Annual Report 2022

HSC Cores Research Facilities

HEALTH
UNIVERSITY OF UTAH

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HSC CORES
Facilities

Overall Financial Summary

Revenue & Expenses

- HSC Core Facilities budgeted $10.9 million for FY22, with expenses totaling to $9.32 million. Approximately $5.2 million in expenses went to salaries and benefits while $4.12 million was spent on equipment and operating supplies.
- In FY22, $6.82 million in services were billed, and collected from all units combined. An overhead fee of 5% ($341,000) was used for administrative support.

Core Research Facilities

Core	Total Expenses	Equipment Expenses	Total Revenue	SVPHS	VPR	RIF/Match
Administration	$1,558,689	$100,431	$1,742,640	$505,000	$870,393	
Biomedical Imaging & Data	$123,166		$130,809			
Cell Imaging	$382,073		$533,399	$225,000		
Data Science Services	$836,682		$1,469,534	$139,161		
DNA Peptide	$411,373	$145,974	$431,531	$50,000		$144,874
DNA Sequencing	$288,158		$289,784			
Drug Discovery	$192,168		$169,528	$75,000		
Electron Microscopy	$967,932		$1,067,335	$20,000	$25,000	
Flow Cytometry	$614,099		$800,573			$210,000
Fly Food	$110,945		$108,911			
Genomics	$132,734		$118,949			
Machine Shop	$247,304		$259,306	$50,000		
Mass Spectrometry & Proteomics	$346,189		$332,924	$145,000		
Metabolic Phenotyping	$215,245		$161,236	$70,000		
Metabolomics	$507,315		$578,815	$240,000		
Mutation Generation & Detection	$160,838		$150,281	$50,000		
Nuclear Magnetic Resonance	$114,063		$100,100	$70,000		
PreClinical Imaging	$196,241		$197,861	$50,000	$50,000	
Small Animal Ultrasound	$46,766		$57,754	$20,000		
Transgenic Mouse	$493,614		$691,668	$434,603		
UTAH Center Genetic Discovery	$1,215,664		$1,047,761	$828,967		
Zebrafish	$188,650		$548,100	$150,000		

Service Recharge Centers

Service Recharge Center	Total Expenses	Equipment Expenses	Total Revenue	SVPHS	VPR	RIF
Anticonvulsant Drug Dev.	$26,106		$40,262			
Behavioral Health Innovation	$2,554		$9,667			
CRUS Center	$20,517		$1,206			
Genetic Science Learning CTR	$1,734,394		$1,303,067			
Iron & Heme	$32,897		$95,767			
Materials Characterization Lab	$165,555		$144,854			
Nuclear Engineering	$3,419		$3,978			
Platform for Open Wireless Data	$19,376		$63,425			
Scalable Analytics & Informatics	$41,364		$66,573			

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 31 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
- Elliot Francis, Program Software Engineer
- Iryna Wiley, Accountant
- Megan, Bowler, Program Software Engineer
- Terra Curley, Senior Accountant

Advisory Board Committee

Last meeting date: February 9th, 2022

- James Cox Ph.D., Director Cores Research Facilities
- Joseph Yost Ph.D., Professor, Neurobiology and Anatomy
- Mark Yandell Ph.D., Professor, Human Genetics
- Erin Rothwell Ph.D., VP for Research
- Will Dere M.D., Associate Vice President Research, Professor, Endocrinology
- Alana Welm Ph.D., Professor, Oncological Sciences
- Wes Sundquist Ph.D., Professor, Biochemistry
- Dean Tantin Ph.D., Professor, Huntsman Cancer Institute
- Scott Summers Ph.D., Professor, Nutrition & Integrative Physiology
- Eric Schmidt Ph.D., Professor, Medicinal Chemistry
- Matthew Rondina M.D., Associate Professor, Internal Medicine
- Sarah Franklin Ph.D., Associate Professor, Internal Medicine
- Chris Hill D.Phil., Professor, Biochemistry

2022 Annual Update

- In light of the global pandemic the Administrative Office was critical in obtaining and distributing safety supplies to staff, all cores remained active during the orange level status of research on campus. This was very positive and allowed individual laboratories to continue to make progress with minimum disruption.
- In FY22, the Cores Administration office was successfully able to process billing in 1/2 business day even though the amount of billed revenue has increased to 29 labs. The new HSC scheduling/billing system validates chartfields with the University's CIS system which has eliminated the majority of billing errors.

- In FY22 the core billed $6.82 million; 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.
- The two new Service/Recharge Centers (Anticonvulsant Drug Lab and Fly Food) are now managed through the administrative office to increase accountability and reduce expenses associated with billing and collections.
- The annual retreat was not held in September 2021 due to COVID.
- The electronic inventory system created for capital equipment tracking is still being heavily used by additional departments and groups in Health Sciences and Main Campus. Upgrades for FY22 allow more reporting and tracking of equipment and better access from hand held devices. As of July 2021, there are 86 Departments, and 6,820 items entered into the system. These items are located in 1,274 rooms across campus. The total asset value of these items is $107.9 million. This system continues to expand and is free to use by any group on campus.

FY2023 Goals

- Upgrade the electronic inventory system
- Upgrade the resource/billing system
- Create a new real time system for expenses and revenue

Cores Administration Revenue & Expenses

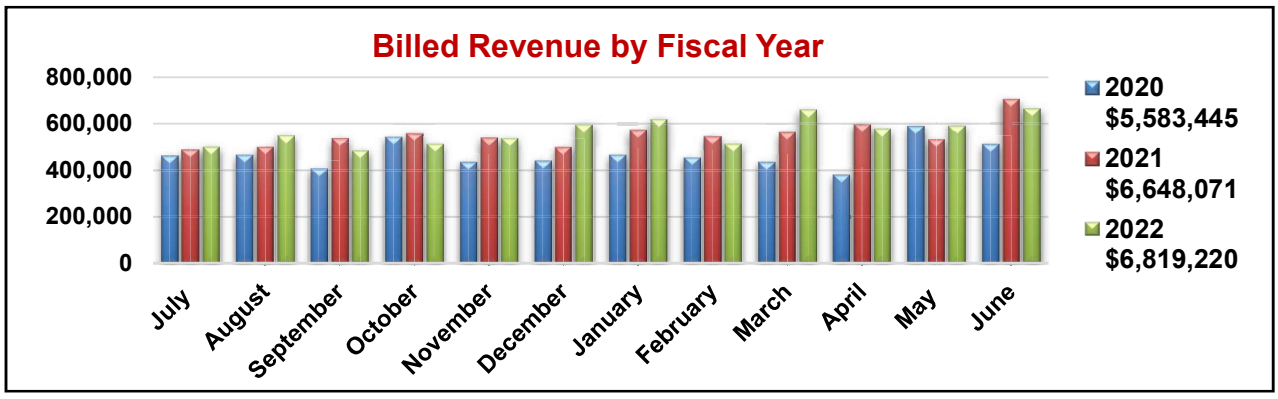
FY22 Expenses: Total $1,558,689

The Cores Administration Budget covers the following expenses:

- Salaries/Benefits: $715,139
- Fixed Expenses (IT Support for 76 staff, developer, x-ray, software, COVID Expenses): $786,809.
- Unanticipated equipment repairs and replacement: $56,742

FY22 Revenues: Total $1,696,364

- VP of Health Sciences Support: $505,000
- FY22 Revenue Generated from Services: $336,910
- FY22 VP for Research: $854,454 (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 AI 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 are actively developing new services that are based on the needs of HSC researchers and core users. As a resource for advanced medical computing, 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 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

2022 Annual Update

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

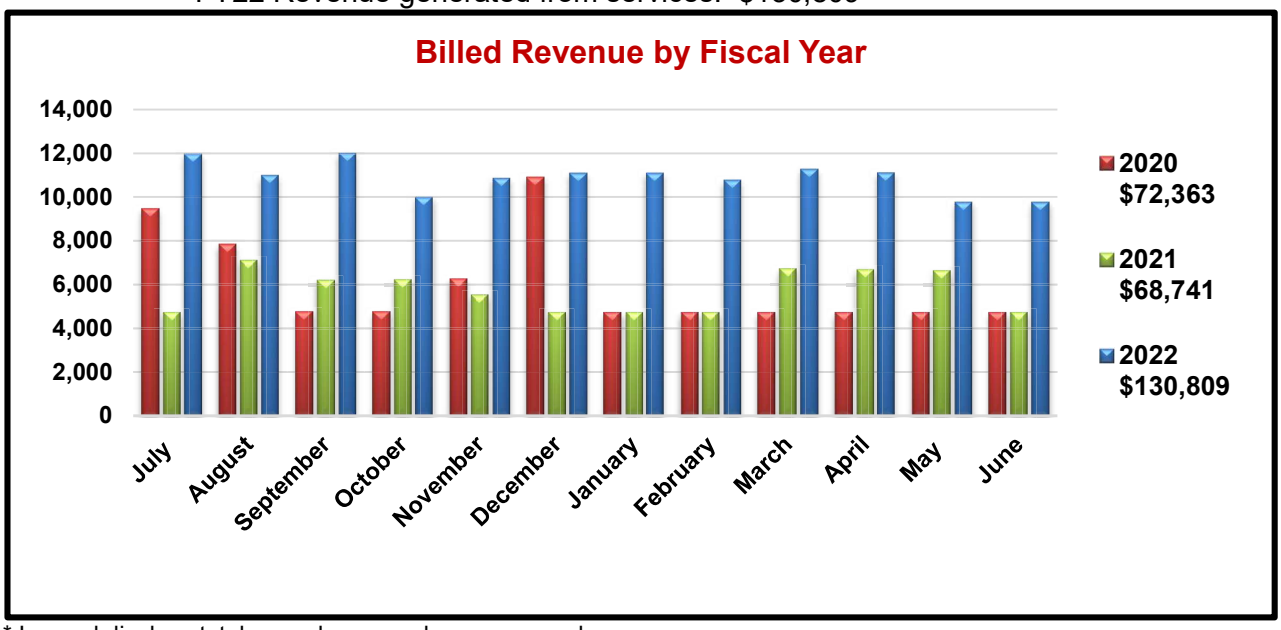
- NSF SBIR Phase II – Rudy Wilcox, RefloDx LLC.

Revenue/Expenses

FY22 Expenses: **Total $123,166**

FY22 Revenue: **Total $130,809**

- VP of Health Sciences Support: $ 0
- FY22 Revenue generated from services: $130,809

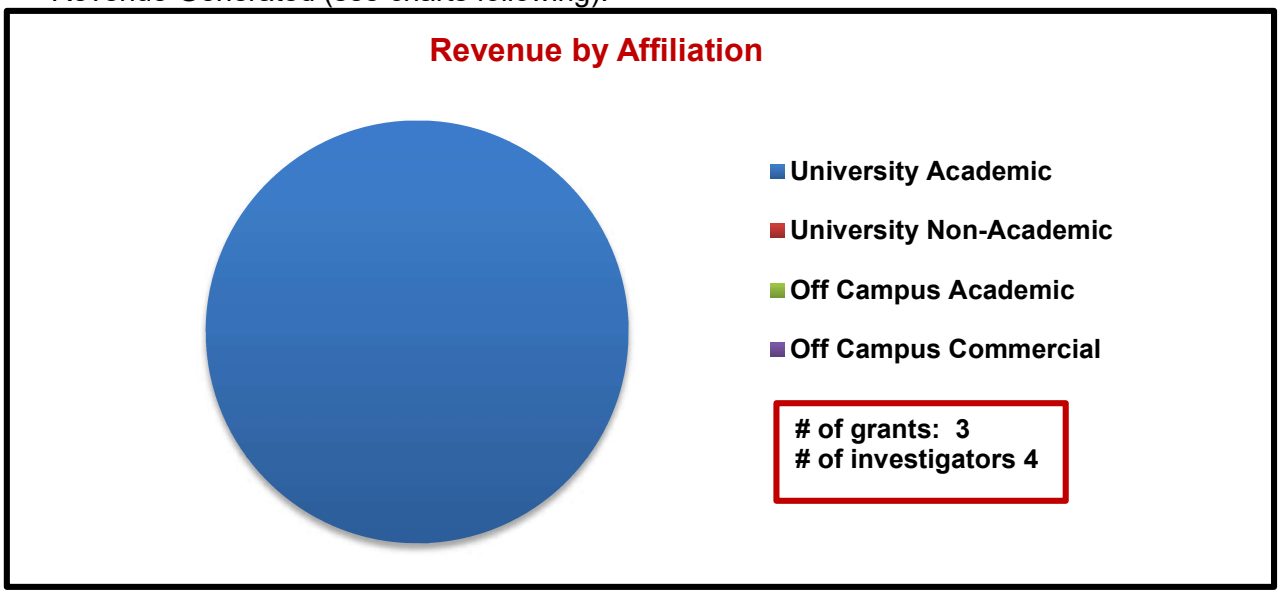


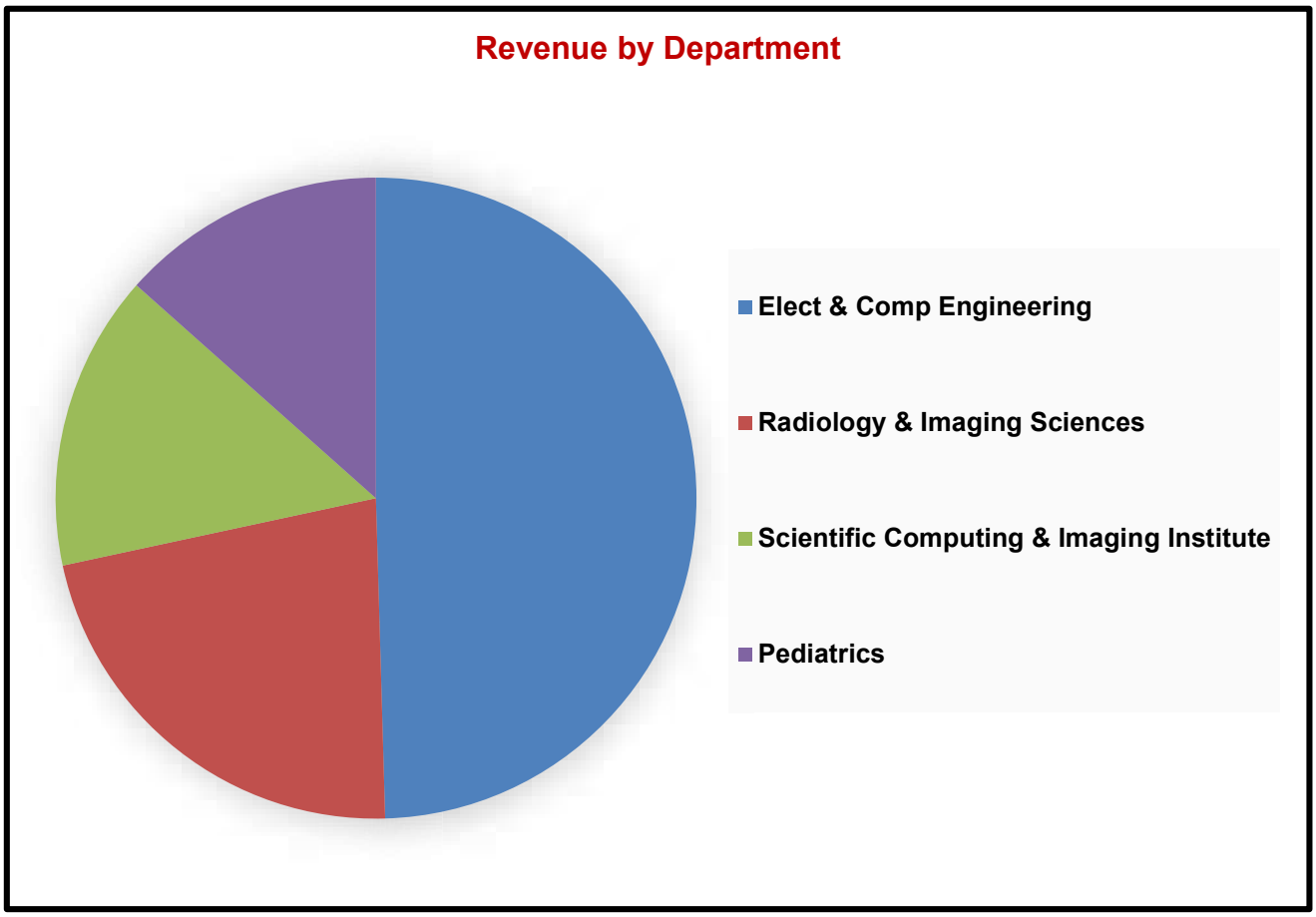
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Tasdizen, Tolga	Dept. Homeland Security, Elphel Inc.
2	Minoshima, Satoshi	Department
3	Jackson, Daniel	Department
4	McNally, Scott	Department

Publications

1. C. Ly, C. Nizinski, A. Toydemir, C. Vachet, L. McDonald, T. Tasdizen (2021) Learning to Estimate the Composition of a Mixture with Synthetic Data. Microscopy and Microanalysis, **27**(S1): 2522-2525. 10.1017/S1431927621008990
2. Ly, C., C. A. Nizinski, A. Toydemir, C. Vachet, L. W. McDonald and T. Tasdizen (2021). Determining the Composition of a Mixed Material with Synthetic Data. Microscopy and Microanalysis **27**(6): 1465-1475. 10.1017/S1431927621012915
3. Nizinski, C. A., C. Ly, C. Vachet, A. Hagen, T. Tasdizen and L. W. McDonald (2022). Characterization of uncertainties and model generalizability for convolutional neural network predictions of uranium ore concentrate morphology. Chemometrics and Intelligent Laboratory Systems **225**.ARTN 104556. 10.1016/j.chemolab.2022.104556

Cell Imaging Facility

Overview

The Cell Imaging Facility provides training and consultation on the use of confocal, automated widefield, 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, two Olympus FV1000 Spectral confocals, 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. 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 in an effort to provide the service within proximity to the user base.

Goals 2022

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

Equipment Location

HSC Location

- Zeiss 700 Confocal Microscope
- Nikon A1R Confocal Microscope
- 2x Prairie Multi-Photon Microscope
- Zeiss Axioscan Z1 automated slide scanner with 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

SMBB Location

- Olympus FV1000 Confocal Microscope

Biology ASB/Crocker Location

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

EEJMRB Location

- Spinning Disk Confocal Microscope
- DeltaVision Ultra Widefield Microscope
-

Personnel

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

Advisory Board Committee

Last meeting date: July 15th, 2021

- 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, Assistant Professor, Neurobiology and Anatomy
- Mark Smith, Research Assistant Professor, Oncological Sciences

2022 Annual Update

New Services

- Consultation is available at five locations: Building 5 CSC, 151 SMBB, 555 HCI, 565 EEJMRB and 585 HSC

New Equipment

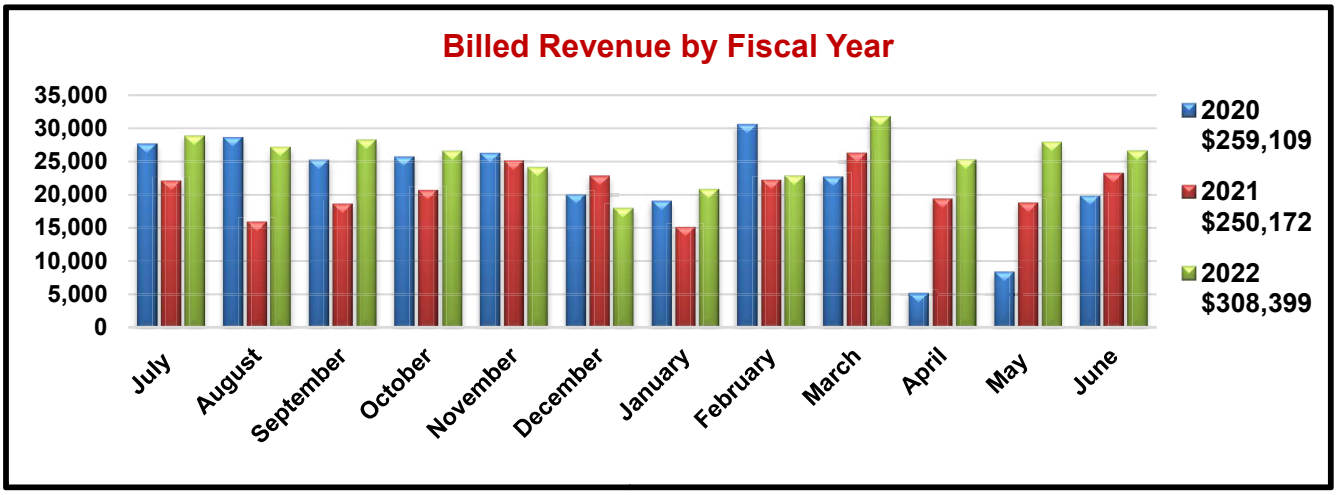
- None

Revenue/Expenses

FY22 Expenses: **Total $382,073**

FY22 Revenue: **Total $533,399**

- VP of Health Sciences Support: $225,000
- FY22 Revenue generated from services: $308,399



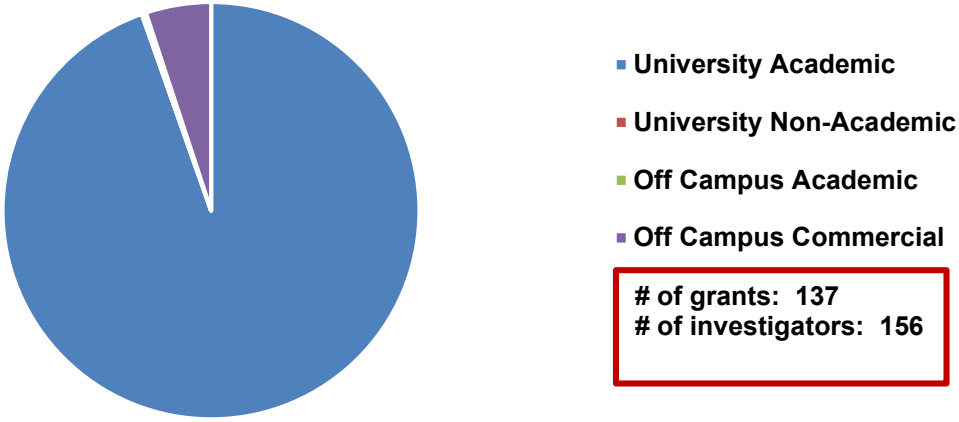
*Legend displays total annual revenue by year earned.

FY22 Scientific Impact

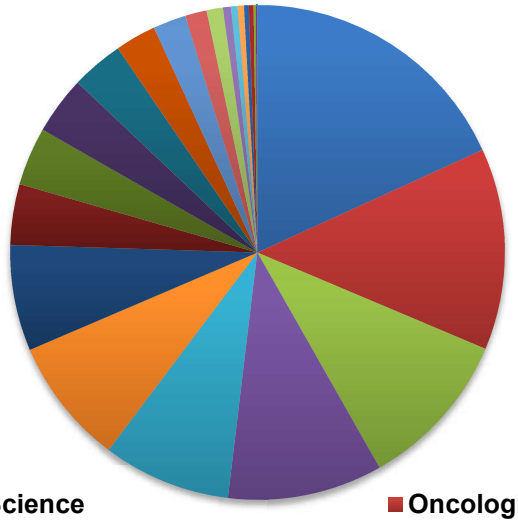
Research Support

Revenue Generated (see charts following)

Revenue by Affiliation



Revenue by Department



Top Users

1	Edgar, Bruce	NIH
2	Kardon, Gabrielle	NIH, Wheeler Foundation, Department
3	Caron, Sophie	Department, NIH, NSF
4	Roh-Johnson, Minna	NIH, Department, DOD
5	Jorgensen, Erik	Department
6	Drummond, Micah	NIH, American Diabetes Assoc., Utah State University
7	Shcheglovitov, Oleksandr	Department, NIH
8	Beckerle, Mary	NIH, Department
9	Gagnon, James	Department, Gentex Corporation
10	Timmins, Lucas	Department

Publications

1. Batot, G., Metcalf, C., Bell, L., Pauletti, A., Wilcox, K., & Bröer, S. (2022). A Model for Epilepsy of Infectious Etiology using Theiler's Murine Encephalomyelitis Virus. *Journal of Visualized Experiments*. doi:10.3791/63673
2. Cho, J. M., Park, S., Kwon, O. S., La Salle, D. T., Cerbie, J., Fermoyle, C. C., Morgan, D., Nelson, A., Bledsoe, A., Bharath, L. P., Tandar, M., Kunapuli, S. P., Richardson, R. S., Anandh Babu, P. V., Mookherjee, S., Kishore, B. K., Wang, F., Yang, T., Boudina, S., Trinity, J. D., & Symons, J. D. (2022). Activating P2Y1 receptors improves function in arteries with repressed autophagy. *Cardiovascular Research*. doi:10.1093/cvr/cvac061
3. Fadul, J., Zulueta-Coarasa, T., Slattum, G. M., Redd, N. M., Jin, M. F., Redd, M. J., Daetwyler, S., Hedeen, D., Huisken, J., & Rosenblatt, J. (2021). KRas-transformed epithelia cells invade and partially dedifferentiate by basal cell extrusion. *Nat Commun, 12*(1), 7180. doi:10.1038/s41467-021-27513-z
4. Falekun, S., Sepulveda, J., Jami-Alahmadi, Y., Park, H., Wohlschlegel, J. A., & Sigala, P. A. (2021). Divergent acyl carrier protein decouples mitochondrial Fe-S cluster biogenesis from fatty acid synthesis in malaria parasites. *Elife, 10*. doi:10.7554/eLife.71636
5. Ferrara, P. J., Verkerke, A. R. P., Maschek, J. A., Shahtout, J. L., Siripoksup, P., Eshima, H., Johnson, J. M., Petrocelli, J. J., Mahmassani, Z. S., Green, T. D., McClung, J. M., Cox, J. E., Drummond, M. J., & Funai, K. (2021). Low lysophosphatidylcholine induces skeletal muscle myopathy that is aggravated by high-fat diet feeding. *Faseb Journal, 35*(10). doi:10.1096/fj.202101104R
6. Figueroa, K., Anderson, C. J., Paul, S., Dansithong, W., Gandelman, M., Scoles, D. R., & Pulst, S. M. (2022). Slc9a6 mutation causes Purkinje cell loss and ataxia in the *shaker* rat. *bioRxiv*. doi:10.1101/2022.03.28.486143
7. Fix, D. K., Ekiz, H. A., Petrocelli, J. J., Mckenzie, A. M., Mahmassani, Z. S., O'Connell, R. M., & Drummond, M. J. (2021). Disrupted macrophage metabolic reprogramming in aged soleus muscle during early recovery following disuse atrophy. *Aging Cell, 20*(9). doi:10.1111/acel.13448
8. Fix, D. K., Mahmassani, Z. S., Petrocelli, J. J., de Hart, N. M. M. P., Ferrara, P. J., Painter, J. S., Nistor, G., Lane, T. E., Keirstead, H. S., & Drummond, M. J. (2021). Reversal of deficits in aged skeletal muscle during disuse and recovery in response to treatment with a secrotome product derived from partially differentiated human pluripotent stem cells. *Geroscience, 43*(6), 2635-2652. doi:10.1007/s11357-021-00423-0
9. Guillen, K. P., Fujita, M., Butterfield, A. J., Scherer, S. D., Bailey, M. H., Chu, Z., DeRose, Y. S., Zhao, L., Cortes-Sanchez, E., Yang, C. H., Toner, J., Wang, G., Qiao, Y., Huang, X., Greenland, J. A., Vahrenkamp, J. M., Lum, D. H., Factor, R. E., Nelson, E. W., Matsen, C. B., Poretta, J. M., Rosenthal, R., Beck, A. C., Buys, S. S., Vaklavas, C., Ward, J. H., Jensen, R. L., Jones, K. B., Li, Z., Oesterreich, S., Dobrolecki, L. E., Pathi, S. S., Woo, X. Y., Berrett, K. C., Wadsworth, M. E., Chuang, J. H., Lewis, M. T., Marth, G. T., Gertz, J., Varley, K. E., Welm, B. E., & Welm, A. L. (2022). A human breast cancer-derived xenograft and organoid platform for drug discovery and precision oncology. *Nat Cancer, 3*(2), 232-250. doi:10.1038/s43018-022-00337-6
10. Happ, J. T., Arveseth, C. D., Bruystens, J., Bertinetti, D., Nelson, I. B., Olivieri, C., Hedeen, D. S., Zhu, J.-F., Capener, J. L., Bröckel, J. W., Vu, L., King, C. C., Ruiz-Perez, V. L., Veglia, G., Herberg, F. W., Taylor, S. S., & Myers, B. R. (2021). A PKA Inhibitor Motif within Smoothened Controls Hedgehog Signal Transduction. *bioRxiv*. doi:10.1101/2021.07.05.451193

11. Hill, J. H., Massaquoi, M. S., Sweeney, E. G., Wall, E. S., Jahl, P., Bell, R., Kallio, K., Derrick, D., Murtaugh, L. C., Parthasarathy, R., Remington, S. J., Round, J. L., & Guillemin, K. (2022). *A microbiota membrane disrupter disseminates to the pancreas and increases β-cell mass*. bioRxiv. doi:10.1101/2022.03.24.485696
12. Ingram, K., Samson, S. C., Zewdu, R., Zitnay, R. G., Snyder, E. L., & Mendoza, M. C. (2022). NKX2-1 controls lung cancer progression by inducing DUSP6 to dampen ERK activity. *Oncogene, 41*(2), 293-300. doi:10.1038/s41388-021-02076-x
13. Jensen, O., Trivedi, S., Meier, J. D., Fairfax, K. C., Hale, J. S., & Leung, D. T. (2022). A subset of follicular helper-like MAIT cells can provide B cell help and support antibody production in the mucosa. *Science Immunology, 7*(67). doi:10.1126/sciimmunol.abe8931
14. Kaur, K., Mohammadpour, R., Ghandehari, H., Reilly, C. A., Paine, R., & Kelly, K. E. (2022). Effect of combustion particle morphology on biological responses in a Co-culture of human lung and macrophage cells. *Atmospheric Environment, 284*, 119194. doi:10.1016/j.atmosenv.2022.119194
15. Kaur, K., Mohammadpour, R., Sturrock, A., Ghandehari, H., Reilly, C., Paine, R., & Kelly, K. E. (2022). Comparison of biological responses between submerged, pseudo-air-liquid interface, and air-liquid interface exposure of A549 and differentiated THP-1 co-cultures to combustion-derived particles. *Journal of Environmental Science and Health, Part A*, 1-12. doi:10.1080/10934529.2022.2083429
16. Kidwell, C. U., Casalini, J. R., Pradeep, S., Scherer, S. D., Greiner, D., Johnson, J. S., Olson, G. S., Rutter, J., Welm, A. L., Zangle, T. A., & Roh-Johnson, M. (2021). Laterally transferred macrophage mitochondria act as a signaling source promoting cancer cell proliferation. *bioRxiv*. doi:10.1101/2021.08.10.455713
17. Kursel, L. E., Cope, H. D., & Rog, O. (2021). Unconventional conservation reveals structure-function relationships in the synaptonemal complex. *Elife, 10*. doi:10.7554/eLife.72061
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19. Lai, S. A., Gundlapalli, H., Ekiz, H. A., Jiang, A., Fernandez, E., & Welm, A. L. (2021). Blocking Short-Form Ron Eliminates Breast Cancer Metastases through Accumulation of Stem-Like CD4(+) T Cells That Subvert Immunosuppression. *Cancer Discovery, 11*(12), 3178-3197. doi:10.1158/2159-8290.CD-20-1172
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21. Lin, Y., Perovanovic, J., Kong, Y., Igyarto, B. Z., Zurawski, S., Tantin, D., Zurawski, G., Bettini, M., & Bettini, M. L. (2022). Antibody-Mediated Targeting of a Hybrid-Insulin-Peptide Towards Neonatal Thymic Langerin+ Cells Enhances T Cell Central Tolerance and Delays Autoimmune Diabetes. *Diabetes*. doi:10.2337/db21-1069
22. Liu, H., Gordon, S. G., & Rog, O. (2021). Heterologous synapsis in C. elegans is regulated by meiotic double-strand breaks and crossovers. *Chromosoma, 130*(4), 237-250. doi:10.1007/s00412-021-00763-y
23. Marchetti, M., Zhang, C., & Edgar, B. A. (2021). An improved organ explant culture method reveals stem cell lineage dynamics in the adult Drosophila intestine. *bioRxiv*. doi:10.1101/2021.12.17.473114
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DNA Peptide Facility

Overview

The DNA Peptide Facility provides researchers with chemical synthesis of custom oligonucleotides and oligopeptides. The facility synthesizes standard DNA/RNA oligos and peptides with multiple purity options, ranging from crude to HPLC. This Core has the ability to incorporate a wide array of specialty modifications, including fluorophore-labeling and functional group derivatization via amino-, thiol-, and modifications compatible with click chemistry. The goal of the facility is to provide quality service with speedy turnaround times.

Services

- Routine and custom DNA synthesis
- Routine and custom RNA synthesis
- Routine and custom peptide synthesis
- Peptide purification
- Amino acid analysis

Equipment

- Dr. Oligo 192 DNA Synthesizer
- ABI 3900 DNA Synthesizer
- K&A H-8 Synthesizer (2)
- ABI 394 DNA Synthesizer (2)
- ABI 433 Peptide Synthesizer
- ABI 433 Peptide Synthesizer
- Beckman Coulter System Gold 125P HPLC System
- Beckman Coulter System Gold 126 HPLC System
- Hewlett Packard Series 1100 HPLC system (2)
- Beckman Coulter DU800 Spectrophotometer
- BioTek Epoch Plate Reader Spectrophotometer

Personnel

- Mike Hanson, Ph.D., Director
- Andrea Koehler, Lab Technician
- Meredith Ford, Lab Technician

Advisory Board Committee

Last meeting date: June 2021

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

2022 Annual Update

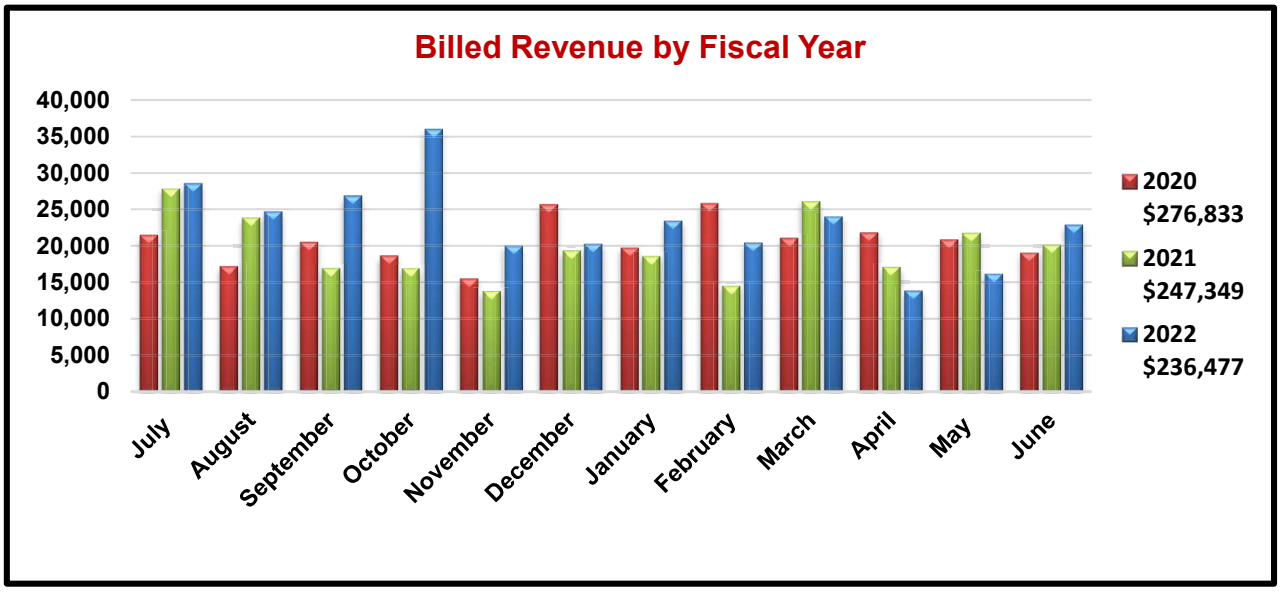
New Equipment

- The DNA Peptide Facility can now synthesize DNA oligos up 275 bases. This allows for specialty modifications to be incorporated into gene synthesis projects.

Revenue/Expenses

FY22 Expenses: **Total $411,373**
FY22 Revenue: **Total $431,351**

- VP of Health Sciences Support: $50,000
- FY22 Revenue Generated from Services: $236,477
- FY22 RIF Funds: $144,874

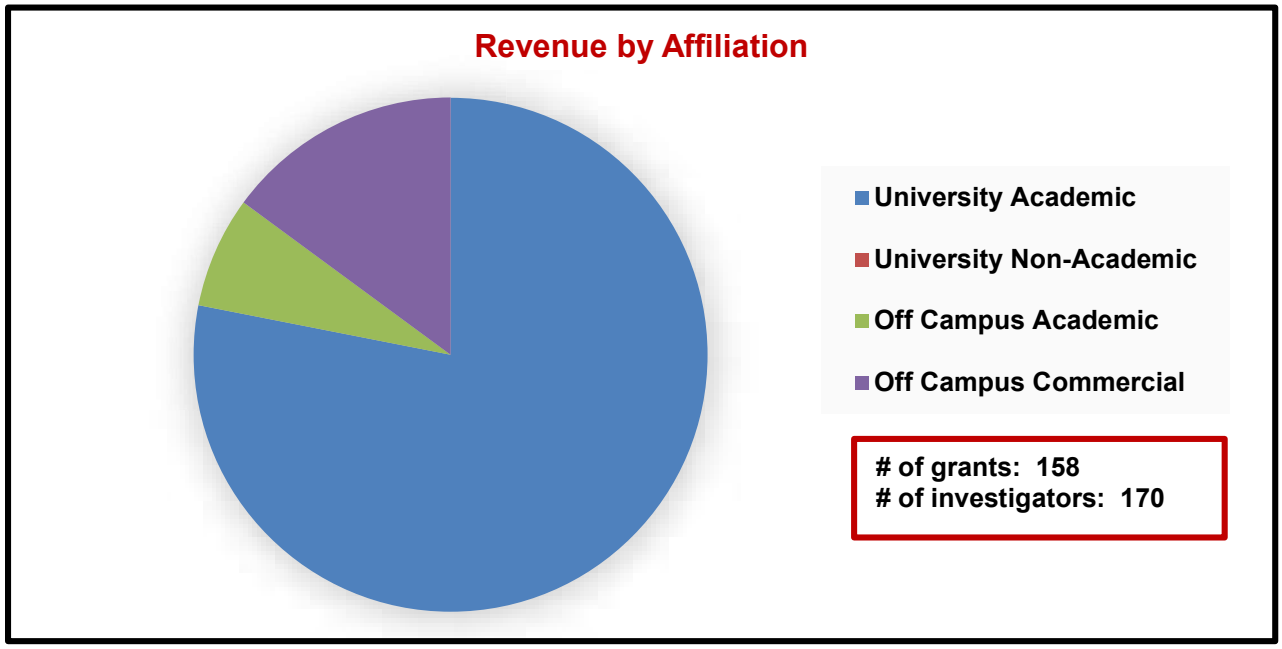


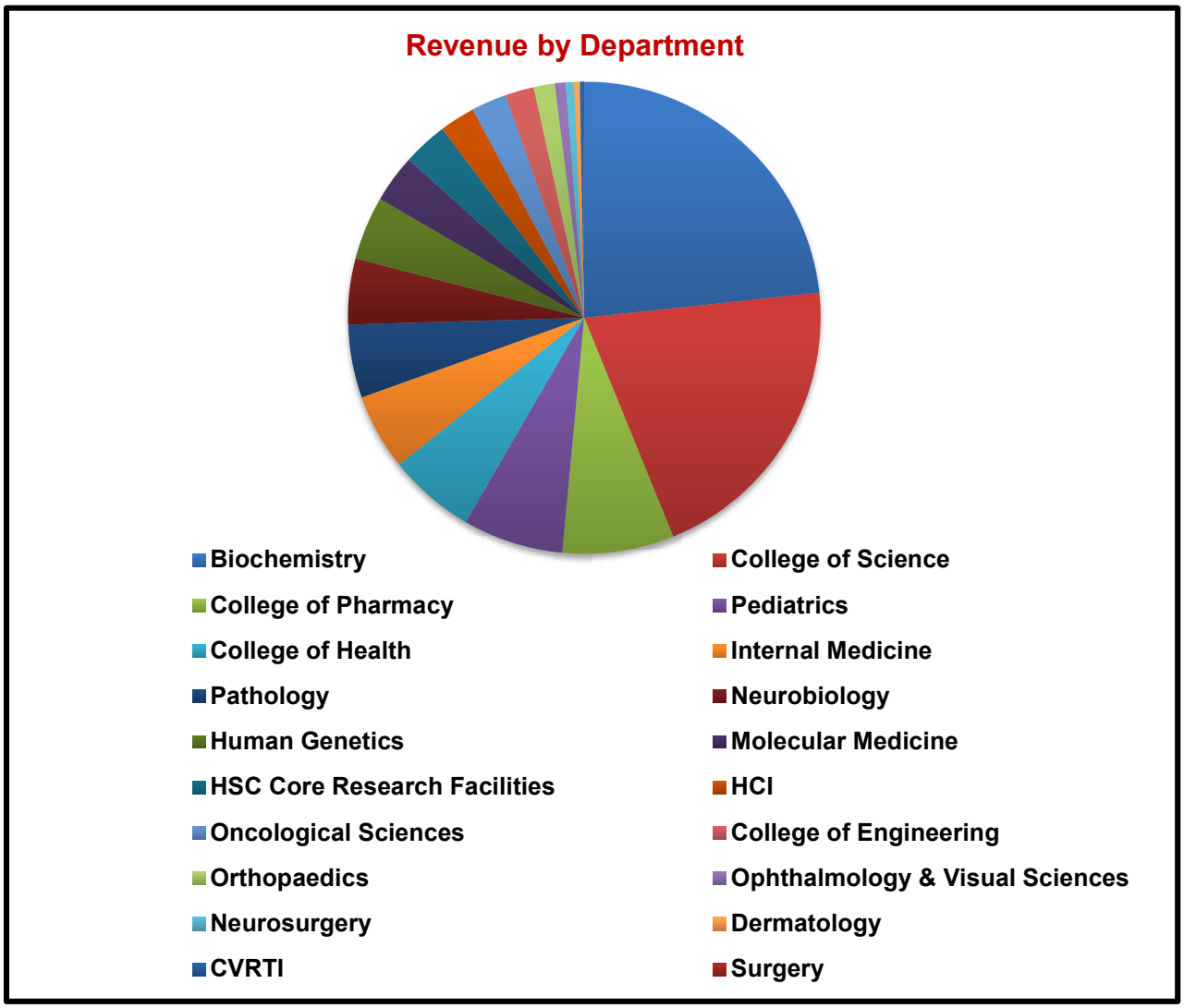
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Burrows, Cynthia	NIH
2	Rutter, Jared	HHMI, NIH
3	Sundquist, Wesley	Department, NIH
4	BioFire Diagnostics	Commercial
5	Emory University	Off Campus Academic
6	Schiffman, Joshua	Department
7	Bass, Brenda	Department, NIH
8	Hammond, Ming	Department, NIH, NSF, Office Naval Research
9	Cao, Erhu	NIH, Department, Pew Charitable Trust, UCSF
10	Davey-Hicks, Crystal	HSC Cores Research Facilities

Publications

1. Argueta-Gonzalez, H. S., Swenson, C. S., Song, G., & Heemstra, J. M. (2022). Stimuli-responsive assembly of bilingual peptide nucleic acids**. *RSC Chem. Biol.***, 2022, **3**, 1035-1043. doi: 10.1039/d2cb00020b
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4. Fleming AM, Manage SAH, Burrows CJ. (2021) Binding of AP endonuclease-1 to G-quadruplex DNA depends on the N-terminal domain, Mg^{2+} and ionic strength. ACS Bio Med Chem Au. 2021 Dec 15;1(1):44-56. doi: 10.1021/acsbiomedchemau.1c00031
5. Manuel BA, Sterling SA, Sanford AA, Heemstra JM. (2022) Systematically Modulating Aptamer Affinity and Specificity by Guanosine-to-Inosine Substitution. Anal Chem. 2022 May 3;94(17):6436-6440. doi: 10.1021/acs.analchem.2c00422
6. Mathew B, Aoyagi KL, Fisher MA. (2021) *Yersinia pestis* Lipopolysaccharide Remodeling Confers Resistance to a *Xenopsylla cheopis* Cecropin. ACS Infect Dis. 2021 Aug 13;7(8):2536-2545. doi: 10.1021/acsinfecdis.1c00275
7. Ramiro IBL, Bjørn-Yoshimoto WE, Imperial JS, Gajewiak J, Salcedo PF, Watkins M, Taylor D, Resager W, Ueberheide B, Bräuner-Osborne H, Whitby FG, Hill CP, Martin LF, Patwardhan A, Concepcion GP, Olivera BM, Safavi-Hemami H. Somatostatin (2022) venom analogs evolved by fish-hunting cone snails: From prey capture behavior to identifying drug leads. Sci Adv. 2022 Mar 25;8(12):eabk1410. doi: 10.1126/sciadv.abk1410.
8. Sanford AA, Rangel AE, Feagin TA, Lowery RG, Argueta-Gonzalez HS, Heemstra JM. (2021) RE-SELEX: restriction enzyme-based evolution of structure-switching aptamer biosensors. Chem Sci. 2021 Jul 24;12(35):11692-11702. doi: 10.1039/d1sc02715h
9. Strohacker LK, Mackay DR, Whitney MA, Couldwell GC, Sundquist WI, Ullman KS (2021) Identification of abscission checkpoint bodies as structures that regulate ESCRT factors to control abscission timing. Elife. 2021 Aug 4;10:e63743. doi: 10.7554/eLife.63743

DNA Sequencing Facility

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 Qiagen Q24 Pyrosequencer, 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

- 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

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

Liquid Handlers

- 1 Biomek FX programmable liquid sample dispenser

Fragment Analysis

- AATI Fragment Analyzer

Personnel

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

Advisory Board Committee

Last meeting date: June 29, 2021

- 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

2022 Annual Update

New Equipment

- BioMek FXp replaced the BioMek FX that became obsolete.

