness to data quality degradation. In *2022 international joint conference on neural networks (IJCNN)* (pp. 1–8). 10.1109/IJCNN55064.2022.9892247
3. Chuprov, S., Satam, A. N., Reznik, L. (2022, November). Are ML image classifiers robust to medical image quality degradation? In *2022 IEEE western New York image and signal processing workshop (WNYISPW)* (pp. 1–4). 10.1109/WNYISPW57858.2022.9983488
4. Sharma, S., Urumkar, S., Fontanesi, G., Karanam, V. S. S. L., Hu, B., Ramamurthy, B., Nag, A. (2022, July). Towards emulation of intelligent IoT networks on EU-US testbeds. In *2022 international seminar on intelligent technology and its applications (ISITIA)* (pp. 484–489). 10.1109/ISITIA56226.2022.9855352
5. Tadik, S., Varner, M. A., Mitchell, F., Durgin, G. D. (2023). Augmented RF propagation modeling. *IEEE Journal of Radio Frequency Identification, 7,* 211–221. 10.1109/JRFID.2023.3285452
6. Varner, M. A., Mitchell, F., Wang, J., Webb, K., Durgin, G. D. (2022, October). Enhanced RF modeling accuracy using simple minimum mean-squared error correction factors. In *2022 IEEE 2nd international conference on digital twins and parallel intelligence (DTPI)* (pp. 1–5). 10.1109/DTPI55838.2022.9998888

Scalable Analytics & Informatics

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 (USAI) 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 and chart review products help machines and subject matter experts mark-up and abstract data for classification. Natural Language Processing (NLP) processes text data to extract structured data to infer concepts that can be understood by machines and humans for further analysis. USAI's annotation and chart review 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 parts 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. Natural language processing algorithms can help automate the identification of relevant clinical data from the medical record. Data science and machine learning are new areas that expand the capability from traditional statistical modeling. USAI provides Enterprise Architecture and Application Development and has developed tools to improve efficiency and outcomes in health services research, reduces the costs to researchers. 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
- Data Science and Machine Learning
- Enterprise Architecture and Application Development

Consultation is provided 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.

FY24 Goals
USAI has lost some key members of our natural language processing, data and analytics, and data science and machine learning service lines to companies in the technology and healthcare industries. We have been working on recruitment. In addition, we have made great advances in designing the next generation chart review tool, called Abstract, and new methods for probabilistic phenotyping that are ongoing. We have also implemented transformer models into our Natural Language Processing team and are planning how to incorporate Large Language Models in FY24.

Specialized Software
Chart Review
- eHOST
- ChartReview
- Abstract

Natural Language Processing
- Leo
- Chex
- MedSpaCy

Clinical Trial Management
- ProjectFlow

Data Exploration and Visualization
- OHDSI Atlas

Personnel
- Scott L DuVall, PhD, Director
- Patrick Alba, NLP Analyst
- Lacy Castleton, Clinical Annotator
- Hannah Eyre, NLP Analyst
- Jeffrey Ferraro, Data Science Lead
- Kristi Gregory, Clinical Annotator
- Kelli Henricksen, Clinical Annotator
- Brent Hill, Annotation Manager
- David Kotter, Clinical Annotator
- Chris Ledding, Financial Analyst
- Qingzhu Liu, Software Designer and Programmer
- Sally MacDonald, Clinical Annotator
- Tiffany Quilter, Clinical Annotator
- Hamid Saoudian, Enterprise Architect
- Ramana Seerapu, IT Project Manager
- Cara Shimizu, Clinical Annotator
- Denise Stone, Clinical Annotator
- Shaoyu Su, Software Designer and Programmer
- Alexis Tabish, Clinical Annotator

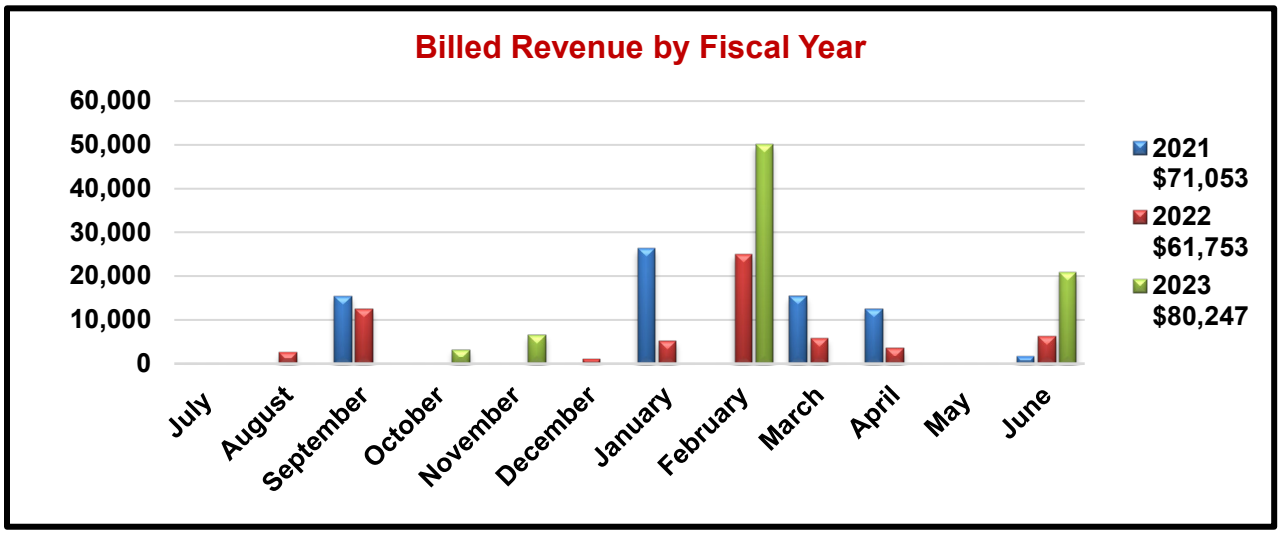
Management Meeting
Last meeting date: We meet weekly on Wednesday afternoons.
- Scott L DuVall, PhD, Director
- Christopher Ledding, MBA, Financial Analyst