New Services

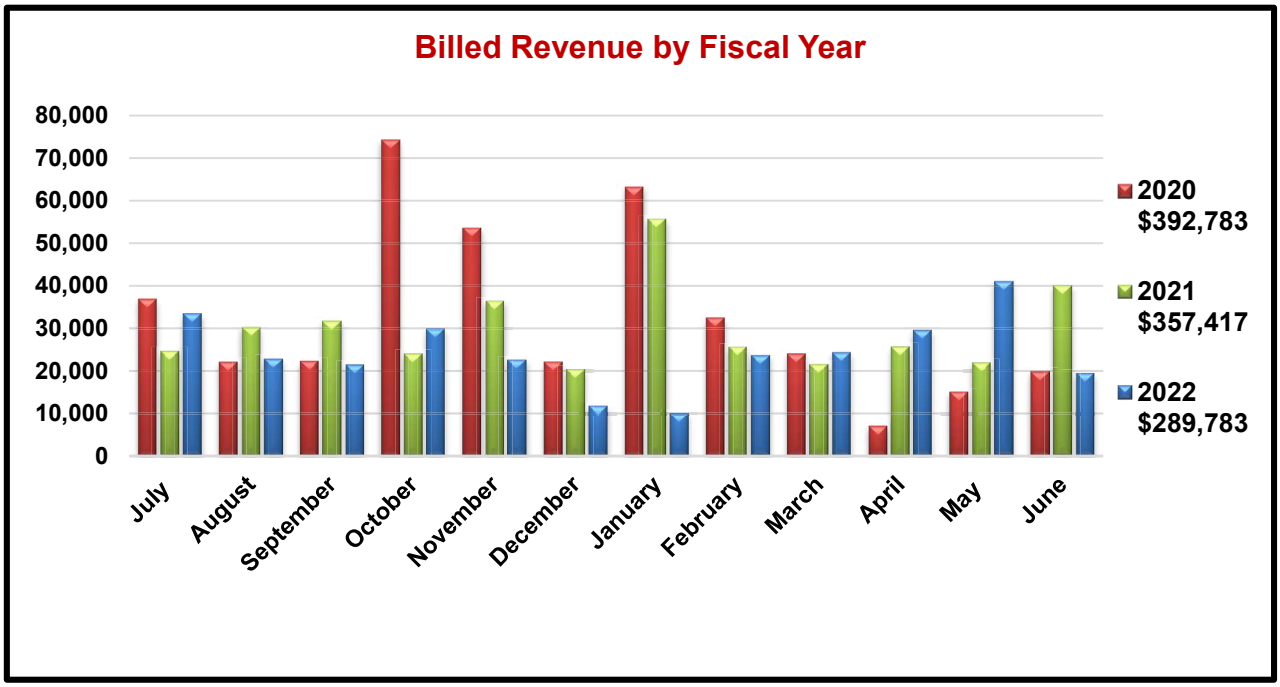
- The Sequencing Core did not implement additional services in FY22

Revenue/Expenses

FY22 Expenses: **Total $288,158**

FY22 Revenue: **Total $289,783**

- VP of Health Sciences Support: $0
- FY22 Revenue generated from services: $289,783



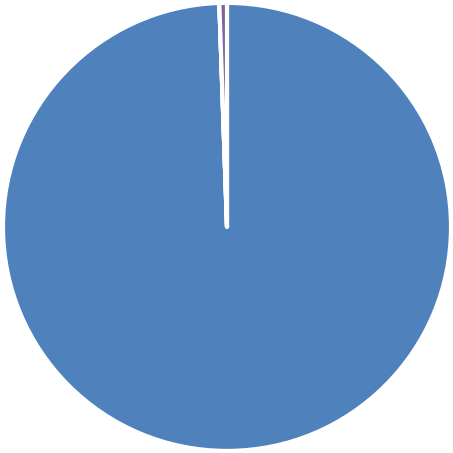
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):

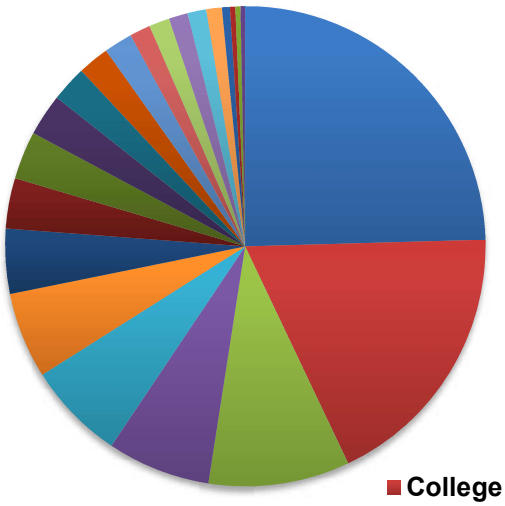
Revenue by Affiliation



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

# of grants: 142
# of investigators: 142

Revenue by Department



- Pathology
- Obstetrics & Gynecology
- College of Health
- Oncological Sciences
- Pediatrics
- HCI
- HSC Core Research Facilities
- Ophthalmology & Visual Sciences
- Orthopaedics
- Psychiatry
- Neurosurgery
- Surgery
- College of Science
- Biochemistry
- Human Genetics
- Neurobiology
- Internal Medicine
- College of Pharmacy
- Molecular Medicine
- Dermatology
- College of Engineering
- CVRTI
- College of Social & Behavioral Science
- School of Biological Sciences

Top Users

1	Lamb, Tracey	Department, NIH
2	Silver, Robert	NIH
3	Sundquist, Wesley	Department, NIH
4	Fairfax, Keke	Department, NIH
5	Evavold, Brian	Department
6	Hammond, Ming	Arnold & Mabel Beckman FTD, NIH, NSF, ONR
7	Drews, Gary	Department, University of Arizona
8	Parkinson, John	NIH
9	Miller, Lezlee	Department
10	Mulvey, Matthew	Department, NIH

Publications

1. Breevoort, S., S. Gibson, K. Figueroa, M. Bromberg and S. Pulst (2022). Expanding Clinical Spectrum of C9ORF72-Related Disorders and Promising Therapeutic Strategies: A Review. Neurol Genet **8**(3): e670.10.1212/NXG.0000000000000670
2. Clark, K. A., A. Paquette, K. Tao, R. Bell, J. L. Boyle, J. Rosenthal, A. K. Snow, A. W. Stark, B. A. Thompson, J. Unger, J. Gertz, K. E. Varley, K. M. Boucher, D. E. Goldgar, W. D. Foulkes, A. Thomas and S. V. Tavtigian (2022). Comprehensive evaluation and efficient classification of BRCA1 RING domain missense substitutions. Am J Hum Genet 109(6): 1153-1174.10.1016/j.ajhg.2022.05.004
3. Gandelman, M., W. Dansithong, S. C. Kales, S. Paul, G. Maag, E. Aoyama, A. Zakharov, G. Rai, T. Dexheimer, B. M. Whitehill, H. Sun, A. Jadhav, A. Simeonov, M. J. Henderson, D. P. Huynh, S. M. Pulst and D. R. Scoles (2021). The AKT modulator A-443654 reduces alpha-synuclein expression and normalizes ER stress and autophagy. J Biol Chem 297(4): 101191.10.1016/j.jbc.2021.101191
4. Hateley, S., A. Lopez-Izquierdo, C. J. Jou, S. Cho, J. G. Schraiber, S. Song, C. T. Maguire, N. Torres, M. Riedel, N. E. Bowles, C. B. Arrington, B. J. Kennedy, S. P. Etheridge, S. Lai, C. Pribble, L. Meyers, D. Lundahl, J. Byrnes, J. M. Granka, C. A. Kauffman, G. Lemmon, S. Boyden, W. Scott Watkins, M. A. Karren, S. Knight, J. Brent Muhlestein, J. F. Carlquist, J. L. Anderson, K. G. Chahine, K. U. Shah, C. A. Ball, I. J. Benjamin, M. Yandell and M. Tristani-Firouzi (2021). The history and geographic distribution of a KCNQ1 atrial fibrillation risk allele. Nat Commun **12**(1): 6442.10.1038/s41467-021-26741-7
5. Jurynec, M. J., C. M. Gavile, M. Honeggar, Y. Ma, S. R. Veerabhadraiah, K. A. Novak, K. Hoshijima, N. H. Kazmers and D. J. Grunwald (2022). NOD/RIPK2 signalling pathway contributes to osteoarthritis susceptibility. Ann Rheum Dis **81**(10): 1465-1473.10.1136/annrheumdis-2022-222497
6. Li, P. P., R. Moulick, H. Feng, X. Sun, N. Arbez, J. Jin, L. O. Marque, E. Hedglen, H. Y. E. Chan, C. A. Ross, S. M. Pulst, R. L. Margolis, S. Woodson and D. D. Rudnicki (2021). RNA Toxicity and Perturbation of rRNA Processing in Spinocerebellar Ataxia Type 2. Mov Disord 36(11): 2519-2529.10.1002/mds.28729
7. Ost, K. S., T. R. O'Meara, W. Z. Stephens, T. Chiaro, H. Zhou, J. Penman, R. Bell, J. R. Catanzaro, D. Song, S. Singh, D. H. Call, E. Hwang-Wong, K. E. Hanson, J. F. Valentine, K. A. Christensen, R. M. O'Connell, B. Cormack, A. S. Ibrahim, N. W. Palm, S. M. Noble and J. L. Round (2021). Adaptive immunity induces mutualism between commensal eukaryotes. Nature **596**(7870): 114-118.10.1038/s41586-021-03722-w
8. Strohacker, L. K., D. R. Mackay, M. A. Whitney, G. C. Couldwell, W. I. Sundquist and K. S. Ullman (2021). Identification of abscission checkpoint bodies as structures that regulate ESCRT factors to control abscission timing. Elife **10**.10.7554/eLife.63743
9. Sundberg, C. A., M. Lakk, S. Paul, P. F. K, D. R. Scoles, S. M. Pulst and D. Krizaj (2022). The RNA-binding protein and stress granule component ATAXIN-2 is expressed in mouse and human tissues associated with glaucoma pathogenesis. J Comp Neurol **530**(2): 537-552.10.1002/cne.25228
10. Wozniak, E. A. L., Z. Chen, S. Paul, P. Yang, K. P. Figueroa, J. Friedrich, T. Tschumperlin, M. Berken, M. Ingram, C. Henzler, S. M. Pulst and H. T. Orr (2021). Cholecystokinin 1 receptor activation restores normal mTORC1 signaling and is protective to Purkinje cells of SCA mice. Cell Rep 37(2): 109831.10.1016/j.celrep.2021.109831

Drug Discovery Facility

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 that it coordinates the cooperative efforts of individual research groups in a wide variety of different drug discovery stuides, ultimately leading to discovery of 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 assistance 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 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

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
- Biotek 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

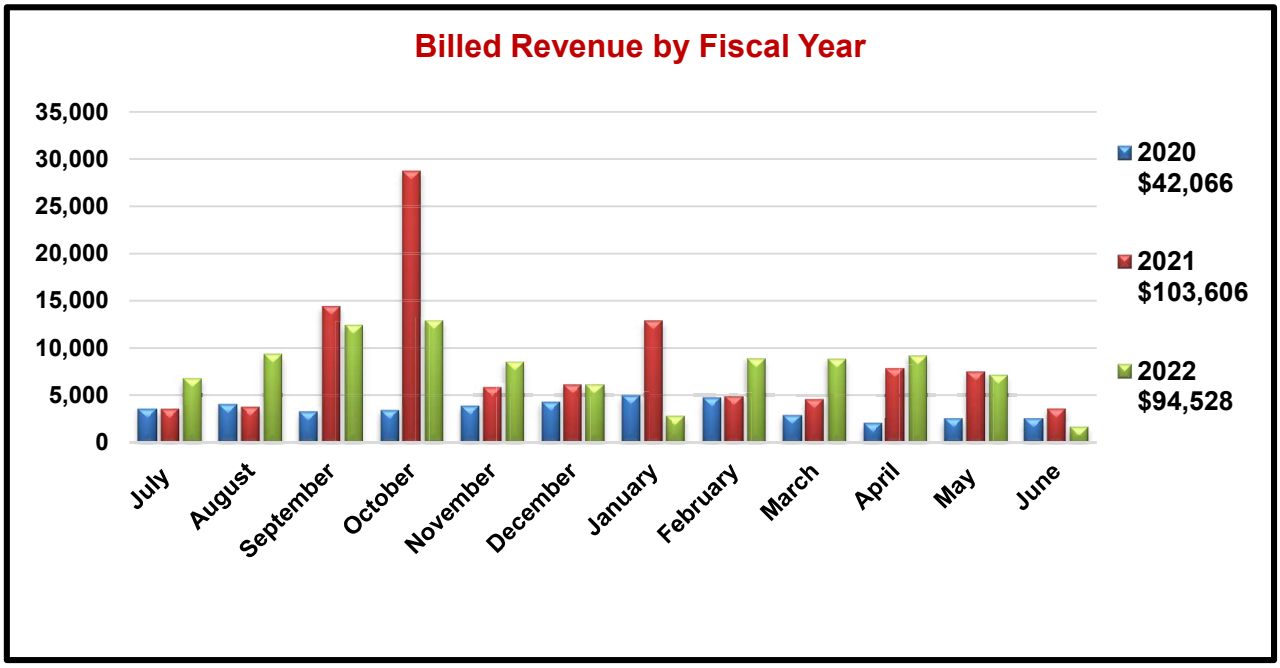
Personnel
- Bai Luo, Ph.D., Director

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., Associate Professor, HCI

Goals for FY23
- Expand CRISPR Screening Service
- Increase user base/revenue
- Present services in various department seminar series

Revenue/Expenses
FY22 Expenses: **Total $192,168**
FY22 Revenue: **Total $174,528**

- VP of Health Sciences Support: $80,000
- FY22 Revenue Generated from Services: $94,528

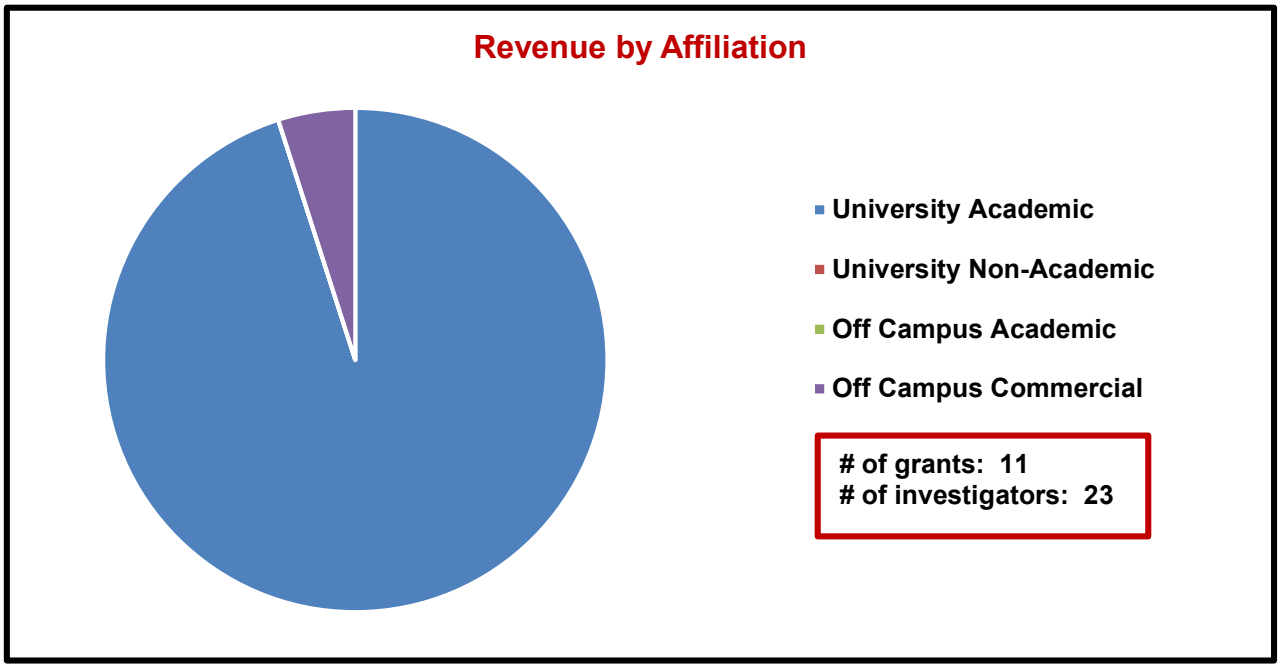


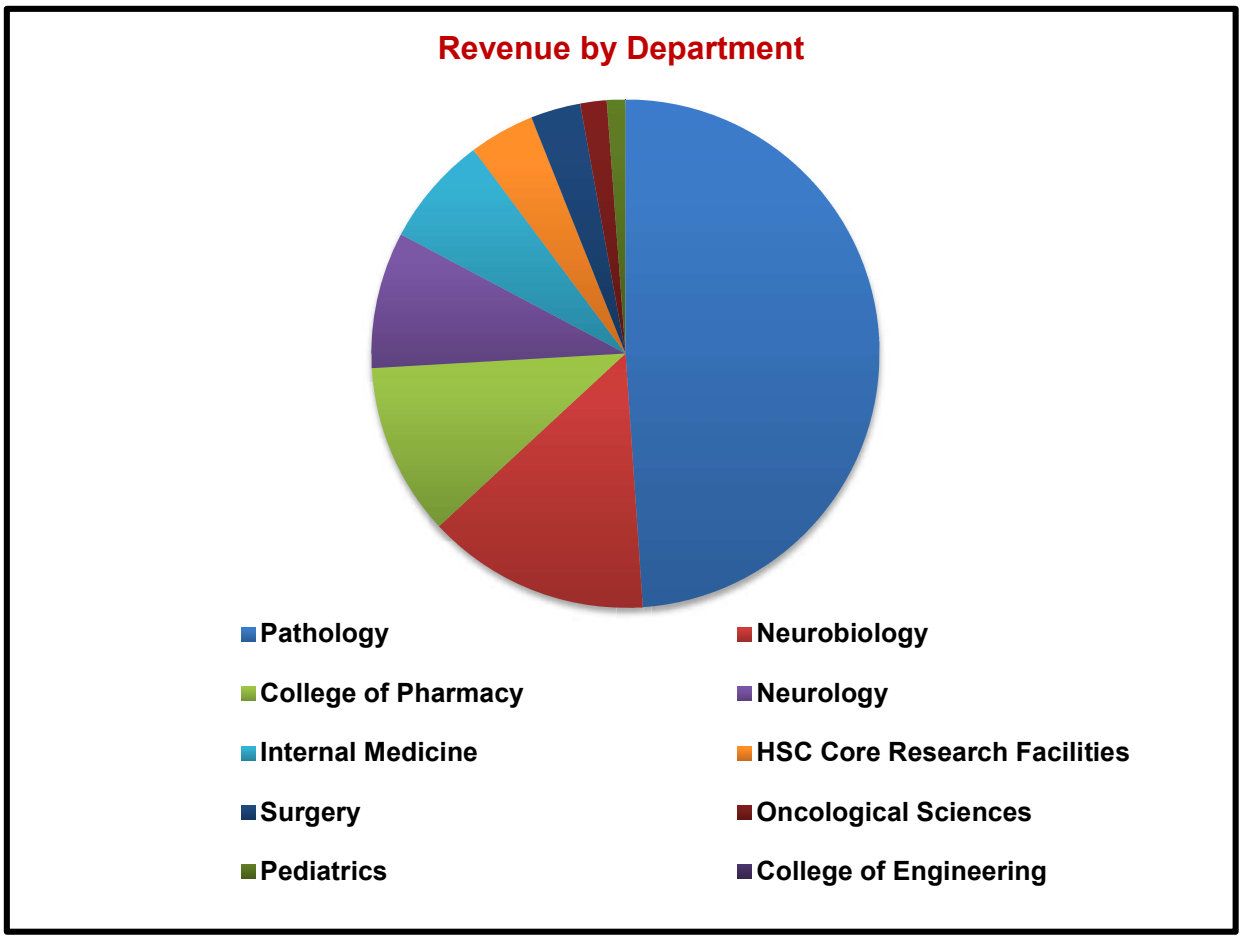
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Haeckler, Hans	NIH
2	Penovich, Wanda	Department
3	Franzini, Raphael	NIH, Department
4	Shepherd, Jason	Silicon Valley Community Foundation, NIH
5	Pezzolesi, Marcus	NIH
6	Brigidi, Stefano	Department
7	Ladder Therapeutics Inc	Off Campus Commercial
8	Davey Hicks, Crystal	Department
9	Agarwal, Jay	Department
10	Phillips, John	NIH, Department

Publications

No publications acknowledged this facility in FY22.

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 four spatially distinct locations to serve the needs of the clinical and research groups. The main facility is in SMBB, and two transmission electron microscopes (TEMs) are located there. Two TEMs and one scanning electron microscope (SEM) are located in CSC. RB LAB and BIOL each house one TEM.

Services

Clinical Services:

- Thin-section electron microscopy of tissue biopsies (technical portion of clinical EM)

Research Services:

- Training on the TEMs, SEM, microtomes, sample preparation, and 3D image reconstruction
- 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 some cases distances < 3 Å can be resolved)
- Remote access to TEMs and SEM

Equipment:

- JEOL JEM-1400 Plus, transmission electron microscope
- ThermoFisher Tecnai 12, transmission electron microscope
- Two Hitachi 7100, transmission electron microscopes
- 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
- Zeiss GeminiSEM 300 scanning electron microscope
- Leica UC7 ultramicrotome, with cryogenic attachments
- Three 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
- Sputter coater
- Glow discharger
- Baltec HPM010 high-pressure freezer
- Freeze substitution machine
- Critical-point dryer
- High-performance computing nodes (maintained by CHPC)

Personnel

- David Belnap, Ph.D., Director
- Nancy Chandler, Senior Laboratory Specialist
- Bryan Gustafson, Laboratory Technician
- Willisa Liou, Ph.D., Senior Laboratory Specialist
- Linda Nikolova, Senior Laboratory Specialist
- David Timm, 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: February 24, 2022.

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

Goals for FY23

- Continue obtaining high-quality TEM data from Titan Krios microscope
- Maintain high-quality clinical services
- Increase research usage
- Increase usage of underutilized microscopes
- Improve efficiency of lab by consolidation or other means
- Become more proficient at tomography and start doing micro electron diffraction

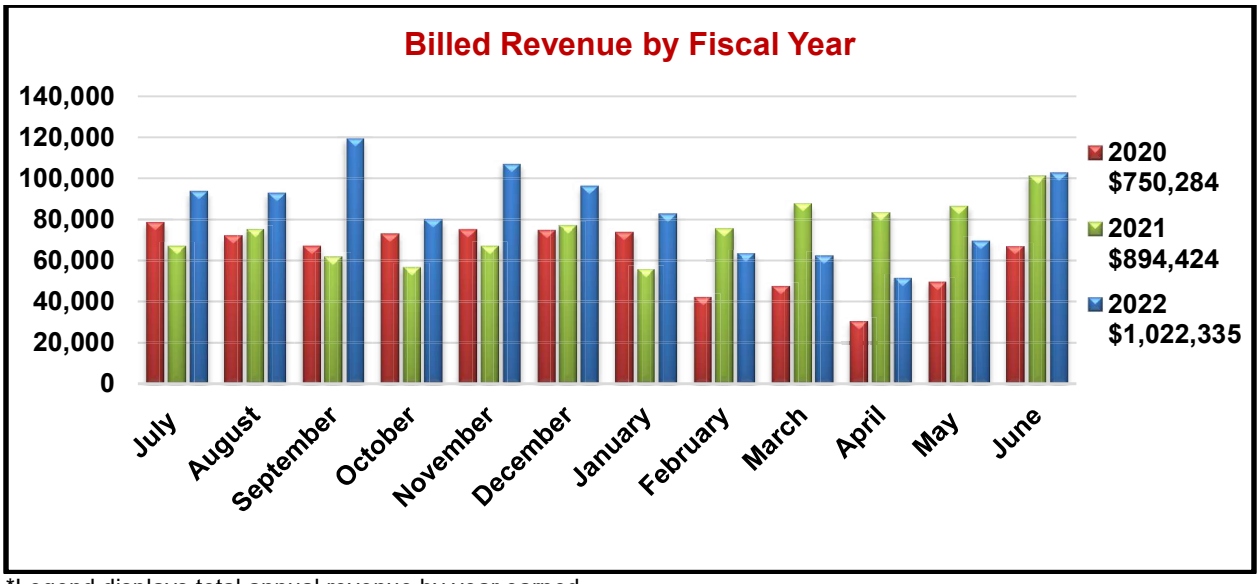
2022 Annual Update

Revenue/Expenses

FY22 Expenses: Total $967,932

FY22 Revenue: Total $1,067,335

- VP of Health Sciences Support: $20,000
- VP of Research Support : $25,000
- FY22 Revenue generated from services: $1,022,335

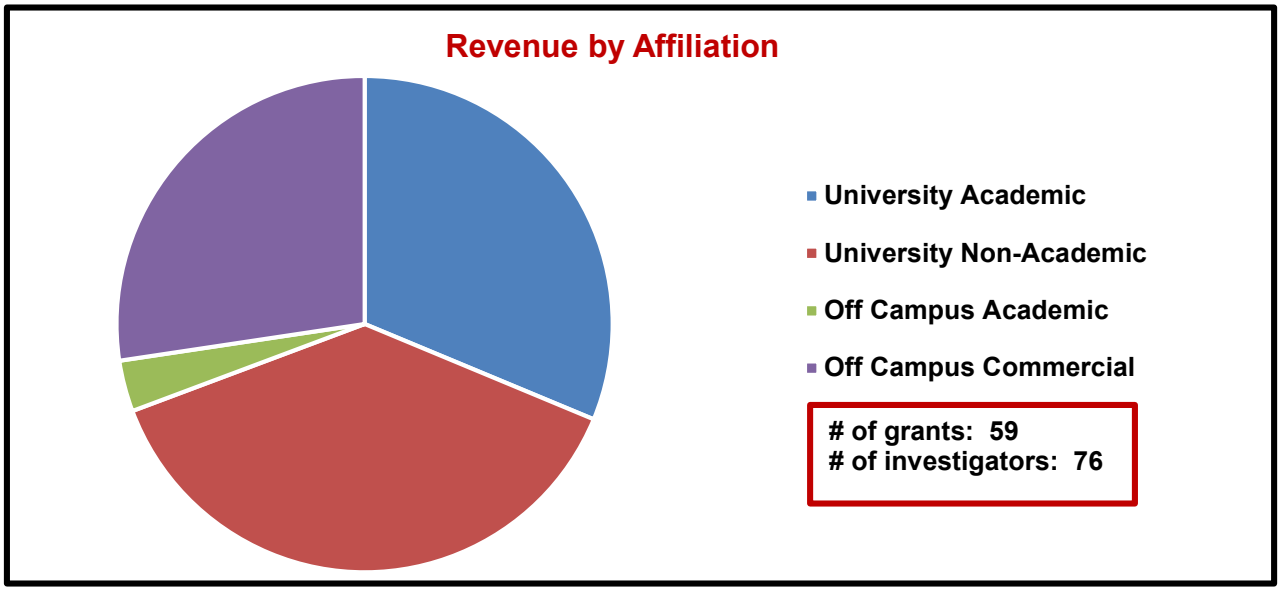


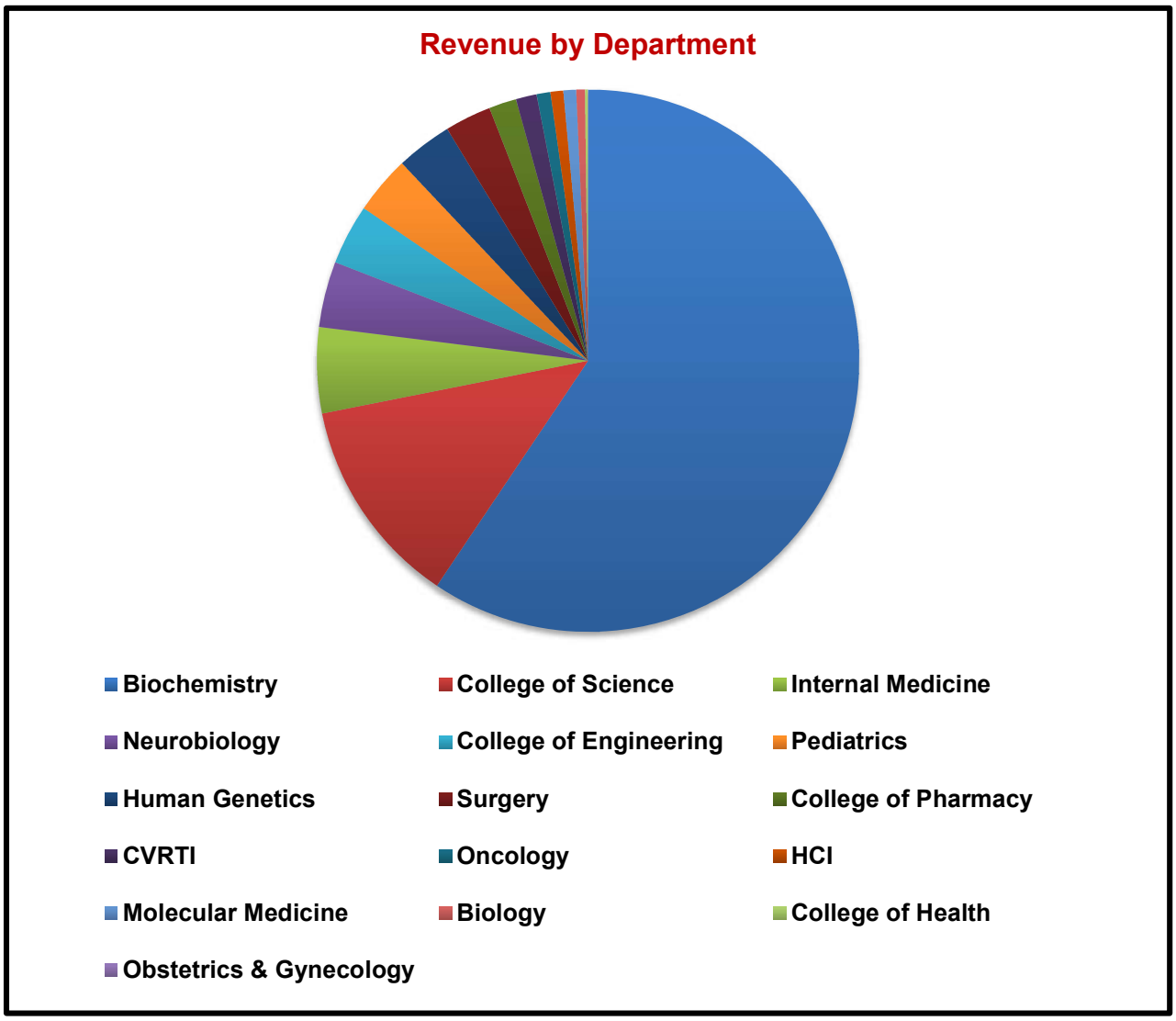
*Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	ARUP	University Non-Academic
2	Bristol-Myers Squibb	Off Campus Commercial
3	Shen, Peter	Department, BYU, NIH
4	Sundquist, Wesley	Off Campus Commercial
5	Saint John's	Department, NIH
6	Science Exchange	Commercial
7	Cao, Erhu	Department, NIH, Pew Charitable Trusts
8	Vir Biotechnology	Commercial
9	Sanofi	Commercial
10	Neomorph	Commercial

Publications

1. Rollins, M. G., M. Shasmal, N. Meade, H. Astar, P. S. Shen and D. Walsh (2021). "Negative charge in the RACK1 loop broadens the translational capacity of the human ribosome." Cell Rep **36**(10): 109663.10.1016/j.celrep.2021.109663
2. Wardzala, C. L., A. M. Wood, D. M. Belnap and J. R. Kramer (2022). "Mucins Inhibit Coronavirus Infection in a Glycan-Dependent Manner." ACS Cent Sci **8**(3): 351-360.10.1021/acscentsci.1c01369
3. Xu, Y., H. Han, I. Cooney, Y. Guo, N. G. Moran, N. R. Zuniga, J. C. Price, C. P. Hill and P. S. Shen (2022). "Active conformation of the p97-p47 unfoldase complex." Nat Commun **13**(1): 2640.10.1038/s41467-022-30318-3

Flow Cytometry Facility

Overview

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

Uniqueness

The Flow Cytometry facility is recognized 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 in order 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 in order to define projects in the early stages of development to make optimal and efficient use of flow cytometry. The staff will prepare samples including staining, data collection, quality control, data analysis/interpretation, and creation of graphics. Alternatively, if the investigator chooses, the facility can provide consultation only on any of the above services so that the research is entirely in the hands of the investigator.

Equipment

Sorters

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

Analyzers

- BD FACSCanto
- BD LSRFortessa
- Beckman Coulter Cytoflex 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
- Josh Monts, Senior Lab Technician
- Ashley Taylor, Senior Lab Specialist

Advisory Board Committee

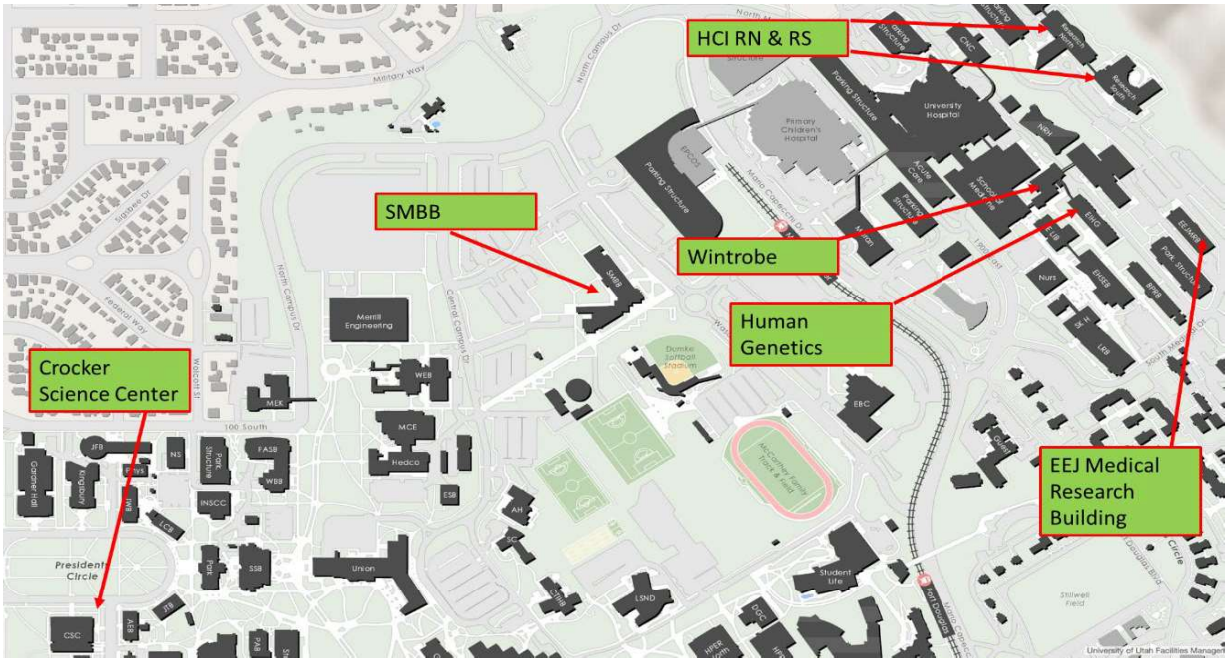
Last meeting date: June 16, 2021

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

FY22 Annual Update

New Equipment

FY22 was relatively quiet for new instrument purchases. Main campus added a Sony Cell Sorter with HHMI funds located in the Crocker Science Center. In addition, the Pathology Department added a Sony Cell Sorter and a Beckman Coulter Cytoflex analyzer. All of these instruments will be managed by the Flow Core staff but owned by other departments.



Staffing

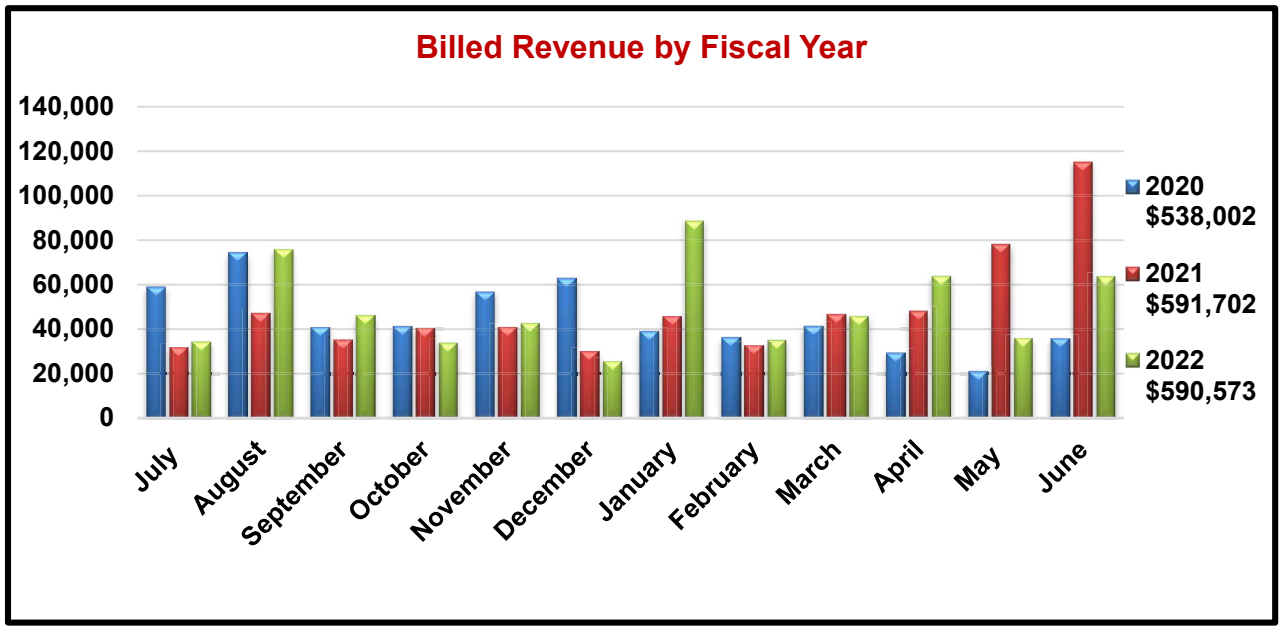
There have been significant staffing changes in the Flow Core in FY22. Vimal Kaliraj left the lab and Josh Monts was hired to replace him.

Revenue/Expenses

FY22 Expenses: Total $614,099

FY22 Revenue: Total $800,573

- FY22 Revenue generated from services: $590,573
- Equipment Support: $210,000



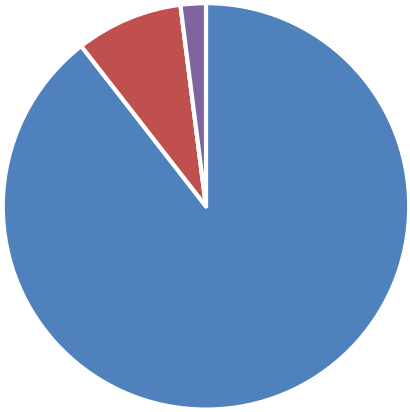
*Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):

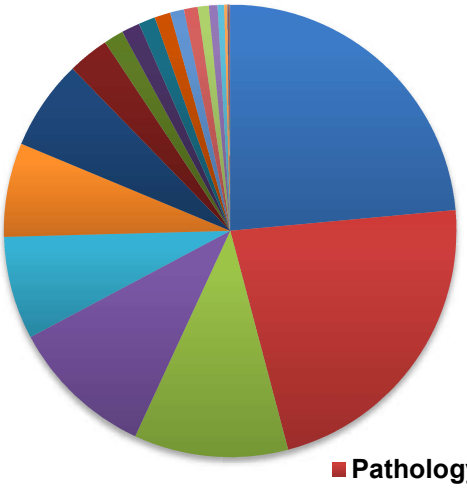
Revenue by Affiliation



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

# of grants: 159
# of investigators: 185

Revenue by Department



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

Top Users

1	Williams, Matthew	Department, NIH
2	ARUP	University Non-Academic
3	Beaudin, Anna	Department, NIH, PEW Charitable Trusts
4	Rutter, Jared	HHMI
5	Deans, Tara	NIH
6	Deininger, Michael	Department, NIH
7	Roh-Johnson, Minna	Department, DOD, NIH
8	Evavold, Brian	Department
9	Leung, Daniel	Department, NIH
10	Stephens, Deborah	Department

Publications

1. Campbell, R. A., H. D. Campbell, J. S. Bircher, C. V. de Araujo, F. Denorme, J. L. Crandell, J. L. Rustad, J. Monts, M. J. Cody, Y. Kosaka and C. C. Yost (2021). Placental HTRA1 cleaves alpha1-antitrypsin to generate a NET-inhibitory peptide. Blood **138**(11): 977-988.10.1182/blood.2020009021
2. Dickey, L. L., L. J. Martins, V. Planelles and T. M. Hanley (2022). HIV-1-induced type I IFNs promote viral latency in macrophages. J Leukoc Biol.10.1002/JLB.4MA0422-616R
3. Falekun, S., J. Sepulveda, Y. Jami-Alahmadi, H. Park, J. A. Wohlschlegel and P. A. Sigala (2021). Divergent acyl carrier protein decouples mitochondrial Fe-S cluster biogenesis from fatty acid synthesis in malaria parasites. Elife **10**.10.7554/eLife.71636
4. Guo, L., S. Shen, J. W. Rowley, N. D. Tolley, W. Jia, B. K. Manne, K. N. McComas, B. Bolingbroke, Y. Kosaka, K. Krauel, F. Denorme, S. P. Jacob, A. S. Eustes, R. A. Campbell, E. A. Middleton, X. He, S. M. Brown, C. N. Morrell, A. S. Weyrich and M. T. Rondina (2021). Platelet MHC class I mediates CD8+ T-cell suppression during sepsis. Blood **138**(5): 401-416.10.1182/blood.2020008958
5. Jensen, O., S. Trivedi, J. D. Meier, K. C. Fairfax, J. S. Hale and D. T. Leung (2022). A subset of follicular helper-like MAIT cells can provide B cell help and support antibody production in the mucosa. Sci Immunol **7**(67): eabe8931.10.1126/sciimmunol.abe8931
6. Martins, L. J., M. A. Szaniawski, E. Williams, M. Coiras, T. M. Hanley and V. Planelles (2022). HIV-1 Accessory Proteins Impart a Modest Interferon Response and Upregulate Cell Cycle-Related Genes in Macrophages. Pathogens **11**(2).10.3390/pathogens11020163
7. Okada, M., K. Rajaram, R. P. Swift, A. Mixon, J. A. Maschek, S. T. Prigge and P. A. Sigala (2022). Critical role for isoprenoids in apicoplast biogenesis by malaria parasites. Elife **11**.10.7554/eLife.73208
8. Olson, M. L., E. R. V. Mause, S. V. Radhakrishnan, J. D. Brody, A. P. Rapoport, A. L. Welm, D. Atanackovic and T. Luetkens (2022). Low-affinity CAR T cells exhibit reduced trogocytosis, preventing rapid antigen loss, and increasing CAR T cell expansion. Leukemia **36**(7): 1943-1946.10.1038/s41375-022-01585-2
9. Sun, W., J. Guo, D. McClellan, A. Poeschla, D. Bareyan, M. J. Casey, B. R. Cairns, D. Tantin and M. E. Engel (2022). GFI1 Cooperates with IKZF1/IKAROS to Activate Gene Expression in T-cell Acute Lymphoblastic Leukemia. Mol Cancer Res **20**(4): 501-514.10.1158/1541-7786.MCR-21-0352
10. Sun, W., X. Jia, M. Liesa, D. Tantin and D. M. Ward (2022). ABCB10 Loss Reduces CD4(+) T Cell Activation and Memory Formation. J Immunol **208**(2): 328-337.10.4049/jimmunol.2100514
11. Warde, Kate M., Lihua Liu, Lorenzo J. Smith, Brian K. Lohman, Chris J. Stubben, H. Atakan Ekiz, Julia L. Ammer, et al (2022). Senescence-Induced Immune Remodeling Facilitates Metastatic Adrenal Cancer in a Sex-Dimorphic Manner. bioRxiv, April 29, 2022. Preprint doi 10.1101/2022.04.29.488426
12. Zhao, H., A. D. Pomicter, A. M. Eiring, A. Franzini, J. Ahmann, J. Y. Hwang, A. Senina, B. Helton, S. Iyer, D. Yan, J. S. Khorashad, M. S. Zabriskie, A. Agarwal, H. M. Redwine, A. D. Bowler, P. M. Clair, S. K. McWeeney, B. J. Druker, J. W. Tyner, D. L. Stirewalt, V. G. Oehler, S. Varambally, K. C. Berrett, J. M. Vahrenkamp, J. Gertz, K. E. Varley, J. P. Radich and M. W. Deininger (2022). MS4A3 promotes differentiation in chronic myeloid leukemia by enhancing common beta-chain cytokine receptor endocytosis. Blood **139**(5): 761-778.10.1182/blood.2021011802

Genomics Facility

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

2022 Annual Update

New Equipment

- The Genomics Facility did not acquire new equipment in FY22

New Services

- The Genomics Facility did not implement additional services in FY22

Advisory Board Committee

Last meeting date: July 6th, 2021

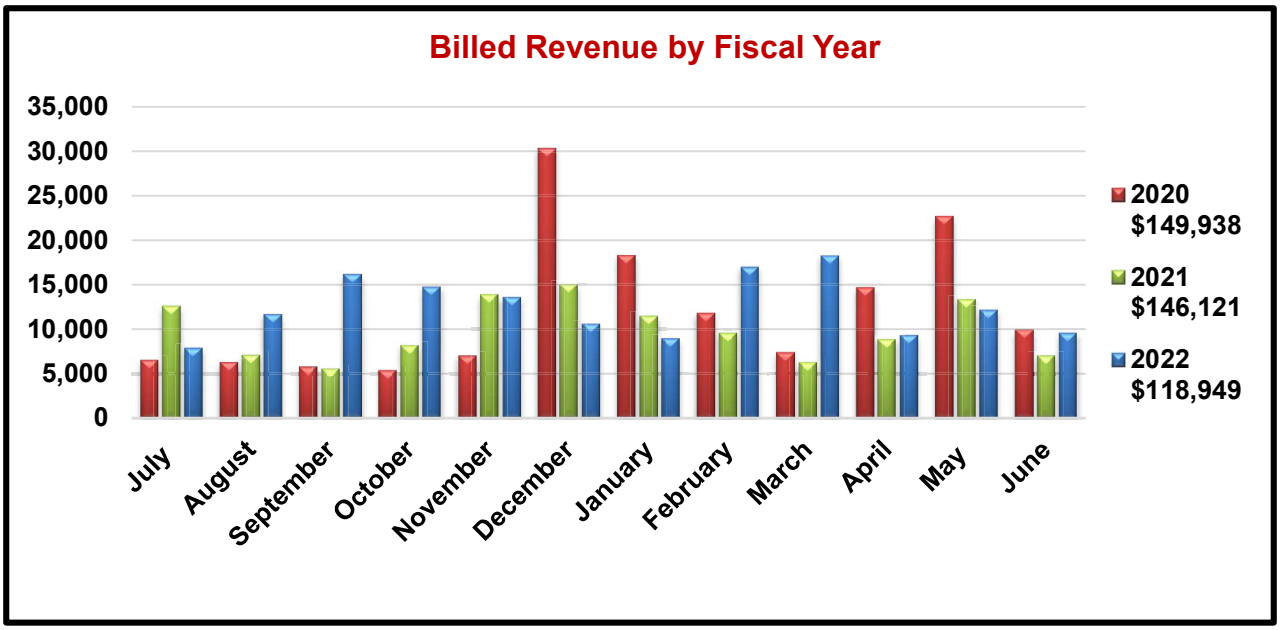
- Gerald Krueger M.D., Professor, Dermatology
- Deborah Neklason Ph.D., Research Associate Professor, Huntsman Cancer Institute
- Nicola Camp Ph.D., Professor, Department of Pathology

Revenue/Expenses

FY22 Expenses: **Total $132,734**

FY22 Revenue: **Total $118,949**

- VP of Health Sciences Support: 0
- FY22 Revenue generated from services: $118,949

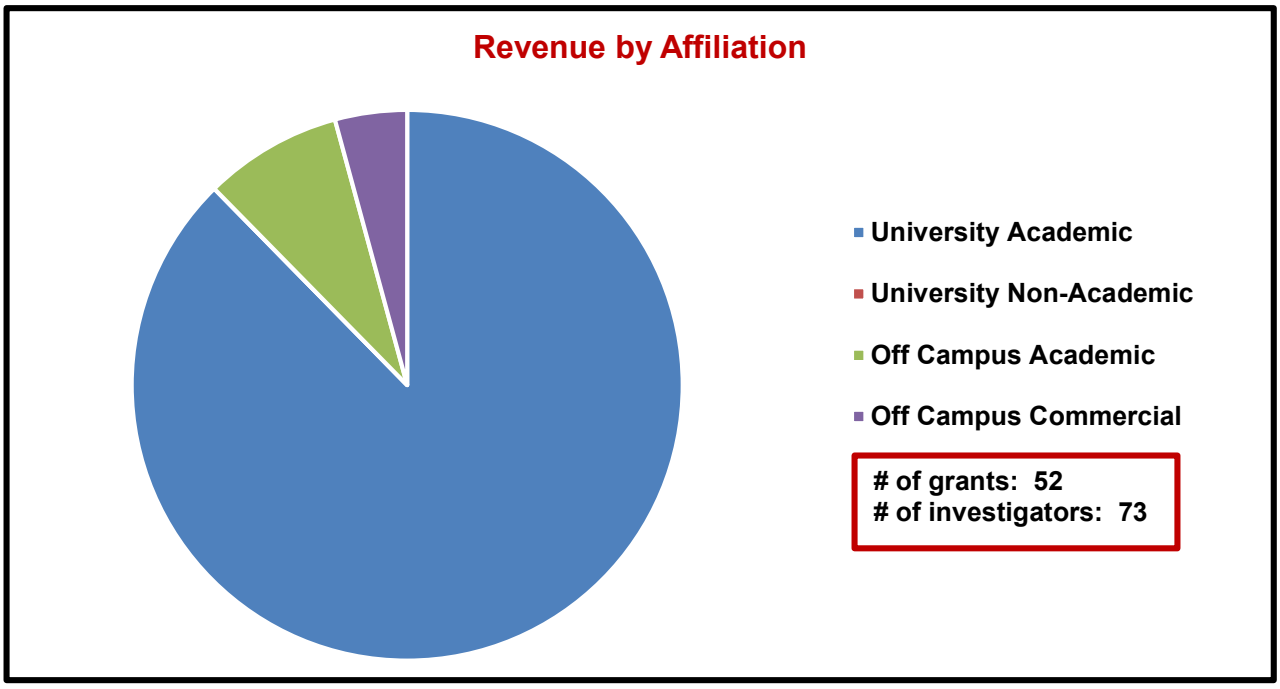


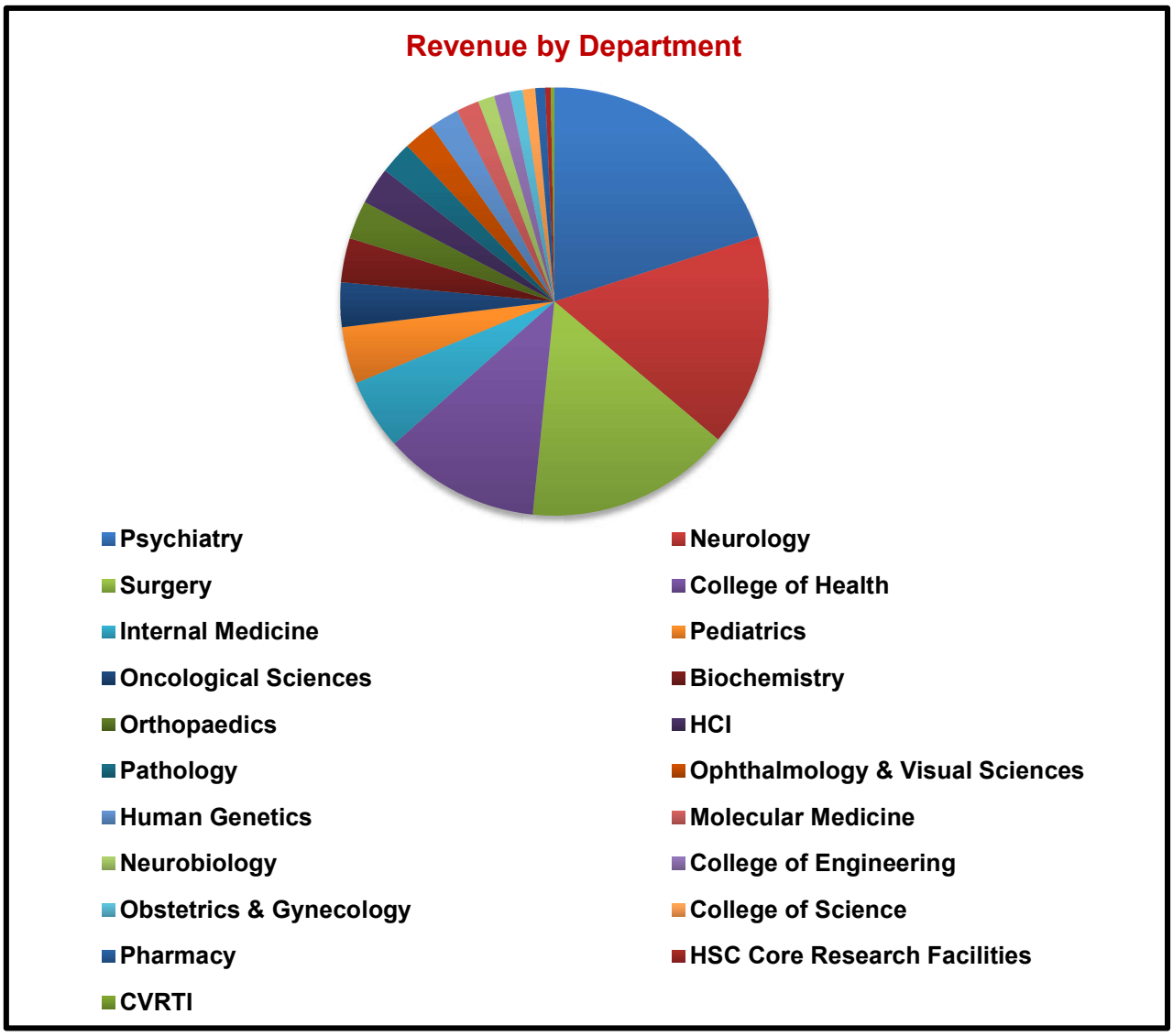
* Legend displays total annual billed revenue by year.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Docherty, Anna	NIH
2	Penovich, Wanda	Department
3	Ashton, Kenneth	Department
4	Summers, Scott	NIH, Potrero Hill Therapeutics
5	Welm, Bryan	NIH
6	Pezzolesi, Marcus	August University, National Kidney FTD
7	Tulane University	Off Campus Academic
8	Jones, Kevin	NIH
9	University of Montana	Off Campus Academic
10	Rutter, Jared	HHMI

Publications

1. Ferrara, P. J., A. R. P. Verkerke, J. A. Maschek, J. L. Shahtout, P. Siripoksup, H. Eshima, J. M. Johnson, J. J. Petrocelli, Z. S. Mahmassani, T. D. Green, J. M. McClung, J. E. Cox, M. J. Drummond and K. Funai (2021). Low lysophosphatidylcholine induces skeletal muscle myopathy that is aggravated by high-fat diet feeding. FASEB J **35**(10): e21867.10.1096/fj.202101104R
2. Gorsi, B., E. Hernandez, M. B. Moore, M. Moriwaki, C. Y. Chow, E. Coelho, E. Taylor, C. Lu, A. Walker, P. Touraine, L. M. Nelson, A. R. Cooper, E. R. Mardis, A. Rajkovic, M. Yandell and C. K. Welt (2022). Causal and Candidate Gene Variants in a Large Cohort of Women With Primary Ovarian Insufficiency. J Clin Endocrinol Metab **107**(3): 685-714.10.1210/clinem/dgab775
3. Guillen, K. P., M. Fujita, A. J. Butterfield, S. D. Scherer, M. H. Bailey, Z. Chu, Y. S. DeRose, L. Zhao, E. Cortes-Sanchez, C. H. Yang, J. Toner, G. Wang, Y. Qiao, X. Huang, J. A. Greenland, J. M. Vahrenkamp, D. H. Lum, R. E. Factor, E. W. Nelson, C. B. Matsen, J. M. Poretta, R. Rosenthal, A. C. Beck, S. S. Buys, C. Vaklavas, J. H. Ward, R. L. Jensen, K. B. Jones, Z. Li, S. Oesterreich, L. E. Dobrolecki, S. S. Pathi, X. Y. Woo, K. C. Berrett, M. E. Wadsworth, J. H. Chuang, M. T. Lewis, G. T. Marth, J. Gertz, K. E. Varley, B. E. Welm and A. L. Welm (2022). A human breast cancer-derived xenograft and organoid platform for drug discovery and precision oncology. Nat Cancer **3**(2): 232-250.10.1038/s43018-022-00337-6
4. Huang, Z., S. Liu, A. Tang, L. Al-Rabadi, M. Henkemeyer, P. N. Mimche and Y. Huang (2021). Key role for EphB2 receptor in kidney fibrosis. Clin Sci (Lond) **135**(17): 2127-2142.10.1042/CS20210644
5. Moriwaki, M. and C. K. Welt (2021). PRL Mutation Causing Alactogenesis: Insights Into Prolactin Structure and Function Relationships. J Clin Endocrinol Metab **106**(8): e3021-e3026.10.1210/clinem/dgab201
6. Petersen, C., D. Bharat, U. D. Wankhade, J. S. Kim, B. R. Cutler, C. Denetso, S. Gholami, S. Nelson, J. Bigley, A. Johnson, S. V. Chintapalli, B. D. Piccolo, A. K. Satheesh Babu, H. A. Paz, K. Shankar, J. D. Symons and P. V. Anandh Babu (2022). Dietary Blueberry Ameliorates Vascular Complications in Diabetic Mice Possibly through NOX4 and Modulates Composition and Functional Diversity of Gut Microbes. Mol Nutr Food Res **66**(8): e2100784.10.1002/mnfr.202100784

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 provide consultation to assist with the design process for products ranging from precise surgical instruments to large-scale testing equipment. They also fabricate as well as repair devices and parts made from carbon-steel, stainless steel, brass, copper, plastics, and other materials depending upon the requirements of design specifications. We provide 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

2022 Annual Update

New Equipment

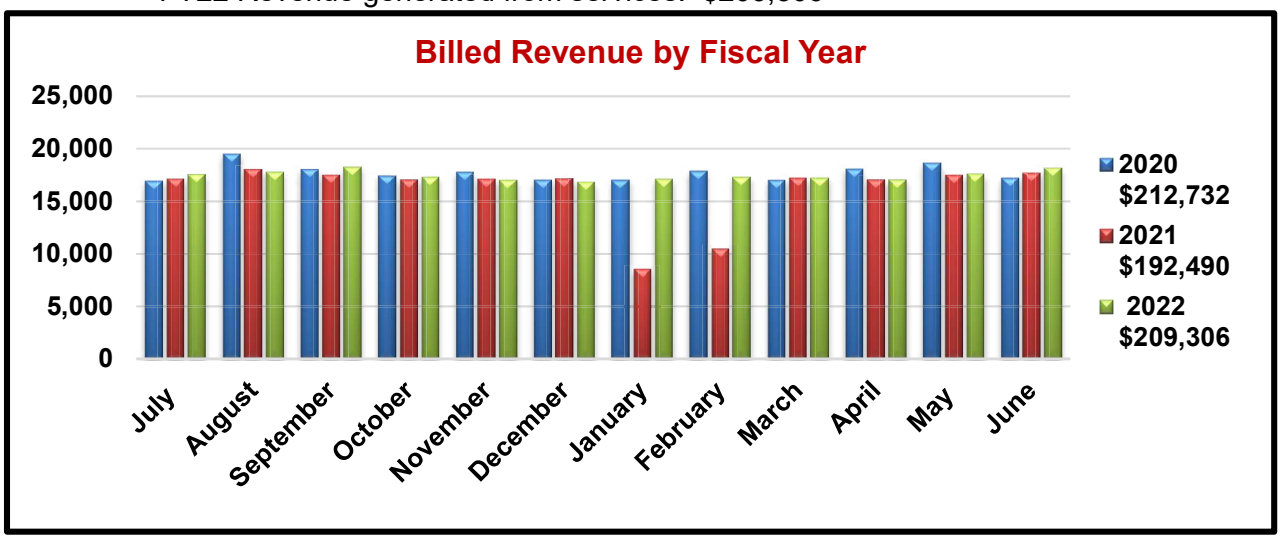
- One Epax E10 4K resolution resin 3D printer
- One Shapeoko XL CNC router

Revenue/Expenses

FY22 Expenses: **Total $247,304**

FY22 Revenue: Total $259,306

- VP of Health Sciences Support: $50,000
- FY22 Revenue generated from services: $209,306

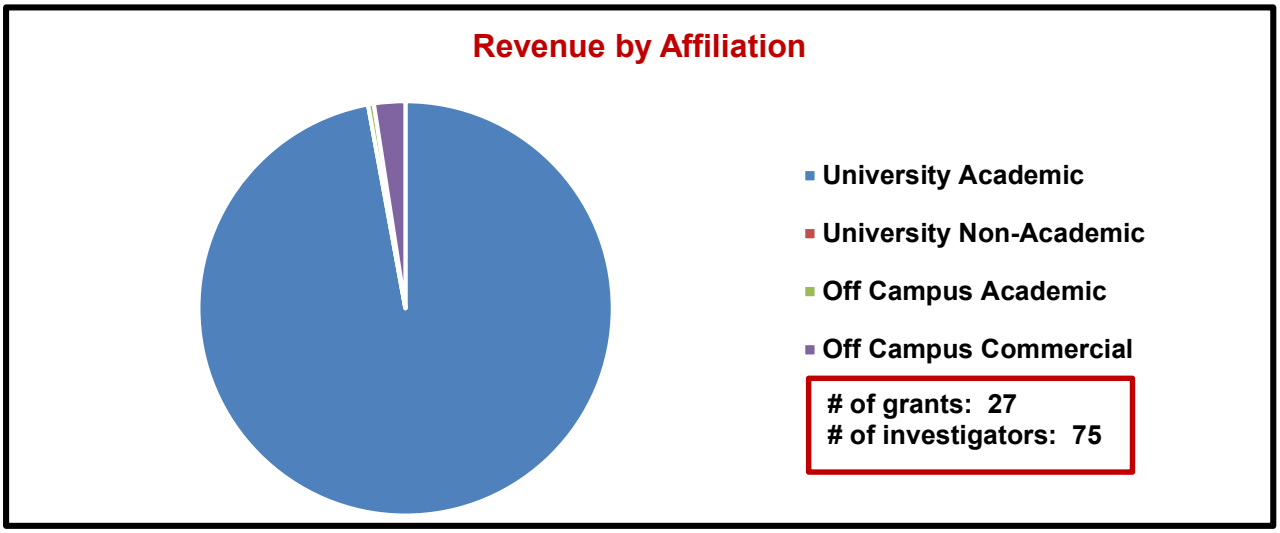


* Legend displays total annual revenue by year generated.

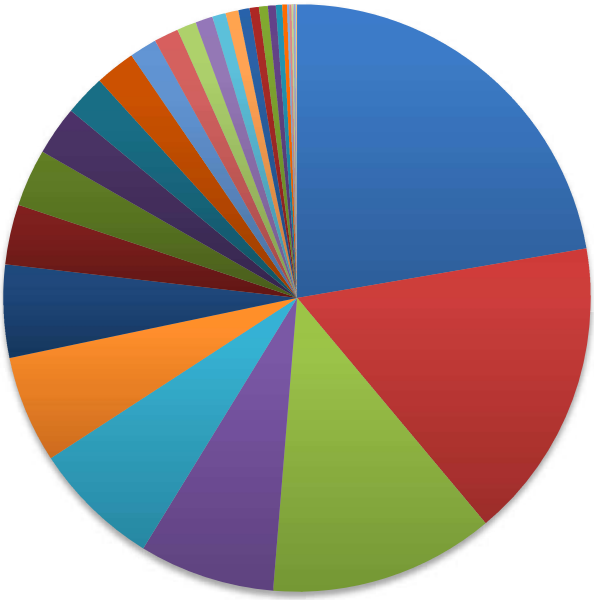
FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):



Revenue by Department



- Hospital Operating Room
- College of Engineering
- Hospital Materials Management
- Radiation Oncology
- Hospital Perioperative Services
- Hospital Surgical Services
- Pediatrics
- Hospital Pharmacy
- Hospital Sterile Processing
- Orthopaedics
- Neurobiology
- Surgery
- Ophthalmology & Visual Sciences
- College of Pharmacy
- College of Health
- Biochemistry
- Mines & Earth Sciences
- Radiology & Imaging Sciences
- HSC Core Research Facilities
- Hospital Restore Surgical
- Molecular Medicine
- College of Social & Behavioral Science
- HCI
- Pathology
- Hospital Maintenance
- Neurosurgery
- Moran Eye Center
- Pysical Medicine & Rehab
- Respiratory Therapy
- SVPHS

Top Users

1	Pectol, Dan	Department
2	Klev, Brent	Department
3	Meisner, Steve	U of U Hospital
4	Hiatt, Catherine	U of U Hospital
5	Maag, Russ	U of U Hospital
6	Henderson, Joey	U of U Surgery
7	Hong, Andy	US Dept. of Interior
8	Wilcox, Karen	NIH
9	Schober, Michelle	NIH
10	Peacock, Darren	Department

Publications

No publications acknowledged this facility in FY22

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 and SILAC labelling
- 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 Ph.D., Research Associate
- Allison Manuel Ph.D., Research Associate

Advisory Board Committee

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

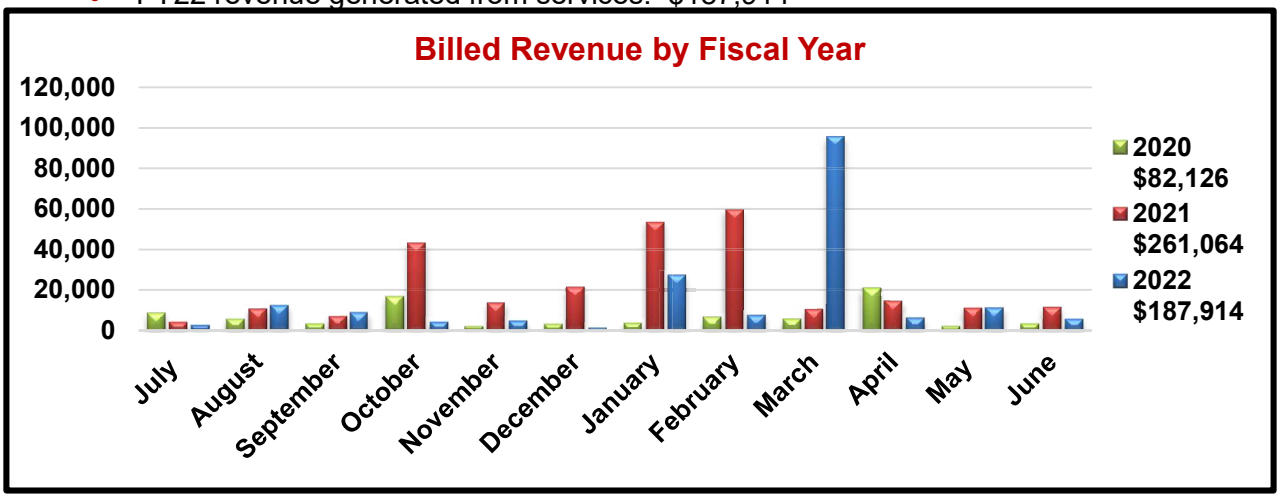
2022 Annual Update

Revenue/Expenses

FY22 Expenses: **Total $346,189**

FY22 Revenue: **Total $332,914**

- VP of Health Sciences Support: $145,000
- FY22 revenue generated from services: $187,914

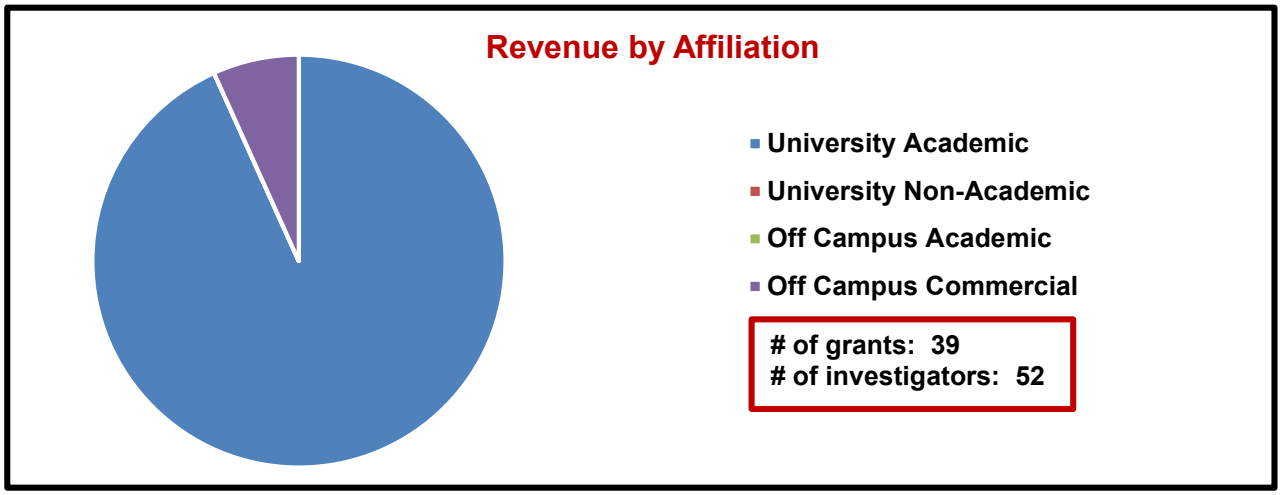


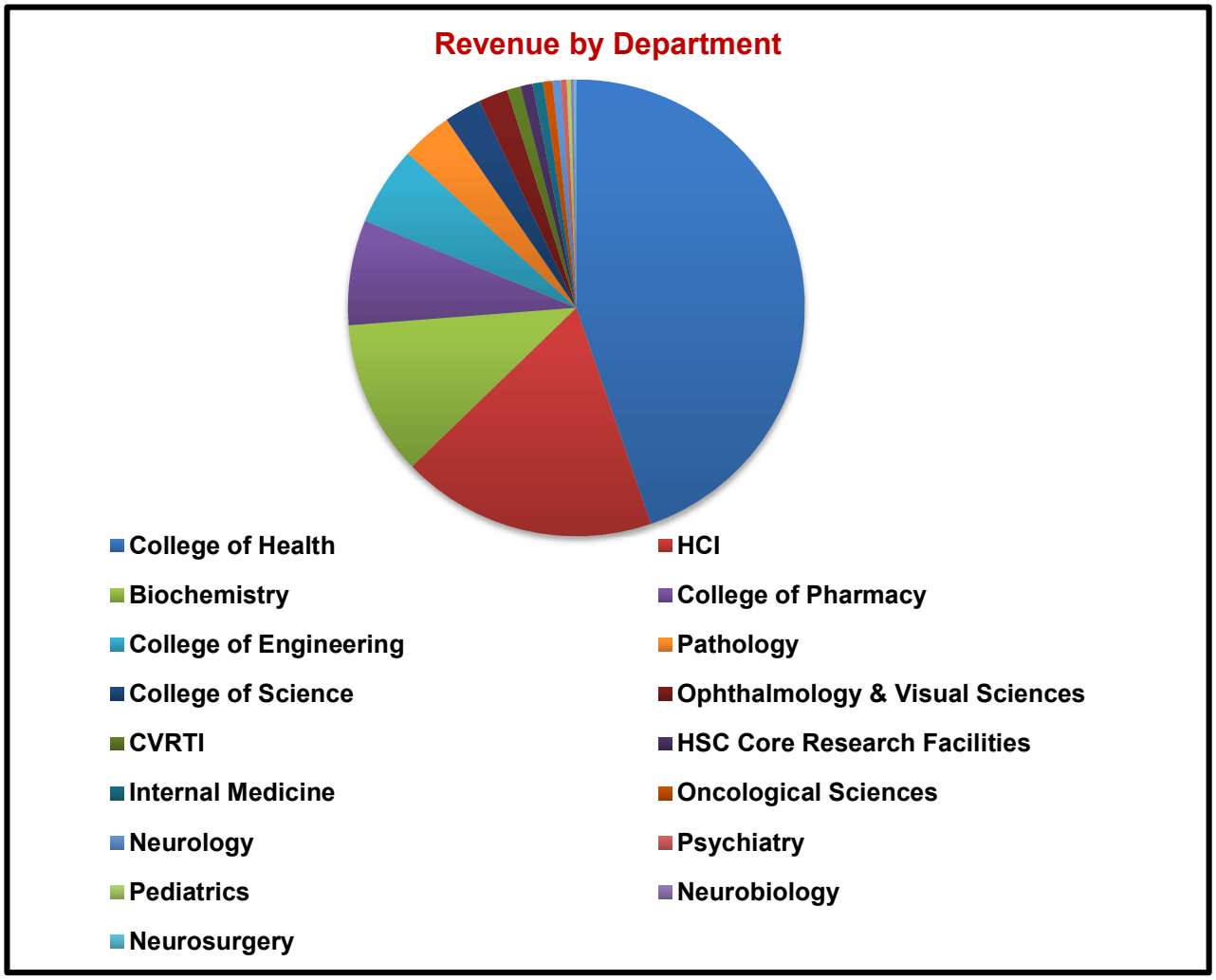
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Playdon, Mary	NIH
2	Ulrich, Neli	NIH
3	Sundquist, Wesley	Department, NIH
4	3Helix	Commercial
5	Weiss, Jeffrey	NIH
6	Deans, Tara	NIH
7	Schmidt, Eric	NIH
8	Vankayalapati, Hari	Department, NIH
9	McMahon, Martin	Department, Pfizer
10	Echelon Bioscience	Commercial

Publications

1. Gambles, M. T., J. Li, J. Wang, D. Sborov, J. Yang and J. Kopecek (2021). Crosslinking of CD38 Receptors Triggers Apoptosis of Malignant B Cells. Molecules **26**(15).10.3390/molecules26154658
2. Ramiro, I. B. L., W. E. Bjorn-Yoshimoto, J. S. Imperial, J. Gajewiak, P. F. Salcedo, M. Watkins, D. Taylor, W. Resager, B. Ueberheide, H. Brauner-Osborne, F. G. Whitby, C. P. Hill, L. F. Martin, A. Patwardhan, G. P. Concepcion, B. M. Olivera and H. Safavi-Hemami (2022). Somatostatin venom analogs evolved by fish-hunting cone snails: From prey capture behavior to identifying drug leads. Sci Adv **8**(12): eabk1410.10.1126/sciadv.abk1410
3. Rheinemann, L., T. Thompson, G. Mercenne, E. L. Paine, F. C. Peterson, B. F. Volkman, S. L. Alam, A. Alian and W. I. Sundquist (2021). Interactions between AMOT PPxY motifs and NEDD4L WW domains function in HIV-1 release. J Biol Chem **297**(2): 100975.10.1016/j.jbc.2021.100975

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
- Luminex 200 System
- Ortho Clinical Vitros 350 chemistry analyzer
- Powers Scientific rodent incubators

Personnel

- Ying Li Ph.D., Director

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

2022 Annual Update

Equipment

MPC purchased a new LF Body Composition Rat/Mice Analyzer (LF 90, Bruker) through RIF to replace the old Bruker LF50. This instrument measures body composition using magnetic resonance technology to provide a precise method for the measurement of lean tissue, fat, and fluid in living mice and rats. It is very important for a large group of researchers at the University of Utah who study metabolic disorders, cancer metabolism, and diet and exercise physiology.

We brought the multiplexing machine, MAGPIX, back online which uses magnetic bead mapping technology to get concentrations of cytokines in samples (blood, media, and tissue extraction).

We brought the Vitros 350 system back online that measures variable analytes concentration in the body fluids. This instrument is used most by groups who study liver function.

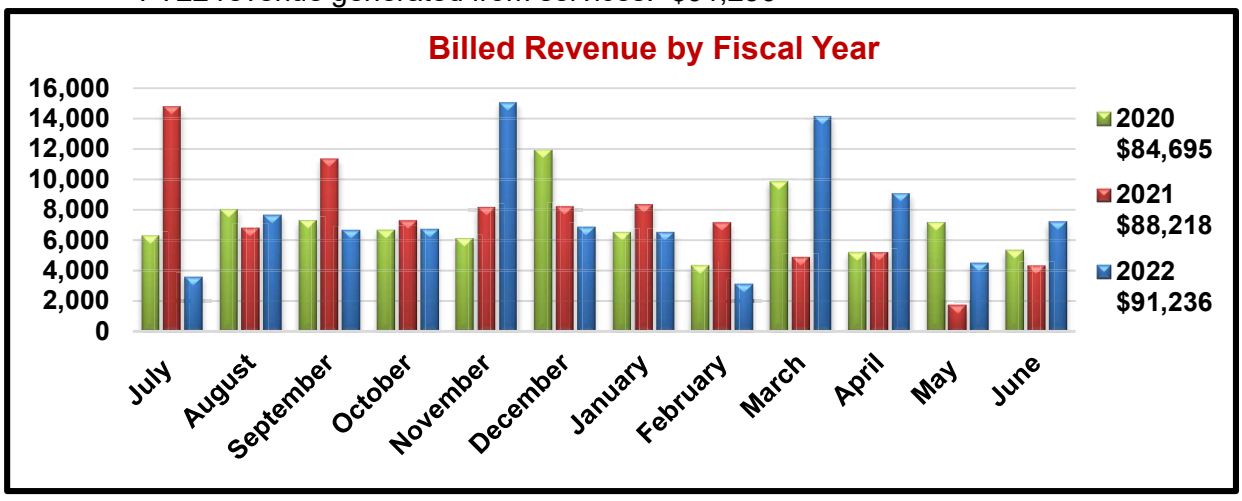
We brought the rodent incubator back online for users who want to study metabolic phenotypes of mice under different ambient temperatures.

We brought the CLAMS system with temperature controller back online.