Revenue/Expenses

FY23 Expenses: $44,826

FY23 Revenue: $80,247

- VP of Research Support: $0
- Revenue generated from services: $80,247

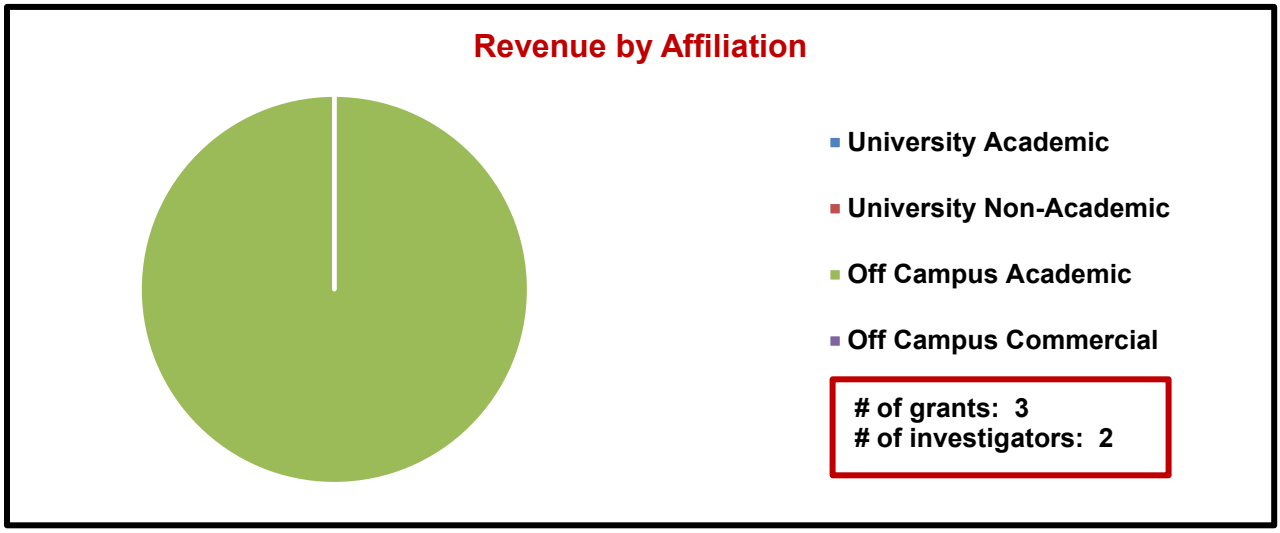


* Legend displays total annual revenue by fiscal year earned.

FY23 Scientific Impact

Research Support

Revenue Generated (see charts):



Top Users

1	University of Pennsylvania	Off Campus Academic
2	Emory University	Off Campus Academic
3	Vanderbilt University Medical Center	Off Campus Academic