Revenue/Expenses

FY22 Expenses: **Total $215,245**
FY22 Revenue: Total $174,236

- VP of Health Sciences Support: $ 70,000
- Equipment Support: $13,000
- FY22 revenue generated from services: $91,236

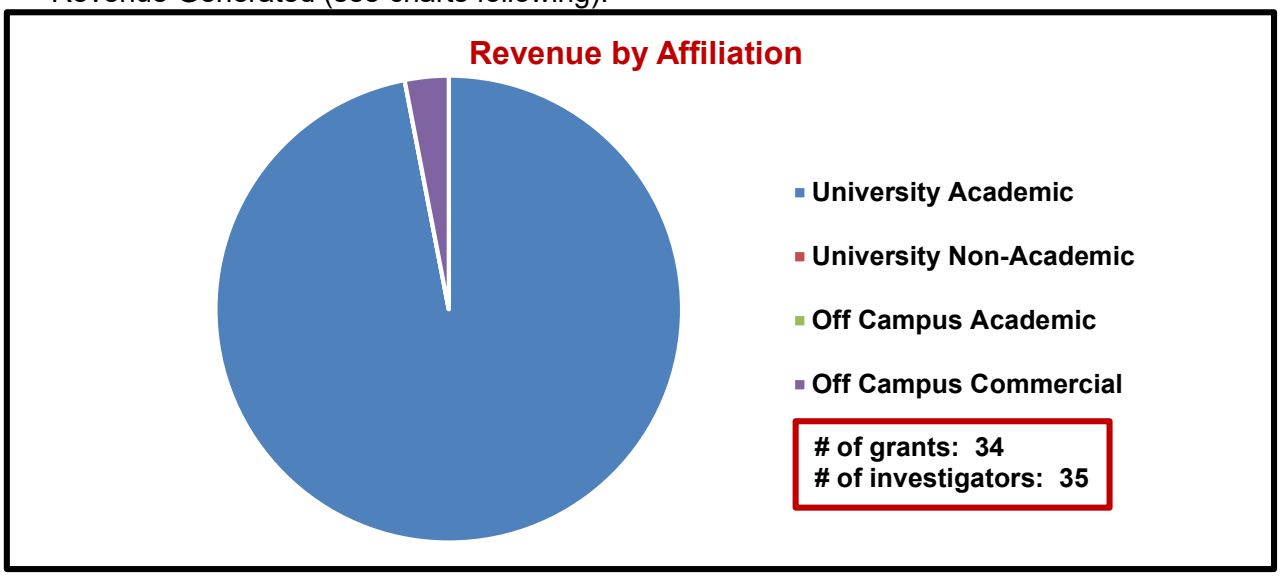


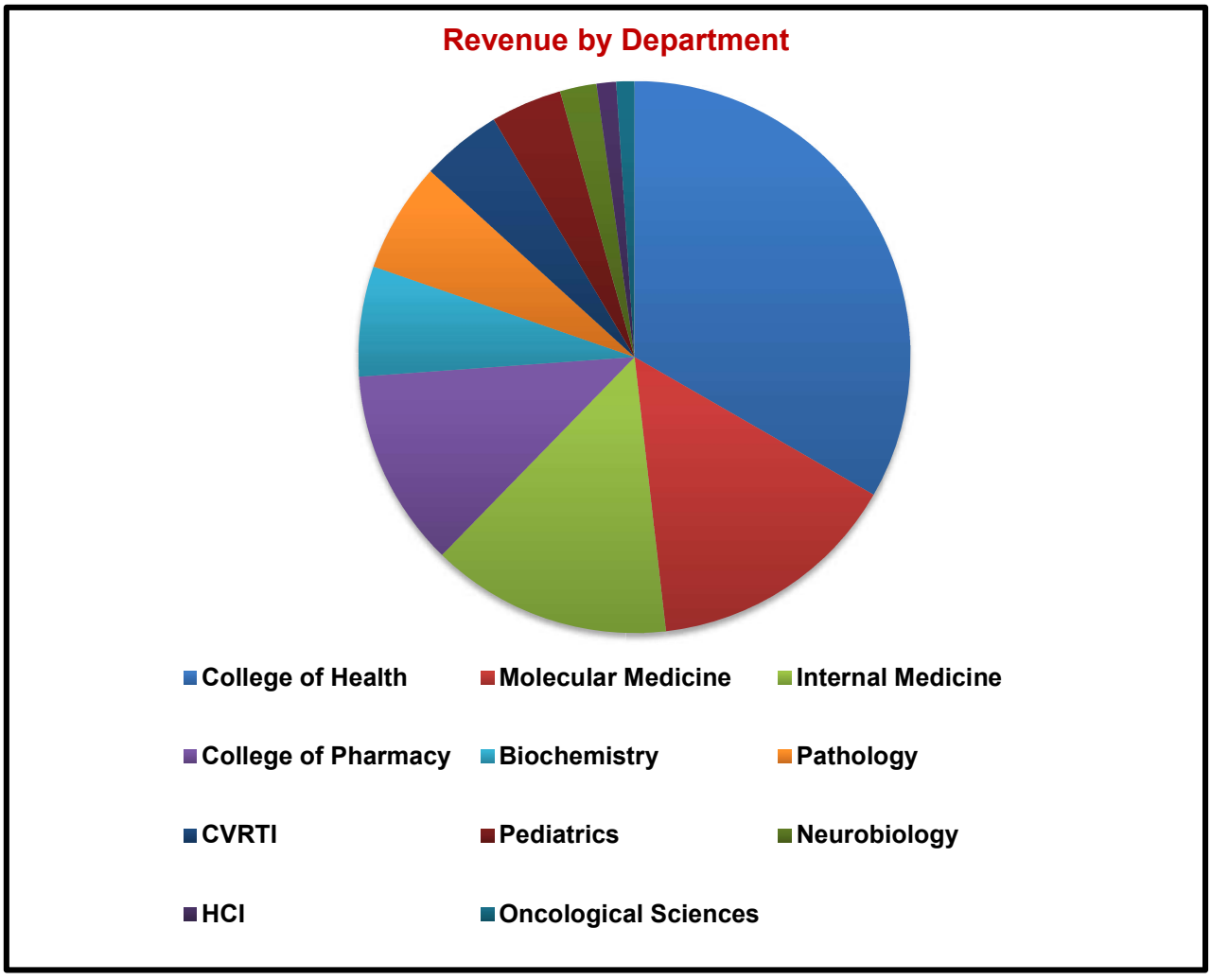
*Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Chaix, Amandine	NIH
2	Drummond, Micah	NIH, Utah State University
3	Funai, Katsuhiko	NIH, Department
4	Yang, Tianxin	NIH
5	Summers, Scott	NIH
6	Hong, TingTing	Department
7	Chaudhuri, Dipayan	NIH
8	Venosa, Alessandro	NIH, Department
9	Hilgendorf, Karen	Department
10	Mimche, Patrice	NIH, Scleroderma FTD

Publications

1. Eberhardt, D. R., S. H. Lee, X. Yin, A. M. Balynas, E. C. Rekate, J. N. Kraiss, M. J. Lang, M. A. Walsh, M. E. Streiff, A. C. Corbin, Y. Li, K. Funai, F. B. Sachse and D. Chaudhuri (2022). EFHD1 ablation inhibits cardiac mitoflash activation and protects cardiomyocytes from ischemia. J Mol Cell Cardiol **167**: 1-14.10.1016/j.yjmcc.2022.03.002
2. Li, Y., C. L. Talbot, B. Chandravanshi, A. Ksiazek, A. Sood, K. H. Chowdhury, J. A. Maschek, J. Cox, A. K. S. Babu, H. A. Paz, P. V. A. Babu, D. K. Meyerholz, U. D. Wankhade, W. Holland, E. Shyong Tai, S. A. Summers and B. Chaurasia (2022). Cordyceps inhibits ceramide biosynthesis and improves insulin resistance and hepatic steatosis. Sci Rep **12**(1): 7273.10.1038/s41598-022-11219-3
3. Nielson, J. R., A. K. Nath, K. P. Doane, X. Shi, J. Lee, E. G. Tippetts, K. Saha, J. Morningstar, K. G. Hicks, A. Chan, Y. Zhao, A. Kelly, T. B. Hendry-Hofer, A. Witeof, P. Y. Sips, S. Mahon, V. S. Bebarta, V. J. Davisson, G. R. Boss, J. Rutter, C. A. MacRae, M. Brenner, R. E. Gerszten and R. T. Peterson (2022). Glyoxylate protects against cyanide toxicity through metabolic modulation. Sci Rep **12**(1): 4982.10.1038/s41598-022-08803-y

Metabolomics Facility

Overview

The Metabolomics Core at the University of Utah is a recognized leader in the field of global metabolomics, lipidomics and metabolic tracer analysis (MTA). It was established 17 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 sample using two distinct but overlapping procedures, a targeted analysis and a non-targeted analysis. The targeted analysis is used to search every chromatogram for known metabolites. The non-targeted analysis uses data mining software to detect chromatographic peaks that are altered in two different conditions. This procedure is done with Principle Components Analysis (PCA) and Partial Least Squares-Discriminate Analysis (PLS-DA).

Equipment

Chemical Analysis Platforms

- 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
- Austin Taylor, BS, Technician
- Jordan Reelitz, BS, Research Specialist

Advisory Board Committee

Last meeting date: August 23, 2021

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

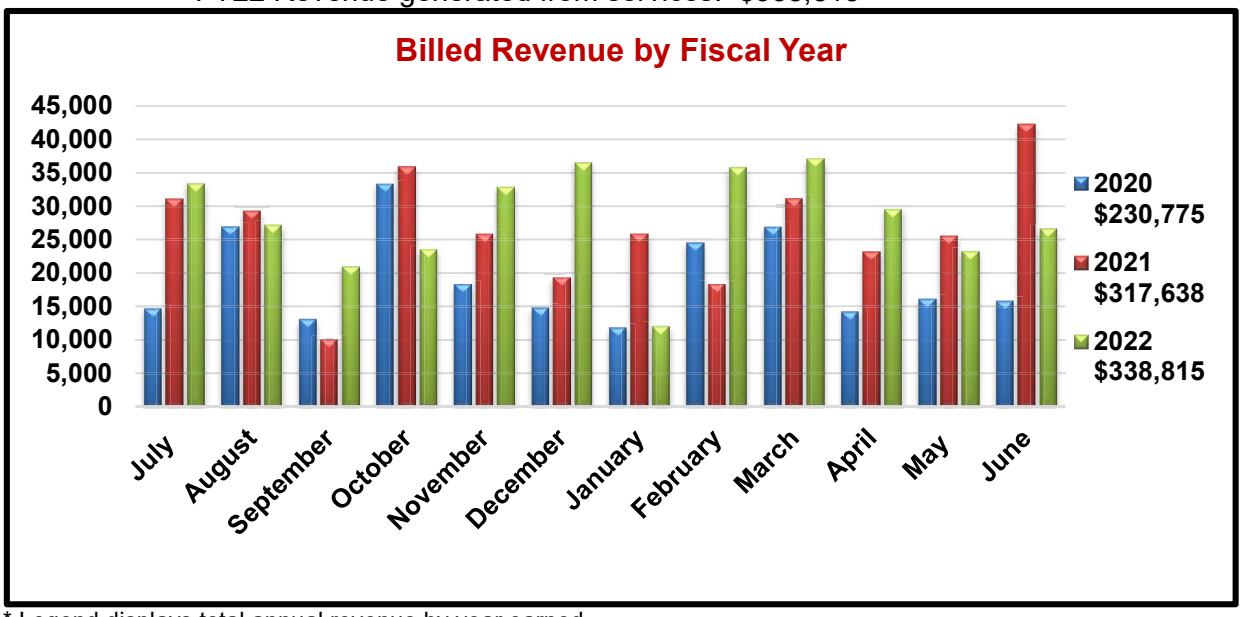
2022 Annual Update

Revenue/Expenses

FY22 Expenses: **Total $507,315**

FY22 Revenue: **Total $578,815**

- VP of Health Sciences Support: $240,000
- FY22 Revenue generated from services: $338,815

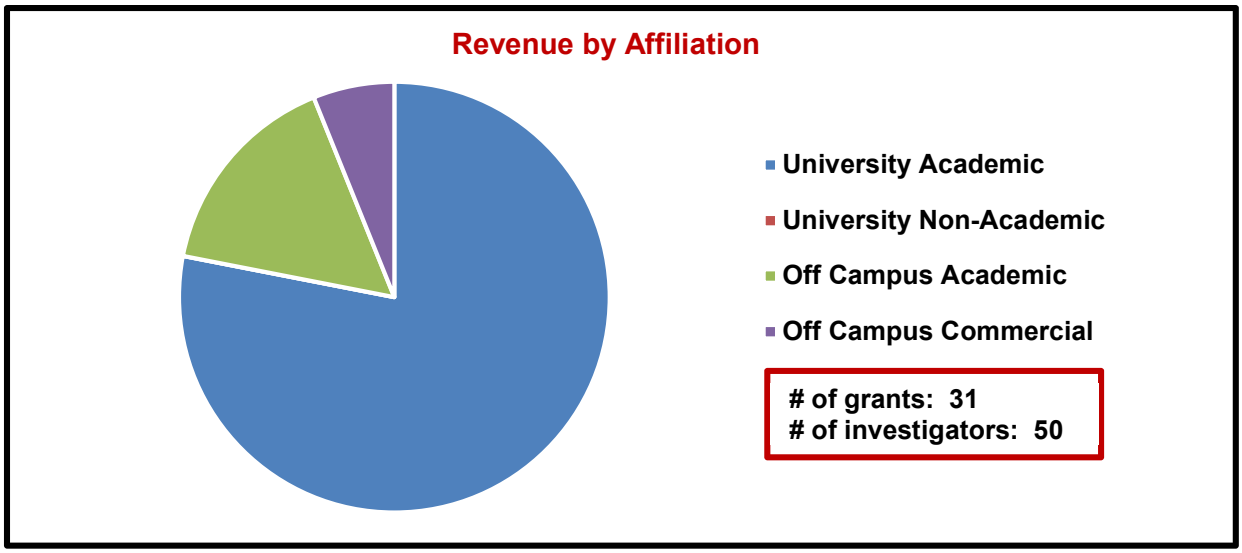


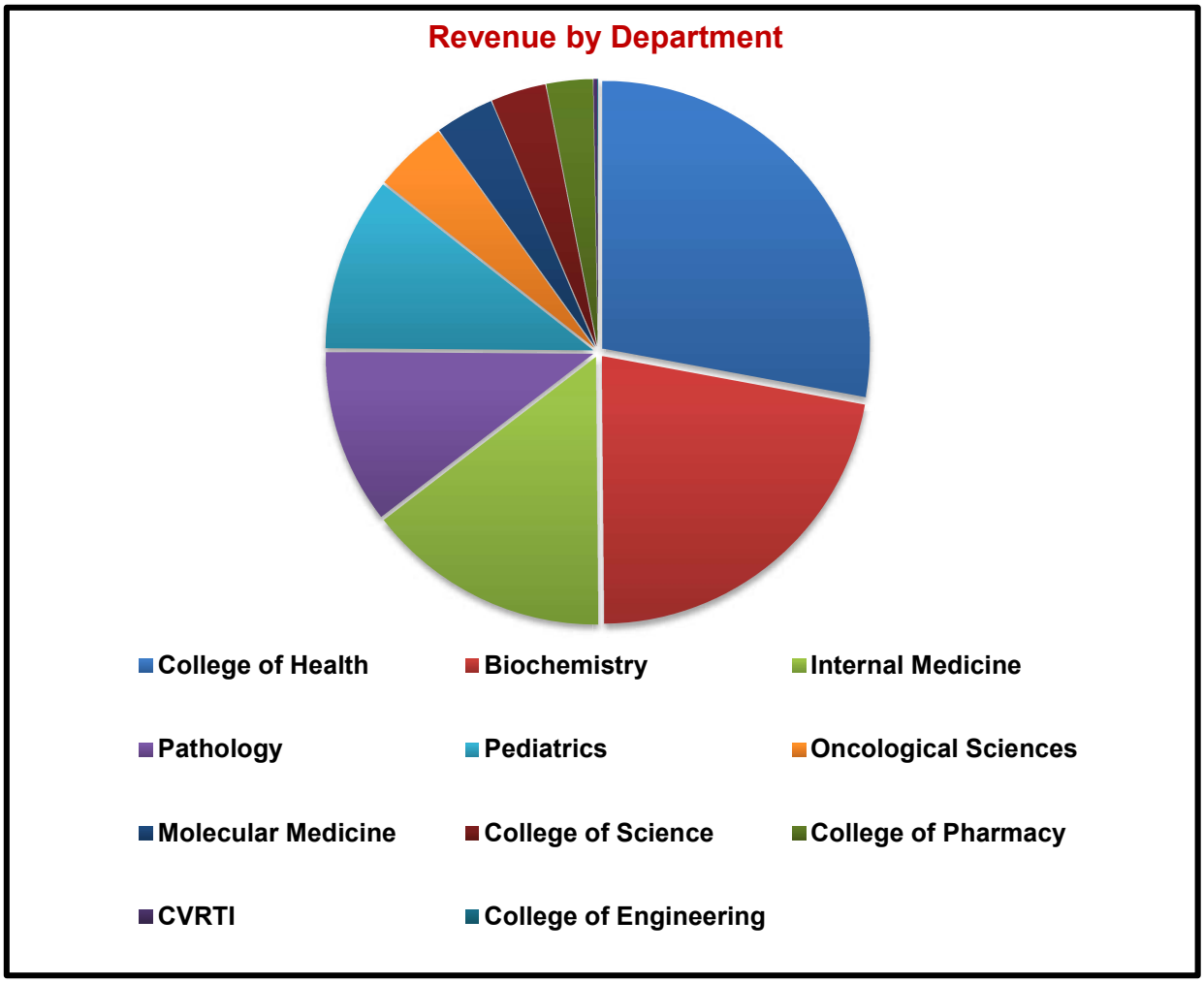
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Summers, Scott	NIH, Potrero Hill Therapeutics
2	Phillips, John	NIH
3	Rutter, Jared	HHMI
4	Lai, Kent	Jaguar Gene Therapy LLC, Bridgebio Pharma LLC, University of Utah Research Foundation
5	Shaw, Janet	HHMI
6	Holland, William	Department, Margolis Foundation
7	Xenter, Inc.	Off Campus Commercial
8	Fairfax, Keke	NIH
9	Mount Sinai School of Medicine	Off Campus Academic
10	University of Iowa	Off Campus Academic

Publications

1. Ferrara, P. J., A. R. P. Verkerke, J. A. Maschek, J. L. Shahtout, P. Siripoksup, H. Eshima, J. M. Johnson, J. J. Petrocelli, Z. S. Mahmassani, T. D. Green, J. M. McClung, J. E. Cox, M. J. Drummond and K. Funai (2021). Low lysophosphatidylcholine induces skeletal muscle myopathy that is aggravated by high-fat diet feeding. FASEB J **35**(10): e21867.10.1096/fj.202101104R
2. Hu, C., K. Beebe, E. J. Hernandez, J. M. Lazaro-Guevara, M. P. Revelo, Y. Huang, J. A. Maschek, J. E. Cox and D. E. Kohan (2022). Multiomic identification of factors associated with progression to cystic kidney disease in mice with nephron Ift88 disruption. Am J Physiol Renal Physiol **322**(2): F175-F192.10.1152/ajprenal.00409.2021
3. Jadhav, S., O. Protchenko, F. Li, E. Baratz, M. Shakoury-Elizeh, A. Maschek, J. Cox and C. C. Philpott (2021). Mitochondrial dysfunction in mouse livers depleted of iron chaperone PCBP1. Free Radic Biol Med **175**: 18-27.10.1016/j.freeradbiomed.2021.08.232
4. Marcero, J. R., J. E. Cox, H. A. Bergonia, A. E. Medlock, J. D. Phillips and H. A. Dailey (2021). The immunometabolite itaconate inhibits heme synthesis and remodels cellular metabolism in erythroid precursors. Blood Adv **5**(23): 4831-4841.10.1182/bloodadvances.2021004750
5. Nicholson, R. J., A. M. Poss, J. A. Maschek, J. E. Cox, P. N. Hopkins, S. C. Hunt, M. C. Playdon, W. L. Holland and S. A. Summers (2021). Characterizing a Common CERS2 Polymorphism in a Mouse Model of Metabolic Disease and in Subjects from the Utah CAD Study. J Clin Endocrinol Metab **106**(8): e3098-e3109.10.1210/clinem/dgab155
6. Nuebel, E., J. T. Morgan, S. Fogarty, J. M. Winter, S. Lettlova, J. A. Berg, Y. C. Chen, C. U. Kidwell, J. A. Maschek, K. J. Clowers, C. Argyriou, L. Chen, I. Wittig, J. E. Cox, M. Roh-Johnson, N. Braverman, J. Bonkowsky, S. P. Gygi and J. Rutter (2021). The biochemical basis of mitochondrial dysfunction in Zellweger Spectrum Disorder. EMBO Rep **22**(10): e51991.10.15252/embr.202051991
7. Poss, A. M., B. Krick, J. A. Maschek, B. Haaland, J. E. Cox, P. Karra, A. R. Ibele, S. C. Hunt, T. D. Adams, W. L. Holland, M. C. Playdon and S. A. Summers (2022). Following Roux-en-Y gastric bypass surgery, serum ceramides demarcate patients that will fail to achieve normoglycemia and diabetes remission. Med (N Y) **3**(7): 452-467 e454.10.1016/j.medj.2022.05.011
8. Schuler, M. H., A. M. English, T. Xiao, T. J. Campbell, J. M. Shaw and A. L. Hughes (2021). Mitochondrial-derived compartments facilitate cellular adaptation to amino acid stress. Mol Cell 81(18): 3786-3802 e3713.10.1016/j.molcel.2021.08.021

HEALTH
UNIVERSITY OF UTAH

Mutation Generation & Detection Facility

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)
- BioFire LightScanner MasterMix 100 rxns
- BioFire LightScanner MasterMix 500 rxns
- Mineral Oil (500ml bottle)
- HRMA Training
- Help with optimization and analysis of HRMA assays
- Custom Mutation Detection upon request

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
- 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 (in 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
- 27” Apple iMac Desktop with QWC Mercury Elite-AI Pro external hard drive
- Illumina Eco
- Innova 43 bacterial shaker
- Innova 42 bacterial shaker
- Frigidaire -20°C freezer
- Lonza 4D Nucleofector system:
    - 4D-Nucleofector Core Unit
    - 4D-Nucleofector X Unit
    - 4D-Nucleofector Y Unit
    - 4D-Nucleofector 96-well Shuttle
- CCI biological safety cabinet
- NapCo Model 6300 CO_2 incubator
- ThermoFisher TSX600 -80 ºC freezer
- Sorvall RT 6300 centrifuge
- ASUS ZenBook 3 deluxe laptop

Personnel

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

Advisory Board Committee

Last meeting date: August 12th 2022

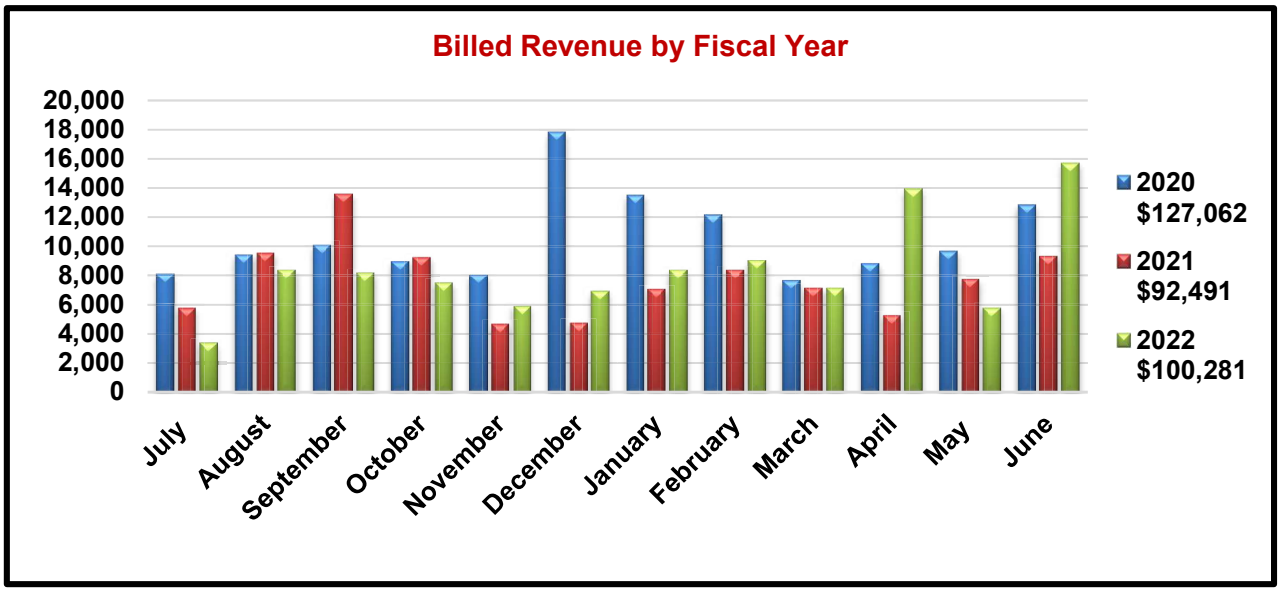
- David Grunwald, Ph.D., Professor, Department of Human Genetics (Senior Faculty Advisor)
- Dana Carroll, Ph.D., Professor, Department of Biochemistry
- Christopher Gregg, Ph.D., Associate Professor, Department of Neurobiology & Anatomy
- Lewis Charles Murtaugh, Ph.D., Associate Professor, Department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

Revenue/Expenses

FY22 Expenses: **Total $160,838**

FY22 Revenue: **Total $150,281**

- VP of Health Sciences Support: $50,000
- FY22 Revenue generated from services: $100,281

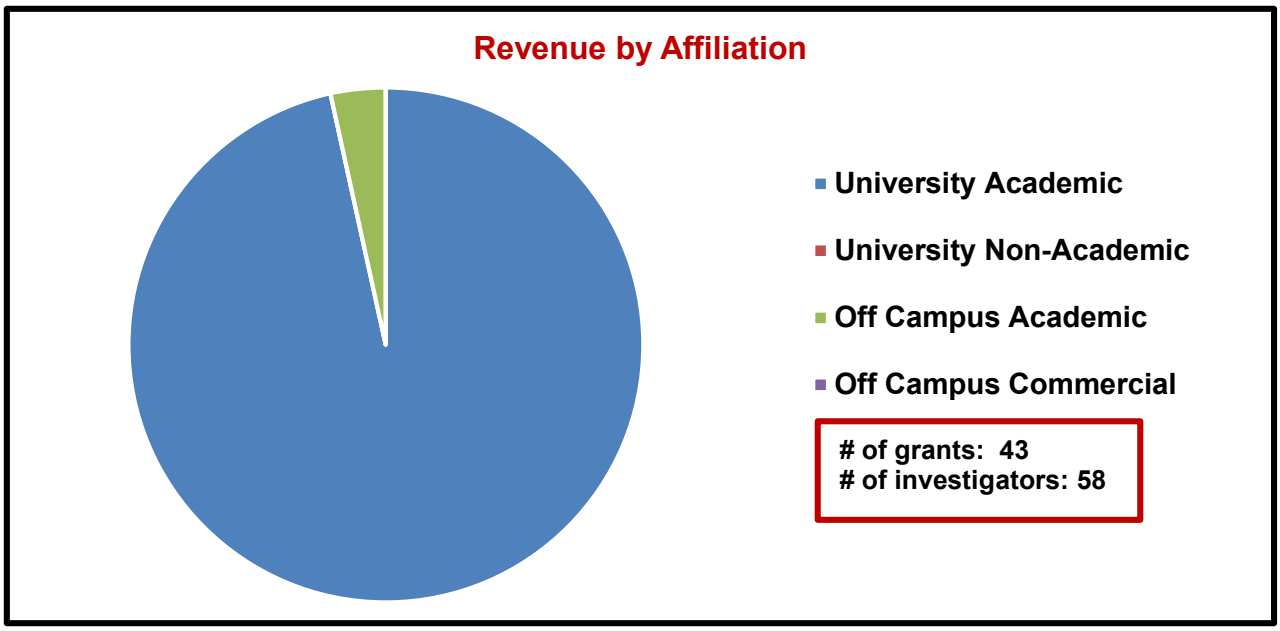


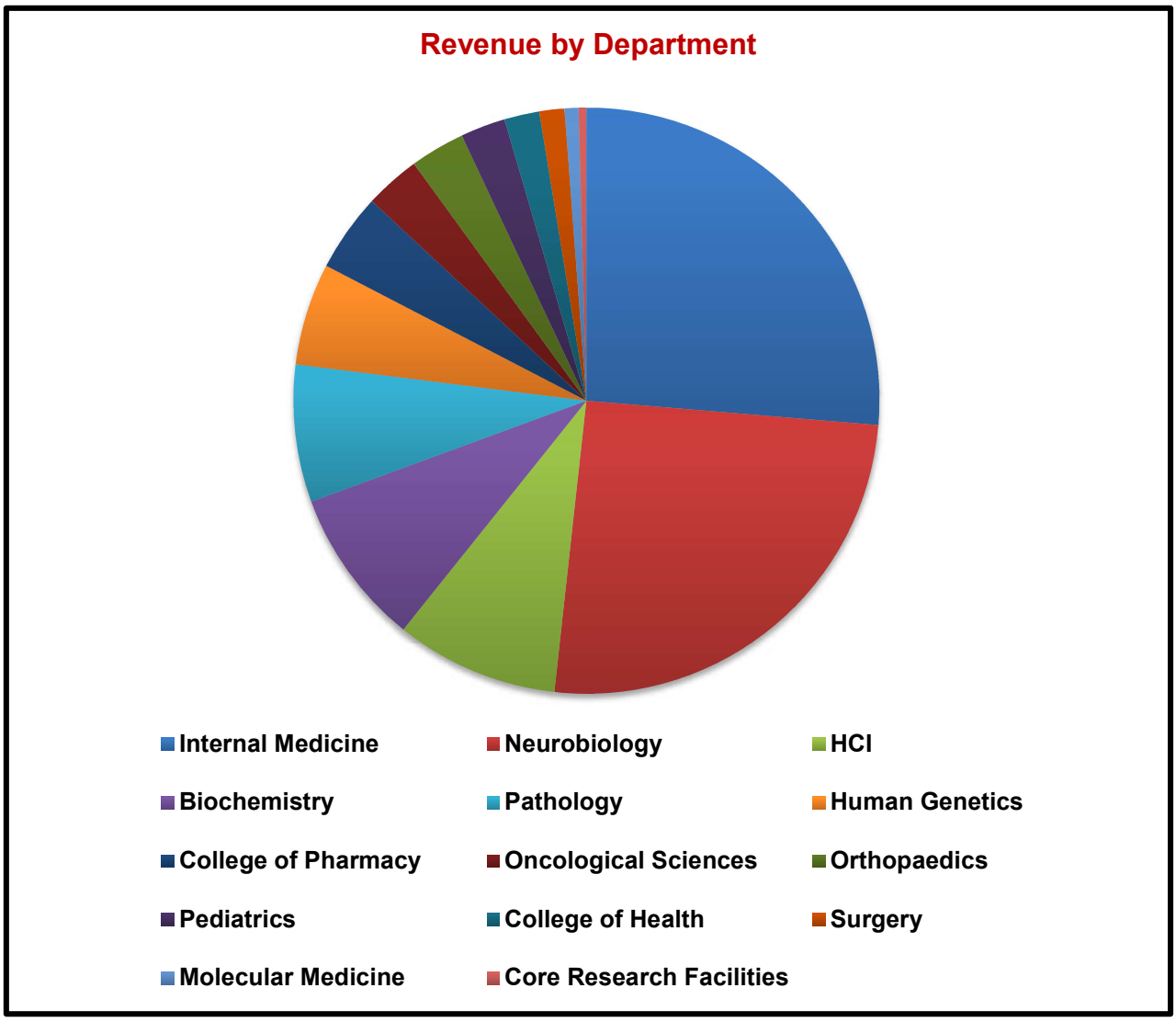
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Phillips, John	NIH, Department
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3	Wachowiak, Matt	University of Colorado at Boulder
4	Evason, Kimberley	Department
5	Haeckler, Hans	NIH
6	Rutter, Jared	HHMI
7	Sundquist, Wesley	NIH
8	Kwan, Kristen	NIH
9	Stewart, Rodney	NIH
10	Pezzolesi, Marcus	NIH, DHHS Office of Minority Health

Collaboration and Support of Other HSC and University Facilities:

- **DNA Sequencing Facility**
  The MGD Core spent $5,103 with the DNA Sequencing Core in FY22.

- **DNA Peptide Facility**
  The MGD Core spent $5,535 with the DNA/Peptide Synthesis Core in FY22.

- **Drug Discovery Facility**
  During FY22 the MGD Core's partnership with the Drug Discovery Facility to produce genetically modified cell lines brought in 4 different projects totaling $11,850 in chargebacks for that facility.

- **Mouse Transgenic Facility**
  During FY22 the MGD Core's partnership with the Mouse Transgenic Facility to produce transgenic mouse models brought in 28 different projects to the Mouse Transgenic Facility totaling $113,480 in chargebacks for that facility.

  Total chargeback impact of the MGD Core on other University Core Research facilities is $135,968

Non-billable Invoice Hours

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

Letters of Support

Written and provided to faculty for support of grant applications:

1. LOS and methods section for Dr. Laith F. Al-Rabadi's grant: "The Serine Protease HTRA1 Antigen: A Gateway to Elucidating Membranous Nephropathy Pathogenesis and the Targeting of Antigen Epitopes.", March, 2021
2. LOS for Dr. Dr. Rajeshwary Ghosh's grant: "Targeted Clearance of Cardiac Mutant Proteins by Chaperone Mediated Autophagy-Based Viral Transgene Technology.", September, 2021
3. LOS for Dr. Dr. Rajeshwary Ghosh's grant: "Chaperone Mediated Autophagy-Based Viral Transgene Technology to Degrade Rare Mutant Proteins – A Powerful Therapeutic Strategy for Treating Rare Disease Pathologies.", November, 2021
4. LOS for Dr. Hans Haecker's grant: "A phospho-tyrosine-based signaling module controlling TLR-mediated inflammatory disease.", September, 2021
5. LOS for Dr. Eileen Hwang's grant: "Cellular, molecular and physical mechanisms of vitreous structural heterogeneity underlying posterior vitreous detachment.", January, 2022
6. LOS for Dr. Lisa Lesniewski's RO1 grant: "CD8 T cell immunosenescence and age-related metabolic dysfunction.", September, 2021

7. LOS and grant figure for Dr. Dean Tantin's proposal to generate a conditional *Pou5f1-C178S* mouse line and a *Oct4* null mouse ESC line, February, 2022
8. LOS for Dr. Katharine Ullman's proposal to generate CHMP4C knock-out cell lines, August, 2021

Publications

1. Aviles, E. C., A. Krol, S. J. Henle, J. Burroughs-Garcia, M. R. Deans and L. V. Goodrich (2022). Fat3 acts through independent cytoskeletal effectors to coordinate asymmetric cell behaviors during polarized circuit assembly. Cell Rep **38**(5): 110307.10.1016/j.celrep.2022.110307
2. Burrell, K. L., N. D. Nguyen, C. E. Deering-Rice, T. A. Memon, M. Almestica-Roberts, E. Rapp, S. N. Serna, J. G. Lamb and C. A. Reilly (2021). Dynamic Expression of Transient Receptor Potential Vanilloid-3 and Integrated Signaling with Growth Factor Pathways during Lung Epithelial Wound Repair following Wood Smoke Particle and Other Forms of Lung Cell Injury. Mol Pharmacol **100**(3): 295-307.10.1124/molpharm.121.000280
3. Lee, S., C. H. Shin, J. Lee, S. D. Jeong, C. R. Hong, J. D. Kim, A. R. Kim, B. Park, S. J. Son, O. Kokhan, T. Yoo, J. S. Ko, Y. B. Sohn, O. H. Kim, J. M. Ko, T. J. Cho, N. T. Wright, J. K. Seong, S. W. Jin, H. J. Kang, H. H. Kim and M. Choi (2021). Somatic uniparental disomy mitigates the most damaging EFL1 allele combination in Shwachman-Diamond syndrome. Blood **138**(21): 2117-2128.10.1182/blood.2021010913
4. Li, L., J. H. Kim, W. Lu, D. M. Williams, J. Kim, L. Cope, R. K. Rampal, R. P. Koche, L. Xian, L. Z. Luo, M. Vasiljevic, D. R. Matson, Z. J. Zhao, O. Rogers, M. C. Stubbs, K. Reddy, A. R. Romero, B. Psaila, J. L. Spivak, A. R. Moliterno and L. M. S. Resar (2022). HMGA1 chromatin regulators induce transcriptional networks involved in GATA2 and proliferation during MPN progression. Blood **139**(18): 2797-2815.10.1182/blood.2021013925
5. Nandamuri, S. P., S. Lusk and K. M. Kwan (2022). Loss of zebrafish dzip1 results in inappropriate recruitment of periocular mesenchyme to the optic fissure and ocular coloboma. PLoS One **17**(3): e0265327.10.1371/journal.pone.0265327
6. Nicholson, R. J., A. M. Poss, J. A. Maschek, J. E. Cox, P. N. Hopkins, S. C. Hunt, M. C. Playdon, W. L. Holland and S. A. Summers (2021). Characterizing a Common CERS2 Polymorphism in a Mouse Model of Metabolic Disease and in Subjects from the Utah CAD Study. J Clin Endocrinol Metab **106**(8): e3098-e3109.10.1210/clinem/dgab155
7. Sun, W., X. Jia, M. Liesa, D. Tantin and D. M. Ward (2022). ABCB10 Loss Reduces CD4(+) T Cell Activation and Memory Formation. J Immunol **208**(2): 328-337.10.4049/jimmunol.2100514

Nuclear Magnetic Resonance Core Facility

Overview

High-resolution structure determinations of proteins and their complexes, chemical structure determinations of natural and synthetic products, nucleic acids, carbohydrates, and polymers are performed within the University of Utah HSC Core facility, with support from Jack Skalicky, Ph.D. (Director and Associate Research Professor of Biochemistry) and the Rocky Mountain NMR consortium where we have full membership. Our Core and Consortium provide us with excellent access to high-field NMR spectrometers including 400, 500, 600, and 900 MHz instruments (described below). Pulse sequences and software paths for structure determinations have been implemented and tested extensively. Data collection, processing, analysis, and structure determinations are performed using OpenVnmrJ, NMRPIPE/Mnova, NMRFAM-Sparky and XPLOR-NIH/ROSETTA/PYMOL. Software packages are installed on core CentOS workstations and servers at the University of Utah Center for High Performance Computing (CHPC). Data collection at the Denver 900 is performed using a secure network portal. Our Core facility is available for the University of Utah research community, regional universities, and for-profit companies. NMR training is required of graduate students, postdocs, and PI's prior to use. Advanced instruction and formal NMR spectroscopy courses are available for those interested.

HSC Core/Varian 600 MHz NMR spectrometer. The Inova 600 has three complete RF channels, a fourth dedicated ^{2}H channel, and is equipped with a 5 mm triple resonance (^{1}H,^{13}C,^{15}N) cryogenic probe with Z-axis pulsed field gradient (PFG) capability. Proton signal/noise is 4800/1.

HSC Core/Varian INOVA 500 MHz spectrometer. The Inova 500 has three complete RF channels, a fourth dedicated ^{2}H channel, two 5 mm Nalorac triple resonance HCN (^{1}H,^{13}C,^{15}N) and HXC (^{1}H, X=50-203 MHz,^{13}C) probes with PFG capability, and a 3 mm Nalorac MDBG500 Dual Broadband PFG probe with PFG capability and X=49-213 MHz.

HSC Core/Varian MERCURY 400 MHz spectrometer. The Mercury 400 has three complete RF channels, is equipped with a 4NG400-5+ 5 mm four nuclei PFG probe designed to observe or decouple ^{1}H, ^{19}F, ^{31}P, and ^{13}C without retuning the probe and with PFG capability.

Denver Consortium/Varian 900 MHz NMR spectrometer. We have ~10% of the time on a Varian DirectDrive 900 housed in Denver, Colorado, purchased by our Rocky Mountain NMR consortium. This instrument is "fully loaded" and includes four complete RF channels, XYZ-axis PFG, and salt-tolerant, carbon-enhanced triple resonance cryogenic probe. Data are typically collected remotely through a secure portal. We primarily use this instrument to record TROSY-based experiments and NOESY experiments for structure determinations. 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, Skaggs Hall)
- Varian Inova 500 MHz NMR (University of Utah, BPRB)
- Varian Inova 600 MHz NMR with HCN cryogenic probe (University of Utah, BPRB)
- Varian DD2 900 MHz NMR with HCN cryogenic probe (University of Colorado-Denver)

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

2022 Annual Update

New Equipment

- Rebuild of 600 cryogenic system: rebuilt pumping station, CCC head, and new cryobay control computer.
- Installation of openVnmrJ (open source software) on Utah spectrometers.

New Services

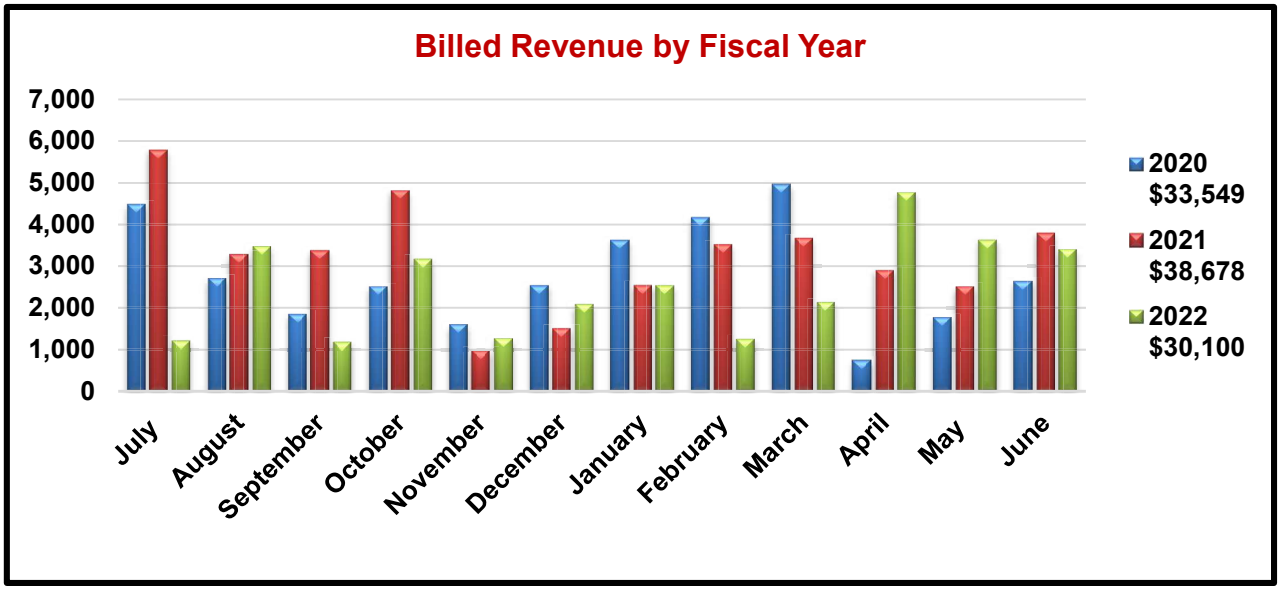
- The NMR Facility did not implement additional services in FY22

Revenues/Expenses

FY22 Expenses: **Total $114,063**

FY22 Revenue: **Total $100,100**

- VP of Health Sciences Support: $70,000
- FY22 Revenue generated from services: $30,100



* Legend displays total annual revenue by year earned.

FY22 Scientific Impact
Research Support
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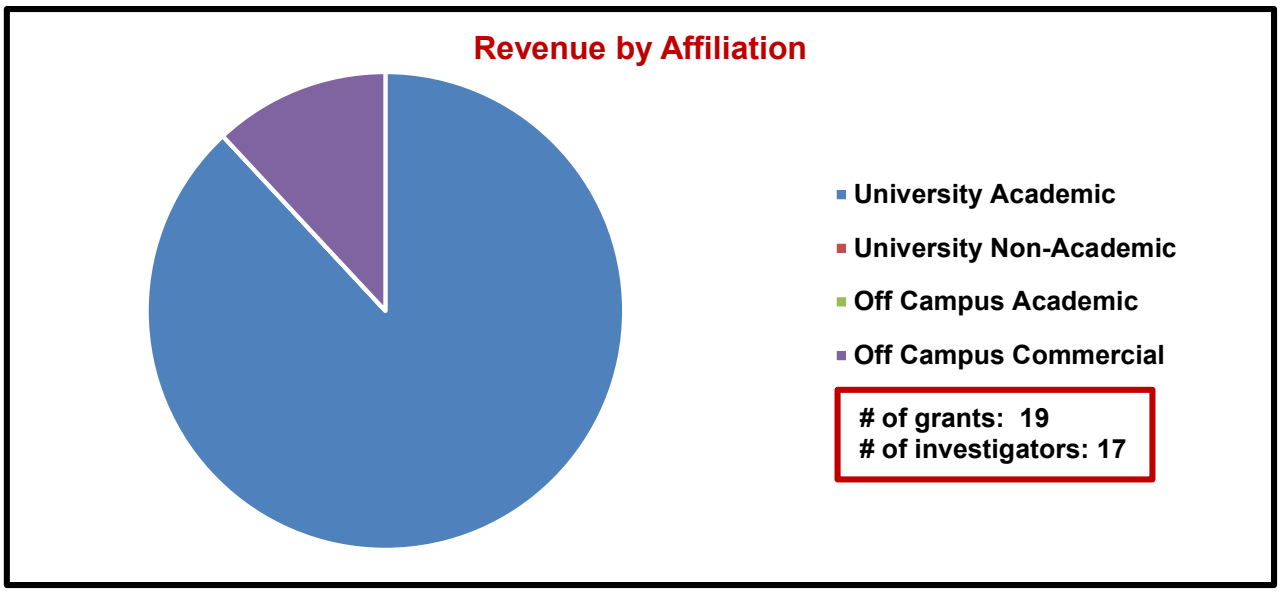

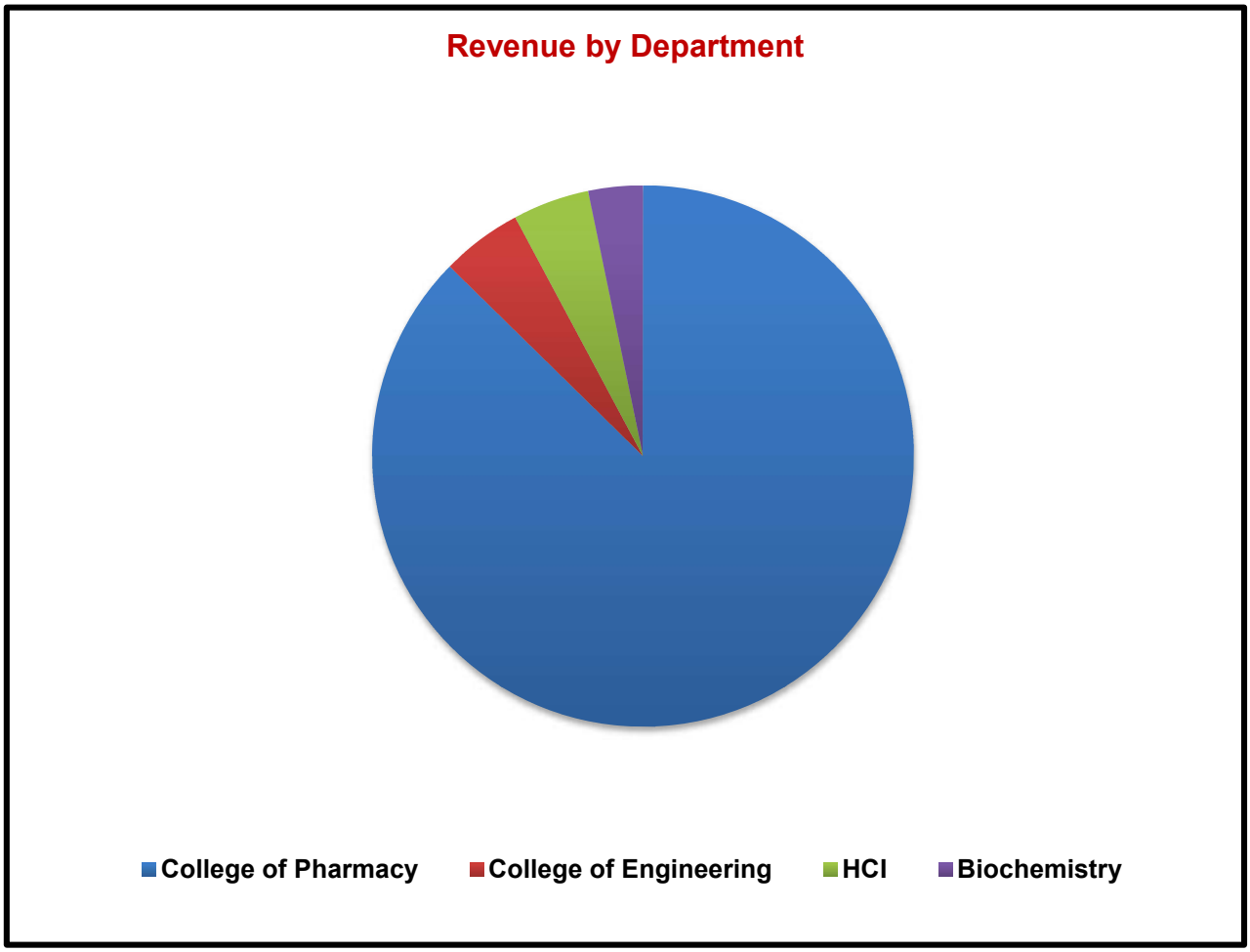

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1	Davis, Darrell	Department
2	Schmidt, Eric	NIH, US Army Medical Research Acquisition Activity
3	Franzini, Raphael	Department, NIH, NSF
4	Echelon Biosciences, Inc.	Off Campus Commercial
5	Winter, Jaclyn	Gordon and Betty Moore Foundation, NIH
6	Barrios, Amy	NSF, NIH
7	Vankayalapati, Hari	HCI, Department
8	Sundquist, Wesley	NIH
9	Zang, Ling	DOE, Gentex Corporation
10	Kramer, Jessica	NSF, Department

Abstracts

1. Kyle Medley, Zhaoliang Li, Dongqing Yan, Umang Swami, Neeraj Agarwal, Hariprasad Vankayalapati. Targeting GCN2 kinase-driven stress response inactivation by orally available small molecules to restore immune tumor microenvironment in prostate cancers [abstract]. In: Proceedings of the American Association for Cancer Research Annual Meeting 2021; 2021 Apr 10-15 and May 17-21. Philadelphia (PA): AACR; Cancer Res 2021;81(13_Suppl):Abstract nr LB136.
2. Zhaoliang Li, Kyle Medley, Dongqing Yan, Kimberly Coffman, Tony Pomicter, David Lum, David J. Bearss, Hariprasad Vankayalapati. Targeting GCN2 kinase-driven stress response inactivation to restore immunity in AML Cancers [abstract]. In: Proceedings of the American Association for Cancer Research Annual Meeting 2022; 2022 Apr 8-13. Philadelphia (PA): AACR; Cancer Res 2022;82(12_Suppl):Abstract nr LB090.
3. Vankayalapati, H., K. Medley, Z. Li, D. Yan, D. Bearss and A. Welm (2021). 870 Targeting GCN2 kinase-driven stress response inactivation to restore tumor immunity in metastatic triple negative breast cancer. Journal for ImmunoTherapy of Cancer 9(Suppl 2): A911-A911.10.1136/jitc-2021-SITC2021.870

Publications

1. 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. bioRxiv: 2022.2002.2009.477148.10.1101/2022.02.09.477148
2. Li, F., Z. Lin, J. P. Torres, E. A. Hill, D. Li, C. A. Townsend and E. W. Schmidt (2022). Sea Urchin Polyketide Synthase SpPks1 Produces the Naphthalene Precursor to Echinoderm Pigments. J Am Chem Soc **144**(21): 9363-9371.10.1021/jacs.2c01416
3. Gu, W., Y. Zheng, T. Pogorelov, S. K. Nair and E. W. Schmidt (2022). Control of Nucleophile Chemoselectivity in Cyanobactin YcaO Heterocyclases PatD and TruD. ACS Chem Biol **17**(5): 1215-1225.10.1021/acschembio.2c00147
4. Miller, B. W., E. W. Schmidt, G. P. Concepcion and M. G. Haygood (2022). Halogenated Metal-Binding Compounds from Shipworm Symbionts. J Nat Prod **85**(3): 479-484.10.1021/acs.jnatprod.1c01049
5. Scesa, P. D., Z. Lin and E. W. Schmidt (2022). Ancient defensive terpene biosynthetic gene clusters in the soft corals. Nat Chem Biol **18**(6): 659-663.10.1038/s41589-022-01027-1
6. Paguigan, N. D., Y. Yan, M. Karthikeyan, K. Chase, J. Carter, L. S. Leavitt, A. L. Lim, Z. Lin, T. Memon, S. Christensen, B. H. Bentzen, N. Schmitt, C. A. Reilly, R. W. Teichert, S. Raghuraman, B. M. Olivera and E. W. Schmidt (2021). The Tunicate Metabolite 2-(3,5-Diiodo-4-methoxyphenyl)ethan-1-amine Targets Ion Channels of Vertebrate Sensory Neurons. ACS Chem Biol **16**(9): 1654-1662.10.1021/acschembio.1c00328
7. Paguigan, N. D., J. O. Tun, L. S. Leavitt, Z. Lin, K. Chase, C. Dowell, C. E. Deering-Rice, A. L. Lim, M. Karthikeyan, R. W. Hughen, J. Zhang, R. T. Peterson, C. A. Reilly, A. R. Light, S. Raghuraman, J. M. McIntosh, B. M. Olivera and E. W. Schmidt (2021). Nicotinic Acetylcholine Receptor Partial Antagonist Polyamides from Tunicates and Their Predatory Sea Slugs. ACS Chem Neurosci **12**(14): 2693-2704.10.1021/acschemneuro.1c00345
8. Mathis, C. L. and A. M. Barrios (2021). Histidine phosphorylation in metalloprotein binding sites. J Inorg Biochem **225**: 111606.10.1016/j.jinorgbio.2021.111606

Preclinical Imaging Facility

Overview

The Preclinical (formerly Small Animal) Imaging Facility extends the benefits of modern diagnostic medical imaging technologies to the studies of anatomy and physiology in small animals. The facility 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

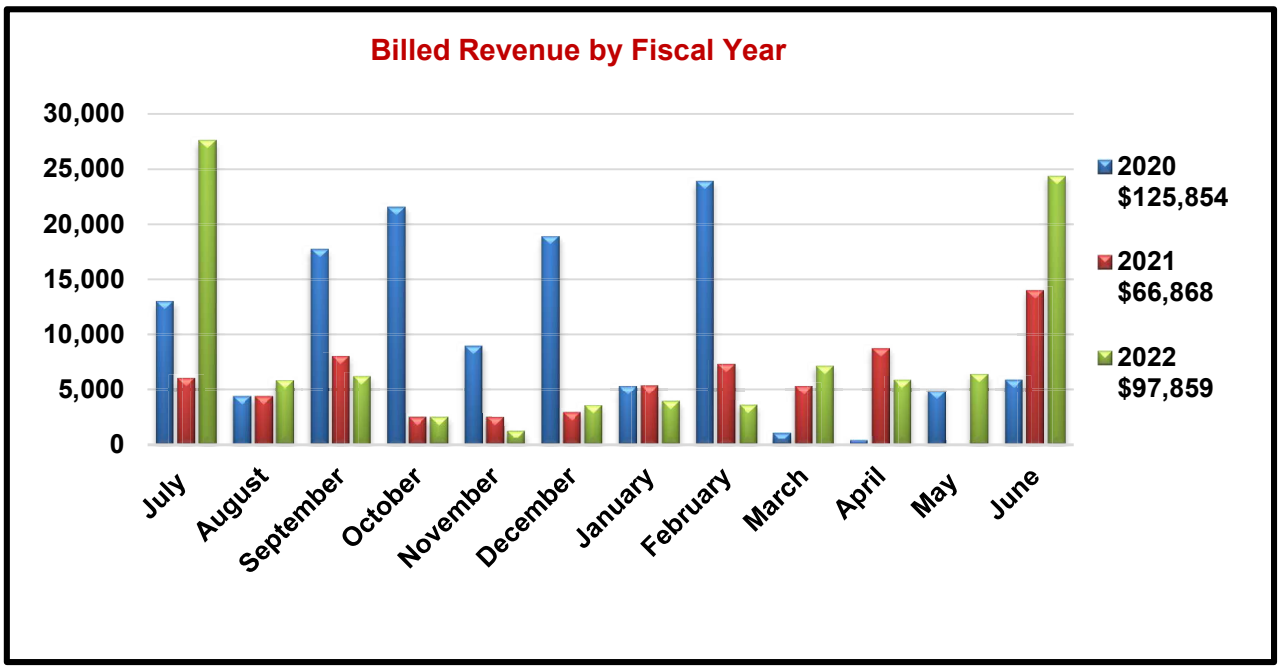
2022 Annual Update

Revenue/Expenses

FY22 Expenses: **Total $196,241**

FY22 Revenue: **Total $197,859**

- VP of Health Sciences Support: $50,000
- VP of Research Support: $50,000
- FY22 Revenue generated from services: $97,859

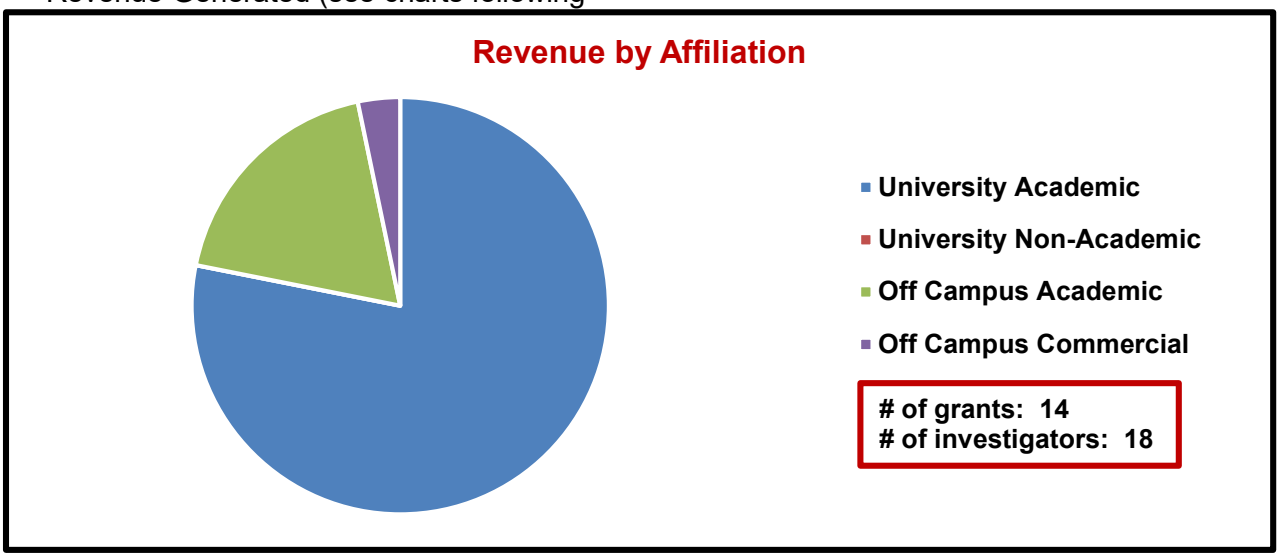


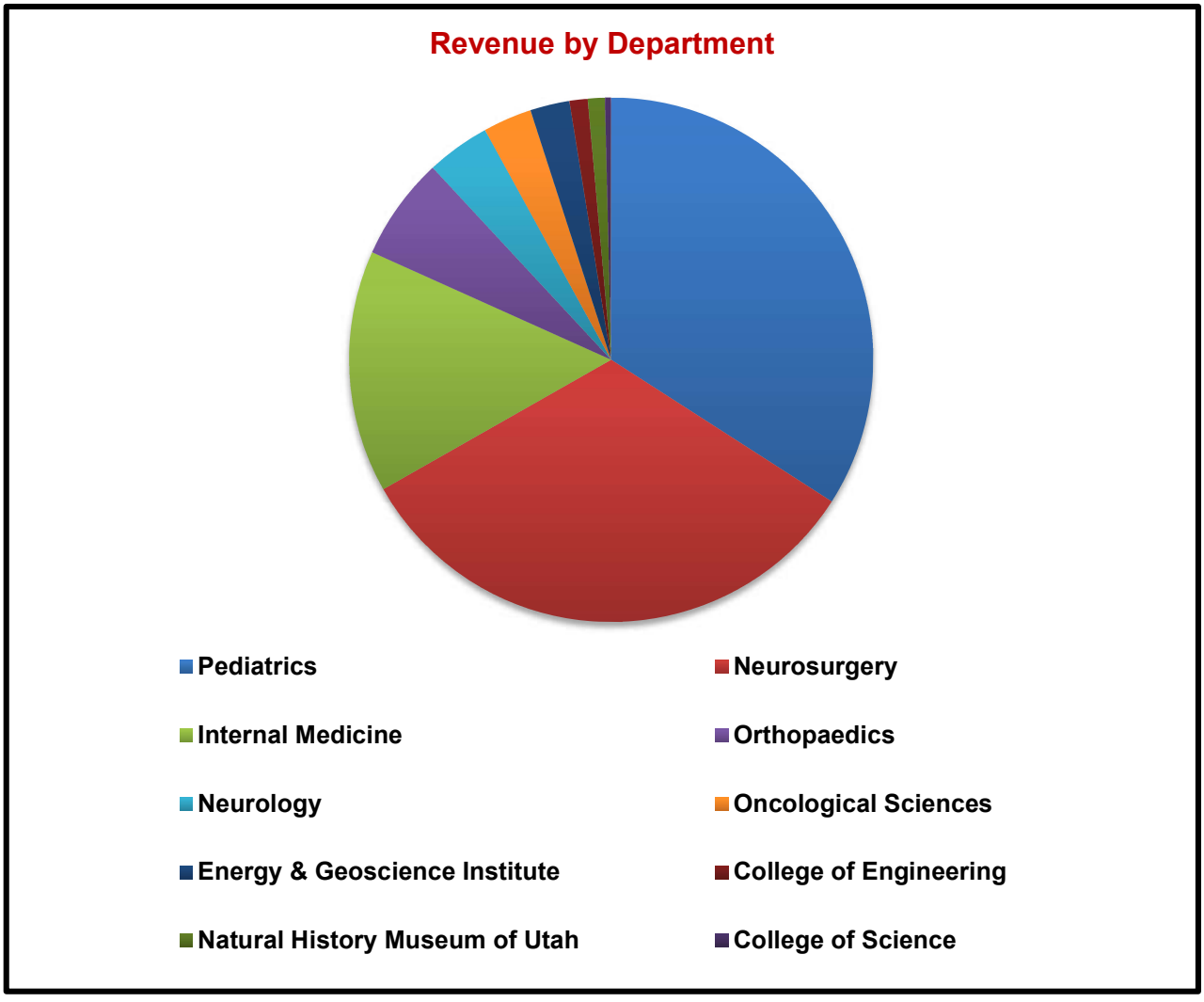
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following





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6	Penovich, Wanda	Department
7	Jones, Kevin	Department
8	Clinicians Report Foundation	Off Campus Commercial
9	Holmen, Sheri	NIH
10	McPherson, Brian	DOE

Publications

1. Boer, E. F., E. T. Maclary and M. D. Shapiro (2021). Complex genetic architecture of three-dimensional craniofacial shape variation in domestic pigeons. Evol Dev **23**(6): 477-495.10.1111/ede.12395
2. Epperson, R. T., B. M. Isaacson, D. L. Rothberg, R. E. Olsen, B. Kawaguchi, J. M. Maxwell, M. Dickerson, P. F. Pasquina, J. Shero and D. L. Williams (2021). Developing a combat-relevant translatable large animal model of heterotopic ossification. Bone Rep **15**: 101127.10.1016/j.bonr.2021.101127
3. Jeong, K. E., S. Y. Lee, S. K. Yeom, N. Carlson, L. M. Shah, J. Rose and E. K. Jeong (2022). Ultrahigh-b diffusion-weighted imaging for quantitative evaluation of myelination in shiverer mouse spinal cord. Magn Reson Med **87**(1): 179-192.10.1002/mrm.28978
4. Melstrom, K. M., A. H. Turner and R. B. Irmis (2022). Reevaluation of the cranial osteology and phylogenetic position of the early crocodyliform Eopneumatosuchus colberti, with an emphasis on its endocranial anatomy. Anat Rec (Hoboken) **305**(10): 2557-2582.10.1002/ar.24777
5. Merchant, S., S. Yeoh, M. A. Mahan and E. W. Hsu (2022). Simultaneous Quantification of Anisotropic Microcirculation and Microstructure in Peripheral Nerve. J Clin Med **11**(11).10.3390/jcm11113036
6. Patel, M., F. Savvopoulos, C. C. Berggren, L. Aslanidou, L. H. Timmins, R. de Silva, R. M. Pedrigi and R. Krams (2021). Considerations for analysis of endothelial shear stress and strain in FSI models of atherosclerosis. J Biomech **128**: 110720.10.1016/j.jbiomech.2021.110720
7. Smith, K. A., S. S. Merchant, E. W. Hsu and L. H. Timmins (2021). Effect of Subject-Specific, Spatially Reduced, and Idealized Boundary Conditions on the Predicted Hemodynamic Environment in the Murine Aorta. Ann Biomed Eng **49**(12): 3255-3266.10.1007/s10439-021-02851-7
8. Welsh, P. J., C. G. Collier, H. M. Clement, M. N. Vakula and J. B. Mason (2021). Cranial Cruciate Ligament Desmotomies in Sheep Resulting in Peroneus Tertius Injury. Case Rep Vet Med **2021**: 2628791.10.1155/2021/2628791
9. Yeoh, S., W. S. Warner, S. S. Merchant, E. W. Hsu, D. V. Agoston and M. A. Mahan (2022). Incorporating Blood Flow in Nerve Injury and Regeneration Assessment. Front Surg **9**: 862478.10.3389/fsurg.2022.862478

Small Animal Ultrasound Facility

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 the resolving the rapid heart rates of mice, or the microscopic size and function of early and mid-gestation embryos, and everything in between. The facility has long been an extremely important tool in the practice of clinical medicine because it offers real-time imaging providing understanding of anatomy and physiology, is non-invasive, and can be repeated serially.

Services

The facility has the capability for anesthesia and monitoring of mice and rats, and will support training laboratory personnel in the design of protocols and the use of the equipment for acquiring images. An off-line image analysis station is also available for later review and analysis of studies.

- Ultrasound imaging access
- Training in use of equipment
- Experiment design and assistance with protocol optimization
- Off-line image review and analysis

Equipment

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

Personnel

- Kevin Whitehead, M.D., Director
- Tiehua Chen, 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

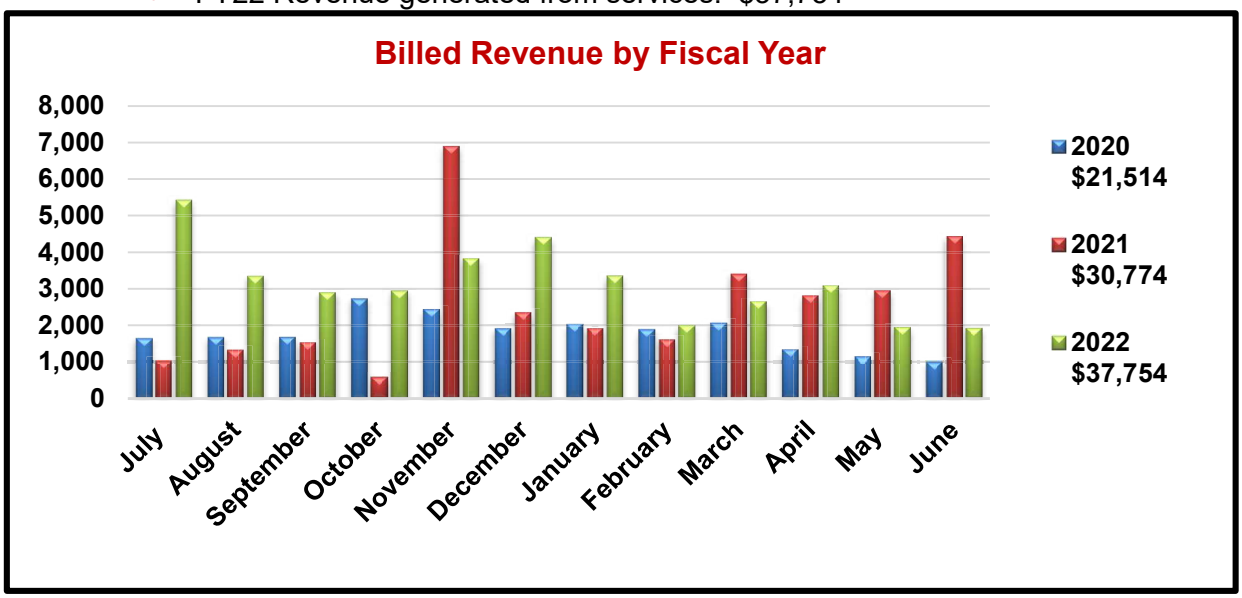
2022 Annual Update

Revenue/Expenses

FY22 Expenses: **Total $46,766**

FY22 Revenue: **Total $57,754**

- VP of Health Sciences Support: $20,000
- FY22 Revenue generated from services: $37,754

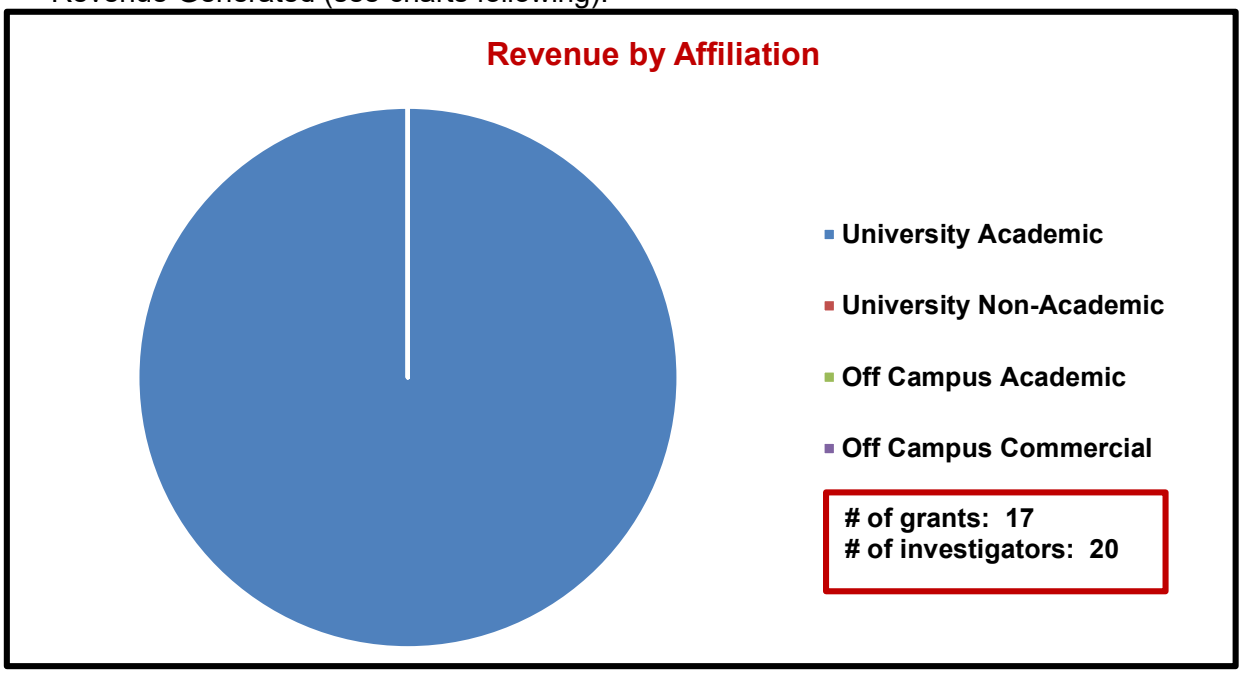


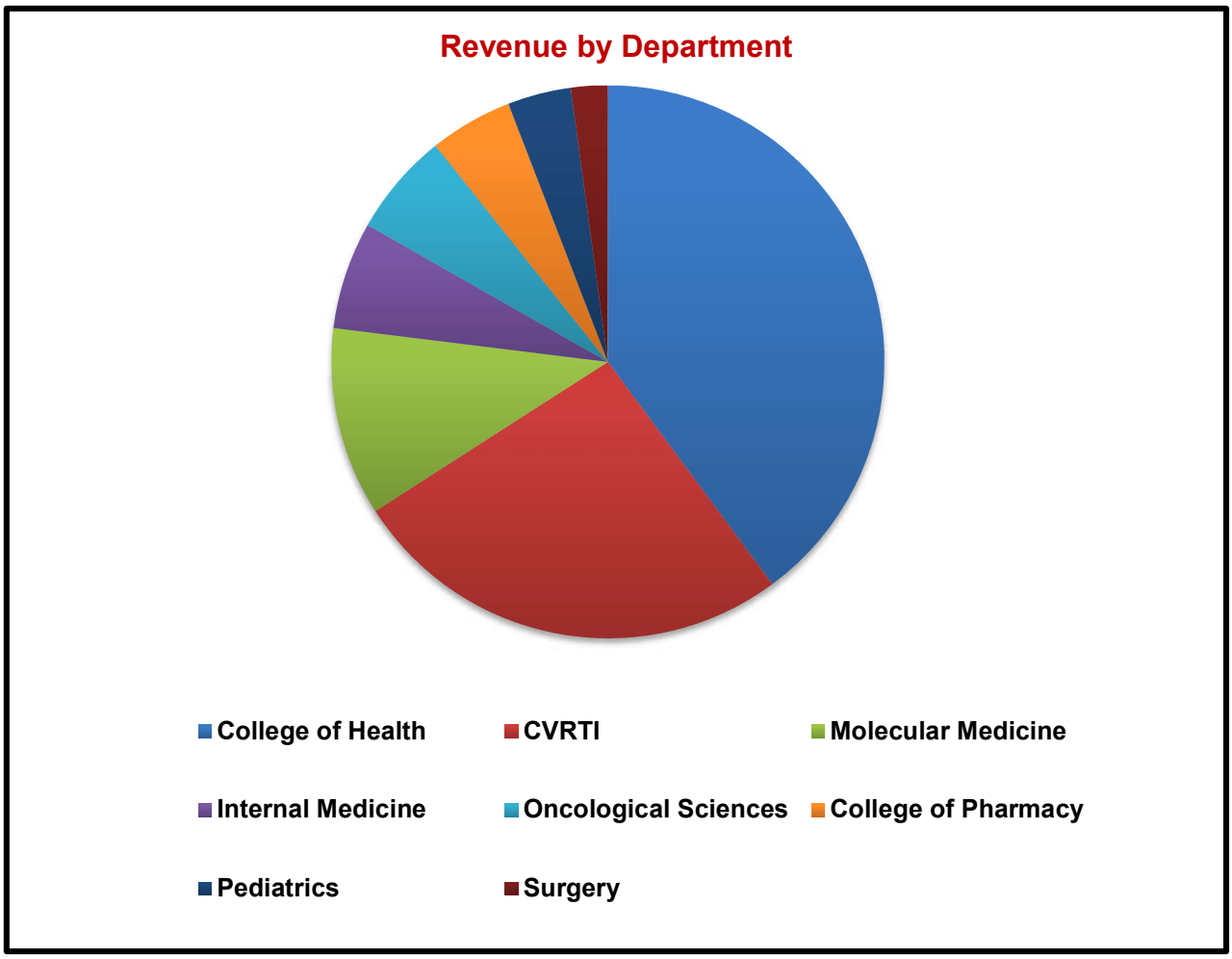
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Chaix, Amandine	NIH
2	Pon Velayutham, Anandh Babu	NIH
3	Donato, Anthony	NIH
4	Selzman, Craig	Department
5	Chaudhuri, Dipayan	NIH
6	Ghandehari, Hamid	Department
7	Yost, Joseph	NIH
8	Basham, Kaitlin	Department
9	Lai, Kent	Mayo Clinic
10	Whitehead, Kevin	Department

Publications

No known publications acknowledged this facility in FY 22.

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
- Thermo Cryomed controlled rate embryo freezer
- Thermo TSX Series -80°C freezer
- Centrifuges, microfuges

Personnel

- Crystal Davey, Ph.D., Co-Director
- Kyle O'Connor, B.S., Co-Director
- He Lan, Ph.D., Senior Lab Specialist
- Nick Black, Lab Specialist

Advisory Board Committee

Last meeting date: August 15th 2022

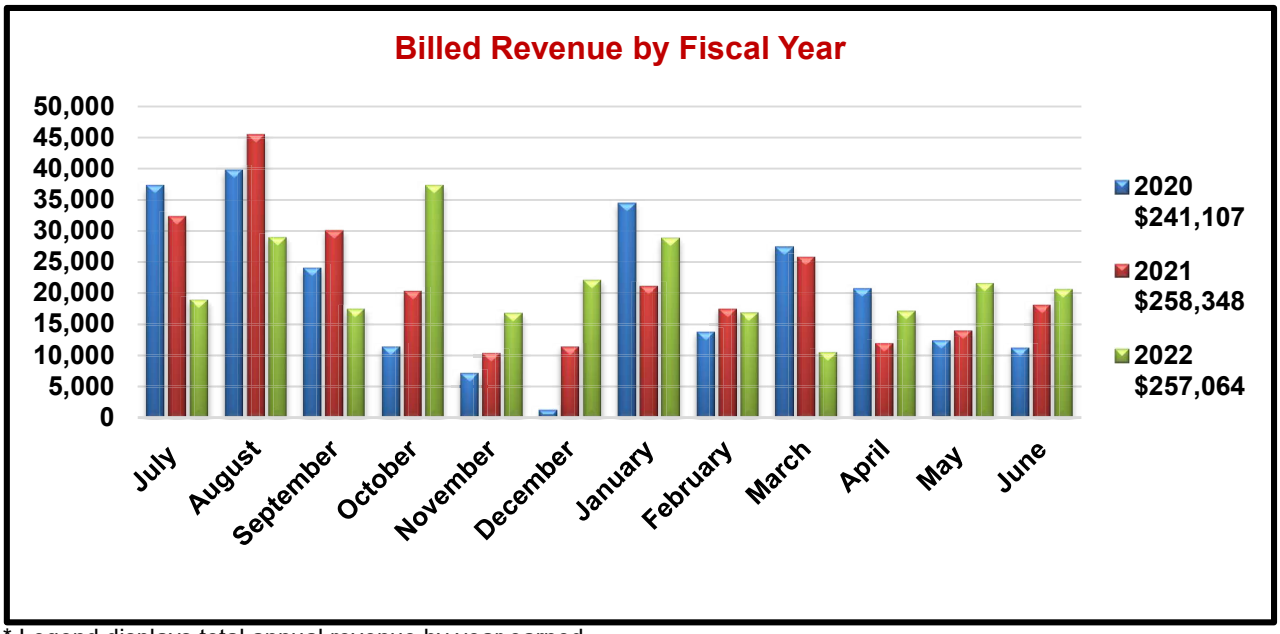
- Lewis Charles Murtaugh, Ph.D., Department of Human Genetics (Sr. Faculty Advisor)
- Christopher Gregg, Ph.D., Department of Neurobiology & Anatomy
- Kevin B. Jones, MD, Huntsman Cancer Institute
- Dean Tantin, Ph.D., Department of Pathology

Revenue/Expenses

FY22 Expenses: **Total $493,614**

FY22 Revenue: Total $691,667

- VP of Health Sciences Support: $434,603
- FY22 Revenue generated from services: $257,064