Publications

1. Hung, A., D. Candelieri, Y. Li, P. Alba, B. Robison, F. Agiri, C. Perez, K. M. Lee, K. N. Maxwell, W. Li, H. Aggarwal, K. Pridgen, S. D. Reed, S. DuVall, Y. N. Wong and J. A. Lynch (2023). Tumor testing and treatment patterns in veterans with metastatic castration-resistant prostate cancer. Semin Oncol **50**(1-2): 11-24.10.1053/j.seminoncol.2023.03.001
2. Ostropolets, A., Y. Albogami, M. Conover, J. M. Banda, W. A. Baumgartner, C. Blacketer, P. Desai, S. L. DuVall, S. Fortin, J. P. Gilbert, A. Golozar, J. Ide, A. S. Kanter, D. M. Kern, C. Kim, L. Y. H. Lai, C. Li, F. Liu, K. E. Lynch, E. Minty, M. I. Neves, D. Q. Ng, T. Obene, V. Pera, N. Pratt, G. Rao, N. Rappoport, I. Reinecke, P. Saroufim, A. Shoaibi, K. Simon, M. A. Suchard, J. N. Swerdel, E. A. Voss, J. Weaver, L. Zhang, G. Hripcsak and P. B. Ryan (2023). Reproducible variability: assessing investigator discordance across 9 research teams attempting to reproduce the same observational study. J Am Med Inform Assoc **30**(5): 859-868.10.1093/jamia/ocad009
3. Pav, V., A. Burns, C. Colahan, B. Robison, J. Kean and S. DuVall (2022). Illustration of Continuous Enrollment and Beneficiary Categorization in DoD and VA Infrastructure for Clinical Intelligence. Mil Med.10.1093/milmed/usac352
4. Bryant, A. K., K. M. Lee, P. R. Alba, J. D. Murphy, M. E. Martinez, L. Natarajan, M. D. Green, R. T. Dess, T. R. Anglin-Foote, B. Robison, S. L. DuVall, J. A. Lynch and B. S. Rose (2022). Association of Prostate-Specific Antigen Screening Rates With Subsequent Metastatic Prostate Cancer Incidence at US Veterans Health Administration Facilities. JAMA Oncol **8**(12): 1747-1755.10.1001/jamaoncol.2022.4319
5. Aday, A. W., M. S. Duncan, O. V. Patterson, S. L. DuVall, P. R. Alba, C. W. Alcorn, H. A. Tindle, M. A. Creager, M. P. Bonaca, S. M. Damrauer, Q. S. Wells, A. Behroozian, J. A. Beckman and M. S. Freiberg (2022). Association of Sex and Race With Incident Peripheral Artery Disease Among Veterans With Normal Ankle-Brachial Indices. JAMA Netw Open **5**(11): e2240188.10.1001/jamanetworkopen.2022.40188
6. Nishimura, A., J. Xie, K. Kostka, T. Duarte-Salles, S. Fernandez Bertolin, M. Aragon, C. Blacketer, A. Shoaibi, S. L. DuVall, K. Lynch, M. E. Matheny, T. Falconer, D. R. Morales, M. M. Conover, S. Chan You, N. Pratt, J. Weaver, A. G. Sena, M. J. Schuemie, J. Reps, C. Reich, P. R. Rijnbeek, P. B. Ryan, G. Hripcsak, D. Prieto-Alhambra and M. A. Suchard (2022). International cohort study indicates no association between alpha-1 blockers and susceptibility to COVID-19 in benign prostatic hyperplasia patients. Front Pharmacol **13**: 945592.10.3389/fphar.2022.945592
7. Oslin, D. W., K. G. Lynch, M. C. Shih, E. P. Ingram, L. O. Wray, et al (2022). Effect of Pharmacogenomic Testing for Drug-Gene Interactions on Medication Selection and Remission of Symptoms in Major Depressive Disorder: The PRIME Care Randomized Clinical Trial. JAMA **328**(2): 151-161.10.1001/jama.2022.9805
8. DuVall SL, Lynch JA, Alba PR, Matheny ME, Suchard MA, Shields AR, Kamauu AWC, Glasser L, Ferreira C, Venkatesan S, Talarico C, Taylor S. Clinical effectiveness of AZD7442 (tixagevimab/cilgavimab) COVID-19 hospitalization among immunocompromised patients in the US Veterans Affairs health system: Overall and during periods of susceptible vs. resistant omicron variants. Poster presented at: 33rd European Congress of Clinical Microbiology & Infectious Diseases (ECCMID); 18 April 2023; Copenhagen, Denmark
9. Pagadala, M., A. Lui, J. A. Lynch, R. Karunamuni, K. M. Lee, A. Plym, B. S. Rose, H. Carter, A. S. Kibel, S. L. DuVall, J. M. Gaziano, M. Panizzon, R. Hauger and T. M. Seibert (2023). Healthy lifestyle, Agent Orange exposure, and inherited PCa risk: An analysis of the Million Veteran Program. Journal of Clinical Oncology **41**(6_suppl): 210-210.10.1200/JCO.2023.41.6_suppl.210
10. Tan EH, Dawoud D, Arshad F, Lane J, Weaver J, Duarte-Salles T, DuVall S, Falconer T, Kostka K, Lynch K, Mathey M, Reich C, Rijnbeelk P, Hripcsak G, Schuemie M, Ryan P, Prieto-Alhambra D, Suchard M. (2022, August). Evaluating the Comparative Effectiveness and Safety of Repurposed Drugs for COVID-19. Podium Presentation at the 38th annual conference of The International Society for Pharmacoepidemiology (ISPE). Copenhagen, Denmark.
11. DuVall SL. DaVINCI Supporting Emerging Diseases. Defense Health Agency and Veterans Health Administration COVID-19 Evolving Data Standards and Strategy Virtual Collaboratory 2.0. Virtual; August 29, 2022.
12. DuVall SL. IT and Data Governance: Building the Strategy. Office of Research and Development System Owner Coordination Meeting. Virtual; July 27, 2022.
13. DuVall SL. Governance and Increasing Access and Capacity. Office of Research and Development Strategy and IT/Data Governance Subcommittee. Virtual; July 19, 2022.
14. DuVall SL. Exploring COVID-19 Cause of Death through Chart Reviews. Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention. Virtual; July 6, 2022.