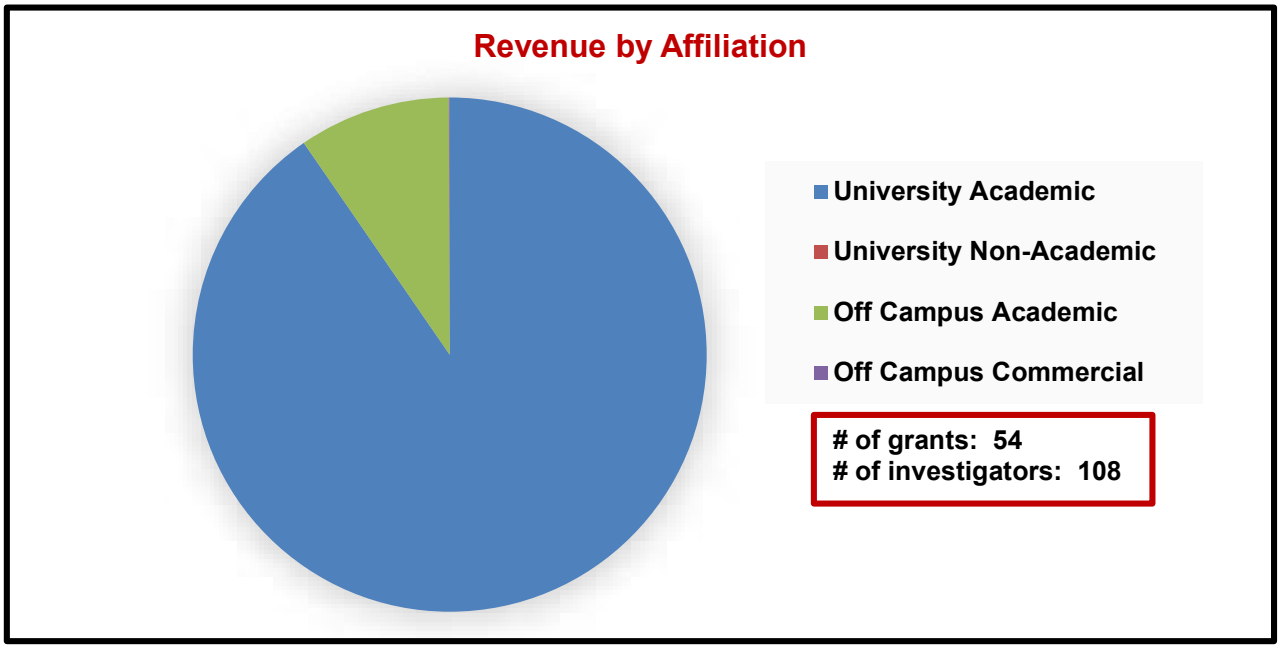


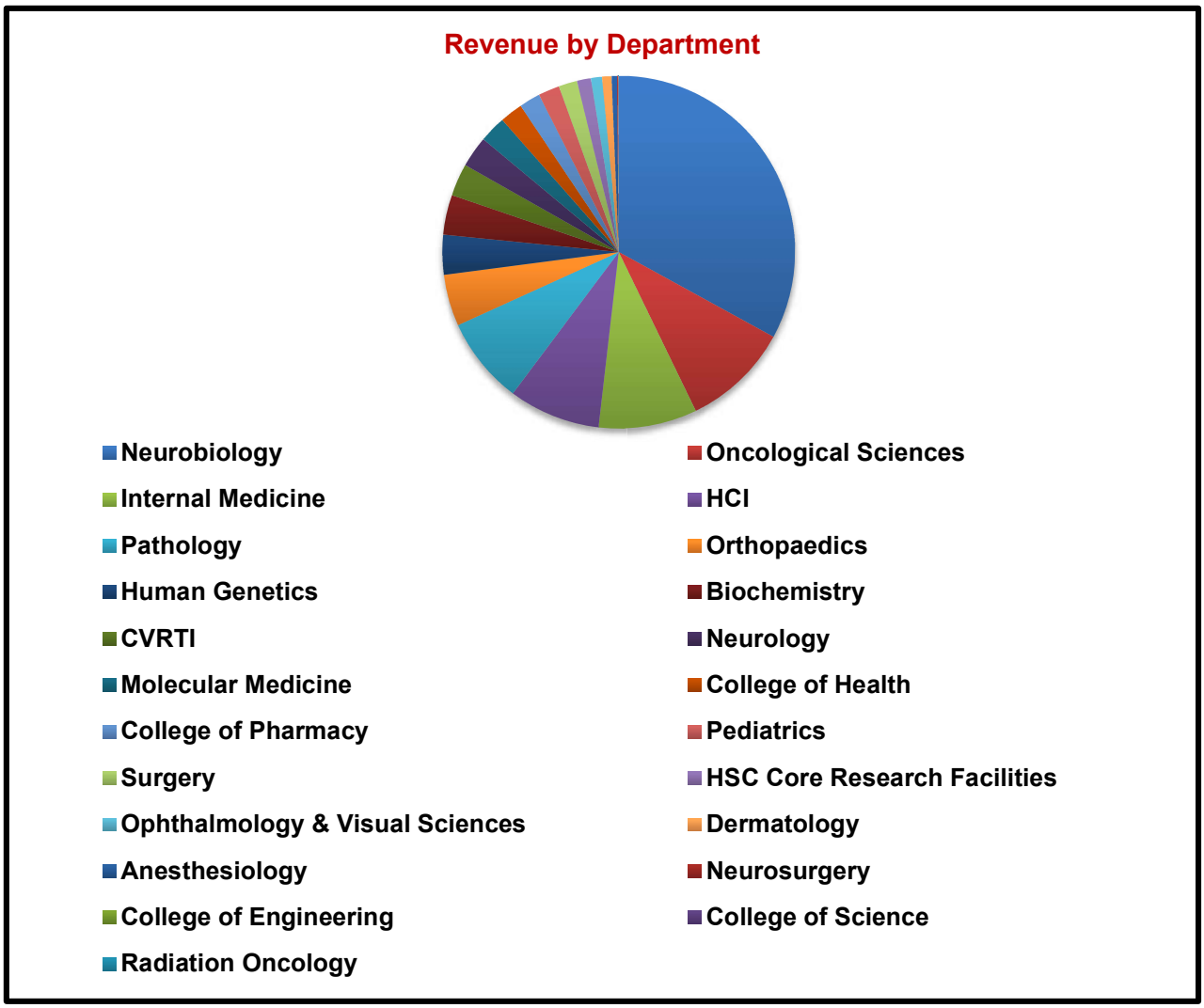
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Gregg, Christopher	NIH
2	Zhu,Weiquan	Department
3	Tantin, Dean	HCI
4	University of Pittsburgh	Off Campus Academic
5	Haeckler, Hans	NIH
6	Deininger, Michael	Department
7	Christian, Jan	NIH
8	Deans, Michael	NIH
9	Fralin Biomedical Research Inst. at Virginia Tech Carilion	Off Campus Academic
10	Jones, Kevin	Department

Letters of Support for grant applications:

1. LOS and methods section for Dr. Laith F. Al-Rabadi's grant: "The Serine Protease HTRA1 Antigen: A Gateway to Elucidating Membranous Nephropathy Pathogenesis and the Targeting of Antigen Epitopes.", March, 2021
2. LOS for Dr. Hans Haecker's grant: "A phospho-tyrosine-based signaling module controlling TLR-mediated inflammatory disease.", September, 2021
3. LOS for Dr. Eileen Hwang's grant: "Cellular, molecular and physical mechanisms of vitreous structural heterogeneity underlying posterior vitreous detachment.", January, 2022
4. LOS for Dr. Lisa Lesniewski's RO1 grant: "CD8 T cell immunosenescence and age-related metabolic dysfunction.", September, 2021
5. LOS and grant figure for Dr. Dean Tantin's proposal to generate a conditional *Pou5fl-C178S* mouse line and a *Oct4* null mouse ESC line, February, 2022

Publications

1. Aviles, E. C., A. Krol, S. J. Henle, J. Burroughs-Garcia, M. R. Deans and L. V. Goodrich (2022). Fat3 acts through independent cytoskeletal effectors to coordinate asymmetric cell behaviors during polarized circuit assembly. Cell Rep **38**(5): 110307.10.1016/j.celrep.2022.110307
2. Bonthuis, P. J., S. Steinwand, C. N. Stacher Horndli, J. Emery, W. C. Huang, S. Kravitz, E. Ferris and C. Gregg (2022). Noncanonical genomic imprinting in the monoamine system determines naturalistic foraging and brain-adrenal axis functions. Cell Rep **38**(10): 110500.10.1016/j.celrep.2022.110500
3. Jurynec, M. J., C. M. Gavile, M. Honeggar, Y. Ma, S. R. Veerabhadraiah, K. A. Novak, K. Hoshijima, N. H. Kazmers and D. J. Grunwald (2022). NOD/RIPK2 signalling pathway contributes to osteoarthritis susceptibility. Ann Rheum Dis **81**(10): 1465-1473.10.1136/annrheumdis-2022-222497
4. Nicholson, R. J., A. M. Poss, J. A. Maschek, J. E. Cox, P. N. Hopkins, S. C. Hunt, M. C. Playdon, W. L. Holland and S. A. Summers (2021). Characterizing a Common CERS2 Polymorphism in a Mouse Model of Metabolic Disease and in Subjects from the Utah CAD Study. J Clin Endocrinol Metab **106**(8): e3098-e3109.10.1210/clinem/dgab155

Utah Center for Genetic Discovery

Overview

The UCGD Core helps investigate the genetic basis for human disease by providing whole exome and genome sequence analyses for research and clinical projects. We specialize in variant calling and disease-gene discovery research. Services offered include alignment and variant calling (including structural variant calling) for NGS datasets, variant interpretation, joint genotyping, disease gene discovery in cohorts and families, and ad hoc research analyses as dictated by the project. In total, the UCGD has available 2992 CPU cores and 4.9 PB of disc storage, plus access to additional shared resources. Total capacity for variant calling is approximately ~200,000 genomes annually via a combination of in-house and cloud-based processing. The UCGD Core has expertise for massively scalable data processing and maintains a web-based data portal for data access and collaborative analysis.

Services

- Alignment and variant calling to identify small nucleotide variants (SNVs), small insertions/deletions (INDELs), and structural variants using our automated, high capacity variant calling pipeline.
- Prioritization and interpretation of variants using a filtering and/or statistical methods.
- Disease gene discovery in cohorts and families.
- Data transfer, storage, and management for large NGS datasets
- Facilitate return of sequencing data from ARUP laboratories (both short read Illumina and long read PacBio sequencing available to researchers)

Personnel

- Carson Holt Ph.D., UCGD Core Director
- Zac Stephens Ph.D., UCGD/3i Core Codirector
- 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

Advisory Board Committee

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

2022 Annual Update

Grant Support – UCGD Core supported the following grant submissions in FY22:

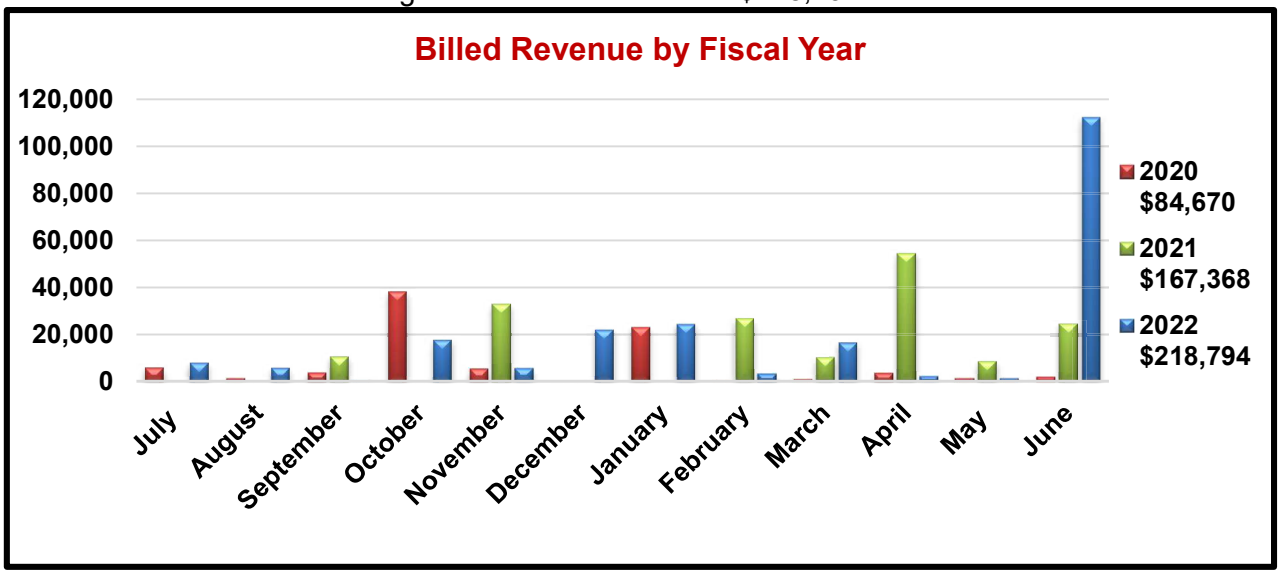
- Genetic and Functional Analysis of Rapid Renal Decline in Diabetes: A Family-based Approach to Accelerate Gene Discovery **(R01 - Awarded)**. PI: Marcus Pezzolesi.
- Improving the analytical flexibility of bedtools **(CZI DAF Silicon Valley Community Foundation Contract - Awarded)**. PI: Aaron Quinlan.
- GEMS: Genomic approach to connecting Elevated germline Mutation rates with male infertility and Somatic health **(R01 - Awarded)**. PI: James Hotaling.
- Developmental and genetic mechanisms of diversity and disease (**R35 supplement - Awarded**). PI: Mike Shapiro.
- Discovering the genetic determinants of pediatric cardiovascular and neurological disease using Artificial Intelligence **(PCCPM, Contract - Awarded)**. PI: Martin Tristani-Firouzi.
- A translational platform for rapid genomic medicine **(UM1)**. PI: Martin Tristani-Firouzi
- University of Utah Diabetes and Metabolism Research Center **(P30)**. PI: Scott Summers.
- A web software system supporting genetic counseling in the age of genomic medicine **(R01)**. PI: Gabor Marth
- A comprehensive de novo mutation discovery tool **(R01)**. PI: Gabor Marth.
- Center of Excellence for Somatic Mosaicism (**RM1**). PI: Gabor Marth.
- Lustre data storage **(S10).** PI: Carson Holt.

Revenue/Expenses

FY22 Expenses: **Total $1,215,664**

FY22 Revenue: **Total $1,047,661**

- VP of Health Sciences Support NeoSeq: $249,079
- VP of Health Sciences Support UCGD: $579,788
- FY22 Revenue generated from services: $218,794

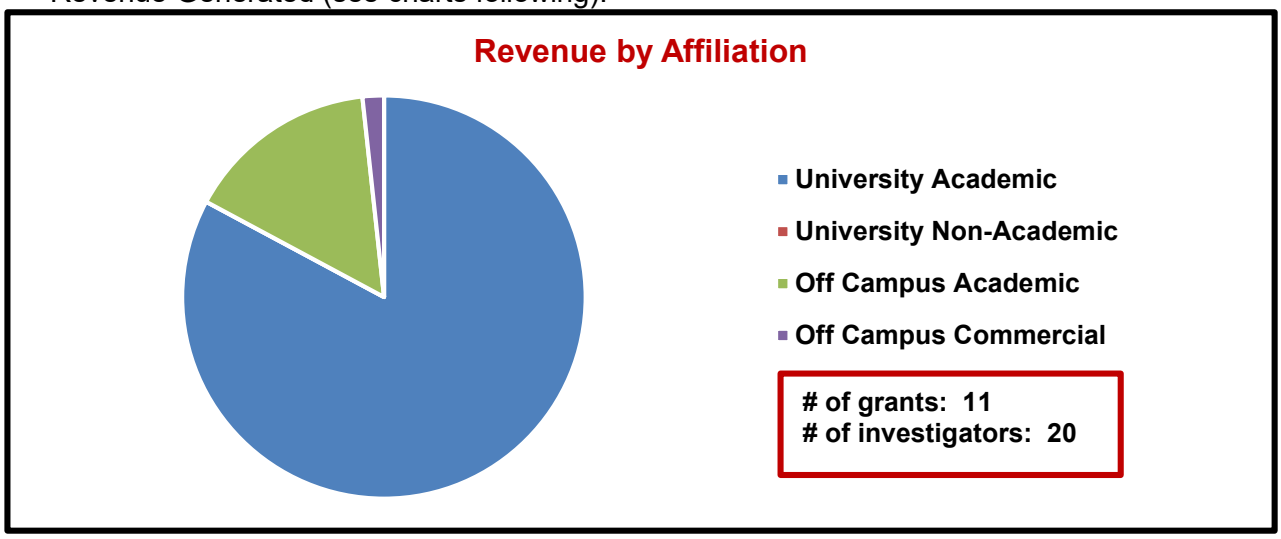


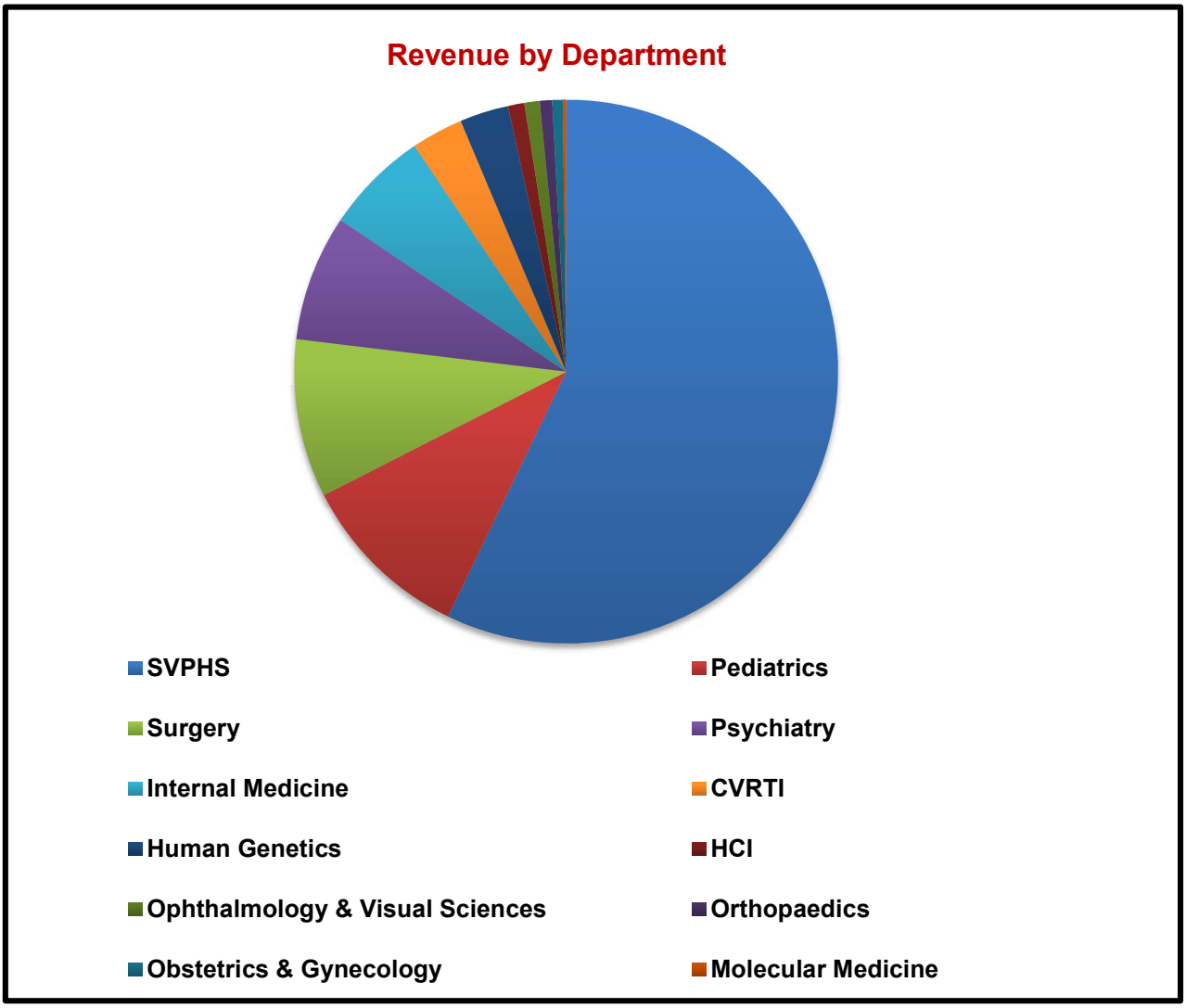
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Smith, Chelsie	Department
2	Emory University	Off Campus Academic
3	Christensen, Ben	Sexual Medicine Society of North America
4	Coon, Hilary	NIH
5	Gupta, Sumati	Huntsman Cancer Institute
6	Malone-Jenkins, Sabrina	Department
7	Yoder, Bradley	Peds, NIH
8	Tristani-Firouzi, Martin	NIH
9	Holt, Carson	Department
10	Fabric Genomics	Off Campus Commercial

Publications

1. Gorsi, B., E. Hernandez, M. B. Moore, M. Moriwaki, C. Y. Chow, E. Coelho, E. Taylor, C. Lu, A. Walker, P. Touraine, L. M. Nelson, A. R. Cooper, E. R. Mardis, A. Rajkovic, M. Yandell and C. K. Welt (2022). Causal and Candidate Gene Variants in a Large Cohort of Women With Primary Ovarian Insufficiency. J Clin Endocrinol Metab **107**(3): 685-714.10.1210/clinem/dgab775
2. Malone Jenkins, S., R. Palmquist, A. L. Kapron, C. Torr, D. H. Best, M. A. Karren, L. Brunelli, M. Yandell, M. Tristani-Firouzi, D. Dimmock, B. Watts, J. R. Botkin, A. Johnson and J. L. Bonkowsky (2021). Addressing ethical and laboratory challenges for initiation of a rapid whole genome sequencing program. J Clin Transl Sci **5**(1): e177.10.1017/cts.2021.833
3. Nicholas, T. J., N. Al-Sweel, A. Farrell, R. Mao, P. Bayrak-Toydemir, C. E. Miller, D. Bentley, R. Palmquist, B. Moore, E. J. Hernandez, M. J. Cormier, E. Fredrickson, K. Noble, S. Rynearson, C. Holt, M. A. Karren, J. L. Bonkowsky, M. Tristani-Firouzi, M. Yandell, G. Marth, A. R. Quinlan, L. Brunelli, R. M. Toydemir, B. J. Shayota, J. C. Carey, S. E. Boyden and S. Malone Jenkins (2022). Comprehensive variant calling from whole-genome sequencing identifies a complex inversion that disrupts ZFPM2 in familial congenital diaphragmatic hernia. Mol Genet Genomic Med **10**(4): e1888.10.1002/mgg3.1888
4. Ward, A., M. Velinder, T. Di Sera, A. Ekawade, S. Malone Jenkins, B. Moore, R. Mao, P. Bayrak-Toydemir and G. Marth (2022). Clin.iobio: A Collaborative Diagnostic Workflow to Enable Team-Based Precision Genomics. J Pers Med **12**(1).10.3390/jpm12010073
5. Yang, G., E. Parker, B. Gorsi, M. Liebowitz, C. Maguire, J. B. King, H. Coon, M. Lopez-Larson, J. Anderson, M. Yandell and A. Shcheglovitov (2022). Neurite outgrowth deficits caused by rare PLXNB1 mutation in pediatric bipolar disorder. medRxiv: 2022.2005.2006.22274499.10.1101/2022.05.06.22274499

Service Recharge Centers

Overview

The HSC Administration Office also manages Service/Recharge Centers. These Centers are not cores but follow most of the same guidelines as the HSC Cores. The Administration Office processes the billing, collections and ordering of supplies for these Centers. Each Center receives monthly reports showing revenue and expenses and has access to the internal tracking system which shows in real time what their account balances are. The Administration Office charges a fee of 5% on revenue collected from billed services. These Centers are listed on the HSC Cores website under Service/Recharge Centers. If it is determined at a later time that a Center would benefit from becoming a Core, then all guidelines must be followed.

Service/Recharge Centers are primarily created to provide services to the University Community but can also provide services to external customers. The administration of these facilities is performed by the home department. Only recharge activity for these groups is managed by the Administrative Office, this is partly due to the efficient billing system that has been developed in collaboration with our IT support group managed by Mr. Rick Haycock.

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, and the post kainate-induced status epilepticus (SE) chronically epileptic model. 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 compound are formulated either by outsourcing or can be custom made in-house. Prices will be determined based on the requirements of the planned study.

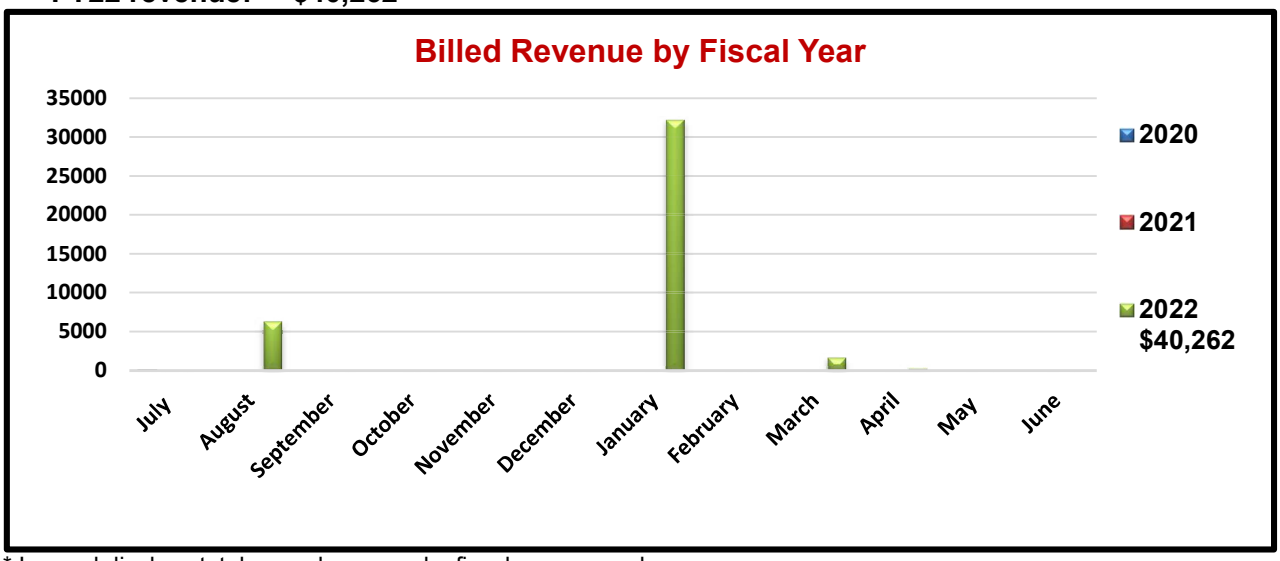
Personnel

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

Goals for FY23

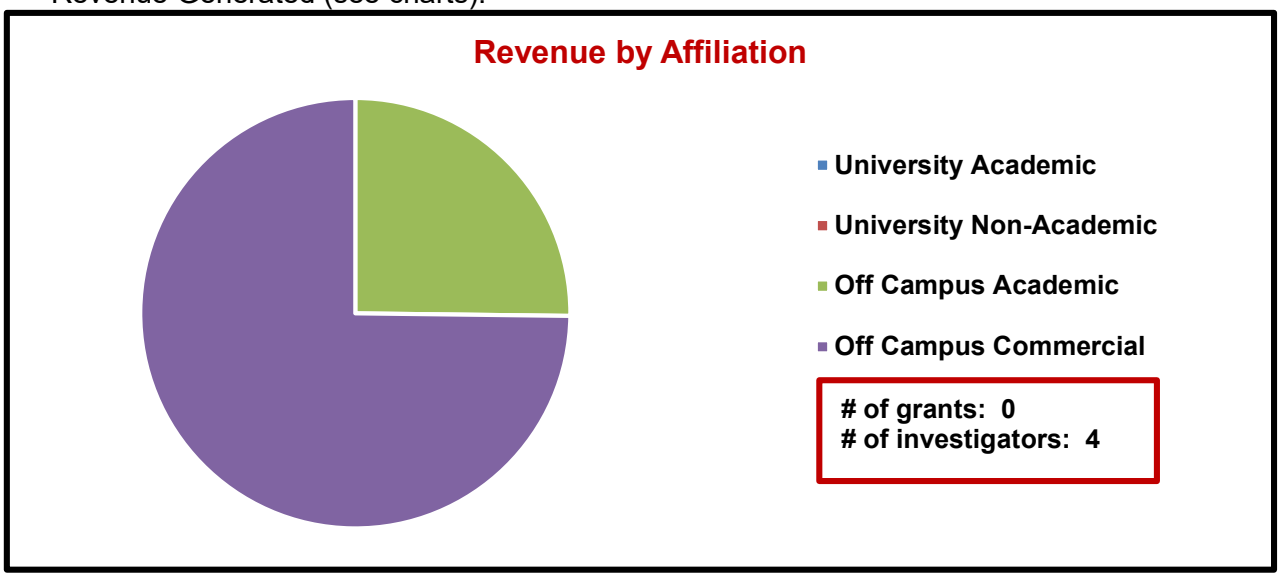
- Continue Established Operations
- Reaching out to new users

2022 Annual Update
Revenue/Expenses- New Service Recharge June 2021
FY22 expenses: $26,106
FY22 revenue: $40,262



* Legend displays total annual revenue by fiscal year earned.

FY22 Scientific Impact
Research Support
Revenue Generated (see charts):



Top Users

1	Rebel Medicine, Inc.	Off Campus Commercial
2	Jagiellonian University Medical College	Off Campus Academic
3	Sea Pharmaceuticals	Off Campus Commercial
4	Kiora Pharmaceuticals	Off Campus Commercial

Publications
No known publications acknowledged this facility in FY 22.

Behavioral Health Innovation and Dissemination Center (BHIDC)

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 FY2022.

Personnel

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

Advisory Board Committee

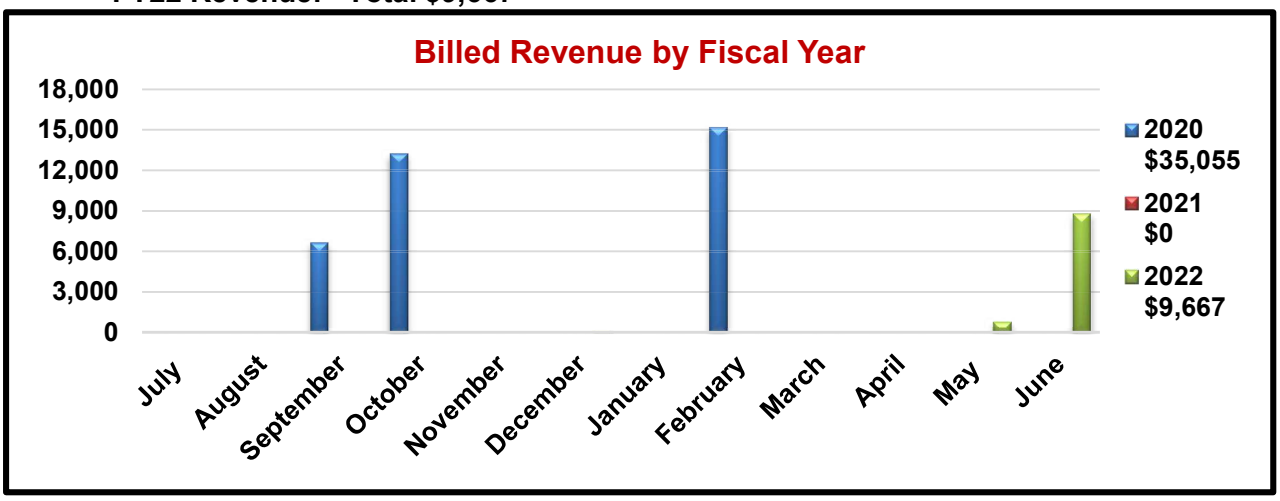
- Cynthia Berg Ph.D., Distinguished Professor of Psychology
- Lee Ellington Ph.D., Professor, College of Nursing
- Rebecca Utz Ph.D., Professor, Department of Sociology
- Lori Kowaleski-Jones Ph.D., Associate Professor, Dept of Family & Consumer Studies

2022 Annual Update

Revenue/Expenses

FY22 Expenses: Total $2,554

FY22 Revenue: Total $9,667

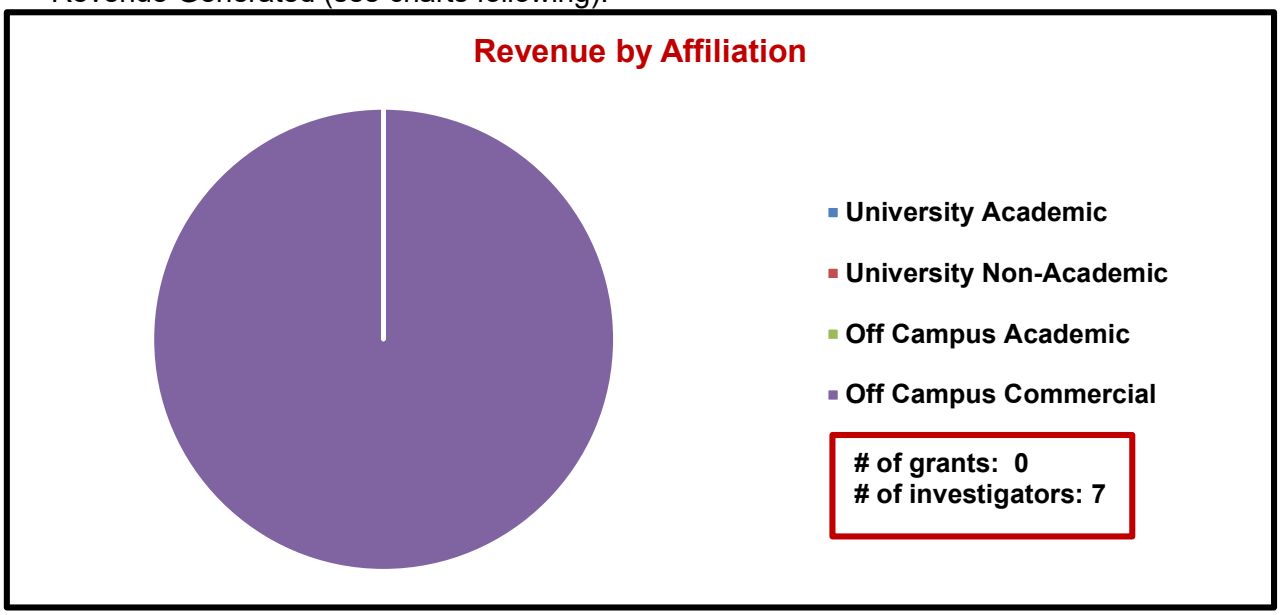


*Legend displays total annual revenue by year earned. ** Managed by HSC Core Administration 2018.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):



Top Users

1	Tim Horton's Foundation	Off Campus Commercial
2	Knopp, Kayla	Off Campus Commercial
3	Choplin, Emma	Off Campus Commercial
4	Ma, Ruofan	Off Campus Commercial
5	Halberstadt, Alexandra	Off Campus Commercial
6	Wiseman, Jennifer	Off Campus Commercial

Grant Support

- Pilot Study Grant (Leifker)
  University of Utah – Center for Families and Health Research $2,575
  Effectiveness of Cognitive Behavioral Conjoint Therapy for PTSD in Law Enforcement Officers
  Role: Principal Investigator

Extramural – Primary Investigator (1 gift total)

- B. Baucom (PI)
  Apple
  A standardized data set for benchmarking mental health status
  $ 100,000

Extramural – Co-Investigator (8 awards total)

- R41 Asnaani (PI)
  NIH / NIMH
  $449,760 (.10 FTE)
- R34 D. Baucom, Bulik (PI)
  NIH / NIMH
  A Couple-Based Treatment for Bulimia Nervosa (UNITE)
  $ 450,000 (.14 FTE)
- Bryan (PI)
  Department of Defense (DoD)
  Replication trial of Brief Cognitive Behavioral Therapy to prevent suicide
  $ 3,169,280 (.10 FTE)
- May, Bryan (PI)
  DoD / MSRC
  Couples Crisis Response Planning to Reduce Post-Discharge Suicide Risk
  $ 1,163,719 (.10 FTE)
- R01 MH119084 01 Butner, Bulik (PI)
  NIH / NIMH
  Predicting binge and purge episodes in from passive and active Apple watch data using a dynamical systems approach
  $ 2,000,000 (.10 FTE)
- R21 Baron (PI)
  A couple-based intervention for sleep apnea
  NIH/NHLBI
  (.10 FTE)
- Terrill (PI)
  ReStoreD
  NIA
  (.16 FTE)
- Himle (PI)
  NIH
  Role: Co-I (.083 FTE)
- R01MH129169 Huebner (PI)
  NIH / NIAID
  RCT of a parent-focused approach to reducing HIV risk in adolescent MSM
  (.12 FTE)

Extramural – Consultant (3 awards total)

- R01CA201179 Langer/Porter (PIs)
  NIH / NCI
  Couple Communication in Cancer: A Multi-Method Examination
- Dekel (PI)
  Israel Science Foundation
  Cognitive Behavioral Conjoint Therapy for Israeli Veterans
- Heinrichs (PI)
  Federal Ministry of Education and Research, Germany
  Family climate and relationship quality in dyads of mothers with Borderline Personality Disorder and their infants

Publications

1. Bryan, C. J., H. A. Russell, A. O. Bryan, D. C. Rozek, F. R. Leifker, K. F. Rugo, J. C. Baker, L. R. Khazem, E. M. Roberge, D. M. Shirley and A. Asnaani (2022). Impact of Treatment Setting and Format on Symptom Severity Following Cognitive Processing Therapy for Posttraumatic Stress Disorder. Behav Ther **53**(4): 673-685.10.1016/j.beth.2022.01.014
2. Fischer, M. S., D. H. Baucom, J. S. Abramowitz and B. R. W. Baucom Interpersonal Emotion Dynamics in Obsessive-Compulsive Disorder: Associations With Symptom Severity, Accommodation, and Treatment Outcome. Couple and Family Psychology-Research and Practice: 10.10.1037/cfp0000218
3. Flatt, R. E., L. M. Thornton, T. Smith, H. Mitchell, S. Argue, B. R. W. Baucom, P. R. Deboeck, C. Adamo, R. E. Kilshaw, Q. X. Shi, J. Tregarthen, J. E. Butner and C. M. Bulik (2022). Retention, engagement, and binge-eating outcomes: Evaluating feasibility of the Binge-Eating Genetics Initiative study. International Journal of Eating Disorders **55**(8): 1031-1041.10.1002/eat.23726
4. Johnson, K. T., P. G. Williams, T. W. Smith and B. R. W. Baucom (2021). Individual differences in aesthetic engagement and proneness to aesthetic chill: Associations with stress-related growth orientation. Psychology of Aesthetics, Creativity, and the Arts: No Pagination Specified-No Pagination Specified.10.1037/aca0000410
5. Khalifian, C. E., S. A. Chalker, F. R. Leifker, K. Rashkovsky, K. Knopp, L. A. Morland, S. Glynn and C. Depp (2022). Veteran and partner interest in addressing suicidality from a couple-based treatment approach. Couple and Family Psychology: Research and Practice **11**: 74-81.10.1037/cfp0000195
6. Khalifian, C. E., F. R. Leifker, K. Knopp, C. R. Wilks, C. Depp, S. Glynn, C. Bryan and L. A. Morland (2022). Utilizing the couple relationship to prevent suicide: A preliminary examination of Treatment for Relationships and Safety Together. J Clin Psychol **78**(5): 747-757.10.1002/jclp.23251
7. Kilshaw, R. E., C. Adamo, J. E. Butner, P. R. Deboeck, Q. Shi, C. M. Bulik, R. E. Flatt, L. M. Thornton, S. Argue, J. Tregarthen and B. R. W. Baucom (2022). Passive Sensor Data for Characterizing States of Increased Risk for Eating Disorder Behaviors in the Digital Phenotyping Arm of the Binge Eating Genetics Initiative: Protocol for an Observational Study. JMIR Res Protoc **11**(6): e38294.10.2196/38294
8. Langer, S. L., J. M. Romano, F. Keefe, D. H. Baucom, T. Strauman, K. L. Syrjala, N. Bolger, J. Burns, J. B. Bricker, M. Todd, B. R. W. Baucom, M. S. Fischer, N. Ghosh, J. Gralow, V. Shankaran, S. Y. Zafar, K. Westbrook, K. Leo, K. Ramos, D. M. Weber and L. S. Porter (2021). Couple Communication in Cancer: Protocol for a Multi-Method Examination. Front Psychol **12**: 769407.10.3389/fpsyg.2021.769407
9. Rozek, D. C., S. N. Baker, K. F. Rugo, V. L. Steigerwald, L. M. Sippel, R. Holliday, E. M. Roberge, P. Held, N. Mota and N. B. Smith (2022). Addressing co-occurring suicidal thoughts and behaviors and posttraumatic stress disorder in evidence-based psychotherapies for adults: A systematic review. J Trauma Stress **35**(2): 729-745.10.1002/jts.22774
10. Rugo-Cook, K. F., P. K. Kerig, S. E. Crowell and C. J. Bryan (2021). Fluid vulnerability theory as a framework for understanding the association between posttraumatic stress disorder and suicide: A narrative review. J Trauma Stress **34**(6): 1080-1098.10.1002/jts.22782
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12. Smith, T. W., S. E. Carlson, B. N. Uchino and B. R. W. Baucom (2022). To put asunder: Are there perils of partialing in actor-partner interdependence models? J Fam Psychol.10.1037/fam0001011
13. Terrill, A. L., M. Reblin, J. J. MacKenzie, B. R. W. Baucom, J. Einerson, B. Cardell, L. G. Richards and J. J. Majersik (2022). Intimate Relationships and Stroke: Piloting a Dyadic Intervention to Improve Depression. Int J Environ Res Public Health **19**(3).10.3390/ijerph19031804
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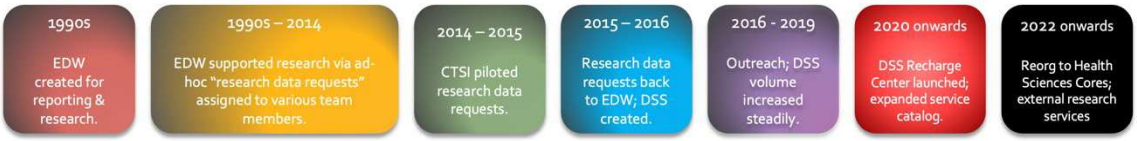
Data Science Services

Overview

Data Science is a set of fundamental principles that guide the extraction of knowledge from data. Data Science *Services* (DSS) provides Data Science expertise to the UHealth clinical and translational research community. DSS handles research-related matters that involve the Enterprise Data Warehouse (EDW) and Epic data. DSS operated as an org at the UHealth Hospital since 2016 and transitioned to the HSC Cores in late 2021.



DSS provides direct technical and consultative support, education, and training to clinicians and researchers on EDW/Epic data, self-service query tools, and the effective use of all available institutional resources to answer complex research questions.

Services

In addition to being the research data concierge for UHealth EDW/Epic data, DSS offers the following services:

- 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.
- Datasets: we provide raw data, analytic datasets, 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.
- Clinical trials: we enhance clinical trials recruitment through EDW informatics tools like the Human Subject Recruitment Tool (HSRT), automated Business Objects Enterprise (BOE) and Tableau reports, etc. to meet accrual goals and reduce cost.
- Natural Language Processing (NLP): we provide 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.
- Tools and applications: we provide access and ongoing support for various EDW research tools like BOE Clinical Universe, HSRT, Warthog, DWCell, etc.
- Collaborations: we support multi-center studies through Epic Cosmos and other research networks, and external investigators through the University's Partners for Innovation, Ventures, Outreach & Technology (PIVOT) Center.

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
- Mike Newman, PhD, MS – Data Scientist, DSS and Huntsman Cancer Institute Pedigree and Population Resource Center
- Ryan Butcher, MBA – Medical Informaticist, DSS
- Vasee Sivaloganathan, MS – Medical Informaticist, DSS

Academic Oversight Committee

- **Chair**: Yves Lussier, MD, FACMI (Professor and Chair, Biomedical Informatics Biomedical Informatics)
- **Vice-Chair**: Julio Facelli, PhD, FACMI (Professor and Vice-Chair, Biomedical Informatics)
- Michael B. Strong, MD, FHM (Clinical Professor, Internal Medicine; Chief Medical Information Officer, University of Utah Hospital)
- Andrea 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)
- Joseph Biskupiak, PhD, MBA (Research Professor, College of Pharmacy)
- 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)

Contact

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

2022 Annual Update

Transition to HSC Cores – DSS transitioned from the University Hospital to HSC Cores in Nov. 2021 and the grants and revenue data below only reflects the post-transition period. The list of publications that follows provides a more complete picture of our scientific impact.

Grant Support – DSS provided letters of support for the following grant/contract submissions:

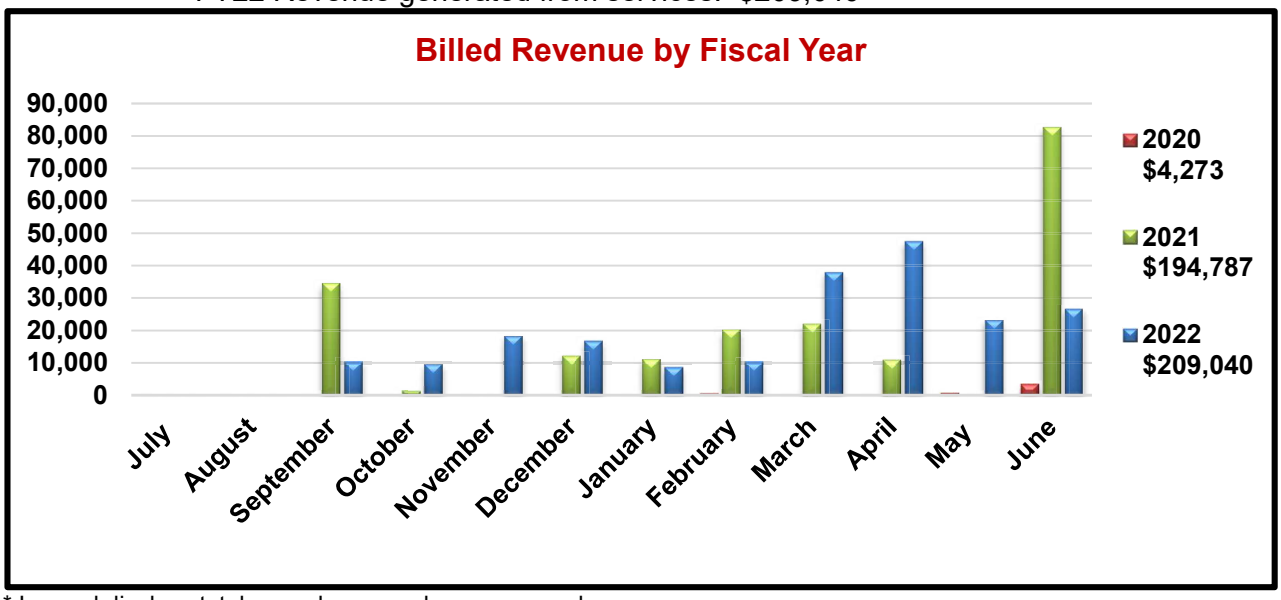
- NIH – Nancy Allen, PhD, ANP-BC (College of Nursing)
- NIH – Gwen Latendresse, PhD, CNM (College of Nursing)
- AHRQ – Valerie Vaughn, MD, MSc (Internal Medicine)
- AHRQ – Andrea Wallace, PhD, RN, FAAN (College of Nursing)
- DoD – Jian Ying, PhD, MStat, MS (Internal Medicine)

Revenue/Expenses

FY22 Expenses: **Total $836,682**

FY22 Revenue: **Total $1,469,534**

- VP of Health Sciences Support: $ 139,161
- Internal Medicine: $151,398
- HCI: $85,763
- Surgery: 77,855
- Ustar: $53,090
- University Hospital: $753,227
- FY22 Revenue generated from services: $209,040

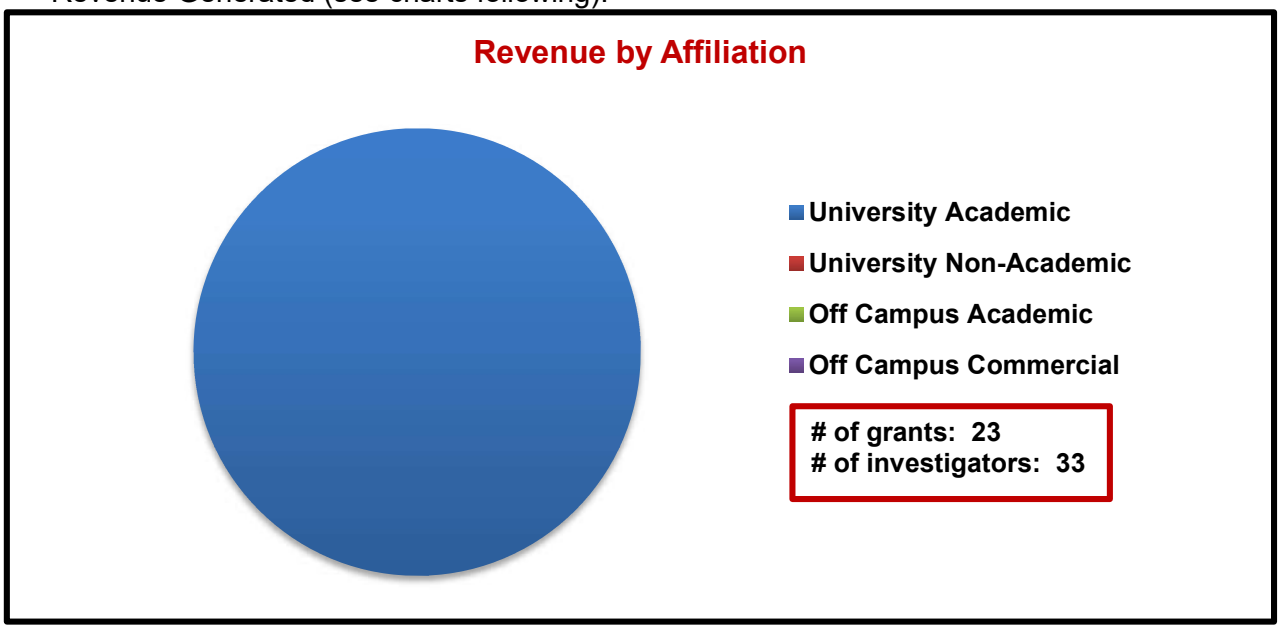


* Legend displays total annual revenue by year earned.

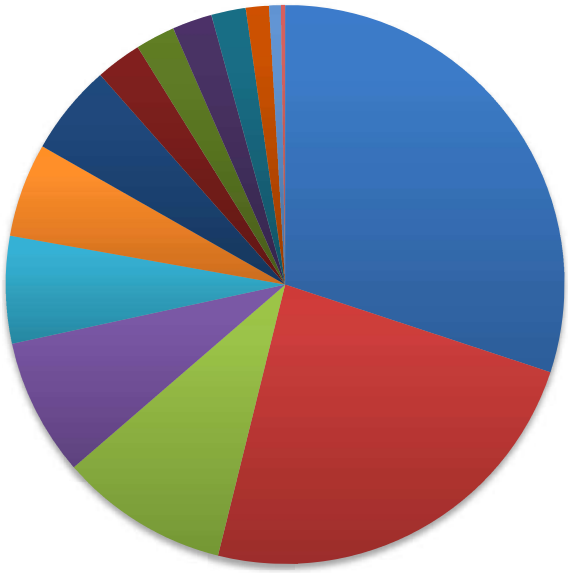
FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):



Revenue by Department



- Obstetrics & Gynecology
- Internal Medicine
- Family & Preventative Medicine
- Emergency Medicine
- Population Health Sciences
- College of Pharmacy
- College of Nursing
- College of Denistry
- Oncological Sciences
- Occupational & Enviromental Health
- Dermatology
- College of Health
- Pediatrics
- College of Social & Behavioral Science

Top Users

1	Smid, Marcela	Task Force for Global Health
2	Samore, Matthew	CDC, DHHS
3	Okuyemi, Kola	NIH
4	Madsen, Troy	CDC
5	Lindley, Erika	Department
6	Steinberg, Benjamin	NIH
7	Pezzolesi, Marcus	NIH, Renalytix AI Inc.
8	Tak, Casey	University of Colorado at Denver
9	Varner, Michael	Department
10	Deshmukh, Vikrant	University of Wisconsin-Madison

Publications

1. Allen, N. A., A. Bristol, E. G. Grigorian, E. Iacob, C. A. Berg and M. L. Litchman (2022). SHARE plus: Delivering a Telehealth CGM Data-Sharing Intervention to Older Adults and Their Care Partners. Diabetes Spectr **35**(1): 16-25.10.2337/dsi21-0016
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9. Coon, H., A. Shabalin, A. V. Bakian, E. DiBlasi, E. T. Monson, A. Kirby, D. Chen, A. Fraser, Z. Yu, M. Staley, W. B. Callor, E. D. Christensen, S. E. Crowell, D. Gray, D. K. Crockett, Q. S. Li, B. Keeshin and A. R. Docherty (2022). Extended familial risk of suicide death is associated with younger age at death and elevated polygenic risk of suicide. Am J Med Genet B Neuropsychiatr Genet **189**(3-4): 60-73.10.1002/ajmg.b.32890
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23. Johnson, S. A., A. E. Jones, E. Young, C. Jennings, K. Simon, R. P. Fleming and D. M. Witt (2021). A risk-stratified approach to venous thromboembolism prophylaxis with aspirin or warfarin following total hip and knee arthroplasty: A cohort study. Thromb Res **206**: 120-127.10.1016/j.thromres.2021.08.009
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49. Toy, G., R. Butcher, H. Li, Y. Zhang, J. F. Gallegos-Orozco and E. A. Rodriguez Zarate (2021). S1150 A Remarkable Increase in Alcohol-Related Liver Disease in the Setting of COVID-19. Official journal of the American College of Gastroenterology | ACG **116**: S539.10.14309/01.ajg.0000778132.31801.13
50. Vaughn, V. M., A. L. Hersh and E. S. Spivak (2022). Antibiotic Overuse and Stewardship at Hospital Discharge: The Reducing Overuse of Antibiotics at Discharge Home Framework. Clin Infect Dis **74**(9): 1696-1702.10.1093/cid/ciab842
51. Vehawn, J., M. Choudry, T. C. Hunt, C. Martin, J. P. Ambrose, B. Haaland, J. Chipman, H. A. Hanson and B. O. Neil (2022). Urban families ameliorate rural genitourinary cancer disparities. Journal of Clinical Oncology **40**(6_suppl): 25-25.10.1200/JCO.2022.40.6_suppl.025
52. Wirostko, B. M., K. Curtin, S. C. Taylor, C. Paulson, C. Pompoco, B. M. Besch, R. Ranjan and R. Ritch (2022). Risk of atrial fibrillation is increased in patients with exfoliation syndrome: the Utah project on exfoliation syndrome (UPEXS). Acta Ophthalmol **100**(4): e1002-e1009.10.1111/aos.15017

53. Wohlfahrt, P., J. Nativi-Nicolau, M. Zhang, C. H. Selzman, T. Greene, J. Conte, J. E. Biber, R. Hess, F. L. Mondesir, O. Wever-Pinzon, S. G. Drakos, E. M. Gilbert, L. Kemeyou, B. LaSalle, B. A. Steinberg, R. U. Shah, J. C. Fang, J. A. Spertus and J. Stehlik (2021). Quality of Life in Patients With Heart Failure With Recovered Ejection Fraction. JAMA Cardiol **6**(8): 957-962.10.1001/jamacardio.2021.0939
54. Yoon, S. K., K. T. Hegmann, M. S. Thiese, J. L. Burgess, K. Ellingson, K. Lutrick, L. E. W. Olsho, L. J. Edwards, B. Sokol, A. J. Caban-Martinez, N. Schaefer-Solle, J. M. Jones, H. Tyner, A. Hunt, K. Respet, M. Gaglani, K. Dunnigan, S. Rose, A. Naleway, H. Groom, J. Kuntz, A. L. Fowlkes, M. G. Thompson, Y. M. Yoo, H.-R. N. Investigators and H.-R. N. Investigators (2022). Protection with a Third Dose of mRNA Vaccine against SARS-CoV-2 Variants in Frontline Workers. N Engl J Med **386**(19): 1855-1857.10.1056/NEJMc2201821
55. Zukauckas, K., Benefield, R. J., Newman, M., & Certain, L. (2022). Why Bother? Lab Monitoring in Beta-LaZukauckas, K., R. J. Benefield, M. Newman and L. Certain (2022). Why Bother? Lab Monitoring in Beta-Lactam Outpatient Parenteral Antimicrobial Therapy. Antimicrob Agents Chemother **66**(6): e0057922.10.1128/aac.00579-22

Fly Food

Overview

The mission of the Fly Food Core is to provide fly food for the labs using Drosophila as a model organism. The food is critical to the maintenance and propagation of Drosophila. All seven labs in the School of Medicine, that use Drosophila, order food from this core.

Services

- Produces food for each lab on a weekly basis.

Equipment

- S Robot

Personnel

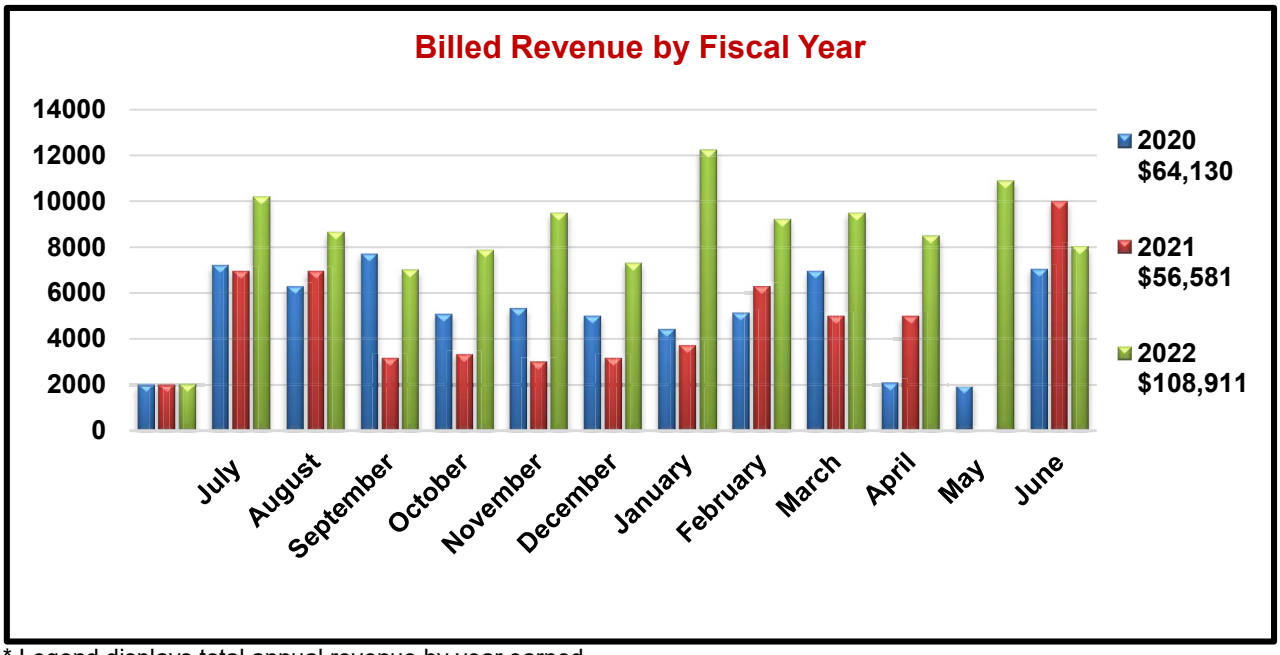
- Clement Chow, Ph.D., Director
- Emily Coelho
- Steve Pronovost

Revenue/Expenses

FY22 Expenses: **Total $110,945**

FY22 Revenue: Total $108,911

- VP of Health Sciences Support: $ 0
- FY22 Revenue generated from services: $108,911

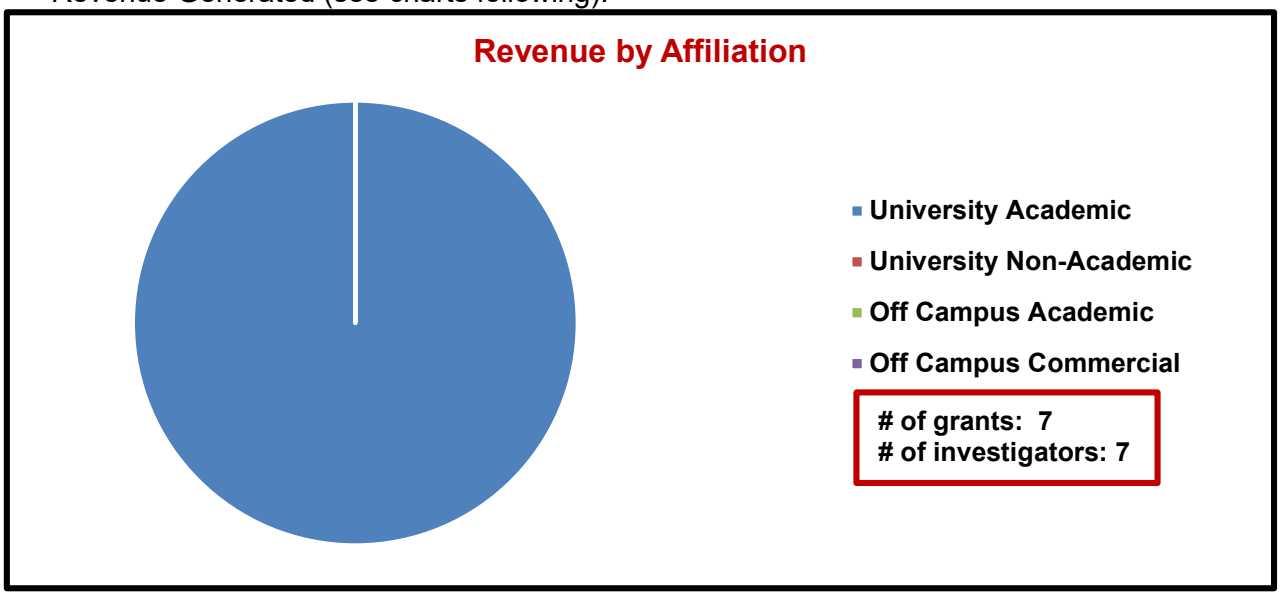


* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):



Top Users

1	Chow, Clement	Department, NIH
2	Rothenfluh, Adrian	Department, NIH
3	Edgar, Bruce	NIH
4	Rodan, Aylin	Department, American Physiological Society
5	Link, Nichole	Department
6	Rutter, Jared	NIH
7	Letsou, Anthea	Department

Publications

1. Balderas, E., D. R. Eberhardt, S. Lee, J. M. Pleinis, S. Sommakia, A. M. Balynas, X. Yin, M. C. Parker, C. T. Maguire, S. Cho, M. W. Szulik, A. Bakhtina, R. D. Bia, M. W. Friederich, T. M. Locke, J. L. K. Van Hove, S. G. Drakos, Y. Sancak, M. Tristani-Firouzi, S. Franklin, A. R. Rodan and D. Chaudhuri (2022). Mitochondrial calcium uniporter stabilization preserves energetic homeostasis during Complex I impairment. Nat Commun **13**(1): 2769.10.1038/s41467-022-30236-4
2. Dalton, H. M., R. Viswanatha, R. Brathwaite, J. S. Zuno, S. E. Mohr, N. Perrimon and C. Y. Chow (2021). A genome-wide CRISPR screen identifies the glycosylation enzyme DPM1 as a modifier of DPAGT1 deficiency and ER stress. bioRxiv: 2021.2012.2003.471178.10.1101/2021.12.03.471178
3. Hope, K. A., A. R. Berman, R. T. Peterson and C. Y. Chow (2022). An in vivo drug repurposing screen and transcriptional analyses reveals the serotonin pathway and GSK3 as major therapeutic targets for NGLY1 deficiency. PLoS Genet **18**(6): e1010228.10.1371/journal.pgen.1010228
4. Gorsi, B., E. Hernandez, M. B. Moore, M. Moriwaki, C. Y. Chow, E. Coelho, E. Taylor, C. Lu, A. Walker, P. Touraine, L. M. Nelson, A. R. Cooper, E. R. Mardis, A. Rajkovic, M. Yandell and C. K. Welt (2022). Causal and Candidate Gene Variants in a Large Cohort of Women With Primary Ovarian Insufficiency. J Clin Endocrinol Metab **107**(3): 685-714.10.1210/clinem/dgab775

5. Merrill, C. B., M. A. Pabon, A. B. Montgomery, A. R. Rodan and A. Rothenfluh (2022). Optimized assay for transposase-accessible chromatin by sequencing (ATAC-seq) library preparation from adult Drosophila melanogaster neurons. Sci Rep **12**(1): 6043.10.1038/s41598-022-09869-4
6. Merrill, C. B., A. B. Montgomery, M. A. Pabon, A. A. Shabalin, A. R. Rodan and A. Rothenfluh (2022). Harnessing changes in open chromatin determined by ATAC-seq to generate insulin-responsive reporter constructs. BMC Genomics **23**(1): 399.10.1186/s12864-022-08637-y
7. Øvrebo, J. I., M. R. Bradley-Gill, N. Zielke, M. Kim, M. Marchetti, J. Bohlen, M. Lewis, M. van Straaten, N. S. Moon and B. A. Edgar (2022). Translational control of E2f1 regulates the Drosophila cell cycle. Proc Natl Acad Sci U S A **119**(4).10.1073/pnas.2113704119
8. Philyaw, T. J., A. Rothenfluh and I. Titos (2022). The Use of Drosophila to Understand Psychostimulant Responses. Biomedicines **10**(1).10.3390/biomedicines10010119
9. Schellinger, J. N., Q. Sun, J. M. Pleinis, S. W. An, J. Hu, G. Mercenne, I. Titos, C. L. Huang, A. Rothenfluh and A. R. Rodan (2022). Chloride oscillation in pacemaker neurons regulates circadian rhythms through a chloride-sensing WNK kinase signaling cascade. Curr Biol **32**(6): 1429-1438 e1426.10.1016/j.cub.2022.03.017
10. Titos, I. and A. Rothenfluh (2021). From single flies to many genes: Using Drosophila to explore the genetics of psychostimulant consumption. Proc Natl Acad Sci U S A **118**(31).10.1073/pnas.2109994118
11. Zhang, P. and B. A. Edgar (2022). Insect Gut Regeneration. Cold Spring Harb Perspect Biol **14**(2).10.1101/cshperspect.a040915

HEALTH
UNIVERSITY OF UTAH

Genetic Science Learning Center

Overview

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

Uniqueness

The GSLC brings together in one team synergistic expertise in design and production of educational materials and programs as well as research and evaluation on the efficacy of both. It's team is unique among groups at US academic institutions that produce science and health education materials in that it includes expertise in science and health writing, science research, instructional and educational material design, multimedia animation and interactivity, graphic design, video production, video game and app development, original music composition and audio engineering, course and workshop design, and research and evaluation of educational materials and programs; other groups outsource some of these functions.

The GSLC produces the most highly-used online life science education resource in the world. Each year its Learn.Genetics and Teach.Genetics websites are visited by over 16 million individuals who view over 60 million pages and come from every country. These sites provide an unparalleled, international dissemination mechanism for educational materials developed through collaborative projects with faculty. The GSLC has received numerous awards for the educational materials it produces. Among others, these include the inaugural award of the *Science* Prize for Online Resources in Education from *Science Magazine* and AAAS.

The GSLC has over 27 years of experience in producing educational materials and programs for patients, the lay public, students at the K-12 and higher education levels, and K-12 teachers. They successfully collaborate with faculty and others in producing materials and programs and in conducting evaluations for both large and small projects.

Services

The GSLC offers the following services:

Design and Production of Educational Materials

- Design and production of educational materials for:
  - Research studies
  - Clinical trials recruitment
  - Patients and families
  - K-12 students and teachers
  - Higher education students
  - Diverse audiences, including tailoring for cultural and language differences
- Science and health writing
- Instructional design
- Multimedia animation and interactivity
- 2D and 3D animation
- Graphic design for online and print-based materials

- Video production, including script writing, production and scheduling, videography, editing, and post-production
- Original music composition/scoring and audio engineering for video and multimedia materials
- Video game development
- App design and development
- Website design and development

Designing and Holding Educational Programs and Conferences

- Online courses in Canvas for University credit
- In-person courses and workshops, with or without University credit
- Classroom programs for K-12 students
- Programs for the lay public
- Facilitating connections with K-12 teachers, schools and districts
- Planning and coordinating local and national conferences

Conducting Research and Evaluation Studies

- Evaluation of educational materials and programs
- Quantitative, qualitative and mixed-methods designs
- Small and medium-scale randomized controlled trials
- Development of valid knowledge assessment (test) items
- Focus groups and key informant or participant interviews
- Survey design

Cross-Cutting Services

- Dissemination of educational materials via conference presentations and manuscripts
- Writing education sections of grant proposals
- Planning Broader Impacts activities for NSF grant proposals

An initial consultation is provided in order to define a project's scope and budget. For grant proposals, text describing the GSLC and its contributions to the project, a budget and justification are provided. Once a project is agreed to and/or funded, a project lead is assigned, who serves as the primary GSLC contact for the project.

Personnel

- Louisa A. Stark, PhD, Director
- Kagan Breitenbach, BMu, Specialty Media Coordinator
- Rochelle Cassells, PhD, Research Associate
- Jonathan Conger, BS, Associate Software Engineer
- Kristin Fenker, PhD, Research Associate
- Jason Harris, AS, Sr. Web Software Developer
- Nathan Holland, BA, Graphic Designer
- Jonny Holmgren, AA, Web Designer
- Sheila Homburger, MS, Science Content Manager
- John Maxwell Kelly, BFA, Multimedia Manager
- Harini Krishnan, PhD, Research Associate
- Molly Malone, BS, Senior Education Specialist
- Steve Ortiz, MLS, Administrative Program Coordinator

- Jen Taylor, BS, Education Specialist
- Arthur Veenema, BS, Video Producer/Director
- Brooklee Watters, AS, User Experience Developer

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

Goals for FY23

The GSLC will continue to produce high-quality, award-winning educational materials, programs, and evaluations. 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.

FY22 Annual Update

New Services

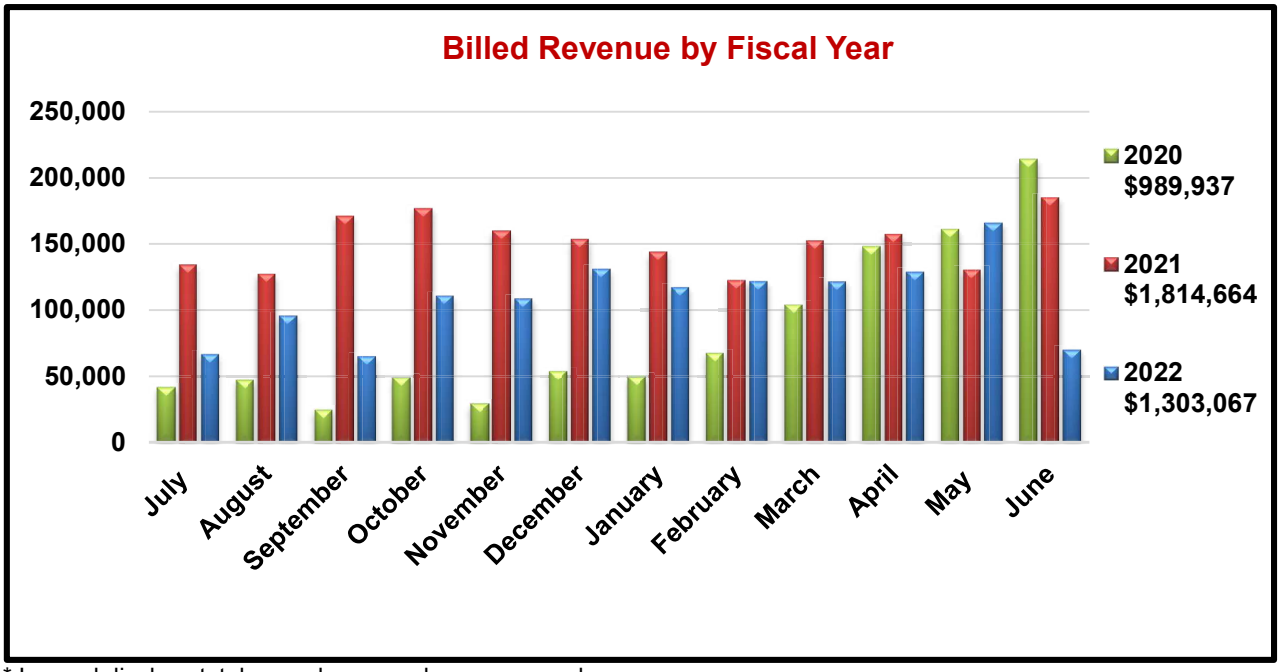
Evaluation of training programs

Revenue/Expenses

FY22 Expenses: **$1,734,394**

FY22 Revenue: **$1,520,278**

- Other Revenue Sources: $217,211
- FY22 revenue generated from services: $1,303,067

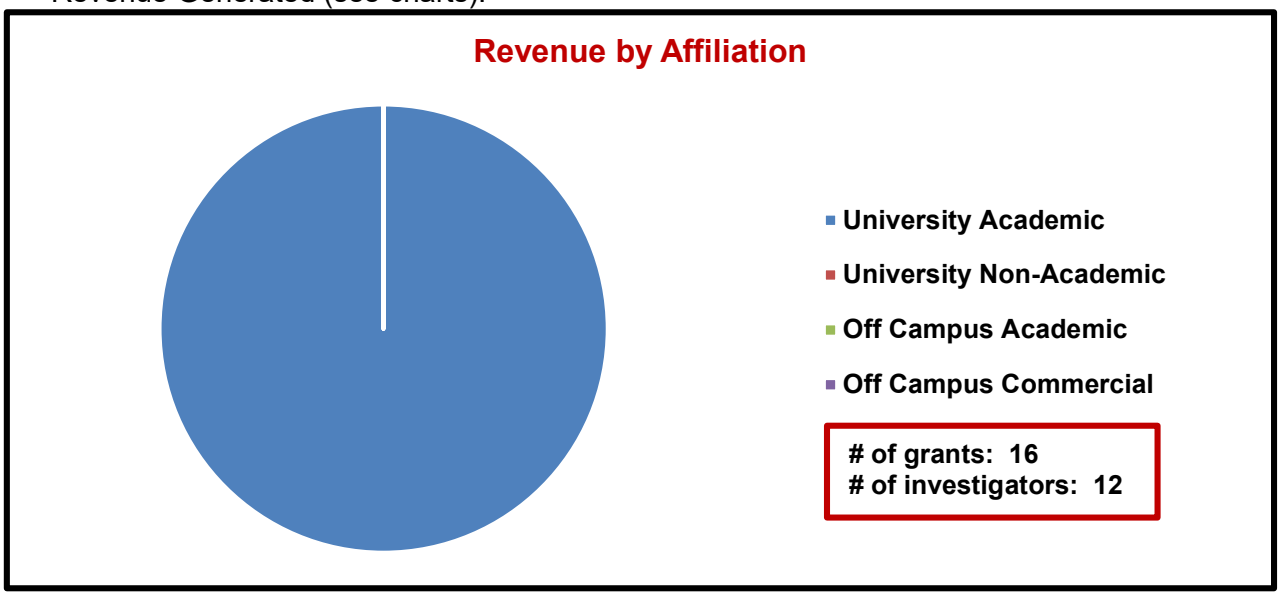


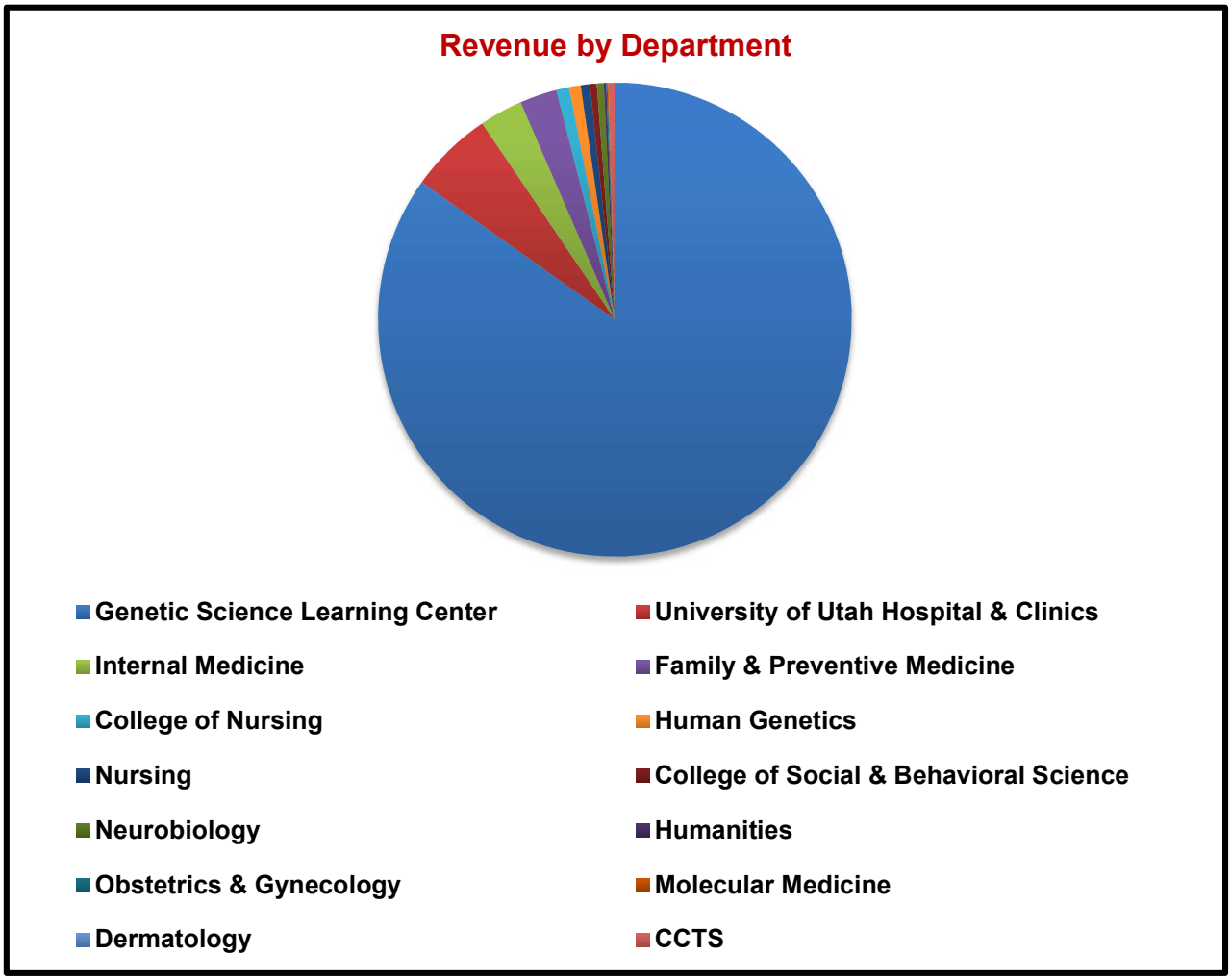
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts):





Top Users

1	Stark, Louisa	NIH, NSF, Utah Dept of Health
2	Ransco, Mari	UUHC
3	Phillips, John	NIH
4	Okuyemi, Kola	NCI, Department
5	Edelman, Linda	Dept Human Health Resources & Services
6	Johnson, Natalie	Department
7	Yost, Joseph	NIH, Department
8	Utz, Rebecca	NIH
9	Botkin, Jeffrey	NIH
10	Rothwell, Erin	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. Delaney, R. K., N. M. Pinto, E. M. Ozanne, H. Brown, L. A. Stark, M. H. Watt, M. Karasawa, A. Patel, M. T. Donofrio, M. M. Steltzer, S. G. Miller, S. L. Zickmund and A. Fagerlin (2022). Parents' decision-making for their foetus or neonate with a severe congenital heart defect. Cardiol Young **32**(6): 896-903.10.1017/S1047951121003218
2. Docherty, A., B. Kious, T. Brown, L. Francis, L. Stark, B. Keeshin, J. Botkin, E. DiBlasi, D. Gray and H. Coon (2021). Ethical concerns relating to genetic risk scores for suicide. Am J Med Genet B Neuropsychiatr Genet **186**(8): 433-444.10.1002/ajmg.b.32871
3. Drits-Esser, D., J. Hardcastle, K. M. Bass, S. Homburger, M. Malone, K. Pompei, G. E. DeBoer and L. A. Stark (2021). Randomized Controlled Trial of a Cohesive Eight-Week Evolution Unit That Incorporates Molecular Genetics and Principles of the Next Generation Science Standards. CBE Life Sci Educ **20**(3): ar50.10.1187/cbe.20-01-0008
4. Delaney, R. K., N. M. Pinto, E. M. Ozanne, L. A. Stark, M. L. Pershing, A. Thorpe, H. O. Witteman, P. Thokala, L. M. Lambert, L. M. Hansen, T. H. Greene and A. Fagerlin (2021). Study protocol for a randomised clinical trial of a decision aid and values clarification method for parents of a fetus or neonate diagnosed with a life-threatening congenital heart defect. BMJ Open **11**(12): e055455.10.1136/bmjopen-2021-055455

Iron & Heme

Overview

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

Uniqueness

The Iron and Heme Core provides a service, not available at most universities including experienced UPLC/HPLC analysis of heme and porphyrin and tetrapyrrole precursor (ALA and PBG) content, assays for activity 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 assay and measure each of the 8 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:

- Metal analysis by ICP-MS
- UPLC Analysis of Total Heme and protoporphyrin IX
- Spectral Analysis of Heme
- UPLC analysis of porphyrins
- Assays for the following Heme Biosynthetic Enzymes (ALAS, ALAD/PBGS, PBGD, U3S, UROD, COPOX, PPOX & FECH)
- Sample preparation (cells & tissues) by homogenization, with protein concentration determination

Equipment

Metal Analysis:

- Agilent 7900-ICP mass spectrometer
- Agilent SPS4 autosampler

Heme and Porphyrin analysis:

- Two Waters Corporation ultra-performance liquid chromatography (UPLC) systems, ACQUITY UPLC classic and ACQUITY UPLC H-class PLUS (installed February 2022), each including a sample manager, a solvent manager, a photodiode array detector, and a fluorescence detector
- Agilent 8453 diode array spectrophotometer

Personnel

- Hector A. Bergonia, MS, Lab Specialist Tetrapyrrole Biochemistry, Core Account Executive (as of March, 2022)
- Laurie K. Jackson, PhD, Core Director (resigned March, 2022)
- Alexander K. Anderson, BS, Lab Technician (started June, 2022)

Advisory Board Committee (CIHD Operations Committee)

Last meeting date: July 2, 2021

- John D. Phillips, PhD, Hematology
- James Cox, PhD, Biochemistry
- Diane M Ward, PhD, Pathology
- Dennis Winge, PhD, Hematology

Goals for FY23

- Increase awareness of our services
- Balance core management with lab responsibilities for HAB
- Increase core efficiency

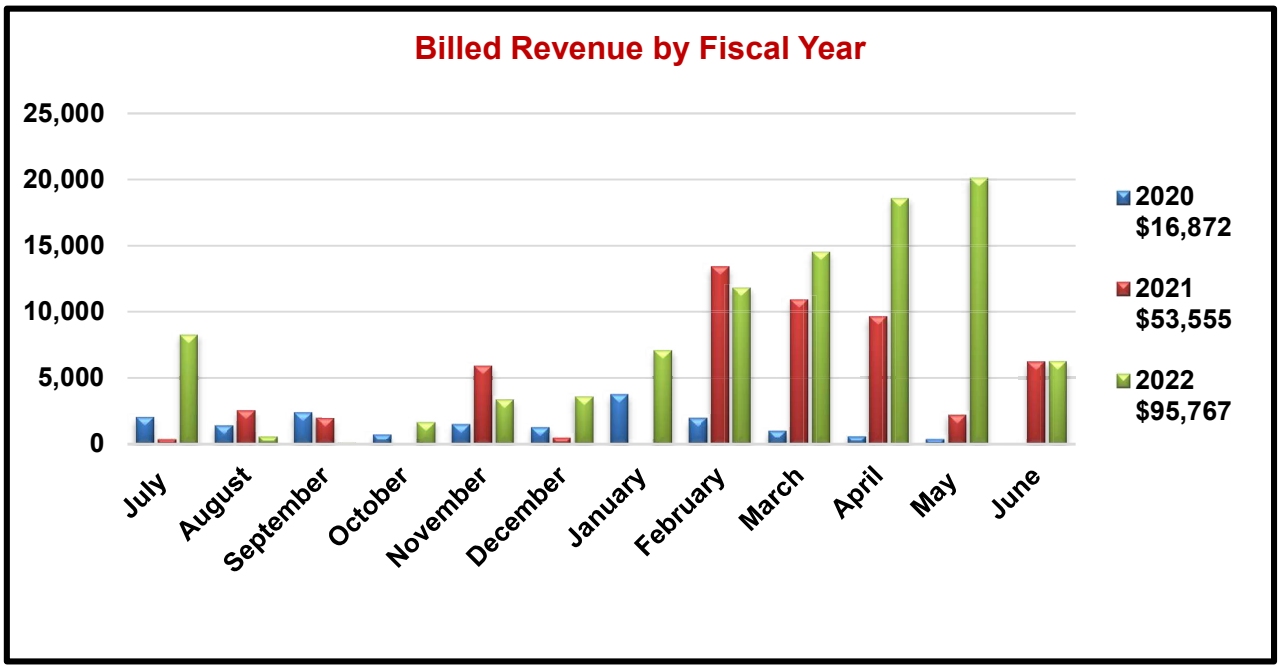
2022 Annual Update

Revenue/Expenses

FY22 Total Expenses: **$32,897**

FY22 Total Revenue: **$95,767**

- VP of Research Support: $0
- FY22 Revenue generated from services: $95,767

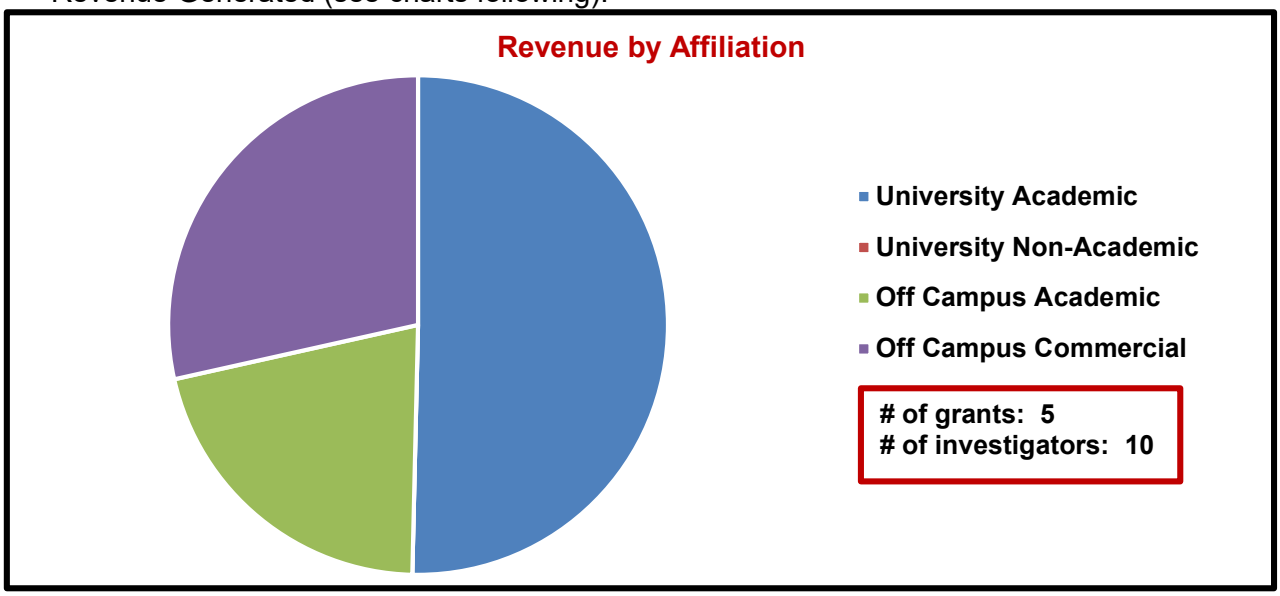


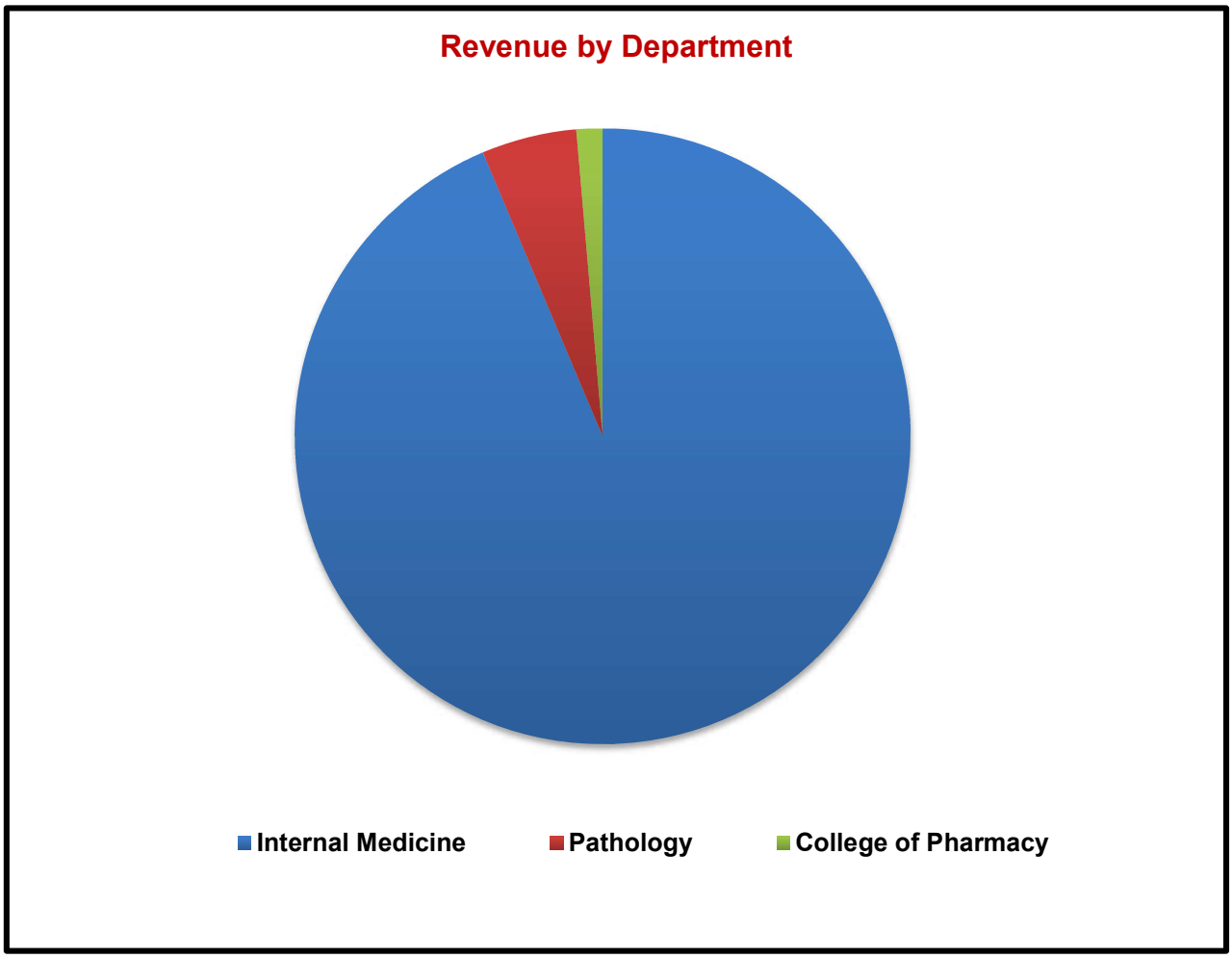
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Phillips, John	NIH, U54 Supplement Award
2	Protagonist Therapeutics	Off Campus Commercial
3	East Carolina University	Off Campus Academic
4	University of Texas Southwestern Medical Center	Off Campus Academic
5	NYU Langone Health	Off Campus Academic
6	Koh, Mei Yee	Kuda Therapeutics, NIH
7	Massachusetts General Hospital/HMS	Off Campus Academic
8	University of Washington	Off Campus Academic
9	University of Maryland	Off Campus Academic
10	Ward, Diane	Department

Publications

1. Sishtla, K., N. Lambert-Cheatham, B. Lee, D. H. Han, J. Park, S. P. B. Sardar Pasha, S. Lee, S. Kwon, A. Muniyandi, B. Park, N. Odell, S. Waller, I. Y. Park, S. J. Lee, S. Y. Seo and T. W. Corson (2022). Small-molecule inhibitors of ferrochelatase are antiangiogenic agents. Cell Chem Biol **29**(6): 1010-1023 e1014.10.1016/j.chembiol.2022.01.001
2. Marcero, J. R., J. E. Cox, H. A. Bergonia, A. E. Medlock, J. D. Phillips and H. A. Dailey (2021). The immunometabolite itaconate inhibits heme synthesis and remodels cellular metabolism in erythroid precursors. Blood Adv **5**(23): 4831-4841.10.1182/bloodadvances.2021004750
3. Rondelli, C. M., M. Perfetto, A. Danoff, H. Bergonia, S. Gillis, L. O'Neill, L. Jackson, G. Nicolas, H. Puy, R. West, J. D. Phillips and Y. Y. Yien (2021). The ubiquitous mitochondrial protein unfoldase CLPX regulates erythroid heme synthesis by control of iron utilization and heme synthesis enzyme activation and turnover. J Biol Chem **297**(2): 100972.10.1016/j.jbc.2021.100972

Materials Characterization Lab

Overview

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

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

The MCL maintains a ~1300 sq. ft. lab facility, including optical and metallographic microscopes, a scanning electron microscope (SEM), an energy dispersive X-ray spectrometer (EDS), a Fourier transform infrared (FTIR) spectrometer, an ultraviolet-visible-near-infrared (UV-Vis-NIR) spectrophotometer, two X-ray diffractometers (XRD), a differential scanning calorimeter (DSC), a combination thermogravimetric analyzer and differential scanning calorimeter (DSC-TGA), a rheometer/ dynamic mechanical analyzer (DMA), a dilatometer, a helium pycnometer, an Instron mechanical testing system, a physisorption analyzer, a particle size analyzer (PSA), carbon and gold sputter coaters, a compression hot-mounting press, and a grinding and polishing system.

Uniqueness

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

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

The MCL has expertise in:

- Biomedical materials and devices
- Ceramics
- Composites
- Electronic materials
- Metals and metal oxides
- Polymers

The MCL provides the following:

- Cross-sectional analysis
- Materials analysis, comparison, and identification
- Microphotography suitable for advertising and training purposes
- Routine analysis for quality assurance and control

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 the 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.

Macroscopic & Physical Testing

- NETZSCH DSC 3500 Sirius Differential Scanning Calorimeter (DSC)
- TA Instruments SDT 650 thermogravimetric analyzer and differential scanning calorimeter (DSC-TGA) with autosampler
- TA Instruments DHR 20 Rheometer with Dynamic Mechanical Analysis (DMA) and dielectric testing mode
- Anton Paar MCR viscometry, rheology, and tribology
- Anter Corporation Work Horse IB Dilatometer
- 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

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

Personnel

- Angela Nelson, Administrative Officer
- Kimberly Watts Ph.D., Lab Manager

Goals for FY23

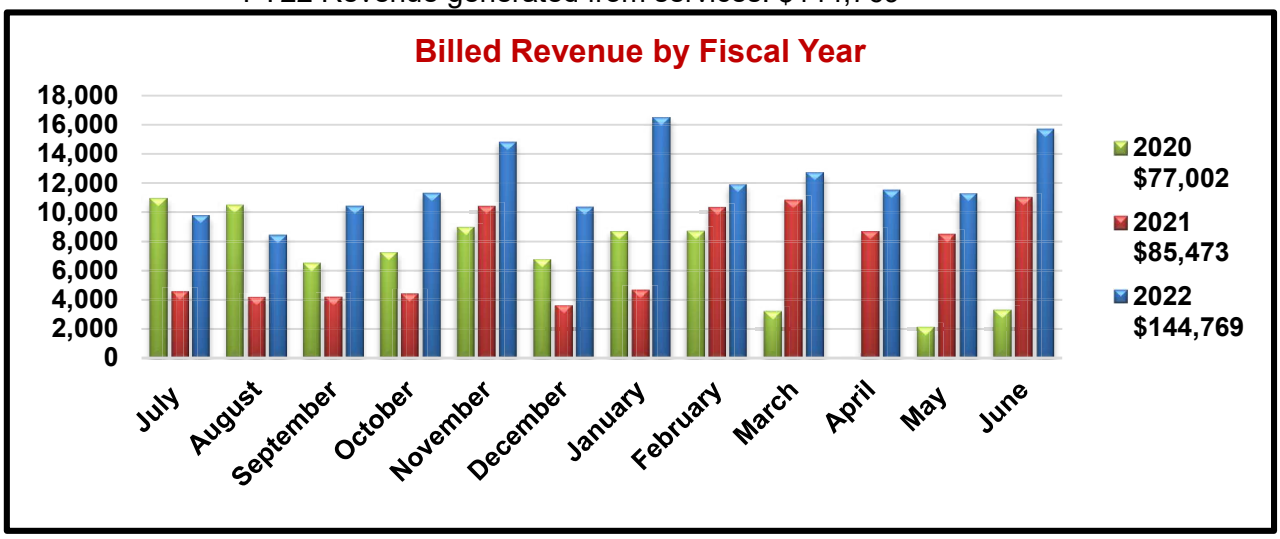
- Increase online availability of training and usage resources, including digital machine manuals and training videos.
- Streamline sample submission process

Revenue/Expenses

FY22 Expenses: Total $165,555

FY22 Revenue: Total $144,769

- VP of Research Support: $ 0
- FY22 Revenue generated from services: $144,769

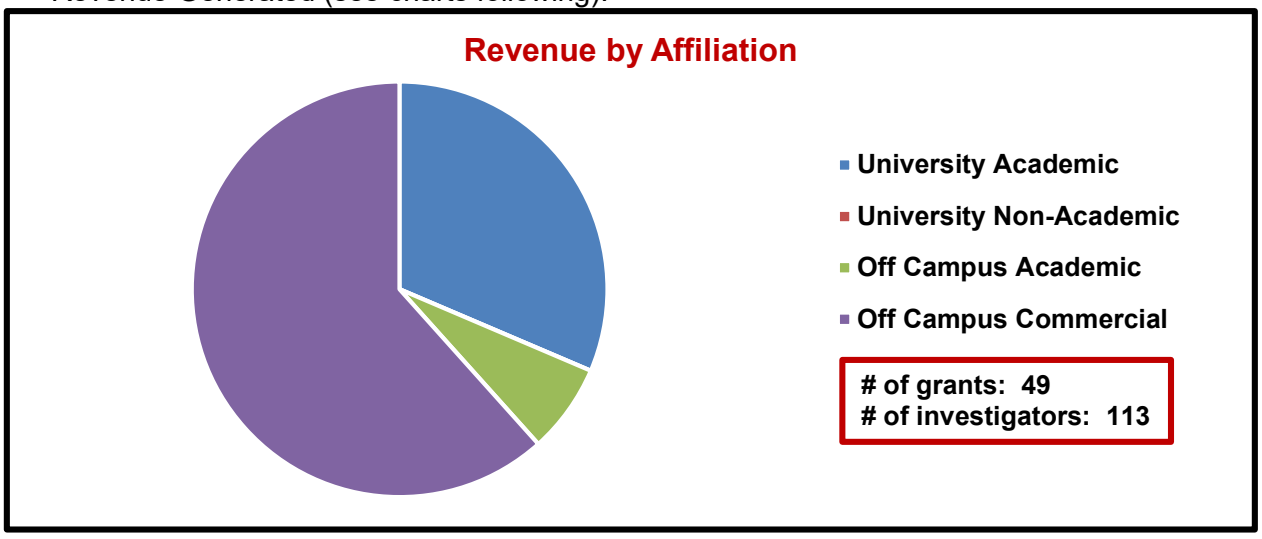


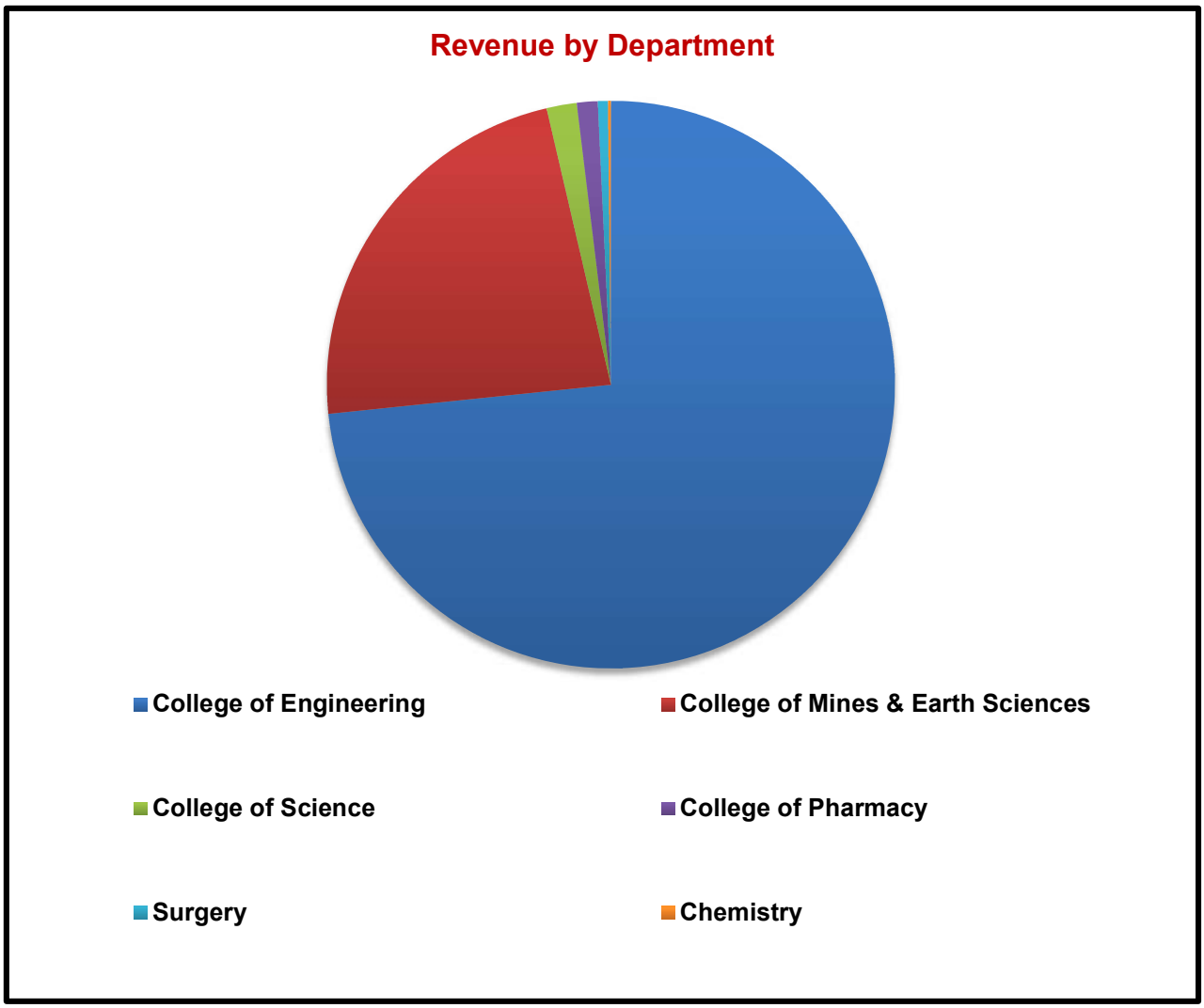
* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):





Top Users

1	Rebel Medicine, Inc.	Off Campus Commercial
2	HiFunda, LLC	Off Campus Commercial
3	OxEon Energy	Off Campus Commercial
4	University of Central Florida	Off Campus Commercial
5	Qnergy Inc.	Off Campus Commercial
6	Shero, LLC	Off Campus Commercial
7	Jackson, Marie	DOE
8	Sparks, Taylor	NSF, Dept, DOE, L3Harris Technologies
9	Advanced Materials Scientia	Off Campus Commercial
10	Smith, York	Univ of Utah Research Foundation, SMIA

Publications

1. Lim, T., M. Kim, A. Akbarian, J. Kim, P. A. Tresco and H. Zhang (2022). Conductive Polymer Enabled Biostable Liquid Metal Electrodes for Bioelectronic Applications. Adv Healthc Mater **11**(11): e2102382.10.1002/adhm.202102382
2. Bates, J., A. Dobron, K. Albertson, A. R. Falkowski and D. S. Pruzan (2022). Video Analysis Techniques for Calculating the Coefficient of Friction of Ski Wax and Ski Base Treatments Using Miniature Ski Sleds
3. Lim, T., T. A. Ring and H. Zhang (2022). Chemical Analysis of the Gallium Surface in a Physiologic Buffer. Langmuir **38**(22): 6817-6825.10.1021/acs.langmuir.1c03281
4. Lim, T. and H. Zhang (2021). Multilayer Carbon Nanotube/Gold Nanoparticle Composites on Gallium-Based Liquid Metals for Electrochemical Biosensing. ACS Applied Nano Materials **4**(11): 12690-12701.10.1021/acsanm.1c03244
5. Lim, T., H. Zhang and S. Lee (2021). Gold and silver nanocomposite-based biostable and biocompatible electronic textile for wearable electromyographic biosensors. APL Materials **9**(9): 091113.10.1063/5.0058617
6. Klosterman, M. R., E. J. Oerter, A. L. Deinhart, S. Chakraborty, M. J. Singleton and L. W. McDonald (2021). Oxygen Kinetic Isotope Effects in the Thermal Decomposition and Reduction of Ammonium Diuranate. ACS Omega **6**(45): 30856-30864.10.1021/acsomega.1c05388
7. Klosterman, M. R., E. J. Oerter, M. J. Singleton and L. W. t. McDonald (2022). Oxygen Isotope Fractionation in U3O8 during Thermal Processing in Humid Atmospheres. ACS Omega **7**(4): 3462-3469.10.1021/acsomega.1c05838
8. Tasnim, T., M. D. Adkins, T. Lim, H. Feng, J. J. Magda, J. E. Shea, J. Agarwal, C. M. Furse and H. Zhang (2021). Thermally tunable hydrogel crosslinking mediated by temperature sensitive liposome. Biomed Mater **16**(6).10.1088/1748-605X/ac246c

Platform for Open Wireless Data-driven Experimental Research (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
- 2 massive MIMO rooftop base stations
- 10 fixed-location wireless endpoints
- 20+ 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 Chicago
- Raymond Knopp, PhD, Professor, EURECOM
- Zhi-Li Zhang, PhD, Professor, University of Minnesota
- Lin Zhong, PhD, Professor, Yale University

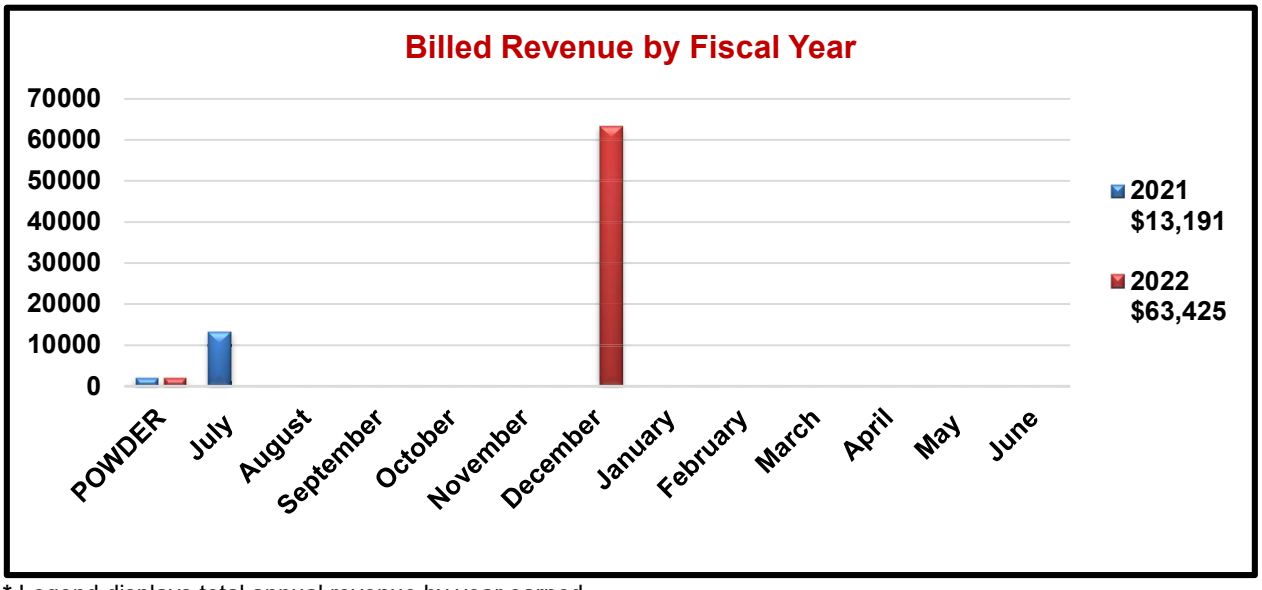
2022 Annual Update

Revenue/Expenses

FY22 Expenses: **Total $19,376**

FY22 Revenue: **Total $63,425**

- VP of Health Sciences Support: $ 0
- FY22 revenue generated from services: $63,425

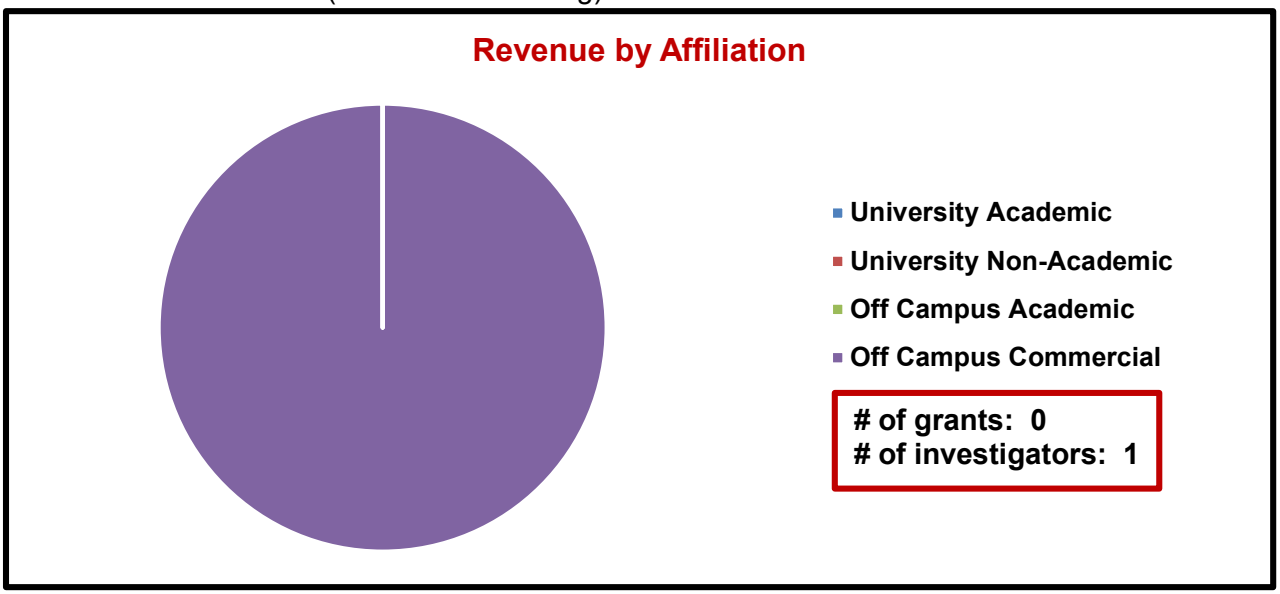


* Legend displays total annual revenue by year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts following):



Top Users

1	O-Ran Alliance	Commercial

Publications

1. Chuprov, S., L. Reznik, A. Obeid and S. Shetty (2022). How Degrading Network Conditions Influence Machine Learning End Systems Performance? IEEE INFOCOM 2022 - IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS).10.1109/INFOCOMWKSHPS54753.2022.9798388
2. Gottipati, A., A. Stewart, J. Song and Q. Chen (2021). FedRAN: Federated Mobile Edge Computing with Differential Privacy.10.1145/3472735.3473392
3. Johnson, D., D. Maas and J. V. D. Merwe (2022). NexRAN: Closed-loop RAN slicing in POWDER -A top-to-bottom open-source open-RAN use case. Proceedings of the 15th ACM Workshop on Wireless Network Testbeds, Experimental evaluation & CHaracterization. New Orleans, LA, USA, Association for Computing Machinery: 17–23.10.1145/3477086.3480842
4. Keshavamurthy, B., Y. Zhang, C. Anderson, N. Michelusi, J. Krogmeier and D. Love (2021). A Robotic Antenna Alignment and Tracking System for Millimeter Wave Propagation Modeling
5. Kuo, C.-Y. (2022). *Locating unknown interference sources with time difference of arrival estimates* (Master's thesis, Washington University in St. Louis, St. Louis, MO). Retrieved from https://openscholarship.wustl.edu/eng_etds/711/
6. Larrea, J., Marina, M., Van der Merwe, J. (2021a). Nervion: A cloud native RAN emulator for core network evaluations. In *Proceedings of the 27th Annual International Conference on Mobile Computing and Networking* (pp. 865–867). doi: 10.1145/3447993.3510588
7. Larrea, J., Marina, M., Van der Merwe, J. (2021a). Nervion: A cloud native RAN emulator for core network evaluations. In *Proceedings of the 27th Annual International Conference on Mobile Computing and Networking* (pp. 736–748). doi: 10.1145/3447993.3483248
8. Sharma, S., A. Nag and B. Ramamurthy (2022). Cross-Atlantic Experiments on EU-US Test-Beds. IEEE Networking Letters **4**(3): 108-112.10.1109/LNET.2022.3177712
9. Sharma, S., S. Urumkar, G. Fontanesi, B. Ramamurthy and A. Nag (2022). Future Wireless Networking Experiments Escaping Simulations. Future Internet **14**: 120.10.3390/fi14040120

Wang, J., J. V. d. Merwe and N. Patwari (2021). A Compliance Monitoring System for Open SDR Platforms. Proceedings of the 19th ACM Conference on Embedded Networked Sensor Systems. Coimbra, Portugal, Association for Computing Machinery: 351–352.10.1145/3485730.3492884

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

Specialized Software

Chart Review

- eHOST
- ChartReview
- 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

Goals for FY23

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 will work on recruitment. In addition, we have made great advances in designing the next generation chart review tool and new methods for probabilistic phenotyping that we will implement in FY23.

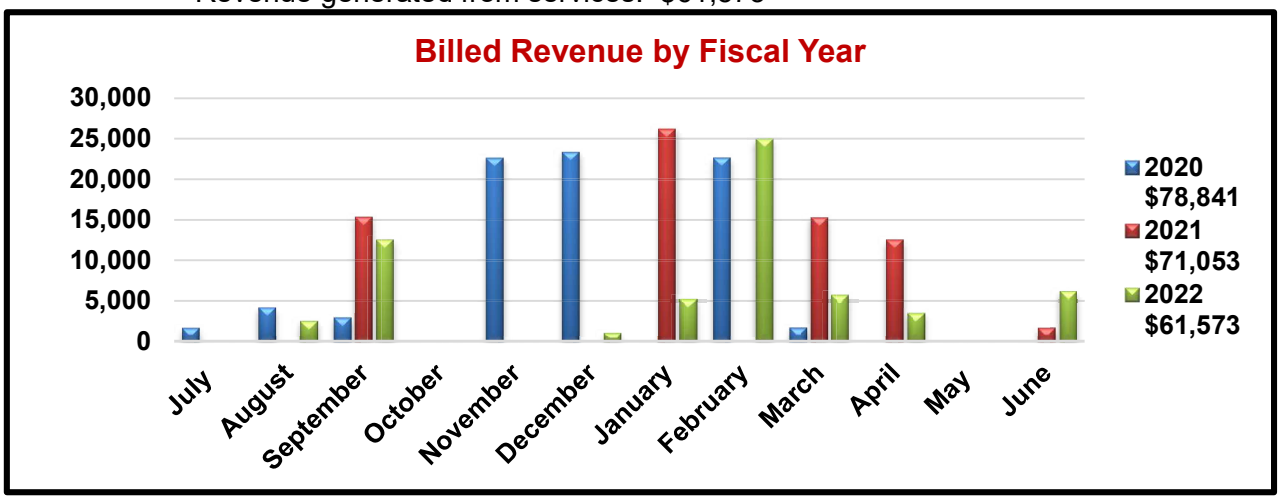
FY22 Annual Update

Revenue/Expenses

FY22 Expenses: $41,364

FY22 Revenue: $61,573

- VP of Research Support: $0
- Revenue generated from services: $61,573

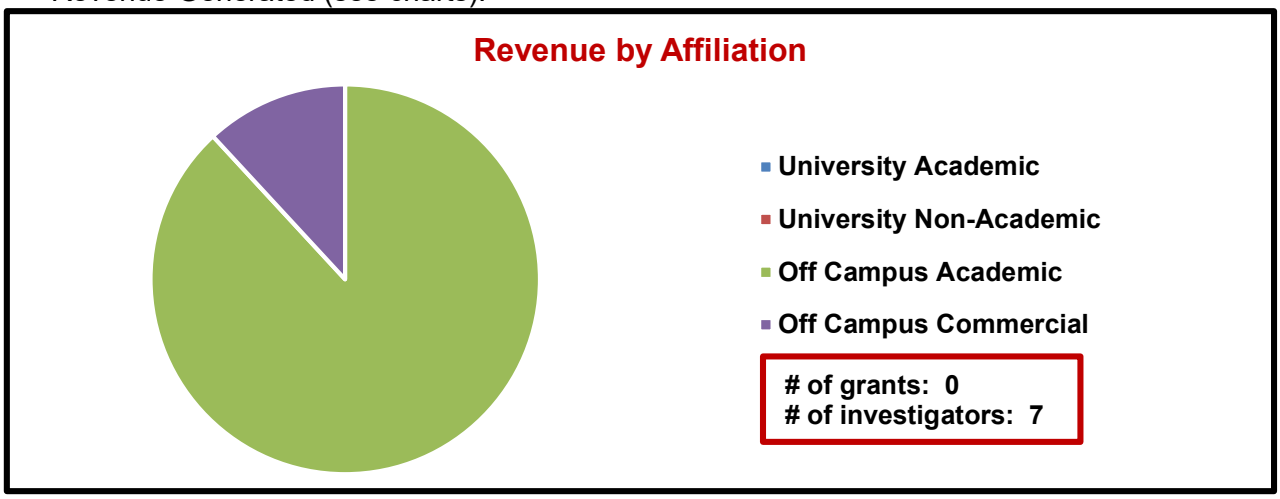


* Legend displays total annual revenue by fiscal year earned.

FY22 Scientific Impact

Research Support

Revenue Generated (see charts):



Top Users

1	University of Pennsylvania	Off Campus Academic
2	Vanderbilt University Medical Center	Off Campus Academic
3	Western Institute for Biomedical Research	Off Campus Academic
4	Bedford VA Research Corp, Inc.	Off Campus Commercial
5	Northwestern University	Off Campus Academic
6	Southern California Permanente Medical Group	Off Campus Commercial

Publications

1. Alba, P. R., A. Gao, K. M. Lee, T. Anglin-Foote, B. Robison, E. Katsoulakis, B. S. Rose, O. Efimova, J. P. Ferraro, O. V. Patterson, J. B. Shelton, S. L. Duvall and J. A. Lynch (2021). Ascertainment of Veterans With Metastatic Prostate Cancer in Electronic Health Records: Demonstrating the Case for Natural Language Processing. JCO Clin Cancer Inform **5**: 1005-1014.10.1200/CCI.21.00030
2. Anglin-Foote, T., K. M. Lee, B. Robison, P. Alba, S. DuVall and J. Lynch (2022). Diagnosis codes overestimate the burden of prostate cancer cases. Journal of Clinical Oncology **40**: 72-72.10.1200/JCO.2022.40.6_suppl.072
3. Butler, J. M., B. Gibson, O. V. Patterson, L. J. Damschroder, C. H. Halls, D. W. Denhalter, M. H. Samore, H. Li, Y. Zhang and S. L. DuVall (2022). Clinician documentation of patient centered care in the electronic health record. BMC Med Inform Decis Mak **22**(1): 65.10.1186/s12911-022-01794-w
4. Chanfreau-Coffinier, C., S. Tuteja, L. E. Hull, S. MacDonald, O. Efimova, J. Bates, D. Voora, D. W. Oslin, S. L. DuVall and J. A. Lynch (2022). Drug-drug-gene interaction risk among opioid users in the U.S. Department of Veterans Affairs. Pain.10.1097/j.pain.0000000000002637
5. Dhond, R., D. Elbers, N. Majahalme, S. Dipietro, S. Goryachev, R. Acher, S. Leatherman, T. Anglin-Foote, Q. Liu, S. Su, R. Seerapu, R. Hall, R. Ferguson, M. T. Brophy, J. Ferraro, S. L. DuVall and N. V. Do (2021). ProjectFlow: a configurable workflow management application for point of care research. JAMIA Open **4**(3): ooab074.10.1093/jamiaopen/ooab074
6. Eyre, H., A. B. Chapman, K. S. Peterson, J. Shi, P. R. Alba, M. M. Jones, T. L. Box, S. L. DuVall and O. V. Patterson (2021). Launching into clinical space with medspaCy: a new clinical text processing toolkit in Python. AMIA Annu Symp Proc **2021**: 438-447
7. Holder, N., A. J. Batten, B. Shiner, Y. Li, E. Madden, T. C. Neylan, K. H. Seal, O. V. Patterson, S. L. DuVall and S. Maguen (2022). Veterans receiving a second course of cognitive processing therapy or prolonged exposure therapy: is it better to switch or stay the same? Cogn Behav Ther **51**(6): 456-469.10.1080/16506073.2022.2058996
8. Hung, A., Y. Li, D. Candelieri, P. Alba, T. Anglin-Foote, K. M. Lee, F. Agiri, C. Perez, W. Li, S. Amin, S. Jiang, S. DuVall, Y.-N. Wong, S. Reed and J. Lynch (2022). Factors associated with gene mutation testing in United States veterans with metastatic castration-resistant prostate cancer. Journal of Clinical Oncology **40**: 47-47.10.1200/JCO.2022.40.6_suppl.047
9. Kostka, K., T. Duarte-Salles, A. Prats-Uribe, A. G. Sena, A. Pistillo, S. Khalid, L. Y. H. Lai, A. Golozar, T. M. Alshammari, D. M. Dawoud, F. Nyberg, A. B. Wilcox, A. Andryc, A. Williams, A. Ostropolets, C. Areia, C. Y. Jung, C. A. Harle, C. G. Reich, C. Blacketer, D. R. Morales, D. A. Dorr, E. Burn, E. Roel, E. H. Tan, E. Minty, F. DeFalco, G. de Maeztu, G. Lipori, H. Alghoul, H. Zhu, J. A. Thomas, J. Bian, J. Park, J. Martinez Roldan, J. D. Posada, J. M. Banda, J. P. Horcajada, J. Kohler, K. Shah, K. Natarajan, K. E. Lynch, L. Liu, L. M. Schilling, M. Recalde, M. Spotnitz, M. Gong, M. E. Matheny, N. Valveny, N. G. Weiskopf, N. Shah, O. Alser, P. Casajust, R. W. Park, R. Schuff, S. Seager, S. L. DuVall, S. C. You, S. Song, S. Fernandez-Bertolin, S. Fortin, T. Magoc, T. Falconer, V. Subbian, V. Huser, W. U. Ahmed, W. Carter, Y. Guan, Y. Galvan, X. He, P. R. Rijnbeek, G. Hripcsak, P. B. Ryan, M. A. Suchard and D. Prieto-Alhambra (2022). Unraveling COVID-19: A Large-Scale Characterization of 4.5 Million COVID-19 Cases Using CHARYBDIS. Clin Epidemiol **14**: 369-384.10.2147/CLEP.S323292
10. Lee, K. M., K. Heberer, A. Gao, D. J. Becker, S. Loeb, D. V. Makarov, B. Gulanski, S. L. DuVall, M. Aslan, J. Lee, M. C. Shih, J. A. Lynch, R. L. Hauger and M. Rettig (2022). A Population-Level Analysis of the Protective Effects of Androgen Deprivation Therapy Against COVID-19 Disease Incidence and Severity. Front Med (Lausanne) **9**: 774773.10.3389/fmed.2022.774773
11. Livingston, N. A., K. E. Lynch, Z. Hinds, E. Gatsby, S. L. DuVall and J. C. Shipherd (2022). Identifying Posttraumatic Stress Disorder and Disparity Among Transgender Veterans Using Nationwide Veterans Health Administration Electronic Health Record Data. LGBT Health **9**(2): 94-102.10.1089/lgbt.2021.0246
12. Lynch, K. E., J. C. Shipherd, E. Gatsby, B. Viernes, S. L. DuVall and J. R. Blosnich (2022). Sexual orientation-related disparities in health conditions that elevate COVID-19 severity. Ann Epidemiol **66**: 5-12.10.1016/j.annepidem.2021.11.006
13. Lynch, K. E., B. Viernes, E. Gatsby, S. L. DuVall, B. E. Jones, T. L. Box, C. Kreisler and M. Jones (2021). Positive Predictive Value of COVID-19 ICD-10 Diagnosis Codes Across Calendar Time and Clinical Setting. Clin Epidemiol **13**: 1011-1018.10.2147/CLEP.S335621

14. Morales, D. R., A. Ostropolets, L. Lai, A. Sena, S. Duvall, M. Suchard, K. Verhamme, P. Rjinbeek, J. Posada, W. Ahmed, T. Alshammary, H. Alghoul, O. Alser, C. Areia, C. Blacketer, E. Burn, P. Casajust, S. C. You, D. Dawoud, A. Golozar, M. Gong, J. Jonnagaddala, K. Lynch, M. Matheny, E. Minty, F. Nyberg, A. Uribe, M. Recalde, C. Reich, M. Scheumie, K. Shah, N. Shah, L. Schilling, D. Vizcaya, L. Zhang, G. Hripcsak, P. Ryan, D. Prieto-Alhambra, T. Durate-Salles and K. Kostka (2022). Characteristics and outcomes of COVID-19 patients with and without asthma from the United States, South Korea, and Europe. J Asthma: 1-11.10.1080/02770903.2021.2025392
15. Moreno-Martos, D., K. Verhamme, A. Ostropolets, K. Kostka, T. Duarte-Sales, D. Prieto-Alhambra, T. Alshammari, H. Alghoul, W.-U.-R. Ahmed, C. Blacketer, S. DuVall, L. Lai, M. Matheny, F. Nyberg, J. Posada, P. Rijnbeek, M. Spotnitz, A. Sena, N. Shah, M. Suchard, S. Chan You, G. Hripcak, P. Ryan and D. Morales (2022). Characteristics and outcomes of COVID-19 patients with COPD from the United States, South Korea, and Europe, Wellcome Open Res.10.12688/wellcomeopenres.17403.1
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